



FROM ZERO TO HERO

Wise Energy Use Volunteering Scheme for Youngster

ITALY – National Report

Author: CIAPE – Italian Centre for Permanent Learning



Funded by the
Erasmus+ Programme
of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

1	Preface	5
2	List of Symbols and Abbreviations	6
3	Introduction	7
3.1	GENERAL OVERVIEW ON CLIMATE CHANGE AND ENERGY ISSUES IN ITALY	7
3.2	DEFINITION OF PHYSICAL CONTEXT	8
4	National Situation of Energy and Built Environment	12
4.1	ENERGY SUPPLY AND CONSUMPTION	12
4.2	GENERAL DEFINITIONS ON ENERGY AND BUILT ENVIRONMENT ISSUES	13
4.3	IDENTIFICATION OF THE PROBLEMS	15
4.4	ENVIRONMENTAL FRIENDLY (ENERGY EFFICIENT) BUILDING APPROACHES	21
4.5	WHAT CAN ITALY WIN WITH ZEB?	24
5	Overall National Energy Efficiency Policy and Strategy	27
5.1	PRIMARY ENERGY SOURCES AND SUSTAINABLE ENERGY SUPPLY SAFETY	27
5.2	LEGISLATIONS AND REGULATIONS REGARDING BUILDING ENERGY PERFORMANCE	31
5.3	REGULATORY FRAMEWORKS: LAWS, REGULATIONS AND PERFORMANCE STANDARDS REGARDING ENERGY PERFORMANCE	34
5.4	INSTITUTIONAL FRAMEWORKS	37
6	Knowledge and Awareness in the Country	42
6.1	EDUCATIONAL POTENTIALS, ACTIVITIES AND CURRICULUM ON ENERGY AND ENERGY EFFICIENCY IN BUILT ENVIRONMENTS	42
6.2	SURVEY RESULTS SHOWING THE AWARENESS LEVEL OF YOUNG PEOPLE	44
6.3	AVAILABLE TECHNICAL/CONCEPTUAL BACKGROUND	55
6.4	EVALUATION OF SURVEY RESULTS	62
7	Conclusions and Future Remarks.....	63
8	References	64



Co-funded by the
Erasmus+ Programme
of the European Union

1 PREFACE

The design, construction, operation, maintenance of buildings normally requires enormous amounts of energy, water and raw material and generating large quantities of waste cause air and water pollution. Whereas green buildings is the only answer through creating healthier and more resource efficient models of construction, renovation, operation and maintenance.

Green Architecture and sustainable buildings are considered a modern trend in architectural thinking which manipulates the relationship between the building and the environment.

So it's very important for a construction professional to implement specific strategies in order to decrease energy consumption especially in this type of buildings, by using renewable energy sources such as solar energy, wind energy and other sources which contribute in electric energy rationalization.

But more important is to improve the awareness of young people to Zero Energy Buildings among youngsters and "[From Zero to Hero: Wise Energy Use Volunteering Scheme for Youngster Project](#)" will empower young people actively learn and understand the energy efficient building approaches through different types of non-formal learning environments.

This National report, include the description of ZEBs researches, implementations, related literature to put forward state of current knowledge in Italy. It also represents the bases for further development of the other intellectual outputs of the projects, to improve the development of teaching and learning materials and to enhance accessibility and transparency of current literature review.



Co-funded by the
Erasmus+ Programme
of the European Union

2 LIST OF SYMBOLS AND ABBREVIATIONS

- AIEE (Italian Energy Economists Association)
- AESS (Energy and Sustainable Development Agency)
- CNR (National Research Council)
- ENEA (Italian National Agency for Energy Efficiency)
- ENEL (Ente nazionale per l'energia elettrica)
- ENS (Energy National Strategy)
- EPBD (Energy Performance of Buildings Directive)
- GDP (Gross Domestic Product)
- GHG (Greenhouse Gases)
- GW (gigawatt)
- IAEE (International Association for Energy Economics)
- IPCC (Intergovernmental Panel on Climate Change)
- ISAC (Institute of Atmospheric Sciences and Climate)
- ISPRA (Italian Institute for Environmental Protection and Research)
- NES (National Energy Strategy)
- PAESC (Action Plan for Sustainable Energy and Climate)
- RES (Renewable Energy Sources)
- SMEs (Small and Medium Enterprises)
- TWh (terawattora)
- ZEB or ZEBs (Zero Energy Buildings and/or Zero Emission Buildings)
- WEC (World Energy Council)
- WMO (World Meteorological Organization)



Co-funded by the
Erasmus+ Programme
of the European Union

3 INTRODUCTION

3.1 General Overview on Climate Change and Energy Issues in Italy

Mitigation and adaptation to climate change are key challenges of the 21st century. Underlying these challenges is the issue of energy or, more precisely, the overall energy consumption and our dependence on fossil fuels. In order to limit global warming, the world urgently needs to use energy efficiently, using clean energy sources to get things moving, heating and cooling. European Union policies play an important role in favor of this transition.

The debate on the energy issue, on the one hand, and the issue of climate change, on the other, have been based, for a long time, on apparently non-convergent arguments. Energy and climate have appeared terms that are difficult to combine in a positive way. These are, in fact, two aspects of the same question, which cannot be effectively addressed, if considered separately from one another. In early 2007, Europe explicitly took note of this new approach to the energy and environmental issues.

The growing demand for fossil fuels worldwide and increased competition on the markets are likely to penalize Italy, which is poor in raw materials. The fuel mix used in Italy for electricity generation has gradually become unbalanced towards natural gas: today we are the country that, proportionately, uses more natural gas for its own energy needs than all other European countries.

Regarding the availability of "national" resources and dependence on imports, Italy already today imports practically the entire quantity of coal it uses, as well as a very large percentage of its oil and gas needs.

To the criticalities deriving from the particular fuel mix used in Italy, expensive and excessively dependent on gas, the infrastructural system in part inadequate to the progressive evolution of the demand has to be taken into account, especially as regards the gas transportation and storage system.



Co-funded by the
Erasmus+ Programme
of the European Union

3.2 Definition of Physical Context

Italy is a peninsula located in the south of Europe into the centre of the Mediterranean Area. It extends in latitude from 47° N to 36° N. The great extension in latitude makes the climatic characteristics really varied: moreover the country also presents a complex orography, characterized by the presence of the Apennines and the Alps that contribute to influence the path of the perturbations and interact with the prevailing winds, exposing more or less a sector to a certain type of circulation, without forgetting the mitigating action of the Mediterranean Sea. Making a general discussion, Italy is included in a temperate zone with a Mediterranean climate; however, it is possible to divide Italy in more sectors with similar climatic characteristics: these are macro sectors; obviously, even within these portions there are sub-units with their own climatic peculiarities. The main climatic areas of the Italic Peninsula are: the Alpine Region, the Po Valley and the Upper Adriatic, the Middle Adriatic, the Ligurian-Tyrrhenian side, the Apennine Area and the Mediterranean Region.

- The **Alpine Region** includes Valle d'Aosta, Trentino Alto Adige, and the mountainous areas of Piedmont, Veneto, Lombardy and Friuli Venezia Giulia. The alpine climate is conditioned by the altitude and is due to the cold temperate, which becomes snowy at heights higher than 2700-2800 m. The Alps and the Pre-Alps show high rainfall with peaks of 3000 mm on the eastern sector, best exposed to Atlantic perturbations. Anyway, there are isolated events that do not change the general attributes of the Alpine climate. The Foehn and Stau winds are typical of the Alps: the first blows in the leeward slopes, the second in the windward ones. The Italian side of the Alps is affected by the Foehn when the currents come from the North. The Foehn causes abrupt temperature relief, snow melting and high avalanche risk.
- The **Po Valley and the Upper Adriatic** can be comparable to the cool continental temperate climate. In fact, the salient feature of this Italian climate zone is a marked seasonal excursion, with maximums that often exceed the 30°C in winter and minimum winter temperatures that often fall below zero. The rains



Co-funded by the
Erasmus+ Programme
of the European Union

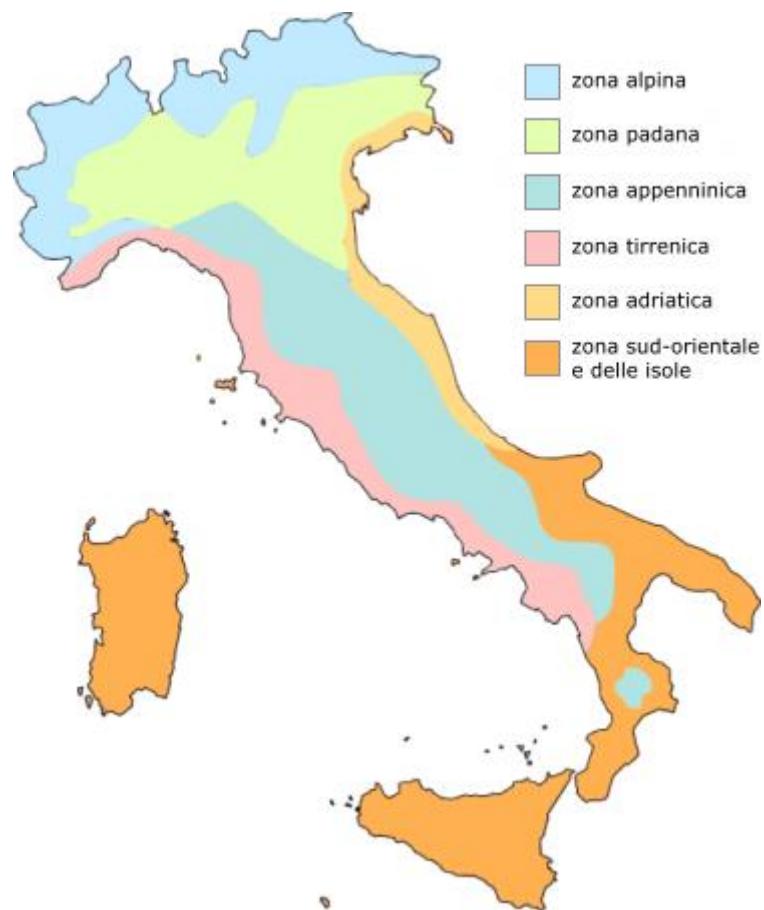
are not heavy and are between 600 and 800 mm with more frequency in Autumn and Spring.

- The **Middle Adriatic** has Mediterranean characters, but with continental elements dictated by the limited mitigating influence of the Adriatic Sea and by favourable exposure to currents from the North and East. Precipitations are not abundant and included between 600 and 700 mm. The rains are more frequent in Spring and Autumn with the latter being the wettest period of the year. Winter is not very rainy, however, during cold spells from the North-East, there may be brief cold spells with snow on the coasts.
- The **Ligurian-Tyrrhenian** side includes Liguria, the coastal sectors and the neighboring hinterland of Lazio, Tuscany and Campania. Even western Umbria, although with some continental elements, is affected by the mitigating action of the Tyrrhenian Sea. The latitude of these regions is much milder and more humid than in the Adriatic sector; this essentially for two factors; on the one hand the presence of the Apennines limits the effects of the currents from the North and East, preserving the western sectors from the influences of the continental Arctic air masses, on the other the Tyrrhenian Sea is a deep basin and with surface waters warm enough to mitigate in a sensitive way the climate that we can define Mediterranean, but with some elements of ocean climate. The wettest seasons of the year are Autumn and Spring. Summers are hot and dry with highs that often exceed 30° C. Winter snow especially on coastal areas is very rare and even very cold periods are generally very short.
- The **Apennine Region** includes the mountainous areas of Emilia Romagna, Tuscany, Lazio, Marche, Campania, Abruzzo, Molise, eastern Umbria and most of the Basilicata. The characteristics of this climatic area are determined by the altitude and are comparable with those of the fresh continental temperate zones with lower thermal values with increasing altitude. Winters are cold and snowy and hot summers in the basins, progressively cooler in altitude.
- The **Mediterranean Region** includes Calabria, coastal areas of Basilicata and Molise, Puglia, Sicily and Sardinia. These areas have a climate behavior similar



Co-funded by the
Erasmus+ Programme
of the European Union

to that of the Tyrrhenian belt, but with a marked accentuation of Mediterranean features and the appearance of some subtropical stretches in the inland areas of Sicily and Sardinia. The sea strongly influences the climatic parameters. Summers are dry and hot with temperatures that can exceed even 40° C during expansions of the African anticyclone, while winters are very rainy with precipitation having a predominantly inverted or temporal character. Snow on the coastal areas is very rare and often even in the winter months the highs on the coasts exceed 12° C.



Source: Gruppo Mineralogico Paleontologico Euganeo

According to some CNR-ISAC studies, the annual average temperatures in Italy have increased in the last two centuries by 1.7° C, but the most significant contribution to this increase has occurred in the last 50 years, for which the increase was around 1.4° C.

