TECHNICAL REPORT

UniCredit Green Bond

Milan, May 2022

REValuta
TINEXTA GROUP

SUMMARY

RE VALUTA S.p.A. COMPANY SUBJECT TO THE MANAGEMENT AND COORDINATION OF TINEXTA S.P.A.
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1. FOREWORD

The European Union started to express interest in environmental issues from the late 1980s. In 1997, it was among the first signatories to the Kyoto Protocol, published on 11 December 1997, under the framework of the Conference of the Parties "COP 3" of the United Nations Framework Convention on Climate Change (UNFCCC).

The focus on environmental issues by the European Union became even stronger in the following years: for Europe the fight against climate change is a priority. The EU is committed to precise targets and has taken a number of initiatives to reduce greenhouse gas emissions.

The first target set is **the Climate and Energy Package** adopted in 2008. Among the stated objectives, the one of particular interest was the reduction of greenhouse gas emissions compared to 1990 levels: the package envisaged a general reduction of CO_2 and greenhouse gases by 20% compared to 1990 levels. As far as can be seen from EU communications, this target has been achieved: From a figure of around 5,700 million tonnes of CO_2 in 1990, a quota of just over 4,250 million tonnes of CO_2 was passed, which is below the target level of 4,600 million tonnes. The result was achieved ahead of schedule: as can be seen in Figure 1, the threshold set was reached as early as 2018 (Fig. 1) .

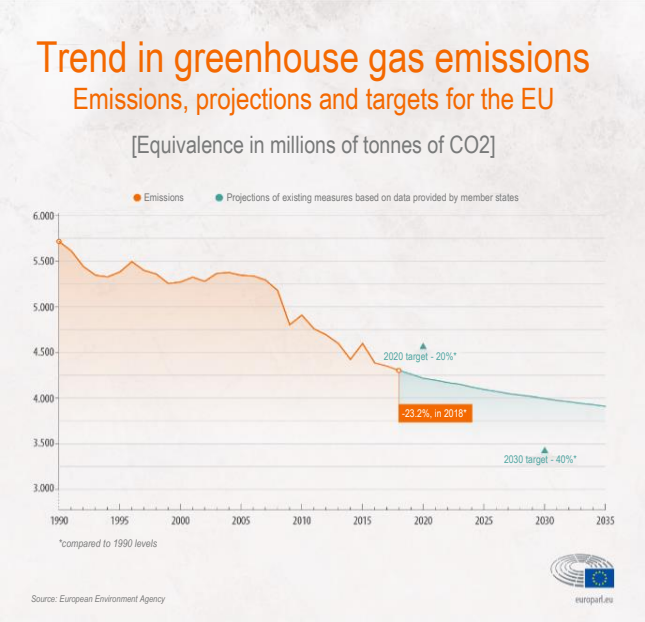

Fig. 1 source: European Environment Agency

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EU emissions in 2020 were estimated to be 31% lower than in 1990, which means the target was exceeded by 11 percentage points. Compared to 1990, the figures show a 24% decrease in emissions in 2019. Between 2019 and 2020, there was a further significant drop in EU greenhouse gas emissions, which correlates closely to the Covid-19 pandemic. The projections shown in Figure 1, based on the assumptions adopted in the 2008 Climate Package, indicate that a 41% reduction in emissions would be achieved in 2030.

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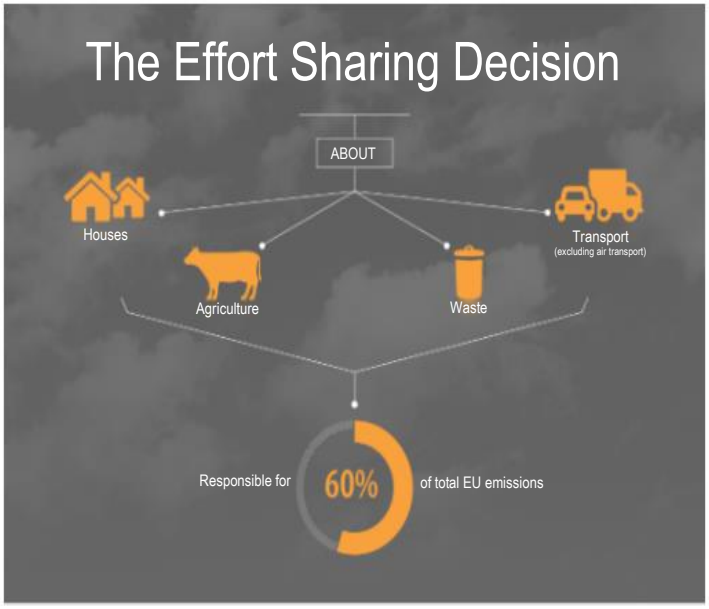

Fig. 2 – Source: European Parliament Research Service, European Commission, European Environment Agency

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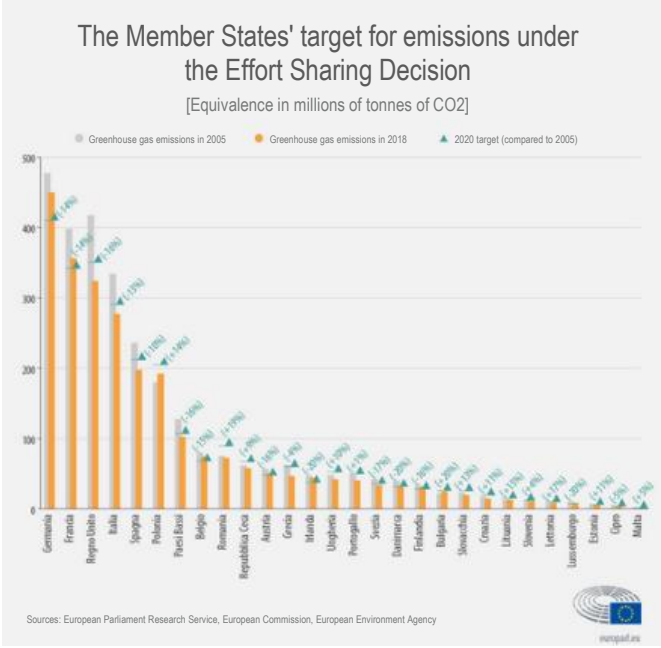

Fig. 3 Source: European Parliament Research Service, European Commission, European Environment Agency

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2. THE EUROPEAN GREEN DEAL

The EU is committed to achieving climate neutrality by 2050 by fulfilling its international commitments under the Paris Agreement. On 12 December 2015, the European Union acceded to the United Nations Framework Convention on Climate Change (UNFCCC). Th e objectives defined in the Agreement are as follows:

a) contain the increase in the global average temperature well below 2°C compared to pre-industrial levels and continue action to limit this increase to 1.5°C compared to pre-industrial levels, thereby significantly reducing the risks and effects of climate change;
b) increase adaptive capacity to the adverse effects of climate change, promote climate resilience and develop low greenhouse gas emission in ways that do not threaten food production;
c) make the financial flows consistent with a pathway to low greenhouse gas emissions and climate resilient development.

The Paris Agreement entered into force on 4 November 2016.

On 11 December 2019, as the targets under the **Climate and Energy Package adopted in 2008 came to an end,** the European Commission presented the European Green Deal, a set of actions and

strategies aimed at **making the EU economy sustainable**: design must become "sustainable", the economy must become "sustainable".

It is a Copernican revolution: as the economy becomes green, environmental and climate sustainability become the cornerstones of new economic development; no longer a problem to be solved but an opportunity for technological and economic development (Fig. 4).

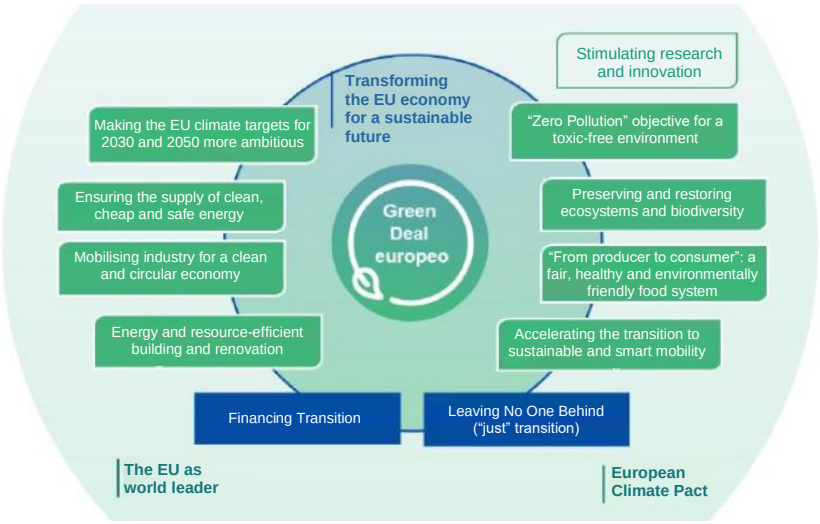

Fig. 4 (source: European Commission)

A first step in implementing the Green Deal was the approval by the European Parliament of **Regulation No. 1056 on 24 June 2021** which **establishes the JTF: (Just Transition Fund)**. This is a financial instrument whose function is to support the territories of the European Community in order to contain the impact that individual countries will have to face on a socio-economic level in order to achieve climate neutrality. In order to be eligible, each Member State must submit a plan in which the areas of intervention will be indicated.

