ISSN: 2771-7763

Research Article

Journal of Economic Research & Reviews

# Renewable Energy Communities as Leverage for The Energy Transition and The Fight Against Energy Poverty: the Situation in Italy

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**Submitted:** 2023, Jun 10; **Accepted:** 2023, Jun 30; **Published:** 2023, July 05

**Citation:** Martoni, A., Georgiadis, T., Nardino, M., Cremonini, L., Saraceni, S. (2023). Renewable Energy Communities as Leverage for The Energy Transition and The Fight Against Energy Poverty: the Situation in Italy. *J Eco Res & Rev, 3*(3), 98-113.

**Abstract**

*We are facing a period of epochal changes. Meteorological and climatic emergencies and global geopolitical structures pose the challenge of radically changing the sources of energy supply by abandoning hydrocarbons after 150 years and coal after millennia. Cities already have, and will assume more and more in the future, an essential role in the fight against climate change both because it is expected that in 2050 the majority of the population will live in urban areas and because cities already play an active role in climate change becoming hot spots. Urban areas can and must become areas of electricity production, or at least in equilibrium between consumption and production, rather than just being consumers. A rapid historical excursus is made on the concept of quality of life applied to the structure and function of the city up to the paradigm, still current, between ecological complexity and pure function that goes beyond the population's well-being. Urban areas have developed mainly pursuing commercial and industrial interests.*

*In the immediate future, they will have to develop pursuing environmental, energy, and human interests. The problem of intervening in pre-existing urban fabrics and the historic centers of European cities is analyzed. Two approaches that can coexist were analyzed: Renewable Energy Communities and Near Zero Emission Buildings. Transforming all buildings in the consolidated city into NZEBs is neither feasible nor sustainable, and the goal of transforming cities into electricity producers risks failing. Energy communities can help solve the problem by building medium and large power photovoltaic systems on public buildings or areas such as car parks and roads. Finally, the study outlines some interventions considered essential for solving the energy problem in urban areas and its impact on the community system.*

**Keywords:** Renewable Energy Communities, Near Zero Emission Buildings, Energy Poverty, Building Heritage, Community System.

## 1. Introduction

The theme of improving the quality of life of communities has always been an object of study for architects. Let us take, for example, the archaeological site of Amarna, the modern name of the city of Akhetaton, a city wanted and built by the heretic pharaoh Akhenaten as the only capital of the kingdom of Egypt, replacing the administrative capital, Memphis, and the religious one, Thebes. Amarna arouses attention for the schematic, regularity, and, one can say, the rhythm with which its urban layout has been designed. An original prototype of a modern city, with its almost modular houses, theorized in the modern era, for example, by Walter Gropius and the Bauhaus movement he founded [1]. The organizational functioning of the city, where the function dictates the form, is an urban-social evolution of functional, schematic, and futuristic evolutionary development.

The evolution from the city of Akhetaton to the working-class cities chronologically closest to us, such as the Salt Pans of Chaux, the work of Claude-Nicolas Ledoux, or the Familisterio of Jean Baptiste Godin, the inspiring archetype of the housing unit, up to the working-class neighborhoods of Vienna or the working-class neighborhoods of J.J.P. Ouds are the evolution of the idea that it is the purpose that determines the shape of the city but also the shape of social and community relations. It was believed that human well-being coincided with functional well-being based on inhabited areas' organizational and operational systems. Over time, this utopian vision has given way to the observation that functionality alone pursues economic and non-humanistic ends.

Even within the architectural and urban planning community, voices have been raised in disharmony with what Nikos Salingaros has termed "geometric fundamentalism" [2]. Elizabeth K. Meyer addressed the debate between sustainability and aesthetics, which, due to the growing public awareness of climate change and its consequences, takes on increasingly urgent tones daily. With her repeated reflections, Meyer has entered the tradition of thinking about creating a landscape that best serves both the interests of man and nature's interests [3].

Christopher Alexander describes the guidelines that an "organic" development of a city should have: not ideological choices descended from above, which have often led to the alienation and distortion of places and contexts, but a spontaneous evolution guided by seven "rules" which rather constitute the backbone of thought rather than a desire for deterministic imposition [4]. Cities have their metabolism and consume huge amounts of electrical and chemical energy. Electricity at the moment is consumed by domestic users (household appliances, heating, and cooling systems, domestic lighting), condominium users (lifts, condominium lighting), commercial users (sales points, refreshment points), industrial users, transport (railways, subways, tramways, trolleybuses), urban uses (public lighting, road signs) and heating/air conditioning systems. In the coming decades, cities will have to face epochal changes to be able to face the emerging two great challenges: the energy crisis and the climate crisis. Today half of humanity, that is: 4 billion people, live in cities. By 2030, nearly 60% of the world's population is expected to live in urban areas. 95% of urban expansion in the coming decades will take place in developing countries. Currently, 828 million people live in slums, and the number is constantly increasing. Cities occupy only 3% of the earth's surface, and yet they are responsible for 60-80% of energy consumption and 75% of carbon emissions (ONU – Centro Regionale delle Nazioni Unite, 2022).

Two critical questions arise from these considerations: Can cities, or relatively urban areas, become producers of the amount of electricity necessary for their metabolism? Can cities, or rather communities, become "human-centered" to respond to the aspirations of citizens? The needs related to the climate crisis impose the replacement, as far as possible, of the systems and engines powered by chemical energy with similar systems and electric engines, with the consequent exponential increase in electricity consumption in the coming years. Here one of the "dogmas" of a particular ecological ideology is immediately reduced: one cannot think of tackling climate change by thinking only of reducing consumption. One must think of producing huge quantities of "clean" electricity.

In a dense urban environment so rigid to change, every minimum intervention carried out on the scale of the neighborhood or portion of the city, up to the building sector, must be optimized for an increasingly diversified new energy demand, especially in social terms. In this sense, the experience of the last few decades has made it possible to select technological and managerial solutions in the urban energy chain that adapt well to the consolidated Italian urban fabrics.

At the level of the building sector, today, we have the NZEB building as a reference rather than the passive house, which has more restrictive requirements. The almost zero energy NZEB building, produced from renewable sources, also responds to urban challenges in decarbonization and consumption reduction. The substantial step, which is also a challenge, concerns its electrification, ensuring the reduction of dependence on fossil fuels in a context of self-consumption that must spread widely.

One of the most followed self-consumption solutions is the Renewable Energy Communities (RECs), where people are encouraged to transform themselves from disinterested consumers into energy protagonists by establishing an energy community [5]. The crisis we are experiencing requires an energy transition to build a new model of social organization based on the production and consumption of energy from renewable sources that inspire a more sustainable lifestyle and protects the most disadvantaged users.

The production of energy from renewable sources calls into question some plants from renewable sources that have been put into practice in recent decades. Among these are the mini wind turbines, which, however, present three problems for their application: the first is that they require the presence of these and constant winds to guarantee good productivity, and not all areas have this anemological characteristic, in particular, it is certainly excluding the Po valley. The second is their noisiness, which has made installing small wind turbines in urban areas unthinkable. A third aspect is their visual impact: the dense Italian urban fabrics are, for the most part, restricted from an architectural and landscape point of view, making the use of this technology even more unlikely. Another typology is the mini hydroelectric plants, which exploit the natural water current of our rivers and streams with mini turbines and impellers, as was done in the past with mills. There are also various problems. The first is the seasonality with the flow of water, which tends to zero in the summer months, which are increasingly hot and drier. It is an inverse seasonality to that of photovoltaic systems: here, more is produced in winter than in summer.

The second is that it remains a source of energy for a predominantly mountainous and non-urban area. Although the cities crossed by waterways are numerous, the management of these waters is strongly directed towards responding to the water demand of users and urban and peri-urban production systems in an already delicate balance of flow regulation between managers. However, another typology is the photovoltaic system (PV), which, although presenting some defects, to date is the typology that best adapts to the structure and constraints of the dense urban context as their source of supply reaches everywhere.

They do not require significant transformations in the buildings on which they are installed (in particular the roofs, which occupy a high percentage of the surface of the dense city), they require little maintenance (cleaning of the panels), and finally, during their working cycle, they do not produce pollution or even noise. The defects concern the production of energy only during the day, in the presence of good solar radiation, in March-October, mainly in summer, and almost nothing in winter. Furthermore, they have an operational life of several decades, and, again, their production and disposal activities are polluting. The first problem has been tackled and solved with battery-powered systems that accumulate the energy produced and not directly consumed during the day and make it available at night. However, there needs to be a solution to the problem of the difference in production between summer and winter. Here the batteries need to be more. It is necessary to resort to long-term storage systems, such as compressed air storage systems (CAES) or plants with regenerative fuel cells. Plants of this kind are currently of dimensions and costs that the individual user cannot face [6,7].

