

Smart grids



Component
École Nationale
Supérieure
d'Électrotechnique
d'Électronique

In brief

- **Ametys Code:** N9EE35E
- **Open to exchange students:** Yes

Presentation

Objectives

The aim of this 4-session course is to make students aware of the emergence of smart grids, distinguishing them from current grids.

The concept of "smart grids", their characteristics and main challenges are introduced in relation to current power grids. The notions of "system services/grid services" (contribution to frequency/voltage reserves, adjustment/shaving, self-consumption, etc.) are presented. Similarly, new degrees of freedom (storage, massive electric mobility, production and consumption predictions, communicating meters, etc. for consumption adjustment, etc.) enabling "intelligent management of electrical networks" are described. As the cost to the user of these new concepts is essential, an overview of market mechanisms and elements of economic models (investment, operation) will enable students to make a "technical-economic" link between energy performance and economic impact. Finally, a few examples of smart grids, and the detailed example of self-consumption in an eco-neighborhood, will provide a more concrete illustration of these concepts.

Description

smart grids are fully in line with the energy transition. Mass electrification is a key route to the necessary decarbonization of the landscape. After mechanization and information technology (the Internet), smart grids are considered to be the 3rd industrial revolution, as they are the essential link for balancing electricity production and consumption, which will become increasingly precarious with the massive integration of intermittent renewable energies (solar, wind). Smart grids are defined by the idea of integrating electrical infrastructure (energy) with Information and Communication Technologies, in order to provide the flexibility

needed to solve this power balancing problem in reliable conditions (resilient to faults, cyber-attacks, etc.) and at a cost acceptable to consumers.

Pre-requisites

This course is intended to be introductory and requires only fairly general skills in terms of electrical networks, skills taught in 3rd year 3EA, particularly in the CERE and Eco Energie options.