UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Implementing An Economically Sustainable Renewable Energy Project

2526-1-F7603Q021-F7603Q02102

Aims

This module is part of the Laboratory of Renewable Energy Technologies, an interdisciplinary program that integrates physics and economics to analyze the feasibility and sustainability of modern energy systems. The course provides students with a fundamental understanding of the economics principles that govern investment in energy sources, focusing on renewable energy technologies, and market-based models for production and sale of energy.

A key focus will be on:
• The economic principles governing energy production and utilization.
• The fundamentals of market-based models for energy production and dispatch
• The role of uncertainty in the investment decisions.
• The relevance of long-term contracting and hedging for RES projects.

By the end of the course, students will have a multidisciplinary perspective on global energy systems and their economic management and will be able to critically assess energy challenges and evaluate sustainable solutions.

Students are invited to consult the syllabus of the entire course for details regarding learning- and skill-related objectives.

Contents

• Introduction to electricity markets: economic principles applied for the integration of different technologies into a production and delivery program.
• Energy markets integration: cross border energy management from an economic point of view.
• How electricity markets can survive with zero-marginal-cost technologies: electricity market reform.

• The investment in sustainable technologies and financing issues.

Detailed program

Introduction to Electricity markets
• liberalization and privatization of the electricity industry;
• a primer on market allocation;
• efficient allocation of production and least cost dispatch: the electricity market;
• analysis of different services provided by different technologies: real time market and balancing activity;
• how technical requirements can correct the economically efficient allocation: grid congestion and management.

Renewable energy sources in the electricity exchange
• priority of dispatch;
• effect of RES on the merit order;
• RES variability and price effects;
• the interplay of conventional sources and RES.

Investment and profitability
• investment under uncertainty;
• internal rate of return, opportunity cost and net present value;
• business plan components;
• support mechanisms for RES;
• case studies: solar (utility scale) installation, the nuclear renaissance and SMR.

Long-run issues and market reform
• electricity markets under stress;
• decoupling of conventional and renewable energy sources;
• long-term contracts: PPAs, Contracts for differences.

Prerequisites

• Basic principles on consumer's behavior and firm profit maximization.
• Single and multivariable calculus.

Teaching form

3 CFUs of theoretical lessons in the classroom (30 hours).
• 10 two-hour lectures, in person, Delivered Didactics;
• 5 two-hour , in person, reading and discussing case studies, discussions on sustainable energy projects, data analysis of energy markets and pricing trends, possible guest lectures from experts in economics and policy-making, and joint discussions between physical and economic aspects of renewable energy, Interactive Teaching.

Attendance to lectures and interactive exercises is highly recommended.

Textbook and teaching resource

• Energy Economics - Theory and Applications, Peter Zweifel, Aaron Praktiknjo, Georg Erdmann,Springer, 2017
• Lecture slides, notes, and additional scientific articles provided on the e-learning platform.

Semester

II semester (March - June)

Assessment method

The final examination consists of a single oral exam at the end of the course. The exam will evaluate the student's ability to discuss various topics covered in the course, with an emphasis on theoretical understanding, interdisciplinary connections, and critical evaluation of sustainable energy technologies.

The final score will be between 18/30 and 30/30 *cum laude*, based on the overall assessment considering the following criteria:
(1) knowledge and understanding;
(2) ability to connect different concepts;
(3) autonomy of analysis and judgment;
(4) ability to correctly use scientific language.

Office hours

Always, after scheduling an appointment *via* phone or e-mail.

Sustainable Development Goals

QUALITY EDUCATION | AFFORDABLE AND CLEAN ENERGY | CLIMATE ACTION