3. FIT FOR 55%

A further step towards the realisation of the Green Deal is the enactment of Regulation 2021/1119 of 30/06/2021, establishing the framework for achieving climate neutrality and amending Regulation (EC) No 401/2009 and Regulation (EU) 2018/1999 ("European Climate Regulation"): the regulation transposes the policy measures and the Paris Agreement: the goal of achieving climate neutrality by 2050 becomes binding for all EU Member States. To achieve such a reduction in greenhouse gas production, the targets originally set in the interim period, i.e. 2030, must also be changed accordingly: the reduction of greenhouse gas emissions (mainly CO_2) compared to 1990 will have to be increased from 40% to 55%. To achieve this result, Fit for 55% is preparing regulatory changes to current climate regulations.

The Fit For 55% package brings together a number of proposals to revise and update European climate regulations in order to meet the 2030 target.

Figure 5 shows the structure of the proposals envisaged for the Fit for 55% package.

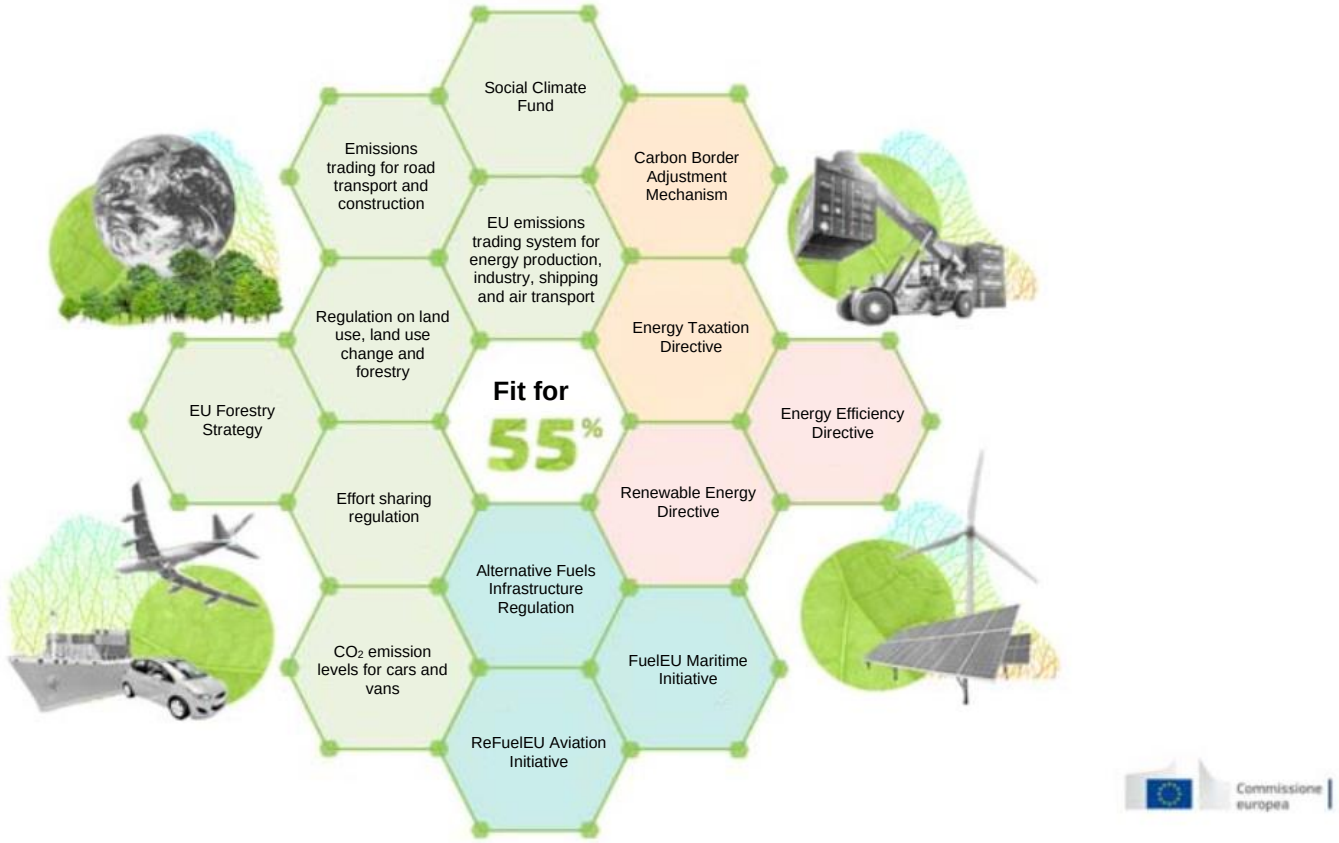

Fig. 5: Structure of the Fit for 55% Package - Source: European Union

4. NEXT GENERATION

Making an already complex socio-economic picture even more complicated, since the early 2020s, the entire planet has had to deal with the social and economic consequences of the Covid-19 pandemic. The European Union After a tense confrontation between the representatives of the Member States, the creation of a fund, known as the Next Generation EU (NGEU), was considered useful for overcoming the crisis. The Next Generation EU, or Recovery Fund, is a substantial allocation of funds with the aim of mitigating the negative economic effects suffered by all EU Member States affected by the Covid-19 pandemic, and boosting the economy through investments in the green and digital economy.

The fund was set up by the European Council on 21 July 2020: it is a temporary (i.e. not structural) instrument with a ceiling of approximately 800 billion euros. Next Generation EU basically consists of two facilities:

1. **The Recovery and Resilience Facility (RRF)**

2. Recovery Assistance Package for Cohesion and the Territories of Europe (REACT-EU)

The RFF has a duration of six years, from 2021 to 2026, and a total size of 672.5 billion euros (312.5 on grants, and the remaining 360 billion on soft loans).

REACT-EU is an initiative that provides measures for post-crisis recovery at European level. REACT-EU continues and expands on the crisis response measures implemented through the Coronavirus Response Investment Initiative (CRII) and the Coronavirus Investment Initiative

Fig. 6: Source European Commission

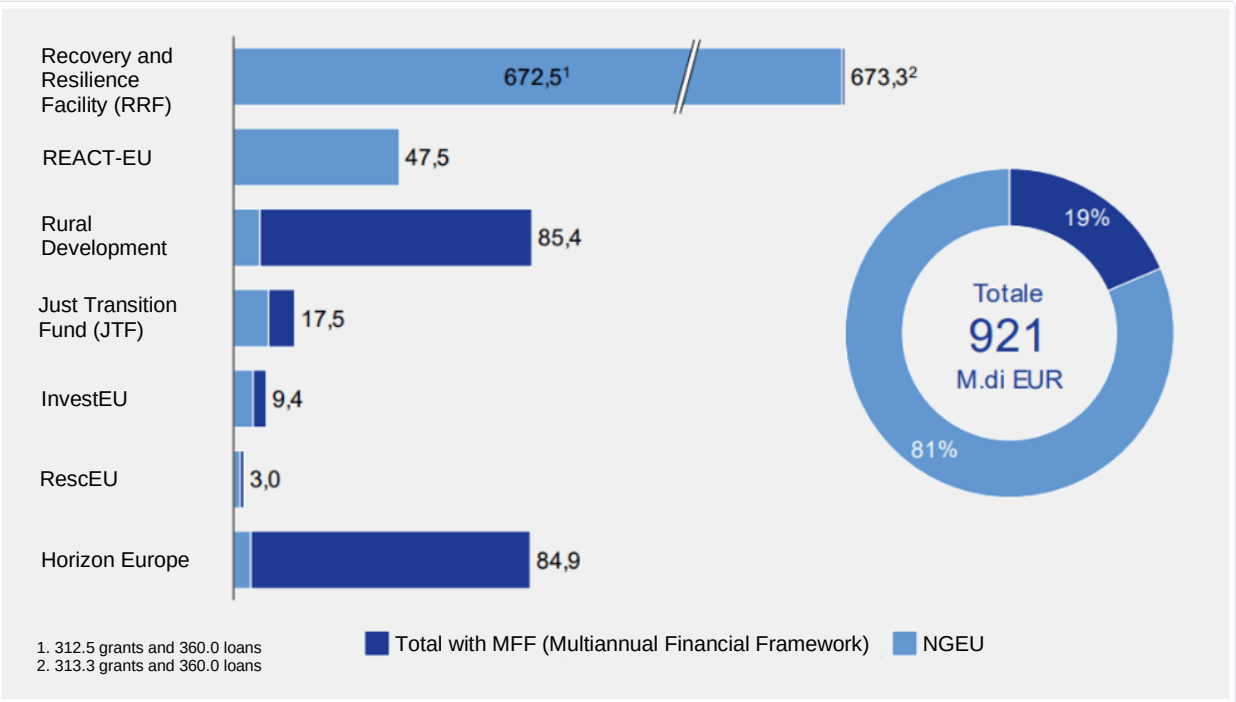

Figure 1.1: Next Generation EU - Available devices and resources, billions of euros
Source: European Commission
Recovery and Resilience Facility (RRF): 672.5[1]/672.3[2], REACT-EU: 47.5; Rural Development 85.4; Just Transition Fund (JTF): 17.5; InvestEU: 9.4; RescEU: 3.0; Horizon Europe: 84.9; Total: 921 billion; Total with MFF (Multiannual Financial Framework): 19% - NGEU: 81%

1. 312.5 grants and 360.0 loans

2. 313.3 grants and 360.0 loans

5. THE NATIONAL RECOVERY AND RESILIENCE PLAN

The National Recovery and Resilience Plan (NRP) is part of the Next Generation EU (NGEU) programme agreed by the European Union in response to the pandemic crisis.

