POLITECNICO MILANO 1863

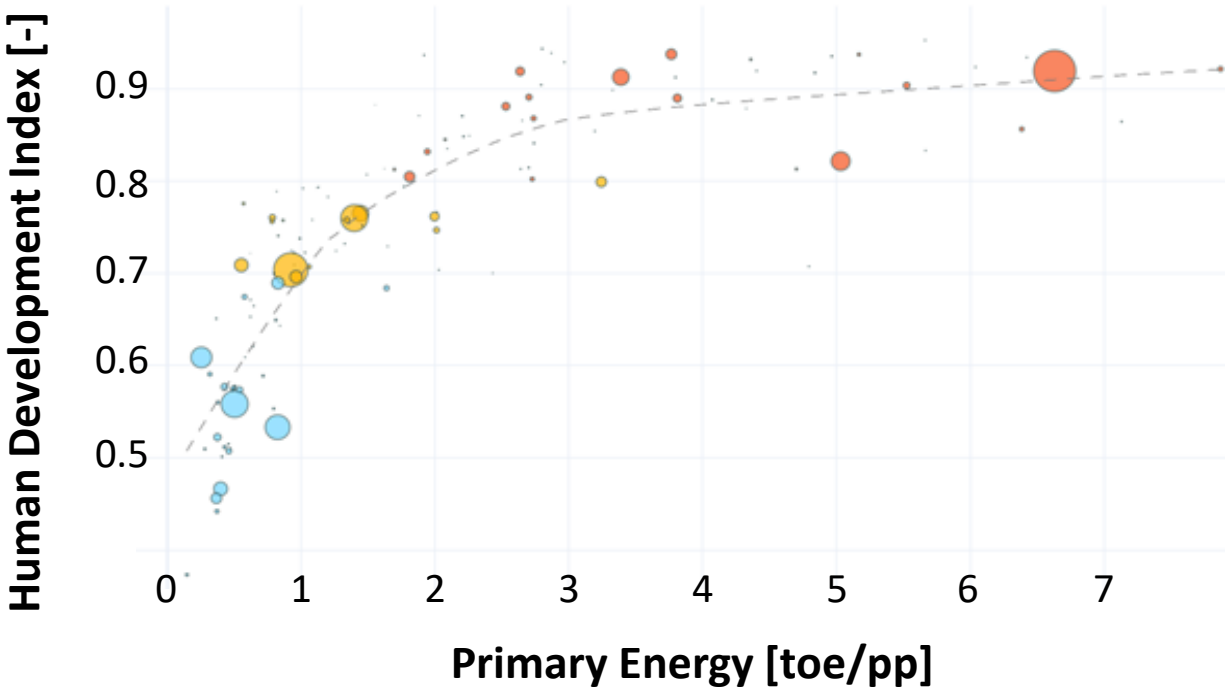
OPENDAY 2025

MASTER OF SCIENCE IN ENERGY ENGINEERING

ACADEMIC YEAR 2025-26

WHY ENERGY ENGINEERING?

Energy has a central role for the development of the countries and for the quality of life of the people



Human Development Index:
- Health
- Knowledge
- GNI per person

The future challenges of the Energy:
- Increasing world population
- Environmental sustainability
- Evolution of the global geopolitic scenario

WHAT IS ENERGY ENGINEERING?

Energy Engineering is the engineering sector that deals with the **development, design and management of energy systems and their components.**

- Energy plants are all those installations for the **production, transformation and use of energy**
  - Some examples are large power plants, air conditioning systems for residences and offices, the engine of a car or of an aircraft, a solar collector and so on