The average temperature increase recorded in Italy in the last few decades is higher than the global average (ISPRA, 2009).

Observations carried out on land and on the oceans show - as highlighted by the Fourth Assessment Report of the IPCC - that many natural systems are suffering from climate change on a regional scale, in particular the increase in temperature.

Climatic changes have not only influence on the physical and biological systems, but also on the socio-economic sectors that depend on the climatic conditions, and that already today are experiencing the consequences, such as in particular agriculture, fishing, tourism, energy and health.



Co-funded by the
Erasmus+ Programme
of the European Union

4 NATIONAL SITUATION OF ENERGY AND BUILT ENVIRONMENT

4.1 Energy Supply and Consumption

According to the 2017 Italian Electricity Report draft by Terna's¹ Statistical Office, the 2017 electricity requirement, equal to 320.5TWh (+ 2.0% on 2016), was satisfied for 88.2% by national production (282.8TWh: + 2.0% on 2016) and for the remaining portion from net imports from abroad (37.8TWh: + 2.0% on 2016).

Gross national production, equal to 295.8TWh, was covered for 70.8% by thermoelectric production which continues to record a positive increase (209.5TWh: + 5.0% compared to 2016), for 12.8 % from hydroelectric production (38.0TWh) which continues with a significant drop (-14.1% compared to 2016) and the remaining 16.3% from geothermal, wind and photovoltaic sources. The latter recorded a more than positive change of + 10.3% compared to last year: in 2016, for the first time, there was a decrease of -3.7% compared to 2015.

Electricity consumption, up 2.2% compared to 2016, stood at 301.9TWh.

In terms of installed capacity, as at 31 December 2017 the gross efficient generation power was 117.1GW, in line with the figure for last year, as the entry into operation of new plants, even small-scale thermoelectric plants, has offset the large divestitures in the traditional DC-connected power park. The capacity of renewable sources such as photovoltaic, wind and hydroelectric is increasing.

¹ Terna – Rete Elettrica Nazionale: is an operator managing electricity transmission networks based in Rome, Italy. Through Terna Rete Italia, it manages the National Transmission Grid with 74.442 km of high voltage power lines. It is the first independent operator in Europe for kilometers of lines managed.



Co-funded by the
Erasmus+ Programme
of the European Union



4.2 General Definitions on Energy and Built Environment Issues

In order to assess the energy performance of a building or part of it (therefore to certify them or assigning them a score) it is necessary to define a balance of their energy flows. This can be done not only to comply with the laws, but also to decide on improvements that are not yet regulated by the legislation.

The energy balance describes the quantitative analysis of energy flows within a defined system, highlighting how much and what kind of energy is consumed in a considered period and how it was produced, bought, transformed and consumed.

The energy balance of a building unit follows the following logic:

- INPUTS: everything that in terms of heating comes from outside and becomes well-being without energy costs (solar heating, natural light); any other internal heating sources at zero cost (for example heating radiating from another building unit). Calculations are made according to the climate zone tables.x
- LOSSES: everything that in terms of heat leaves the building through transmission (walls, roofs) or ventilation (windows, doors).

Placing as desired results a certain air temperature during the winter and a certain supply of hot water, it will be the subtracting of these flows (all the inputs minus all the losses) to determine the amount of heat and therefore energy that must be provided by facilities.

When consumption and contributions are known, the energy needs can be defined and it depends on different factors:

- Climate (position and orientation);
- Architectural features of the external structure;



Co-funded by the
Erasmus+ Programme
of the European Union

- Thermal characteristics of the external structure (materials, etc.);
- Free contributions (solar, etc.);
- More or less virtuous behavior of the inhabitants;
- Characteristics of the systems installed (type, maintenance, yields, etc.);

So, the heating requirements of a building is the difference between heat losses during the heating period and free inputs (solar and those from internal sources) in the same period.

The reasons for calculating the energy needs of a building can be different. Today is important to follow precise legal definitions in designing and building new buildings, as well as in reforming existing buildings that want to enjoy incentives and benefits from the Italian Government.

The legislation prescribes precise limits to the primary energy needs of a building with respect to the shape and size, the intended use, the climatic conditions. It also prescribes the Energy Certification, of which the calculation of energy needs is the basis. As already mentioned, the attention of the Italian legislator has focused so far on the problem of winter heating, not dictating any rules regarding other energy problems (cooling, electricity consumption).

However, the reasons for calculating energy flows may well exceed the need to comply with the "minimum requirements" of the law. There is great potential to improve the energy balance of the buildings in which people live, maintaining the same levels of comfort and often improving them. Therefore, the analysis of all the flows and their rationalization can well be considered the strategically most winning move for all levels of building intervention, from the design of a skyscraper to the modest intervention on apartments.



Co-funded by the
Erasmus+ Programme
of the European Union

4.3 Identification of the Problems

Effects of climate changes are defined as the effects of climate change on natural and human systems. The impacts generally refer to the effects on life, environment, health, ecosystems, economies, societies, cultures, services and infrastructures due to the interaction of climate change or dangerous climatic events verifying during a specific period of time with the vulnerability of a company or of an exposed system.

One of the ways cities can contribute to climate change mitigation is therefore to reduce energy consumption for the construction, maintenance and renovation of buildings. The retrofitting of existing buildings requires innovative and efficient technologies, it can at the same time provide important economic and employment opportunities, improve energy security, and save on energy bills those who are living or who use the buildings. And it can be used to better adapt to ongoing global warming.

To facilitate rapid efficiency of buildings, it is necessary to implement the legislation already in force, as well as a stable incentive framework, which provides certainty to the market and sector operators. But also a lot of innovation in materials and their use in building projects.

So, the greatest effects of climate change have repercussions on:

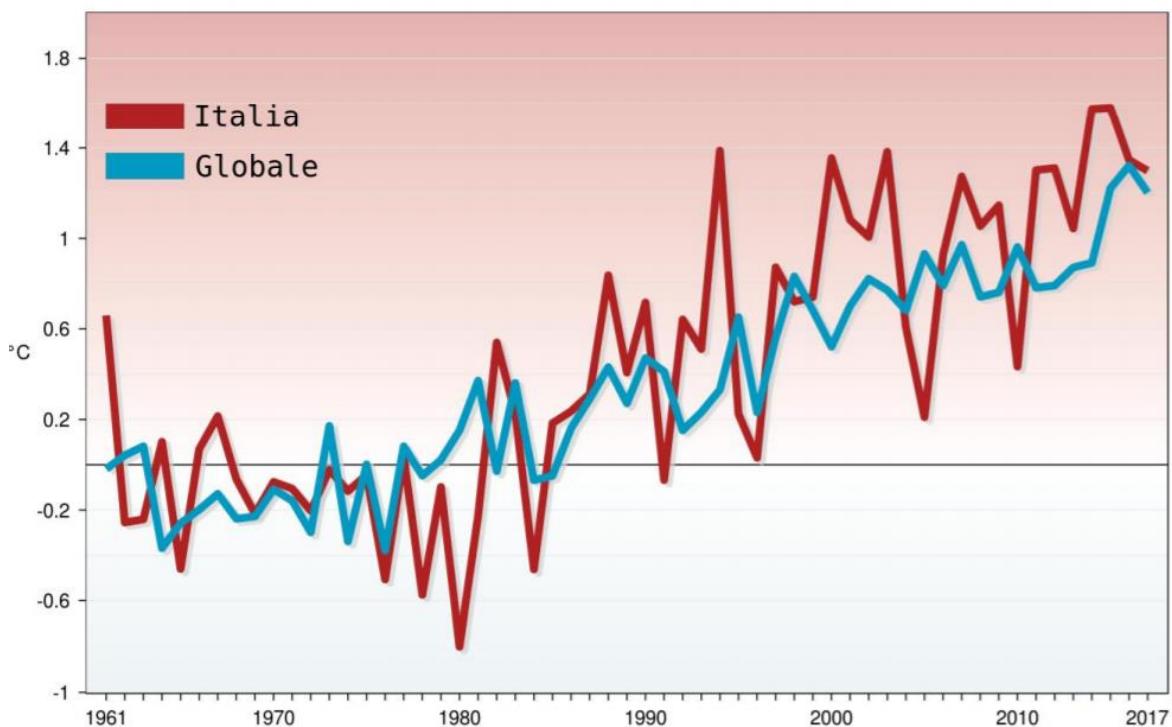
- human health
- productivity
- agriculture
- tourism
- energy demand
- infrastructures

In Italy, as well as in all Southern part of Europe, climate change is increasing extreme weather events such as heat waves, intense rainfall and coastal flooding, an expansion of new kind of disease vectors and are associated with a deterioration of air quality and risk of fires aggravated by drought.



Co-funded by the
Erasmus+ Programme
of the European Union

In July 2017, the Higher Institute for Environmental Protection and Research (Ispra) published the usual update of the "Climate indicators in Italy" report illustrating the trend over the year just ended and updates the estimate of climatic variations in recent decades. Compared to thirty years of reference (1961-1990), 2016 showed an increase in the average temperature of 1.35 ° C, slightly higher than the increase of + 1.31 ° C of the global one. Unlike the latter, which for the third consecutive year has set a new record, 2016 is the sixth warmest year in the Italian historical series, whose primacy was established in 2015.



Source: Series of global average temperature anomalies on land and in Italy, compared to values normal climatological 1961-1990. Sources: NCDC / NOAA and ISPRA. Processing: ISPRA

In Italy the most important natural phenomena linked to the climate in terms of the damages and consequences they cause are: river floods, hail, heavy rainfall, heat waves, air horns, lightning, landslides.



Co-funded by the
Erasmus+ Programme
of the European Union

All these phenomena are triggered by meteorological processes that depend on climatic conditions. When the weather conditions change, the frequency and intensity of these phenomena can change.

Consequently the risk associated with each of these events depends strictly on the climate and on its own change.

Because of these changes many natural phenomena related to the climate have consequently changed and the risk associated with them has increased. Floods for example, they represent a great risk for Italy. Current hydrogeological risk conditions in Italy are linked both to geological features, morphological and hydrographic features of the territory, both at the strong increase in urbanized, industrial and urban areas linear communication infrastructures. Moreover, this development has often occurred in the absence of a correct territorial planning with abusive rates. Today the number of inhabitants residing in areas at risk of floods and landslides exceeds 7 million (12% of the total), of which over 1 million live in areas of high and very high danger, and almost 6 million live in areas flooding classified as medium hydraulic hazard.

- RIVER FLOODS: River floods are floods caused by the flooding of water from natural beds. River floods are one of most dramatic natural calamities, in terms of impact on life and human works.
- HEAT WAVES: are extreme weather conditions occur during the summer season, characterized by high temperatures, above the usual values, which can last days or weeks. Even if the World Meteorological Organization - WMO², has not formulated a common definition of heat wave and, in several countries, the definition is based on exceeding values temperature threshold defined by identifying the highest values observed in the historical data series registered in a specific area.
In recent decades, a weather-climate situation associated with the waves of waves has come to Italy heat visible even from a general. In particular, in recent years there have been prolonged periods of poor difficulties that have led to emergency situations water in most of the national territory aggravating all previously already in a state of crisis.
- WHIRLWINDS: Within particular meteorological and environmental situations, a storm is contribute to produce a whirlwinds, a brief and local phenomenon but

² World Meteorological Organization: <https://public.wmo.int/en>



Co-funded by the
Erasmus+ Programme
of the European Union

intense and destructive, easily recognizable from the funnel-shaped cloud descends from the cumulonimbus towards the ground and capable of activating very high instantaneous wind intensities. When a similar vortex triggers on the surface of the sea, we speak of a “waterspout”, a phenomenon of an even shorter duration but at same time dangerous as it can reach the coast. The process of forming an whirlwinds is linked to particular atmospheric characteristics.

- LANDSLIDE: it is a "movement of a mass of rock, ground or detritus along a slope ". Landslides are widespread in Italy for the orographic conditions and the geological conformation of the territory. Causes that determine these processes of destabilization are multiple, complex and often combined between them. In addition to the amount of water, or of snow, also the deforestation and fires cause landslides: in wooded slopes, in fact, tree roots consolidate the soil and absorb water in excess. The Alpine and Apennine territories of the country, but also the coastal ones, are generally exposed at risk of landslides, due to the nature of the rocks and the slope, which they can give to a certain instability. In addition, the climatic characteristics and the annual precipitation distribution they contribute to increasing the vulnerability of the territory. Also the action of man on the territory can provoke landslide events. The intense transformation of the territories made by human activities often without criteria and respect of the environment (construction of buildings or roads at the foot of a slope or halfway up, of ski slopes, etc.) can cause subsidence of the ground.

The risk from natural disasters, and in particular from floods, can be reduced by using some practices.

First of all, knowledge is fundamental; know the potential for danger, the actual vulnerability and the exposure estimate. Risk mitigation takes place on all three components, using three words key: prevention, protection and planning.