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Figure 1.10: Allocation of RRF Resources to Missions

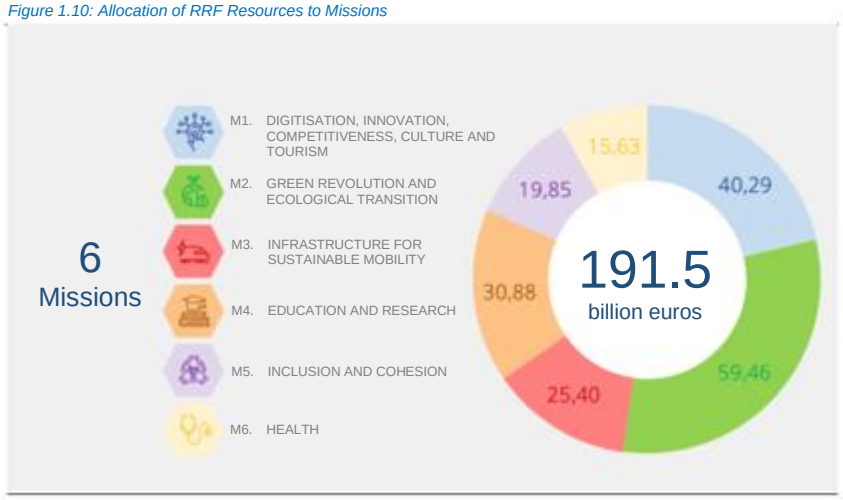

Fig. 7 - National Recovery and Resilience Plan

With the Recovery and Resilience Plan, Italy will have some 248 billion euros at its disposal.

There are three strategic assets on which the plan focuses (digitisation and innovation, ecological transition, social inclusion) and six missions along which it is developed, including the "Green Revolution and Ecological Transition" (mission 2) that allocates a total of more than 68 billion euros with the main objectives of improving the sustainability and resilience of the economic system and ensuring a fair and inclusive environmental transition.

Fig. 8 and 9: National Recovery and Resilience Plan

M2. GREEN REVOLUTION AND ECOLOGICAL TRANSITION	National Recovery and Resilience Plan (PNRR) (a)	React EU (b)	Supplementary Fund (c)	Total (d)=(a)+(b)+(c)
M2C1 - SUSTAINABLE AGRICULTURE AND CIRCULAR ECONOMY	5,27	0,50	1,20	6,97
M2C2 - ENERGY TRANSITION AND SUSTAINABLE MOBILITY	23,78	0,18	1,40	25,36
M2C3 - ENERGY EFFICIENCY AND UPGRADING OF BUILDINGS	15,36	0,32	6,56	22,24
M2C4 - LAND AND WATER RESOURCE PROTECTION	15,05	0,31	0,00	15,36
Total Mission 2	**59,46**	**1,31**	**9,16**	**69,93**

Mission 2: Green revolution and ecological transition

Aimed at achieving the green and ecological transition of society and the economy to make the system sustainable and ensure its competitiveness. It includes interventions for sustainable agriculture and improving waste management capacity; investment and research programmes for renewable energy sources; investments for the development of key industrial sectors of ecological transition and sustainable mobility. It also provides for actions to improve the efficiency of public and private real estate; and initiatives to combat hydrogeological instability, to safeguard and promote the biodiversity of the territory, and to ensure the security of supply and the sustainable and efficient management of water resources.

Mission 2 consists of four components:

C1. Sustainable Agriculture and Circular Economy
C2. Renewable energy, hydrogen, grid and sustainable mobility
C3. Energy efficiency and building renovation
C4. Protection of land and water resources

Fig. 10 and 11 - National Recovery and Resilience Plan

Through Component 3, the aim is to strengthen energy efficiency by increasing the level of efficiency of buildings, considering that in our country more than 60 per cent of the buildings are more than 45 years old, both with regard to public buildings (e.g. schools, judicial citadels) and private buildings.

Current targets for primary and final energy consumption by 2030 are 103.8 Mtoe (0.8 per cent annual efficiency), with a trajectory of around 35 per cent of savings in the building sector. Considering that Italian buildings account for more than one third of the country's energy consumption, the Component therefore captures a very relevant dimension for the reduction of consumption and of CO2 emissions, which is also significant regarding our country's exposure to seismic risk. Specifically, the component is expected to save 209 Ktoe per year of final energy and 718 KtCO2 per year when fully operational (i.e., 2027).

(Source: National Recovery and Resilience Plan)

6. FINANCING METHODS FOR ACHIEVING ECOLOGICAL TRANSITION AND THE ROLE OF CREDIT INSTITUTIONS

The costs to be incurred by 2030 in order to realise the goals of the Green Deal for the energy transition are estimated to be between approximately 2,600 and 2,700 billion euros.

The direct investments envisaged by the European Union are represented by:

1. EU budget and Next Generation, funds totalling 743 billion euros;
2. Mechanism for Just transition, funds totalling 100 billion euros;

3. European Investment Guarantee through the European Investment Bank (EIB) and the National Promotion Banks, with public/private investments estimated at around 112 billion euros.

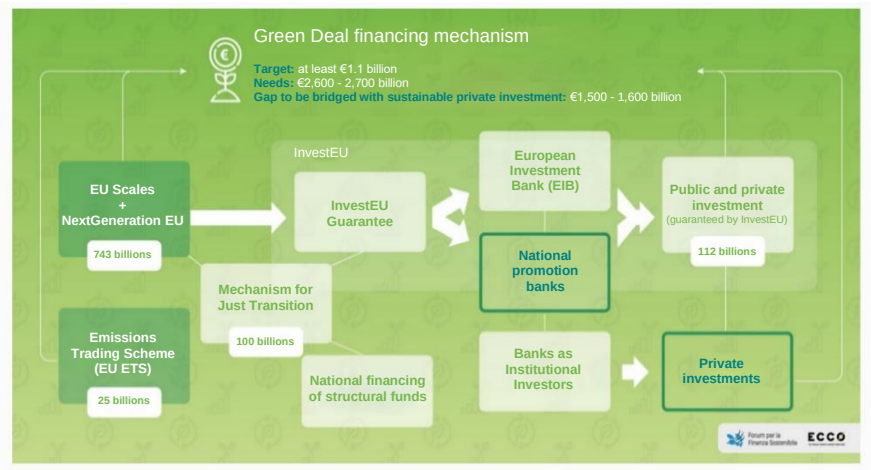

Fig. 12: Source "Forum for Sustainable Finance"

As shown in Fig. 12, the financial target to be reached for financing the Green Deal is at least 1,100 billion euros; private investment should make up the difference, i.e. an amount of approximately 1,500 to 1,600 billion euros.

The decarbonisation process carries a cost of about 180 billion euros per year. The European Union cannot cope with such an investment alone, i.e. the planned objectives cannot be achieved without the contribution of private capital. The green revolution must therefore also start with finance: the economy must become sustainable.

As early as 2018, the European Commission had already laid the foundations for an action plan on the sustainable economy. Among the many topics to be regulated, the most important was the definition of "sustainable intervention" and consequently the drawing up of hierarchical classifications of green financial investments. Economists have borrowed scientific nomenclature to classify sustainable products: green interventions have been categorised according to a taxonomic criterion, i.e. a hierarchical classification of investments.

The European standard that introduced and regulates the Taxonomy for sustainable finance is the European Regulation 2020/852, in force since 3 July 2020. The technical criteria for awarding the green label to a financial investment were subsequently published in the form of delegated acts. On 9 December 2021, a first delegated act on sustainable climate change mitigation activities and adaptation targets of the EU taxonomy ("Climate delegated act") was published in the Official Journal. The criteria became effective on 1 January 2022.

Fig. 13 Source: extract from EU Taxonomy accelerating sustainable investment, 02/02/2022 #Euinvest

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7. GEOGRAPHICAL AND ENERGY CHARACTERISTICS OF THE ITALIAN HOUSING STOCK

The geographical boundaries of Italy are represented to the North by the Vetta D'Italia, located at 47° 5' 33'' North latitude, to the South by Capo Maluk on the island of Lampedusa (35° 29' 24'' North Latitude), to the by East Capo D'Otranto (18° 31' 10'' East Longitude) and to the West by Alpi Cozie (6° 37' 34'' East Longitude). Italy extends out across the Mediterranean Sea, the coastal strip is therefore very wide.

The morphological conformation of Italy is very complex: The climate is strongly influenced by latitude (i.e. the distance between the equator and the Poles) and the morphology of the land (whether mountainous, hilly, coastal). Italy has a large latitude range, extending between 35° and 47° North latitude, i.e. it goes from the subtropical Mediterranean climate in the south of the peninsula to the temperate continental climate in the northern areas.

Geographical location is therefore directly responsible for the energy consumption needed to achieve the right levels of comfort in living environments, whether homes, offices, factories, or hospitals. While in the extreme areas of the south it is to be expected that, due to the high temperatures lasting for long periods of time, energy consumption will be more geared towards the cooling of rooms, in the higher latitude areas a colder climate is more likely, with energy consumption being mainly related to heating.