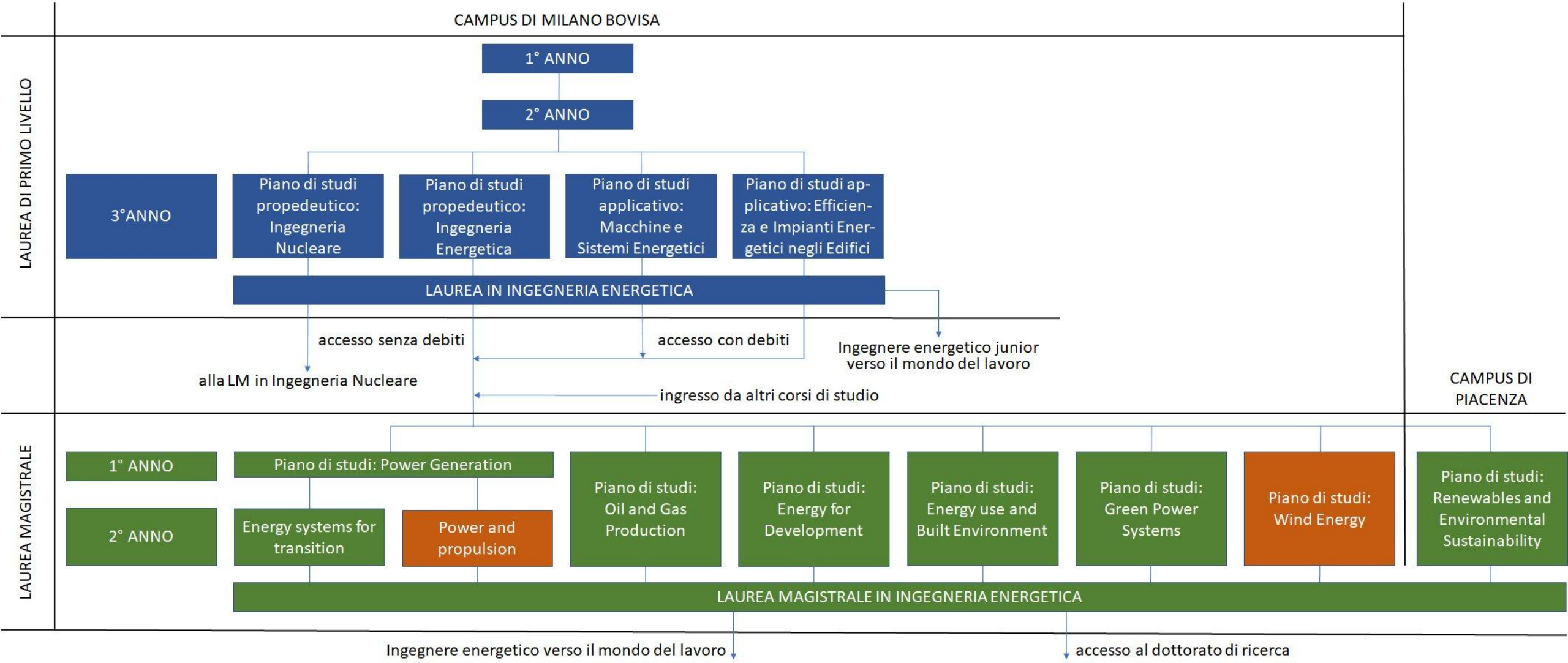
- The energy engineer is called to contribute to the **development of technologies** for the production and rational use of energy and the consequent **environmental impact** in a context where energy is a fundamental element of **developed societies**, and essential for the economies of the **emerging countries**.

Career Opportunities

- Energy industries operating with renewable and/or fossil sources involved in the **production, dispatching or distribution processes**
- Industries manufacturing and selling **machines as well as components** as gas/steam turbines and compressors, hydraulic or wind turbines, engines, solar panels, boilers, air conditioners, refrigerators, heat exchangers
- **Design, testing, operation and maintenance** of energy systems such as, for example, air conditioning systems, food storage systems, small and medium-sized systems for the production, distribution and use of energy
- Design of **Zero Energy Buildings** (ZEB), decarbonization of built environment, urban energy planners, designer of renewable energies integration
- **Energy management sector**, in private and public companies that supply the energy service (Energy Manager)
- **"Energy analyst"** in private / public companies and international organizations, responsible of collecting and analyzing energy data to provide information, trends and future scenarios to support the strategic choices.




Structure of the Study Programme



Teaching Activities

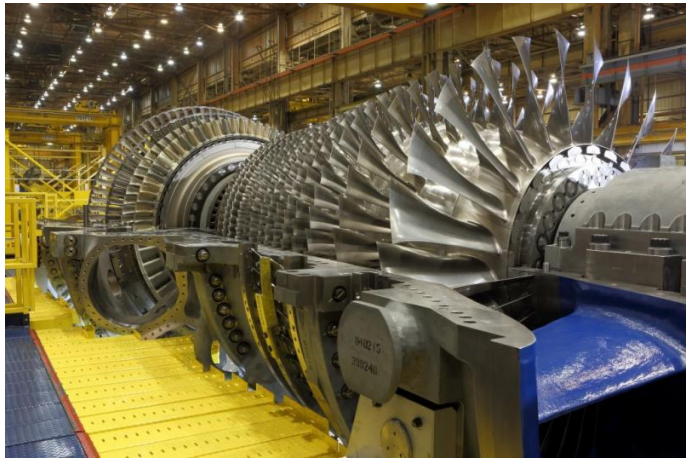
Overall ETCS: 120 = 100 Courses + 20 Thesis

- **Fundamentals (36 ECTS)**: *common to all the tracks*
  - Heat and Mass Transfer (10 ECTS)
  - Energy Conversion or Heating and Cooling Systems (10 ECTS)
  - Fundamentals of Chemical Processes (8 ECTS)
  - Electric Power Systems or Electric Conversion from Green Sources of Energy (8 ECTS)
- **Specialized (32 ECTS)**: *giving the character of each track*
- **Interdisciplinary (32 ECTS)**: *linking various engineering areas*
  - Guided choice in groups (24 ECTS)
  - Free choice (8 ECTS) among all the subjects of the Study Programme or in the **Labs** and Soft Skills groups

