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COURSE: Applied Energy

TEACHER: Antonio D'Angola

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Language: Italian

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ECTS: 9

n. of hours: 81

Academic year: 2014/15

Campus: Potenza

Semester: I

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#### TOPICS

The course deals with issues related to the production of electricity from renewable (photovoltaic, wind power, biomass, hydro power, solar, geothermal) and nuclear sources. It covers issues related to the characterization of the source of energy for conversion into electricity and the related plant applications.

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#### TEACHING METHODS

- Theoretical lessons
  - Tutorials in classroom
  - Tutorials in laboratory
  - Project works
  - Technical visits
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#### TEXTBOOKS

Lecture Notes.

Andrea Bartolazzi, "Le Energie Rinnovabili", Hoepli. - Rodolfo Pallabazzer, "Sistemi Eolici", Rubettino. - Francesco Groppi e Carlo Zuccaro, "Impianti Solari fotovoltaici a norme CEI", Editoriale Delfino. Orio De Paoli, "Sistemi solari fotovoltaici e termici", Celid. Mario A. Cucumo, "Ingegneria Solare, Principi ed applicazioni", Pitagora Editrice Bologna.

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#### ON-LINE EDUCATIONAL MATERIAL

web address: <http://oldwww.unibas.it/dangola/>

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#### LEARNING OUTCOMES

The course offers advanced studies in scientific and technological topics applied in the field of renewable energy and nuclear engineering.

The course aims to provide advanced skills in energy problems, and the analysis of plant and systems for energy processing and utilization in various fields of application. The program is designed to train the student to develop mathematical models and numerical simulations of complex energy systems using renewable resources and nuclear energy. The student should be able to use these skills in modeling, design, optimization and verification, finalizing the understanding of the critical analysis and the resolution of typical energy engineering problems.

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#### REQUIREMENTS

Basic knowledge of Physics and Electrotechnics.

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#### EVALUATION METHODS

- Intermediate verifications
  - Written examination
  - Discussion of a project work
  - Practical test
  - Oral examination
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#### DETAILED CONTENT

Spectral characterization of solar energy; beam, diffuse, "albedo" and global irradiation. Structure of photovoltaic (PV) devices: energy bands in semiconductors; "p" and "n" types of doping; junction and electric field; photocurrent as electron - hole pairs; losses in the conversion. Operation principle and equivalent circuit of the solar cell. Current-voltage (I-V) and power-voltage (P-V) characteristics. Assessment of PV energy production; economic analysis by Net-Present-Value method. Design of a grid connected PV system: optimal sizing between PV modules and inverter. Characterization of the wind: speed and direction; power density; surface roughness; statistic distributions.

Structure of a wind turbine: blades, hub, gearbox, electric generator, tower.

Operating Principle of a wind turbine: lift and drag in a blade; pitch and yaw regulations; pitch-adjustment toward

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stall/feather. Wind farms: interference among turbines. Environmental impact of wind turbines: acoustic noise.

Power size, diffusion of wind installations in the world.

Hydropower. Biomass. Solar, geothermal. General principles of nuclear fission reactors. Types of nuclear fission reactors. Basic notions of plasmas for controlled thermonuclear fusion.

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SEMINARS BY EXTERNAL EXPERTS    YES     NO

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**FURTHER INFORMATION**

Teaching material and informations available at the URL: <http://oldwww.unibas.it/dangola/>

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