According to the “Climate Change Adaptation Strategy”³, expected impacts of climate change and main vulnerabilities in Italy can be sum up in two approaches:

SOCIO-ECONOMIC PERSPECTIVE

- probable worsening of the already existing conditions of strong pressure on

³ Strategia Nazionale di Adattamento ai Cambiamenti Climatici:
http://www.pdc.minambiente.it/sites/default/files/allegati/Strategia_nazionale_adattamento_cambiamenti_climatici.pdf



Co-funded by the
Erasmus+ Programme
of the European Union

water resources, with a consequent reduction in terms of quality and availability of water, especially in summer in the southern regions and in the small islands where the ratio between alluvial aquifers and mountain areas is low;

- possible alterations of the hydro-geological regime that could increase the risk of landslides, mud flows and debris, rock collapses and flash floods. The most exposed areas to hydrogeological risk include the Po river valley (with an increased risk of flooding) and the Alpine and Apennine areas (with the risk of flash floods);
- possible soil degradation and higher risk of erosion and desertification of the land;
- greater risk of forest fires and droughts for Italian forests;
- greater risk of loss of biodiversity and natural ecosystems, especially in the alpine areas and mountain ecosystems;
- greater risk of flooding and erosion of coastal areas due to one higher incidence of extreme meteorological events and of raising the level of the sea;
- potential reduction of agricultural productivity especially for crops of wheat, but also fruit and vegetables;
- effects on human health, especially for vulnerable groups of population, due to a possible increase in disease and heat-related mortality, cardio-respiratory diseases from pollution, atmospheric conditions, injuries, deaths and diseases caused by floods and fires, allergic disorders and changes in the appearance and spread of diseases of origin infectious, water and food;
- potential damage to the Italian economy as a whole, mainly due the possibility of reduced hydroelectric energy production potential; to a reduced winter tourist offer (or more expensive) and less attractiveness tourist of the summer season; to a drop in productivity in the sector agriculture and fisheries; to effects on urban and rural infrastructures with possible interruptions or inaccessibility of the transport network with damage to the human settlements and socio-economic activities.

GEOSTRATEGIC PERSPECTIVE

- water resources and areas at risk of desertification;
- erosion and flooding of coastal areas and alteration of marine ecosystems;
- the Alpine region and mountain ecosystems, with the loss of glaciers and cover snow;
- health, well-being and safety of the population;
- areas subject to hydrogeological risk;
- hydrographic area of the river Po and the water catchment areas of the Apennine district;
- Central area where the large water regulation reservoirs are located.



Co-funded by the
Erasmus+ Programme
of the European Union

In order to reduce the phenomenon of heat waves, or particularly high local temperatures, it is necessary to use materials with high levels of reflection to solar radiation, both in public spaces and on the surfaces of private buildings. The use of technologies promoting the exploitation of renewable energy sources should also be encouraged, but above all the energy performance of the buildings in which we live and work must be improved, by acting on the building envelope and replacing heat generators with low performance and high emissions of pollutants. In order to reduce the environmental impact, improving the living conditions of the citizens, pedestrian areas and routes, the use of bicycles and bicycle paths, public transport, light and shared vehicles (scooters) must be promoted and extended and car sharing) and finally technologies with reduced local emissions.



Co-funded by the
Erasmus+ Programme
of the European Union

4.4 Environmental Friendly (Energy efficient) Building Approaches

In the last decades a new approach has come to light, the Green building concept. It refers to living and building in a "healthy" way to protect and preserve the environment. In fact, this approach to construction aims to reduce the environmental impact of buildings, which have always been considered destructive, as much as possible due to the consumption of materials and natural resources, and to the emissions produced.

It is, nowadays, easy to talk about bio-architecture and green building more and more often and it is easy to understand why. Buildings constructed with traditional techniques have in fact a strong negative impact on the environment and sometimes also on human health, therefore bio architecture represents a considerable step forward in this sense because it aims to give shape and quality to green buildings, fully meeting the demands of sustainability and environmental well-being. There are many advantages and potentials of this construction technique, but it is first of all important, how an ecological and sustainable material can be identified and what are the most commonly used ones.

Environment, health and energy saving are the three pillars on which bio-construction is based, which pursues respect for the relationship between man and nature. To do this, bio-architecture makes use of the choice of renewable resources, innovative techniques and natural materials, which are not harmful to the environment when designing and building a structure.

It is important to be aware on the advantages that the method of construction of green buildings offers, which are mainly two: the possibility of using resources (those our planet offers us) more efficiently, and of creating low houses energy consumption, which does not go to undermine the comforts of today's living. Green building can reduce household energy costs by about 50% and reduce the pollution produced by heating, lighting and even air conditioning, given the natural cooling that characterizes this type of building, thanks to the use of materials that facilitate the passage of hot and cold from the outside inside the house. It is therefore the winning technique to combat thermal bridges. The structures built in green building then have a greater seismic resistance and strong winds, since they oscillate but do not collapse and are firmly anchored; they also resist fire, because the wood burns only if it is thin and airy. And yes, they can also be beautiful to see.



Co-funded by the
Erasmus+ Programme
of the European Union

It is also essential to check that there are no negative geological factors in the soil where the new building will be built, so make sure it is far from sources of pollution and that there are no underground streams, fractures or geological faults. However, the geologist will have to study other factors including exposure to the sun, the direction of the winds and possible slopes of the ground. Eco-sustainable materials to use is one of the most discussed topics by professionals in step with the times, in fact they must be chosen with certain criteria, ensuring that they also meet different parameters, follow ecological criteria, such as:

- natural origin of the material or its components;
- availability in kind;
- material extraction process;
- energy expenditure that involves its processing;
- radioactivity, gas emission, toxicity of the material and its impact on the environment.

At the physical-chemical level the eco material should instead be evaluated according to:

- reaction to heat and humidity;
- static and electromagnetic behavior.

It is important to not forget people will live in that building, thus ensuring that the materials chosen for the construction of the eco house meet their aesthetic and functional needs, that is, that they are beautiful to look at, resistant and also easy to clean.

It is good to clarify that the choice of ecological and sustainable materials to use for each specific project should depend on the origin: it is absolutely better to prefer those of local origin, not only because their cost is less than others but also because they also allow to reduce pollution due to transport and especially because they are generally better suited to the climate of the chosen place. In green building we recommend the use of pure cement, without radioactivity, such as the white one. Then there are the most common materials:

- wood and microporized bricks with wood flour, for the structure of buildings, such as roofs and floors;
- for insulations, panels in wood fiber, cork and vegetable fiber, including linen, kenaf and hemp;
- lime for surface finishes;



Co-funded by the
Erasmus+ Programme
of the European Union

- for paintings, varnishes and adhesives vegetable resins, vegetable oils, vegetable waxes, gums and vegetable glues, vegetable spirits and dyes are used. Elaborate natural mineral substances ;
- for waterproofing, bentonite is used;
- cork, wood fiber panels, cotton, expanded lime, cellulose, perlite are excellent for thermal and acoustic insulation.

These are new architectural and building techniques, which already allow professionals to design new structures that adopt sustainability criteria and therefore respect the environment, which reduce waste to a minimum, whether they are particularly durable and able to fully satisfy the needs and desires of those who will live there.



Co-funded by the
Erasmus+ Programme
of the European Union

4.5 What can Italy win with ZEB?

In the two-year period 2016-2017, according to the first data available of the National Observatory NZEB⁴ launched last year by ENEA, in Italy about 600 buildings were built with almost Zero Energy requirements, covered to a significant extent by renewable sources.

In Italy, the concept of almost zero-energy building (NZEB) was adopted by directive 2010/31/UE (EPBD⁵) recast with the previous 91/2002. According to the law 90/2013, which transposes this directive, a NZEB⁶ is a "very high building energy performance in which the energy requirement is very low or almost zero is covered to a significant extent by energy from renewable sources, dwelling in situ "(the definition of the EPBD also includes the production of energy from renewable sources nearby - "nearby").

Despite the still limited number, there is a rapid increase in NZEB between one year and another. The contribution of voluntary certifications is also not clear on the dissemination and qualification in the field of NZEB and on the dissemination of good practices. Among the non-residential NZEBs, the contribution of the new and renovated school buildings seems to be relevant, financed with national and regional resources, whose impact is monitored by the mission structure at the Presidency of the Council of Ministers.

Always from the first results of the ENEA NZEB Observatory, most of NZEB applies a reduced set of technologies: substantial insulation of enclosure, electric heat pumps (mostly air-water) and photovoltaic system for electricity production is the most frequent combination, with the variant of the condensing boiler combined with solar thermal system for the production of domestic hot water. So, the electric vector is prevalent. The percentage of district heating and the use of biomass respectively in the urban

⁴ Osservatorio nazionale NZEB: <http://www.efficienzaenergetica.enea.it/news-eventi/osservatorio-nazionale-degli-edifici-a-energia-quasi-zero-nzeb>

⁵ Energy Performance of Buildings Directive: <https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-performance-of-buildings>

⁶ The Italian NZEB definition is recent, but not least in the transposition of the 2010 EPBD directive in Europe: today almost 25% of the countries has not yet done it.



Co-funded by the
Erasmus+ Programme
of the European Union

environment is irrelevant and rural, even in the coldest climates and in the presence of only heating and domestic hot water services. Although in

limits of the availability and quality of the data of the examined sample, only two are the cases (in Piedmont) of NZEB with district heating plant, a solution for which the share of renewables and economically more is not mandatory convenient for the user where the infrastructure already exists.

Recurrent is the wood construction technology, which also allows the construction of building structures of quite big size with high casing performance and reduced assembly time.

Regarding costs of NZEB, from a quick analysis, there are conflicting results. It's obvious, however, without an approach in the life cycle of the building, the return times of the investment in NZEB are too long and extremely high initial costs.⁷

Data on costs are at moment not enough and need a more extensive investigation.

About the promotion of NZEBs with targeted policies, of the 21 requests for funding received at GSE for transformation of Public Administration buildings into NZEB⁸, only 1/3 were funded according to stringent requirements and analyzes of energy and economic audits.

There are only three regions, (Lombardy, Umbria and Veneto) which expressly require the NZEB level within the calls for the POR FESR 2014-2020 Programme, for financing efficiency improvement measures energy efficiency of public buildings.

The continuous acquisition and dissemination of NZEB good practices is therefore essential speaking about results, processes, financing, costs and timing able to reassure the feasibility and repeatability of these projects.

⁷ Energy Efficiency Report 2017 of Energy&Strategy Group - School of Management del Politecnico di Milano.

⁸ Rapporto Attività GSE 2016, Marzo 2017 e Presentazione GSE Il Conto Termico: un'opportunità per il patrimonio immobiliare di Roma GSE 2017, Roma, La Sapienza 11 Aprile 2017.



Co-funded by the
Erasmus+ Programme
of the European Union

In the view of training, the different stakeholders in the area are working to update their professional skills and competences. However, there is no national orientation in this regard.

Results of activities conducted in the context of recent European projects are available

More in general, according to the Italy's National Energy Strategy 2017⁹, in 2016, in a global context of economic recovery and low prices of raw materials, Italy proceed on its path to strengthen its environmental sustainability, reduce its greenhouse gas (GHG) emissions, and improve the efficiency and security of its energy system.

Results:

- Renewable Energy Sources (RES) covered 17.5% of gross final energy consumption;
- Energy efficiency continued to grow: the GDP energy intensity dropped by 4.3% as compared to 2012;
- Italy's dependence on foreign supply sources continued to fall: energy imports were down by 7 percentage points versus 2010;
- there remains an energy cost gap between Italy and the EU, which puts Italy at a disadvantage

Future Challenges:

- pursuing the growth of RES in an efficient way, while holding down system charges;
- strengthening its energy efficiency policy, especially in non-industrial sectors, primarily construction and transport;
- ensuring energy security by diversifying supply sources protecting the industrial sector and retrofitting infrastructures for sustainability.

⁹ Source: https://www.mise.gov.it/images/stories/documenti/BROCHURE_ENG_SEN.PDF



Co-funded by the
Erasmus+ Programme
of the European Union

5 OVERALL NATIONAL ENERGY EFFICIENCY POLICY AND STRATEGY

5.1 Primary Energy Sources and Sustainable Energy Supply Safety

In Italy, energy production depends to the needs of the society and it is difficult summarize them. Anyway, electricity can be produced using non-renewable sources, renewable sources and buying it from other countries.

Since the 1980s, less polluting methods for producing electricity have been adopted, trying to abandon the “decarbonisation” program that marked the Country before.

This need has grown since the Chernobyl accident occurred: this event led to the exclusion, after several referendums, of the possibility of using nuclear power to generate energy.