The civil sector is currently responsible for 45 per cent of final energy consumption and 17.5 per cent of direct CO_2 emissions, but it is the sector where the potential for improvement is very high as a result of the adoption of special measures.

In Italy, the first law aimed at limiting energy consumption related to the use of space heating devices dates back to 1976. It all started due to geopolitical reasons: in 1973, following the Arab-Israeli war, there was a disruption in the flow of oil from OPEC countries. The price of crude oil rose uncontrollably and the consequences for Italy were severe, austerity was introduced, i.e. a series of coercive measures aimed at limiting oil consumption as much as possible. The geopolitical instability in the Middle East and its consequences led to a general reflection on energy sources and their use.

Law 373/76 was divided into three parts: the first part dealt with heat production systems and thermoregulation systems, the second part was dedicated to the thermal insulation of buildings, and finally, the third part described the sanctions imposed for failure to comply with the regulation.

The concept of Climate Zone was first introduced in Ministerial Decree 10/03/1977: this regulatory provision, together with Presidential Decree 1052/77 and Ministerial Decree 30/07/1986 are the additions to Law 373/76.

The first regulation introducing the concept of climate zones is the Ministerial Decree of 3 March 1977: Determination of climate zones and the minimum and maximum values of their global heat loss coefficients. The national territory is divided into six climate zones according to degree days, regardless of geographical location. The climate zone is defined by the number of degree days; the lower the number of degree days, the lower the use of heating devices. The annex to the decree

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contained a table with a list of locations where degree days were defined. For cities not included in the list, the identification of the climatic zone followed the concept of proximity and the adjustment of the number of degree days according to altitude using special coefficients (Art. 1 of the Ministerial Decree)

Presidential Decree 412/1993, Regulation containing standards for the design, installation, operation and maintenance of thermal systems in buildings for the purposes of energy consumption containment, in implementation of Article 4, paragraph 4, of Law 10/91, Article 1, letter z, gives the definition of Degree Day as: the sum, extended to all the days of a conventional annual heating period, of only the positive differences between the room temperature, conventionally set at 20°C, and the daily average outdoor temperature. Article 2 of the same regulation confirms the division of the Italian territory into six climatic zones according to day degrees, as already provided for by Ministerial Decree 10/03/1977. The number of municipalities for which the climatic zone is defined is significantly higher than that stated in Ministerial Decree 17/03/1977, however for those not listed, the criterion to be adopted for the identification of the climatic zone is the same as that set out in Decree 17/036/1977.

The energy requirements for maintaining a comfortable climate vary according to the climate zone.

The municipalities that fall within the climate zone characterised by a degree day rate of 600 or less are those located in areas where the climate is milder, in contrast, the municipalities with the highest degree days are characterised by a temperate climate.

Table 1 - Number of Italian municipalities by climate zone and "degree days"

CLIMATE ZONE	DEGREE DAYS (DD)	NUMBER OF MUNICIPALITIES as at 1/1/2019	RESIDENT POPULATION as of 2018	% RESIDENT POPULATION
A	GG < 600	2	23,266	0.04%
B	600 < GG ≤ 900	157	3,217,288	5.33%
C	900 < GG ≤ 1.400	981	12,826,700	21.25%
D	1.400 < GG ≤ 2.100	1572	15,168,668	25.13%
E	2.100 < GG ≤ 3.000	4176	27,482,108	45.53%
F	GG > 3.000	1026	1,641,892	2.72%

Source: ENEA processing of Istat data.

Data source STREPIN 2020

As can be seen from the table, most Italian municipalities fall in climate zone E, only two municipalities fall in zone A.

8. REGULATORY EVOLUTION OF THE ENERGY PERFORMANCE CERTIFICATE

With the 1987 referendum, Italy abandoned the use of nuclear energy: this necessarily led to a review of national energy strategies. In the late 1980s, the first ecological consciences were raised and the first scientific evidence of a direct correlation between pollution and climate change began to emerge. Pollution from the use of fossil fuels has been shown to be one of the main causes of the

greenhouse effect, which in turn causes the earth's atmosphere to overheat. Europe and Italy have been promulgating a series of regulations since the early 1990s, the aim of which was to reduce energy consumption.

The first regulation that marks this new direction is Law 10/91 "Regulations for the implementation of the national energy plan on the rational use of energy, energy savings and the development of renewable energy sources". It is a framework law in which the direction of energy policies is represented, which translated into activities to contain energy consumption and the desire to pursue the development of alternative energies, in accordance also with the decisions of the European Community.

In Art. 28 the Technical Report on compliance with the requirements is introduced, and in Art. 30 the Energy Performance Certificate is included for the first time. But while the report under Art. 28 will become effective after the entry into force of Presidential Decree No. 412 of 26/8/1993, no implementing decree will be issued for the Energy Performance Certificate.

The Energy Performance Certificate made its definitive appearance in our legal system in the 2000s: in 2005, following the transposition of European Directive 2002/91/EC, the Legislative Decree 19 August 2005, no. 192 *Implementation of Directive 2002/91/EC on the energy performance of buildings, subsequently amended by* **Legislative Decree 29/12/06 no. 311** . This last regulation introduced on a transitional basis, and until the national guidelines for the energy certification of buildings came into force, was the **Energy Performance Certificate**, a document prepared and certified by a qualified professional, in which the primary energy requirements for calculation, the class to which the building (or building unit) belongs in relation to the energy certification system in force and the corresponding maximum admissible values set for the specific type, or, where these were not indicated, for an identical new building, had to be reported; the certificate also had to include an indication of possible improvements in energy performance and possible class upgrades following the implementation of such measures. The purpose of the Energy Performance Certificate was to provide a "snapshot" of the energy performance of a building or individual building unit. A further step forward was brought about by the entry into force first of Presidential Decree 59/2009 (Regulation implementing Article 4(1)(a) and (b) of Legislative Decree 192 of 19 August 2005, concerning the implementation of Directive 2002/91/EC on the energy performance of buildings) and the Ministerial Decree of 26 June 2009 defined the national guidelines for energy certification. In particular, *Annex A* contained the national rules on the energy certification of buildings and the model certificate. The Energy Performance Certificate had to contain indications of the building's energy efficiency, legal reference values and performance classes, as well as provide economically sustainable indications of energy improvement measures.

The regulations were further amended in subsequent years as a result of the transposition of European Directives. **Legislative Decree 28/2011**, a regulation implementing Directive 2009/28/EC on the promotion of the use of energy from renewable sources, has led to the introduction of important innovations such as the obligation to use renewable sources in new buildings or buildings undergoing renovation, the obligation to present the Energy Performance Certificate when buying, selling, and renting, and the obligation to publish the energy performance of the building in sales advertisements.

Another important change to the Energy Performance Certificate is due to the entry into force of Legislative Decree 63/2013 (Ecobonus / Energy Decree) converted into Law 90/2013: the Certification Certificate is replaced by the **Energy Performance Certificate**.

In 2015, as a consequence of the transposition of European Directive 2010/31/EU and the entry into force of the implementing decrees of Law 90/2013 and the entry into force of the Interministerial Decree of 26/06/2015 - Adaptation of National Guidelines for the Energy Certification of Buildings - the regulatory framework on the energy efficiency of buildings was completed.

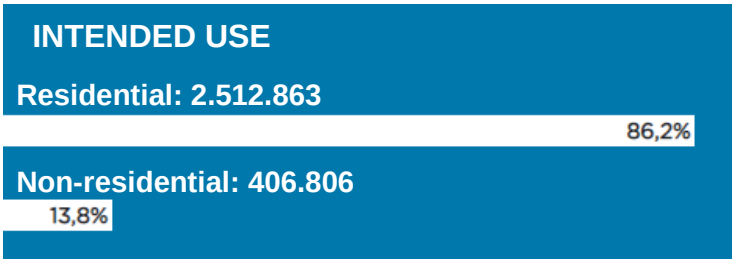
9. THE ENERGY PERFORMANCE CERTIFICATE INFORMATION SYSTEM (EPCIS) - BENCHMARKING METHODOLOGY

It was established by the Interministerial Decree of 26 June 2015 "Adaptation of national guidelines for the energy certification of buildings". The site was created and is managed by ENEA.

EPCIS is a digital archive where energy performance certificates drawn up nationwide are stored. In fact, to date not all regions have transmitted data on EPC to EPCIS: data from Sardinia, Campania and Basilicata have not yet been received. The data relating to Tuscany are being updated. The number of certificates in the computerised archive was 2,915,699 as at 31 December 2021. The data can be found at
https://siape.enea.it/analisi-territoriali.