POWER GENERATION | TOPICS

Power plants

Industrial processes



Turbomachines

IC and Hybrid engines – Fuel cells

POWER GENERATION | STRUCTURE

1th year:
General

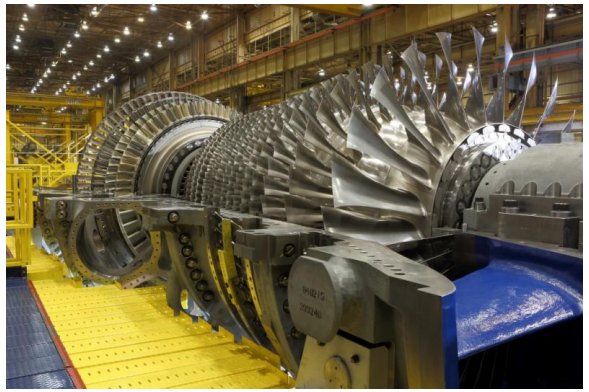
NEW

2th year track:
Energy Systems for Transition

2th year track:
Propulsion and Power
(Joint Track with Mech. Eng.)

Power plants

Industrial processes



Turbomachines

Engines – Fuel cells

Energy systems for transition

Chemical Processes and Technologies aims to provide knowledge of the fundamental unit operations of the chemical and process industry, which are used in transformations related to energy production.

Advanced Energy Systems deals with the production of decarbonized energy vectors (electricity and hydrogen) from fossil fuels

Power Production from Renewable Energy illustrates the potential and technical and economic problems associated with the use of various technologies for the production of electrical power from renewable sources

Chemical processes for energy vectors provides the bases of chemical and physical equilibria and on chemical kinetics, which are necessary for the understanding of unit operations and chemical processes relevant to applications in the energy field

Electrochemical energy conversion and storage enables to model and design electrochemical energy devices, including fuel cells and batteries dealing with both automotive and stationary applications

Propulsion & Power

Internal combustion engines provides a physical and mathematical description of reciprocating spark and compression ignition engines

Turbomachinery analyze in detail the theoretical and practical fluid-dynamic features of hydraulic and thermal turbomachines suited for energy conversion, industrial processes and transportation

Power Production from Renewable Energy illustrates the potential and technical and economic problems associated with the use of various technologies for the production of electrical power from renewable sources

LAB - Internal Combustion Engines and Turbomachinery

Applied CFD for Industrial Engineering introduces the students to the Computational Fluid-Dynamics, providing the required abilities to manage the whole CFD project cycle with awareness of the modelling problems involved.

Modeling of Automotive Propulsion Systems enables to model and design automotive propulsion systems based on electric and I.C.E. hybrid technologies.

Oil and Gas Production | Topics

Exploration

Production

Transportation

Refining

Fundamentals of Oil and Gas engineering

- This subject deals with geology, hydraulics and physics matters mainly, including the most advanced concepts of physics and chemistry of 2 and 3 phase reservoir systems

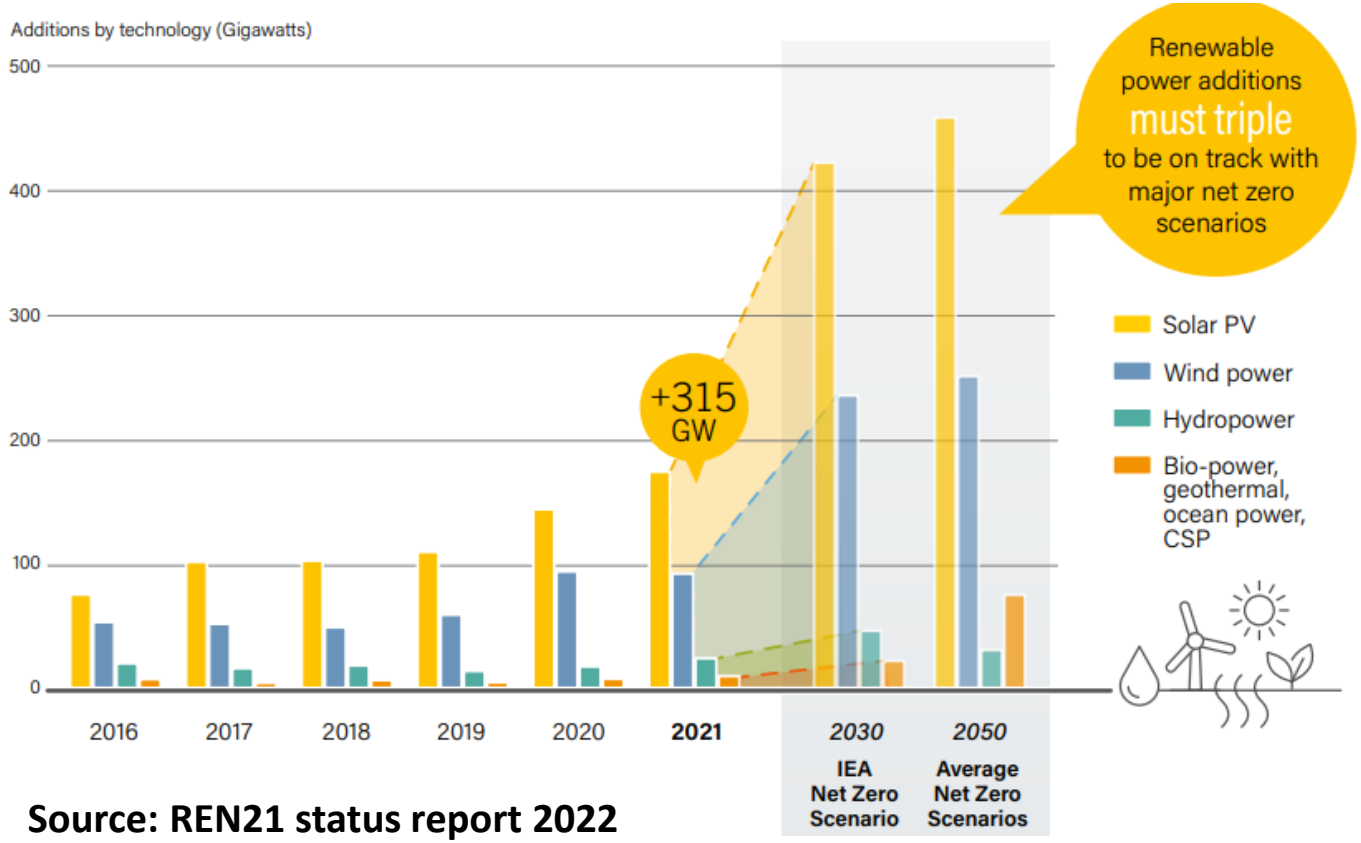
Sustainable Use of Underground Energy Resources