Storage systems are an essential and physiological completion of renewable energy sources. Storage plants must stabilize the network's filter and allow the storage of energy when it is consumed in excess (during the day in summer) to make it available when the plant is not working. Various types of accumulation plants and other innovative ones are under development. Each of these types has different technical characteristics and methods of use, which make it possible to incorporate two different accumulation systems in the same plant. The technical aspects to be considered in accumulation systems, in addition to the accumulation capacity (the amount of energy that can be stored), are: the discharge time, the storage capacity over time (how long the charge lasts inside the storage system); the yield. The technologies currently used for storage systems are supercapacitors (Supercapacitors); flywheel systems (Flywheels); batteries; hydroelectric plants; compressed air/gas storage systems (CAES Compressed Air Energy Storage); the technologies under development are regenerative fuel cells (RFCS Regenerative Fuel Cells Storage).

To date, the most used storage system is the lithium battery. Electrochemical accumulators are currently the subject of intense research and development activity, and a growing penetration is expected, both on the transmission network and for applications distributed near the user and in small and medium-sized smart grids (between 1 MW and a few tens of MW). Alongside high-temperature batteries (Na/S and Na/NiC1), the most promising technologies are those based on lithium ions and redox/vanadium. In a longer-term view, metal/air technology is interesting RSEview, 2011[6,7].

So we find ourselves available a combination of technological and technical-operational solutions which allow, alongside a regulatory dimension that is increasingly taking shape, the implementation of sustainable living, which, on the one hand, means paying attention to maximum energy efficiency and the reduction of energy needs during the construction or renovation/requalification of a building, on the other hand, it consists in pursuing the sharing of available resources in order to reduce one's ecological impact and for a growing social coexistence. In the following chapters, the renewable energy community is presented in its organizational framework, placing it in managerial synergy with those regulatory and operational solutions already ready to take those steps today toward fair urban energy autonomy, especially with the NZEB.

## 2. Materials and Methods

How can the energy performance of the existing Italian building heritage be increased, making it a producer of energy and simultaneously responding to social needs? Starting from the Energy Community, the regulatory and operational valuable context for intervening in this heritage is outlined below, then distinguishing in the building fabrics between listed historic buildings and simply "old" buildings on which more active intervention can be done. A framework of operational tools, management methods, and cognitive surveys carried out by other research groups has been summarized below, which, if placed in synergy, can make energy communities become the leverage they potentially are. For this reason, some images and quotations have been included for the sole purpose of giving the reader linearity of reasoning.

## 3. The Renewable Energy Communities

What is a Renewable Energy Community? How do you do it? What are the significant aspects of this way of creating an alternative energy market?

The European Union directives set out in the Clean Energy for all Europeans Package (CEP) legislative package seek to put in place adequate legal frameworks to enable the energy transition and give citizens a leadership role in the energy sector. Of particular note are two of the directives of the CEP: the Renewable Energy Directive (EUR-Lex Access to European Union law, 2018, December 21), also called RED II, which contains definitions of collective self-consumption and the Renewable Energy Community (REC), and the Internal Market in Electricity Directive (EUR-Lex Access to European Union law, 2019, June 6) which defines the Energy Community of Citizens (CEC) distinguishing it from the Renewable Energy Community (REC), highlighting that the former (CEC) manages the energy produced from renewable and non-renewable sources. While the second manages energy in various forms, but this must come exclusively from renewable energy sources [8].

The Directives, although different from each other, both define the energy community as "a legal entity" founded on "open and voluntary participation", whose primary purpose is not the generation of financial profits but the achievement of environmental, economic, and social benefits for its members or associates or to the territory in which it operates. To guarantee the non-profit character of the energy communities, the participation, as community members, of companies in the energy sector (suppliers and ESCOs) which can, however, provide supply and infrastructure services is not allowed.

At the Italian regulatory level, the concepts of collective self-consumption and energy community are defined by article 42-bis of legislative Decree no. 162/2019, the so-called 2019 Milleproroghe Decree [9]. This Decree also made the 2001/2018 RED II Directive experimental with the hypothesis of sharing the electricity generated between citizens, businesses, and public administrations. It is then the Legislative Decree 199/2021, which fully implements the European Directive 2001/2018 (RED II) on the promotion of the use and management of energy from renewable sources [10,11]. In order to make the rules contained therein fully enforceable, the Decree provided that implementing ministerial decrees should be promulgated by December 2022, which to date have yet to be issued.

Therefore, there are two forms of alternative energy production in the current regulatory landscape: groups of self-consumers of renewable energy and renewable energy communities. Both are a coalition of users who, through voluntary acceptance of a contract, collaborate in order to produce, consume and manage energy through one or more local energy plants. Each form has its specific characteristics, but both share the same goal: to self-produce and supply renewable energy at affordable prices to their members, as well as generate environmental, economic, and social benefits locally [12].

The principles on which these two forms of energy production are based are the decentralization and localization of the same energy production. Through the involvement of citizens, businesses, businesses, and other local realities, it is possible to produce, consume and exchange energy with a view to self-consumption and collaboration.

Self-consumption means consuming the electricity a local generation plant produces on-site to meet one's energy needs. The energy community members are active protagonists in the management of energy flows, which is why they are called prosumers. The prosumer can enjoy not only relative energy independence but also economic benefits. He has his own energy production plant: he consumes what he needs and feeds the excess energy into the grid to exchange it with other community members or accumulates it to return it to the consumption units at the most appropriate time. The role of the prosumer is not limited to the consumer's (consumer) passive role, but actively participates in the various phases of the production process (producer).

Self-consumption of energy can therefore be achieved at three levels: individual, collective - which corresponds to the groups of self-consumers of renewable energy - and community, which corresponds to the renewable energy community. In Italy, the last two types have been legally recognized since 2020, even if, as mentioned above, in May 2023, the implementing decrees that must transpose the relative discipline have yet to be approved.

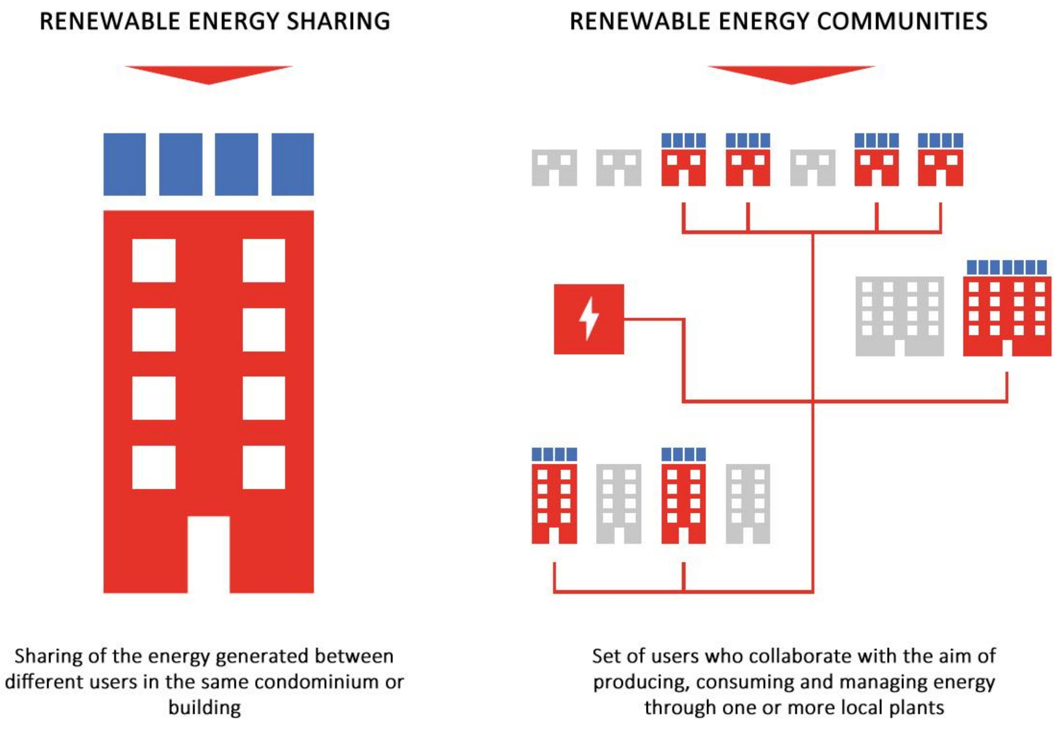


**Figure 1:** The two different types of self-consumption: collective and energy community.
**Source:** ART-ER, Regione Emilia-Romagna, Aess, 2022.

