Ordine degli Ingegneri della Provincia di Roma

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Energy Efficiency in Italian Buildings: disruptive NZEB versus traditional constructions for decarbonization

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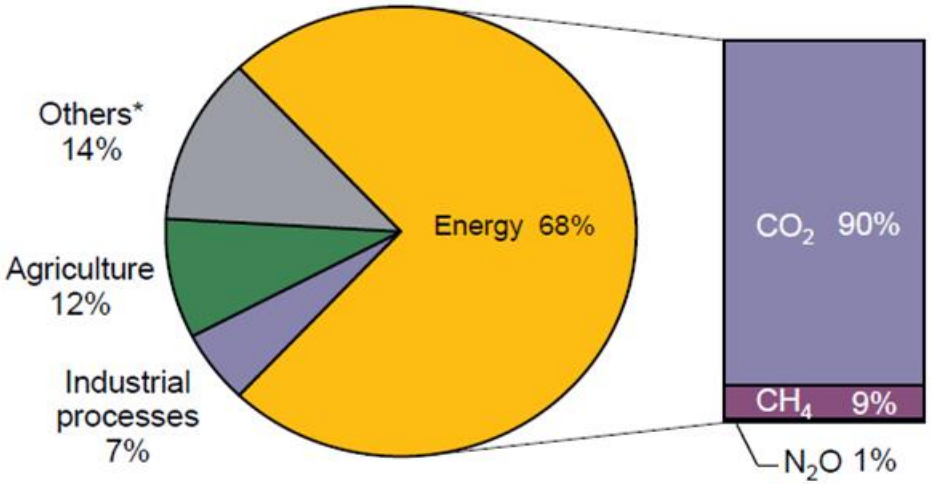
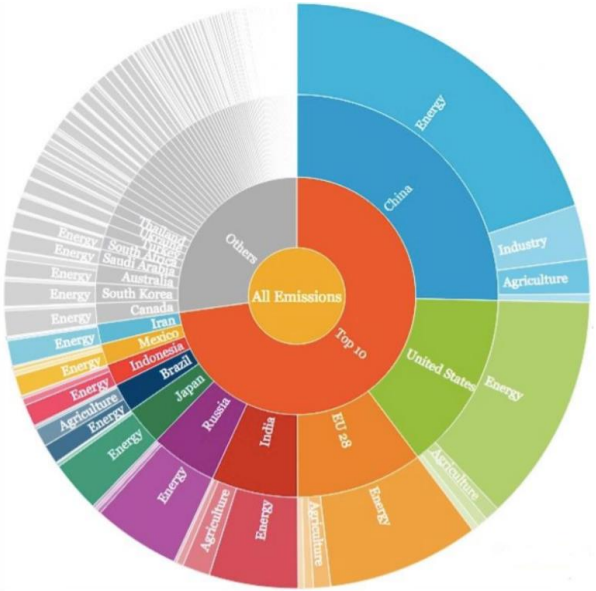
Global Action on Climate Change: Global greenhouse gas emissions

Why we are speaking about energy?
Energy has a key role in Economic Growth and among the many human activities that produce greenhouse gases, energy use is by far the largest source of CO_2 emissions.
Climate scientists have observed a progressive increase of CO_2 in the atmosphere by about 40% compared to the pre-industrial era.





As we can see, in this figure more interesting in Climate DATA Explorer interactive chart, the Europe in 2017 is in the top ten energy-emitting countries, registering a percentage of 8%.
World resource Institute

ENERGY CONTEXT

Together with the Kyoto Protocol, the United Nations Framework Convention on Climate Change provided the main impetus for the 2007 launch of the Climate-Energy Package with challenging goals for 2020.
The European Union has taken a leading role on a global scale in the fight against global warming, concentrating the interventions useful for achieving the objectives set, on three directions: development of renewable sources, increase in energy efficiency and innovation in industrial processes.
Buildings are key to a secure and **sustainable energy system** because their design, construction, operation, and the activities in buildings are significant contributors to energy-related challenges.

Decarbonizating buildings for energy security and sustainability Why?

