



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Sostenibilità Energetica

2122-1-F1701Q142

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#### Aims

Analysis of energetic aspects connected with the use of energetic resources and with the energetic sustainability referred to global and local contexts.

#### Contents

Thermodynamics

Thermal machines

Refrigeration machines

Energy Saving

Global energy system

Environmental effects of energy consumption

#### Detailed program

## Thermodynamics

- Concept of temperature and of thermodynamic system
- First law of thermodynamics: the conservation of energy
- Enthalpy and its application to thermal reactions
- Second law of thermodynamics: reversibility and irreversibility
- Entropy function and its evolution
- Thermodynamic efficiency

## Thermal machines

- Internal combustion engines
  - Otto cycle (gasoline engine)
  - Diesel cycle
- Brayton cycle (turbine engine)
- Fuels for internal combustion engines
- External combustion engines
- Rankine cycle
- Cogeneration systems
- Optimization of the thermal machines

## Refrigeration Machine

- Cooling performance coefficient
- Cooling cycles
- Refrigerant gasses
- Heat pumps
- Geothermal application of heat pumps
- Trigeration systems

## Energy Saving

- Energy saving strategies
- Determination of energy efficiencies in various technological applications
- Dispersion of heat
- Methods for efficient use of energy
- Comparison between different technologies for energy saving

## Global energy system

- Global energy balance
- Distribution of energy consumption
- Evolution of energy consumption
- Energy requests by their possible applications
- Peculiar aspects of global energy consumption
- Peculiar aspects of energy consumption in Italy

## Environmental effects of energy consumption

- Earth's radiation balance
- Temperature on Earth
- Earth atmosphere and greenhouse effect
- Possible reasons of the global warming
  
- Radiative forcing
- Global effect on Earth climate changes
- Strategies to mitigate the global warming

## Prerequisites

Basic knowledge of the three-year degree in physics

## Teaching form

Lectures.

Some seminars on specific arguments will be organized as parts of the course program.

## Textbook and teaching resource

Egbert Boeker and Rienk Van Grondelle - Environmental Physics: Sustainable Energy and Climate Change (3rd edition)

David JC MacKay - Sustainable Energy — without the hot air (2008) - <https://www.withouthotair.com>

Y. A. Çengel – Introduction to thermodynamics and heat transfer – McGraw-Hill

During the course some bibliographic references will be indicated and some lecture notes will be available

## **Semester**

Second semester

## **Assessment method**

Oral examination - No intermediate evaluation will be organized

- Discussion on argument presented during the course
- Analysis on some aspects related to production and use of energy
- Description of possible approaches connected with energy sustainability

## **Office hours**

Monday - Friday by appointment

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