- The course will cover the basic processes associated with fluid flow in porous and fractured media, geological storage technologies and its extensions to multiphase flows

Oil and Gas field development and production

- The course will provide the basis for understanding how an oil or gas field is designed, developed and managed during the production life

Annual Additions of Renewable Power Capacity [GW]



Source: REN21 status report 2022

Wind, Hydro and geothermal power generation & Solar and biomass power generation

- These courses provide the knowledge and the tools to correctly design and operate renewable power systems

Electric conversion from green sources of energy

- The goal of the course is to provide the fundamental elements of the energy conversion produced by renewable sources and their connection to the electric grid

Design of fluid machines for clean power generation

- The course provides the necessary basic skills for the aerodynamic design and performance analysis of fluid machines in the frame of power production from renewable energy (i.e. wind and hydraulic turbines)

WIND ENERGY | TOPICS AND SPECIALIZATION COURSES

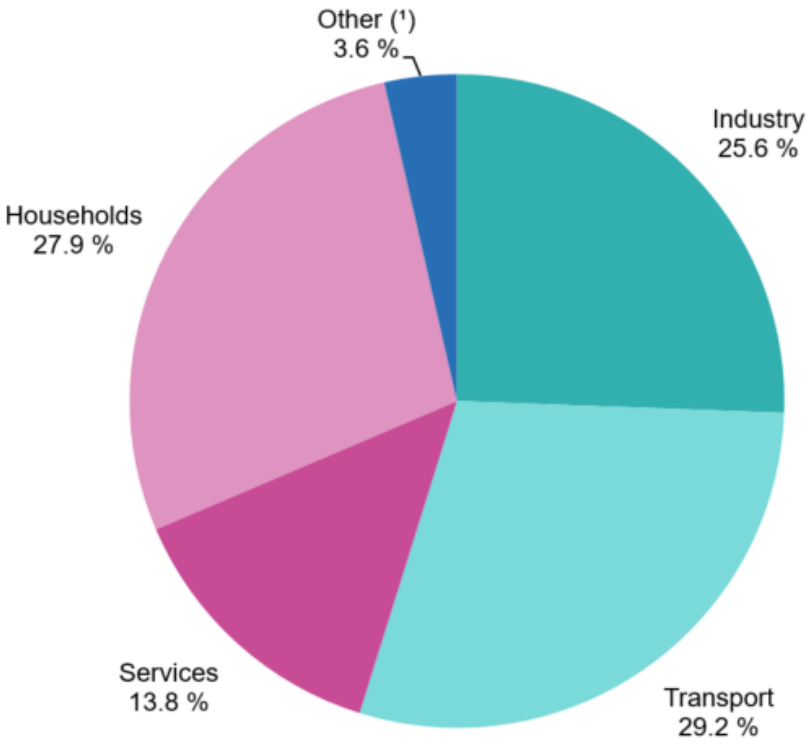



- **Design of fluid machines for clean power generation**
- **Wind turbines and wind farm modelling and control**
- **Wind farm O&M**
- **Lab Wind Energy**