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Energy Strategies: Time Line

1997
Kyoto Protocol
COP 3

greenhouse gas emissions reduction by 2012 by 5.2% compared to 1990

2007
Energy Policy Package 2020

- 20% cut in greenhouse gas emissions compared to 1990;
- 20% of the energy requirement derived from renewable sources
- 20% improvement in energy efficiency

2014
2030 climate & energy framework

- reduction of greenhouse gas emissions by at least 40% compared to 1990
- at least 27% of renewable energy
- an improvement of at least 27% in energy efficiency

Energy Strategies: Time Line

2015

COP21 - Paris Climate Conference 2015

- avoid dangerous climate change by limiting global warming to well below 1.5 ºC compared to the pre-industrial era by 2050

2018

Clean energy for all Europeans package

- 40% cut in greenhouse gas emissions compared to 1990 levels
- at least 32% share of renewable energy consumption, with upward revisions clause for 2023
- indicative targets for energy efficiency at EU level at least 32.5%, following on from the existing 20% target for 2020

Target!

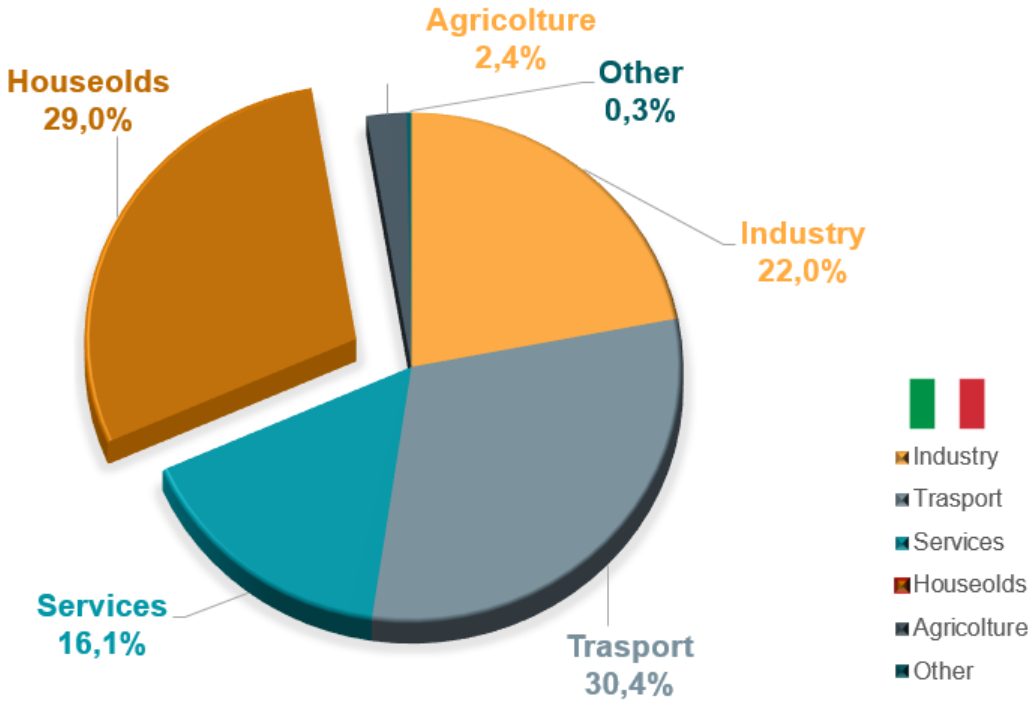
Final energy consumption by sector

DATA

From an analysis of Eurostat data, which looks at the end uses of energy by sector, shows that similar as the EU data, in Italy in 2017 the transport and residential sectors (34.60 and 32.90 TOE respectively) are those with the highest consumption .
Respectively 30.4% and 29.0%.

TARGETS

So the increase in energy efficiency in buildings and the transition to almost zero energy buildings is a priority to effectively combat Europe's energy security concerns and limit the environmental degradation associated with the consumption of fossil fuels.