In individual self-consumption, the citizen (or family nucleus) is the owner of a renewable energy production plant and self-consumes the energy that he himself has produced [13]. Renewable energy, like any energy, is precious; therefore the efficiency of the system, combined with the conscious use of the energy produced and the reduction of waste, contribute to energy saving, bringing environmental as well as economic benefits.

Collective self-consumption, which corresponds to groups of renewable energy self-consumers, is made up of a plurality of consumers (at least two) located inside a building or condominium in which there are one or more plants powered exclusively by renewable sources. The plants can be owned by third parties and take advantage of specific benefits, such as tax deductions. The typical example, in fact, is that of the condominium with a photovoltaic system on the roof which supplies a part of the electricity needs to the condominium users and to the housing units of those who adhere. The energy produced in excess is introduced into the sales network, and therefore can also be sold, provided that this sales activity does not constitute the subject's main professional activity. Collective self-consumption therefore concerns the scale of a building or a condominium and is managed by the condominium administrator or by a representative recognized by the plurality involved or by the owner of a system available to the group of self-consumers. It is subject to the conclusion of a contract, but there is no obligation of a legal form constitution.

At the community level, i.e. in the energy community, the participating subjects must obligatorily establish themselves as a legal entity for the purpose of producing energy for their own consumption with plants powered by renewable sources, always with the main objective of not making profits, but rather generating benefits from an environmental and social point of view. To share the energy produced, users can use existing distribution networks and forms of virtual self-consumption.

Participation in the Renewable Energy Community (synonymous with Renewable Energy Community), as stated at the outset, must be open, voluntary and based on objective, transparent and non-discriminatory criteria [13]. Participants retain their rights as end customers, including the right to choose their supplier and to leave the community when they wish. In the contract that is stipulated, the person responsible for the distribution of the shared energy must be identified, who also manages the payment and collection items towards the GSE and the sellers.

Legislative Decree 199/2021 highlights some substantial constraints that each REC must comply with: in order to be able to access (and therefore be part of) a specific REC, consumers must verify that their POD (Point of Delivery or the identification number of the final customer indicated in the electricity grid meter) is included within the perimeter underlying the same secondary transformation substation to which the REC belongs [11]. Furthermore, the individual energy generation plants must have a total power not exceeding 200 kW. Lastly, RECs can be set up by those entities responsible for new plants powered by renewable sources, or plant upgrades that came into operation on 1 March 2020. These constraints in this first implementation phase have proved to be very critical, in particular by disadvantaging the creation of energy communities that can start from the bottom, i.e. from the citizens. These critical issues have already been resolved in future ministerial decrees whose issue is awaited. In particular, the primary high/medium voltage transformation substation was placed as the perimeter under the REC, and the incentive power limit will be extended to 1000 kW. Coming to the benefits produced by local energy sharing, a citizen, a condominium, a public administration or a company that chooses to self-consume the electricity produced by a renewable production plant has access to a series of economic advantages:

● Bill savings: the more energy you consume directly, the more you reduce the costs of the variable bill components (energy share, network charges and related taxes [12].

● Earnings on energy produced and shared, or fed into the public grid: producing energy with a renewable production plant can represent a source of income thanks to the GSE incentive mechanisms [14].

● Tax benefits (deductions or super-depreciation): you can take advantage of tax deductions with the recovery of 50% of the construction costs for private individuals who build a renewable production plant. For companies there is a super depreciation equal to 130% of the value of the investment (Further details on the website of the Revenue Agency).

There are of course also benefits from an environmental and climate change resilience point of view. In fact, in an energy community, the energy produced is from renewable sources, therefore emissions of CO2 and other climate-altering gases are reduced, and this is in line with objective 13 of the 2030 Agenda of the United Nations [15].

From a social point of view, the REC can have a strong impact on the fight against energy poverty (PE), which in recent years has also assumed an important role in the European Union (European Commission, Citizen Energy Forum 2016), which in fact has included specific measures in the 2030 Energy Package. An indicator of energy poverty is the high incidence of energy expenditure on the overall household income [16]. According to the Observatory of the European Commission, 54 million people have yet to be able to purchase the minimum energy goods necessary for their well-being and Italy is among the European countries where families have the most difficulty paying energy bills. electricity and gas: 14.6% of families are unable to keep their homes adequately heated (2018 data). To these values must be added the strong uncertainty of the current energy markets, which risk putting a much higher percentage of households in difficulty than that already recorded.

The fight against energy poverty (PE) is included in the objectives 1, 7 and 11 of the United Nations Agenda 2030 which undertakes to "ensure access to affordable, reliable, sustainable and modern energy systems for all". The creation of an energy community is one of the solutions to combat energy poverty: by making consumers aware and allowing for the monitoring and optimization of individual energy consumption, it allows household spending to be reduced.

## 4. Organization and Management of an Energy Community

Energy communities can experiment with innovative roles in the social, ethical and civic fields, structuring themselves through local governance with direct responsibility, at the base of which citizens, associations and business realities share a set of principles, rules and procedures concerning the management and governance of the community, towards goals of self-management and sharing of resources. This sharing refers to the collaborative economy: the sharing economy, i.e. an economic system mainly built on interconnected networks of individuals, organizations or communities that are based on collaboration, sharing, exchange, trade of products and services. The principles of the sharing economy can also be applied in the context of energy communities, and this can determine the emergence of new rules within the community that facilitate the exchange of goods and services between the participating members.

Which governance models for energy communities? Initially, the easiest governance to activate is the one that experiments with new energy saving technologies in residential structures. This model can then be extended to the apartment building and surrounding neighborhood. In a second phase, the model that leads to the creation of a collective body is configured, such as for example a cooperative, a living lab or a community association, which has the governance of the established entity as its main objective. Alternatively, the roles of organizations already present in the area can be integrated with the governance principles adopted by the community.

Going into more detail at the national level, so far four energy community governance models have been configured which, with the same environmental benefits, have very different effects from a social, and therefore economic, point of view.

• The first (and so far the most widespread) consists of a company or body which offers its know-how and its ability to produce energy to a group of users who make available the surfaces they own (mainly talks about building roofs) and with which it associates – this model is the one applied by entities such as large multi-utilities, which is the least virtuous model from a social point of view as the economic benefit that the single user has is minimal compared to the benefit to the company.
• The second model sees local bodies, such as for example a public administration or a parish, which associate and involve the community they insist on to respond to the social needs of the community - this model has precisely as its first objective being a driving force social, it is therefore virtuous.
• The third model corresponds to one or more industrial companies which, having thousands of square meters of available surfaces, decide to produce energy for their own sharing and for the benefit of the local community - in this case the model can provide for a benefit formula for users of the energy community, agreed between companies and which can involve the local public administration, in order to support the most fragile segment of the population through savings and incentive tariffs for the purchase of shared electricity.
• The fourth model is the one that starts directly from a group of users, who can form themselves as a self-consumption group or as an energy community, and who make up the bottom-up model, which has the sole objective of producing and sharing energy locally in order to reduce transport costs and related charges. This model, although having little impact on the energy transition, is the most virtuous as it is simple to apply and mainly aimed at providing social and community value, as well as being more repeatable in the short term. Consequently, it would be the one on which to direct the greatest incentives. The birth of the figure of the energy community facilitator can support the development of energy communities by favoring the activation of governance at the various organizational levels already present in a community or by favoring, in this sense, the birth of new active subjects.

As already mentioned in the previous paragraph, three main levels of self-consumption have so far been outlined:
• On an individual level
• Collectively
• At the community level
For each of these, an explanatory example is provided below.

For example, with a system of a private citizen (and his corresponding household) of over 7kWp and a storage battery, it covers over 80% of domestic consumption, and the goal of 100% is not far away even if the house is fully electrified with induction hobs and heating/cooling with a heat pump system. At this point, the idea of an Off-Grid system, completely detached from the national electricity grid, also becomes conceivable.

By collective level we mean condominium level or groups of condominiums. In this case there are two philosophies of intervention:
• Redevelopment / renovation (first or second level) of an already completed building with the installation of a photovoltaic system equipped with a storage system and a heat pump heating system.

• Complete reconstruction or new construction of the building with a design aimed at maximum energy efficiency and maximum solar exposure.