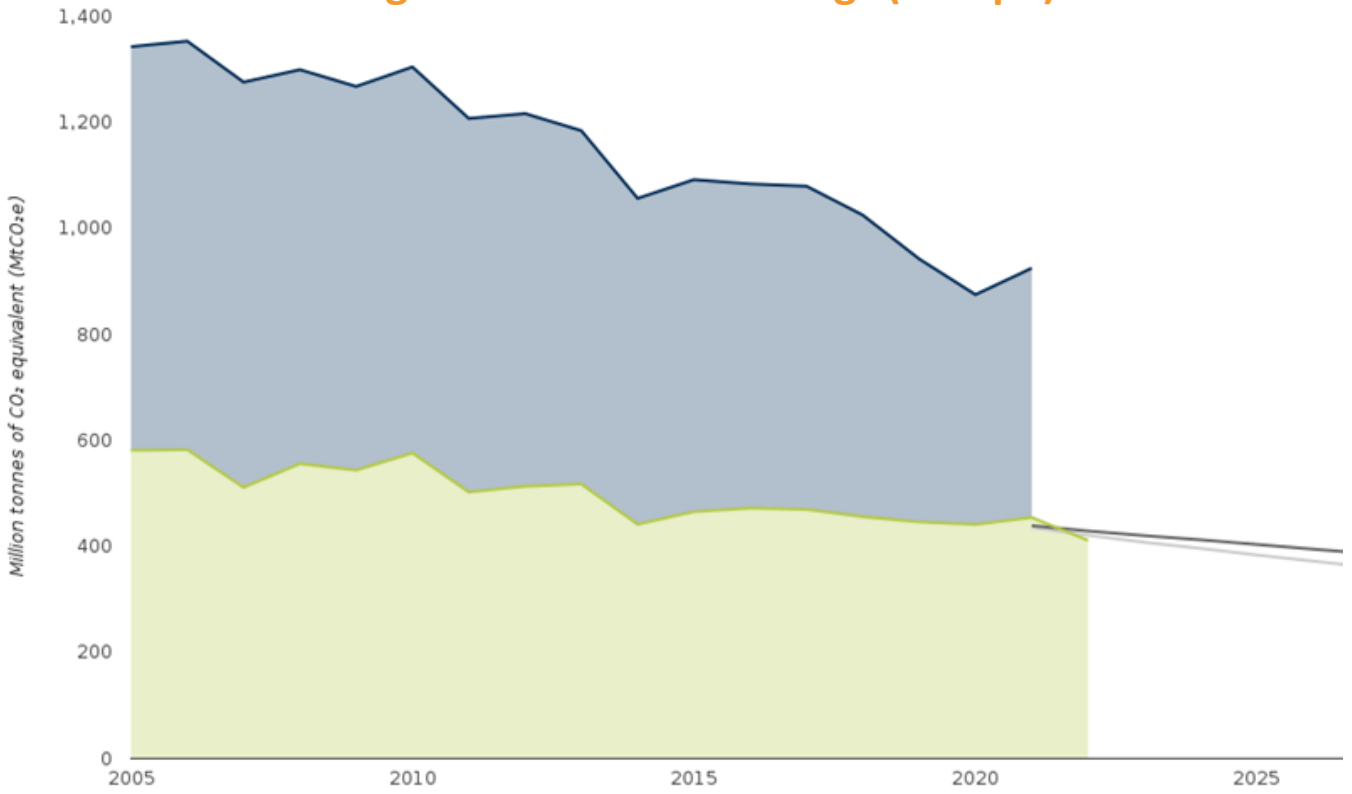
Joint Track with Mechanical Engineering

In Europe **households** (i.e. the built environment) account for about **28% of the end-use energy consumption** and **36% of greenhouse gas emissions**.

Energy consumption by sector (Europe)



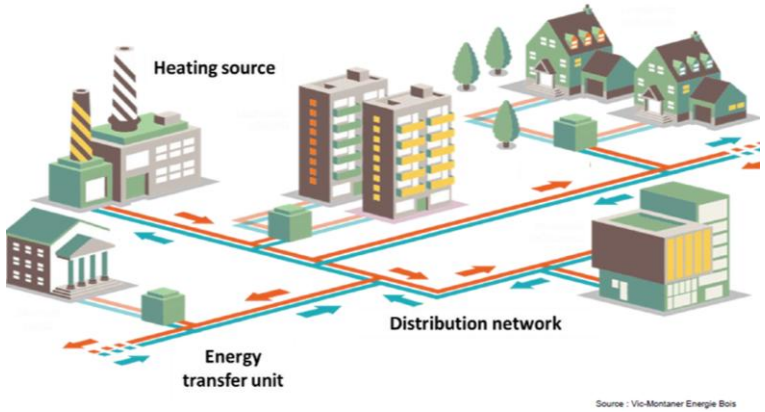
Greenhouse gas emission in buildings (Europe)



ENERGY USE AND BUILT ENVIRONMENT | TOPICS

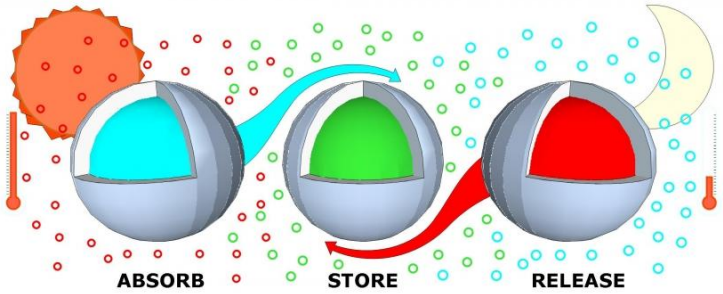
Green Buildings

District Heating & Cooling



Integration of Renewables

Thermal Energy Storage



Industrial HVAC

Automotive HVAC

Zero and positive energy districts

- The course aims to provide the base knowledge and tools for the development of buildings efficiency renovation and new plans at district and urban scale