% of total, based on tonnes of oil equivalent Source: Eurostat (nrg_bal_s)

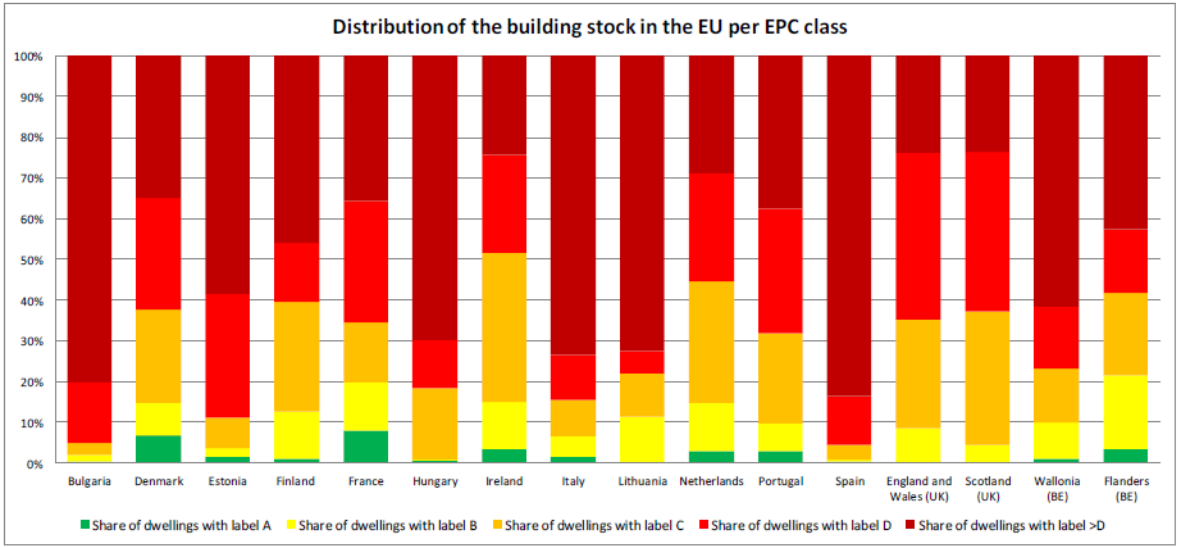
Decarbonizing Buildings: Energy Performance Data

DATA

An analysis of data for 16 countries/regions, covering 66% of the European total floor area, shows that over 97% of the building stock must be upgraded to comply with the 2050 decarbonisation vision.

