Wind Power Systems

Component
École Nationale Supérieure d'Électrotechnique d'Électronique

In brief

- **Ametys Code:** N9EE36A
- **Open to exchange students:** Yes

Presentation

Objectives

This course, consisting of four to five sessions, introduces the main principles and concepts involved in converting wind energy into electricity, covering everything from the main components of wind turbines to the architecture of modern onshore and offshore wind farms. The course content includes: History, context, and markets for wind power generation. Key market players; factors driving and hindering the expansion of the industry. Cost and development factors for a wind farm.

Characterization of wind resources, effects of altitude and wake, theoretical factors (Betz limit) on wind power generation and the energy efficiency of wind turbines; mechanical control through blade adjustment, from start-up to safe shutdown.

Composition of electric wind turbines: nacelles with and without speed multipliers;

design elements of wind turbine chains according to their size and technology;

Transient analysis and stable adjustment of the operating point in the torque-speed plane;

Main power conversion architectures for asynchronous and synchronous chains with and without gearboxes, with and without power electronics; Elements for adjusting active and reactive power in these energy chains.

Pre-requisites

Basic knowledge of energy physics (energy/power concepts), basic concepts of electricity and electromechanical conversion (basic concepts of electricity generation).