The first case is the most widespread solution in the Italian national territory which is mainly composed, as already specified in the introduction, of an existing consolidated and partly also restricted building heritage. Intervening by optimizing this heritage energetically in terms of environmental, economic and social benefits is the greatest challenge. In general (thus without considering the cases of interventions on listed historic buildings) intervening on an existing building can mean facing lower overall intervention costs in the short term compared to a new construction, but at the potential detriment of a more limited energy performance. Each case must be analyzed and there are examples that suggest good results in terms of needs, such as the "Self-User" project of an energy community set up in an ACER (Emilia-Romagna Casa Agency) condominium in Scandiano (RE) consisting of 48 homes , in which the plant under construction will have a production capacity capable of reducing electricity consumption from the grid by over 60%, with direct advantages in terms of reducing bills and combating energy poverty [17].

Equally interesting are community-level energy communities. In this case the community is constituted at the neighborhood or village level. This makes much larger spaces available for the installation of both photovoltaic systems and, if desired, also other types of generators. An example of a REC community is the energy community of Magliano Alpi (CN). "It is one of the first examples of an energy community whose promoter is a public administration. Magliano Alpi is located in the province of Cuneo and is a town of just over 2,100 inhabitants. The community was established pursuant to art. 42 bis of Legislative Decree No. 162 of 2019 (Gazzetta Ufficiale della Repubblica Italiana, 2019, December 31) and related implementing decrees as well as on the basis of ARERA resolution 318/2020/R/EEL and the Decree of the Ministry of Economic Development of 16 September 2020. The energy community also responds to the objectives desired and introduced by the Public Administration in the Single Programming Document (DUP).

The strategy used to set up the Magliano Alpi REC refers to a bottom-up participatory approach and is based on the collaboration between the PA and the Energy Center of the Turin Polytechnic. The REC, adhering to the "Manifesto of the Energy Community" has set itself the goal of activating an energy transition process that can lead to a reduction in the cost of bills for citizens. To form the REC, the administration made available the roof of a municipal building where a 20 kW/p photovoltaic system was installed. by paying a fee of € 25.00. The Municipality shares the energy produced and not self-consumed by the Municipality with the other members. The partners are all connected to the same secondary transformer station. Consumption is monitored by smart meters, electronic devices that record energy consumption and communicate the information to the supplier that have been positioned at the members' PODs. The data is collected by an online platform (ENERGY4COM) and transmitted to the GSE which delivers an incentive rate defined on the basis of the amount of energy produced and self-consumed. The commissioning of an additional 20kW/p system to be installed on the roof of a sports facility was recently approved.

The REC of Magliano Alpi has joined RESCOOP, the European federation of renewable energy cooperatives which includes another 1,900 communities in various EU countries. One of the aspects that most characterizes the REC of Magliano Alpi is the awareness that the relationship with the territory is a generator of economic, social and environmental value; in this perspective, the REC is not only functional to the production and consumption of clean energy, but becomes a useful tool for creating a sustainable and cohesive community". Furthermore, the RECs can become the fundamental tool for guaranteeing free energy to families with disadvantaged economic conditions, freeing them from subsidies [18].

## 5. Nzeb And the Existing Building Stock

The DM June 26, 2015 of the Ministry of Economic Development NZEB in Annex 1, paragraph 3.4, gives the following definition of NZEB [19]. Nearly zero energy buildings are all buildings, new or existing, for which the following are simultaneously respected:

• All the requirements pursuant to letter b), of paragraph 2, paragraph 3.3, determined with the values in force from 1 January 2019 for public buildings and from 1 January 2021 for all other buildings;

• The obligations to integrate renewable sources in compliance with the minimum principles referred to in annex 3, paragraph 1, letter c), of legislative decree [20].

Legislative Decree 3 March 2011, n.28 implements directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources [20]. Here are some of the benefits of NZEB buildings – nearly zero energy buildings:

• make it possible to considerably reduce consumption for heating and hot water - usually between 200 and 400 kWh/m2 year - and to reach around 30 kWh/m2 year;

• improve internal comfort;

• allow the exploitation of renewable sources;

• thermal dispersions towards the outside decrease;

• reduce $CO_2$ emissions into the atmosphere and contribute to decarbonisation.

The topic of energy efficiency was introduced with Legislative Decree 192/2005 then amended by Legislative Decree 63/2013, which became Law 90/2013 in which for the first time, as required by the European Directive on the energy performance of buildings "Energy Performance of Building Directive", there was talk of the production of energy from renewable sources [21-23]. Subsequently, Legislative Decree 102/2004 of 4 July introduced a framework of measures to promote and improve energy efficiency which contribute to achieving a reduction of 20 million tonnes of oil equivalent in primary energy consumption by 2020, equal to 15.5 million tonnes of oil equivalent final energy oil. With this Decree, the Public Administration has moved towards the energy requalification of its buildings [24].

The Ministerial Decree of 26 June 2015 "Application of energy performance calculation methodologies and definition of minimum prescriptions and requirements for buildings" - contains the table that summarizes the main minimum requirements that a new building or building undergoing renovation must compulsorily guarantee starting from 2019 for public buildings and for 2021 for all other buildings [25].

The results obtained following the implementation of the numerous national and community regulations were not satisfactory, therefore the European Union expressed itself once again, publishing the Recommendation in the Official Journal (UE) 2016/1318 del 29 luglio providing guidelines for the promotion of nearly zero-energy buildings and best practices to ensure that, by 2020, all new buildings are nearly zero-energy [26].

The Regional Council Resolution n. 1978 of 13 December 2017 of Emilia Romagna provides for the granting of grants for the implementation of interventions for the energy requalification of public buildings and public residential construction in order to promote:

• the transformation of existing buildings into "nearly zero energy buildings"

• the diffusion of NZEB buildings.

A total of 126 projects were admitted between 2018 and 2019 [27]. However, the percentage of expected nZEBs has yet to be discovered. Also, in 2017, the PANZEB – National Action Plan for NZEB Buildings was approved in Italy [25]. In this document, an assessment of the energy performance index has been elaborated for some existing buildings undergoing transformation into NZEB and new NZEB buildings, based on their building typology, intended use and climatic zone (zones B and E). Furthermore, the document also estimates the extra costs required (compared to November 2015) both for the construction of new NZEB buildings and for the transformation of existing buildings into NZEB. In particular, the column "total global energy performance index" in table 1 indicates the average consumption of primary energy by type of building.

| | Construction time | | | Gross volume | Envelope surface area - gross volume ratio | Glass surface area - envelope surface area ratio | Total global energy performance index | |
|---|---|---|---|---|---|---|---|---|
| | | | $A_{floor,n}$ [$m^2$] | $V_l$ [$m^3$] | $A_{env}/V_l$ [$m^{-1}$] | $A_w/A_{env}$ [-] | $EP_{gl,tot}$ [$kWh/m^2$] Climate zone B | Climate zone E |
| *Residential buildings* | | | | | | | | |
| • Single family | Existing | 1946-76 | 162 | 584 | 0,75 | 0,05 | 113 | 168 |
| | New | 2015 | 98 | 371 | 0,99 | 0,03 | 99 | 120 |
| • Large condominium | Existing | 1946-76 | 1552 | 5949 | 0,46 | 0,07 | 100 | 114 |
| | New | 2015 | 1788 | 6662 | 0,43 | 0,09 | 99 | 95 |
| *Non-residential buildings* | | | | | | | | |
| • Office | Existing | 1946-76 | 363 | 1339 | 0,6 | 0,12 | 145 | 160 |
| | New | 2015 | 1536 | 6077 | 0,35 | 0,20 | 131 | 115 |

**Table 1: Buildings subject to energy assessments: total global energy performance index values (sum of renewable and non-renewable) of the buildings considered for the two climatic zones [25].**