TARGETS

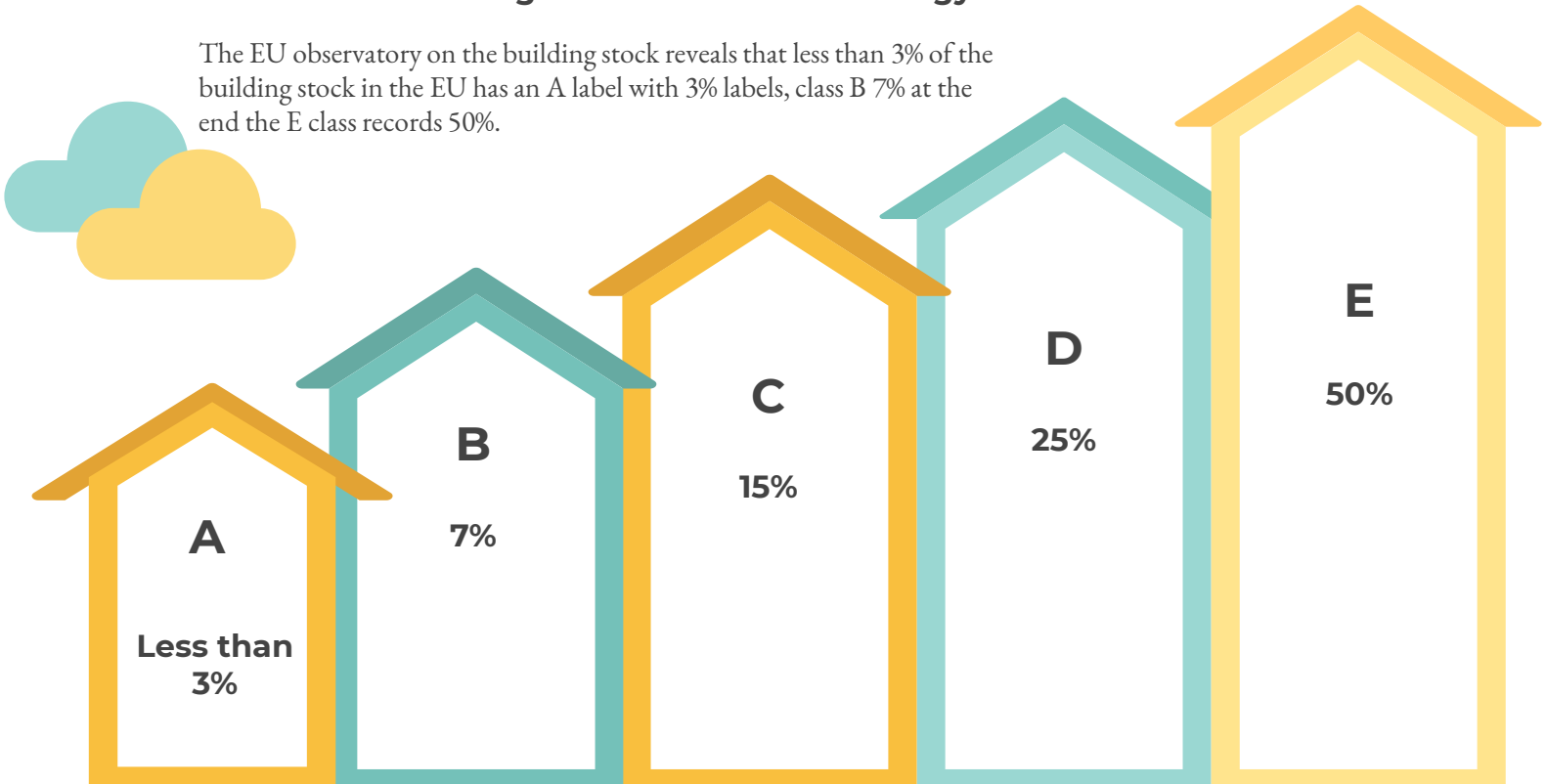
97% of buildings in the EU need to be upgraded, according National Energy Performance Certificate Data, assuming that buildings before 1990 are inefficient.



Energy performance certificate from the EU building Stock Observaory
Buildings Performance Institute Europe

Distribution of the building stock in the EU for Energy Performance Certificate class

The EU observatory on the building stock reveals that less than 3% of the building stock in the EU has an A label with 3% labels, class B 7% at the end the E class records 50%.



Driver for energy savings

In order to achieve the objectives set, the Commission and the European Parliament have issued directives concerning energy efficiency and products related to the use of energy, which are the drivers of energy policy. These Directives have been implemented in Italy through Legislative Decrees.

Energy Efficiency

• **Directive 2006/32 / EC** **EFFICIENCY OF THE END OF ENERGY USES**	**D. Lgs. 115** 30 MAGGIO 2008
• **Directive 2009/28 / EC** **ON THE PROMOTION OF THE USE OF ENERGY FROM RENEWABLE SOURCES**	**D. Lgs. 28** 3 MARZO 2011
• **Directive 2012/27 / EU** **ENERGY EFFICIENCY** **Updated with Directive 2018/2008 / EU** **21 DECEMBER 2018**	**D. Lgs. 102** 4 LUGLIO 2014 Agg. D. Lgs. 141 18 LUGLIO 2016
• **Directive 2010/31 / EU (EPBD)** **ENERGY PERFORMANCE IN THE BUILDING UPDATED with Directive 2018/844 EU19 JUNE 2018**	**D. Lgs. 63** **4 GIUGNO 2013** Convertito con la LEGGE 3 agosto 2013, n. 90

The Directive 2010/31/EU on energy performance in buildings is the main legislative instrument at EU level for improving the energy efficiency of European buildings. A fundamental element of the EPBD directive is represented by the almost zero energy buildings NZEB requirements.

Incentive Mechanisms

In correlation with specific indications of European directives and regulations, the Italian legal system provides for various planning and guidance tools on energy matters.