Green building energy systems

- The course is aimed at providing the knowledge needed to design a "green" building with reduced environmental impact while maximizing occupant health

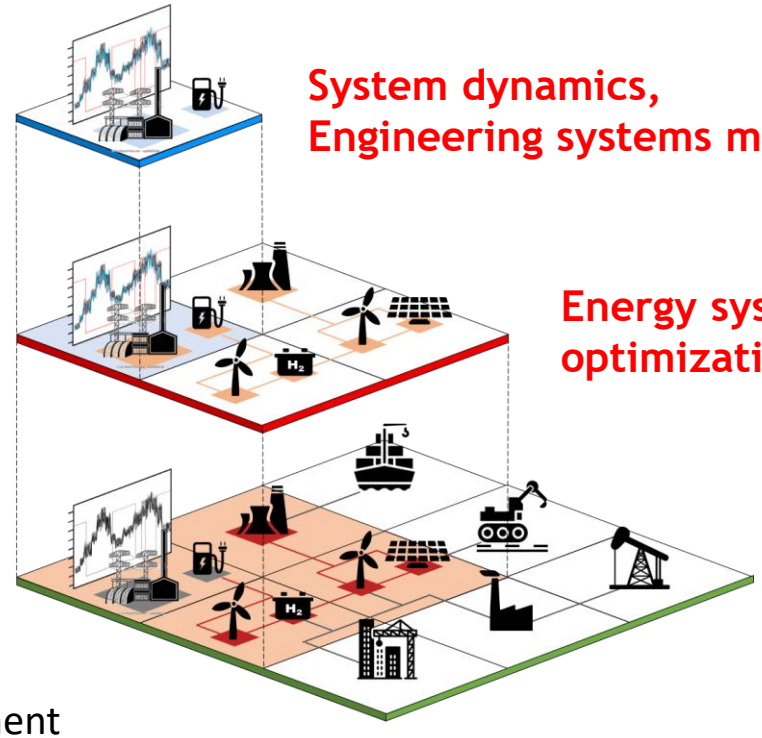
Safety ventilation and HVAC systems design

- The course is aimed at providing the knowledge and the tools needed to design an HVAC system

ENERGY FOR DEVELOPMENT | TOPICS

Agenda 2030 – Goal 7

- Affordable and Clean Energy for All
- Energy is key in achieving socio-economic development



System dynamics, Engineering systems models,

Energy systems optimization models

Industrial-Ecology models, LCA

How to…

- **reach** Goal 7 without hindering the others?
- **model** the evolution of energy systems at local/national scales?
- **measure** the environmental/economic impact of energy transition?

ENERGY FOR DEVELOPMENT | SPECIALIZATION COURSES

Thermoeconomics and Energy modeling

- Fundamentals of cost accounting and Thermoeconomics;
- National energy statistics and energy balances;
- Modelling energy supply chains at national scale in future scenarios;

Energy Accounting and Impact Assessment Methods

- Principles and practice in Quantitative Impact Assessment methods
- Life Cycle Assessment, Industrial Ecology methods

Engineering and cooperation for development

- Project Cycle Management applied to development projects and contexts
- Energy systems planning and modelling at local scale (villages, districts, stand-alone systems)

Development economics

- Principles of development economics are key to understand the global challenges of development

RENEWABLES AND ENVIRONMENTAL SUSTAINABILITY
THE PIACENZA CAMPUS

- Very **well-connected** to Milano
- Limited number of **Students per Teacher** → teaching on a human scale
- Strong **internationalisation** → more than 50% foreign students
- Strong collaboration with **leading energy companies and the nearby lab (LEAP)** → possibilities for MSc Thesis

Courses cover both energy technologies and advanced analysis/optimization methods, including computer-aided tools:

- **Energy engineering courses** as “Bioenergy and Waste-to-Energy Technologies” and “Renewable Energy” and “Low Carbon Technologies”
- **Electric engineering courses as** “Electric Conversion of Renewable Energy Sources” and “Smart Grids and Regulation for Renewable Energy Sources”
- **Environmental engineering courses** as “Air Pollution and Control Engineering” and “Industrial Ecology”
- **Computer lab courses** as “Energy Systems Optimization”, “Machine Learning based modelling for thermal systems” and “Smart Grids Operation for Net Zero Power Systems”