According to the European Union trends, also Italy, facing with the ever-increasing need for energy and several security issues, has adopted a production-oriented policy through sources other than the usual, such as thermoelectric generation using solar collectors. These projects aim to cover the greatest European needs without having to import products, such as fossil fuels, from countries outside Europe. This would contribute to lowering the cost of energy, having favourable repercussions on European products worldwide.

However, today, the above-mentioned sources are the only ones allowing satisfying energy demands in Italy, providing the indispensable electricity for domestic, commercial and industrial needs. A condition that obliges the Country to be dependent on foreign countries, both at European and global level, making the final cost of electricity greater. To remember that in addition to these costs, those state tax rates are added to respond to various events, such as natural disasters, which continue to weigh even when they are no longer current.

- NON RENEWABLE SOURCES OF ENERGY

Non-renewable energy sources are those allowing energy productions through the use of substances and materials that tend to run out; for this reason they increase in value with the passage of time, a condition that influences the cost of the final product. Furthermore, the processing, precisely to generate



Co-funded by the
Erasmus+ Programme
of the European Union

electricity, has important negative consequences for the environment. Today these are the largest resources exploited worldwide for energy production.

Non-renewable sources in Italy are basic for combustion in thermoelectric power plants, a production that has an important impact on pollution and public health, nevertheless fundamental to respond to national energy needs. These sources currently cover 73% of the total national electricity production, responding to 63% of the gross energy need, data that allow us to understand the importance of using fuels in energy production. The thermoelectric plants are powered mainly by natural gas, coal and petroleum derivatives. The main importers of these fuels are: for natural gas Algeria, Libya and Russia, while for coal they are the USA, South Africa, Australia, Indonesia and Colombia. Clearly, Italy depends on these Countries for a large part of its electricity production, and although with the passage of time the percentages of use and need for gas, coal and oil derivatives have changed a lot, importations and its weight on the cost of electricity remains.

However, after the Kyoto Protocol, natural gas has passed coal and oil as an important factor in energy production, also due to its lower impact on the environment. Italy today is the third largest importer of this fuel, a condition that strongly affects the purchase prices of the final product. Nevertheless, even if this classification could lead to suppose that natural gas is preferred for energy production, Italy is at a European level among the major ones dependent on oil to allow its plants to supply electricity.

- RENEWABLE SOURCES OF ENERGY

Renewable energy sources are those that are regenerated in a quite short time. Some of them are considered inexhaustible, since they are regenerated at the same speed in which they are consumed, or they are exhaustible in such a long time as not to affect production. There are some renewable sources assessed as exhaustible, such as forests, the exploitation of which can lead to a decrease in the resource that could compromise its long-term use.

In Italy about 30% of the national electricity production, corresponding to 28% of the requirement, occurs using renewable sources. Data that are interesting, especially due to the negative impact they have on the use of those



Co-funded by the
Erasmus+ Programme
of the European Union

exhaustible sources that are important from abroad. To sum up, the renewable energy sources are:

- Hydroelectric: using the height difference of water, they convey so as to move particular turbines that produce energy. This source has a minimum impact on the environment;
- Solar: thanks to photovoltaic panels, whose physical principle allows semiconductors to supply electricity. Considered an inexhaustible source, however its production is limited to daily hours. This means that the conservation of electricity is only possible to a minimum level, such as batteries, unworkable in large quantities fundamental for the community needs;
- Wind: where turbines are moved by the force of the wind, an inexhaustible source of energy, also limited by the climatic conditions;
- Geothermic: using natural heat and replacing it with fuels to allow power plants to produce energy;

Among these renewable sources, hydroelectric power is the main one, managing to provide Italy with an appreciable production of energy. In fact it covers 13% of the gross requirement, an important percentage, followed by geothermal and solar production. Italy ranks second in the world for installed photovoltaic power, a condition also due to the incentives that allowed citizens to mount solar panels at their houses.

The growth in recent years of the construction of thermoelectric or incineration power plants for the combustion of biomasses, industrial and urban waste should be emphasized. This source of energy, although considered in part inexhaustible, is made of high pollution. Even if it responds to a double need, that is to produce energy and decrease the quantity of waste, it becomes harmful to health and crops.

- IMPORTED ENERGY



Co-funded by the
Erasmus+ Programme
of the European Union

For a long time, Italy has played the role of major importer of electricity from the outside. Even if Enel¹⁰ boasts the co-ownership of some plants placed in foreign soil, electricity is purchased according to the tariffs set for importation. The rates range from 9-11% in the minimum to 23-24% in the maximum electricity demand in Italy, with the largest supplier being Switzerland, followed by France, both countries that use nuclear power for production. Although these percentages may not appear excessive, they have a significant impact on the costs of the energy product that final users are required to undertake. However, the projects and development plans, the result of the necessary responses that the policy and the producers have had to satisfy, foresee a constant decrease in the import, thanks to the greater attention on other energy sources present in Italy.

¹⁰ ENEL, or the Enel Group, is an Italian multinational energy company that is active in the sectors of electricity generation and distribution, as well as in the distribution of natural gas.

Enel was first established as a public body at the end of 1962, and then transformed into a limited company in 1992. In 1999, following the liberalisation of the electricity market in Italy, Enel was privatised.



Co-funded by the
Erasmus+ Programme
of the European Union

5.2 Legislations and Regulations regarding Building Energy Performance

The building sector is still one of the most energy consuming sectors in Italy, responsible for about 45% of primary energy consumption due to building materials and to the final use of energy from tertiary and residential buildings. At European level, the main policy driver related to the energy use in buildings is the Energy Performance of Buildings Directive (EPBD, 2002/91/EC) and its recast, which foresee more and more ambitious provisions. Through the EPBD introduction, requirements for certification, inspections, training or renovation are now imposed in Member States.

The residential sector is the one that mostly influence consumptions, heating (essentially based on natural gas) covering more than two-thirds of the overall consumption (it was 68% of overall consumption in 2010), while hot water production and cooking respectively cover 9% and 6%, while 17% is devoted to the electrical energy consumptions like lighting, appliances and air conditioning.

In Italy the total energy consumption per household is decreased of 8,3% in 2010 as compared to 2000, as an effect of the economic crisis: this confirms that the energy efficiency actions in the buildings sector are not widespread in Italy. Indeed, the consumption reduction is however lower as compared to the overall reduction across EU, since for EU-27 the average reduction is of 15,5%.

As mentioned above, the sectoral policy orientations of Italy must comply with the European main policy driver connected to energy use in buildings, which is today the Energy Performance of Buildings Directive in its last recast (EPBD recast, 2010/31/EU). Reaching objectives like the energy consuming reduction in buildings (Directive 2010/31/UE ‘Energy efficiency in buildings’, introduces the concept of near zero energy buildings), the rational use of energy, the integration of Renewable Energy Sources based production in buildings, etc. are the policy drivers in all the member states and have a natural transposition in national laws and local regulations,



Co-funded by the
Erasmus+ Programme
of the European Union

with a different degree of detail according to the geographical scale to which they refer (provincial, town, etc.).¹¹

In Italy, Decree 192/2005¹², modified by Legislative Decree 311/2006¹³, set the basis for the EPBD implementation in Italy. It was followed by a number of complementary legal acts updating the minimum requirements for buildings, building components and technical building systems, while extending the calculation to cooling and lighting systems and providing guidelines for energy performance certification (2009) and defining requirements for assessors as well as specifications for the inspection of technical building systems (2013). Law 90/2013¹⁴ implemented Directive 2010/31/EU, introducing significant changes to the first 2005 implementation.

In June 2015, three inter-ministerial decrees¹⁵ (26 June 2015) have completed the EPBD transposition, which also established stricter minimum requirements for new buildings and major renovations, defined Nearly Zero Energy Buildings. Italian regions and autonomous provinces (a total of 21 authorities) have final jurisdiction

¹¹ Riva Sanseverino E., Riva Sanseverino R., Scaccianoce G., Vaccaro V. (2014) Municipal Building Regulations for Energy Efficiency in Southern Italy. In: Murgante B. et al. (eds) Computational Science and Its Applications – ICCSA 2014. ICCSA 2014. Lecture Notes in Computer Science, vol 8580. Springer, Cham

¹² DECRETO LEGISLATIVO 19 agosto 2005, n. 192 Attuazione della direttiva 2002/91/CE relativa al rendimento energetico nell'edilizia

¹³ DECRETO LEGISLATIVO 29 dicembre 2006, n. 311 Disposizioni correttive ed integrative al decreto legislativo 19 agosto 2005, n. 192, recante attuazione della direttiva 2002/91/CE

¹³ Decreto interministeriale 26 giugno 2015 – “Applicazione delle metodologie di calcolo delle prestazioni energetiche e definizione delle prescrizioni e dei requisiti minimi degli edifici”

¹³ Costanzo E., Martino A., Varalda G., Antinucci M., Federici A. (2016) EPBD implementation in Italy. Status in December 2016. Concerted Action Energy Performance of Buildings www.epbd-ca.eu

¹⁴ LEGGE 3 agosto 2013, n. 90. Conversione in legge, con modificazioni, del decreto-legge 4 giugno 2013, n. 63, recante disposizioni urgenti per il recepimento della Direttiva 2010/31/UE del Parlamento europeo e del Consiglio del 19 maggio 2010, sulla prestazione energetica nell'edilizia

¹⁵ Decreto interministeriale 26 giugno 2015 – “Applicazione delle metodologie di calcolo delle prestazioni energetiche e definizione delle prescrizioni e dei requisiti minimi degli edifici”



Co-funded by the
Erasmus+ Programme
of the European Union

in energy topics. The recent legislation provided, with a unanimous consensus from these authorities, an advanced harmonisation of the EPBD implementation all over the national territory.

The current overall energy performance of new buildings varies with typology and climatic zone. The new legislation in force requires the calculation of the following energy performance indicators:

- Specific energy needs for heating (EPH), cooling (EPC) and domestic hot water (EPW);
- Energy performance indexes for heating (EPH), cooling (EPC), domestic hot water (EPW), ventilation (EPV), plus lighting (EPL) and transport (EPT) for non-residential buildings, expressed in non-renewable and in total primary energy [kWh/m²];
- Global energy performance index EPgl = EPH + EPC + EPW + EPV + EPL* + EPT* expressed in non-renewable and in total primary energy [kWh/m²] (lighting and transport services for non-residential building only).

The designer has to justify compliance or non-compliance of the new building project to minimum energy performance requirements in a report (model provided in one of the 2015 decrees). This validation is compulsory to get the construction licence.

Controls from local authorities to check compliance are performed on demand.¹⁶

The building renovation rate is still below the potential level in Italy; a wide range of financing mechanisms are, however, in place and are being continuously strengthened. Owing to the lack of awareness and resources for renovating to the NZEB level, a stronger effort is needed which also involves the research and academic world. In respect to central public buildings, a complex programme stimulating renovation uptake and monitoring and improving awareness is ongoing. Different communication campaigns are in place and further initiatives are under preparation.

¹⁶ Costanzo E., Martino A., Varalda G., Antinucci M., Federici A. (2016) EPBD implementation in Italy. Status in December 2016. Concerted Action Energy Performance of Buildings www.epbd-ca.eu



Co-funded by the
Erasmus+ Programme
of the European Union

5.3 Regulatory Frameworks: Laws, Regulations and Performance Standards Regarding Energy Performance

In 2011, the European Commission's Communication "Roadmap to a low carbon economy in 2050"¹⁷ established that greenhouse gas (GHG) emissions should be cut down by at least 80% by 2050 from their 1990 levels, to ensure competitiveness and economic growth in the energy transition, and to meet the Kyoto Protocol pledges.

In 2016, the Commission presented its "Clean Energy Package"¹⁸, consisting of legislative proposals to develop RES and the electricity market, to improve energy efficiency, and to define the governance of the Energy Union, with the following targets by 2030: 27% RES share in EU energy consumption 30% reduction of EU primary and final energy consumption.

The Italian Energy Strategy has thus been incorporated into the Energy and Climate plan that Italy submitted to the European Commission as a contribution to achieving the common European targets.¹⁹

As stated by the National Agency for Energy Efficiency (ENEA)²⁰ within its seventh annual report, following the guidelines of the measures contained in the Clean Energy package, the 2017 National Energy Strategy (NES) confirms the key role of energy efficiency in Italy's energy transition path. The NES is the ten-year plan that the

¹⁷ COM/2011/0112 final/COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS - A Roadmap for moving to a competitive low carbon economy in 2050.

¹⁸ COM(2016) 860 final/COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT BANK - Clean Energy For All Europeans.

¹⁹ Italy's National Energy Strategy (2017), Ministero dello sviluppo economico; Ministero dell'ambiente e della tutela del territorio e del mare.
https://www.mise.gov.it/images/stories/documenti/BROCHURE_ENG_SEN.PDF

²⁰ 2018 ENERGY EFFICIENCY ANNUAL REPORT. Executive summary 2018 ENEA – National Agency for new technologies, energy and sustainable economic development.