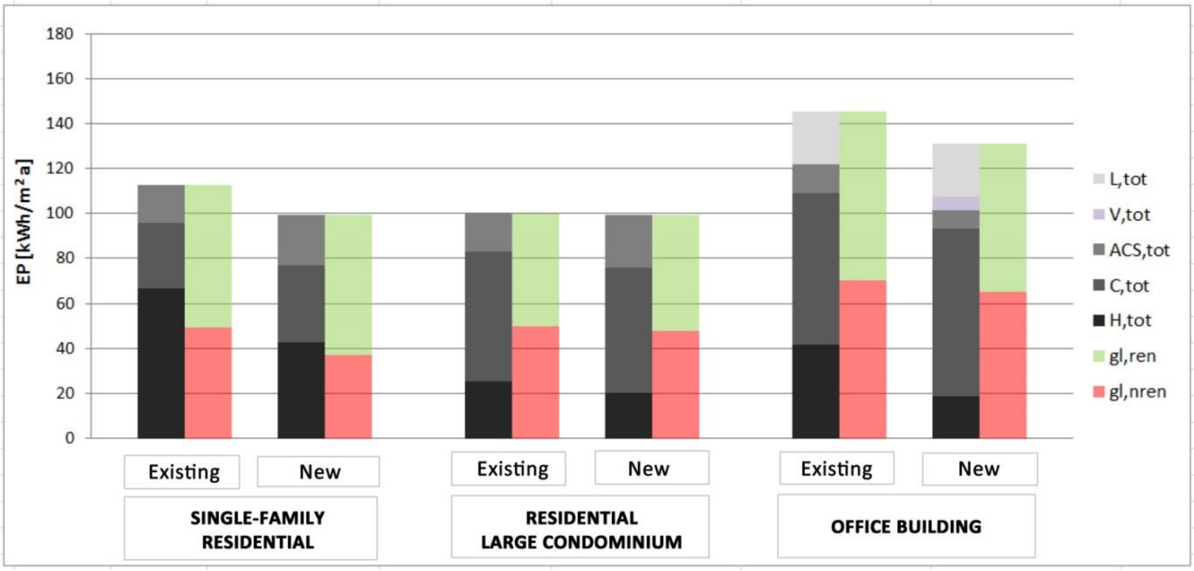


**Figure 2:** Climate zone B, energy performance. . The services considered in the final uses in the calculation of the energy performance are: L,tot= light; V,tot= ventilation; DHW,tot= domestic hot water; C,tot= summer air conditioning or cooling; H,tot= winter air conditioning or heating; gl,ren= share of global renewable energy; gl,nren= share of global non-renewable energy [25].

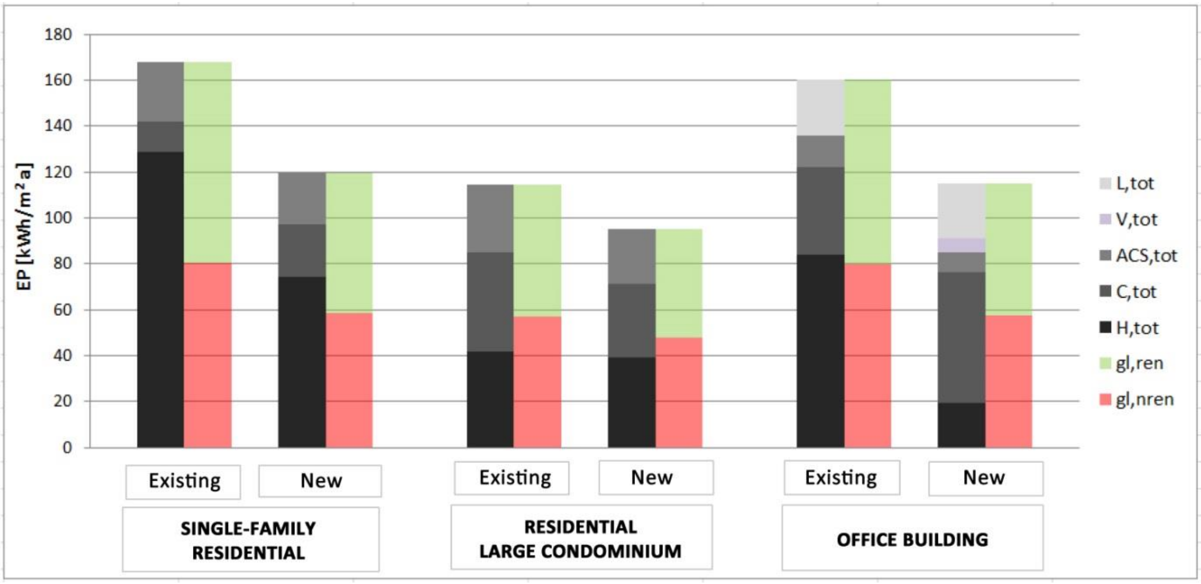


**Figure 3:** Climate zone E, energy performance. The services considered in the final uses in the calculation of the energy performance are: L,tot= light; V,tot= ventilation; DHW,tot= domestic hot water; C,tot= summer air conditioning or cooling; H,tot= winter air conditioning or heating; gl,ren= share of global renewable energy; gl,nren= share of global non-renewable energy [ 25].

The results show a global non-renewable energy requirement between 35 and 60 kWh/m2 per year for both climate zones; the single-family residential building and the existing office in climatic zone E are an exception, with values around 80 kWh/m2 year [25].

In order to satisfy the NZEB requirements, with particular reference to the requirement concerning renewable energy, the use of the heat pump (possibly centralized and combined for the production of thermal energy for heating, domestic hot water and cooling) possibly associated is suggested to photovoltaic panels. The study reports that "the differences in energy performance that can be found between existing buildings undergoing transformation into NZEB and new NZEB buildings is mainly due to the fact that the existing single-family residential buildings and office buildings have an attic on the ground on which there is therefore no possible to intervene, while for new buildings the attic is insulated and guarantees better performance. Furthermore, in many of the cases analysed, the difference is linked to the types of systems used, sometimes different, and which have different performances" [25].

With the Legislative Decree 48/2020 which implemented the European Directive 844, known as "Energy Performance of Buildings Directory III" - EPBD III from 1 January 2021 all new buildings or those on which demolition and reconstruction work must be carried out must be NZEB [28,29]. The obligation had already started for public buildings expiring on 31 December 2018. Emilia Romagna has anticipated the national obligation for which all buildings built from 2017 onwards are NZEB. The new version of the EPBD community directive, which is in the final negotiation stage at the European Commission, after it was approved by the European Parliament in March this year, stipulates that all residential property units must achieve class E by 2030 and class D by 2033, as well as that all new buildings are carbon neutral starting in 2028.

The Thermal Account it is currently the only specific government incentive that aims to increase energy efficiency and the production of thermal energy from renewable sources for small-sized plants [30]. Among the beneficiaries, mainly Public Administrations (PAs) are admitted, but also social cooperative societies and inhabitants' cooperatives, and this expansion aims to encourage the formation of RECs. To make clear a direct will in this sense, it is emphasized that among the PAs the incentive also includes the former Autonomous Institutes for Popular Housing, the cooperatives of inhabitants registered in the National Register of housing cooperatives and their consortia set up at the Ministry of Economic Development, as well as companies with wholly public assets and social cooperative companies registered in the respective regional registers. By private entities, however, access to the incentive mechanisms can be requested directly by these entities or through an ESCO: the PAs will have to sign an energy performance contract, private entities an energy service contract. The amount of funds is equal to 900 million euros per year, of which 200 dedicated exclusively to the PAs. The provision has also admitted to incentives major renovation or redevelopment interventions such as to transform existing buildings into NZEB - measure 1.E [31]. Where demolition and reconstruction is possible, there is the possibility of expansion up to a maximum of 25% of the initial volume, in compliance with the urban planning instruments in force. The maximum expenditure limit ranges from 500 to 575 €/sqm. This specific measure can be accessed directly by the PAs, or, again by the PAs, indirectly through the ESCOs, but on buildings owned by the [32]. In 2017, the NZEB interventions (measure 1E) carried out by the Public Administration were 28 with state funding; in 2016 there were only 7. In Italy as of 2018 there are around 1400 NZEB buildings which, compared to the existing building stock, does not exceed 0.03% on a regional basis. In 2017 there were only 600 The trend is growing [33].

The challenge is to operate simultaneously on two fronts: to create RECs in building sectors composed of NZEB buildings, or for each case by maximizing the achievable energy performance, and, in cases that see it feasible, that the NZEBs created are completely electrified.

As we know, every energy efficiency intervention involves modifying the plant engineering part of the building concerned, making a technological adaptation that can also involve the context, indeed, with a view to creating an energy community, it would be desirable for this adaptation to take place at the same time. Putting the aforementioned directives into practice, and in particular the transformation of existing buildings into NZEBs, opens up questions that deserve more detailed treatment in order to fully understand the complexity of the aspects involved, in general in interventions on the building heritage existing Italian.