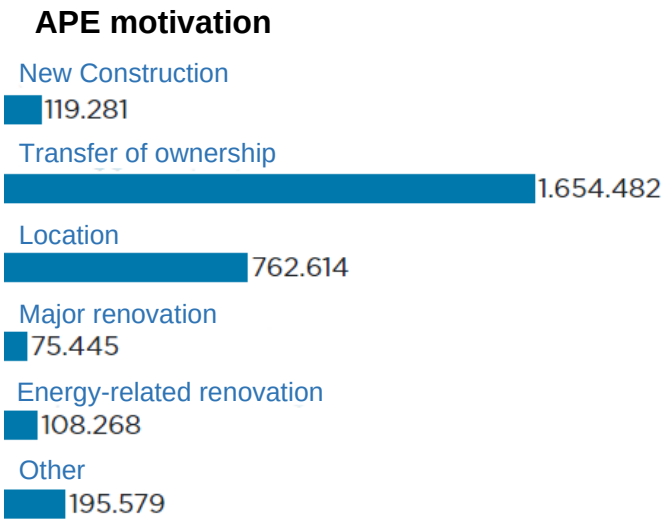
The static data that ENEA has calculated from the archived data is of significant interest:

- **INTENDED USE**: of the 2,915,699 EPCs in the archive, 86.2 per cent concerned residential properties and 13.8 per cent concerned non-residential properties



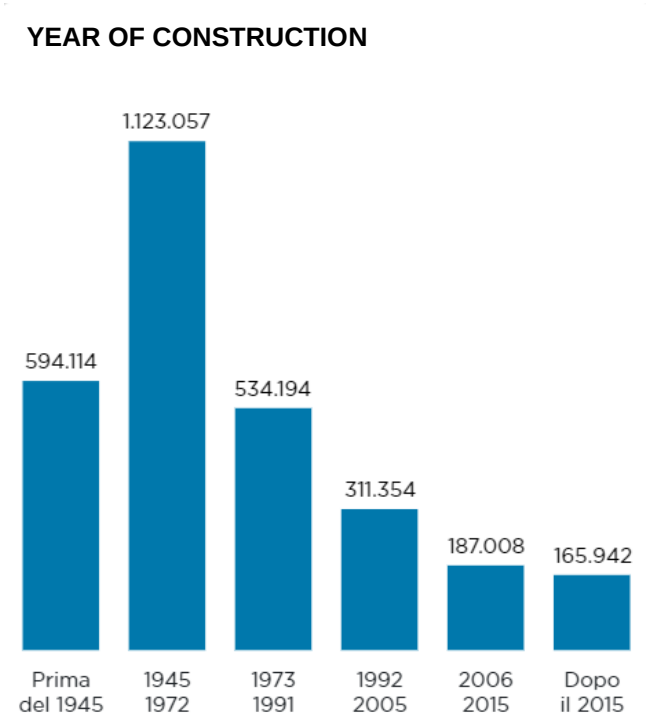
Source:
https://siape.enea.it/analisi-territoriali

- **REASON FOR REQUESTING THE ENERGY PERFORMANCE CERTIFICATE:** MAINLY Transfer of ownership, followed by leasing, unqualified reasons, new construction, energy-related renovation, major renovation



Source:
https://siape.enea.it/analisi-territoriali

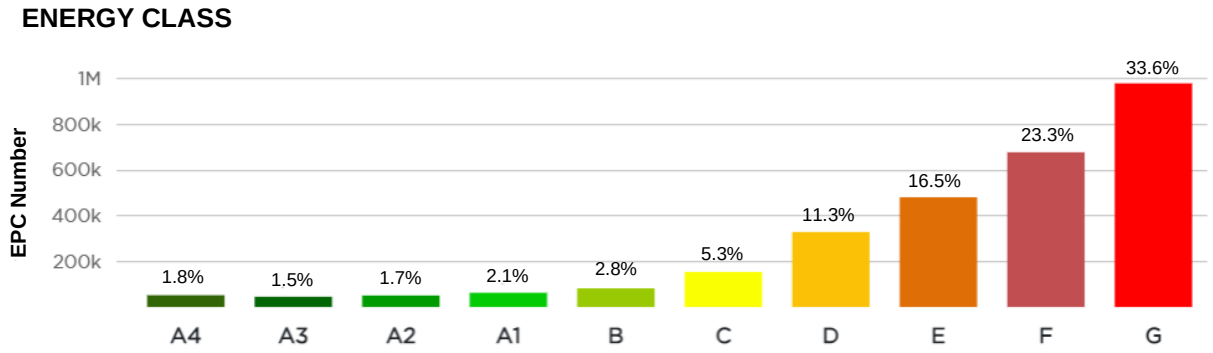
- **YEAR OF CONSTRUCTION OF THE BUILDINGS COVERED BY THE EPCs:** most of the buildings for which the EPC was requested were built between 1972 and 1945, and to a lesser extent pre-1945, and gradually, represented by lower percentages, buildings built after 1973



Source:
https://siape.enea.it/analisi-territoriali

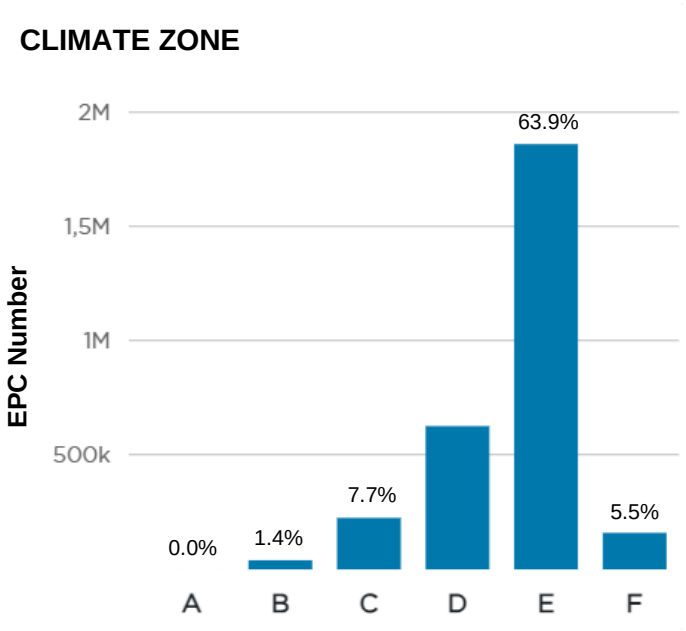
From 2015 to the present, there has been a steady increase in the drafting of EPC, with the highest figures between 2020 and 2021, probably also due to the incentives provided by the state for improving the energy performance of buildings over the years.

Work carried out by ENEA shows that the prevailing energy class is G, the least performing energy class, which affects 33.6% of the sample. Conversely, the most favourable classes (classes A, B and C of the sample) affect only an extremely low percentage: overall, classes A to C affect only 15.2% of the sample.



Source:
https://siape.enea.it/analisi-territoriali

Another significant fact is the climatic zone of the energy performance certificates: in line with the geographical distribution of climatic zones, most of the EPCs are attributable to buildings in climatic zone E, followed by buildings in climatic classes D, C, F B. Climate zone A, present in only two Italian municipalities, is in fact not represented in percentage terms.



Source:
https://siape.enea.it/analisi-territoriali

10.ESG DATA REMEDIATION ON UNICREDIT SPA'S COLLATERAL PORTFOLIO

The key step in determining the best 15 per cent of buildings in terms of energy consumption, compared to the local benchmark, is to identify the energy class of the buildings. RE Valuta, with its *real estate analytics* partner Immobiliare.it, has initiated the ESG Data Remediation project for collaterals on 4 main real estate collateral portfolios, specifically dividing them as follows:

Portfolio	Total (# assets)	Target (# assets)	Top15% (# assets)	Recovered EPCs	Estimated EPCs
Book Collateral	953.801	673.089	89.694	27%	73%
Delta	57.194	51.916	4.154	58%	42%
Leasing	17.425	Not in scope*	Not in scope*	Not in scope*	Not in scope*
Null	131.514	19.588	3.076	30%	70%
Total	**1.159.934**	**744.593**	**96.924**	**29%**	**71%**

*Not considered for the purposes of Top 15% identification

Where the specific EPC of the property under analysis was identified in the owner database, priority was given to those data. In the absence of precise data, a statistical approach was adopted using machine learning fed by a training set of over 8 million specific EPCs at the time of the estimate. Excluded from the classification were those properties that, either due to their type or their lacking of certain key data, were not suitable for processing (see below for more details).
The following information was provided for each property in scope:

- Energy class (A-G)
- Energy Performance Index (EP-GL NREN) referring to energy consumption from non-renewable sources (consumption measured in kWh/m^2 per year).
- Energy Performance Index (EP-GL REN) referring to energy consumption from renewable sources (consumption measured in kWh/m^2 per year).
- CO^2 emissions (measured in kg/m^2 per year)

The Project, which started in July 2021, saw four main phases of activity:

A. MASSIVE COLLATERAL DATA QUALITY AND RESULTS

The data quality, prior and preparatory to the continuation of the project, saw an initial formal and substantial congruity check of the data provided as input by the client, producing a gap analysis report on the deviation between as-is and to-be.
By means of the land registry data (Sheet, Parcel, Sub-parcel), a "Target" dataset was created of properties that are actually workable, which was enriched where possible by the combination of several sources (e.g., the RE Valuta appraisal database) and had the dual purpose of finding EPCs linked to the properties, and which provided fundamental elements in the case of appraisal (geographic information, property information).