Co-funded by the
Erasmus+ Programme
of the European Union

Italian Government drew up to anticipate and manage the change of the national energy system: a document looking beyond 2030, and laying the groundwork for building an advanced and innovative energy model. The document results from a participative process that involved the Italian Parliament, the Regions, and over 250 stakeholders, including associations, companies, public entities, citizens, and representatives of academia. The numerous contributions given to the process testify the priority that the public opinion assigns to energy and environmental issues.

The objective of the Strategy is to make the national energy system more competitive, more sustainable, and more secure. More competitive, this means: aligning Italian energy prices with European ones to the benefit of both companies and consumers; opening up new markets to innovative companies; creating new employment opportunities; and fostering research and development. More sustainable, this means: contributing to decarbonisation, in line with the long-term targets of the Paris Agreement on Climate Change; improving energy efficiency, and encouraging energy conservation to mitigate environmental and climate impacts; promoting environmentally conscious lifestyles, from sustainable mobility to wise energy usage; and confirming Italy's environmental leadership role. More secure, this means: improving the security of energy supply, while ensuring its flexibility; and strengthening Italy's energy independence.

The NES aims to strengthen energy efficiency policies by facilitating the measures that have the best cost-effectiveness ratio in order to achieve 30% energy savings by 2030 compared to the expected consumption at that date. Extensive additional energy efficiency investments are expected over the entire period: 110 billion euros out of the 175 overall which are expected to be spent over the period thanks to the NES. This amount of resources will result in a reduction in final energy consumption from active policies of around 10 Mtoe/year in 2030, equal to about 1 Mtoe of annual savings from new works in the period 2021-2030, to be mainly focused in residential sector, services and transport. Indeed, other core targets of the NES concern the reaching of a 28% share of renewables in total energy consumption by 2030, and a 55% share of renewables in electricity consumption by 2030; strengthening supply security; narrowing the energy price gap; furthering sustainable public mobility and eco-friendly fuels; and phasing out the use of coal in electricity generation by 2025.



Co-funded by the
Erasmus+ Programme
of the European Union

To achieve these objectives, Legislative Decree No 102 of 4 July 2014 was enacted, implementing those provisions of Directive 2012/27/EU not already transposed into Italian law in accordance with the National Energy Strategy guidelines.²¹

²¹ Italian Energy Efficiency Action Plan (2017),
https://ec.europa.eu/energy/sites/ener/files/documents/it_neeap_2017_en.pdf



Co-funded by the
Erasmus+ Programme
of the European Union

5.4 Institutional Frameworks

Other institutions, apart from the formal ones, are involved in the development of policies and best practices on climate changes impact and ZEBs.

❖ Word Energy Council – Italy.

The aims of the Word Energy Council – Italy, based in Rome is to promote the sustainable supply and use of energy for the greatest benefit of all people and develop studies on the supply and use of energy by seeking, in the short and long term, the greatest social benefits and the lowest environmental impact. It publishes and disseminates studies and researches, collaborating with national and international public and private bodies. The Council promotes knowledge on energy issues, planning and organizing congresses, conferences, debates, to achieve the useful and sustainable use of energy.

Thanks to its consolidated experience in the field of study, knowledge and information on energy issues, WEC Italia carries out training activities aimed at providing a broad perspective on the most topical energy issues.

These activities are covered by "The Italian Energy Academy" a training format developed by the World Energy Council (WEC) and implemented at national level by the WEC Member Committees. The Italian Energy Academy is not a specialized technical training course nor does it aim to replace university education, rather it is a path of deepening and analysis that completes and enriches the former by providing a strategic and global vision on energy.

Academy is aimed at employees and managers of companies, associations and institutions belonging and not to the WEC Italia network and interested in having in-house informed professionals who have a strategic vision of the evolution of the global energy sector and the dynamics that drive it as well as aimed at promoting safe, competitive and sustainable energy systems.

The experience of the team of speakers, lecturers and testimonials of the Italian Energy Academy coming from the WEC Italia network, together with the richness



Co-funded by the
Erasmus+ Programme
of the European Union

of the topics covered, allow the contents of the training activities to be adapted to a heterogeneous audience of participants.

❖ **The Italian Energy Economists Association (AIEE).**

It acts as an independent point of reference for the problems of Italian energy policy towards national and international bodies to which it provides opinions; carries out an intense activity of an informative and stimulating nature towards entities and organizations in charge of defining the energy policy in Italy and with which it has meetings and debates.

It organizes meetings with scholars and operators interested in energy, economy and environment - it promotes professional contacts with energy economists from different countries - it sponsors and organizes seminars and conferences at national and international level - it promotes educational activities in the economic-energy sector - carries out studies and publications for members.

It is the Italian affiliate of the IAEE – International Association for Energy Economics.

The AIEE Energy Observatory Report provides monthly analysis and short-medium term forecasts on the performance of international and national markets and of the Italian energy sector.

Furthermore, the report illustrates the dynamics of the prices of the main energy products (oil, oil products, gas, coal, electricity), their competitive situation and provides indications on their evolution in the following months (up to 24 months) and in particular, the estimate of fuel of electricity and gas tariffs.

With this service it is possible to know the trend of the demand and the cost of fuels, the competitiveness between the different sources, optimizing the energy supply contracts in the short to medium term. It is therefore an indispensable tool for those who operate in the Power Exchange and in the Gas Exchange and in general in the energy sector.

The Observatory is designed for those who operate in the energy market and who must face the risks connected to the variability of prices that characterizes the sector and which depends essentially on the trend in fuel prices.

Particular attention is paid to the part relating to the electricity sector, where the components of the electricity tariff are monitored and the situation of competitiveness between the various sources for the production of electricity. In



Co-funded by the
Erasmus+ Programme
of the European Union

addition, the Report is accompanied by various in-depth analyzes related to the world of energy.

❖ The Energy and Sustainable Development Agency.

The energy agency “Agenzia per l’Energia e lo Sviluppo Sostenibile” (AESS) was founded in 1999 with the support of the EC SAVE II Programme by five founding partners (City of Modena, Province of Modena, Modena Chamber of Commerce, the former energy utility of Modena “META” and the former local transport company “ATCM”). Additional members were Legambiente (environmental association) and Unione Italiana Consumatori (consumer association).

AESS is a non-profit organization and a member of the Energy Agency Italian network RENUEL, which gathers more than 22 local Energy Agencies. AESS is also accredited as Energy Saving Company by Italian energy authority AEEG
AESS is primarily involved in the promotion of renewable energy sources, energy efficiency and reduction of energy consumption among Local Authorities, SMEs, schools and consumers.

AESS offers innovative products and services for the territory on the topics of energy efficiency, renewable energy sources and sustainable mobility, through the creation of partnerships with institutions and at regional and national level, as well as the exchange of experiences and good practices within the European Union countries.

Since 1999, AESS has been a partner of a lot of projects funded under European, National and Regional programs. The activities related to them have ranged from communication-training-information to citizens, professionals, technicians and schools on the issues of energy savings-efficiency and renewable sources, to the drafting of plans and tools for monitoring and limiting energy consumption, to definition of Energy Service contracts (eg Energy Performance Contracts) able to guarantee public bodies a reduction in waste and consequent energy savings, professional training and the development of new methods to support cities in the transition to low-carbon communities.

European projects have often seen the active involvement of numerous Local Authorities and have made available both economic resources, for projects undertaken in the territory, and models and success stories that can be replicated,



Co-funded by the
Erasmus+ Programme
of the European Union

realized in other European realities, often also enhancing the commitment of virtuous Local Authorities involved.

❖ ENEA – Italian National Agency for Energy Efficiency.

The Department for Energy Efficiency (DUEE) performs the role of the Italian National Agency for Energy Efficiency - established by Legislative Decree No. 115 of May 30, 2008, implementing Directive 2006/32/EC on the efficiency of use of energy and energy services - towards public administrations, citizens, companies and local areas.

The Agency offers scientific and technical support to companies, it also supports public administration in preparation, implementation and control of national energy policies, and promotes training campaigns and information for the dissemination of the energy efficiency culture.

ENEA has highly qualified professionals, advanced laboratories, experimental facilities and excellent tools for project implementation, studies, tests, evaluations, analysis and training services, with reference to product and process innovation and for the enhancement of research results, contributing to the development and competitiveness of the national economic system.

In 2017, ENEA launched a National NZEB Observatory that allowed the Agency to acquire statistics and information on policies, public and private information and training initiatives and state of research in this sector.

Furthermore, every year it publishes an Annual Report²² for Energy Efficiency containing an Analysis and results of Energy Policies in Italy.

❖ Covenant of Mayors for Climate and Energy.

The Covenant of Mayors is the world's largest movement for local climate and energy actions. Provinces, Regions, ministries, National Energy Agencies, metropolitan areas, local authority groups are the main actors of the Covenant.

²² The last Report available is for 2018. Source: <http://www.enea.it/it/seguici/pubblicazioni/pdf-volumi/2018/raee-2018-executive-summary.pdf>



Co-funded by the
Erasmus+ Programme
of the European Union

The Covenant Coordinators are public authorities able to provide strategic guidelines, technical and financial support to the signatories of the Covenant of Mayors.

Signatory cities are committed to supporting the implementation of the EU's 40% greenhouse gas reduction target by 2030, and the adoption of a common approach to tackle mitigation and adaptation to climate change.

In order to translate their political commitment into practical measures and projects, the Covenant Signatories undertake to present, within two years from the date of the decision of the local council, an Action Plan for Sustainable Energy and Climate (PAESC), which indicates the key actions, they intend to take.

The plan will contain a Basic Emission Inventory to monitor mitigation actions and the Assessment of Vulnerability and Climate Risks.

This bold political commitment marks the beginning of a long-term process that sees cities committed to reporting every year on the progress of their plans.



Co-funded by the
Erasmus+ Programme
of the European Union

6 KNOWLEDGE AND AWARENESS IN THE COUNTRY

6.1 *Educational Potentials, Activities and Curriculum on Energy and Energy Efficiency in Built Environments*

In Italy, the training and learning offer for the Energy efficiency in Building covers a wide range of level, from non-formal education courses to university degree programmes.

Starting from degree curricula developed by Italian Universities, they can be listed as below:

Engineering Studies:

involving a wide spectrum of competences, oriented to the full-field analysis of the context in which the company is established and to the knowledge of the potentials and limits of the used resources and to the study of the processes that govern the sustainability of exploitation, in order to address the complex of actions necessary for the rehabilitation and maintenance of environmental quality and the prevention of future risks.

- Environmental Engineering (Bachelor and Master Degree)
- Energy Engineering (Bachelor and Master Degree)
- Environmental and Resources Engineering (Bachelor Degree)
- Landscape Architecture (Master Degree)

Management and Economic Studies:

- Sustainable Management of Water (Bachelor Degree)
- Security and energy management (Bachelor Degree)

Post degree Masters:

- Green Management, Energy and Corporate Social Responsibility (MaGER)
- Management and Regulation for Sustainable Energy (MRES)
- Energy saving of Buildings (REA - ENERGY)



Co-funded by the
Erasmus+ Programme
of the European Union

From this brief digression, it is clear, therefore, how the Italian academic environment is adapting to the rest of the world, offering students a high level education, characterized not only by theory but also by practice. The students, thanks to the internships, are immediately put in contact with companies and this facilitates, in the future, their access to the workplace. Green revolution, therefore, also in universities.

On the other hand a lot of training courses in this field are developed and customize by private companies, consulting and enterprises and also by public sector institutions.



Co-funded by the
Erasmus+ Programme
of the European Union

6.2 Survey Results Showing the Awareness Level of Young People

Between April to May 2019 CIAPE – The Italian Centre for Permanent Learning conducted a survey among target groups of the project – young people, stakeholders and professionals of building sector.

The survey aimed to identify the needs for support, information and further development – in order to assess the awareness of target groups on the specific field of Energy consumption, climate changes and ZEBs.

Questionnaires have been designed for each specific group. The selection of the sample was carried out using a convenience method with a snowball effect. The results cannot be treated as representative, but they are a valuable illustration of the topic of young people's awareness on energy issues and the role of professionals in the process of new construction approaches.

The questionnaires were distributed by two means - electronically as an online survey and in printed form to maximize the reach to all participants. All results were coded and subjected to statistical analysis.

Surveys and questionnaires were distributed in Italian in order to achieve a large number of people involved.

Età
100 risposte

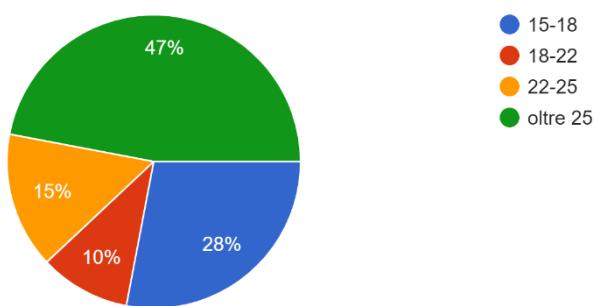


Figure 2: Age of young people involved

Hai mai sentito parlare di cambiamenti climatici?