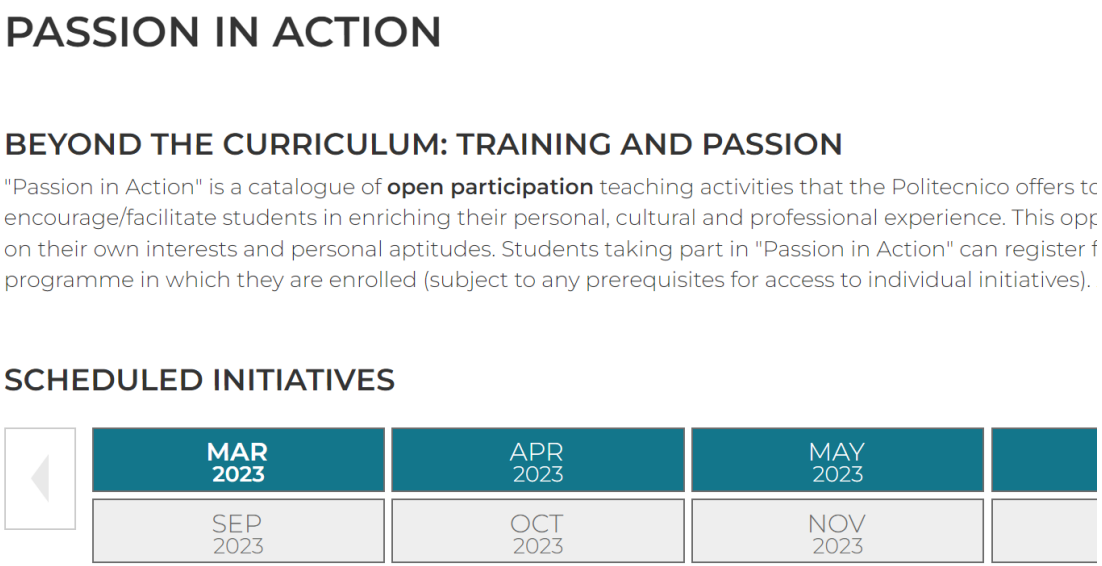
PASSION IN ACTION (PIA)

Passion in Action is a catalogue of open participation teaching activities that Politecnico offers to students to support the development of transversal, soft, and social skills and to encourage/facilitate students in enriching their personal, cultural, and professional experience.

- A range of subjects can be chosen, depending on personal interests and aptitudes.
- A range of activities can be picked: short courses on transversal tools and methodologies; design activities on multidisciplinary areas; group work projects in cooperation with companies; hackathons and students' competitions.

Find out more on the Politecnico Website:

https://www.polimi.it/formazione/passion-in-action



Extra-curricular activities will be tracked in the students' career in the diploma supplement and by an electronic badge.

POLIMI AMBASSADORS

Politecnico di Milano has activated high-level training courses aimed at creating new professional figures, the Polimi Ambassador in **Green Technologies**, **Smart Infrastructures**, **Inclusivity Design,** and **Creative Thinking** which:

- have skills in specific areas consistently with the training project
- acquire digital enabling technologies in line with the profile
- master interdisciplinary tools, methods, and aptitude for a systemic vision
- develop talent to operate in interdisciplinary and multisectoral contexts, acquired through exposure, even in teams, to case studies and challenges

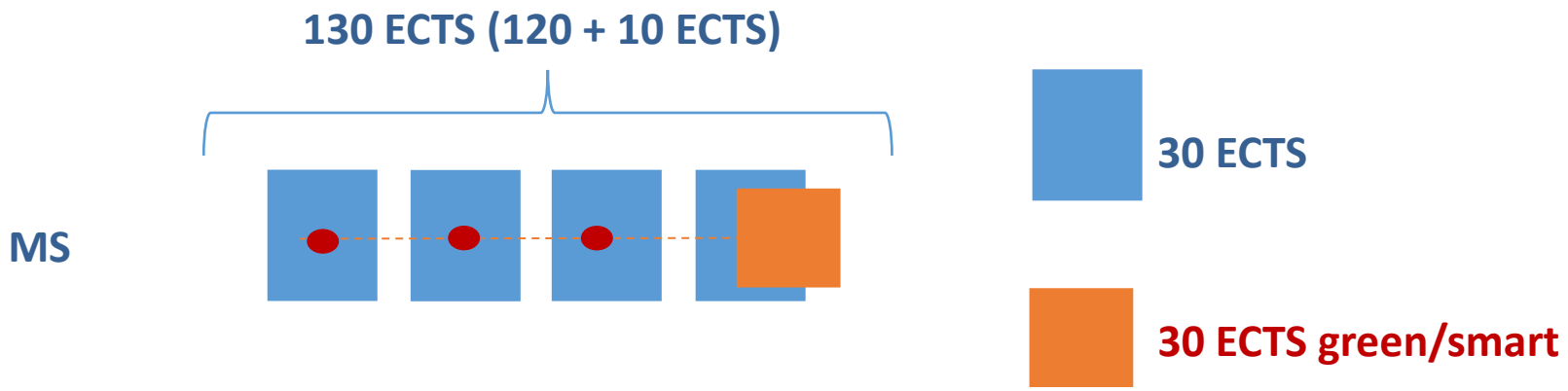
POLIMI AMBASSADOR GREEN TECHNOLOGIES

POLIMI AMBASSADOR SMART INFRASTRUCTURES

To find out more, visit the Politecnico Website:

https://www.polimi.it/formazione/percorsi-di-alta-formazione/programmi-polimi-ambassador