PAE 07/2017, prepared on the proposal of ENEA pursuant to Article 17, paragraph 1 of Legislative Decree 102/2014, following a brief reference to the energy efficiency targets set by Italy in 2020, illustrates the main measures implemented and in the pipeline to achieve the energy efficiency targets for 2020 and the results achieved in 2016.

The incentive measures, listed below, are used in Italy to increase nearly zero-energy buildings and are contains in PANZEB /Attachment 2 of the PAEE - The, approved by interministerial decree on 19 June 2017 National action plan):

- The "**Conto Termico 2.0**" for Public Administration buildings.
- **Tax deductions** for the energy requalification of the building heritage.
- The **Structural Funds**: 2007-2013 programming and 2014-2020 programming (FESR European Regional Development Fund).
- The **National Energy Efficiency Fund**, aimed at supporting interventions carried out by the Public Administration, ESCos and companies.
- The **Fund for energy efficiency in school buildings** (Kyoto Fund).
- **Fund for the purchase and /or renovation of real estate** (Casa Plafond)

Design Method

What is an NZEB?

building with very high energy performance, determined in accordance with Annex I. The very low or almost zero energy requirement should be covered very significantly by energy from renewable sources, including energy from renewable sources produced locally or nearby.

In Italy a "nearly zero energy building" whether new or existing, will meet the following technical requirements defined by law and technical standards:

energy performance indexes calculated according to the values of the minimum requirements established by the Ministerial Decree of 26 June 2015 with reference to the UNI 11300 standards

obligations to integrate renewable sources in compliance with the minimum principles set out in Annex 3, paragraph 1, letter c) of the legislative decree 3 March 2011, n. 28.

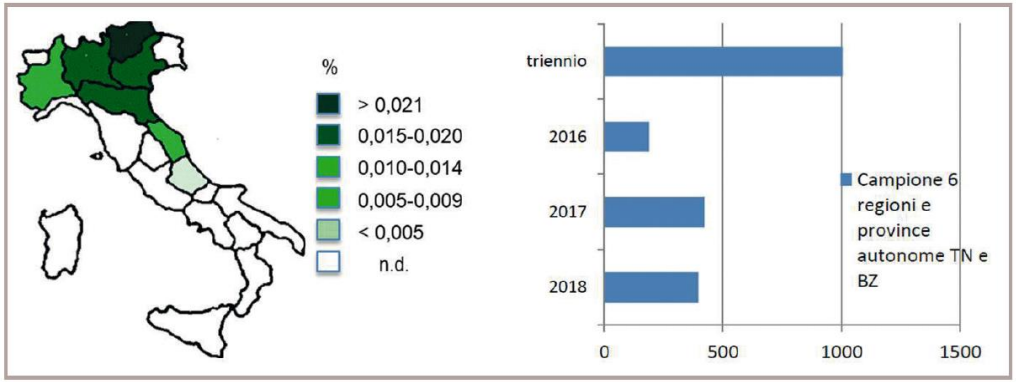
Report NZEB in Italy

The obligation to possess the energy characteristics of nearly zero-energy buildings start from January 2019 for the public sector and from January 2021 for all other sectors (Decree n. 63 of 2013).

In northen Italy the obligation was anticipated, and so for this reason we can see more concentration of this type of buildings:

- in Lombardy the NZEB obligation was brought forward to January 2016,
- in Emilia Romagna at 2017, for the public, and at 2019 for others
- in the province of Bolzano, starting from 1 January 2015, the new buildings must have a minimum energy class CasaClimaA

But there are only a tiny number of NZEB buildings in Italy as we can see in the figure below.



Distribution of nZEB buildings on total buildings at regional level
Number of NZEB buildings in 6 regions and Provinces TN and BZ
Data as of 06.30.2018
(Source: ENEA - National Observatory NZEB: monitoring of nearly zero-energy buildings)

CASE STUDY

Renovation Villa Castelli

	ANTE OPERAM	POST OPERAM
gross surface area	1.270 m^2	1.270 m^2
global transmission	Um = 1,85 W/(m^2K)	Um = 0,22 W/(m^2K)
Energy Consumptions	239 kWh/(m^2a)	18 kWh/(m^2a)
Energy Label	G	A

A significant example of NZEB applicability is a Casaclima R in Bellano, a building of historical interest converted into a nearly zero-energy buildings, preserving its artistic and architectural peculiarities: Energy requirement from 230 kWh/m2 per year to 15 kWh/m2 per year, 87% savings on global consumptions.