100 risposte

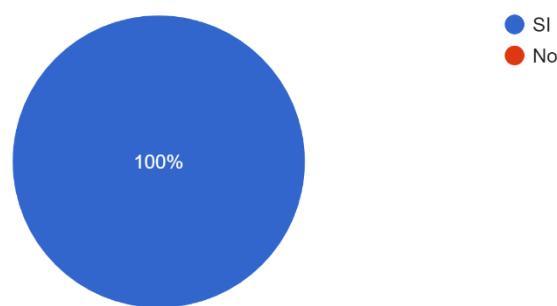


Figure 3. Answers to the question Have you ever heard about climate change?

Cos'è il "cambiamento climatico"?

100 risposte

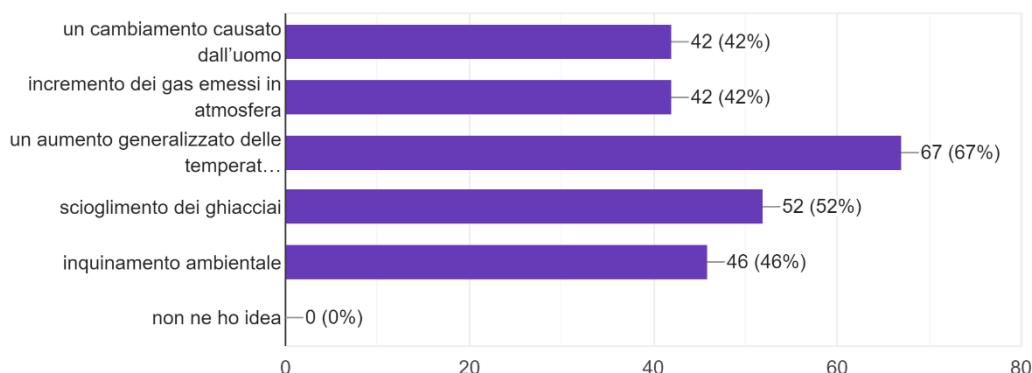


Figure 4. Answers to the question: What “climate change” is?

According to results, 47% of young people interviewed were more than 25 years old and all of them have heard about climate change issues. 67% of them thinks that climate change is an increasing in global average temperatures, 52% because melting of glaciers and 42% thinks it is a change caused by human activities and/or increasing in the proportion of greenhouse gases in the atmosphere.



Co-funded by the Erasmus+ Programme of the European Union

Quali sono le principali cause del cambiamento climatico?

100 risposte

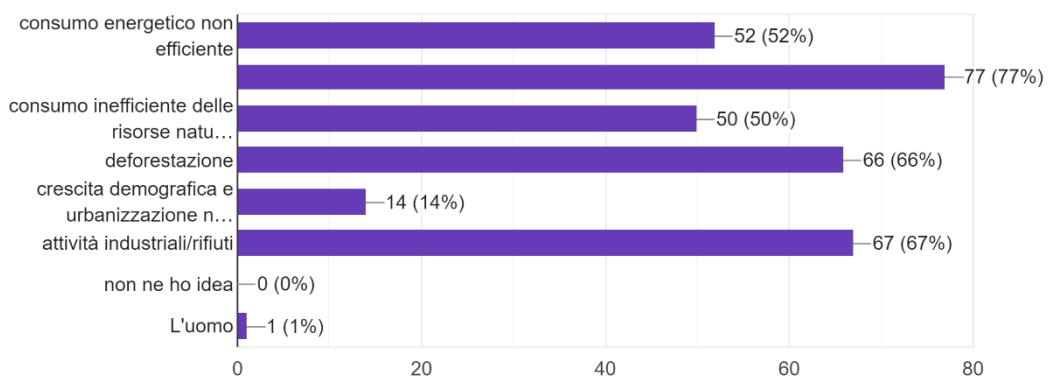


Figure 5. Answers to the question: What are the main reasons of climate change?

77% of young people involved declares that climate change is due to an inefficient consumption of natural resources (66% due to deforestation and 67% due to industrial activities and wastes).

Ritieni che il cambiamento climatico e i problemi ambientali influenzino la qualità della vita?

100 risposte

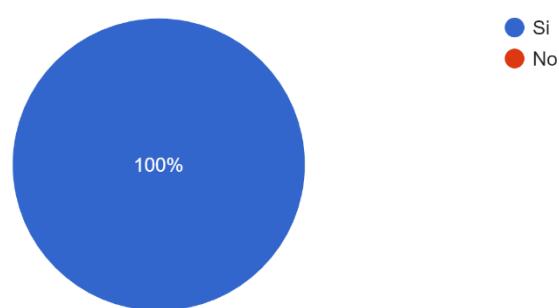


Figure 6. Answers to the question: Do you think that climate change and environmental problems affect your quality of life?



Co-funded by the
Erasmus+ Programme
of the European Union

Vorresti ricevere maggiori informazioni sui cambiamenti climatici?

100 risposte

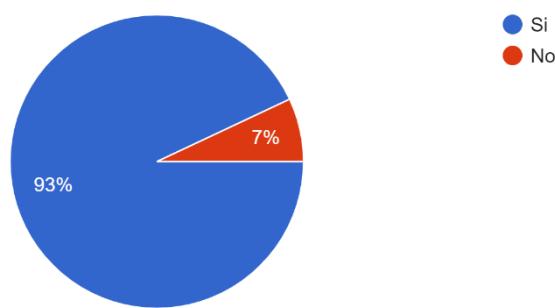


Figure 7. Answers to the question: Would you like to learn more about climate change?

100% of them are aware that climate change and environmental problems affect their quality of life and 93% of them wants to get more information on climate change issues.

Quali sono, a tuo avviso, gli sforzi individuali al fine di ridurre gli effetti del cambiamento climatico e i problemi ambientali?

100 risposte

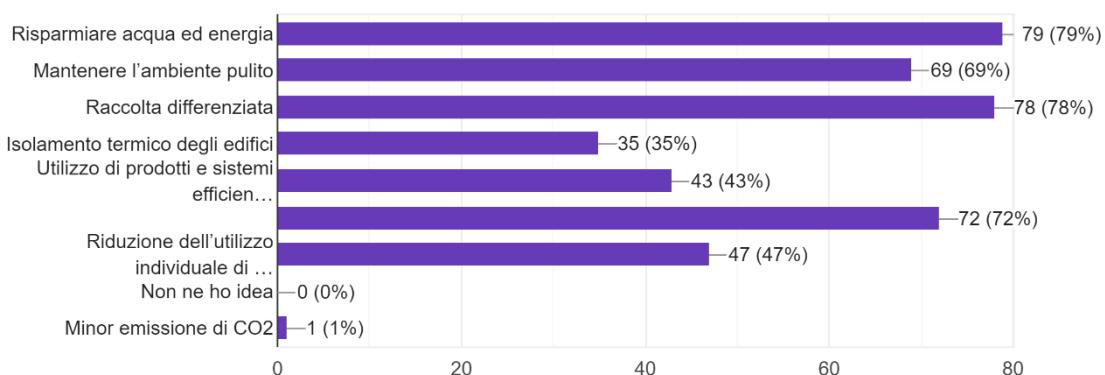


Figure 8. Answers to the question: What should be the individual struggle for reducing climate change and environmental problems?

According to analysed answers, 79% considers saving energy and water the most important individual struggle for reducing climate change and environmental problems, (78% waste sorting and 72% using environmentally friendly and recyclable products). 1%

considers important reducing the use of individual motor vehicles and increasing public transport and bicycle usage.

Indica il tuo livello di consapevolezza in merito all'impatto del consumo energetico.

100 risposte

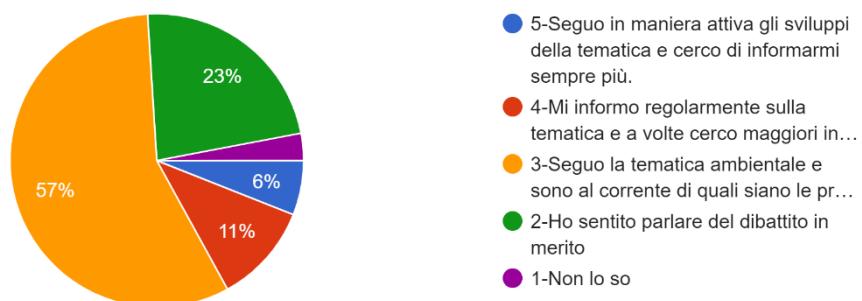


Figure 9. Answers to the question: How much are you aware of the environmental impact of energy use?

Hai mai provato a ridurre il consumo di energia a casa?

100 risposte

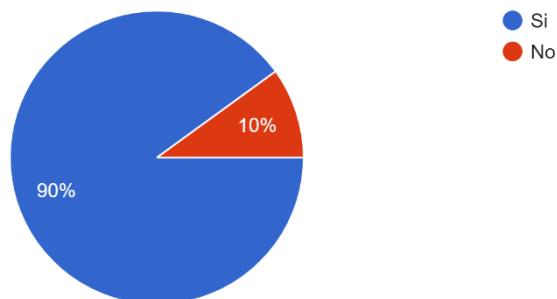


Figure 10. Answers to the question: Do you have an attempt to reduce energy use at home?

57% of respondents is following current environmental issues and knows what the “concerns” are but 3% of them has no idea about the environmental impact of energy use. Most of the young people (90%) try to reduce energy use at home (10% does not).



Co-funded by the
Erasmus+ Programme
of the European Union

Quali tipi di misure/azioni ritieni possano essere adottate al fine di ridurre il consumo di energia in casa?

100 risposte

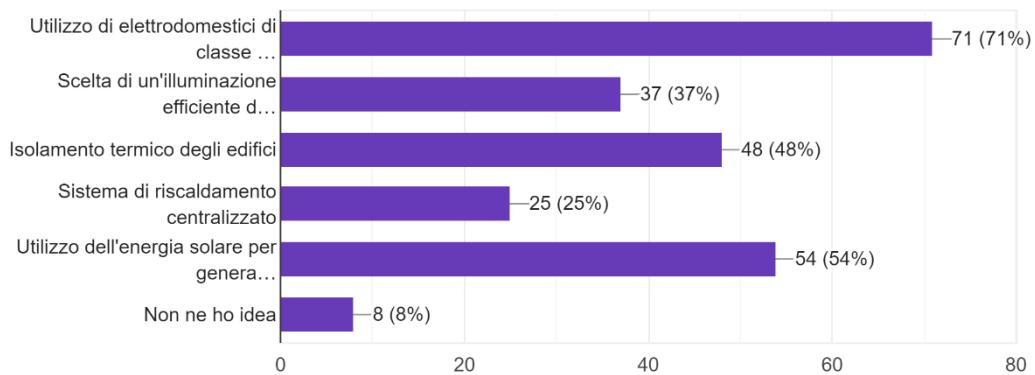


Figure 11. Answers to the question: Do you think what kind of precaution can be taken to reduce energy use at home?

71% of asked people holds that using A+ household appliances can reduce energy use at home. Using solar energy for power generation and water heating is a good practice for 54% of them and insulating buildings is correct for 48%.

Quale è il tuo atteggiamento nei riguardi delle problematiche ambientali?

99 risposte

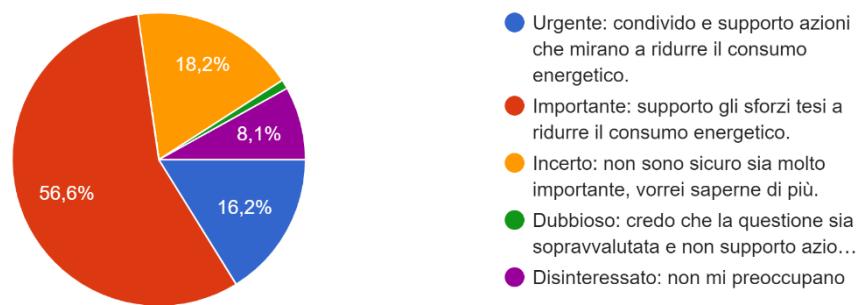


Figure 12. Answers to the question: What are you doing in terms of energy related to environmental problems?

For the 56,6% of youngsters it is important because it supports efforts to reduce energy consumption in their everyday life, but 16,2 % declare there is an urgent need to support these actions. 8,1% is not worried about it.

Cosa intendi per “efficienza energetica”?