A study carried out by ENEA highlights that 90% of the building stock in Italy is made up of old buildings, or more generally built before 1991, i.e. before the legislation that identified the limitations of energy consumption in buildings came into force, in terms of energy performance of the systems and of the construction elements [34]. The average value of the energy requirement of a typical building of this building stock is approximately 200 kWh/m2 per year. Intervening in this consolidated city involves dealing with technical-architectural problems, but also decision-making which involves a bureaucratic chain that starts from the citizen (user and owner), passes by the planners, sector operators, up to the political decision-makers of the Public Administration. The main obstacles to the development of the energy efficiency market within the existing building stock have been specified, in order to develop ad hoc policies and strategies to overcome them:
• economic barriers, linked to the funds available for streamlining and methods of accessing Credit. The elements that have the greatest impact on the potential for efficiency are the initial investments compared to the amortization times, and these strongly depend on the title of enjoyment of the property and the socio-economic profile. So, for example, if the property is rented, the owner will only decide to invest money if he does not directly benefit from the savings on the bill or the improved internal conditions.
• technical barriers, linked to the construction characteristics and materials of the building which can favor or exclude certain technologies a priori. Normally on existing buildings it is always advisable to limit interventions as much as possible in order to avoid extra costs and unexpected events. Furthermore, in general, the state of conservation of the building and its construction characteristics tend to favor the choice of less performing technological solutions from an energy point of view: for example, external insulation often cannot be done on historic buildings (due to) and therefore we intervene in internal environments, knowing that we cannot select those technological solutions that require excessive insulation thicknesses. In these cases, therefore, the focus is on solutions with a high insulating power, which, however, involve innovative technologies, but therefore very expensive (eg nanotechnological materials).

• regulatory barriers, generally linked to historical landscape constraints and local building regulations, but can also be dependent on the specific use to which the building is intended. As mentioned in the previous point, buildings or entire areas forming part of a sector categorically prohibit the use of certain technologies which, although energy efficient, would irreversibly alter the aspect of the restricted sector. This is unacceptable if an identity aspect of the community that lives there is recognized in this sector.
• management barriers, some technologies involve management and administrative complications mainly linked to the common use of some spaces and services which can discourage their adoption;
• cultural barriers, linked to the knowledge of the technologies of end users but also of sector operators or PA decision makers.

These last two points are profoundly united by the need for knowledge of the efficiency improvement process of the building stock. On the one hand, the energy efficiency potential of the building is hardly known, because it depends on the economic availability, on the limits imposed by the characteristics of the building and its context, and on the accessibility of the local market to the various technologies that can be put in place. This lack of knowledge can potentially involve the actors of the chain of this process, which concerns operators in the sector, end users, investors, public administration. An example for all: if the designer or the workforce need to be updated on the technological solutions available, or on how to apply them correctly, this can affect the state-of-the-art realization of the planned works, nullifying, or in any case making much less effective intervention. Reasoning jointly on the obstacles described above, it emerges that the potential energy performance of an existing building also depends on the classification of the building itself with respect to the urban planning instruments in force, or on which interventions are permitted on the building.

## 6. Interventions on Listed or Protected Historic Buildings

If a building is considered historic or modern to be protected as immovable property, then its construction characteristics must be respected and maintained during the interventions. Compared to the Ministerial Decree of 26 June 2015, it is possible to carry out energy requalification in these buildings. To intervene on historic or protected buildings, it may be useful to have clear the phases of a generic energy requalification process on these specific types, with the aim of selecting the most suitable technologies to improve the energy performance of the building system in compliance with the constraints that gravitate around it, whether these are of a normative, economic, technical, functional, expectation or interest (private or public) nature.

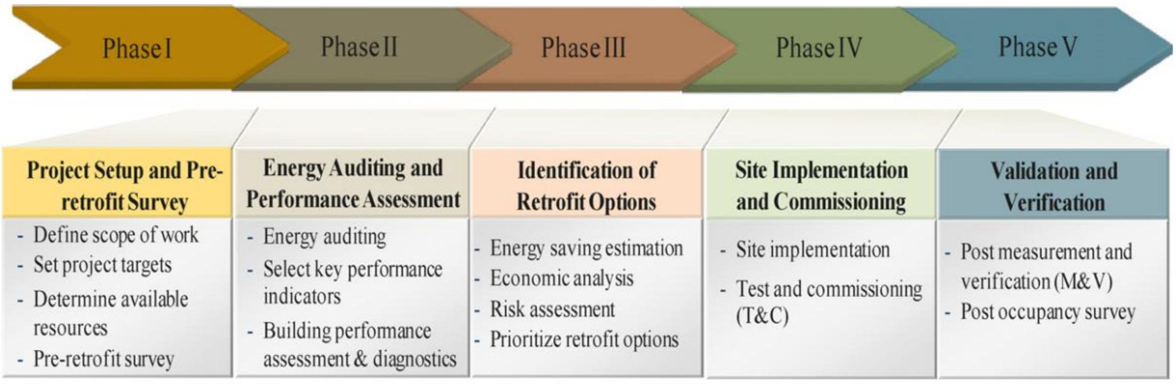


**Figure 4:** General scheme of an energy retrofitting process of a Fonte building:

The first phase corresponds to a preliminary collection of material and identification of objectives based on available resources. An initial retrofitting survey is also carried out on the new components to be introduced; the second concerns the development of the energy model based on the detailed audit of the state of the building; the third phase sees the selection of solutions, the evaluation of the effects of those solutions on the system and the definition of priority options [34]. The last two phases concern the implementation of the intervention and monitoring. The latter guarantees the verification of the effectiveness of the solutions implemented to guarantee then the awareness of the end user about the need for responsible use of the building system.

The European Union, with the intention of giving voluntary support to operators in the supply chain in the selection and use of technologies for the pursuit of energy efficiency objectives, has developed guidelines and dedicated intervention protocols. The guidelines may concern various addresses: the use of specific technologies (for example insights into thermal insulation, solar technologies, Etc.), specific homogeneous classes of buildings (for example schools, historic buildings, public buildings in general, Etc), the peculiarity of a territorial context (distinction based on climate, building types, Etc..). The more strictly methodological parts of these guidelines tend to define in detail the procedural phases of the design process and the suggested execution methods, as well as support tools such as audit forms, instrumental measurement procedures, stakeholder approach techniques, references to decision support tools and communication. The goal is to get to retrofitting managing to find / maintain a balance between the search for the maximum achievable performance and at the same time the protection of the architectural and landscape values of the historic building subject to intervention. The most critical and challenging aspect is the basic awareness that each building is a case in itself, the result of a series of degradation and context actions that make it absolutely unique, therefore a repetitiveness of the process actions can never be guaranteed planning, because these vary according to the narration that the property brings with it. For this reason, the guidelines never outline binding phases, but only indications of methodologies and approaches, accompanied by examples.

The MIC (Ministry of Culture) intervened suggesting that the contents of the design studies and the cognitive investigations of historic buildings must be proportionate to the value of the asset. Therefore it proposes a structure on three distinct levels for the preliminary studies carried out for energy efficiency interventions: the first or preliminary level, recommended in the case of ordinary buildings; the second or standard level, the third level is the one dedicated to the most valuable buildings and to particular situations, and generally requires a lot of technical-economic resources to carry out in-depth and specialized studies.

The guidelines highlight how important it is to evaluate the historical value and identity of all the elements of the building, including the plant engineering part of the buildings linked to the modern architecture of the 1930s and 1950s. For example, for a building from the 1950s considered to be protected, used for public purposes, it could have meant recovering the old cast iron radiators, even if it is known that they are inefficient compared to more contemporary solutions based on low temperature systems. Conversely, thinking of a building for private use of particular value, the same radiator element could easily be replaced with more innovative technologies.

| Analysis level | When to use it | Type of energy analysis | Intervention hypothesis |
|---|---|---|---|
| Preliminary | Low-impact interventions<br>Ordinary buildings<br>Scarcity of resources | Quick investigations<br>Comparison with other similar buildings or with examples in the literature;<br>Analysis of the available documentation | Advice<br>Consolidated technological solutions with limited economic risk |
| First level | Ordinary buildings and/or prestigious buildings but with common building-plant system configurations | Accurate but standard investigations<br>Standard energy model (consistent with regulations) adapted to the building | Technical-economic feasibility analysis of consolidated plant solutions combined in different intervention scenarios |
| Second level | Buildings characterized by high historical and/or economic value characterized by particular configurations of the building-plant system | Accurate investigations also with innovative systems<br>Highly customized dynamic energy models | Other specialized analyzes (FDM, LCA,..)<br>Economic feasibility analysis of technological solutions strongly<br>customized and experimental. |

**Table 2: Overviews of the energy audit levels of the MIC. (Pili, S. et al, 2017)**

The 2019 ISTAT Annual Report reports that the buildings built before 1919 in Italy (and therefore certainly classified as historic) are around 2 million, and their energy requalification can become an opportunity to relaunch the economy, and, at the same time, a challenge of retrofitting even knowing that the energy performance cannot have high values. The operational and process management tools to see how far it is convenient to push the redevelopment in respect of the building heritage are all acquired.

