

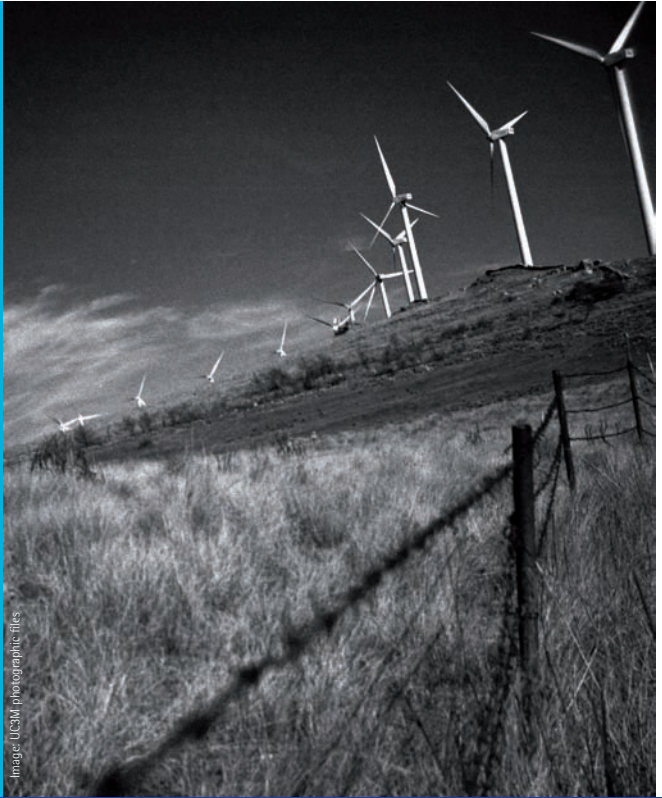
UC3M

REDES

ELECTRICAL ENERGY
NETWORKS AND
SYSTEMS GROUP

R E S E A R C H G R O U P S

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Universidad
Carlos III de Madrid
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Wind Turbine

The Electrical Energy Networks and Systems group (REDES), led by Dr. Julio Usaola García and Dr. Hortensia Amarís Duarte, is formed by a consolidated team of 17 engineers, PhDs and doctoral students, who have a long and acknowledged work experience carrying out studies, diagnoses and predictions related to the electrical energy market, to the integration of wind systems into the national energy network from a technical and economic perspective and to the quality of the electric supply.

• RESEARCH LINES •

- Quality of the electric supply
- Integration of renewable energies into the electrical system and market
- Electrical energy markets
- Renewable energies



Electricity and development

• OUTSTANDING COLLABORATIONS AND R&D&I PROJECTS •

The REDES group usually works with companies and organizations of the electrical sector with which it maintains close and steady relations: RED ELÉCTRICA DE ESPAÑA (Spanish power grid), CENER – *Centro Español de Energías Renovables* (Spanish Renewable Energy Center), Gas Natural Fenosa. The results reached throughout its history have made the REDES group worthy of national and international recognition and has allowed the active participation in the workgroups of AENOR and of the international organizations CIGRE (International Council on Large Electric Systems) and IEC (International Electrotechnical Commission).

Some of the most relevant R&D&I projects of the group are:

- CENIT Programme 2008. Consorcio Solar de I+D (CONSOLIDA).

Funding Entity: Centre for the Development of Industrial Technology (CDTI). Date: 2008-2011

- Strategies for the Efficient Integration of Renewable Energies.

Funding Entity: Ministry of Science and Innovation. Date: 2009-2012.

- Domestic System for Recharging Electric Vehicle Batteries (DOMOCELL-Singular Strategic Project).

Funding Entity: Ministry of Industry, Tourism and Trade. Date: 2009-2011.

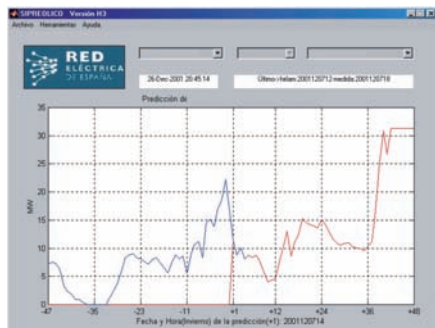
- Distribution Power Networks with Dispersed Energy Generation.

Funding Entity: Ministry of Education and Science. Date: 2007-2010.

- Analysis of the impact of wind power production and contribution of electrical energy storage techniques on power flows in the European electricity transmission network: deterministic and probabilistic approaches.

Funding Entity: Ministry of Science and Innovation. Date: 2009-2010.