100 risposte

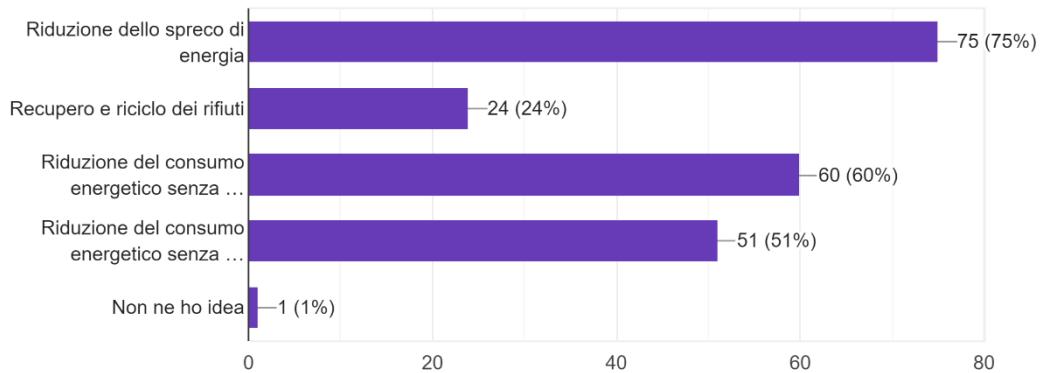


Figure 13. Answers to the question: What is energy efficiency?

75% of respondents thinks that energy efficiency is the prevention of energy losses, 1% has no idea and 60% believe in reducing energy use without compromising on performance and comfort conditions.

Quanto ne sai di energie rinnovabili?

99 risposte

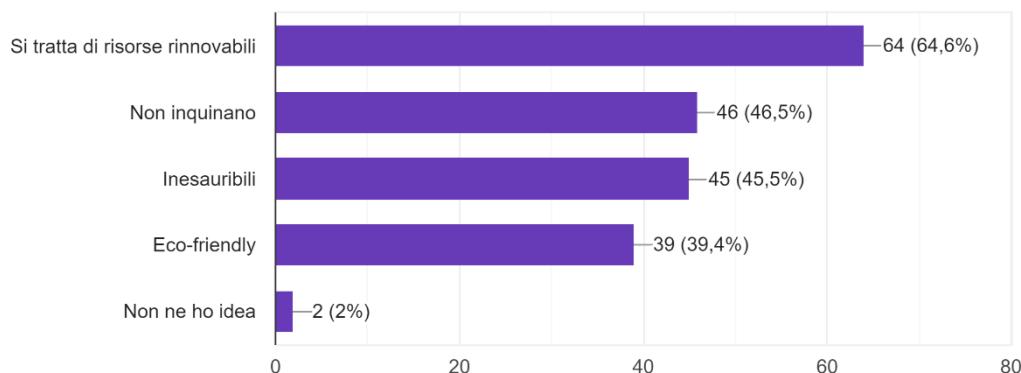


Figure 14. Answers to the question: What do you understand from renewable energy?



Co-funded by the
Erasmus+ Programme
of the European Union

Renewable energy:

- Are recyclable resources (64,6%)
- Does not pollute nature (46,5%)
- Are inexhaustible (45,5%)
- Eco-friendly (39,4%)

Quali delle seguenti fonti sono definite “rinnovabili”?

100 risposte

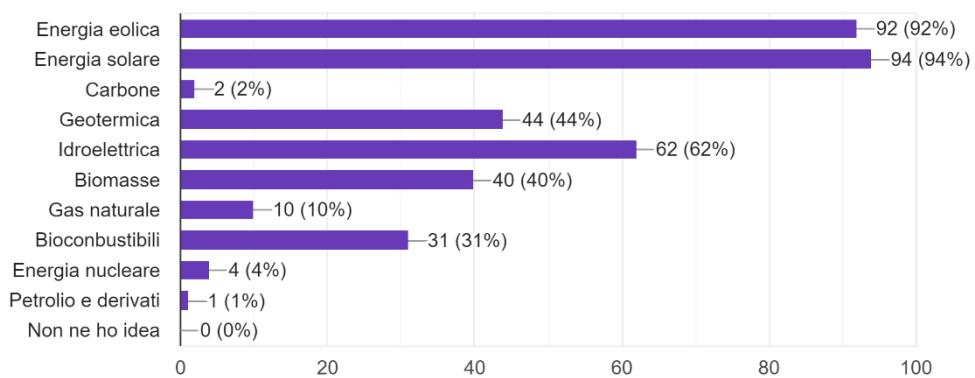


Figure 15. Answers to the question: Which of the followings are renewable energy sources?

People think that wind power (92%) and solar energy (94%) are the most important energy sources we actually have. 1% says that petroleum and its derivatives are also “renewable energy”. Furthermore, geothermal (44%) and hydroelectric (62%) are defined as renewable.

In order to measure the awareness on ZEBs of youngsters, they were asked to give a feedback on this field.

Hai idea di cosa siano gli edifici a energia zero (ZEBs- Zero Energy Buildings)?

100 risposte

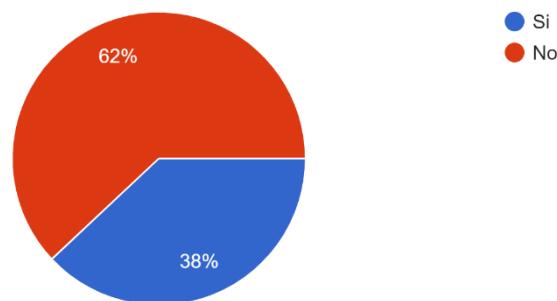


Figure 16. Answers to the question: Do you have any idea about zero energy buildings?

Cosa credi possa essere un edificio a energia zero (ZEB- Zero Energy Building)?

100 risposte

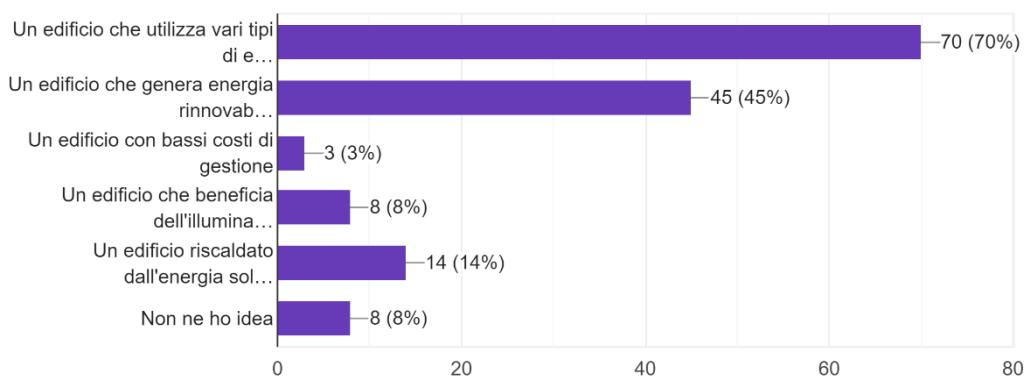


Figure 17. Answers to the question: Do you think what a Zero Energy Building is?

62% of interviewed young people states that it knows what a ZEB: 38% has never heard about Zero Energy Buildings before.

70% of them believes that a ZEB is a building uses energies such as solar, earth, wind as a renewable energy source and 40% believes that it generates renewable energy at least it needs throughout the year. 8% doesn't have idea abou what a ZEB can be.

Hai mai preso parte ad un workshop, seminario o campagna di sensibilizzazione sugli edifici a energia zero (ZEBs- Zero Energy Buildings)?
100 risposte

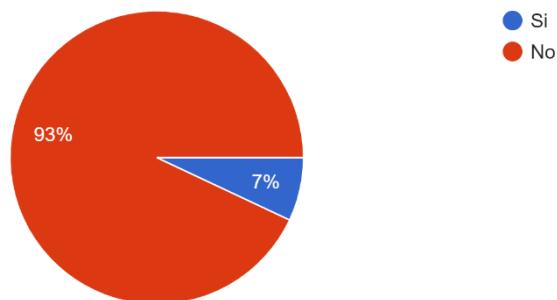


Figure 18. Answers to the question: Have you ever participated in any workshop, awareness campaign or seminar about Zero Energy Building?

Hai mai visto un edificio ad energia zero (ZEBs- Zero Energy Building)?
100 risposte

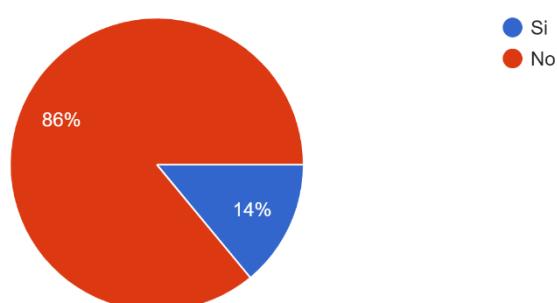


Figure 19. Answers to the question: Have you ever seen a ZEB?



Co-funded by the
Erasmus+ Programme
of the European Union

Between them, 93% has never been participatin in any kind of workshop, awareness campaign or seminar about Zero Energy Building, only 7% did.
 86% has never seen a ZEB but 14% declares it has met a ZEB at least once.

A tuo avviso, quali sono i benefici dell'aumento del numero edifici ad energia zero (ZEBs- Zero Energy Buildings) nel tuo paese?

100 risposte

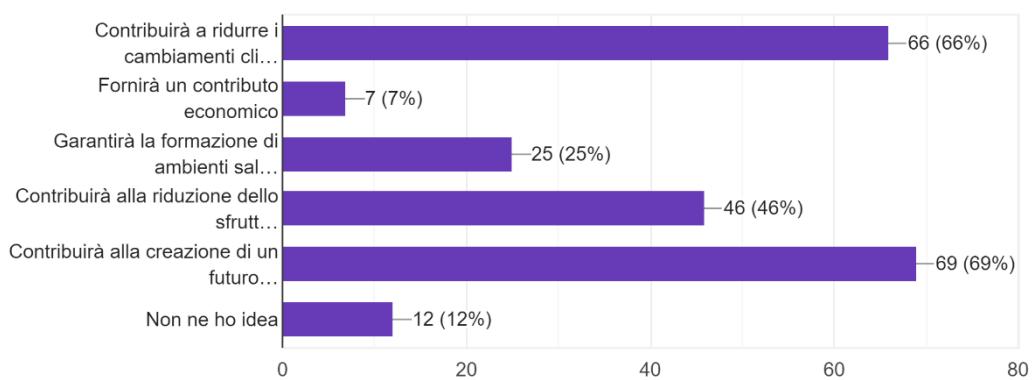


Figure 20. Answers to the question: What can be the benefits of increasing the number of Zero Energy Buildings in your country?

Benefits of adopting ZEBs is seen as a contribution to a sustainable future (69%), as contribution to the reduction of climate change (66%) and as a contribution to the reduction of resource consumption (46%). 12% has no idea on which benefits it could have.



Co-funded by the
Erasmus+ Programme
of the European Union

6.3 Available Technical/Conceptual Background

20 people have been interviewed in order to get a professional and technical background in terms of energy issues.

Professione

20 risposte

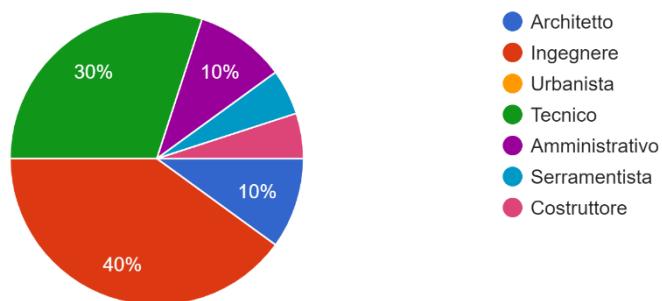


Figure 21. Answers to the question: Profession.

90% of them is a technician (40% Engineers, 30% technicians, 20% builders and Architects) and 10% is part of administrative institutions at local and national level.

Ritieni che il risparmio energetico degli edifici esistenti sia tenuto in considerazione nel tuo Paese?

20 risposte

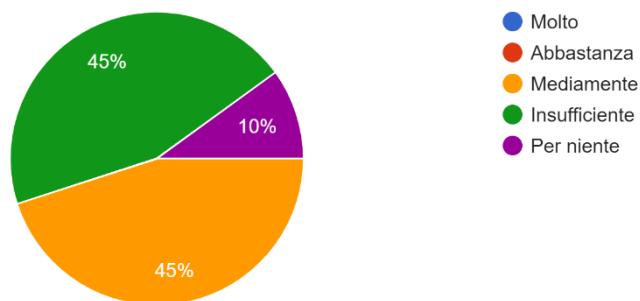


Figure 22. Answers to the question: Do you think that energy conservation in existing buildings is taken into the consideration in your Country?

Ritieni che il risparmio energetico dei nuovi edifici sia tenuto in considerazione nel tuo Paese?