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Renovation Villa Castelli: technical solutions

INNOVATION
The innovative approach of this project has made it completely independent of conventional energy sourceste

SYSTEMS
the building has an energy requirement covered by renewable sources

SUSTAINABILITY
Great attention was paid to the choice of materials

01

HEAT PUMP
A heat pump connected to geothermal probes allows the heat contained in the soil to be exploited during the winter season. Furthermore, through the geothermal probes soft cooling guarantees a very high indoor comfort even in summer.

02

PV
The photovoltaic system installed in the roof covers the entire consumption for heating, cooling, domestic hot water, condominium services (elevators, lighting etc.), as well as part of the electricity consumption of each individual user.

03

FRAMES AND FIXTURES
it was preferred to use wooden windows rather than PVC windows.

04

THERMAL COAT
In particular, the external coat on the façade was made with 20cm of hemp fiber, a recyclable natural product for other uses after disposal.

CASE STUDY

New Building: Aurum

Project Data

gross surface area	1375 m2
Costs	1327 €/m2
Emissioni di CO2 emissions per year	2 kg/m2, a
Energy Consumptions	14 kWh/m2, a

High energy performance can be achieved especially in the creation of new buildings, adopting new design methods and using plant solutions with sustainable and high-performance technologies. By way of example, the Aurum building (BZ), certified by the seal "Casaclima A nature" has an energy requirement for heating of 14 kWh/m2 per year, which is covered entirely by renewable sources.

New Building Aurum: technical solutions

INNOVATION

The innovative approach of this project has made it completely independent of conventional energy sources. Hot and cold are extracted from the earth through a system of geothermal probes, while the sun's energy is transformed by solar panels into electricity, so that the energy balance of the building is equal to zero.

SYSTEMS

Sustainability of materials, but also an energy balance equal to zero, are two strong points in the design of Aurum. In fact, the building has a heating energy requirement of 14 kWh / m2 per year, which is covered entirely by renewable sources.

SUSTAINABILITY

The materials used were chosen to reduce the ecological impact of the building and ensure a healthy environment inside.

01

HEAT PUMP

A heat pump connected to geothermal probes allows the heat contained in the soil to be exploited during the winter season. Furthermore, through the geothermal probes soft cooling guarantees a very high indoor comfort even in summer.

02

PV

The photovoltaic system installed in the roof covers the entire consumption for heating, cooling, domestic hot water, condominium services (elevators, lighting etc.), as well as part of the electricity consumption of each individual user

03

MECHANICAL VENTILATION

The mechanical ventilation system ensures, instead, a constant air exchange through an automated system with CO2 sensor. Furthermore, through the heat recuperator, the air leaving the building heats the clean air for the ventilation of the premises.

04

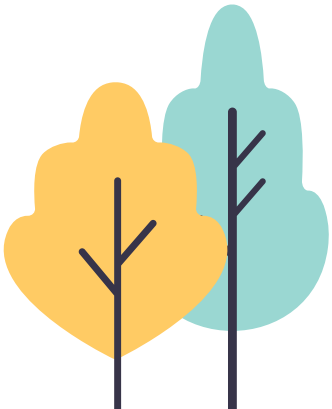
MATERIALS

Aurum is among the first interventions in Europe where hemp fiber has been used for such a large surface. Hemp fiber offers excellent winter and summer protection with very low environmental impact, guaranteeing extremely high acoustic performance.

CONCLUSIONS

In the end what could be good proposals?

- **New measures** need to be put in place to increase NZEB like:
  - the promotion of a volume discount;
  - other national incentives which can be combined with other types of financing.
- **The creation of a transparent** and comprehensive **national database** of individual building data.



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THANKS

Does anyone have any questions?

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