## 7. Intervene on Existing Buildings Not Subject to Constraints and Energy Poverty

For all the other existing buildings and considered not subject to constraints or protection, given a context that allows it, according to the D.M. of 26 June 2015 it is possible to intervene with a major restructuring of the first or second level, and mainly in the urban fabrics that make up the sprawling city [25]. These fabrics are built starting from the 1950s onwards, and we tend to know that better performance can be obtained in those built after 1991, i.e. after the entry into force of the legislation on energy consumption limitations in buildings, in terms of energy performance of the systems and construction elements, mentioned above. These parts of the city are largely made up of more or less large condominiums depending on the housing typology and are also suitable for becoming energy communities. Some studies have gone further by relating the year of construction of buildings, their energy performance and the risk of energy poverty, focusing on the residential building stock.

According to the 2021 ISTAT Census, the Italian building stock is approximately 14.5 million buildings, of which approximately 12.2 million are for residential use. About 70% of these residential buildings have been built since the Second World War. Again, according to the OIPE 2020 report the number of Italian families in energy poverty (PE) is about 3.8 million, or 16% of the total [35].

The characterization of families in energy poverty was carried out considering the age of construction of the building, type of home; title of occupation of the property; family size; Municipal typology of residence; Geographic area. This characterization was then represented in Table 3.

| Construction period | Distribution by construction period Total | NON PE Family | PE Family | Frequency Family in PE |
|---|---|---|---|---|
| After 2009 | 1% | 1% | 0% | 5% |
| 2000 - 2009 | 9% | 9% | 6% | 9% |
| 1990 - 1999 | 9% | 10% | 8% | 12% |
| 1980 - 1989 | 15% | 15% | 15% | 15% |
| 1970 - 1979 | 22% | 23% | 22% | 15% |
| 1960 - 1969 | 19% | 19% | 20% | 16% |
| 1950 - 1959 | 10% | 10% | 13% | 19% |
| 1900 - 1949 | 10% | 9% | 11% | 17% |
| Before 1900 | 5% | 5% | 4% | 13% |
| **Total** | 100% | 100% | 100% | 16% |

**Teble 3: Characterization of households in energy poverty according to the period of construction of the building [35].**

From this it can be seen that 20% of users who do not fall within PE live in homes built after 1990 against 14% of those in PE. A higher percentage of PE users is noted in buildings constructed between 1900 and 1959 (24% against 19% of non-PE users). As regards the frequency of families (compared to the total) who live in buildings of a certain period and who are in PE, there is a greater presence of users in PE in buildings built in the 1950s and a lower presence in those after 2000 (and, above all, to 2009) and a more or less homogeneous frequency in the other classes [35].

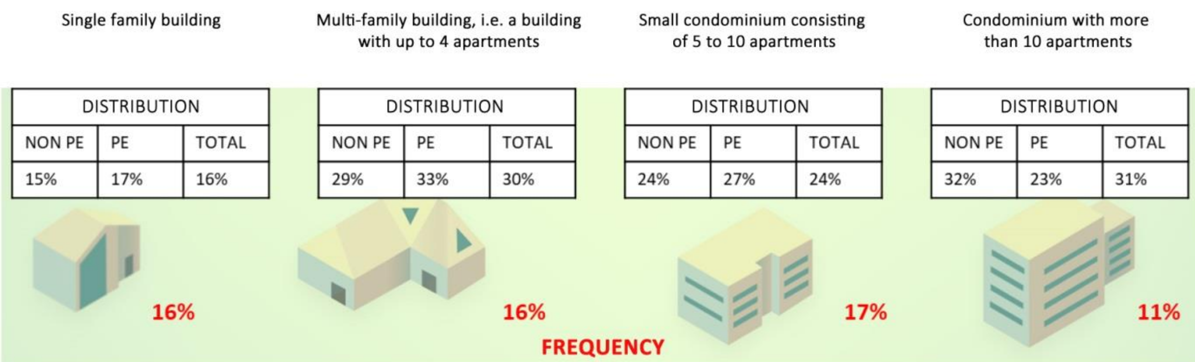


**Figure 4:** Characterization of energy poverty according to the type of house [35].

Making an internal comparison for each type of home between families in PE and those not in PE, there are very marked differences in large condominiums, where there are fewer families in PE. Furthermore, concerning the title of employment, the majority of non-PE families live in owned homes, while 50% of those in PE own their own home (and vice versa is valid for renting: 15% of non-PE families against 38 % of PE households) [35].

As part of the OIPE 2020 Report, for the Emilia Romagna Region, the number of homes that would potentially put a middle-income family at risk of PE was estimated. From this in-depth study elaborated by other scholars, analyzing the APE certificates of the residential building stock, it emerged that the energy classes prevalent in real estate units that result in PE are G, F and E. Interesting is the data about the decades with the highest frequency of units housing that show a greater risk of PE are those ranging from 1950 to 1990, in particular, those built between 1960 and 1969 and classified in class G (20% of the total units below the PE threshold for uses thermal) [35].

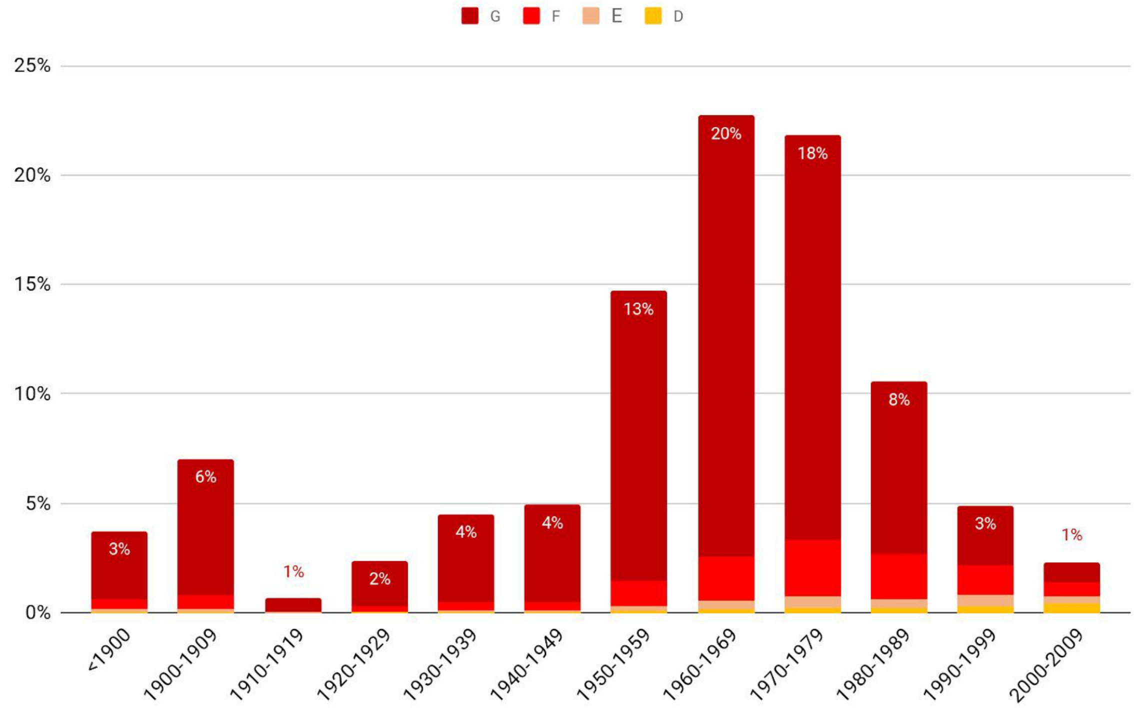


**Figure 5:** Percentage breakdown by construction decades and energy classes of performance certificates above the energy poverty threshold (the percentages refer to class G).

To understand how a better energy performance can reduce the PE risk, the researchers resorted to the scenario analysis method, in order to quantify the decrease in the number of real estate units at PE risk that can be obtained according to three scenarios (A, B, C) reduction of the average EP index (energy performance value) per decade of construction [35]. It emerged that a 45% reduction in the EP index reduces the percentage of problematic buildings from 9% to 1%, i.e. almost cancels the simulated PE [35].