20 risposte

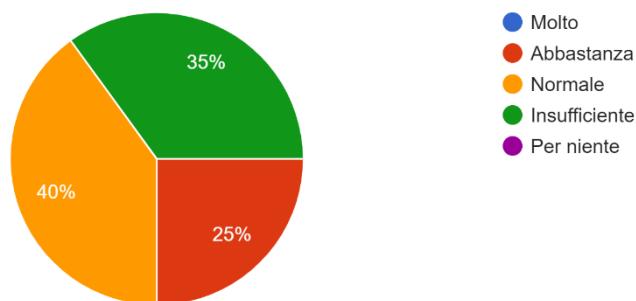


Figure 23. Answers to the question: Do you think that energy conservation in new buildings is taken into the consideration in your Country?

Talking about the consideration energy conservation and efficiency have in existing buildings, 45% of stakeholders believes it is neutral and insufficient and 10% of respondents thinks there is a lack.

With regard to new buildings, 40% believes it is neutral and 35% it is not sufficient instead of 25% thinking about it is sufficient.

Un uso funzionale delle risorse del Paese è garantito dalla progettazione di edifici ad alta efficienza energetica?

20 risposte

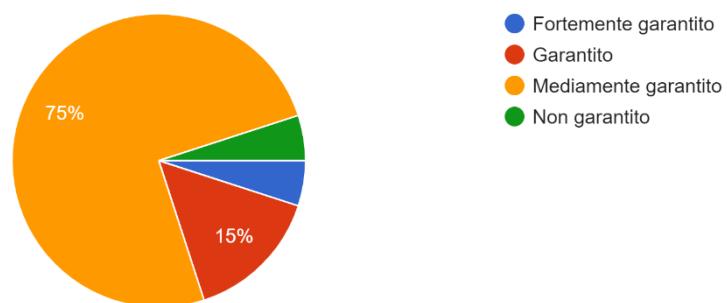


Figure 24. Answers to the question: Does energy efficient building design ensure efficient use of Country resources?

Half of the interviewed people (75%) declares that energy efficient building design ensures in a normal way efficient use of country resources. 15% states that it fully ensures the use of Country resources.

Efficienti approcci di progettazione edile dal punto di vista energetico (parametri di progettazione / sistemi a...si acquista una proprietà immobiliare?

20 risposte

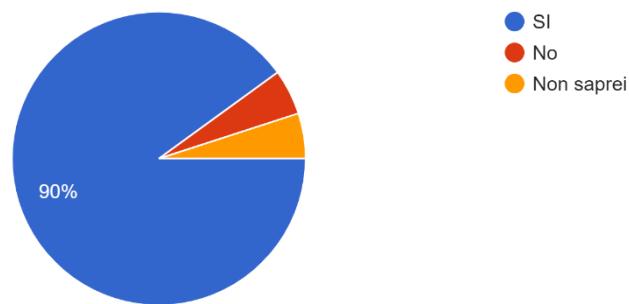


Figure 25. Answers to the question: Do you think energy efficient building design approaches (design parameters / active systems / passive systems) are important when buying a real estate property?

Almost everybody (90%) agrees that energy efficient building design approaches (design parameters / active systems / passive systems) are important when buying a real estate property. Between active and passive systems in energy efficient design approaches that are effective on the economic value of the real estate, it has been proved that thermal dispersions, energy savings, geothermal heat pumps, insulated windows, geothermal heat pump floor system, solar power are mostly adopted.



Co-funded by the
Erasmus+ Programme
of the European Union

Ritieni che i costi operativi subiscano una riduzione all'interno degli edifici a seguito dell'implementazione di un appr...zione/sistemi passivi/sistemi attivi)?

20 risposte

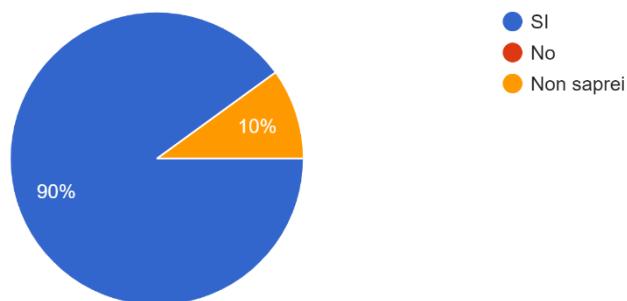


Figure 26. Answers to the question: Do you think that the operation costs will be reduced in buildings with implementation of energy-efficiency building design approach (parameter of design/passive systems/active systems)?

The evidence shows that 90% believes that costs will be reduced in buildings with implementation of energy-efficiency building design approach, putting into practice passive and active systems solutions and efficient parameters of design.

Furthermore, 50% concludes that the design and the implementation of energy-efficiency buildings will increase the investment costs between 50% and 75%, while 35% of interviewed people deducts they will be increased between 25% and 50%.

La progettazione di un edificio ad alta efficienza energetica aumenterà i costi di investimento:

20 risposte

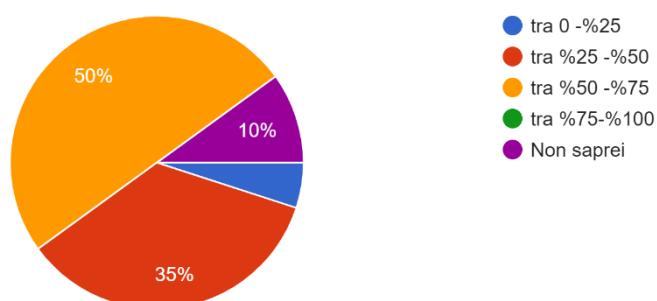


Figure 27. Answers to the question: Do you think that design of an energy-efficiency building will increase the investment cost?

When asked if in Italy energy-efficiency buildings are designed, people declared yes for 90% and not for 10%, as shown in the figure 28:

Nel tuo Paese vengono progettati edifici ad alta efficienza energetica?

20 risposte

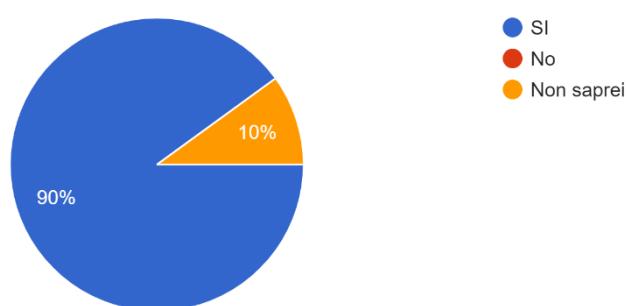


Figure 28. Answers to the question: Do you think that energy-efficiency buildings are designed in your country?

Between factors which contribute to the lack of implementation of the energy efficient building design approach, results are: 65% lack of knowledge and experience of designers and of adequate technical person in practice, 50% lack of knowledge and experience of actors in the construction sector and 25%, lack of public demands for energy-efficiency building design and high initial investment cost.

Se la risposta è "No" quale dei seguenti aspetti non viene implementato con riferimento ad un approccio di progettazione? (È possibile scegliere più opzioni).

20 risposte

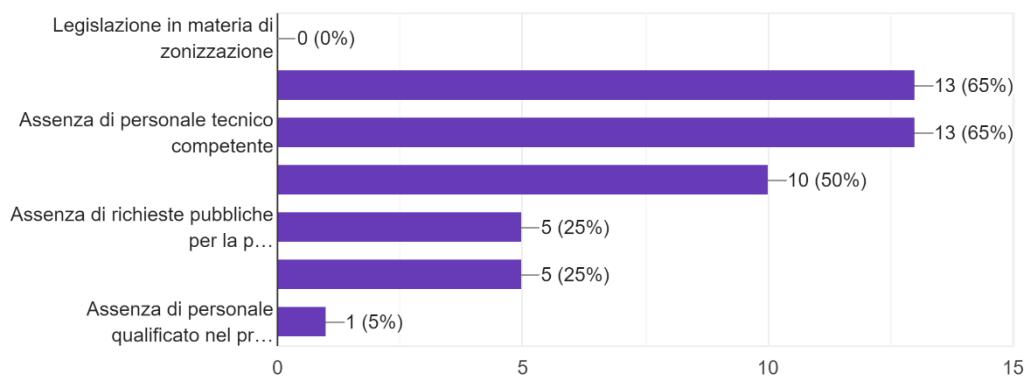


Figure 29. Answers to the question: which of the following issues are not implemented because of the energy efficient building design approach?

6.4 Evaluation of Survey Results

Among interviewed Italian youngsters, there is a wide awareness on what is the definition of climate changes but they are not so aware and informed on which the causes and consequences are. The Survey results also states that in terms of renewable energy they just know the most famous and common sources (solar and wind power) as they are confused on what types of measures and actions can be taken at home level and more in general.

Talking about ZEBs and energy efficiency of buildings, there is still a lot to be done: most of them has never heard before on what a Zero Energy Building is and which are its potentials and benefits.

Between professionals and stakeholders, evidences demonstrate two different behaviours: a strong background in energy efficiency and renewable energy issues applied to construction sector for technicians, engineers, architects working in building designing and construction from one hand. On the other hand, stakeholders with an administrative role are keener to a theoretical approach to energy issues: when they have been asked to provide precise and technical elements they were not well trained on solutions could be applied.



Co-funded by the
Erasmus+ Programme
of the European Union

7 CONCLUSIONS AND FUTURE REMARKS

After an in-depth analysis on results and field and desk research conducted in this report, the usefulness of “From Zero to Hero Project: Wise Energy Use Scheme for Youngster” has been demonstrated. It constitutes, indeed, a strong basis to better understand how institutions and stakeholders work together to achieve better performances in terms of climate changes and energy efficiency in Italy and in the whole Europe, as well, but also to value thinkings and ideas of young people in this field.

Main results and outcomes of the research conducted as IO1 of the Project are:

- Italy is constantly adapting its energy policy to International and European standards aiming to reduce CO₂ emissions and to boost the use of renewable sources;
- The capacity of renewable sources such as photovoltaic, wind and hydroelectric is increasing even if Italy has a wide range of idrogeological risks and geological problems;
- Learning pathways, in Italy, on Energy Efficiency and Environment are limited to engineering, architecture and economics fields;
- Between professionals (engineers, architects, ecc.) there is, from one hand, a lack of information and cultural training on potentials of ZEBs and NZEBs, from the other hand, the desire to get more input and tools;
- Young people in Italy are aware on what climate changes are but most of them don't know what ZEBs and NZEBs are; they are also not so prepared on actions aiming to reduce the impact of climate changes.
- Although, the number of best practices implemented by Italian institutions, apart from the formal ones, together with European and International actors is increasing: they are fully involved in the development of policies and best practices on climate changes impact and ZEBs.



Co-funded by the
Erasmus+ Programme
of the European Union

8 REFERENCES

- AESS - Agenzia per l'Energia e lo Sviluppo Sostenibile: <https://www.aess-modena.it/it/>
- AIEE – Italian Energy Economists Association: <https://www.aiee.it/>
- Architettura Ecosostenibile.it: soluzioni architettoniche per la riduzione dei consumi energetici: <https://www.architetturaecosostenibile.it/>
- Covenant of Mayors for Climate & Energy: <https://www.eumayors.eu/>
- ENEA – Italian National Agency for Energy Efficiency: www.efficienzaenergetica.enea.it
- ENEL: <https://www.enel.it/>
- Energy and Strategy Group: <http://www.energystrategy.it/home.html>
- Energy Performance of Buildings Directive: <https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-performance-of-buildings>
- European Environment Agency: <https://www.eea.europa.eu/it>
- Green.it: <https://www.green.it/abitare/architettura-sostenibile/>
http://www.pdc.minambiente.it/sites/default/files/allegati/Strategia_nazionale_a_dattamento_cambiamenti_climatici.pdf
- Institute of Atmospheric Sciences and Climate – National Research Council of Italy: <http://www.isac.cnr.it/>
- Intergovernmental Panel On Climate Change (IPCC)- Report: <http://www.isprambiente.gov.it/it/temi/biodiversita/documenti/intergovernmental-panel-on-climate-change-ipcc-report>
- ISPRA- Indicatori clima Italia 2017: <http://www.isprambiente.gov.it/it/pubblicazioni/stato-dellambiente/gli-indicatori-del-clima-in-italia-nel-2017>
- Italian Ministry of Environment: <https://www.minambiente.it/>
- La questione energetica, The energy question: <https://www.esteri.it/mae/doc/energiait.pdf>
- Osservatorio nazionale NZEB: <http://www.efficienzaenergetica.enea.it/news-eventi/osservatorio-nazionale-degli-edifici-a-energia-quasi-zero-nzeb>

- Rivista CasaClima DueGradi, gennaio 2019:
<https://www.agenziacasaclima.it/it/rivista-cascaclima-duegradi-gennaio-2019--5-191.html>
- Strategia Nazionale di adattamento ai cambiamenti climatici:
- TERNA SPA: <https://www.terna.it/>
- World Energy Council – Italy: <https://www.wec-italia.org/>
-



Co-funded by the
Erasmus+ Programme
of the European Union