- SAFEWIND: Multi-scale data assimilation, advanced wind modeling and forecasting with emphasis to extreme weather situations for a secure large-scale wind power integration.
Funding Entity: Universidad Carlos III de Madrid, European Commission Date: 2008-2012.
- ANEMOS PLUS: "Advanced Tools for the Management of Electricity Grids with Large-Scale Wind Generation" (PPI B).
Funding Entity: Universidad Carlos III de Madrid, European Commission Date: 2008-2011.



SIPREÓLICO Software



Electromagnetic immunity studies in electrical devices

- COMPAPLUS: Complementary aid to the ANEMOSPLUS project

Funding Entity: Ministry of Education and Science. Date: 2008-2011.

- PWWOW-Prediction of Waves, Wakes and Offshore Wind.

Funding Entity: European Commission. Date: 2005-2009.

• INNOVATIVE TECHNOLOGICAL SOLUTIONS •

- SIPREÓLICO: internally developed program for predicting short-term wind power production (used by the Operator of the Peninsular Electrical System for the daily operation of the system).

- Equipment for evaluating the quality of energy in wind generators.

- Algorithms and methods for optimization the benefits of renewable energy in Electricity Markets under different hypothesis.

- Models for the dynamic analysis of wind generators suitable for studying the interaction with the electrical network.

- Integration of renewable energies into electrical energy markets and networks.

- Active filter for improving the energy efficiency in electric installations.

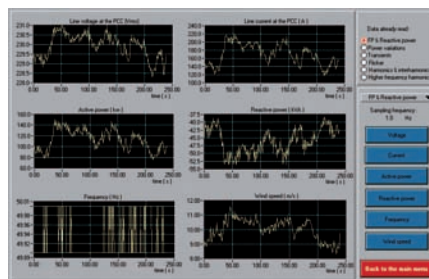
- Inductive sensor for measuring partial discharges in electric machines.

• SCIENTIFIC-TECHNICAL SERVICES •

- Evaluating the technical and economic impact of the integration of wind systems into the national energy network.

- Studying electrical energy markets.

- Analyzing electrical networks.



Analysis and measurement of the energy supplied by electrical generators

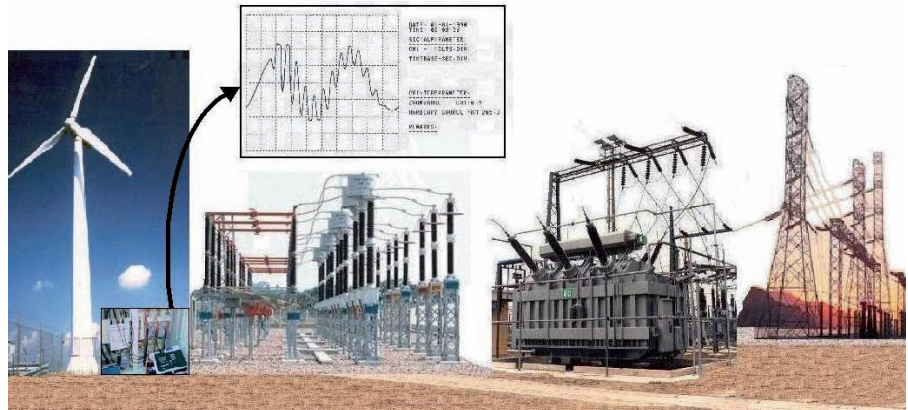
• TECHNOLOGICAL EQUIPMENT •

The laboratories of the group are perfectly equipped with the instruments and tools necessary for successfully conducting any type of study and analysis:

- THALES measuring equipment especially developed for evaluating the Quality of the energy produced by the wind generators according to international standard IEC 61400-21.
- Network analyzing instruments.
- Electrical network analysis and simulation tools and programs: PSCAD/EMTDC, ATP, MATLAB, PSS/E (educational license), GAMS.



Electricity Daily Market results (peninsular system)



Perturbations emission of electrical generators

Science Park Universidad Carlos III de Madrid

Technology Transfer Office

Tel +34 916244023/4011 · Fax +34916244097

E-mail comercializacion@pcf.uc3m.es

Web www.uc3m.es

REDES

Contact Information

HEAD RESEARCHERS

Julio Usaola García

Hortensia Amarís Duarte

E-MAIL

jusaola@ing.uc3m.es

hamaris@ing.uc3m.es

WEB

http://www.uc3m.es/portal/page/portal/research/research_groups/redes



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IMAGE OF COVER: *Blowing*

Julián Bórquez