Cases of exclusion from the obligation to provide the EPC (DM 2015)

On the other hand, no energy class could be assigned to buildings that, by type, do not require an energy performance certificate, as stated in the 2015 Ministerial Decree:

a) detached buildings with a total usable area of less than 50 square metres (Art. 3(3)(d) of the decree);

b) industrial and artisanal buildings when the rooms are heated or cooled for the purposes of the production process, or when using energy waste from the production process that cannot otherwise be used (Art. 3, c. 3(b) of the Legislative Decree), or when their use and/or activities carried out within them do not provide for heating or air conditioning;

c) agricultural or rural, non-residential buildings without air-conditioning systems (Art. 3(3)(c) of the Legislative Decree);

d) buildings that are not included in the categories of buildings classified on the basis of their intended use pursuant to Article 3, Presidential Decree 26.8.1993, No 412, the standard use of which does not include the installation and use of technical systems, such as garages, cellars, parking areas, multi-storey car parks, warehouses and seasonal structures for the protection of sports facilities, (Art. 3, c. 3(e) of the decree). The energy performance certificate is, moreover, required with regard to the portions possibly used as offices and the like, provided that they can be separated for the purposes of the energy efficiency assessment (Art. 3, c. 3-ter of the Legislative Decree);

e) buildings used as places of worship and for carrying out religious activities, (Art. 3, c. 3(f) of the Legislative Decree);

f) ruins, provided that this condition is expressly declared in the notarial deed;

g) buildings under construction for which there is no habitability or practicability at the time of sale, provided that this condition is expressly stated in the notarial deed.
In particular, reference is made:

- to real estate sold in the condition of a “structural skeleton,” i.e., without any external vertical walls or elements of the building’s structure;
- to real estate sold “*al rustico*” or as a shell, i.e., without finishing and technological installations;

l) artefacts, in any case, that do not fall within the definition of building laid down in Article 2(a) of the Legislative Decree (i.e. artefacts that do not qualify as “systems made up of the external building structures that delimit a space with a defined volume, the internal structures that subdivide that volume and any of the technological systems and devices that are permanently located inside it”) (for example: an outdoor swimming pool, a greenhouse not built with building structures, etc.).

For letters f) to l), the obligation remains unchanged to submit, prior to the commencement of completion works, a new technical project report certifying compliance with the standards for the energy efficiency of buildings in force on the date of submission of the application for the building permit, or a declaration of commencement of activities, however it may be named, which, pursuant to paragraph 2.2, of Annex 1 of the Minimum Requirements Decree, the owner of the building, or whoever is entitled to it, must file with the competent administrations at the same time as they file the declaration of commencement of works.

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B. TIMELY EPC RETRIEVAL

Once the "Target" dataset was identified, the system searched for the specific real estate unit within a database containing, at the time of analysis, over 8 million energy performance certificates (of which approximately 85% were residential).
In the absence of the exact match, reference could be made to the EPCs of neighbouring apartments or the building.
In the presence of the certificate, it is possible to trace the point consumption of the building and thus implement an accurate calculation of CO_2 emissions.

The three methods of certificate retrieval are set out below:

Recovery of the certificate at the most accurate cadastral level
The retrieval of previous EPCs (ACE - Attestato di Certificazione Energetica) and currently valid energy performance certificates (APE – Attestato di Prestazione Energetica) from the regional land registers using the correspondence of the cadastral identifier at sub-parcel level has made it possible to recover the official EPC record and therefore all the data described in it, for the specific real estate collateral.

Recovery attested at the Parcel level or by listing addresses
For the positions for which it has been possible to recover the energy classes at parcel level, or at address level through listings, the mode of attribution is the same. The data is presented in the form of a list of energy classes, from which it is necessary to choose the one most likely to belong to the target asset. For assets which have a year of construction in the data tape this information was used for a more consistent attribution of the energy class.
For assets that do not have the year of construction even after data remediation, a class has been assigned that is a function of assumptions on the modal or multimodal characterization of the distribution of classes recovered.

Assignment of class 'A' for Year of Construction greater than or equal to 2015
For assets with the year of construction set at a value greater than or equal to 2015, class 'A' has been assigned based on current national building legislation.

C. STATISTICAL EPC ESTIMATE

Recovery, prediction or attribution of the energy class

For all the locations for which it was not possible to assign an energy class through the previous levels, a prediction is carried out through a classification model using the Random Forest algorithm.

In particular, the energy classes present in the archives from 2016 to 2021 are used and the model is trained on the basis of variables that are recoded to be usable through the data present in the target asset dataset.

Regarding the model, the BalancedRandomForestClassifier algorithm is used, which allows a better management of unbalanced classes through resampling methods between classes.

Calibration

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Given the spatial difference in the distribution of EPC and given the presence in the model of variables referring to the territory, 5 models have been carried out per geographical range using the subdivision of the Italian macro-regions NORTH-WEST, NORTHEAST, CENTER, SOUTH and ISLANDS.

Key variables

The prediction models use a large set of variables to retrieve or to predict the energy class:

- Asset type
- Geographic coordinates
- Administrative area
- Cadastral data
- Surface
- Floor number
- Total floor number of the building
- Year of construction
- Maintenance status
- Quality of the finishes
- Quality of the
- Residential/Commercial
- Value

Only a few among these variables are required, as a set of ancillary models recover or predict the missing ones.

Output testing or backtesting

The performance of methods based on the recovery of EPC data from groups of certificates within a cadastral parcel or a civic number block have been tested based on their ability to predict towards the official EPCs.

The metric used is that of *F1_score* which represents the harmonic mean between the precision and recall measures, i.e.:

F_1*=(2*precision*recall)/(precision+recall)*

The choice of this metric is motivated by the need to give the same importance to both false positives and false negatives, measured respectively by precision and recall. This metric will be weighted by the numerosity of the classes. In addition to the global F1_score, the F1_score concerning only classes A and B will be reported; in this case we observe the ability of the method to classify the best classes.

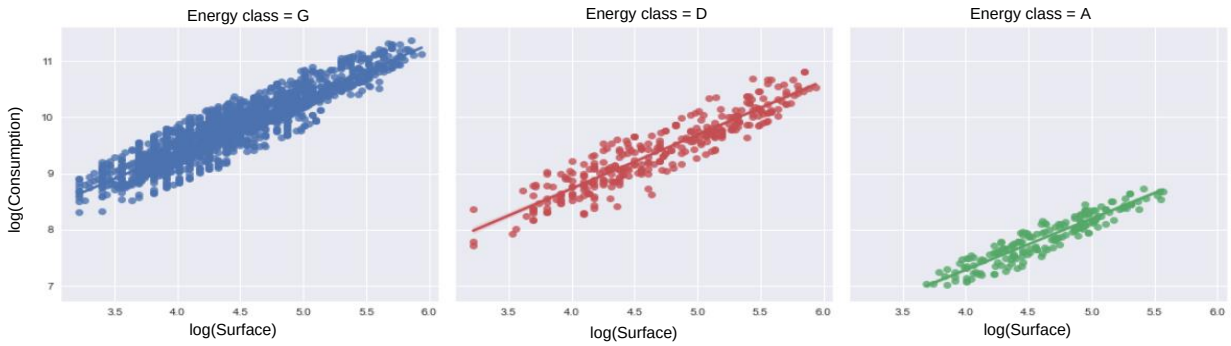
Level	# of records	f1 (tot)	f1 (only a/b)
2_1 (Parcel)	52796	0.55	0.75
2_2 (Address)	10030	0.36	0.48
5 (Model)	68761	0.36	0.34

Recovery, prediction or attribution of the primary energy demand and CO_2 emission

The prediction of consumption is based on the surface area, the relative EPC data attributed and the geographical location of reference of the survey. It is based on a log-log Model, i.e., a simple linear regression model that sees both the dependent and independent variables, i.e., total consumption and area, respectively, transformed into a logarithm:

$log\ Y_i = \beta_0 + \beta_1 log\ x_i + i$

This model was chosen because both variables have a pronounced positive skewness in the distribution, which makes their relationship non-linear and can be brought back to linearity by logarithmic transformation of both variables, clearly visible in the figure:



The coefficient β_1 in a log-log model represents the elasticity of consumption with respect to the surface area, that is, it expresses the percentage change expected from consumption when the surface area increases by a certain percentage.

Using the consumption and the EPC data from the certificates we estimated for each municipality and for each energy class the coefficients β_0 and β_1 of the model described above to give a prediction of consumption as local as possible. Not having information on the type of consumption or source used, the calculation of emissions was done using coefficients derived from regional data.

D. CALCULATION METHODOLOGY TOP 15% OF THE PORTFOLIO

The methodology applied for the identification of energy-efficient buildings compared to the local average is in line with both the TEG Final Report on EU Taxonomy (2020) and the 2019 Climate Bonds Initiative (CBI) Taxonomy, whenever permissible via benchmark data from the national observatory SIAPE (Enea). The TEG suggests using the best 15% of the existing national housing stock, with a natural narrowing of the sample along the Fit-for-55 path. Primary Energy Demand (PED), on the other hand, expresses the annual metric of primary energy consumption measured in kWh/m2 per year.

For the determination of the Top 15% of the Unicredit portfolio, RE Valuta applied the most graded approach possible according to the availability of the SIAPE benchmark, identifying the distribution of energy classes at the provincial scale. Where provincial scale benchmarks were not available, the regional benchmark was used. At the date of publication, the SIAPE website had not reported data for four regions (Tuscany, Sardinia, Campania, Basilicata), the national benchmark being the one used for these regions.

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In April 2022, 1,000,000 more EPCs were loaded into SIAPE, and the regions increased from 14 to 17, making it possible to draw a comparison on a provincial basis.

Methodological overview:

The preparatory step for the analysis was to construct the complete SIAPE benchmark, i.e. that which contains the distributions of energy classes for each available SIAPE zone: provinces, regions, country.

For each observation of the portfolio, the SIAPE area of reference was identified, according to the following cases:

- A province, in the case of a developed province present in SIAPE,
- A region, in the case of an undeveloped province, an enhanced region that is present in SIAPE,
- National, in all other cases, i.e., in the case of no province and region, or where there is no reference in SIAPE.