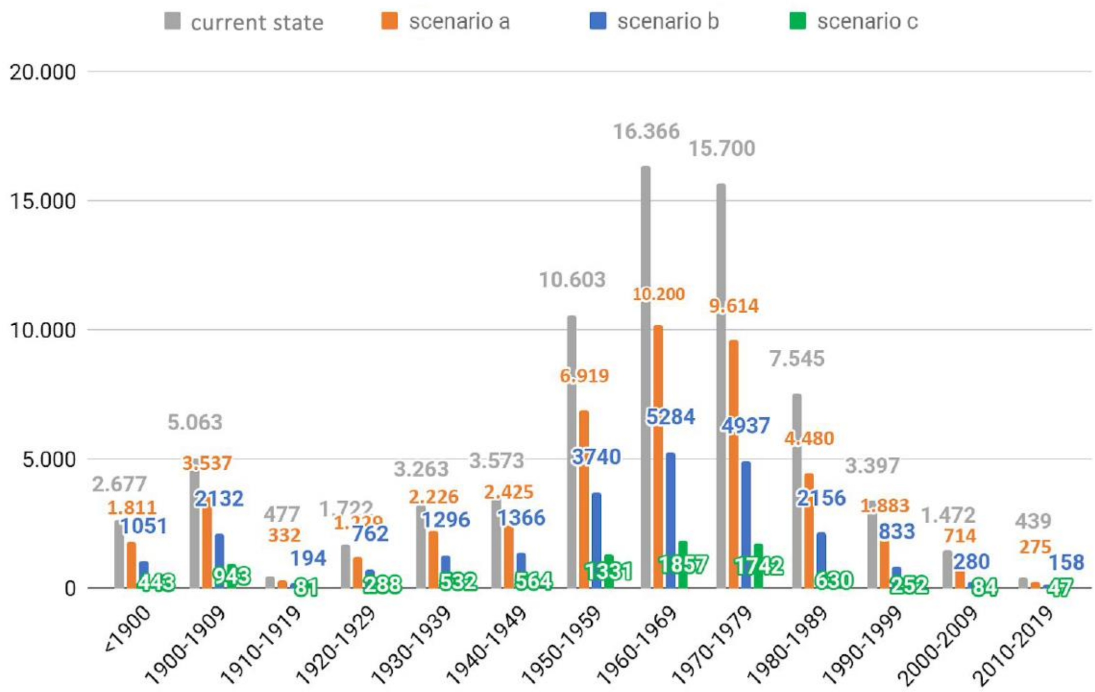


**Figure 6:** Number of real estate units at PE risk per decade of construction. Data referring to the 807,553 real estate units with an Energy Prformance Certificate in the Emilia Romagna Region. Source: (Faiella I. et al, 2020, p. 80)

This study carried out by third-party researchers makes it clear that it is advisable to give priority to a number of actions such as to allow the leap of two energy classes, or to obtain a reduction in energy performance that concerns the entire building with also the use of renewable sources, or the scenario C. However, scenario B, which corresponds to a jump in energy class, can also make its contribution. In this sense, the REC incentives could join the NZEB incentives by directing attention towards the existing building stock between 1950-1990.

## 8. Results

The Italian building heritage, however consolidated, shows good margins of intervention to meet the needs of becoming self-producer / producer of renewable energy. It is true that, on the one hand, the restricted historical fabric does not see the achievement of high levels of energy performance, but it has been able, over the decades, to systematize management methodologies of the design process and technical-scientific methodologies which today allow us to evaluate the convenience of retrofitting and energy performance interventions in compliance with the constraints to which buildings are subject. On the other hand, the unrestricted sectors built from the post-war period up to the 1990s are those which, thanks also to favorable legislation, promise ample room for synergistic action in terms of RECs, the construction of NZEB buildings and the fight against PE.

The study elaborated in the PANZEB report confirms that, even in existing buildings not subject to restrictions, today the technological choice that allows meeting the NZEB requirements with renewable energy supply is the use of the heat pump (where possible centralized and combined for the production of thermal energy for heating / cooling and domestic hot water) associated with photovoltaic panels and solar panels [25]. Another peculiarity emerges which for insiders is not new, but which is good to report for evaluations: in single-family residential buildings and existing office buildings most of the time it is not possible to intervene on the attic on the ground, which, normally due to the age of construction, it is not isolated. This results in a much lower energy performance difference than a new nZEB building. Here the present authors want to underline another detail. Generally, even in large existing condominiums, the attic on the ground is not insulated, but the substantial difference is that the attic on the ground corresponds to the basement level of the cellars or garages. Therefore the attic on which the first floor for residential or commercial use rests can be easily isolated even in post-construction interventions.

The OIPE 2020 Report reconfirms that the building stock on which it is a priority to intervene with respect to the objectives of this analysis is that built from the second post-war period until the end of the 1990s, which is characterized by the least performing energy classes, G, F, E. Again on these properties, the rental / ownership factor of the home in which one resides weighs on the economic thrust in wanting to intervene on the building stock, and consequently also has strong repercussions in terms of PE. The Report highlights that the interventions that guarantee the improvement of two energy classes are those that are decisive in terms of PE. Compared to the D.M. of 26 June 2015 (Ministero delle Imprese e del Made in Italy, 2022) this type of intervention corresponds, basically, to major first-level renovation (incidence greater than 50% of the total gross surface area of the building). While those that guarantee the improvement of an energy class indicatively fall within the major second-level renovation (incidence greater than 25% of the total gross dispersing surface of the building).

Assuming what has been elaborated by the studies analyzed, the governance models of the RECs on which it may be strategic to prioritize are the second model, where the local authority or the parish come together to respond to the needs of the community, and the fourth model, the bottom- up of a group of users who are self-producers of energy. The third model, which sees industrial companies giving the square meters available for the production of energy, may be of interest if upstream there is the PA to distribute benefits to users of the REC equally.

## 9. Conclusions

In recent years, even in a country with a long tradition of social sensitivity, welfare and wellness like ours, we are witnessing an increase in the so-called "energy poverty" phenomenon. It is determined by a plurality of factors, even concomitant and interacting with each other: low incomes, high energy costs, insufficient access to energy, inadequate technologies, social inequalities and, finally, climate change itself. The favor expressed up to now by both the Italian and EU legislators for an energy community model with a promoter from a local authority (municipalities, parishes, Etc.) and beneficiaries of families in difficult economic conditions could be a concrete and effective answer to the problem.

The Italian ministerial implementing Decree, not yet issued but being reviewed by the EU, with an intervention hypothesized for 2.2 billion, non-repayable, aimed at creating at least 2 GW of RECs in Municipalities with less than 5,000 inhabitants, it demonstrates the attention paid to the problem of energy poverty, which is more present in small or very small municipalities. To this intervention will also be added those of the Italian regions which, in turn, are called to regulate the energy communities in their territories.

Impossible to make a cost-benefit analysis of a classic economic nature, here we are faced with a community intervention, even before a state one, aimed at tackling two problems in one fell swoop: decarbonisation also understood as the introduction of new renewable energy sources (even in response to the current energy crisis) and support for the social classes hardest hit by the recent international crises.

Energy communities are an important lever towards the energy and ecological transition of our cities, and according to Gianluca Lilli, Senior Vice President of ABB Italia, a political vision is needed that provides tools and incentives, removing bureaucratic obstacles. For Maria Cristina Papetti, Head of Global Sustainability Enel Grids, we need an ecosystem at a local level that can help build these energy communities, as they represent the opening towards new paradigms for the connection and generation of renewable energy. The energy community is certainly one of the winning aspects - adds Guido Davoglio, Technical Director of Tekser (ANSAcom, 2023). A sharing of electricity between those who produce it and those who consume it locally". In this sense, it is advisable to organize a regulatory sector that can include all subjects, not necessarily legal ones, in order to favor the bottom up driving force.

The design of future "citizens' cities" presupposes a strong commitment to cohesion, responsibility and orientation, since there is no doubt that this constitutes, especially in a critical phase such as the current one, a pressing reminder of the need to work together, bringing together the various professionals who they work in the construction of the urban landscape. Discussion and confrontation are the lifeblood, even and above all when opinions do not coincide. It is the diversity of ideas that stimulates discussion, makes the debate grow and, consequently, the sector itself.

Finally, it must be understood that the development of a new social awareness of environmental and health issues on the one hand, and the increasingly evident awareness of the probability of success of planning policies on the other, also depend on the involvement of citizens in a process of urban regeneration . This is defined as the vision and action aimed at improving the economic, physical, social and environmental conditions of a territory that is changing. It therefore means working on the sense of community and social cohesion, analysing, planning and building cities that incorporate the plant component and technological solutions with low or no environmental impact.

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