POLIMI AMBASSADORS



30 ECTS green/smart =

≈10 ECTS Vertical Courses (topics characterizing the DP of context)	+	≈ 20 ECTS Transversal Courses (topics different from the ones characterizing the DP of context)

Honours Programme *"Scientific Research in Industrial Engineering – Energy"*

- This programme falls within the strategy for ***high level training*** of Politecnico di Milano.
- It is intended for students with ***high predisposition to studies and research*** and aims at improving the students' skills in order to train engineers devoted to science and technological research.
- The programme is structured through the ordinary Course in Energy Engineering and gives the opportunity of ***deepening some subjects*** from the point of view of both methodology and contents, under the ***supervision of a reference professor***.
- For this purpose the programme foresees ***additional training activities*** in several disciplines and within the MSc Thesis for a total of ***20 additional credits***.
- The title of the programme will be ***officially reported in the transcript of records*** together with the description of the conducted activities.

To find out more, visit the Politecnico Website:

https://www.ccs-energetica.polimi.it/it/honours-programme/

Enhance Program - *European Universities of Technology Alliance*

Association of seven renowned Universities of Technology

Chalmers University of Technology (Sweden)

Norwegian University of Science and Technology (Norway)

Politecnico di Milano (Italy)

RWTH Aachen (Germany)

Technische Universität Berlin (Germany)

Universitat Politècnica de València (Spain)

Warsaw University of Technology (Poland)

To find out more, visit the Politecnico Website:

https://www.polimi.it/il-politecnico/network-internazionali/enhance

OCCUPATIONAL SURVEY: AFTER 1 YEAR FROM GRADUATION

Italian students (data 2024)

Working in Italy: 91%

229 Italian students obtained the Master's degree in Energy Engineering. Total respondents to the annual employment survey were 170.

EMPLOYMENT RATE*

* calculated on employed, unemployed, looking for first job

WITHIN 6 MONTHS*

* percentage calculated on those employed 1 year after graduation

NET MONTHLY SALARY

€2,118

(dev.st. 604)

EMPLOYMENT STATUS

- **96%** Employee
- **4%** Self-employed

CONTRACT TYPE*

- **78%** Permanent
- **8%** Fixed-term
- **12%** Apprenticeship
- **2%** Other*

* Project-based; occasional collaboration

COMPANY SIZE*

- **48%** 1-250
- **16%** 251-1.000
- **36%** > 1000

* number of employees

WHERE THEY WORK

9% Italian graduates working abroad

TOP 3 SECTORS

46% Energy
7% Mechanics and Installation
6% Oil&gas

TOP 3 AREAS OF EXPERTISE

49% Design
29% Research and Development
24% Planning

SATISFIED WITH SPECIFIC DEGREE: 89%

JOB THAT FITS WITH THEIR STUDIES: 93%

SATISFIED WITH CURRENT WORK: 89%

International students (data 2024)

Working Abroad: 61%

69 International students obtained the Master's degree in Energy Engineering. Total respondents to the annual employment survey were 49.

EMPLOYMENT RATE*

* calculated on employed, unemployed, looking for first job

WITHIN 6 MONTHS*

* percentage calculated on those employed 1 year after graduation

NET MONTHLY SALARY

€2,524

(dev.st. 849)

EMPLOYMENT STATUS

- **100%** Employee

CONTRACT TYPE*

- **76%** Permanent
- **12%** Fixed-term
- **9%** Apprenticeship
- **3%** Other*

COMPANY SIZE*

- **55%** 1-250
- **21%** 251-1.000
- **24%** > 1000

* number of employees

WHERE THEY WORK

39% International graduates working in Italy

TOP 2 SECTORS

38% Energy
10% Automotive

TOP 4 AREAS OF EXPERTISE

53% Research and Development
38% Design
25% Planning and Control
22% Planning

SATISFIED WITH SPECIFIC DEGREE: 85%

JOB THAT FITS WITH THEIR STUDIES: 97%

SATISFIED WITH CURRENT WORK: 94%

ADMISSION CRITERIA

Students with a BSc from an Italian University

CFU-weighted average score ≥ SC

- **Admission Threshold**
  - ***S***: basic threshold
  - ***N***: number of years from the first enrollment

$$SC = S + \frac{N-3}{2}$$

- **AES, ENG, IPI, MEC Engineering POLIMI** — S = 21
  - *Supplementary subjects for BSc professional tracks*
- **Energy Engineering from other Universities** — S = 24
  - *Supplementary subjects according to the Minimum Requisites Tables*
- **Any Engineering POLIMI or other Universities** — S = 25
  - *Supplementary subjects according to the Minimum Requisites Tables*
- **BSc other than Engineering** — S = 27
  - *Supplementary subjects according to the Minimum Requisites Tables*

CONTACTS

Website: www.ccs-energetica.polimi.it

Teaching rules: https://www.polimi.it/formazione/corsi-di-laurea-magistrale/dettaglio-corso/energy-engineering-ingegneria-energetica

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