The SIAPE benchmark of the reference SIAPE area was then used for each observation.
The classes entirely belonging to the top 15% SIAPE have been identified, for which these classes are assigned to the portfolio under analysis.
Assets per province whose energy class falls within the best 15% of the provincial SIAPE benchmark were selected from the Unicredit portfolio. In case the 15% cutoff fell within an energy class, the selection from the target portfolio was made on the basis of the best *ep_gl_nren* parameter within that energy class. For a representation of the top 15% cutoff, please refer to the table below summarising the averages at regional level.

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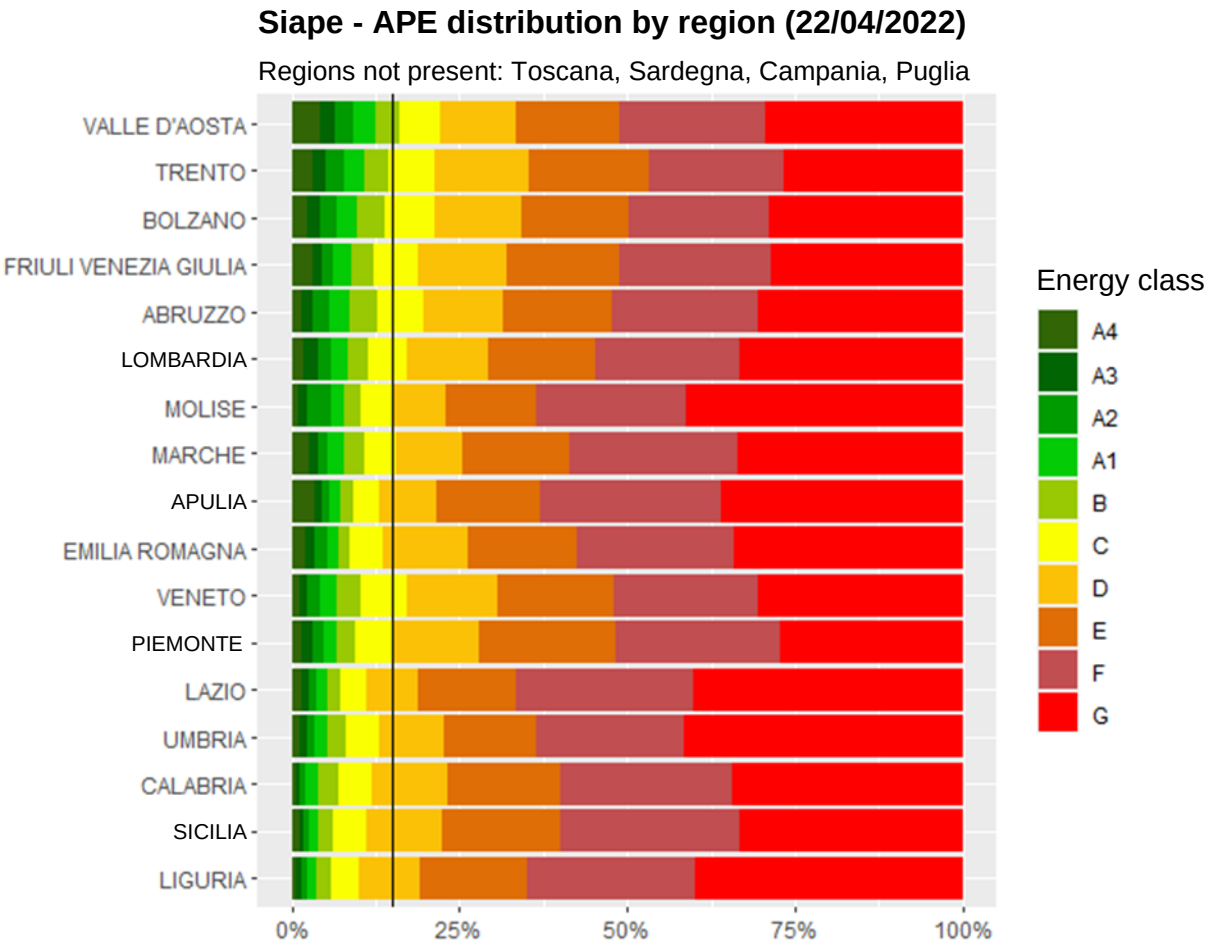


Source: Development of the RE Valuta studies office based on the SIAPE website analysis

This methodology led to the identification of 96,924 Top 15% assets, a specific analysis of which follows in the next chapter.

11. ANALYSIS OF THE REAL ESTATE PORTFOLIO OF UNICREDIT SPA AND METHODOLOGY FOR CALCULATING THE TOP 15% OF THE REAL ESTATE PORTFOLIO ACCORDING TO THE ENERGY CLASS

Below are the main highlights of the Top 15% portfolio, representing a share of the overall portfolio, together with the results of the analysis with the under-represented segmentations:

Top 15% Portfolio - Key highlights

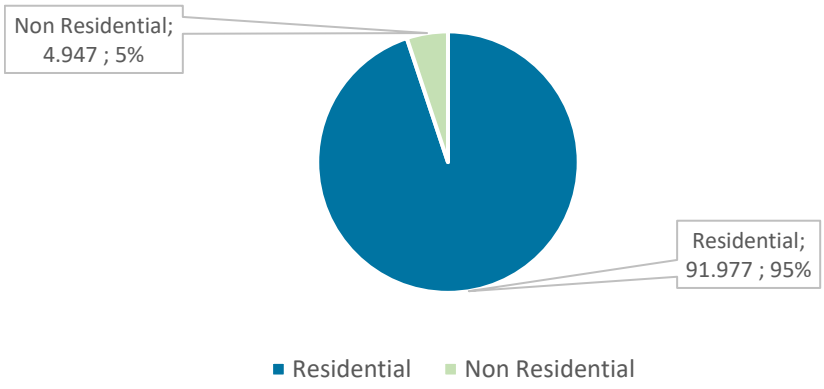
#96,924 Top 15% Assets

13.06 Kg/m^{2}year **AVG CO_2**

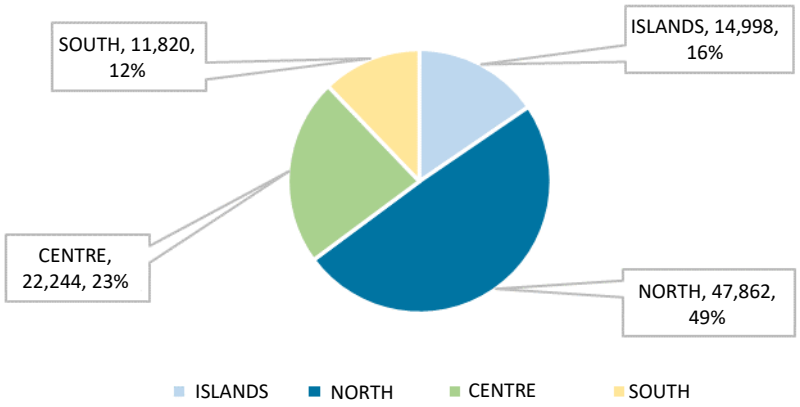
59.78 kWh/m^2 year **AVG** $EP_{gl,nren}$

47% Assets in energy class A

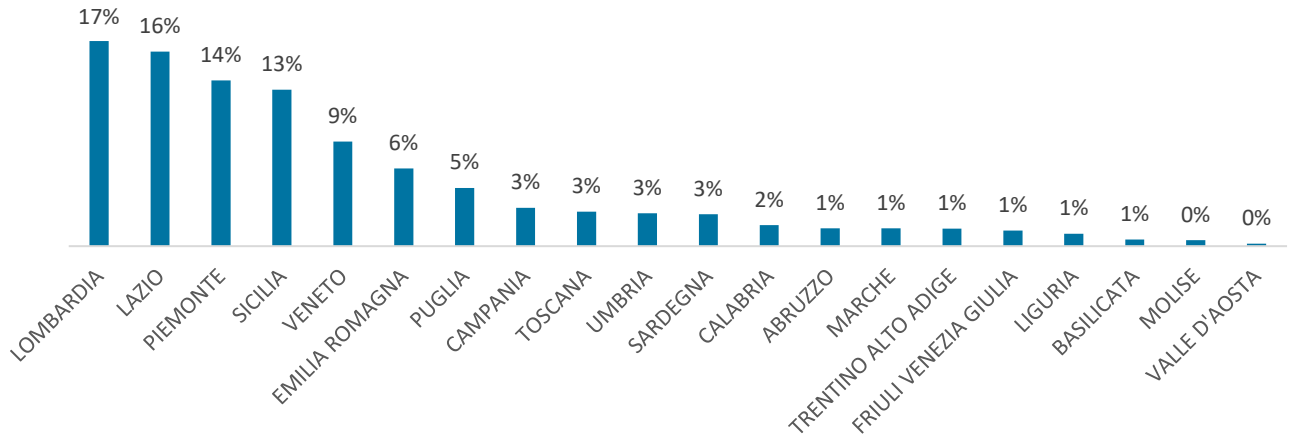
1. Number of Top 15% assets by cluster of intended use:



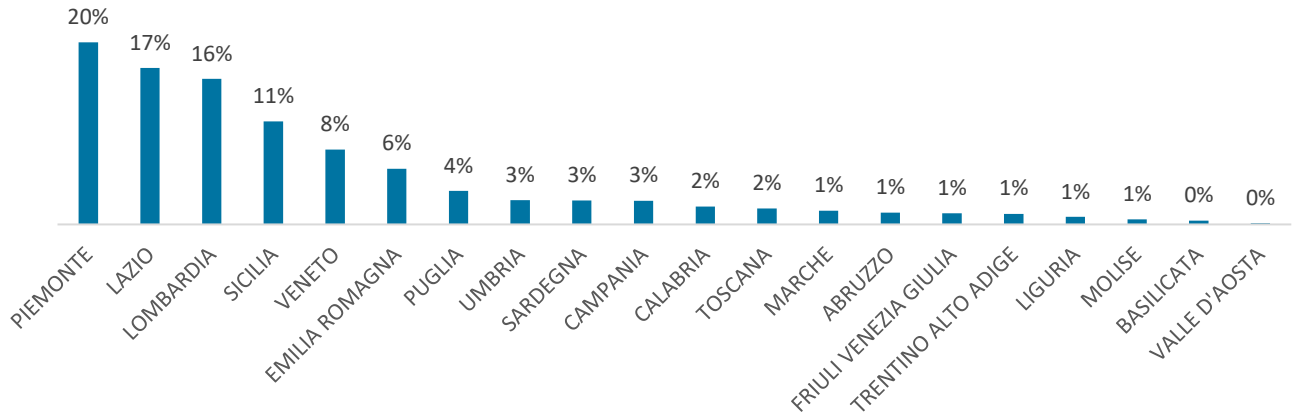
2. Number of Top 15% assets by cluster of macro geographical area:



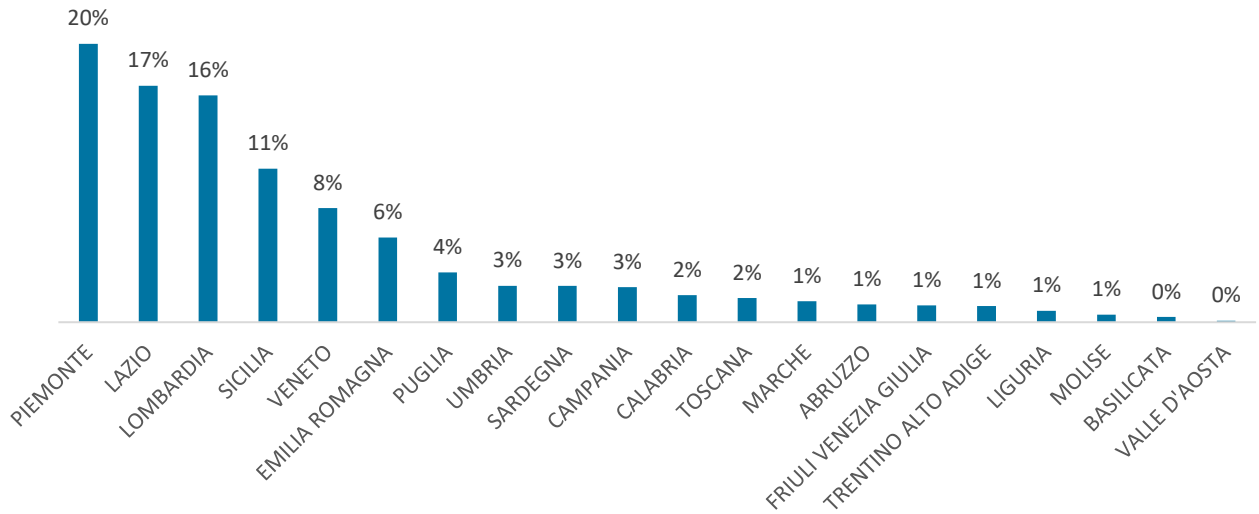
3. Number of Top 15% assets by Region:



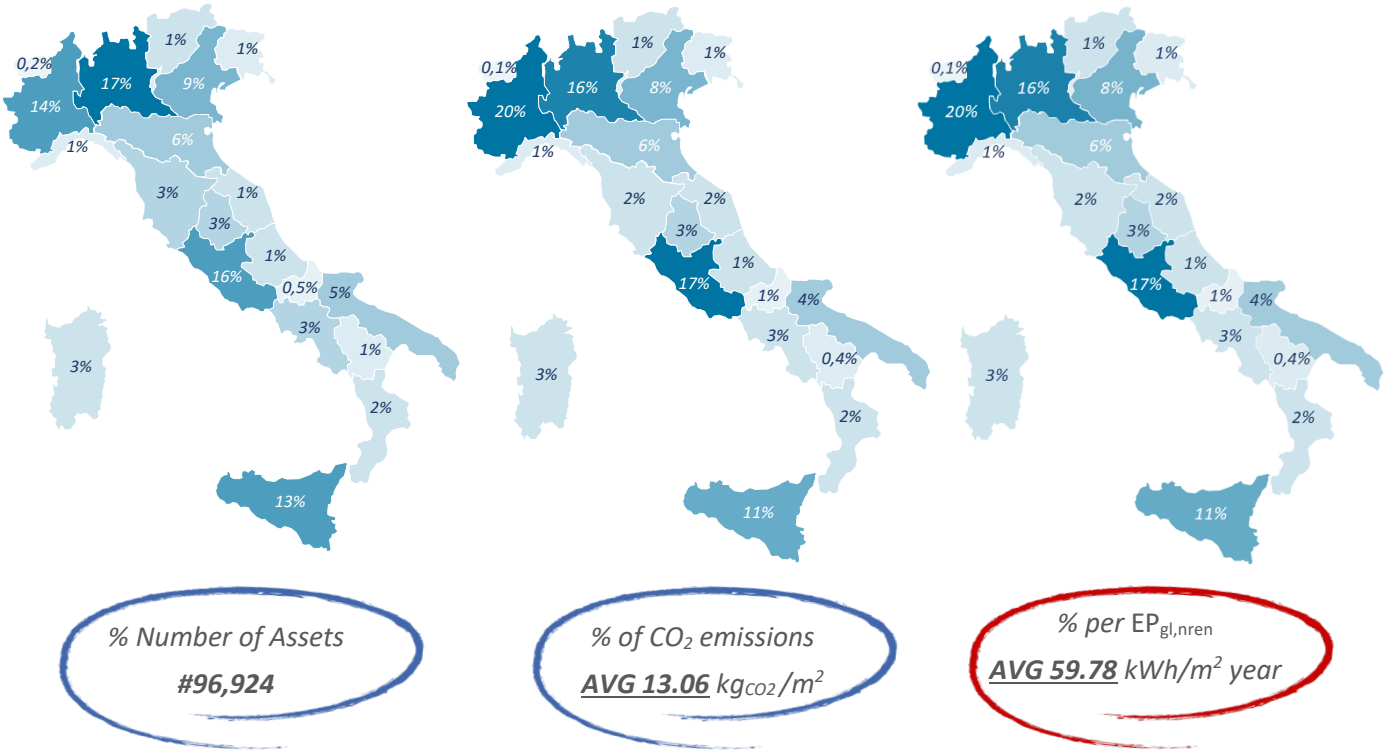
4. Emissions CO_2 kg_{CO2}/m^2 Top 15% by Region:



5. Consumption kWh/m^2 *year* AVG $EP_{gl,nren}$ Top 15% by Region:



6. Top 15% concentration maps by region, by number of assets, by CO_2 emissions and by Global Renewable Energy Performance Index average $EP_{gl,ren}$



Comparison with SIAPE on average national data (Source: SIAPE website)

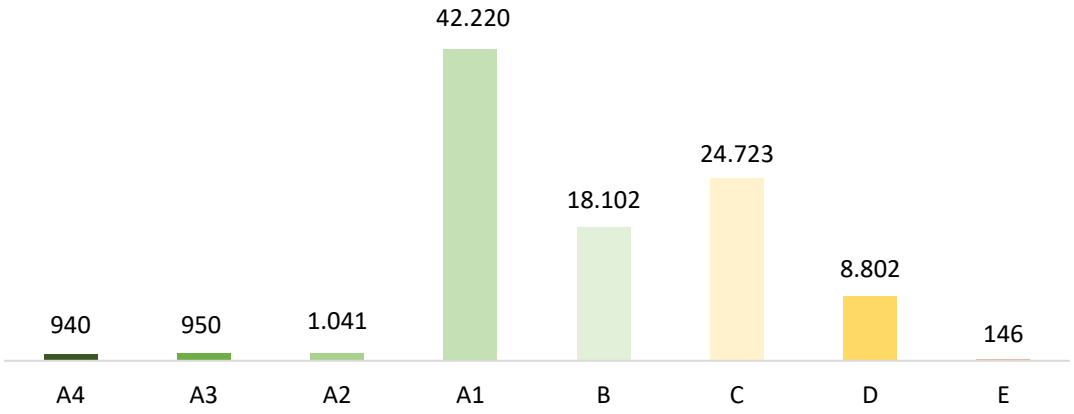
66,6 kg CO_2/m² anno

66.6 kg_{CO2}/m^2 year

Non-renewable Global Energy Performance Index $EP_{gl,nren}$ average

234,8 kWh/m² anno

7. Number of Top 15% assets by energy class:



8. Number of Top 15% assets by energy class and by Region: