Cerved

# Technical Report

## Green Building Framework

**January 2025**

Public version

## Legal Notices

# Contents

# Introduction

## Scope of the Document

This report provides an overview of the selected **ICCREA's mortgage portfolio** with a focus on the energy efficiency of related buildings. Energy efficiency refers to a building's ability to reduce energy consumption and greenhouse gas emissions. The report will examine the environmental benefits of energy-efficient buildings as well as the policies and incentives driving their adoption.

Cerved Group S.p.A. has identified **Green Buildings** within the mortgage portfolio by evaluating eligible assets linked to the acquisition and construction of energy-efficient properties. The analysis aligns with the following:

- The Institution's Green Social Sustainability Bond Framework
- International Capital Market Association's (ICMA) Green Bond Principles (GBPs)
- European Taxonomy for sustainable activities
- The UN Sustainable Development Goals (SDGs) and EU climate objectives

Based on the provided mortgage portfolio from ICCREA, this analysis estimates the following:

- The **commercial value of buildings**.
- The **Energy Performance Certificate (EPC)** where not yet available.
- The **Carbon Dioxide ($CO_2$)** emissions related to the buildings.
- **Global Energy Performance from non-renewable energy sources (EP_gl_NREN)**.

With these metrics assessed, the following analyses will be conducted:

- Estimating the **eligible buildings** within the portfolio. With the following criteria:
    - **Top 15% energy efficiency buildings**, for building built before 2021
    - **NZEB*90%**, for building built after 2021
- Calculating **financed emissions and carbon impact** related to the mortgage portfolio.

## General Overview

The European and Italian transition to energy-efficient building stock is critical for achieving the EU's climate and energy goals. Buildings account for approximately 40% of the EU's energy consumption and greenhouse gas emissions (Eurostat, 2022), with Italy having one of the oldest building stocks in Europe.Renovating and innovating energy performance is essential for reducing energy demand, increasing renewable energy use, enhancing comfort, creating jobs, and addressing energy poverty.

The **European Green Deal** (2020) aims for EU climate neutrality by 2050, including measures across transport, industry, energy, real estate, and environmental protection. Key goals include reducing building emissions and improving energy efficiency through renovations and renewable energy adoption. The **Energy Performance of Buildings Directive (EPBD)**, revised in 2018, sets the legal framework for energy-efficient and decarbonized building stock by 2050. It includes requirements for long-term renovation strategies, nearly zero-energy buildings (NZEBs), and energy performance certificates (EPCs).

Italy has implemented the EPBD through national laws, including a fund for energy efficiency, NZEB plans, and a smart readiness indicator (SRI). The proposed 2021 revision of the EPBD under the "Fit for 55" package introduces stricter goals: achieving zero-emission buildings (ZEBs) for new constructions by 2027 and major renovations by 2030, setting minimum energy performance standards, and revising the EPC framework.

These initiatives aim to significantly reduce emissions and energy consumption, promote renewable energy, improve indoor air quality, create jobs, and enhance property values, contributing to the EU's broader climate and energy objectives.

Energy efficiency is vital for the European real estate market, reducing greenhouse gas emissions, improving indoor comfort, and lowering energy bills. Households account for 27% of the EU's final energy use (2022), with space heating as the primary energy-consuming activity (Eurostat, 2022).

**Share of final energy consumption in the residential sector by type of end-use, 2022** (Eurostat, 2022)

| **Use** | **EU (%)** | **Italy (%)** |
|---|---:|---:|
| *Space Heating* | 63.5% | 67.3% |
| *Space Cooling* | 0.64% | 2.07% |
| *Water Heating* | 14.85% | 10.49% |
| *Cooking* | 6.26% | 7.50% |
| *Lighting & Appliances* | 13.91% | 11.33% |
| *Other* | 0.87% | 1.29% |

It overviews of the Italian real estate market, focusing on energy efficiency and the Energy Performance Certificate (EPC). Explanation of the climatic zone.

# Objectives

## Data Sources

We defined the eligibility limits using both public and proprietary Cerved data. This included national datasets for Italian buildings and over 270,000 proprietary appraisals, ensuring comprehensive analysis of value and energy performance.

Climatic zones also played a crucial role in setting thresholds, as they provide key insights into regional energy efficiency characteristics.

Italy is divided into six climatic zones, as defined by **DPR No. 412 of August 26, 1993**. These zones are classified based on **"degree days,"** which are calculated as the positive difference between a standard internal temperature of **20°C** and the daily average external temperature. The higher the degree days, the colder the climate in that region, which is a key indicator used for energy performance, construction standards, and environmental analysis. The zones are:

| Zones | Criteria |
|---|---|
| Zone A | Municipalities with degree days below 600 |
| Zone B | Municipalities with degree days between 600 and 900. |
| Zone C | Municipalities with degree days between 901 and 1400. |
| Zone D | Municipalities with degree days between 1401 and 2100. |
| Zone E | Municipalities with degree days between 2101 and 3000. |
| Zone F | Municipalities with degree days above 3000. |

## Focus: Cerved Internal Appraisals

For its proprietary evaluation model, which assesses both the value and energy performance of buildings, Cerved has utilized a training dataset of over 270,000 official appraisals. This dataset represents a comprehensive and diverse sample of the Italian real estate market, selected from evaluations conducted in last years. The appraisals are stratified across various geographic and urban segments, ensuring representativeness. Key statistics from the dataset are shown below:

| Segment | N. | % |
|---|---|---|
| Coastal | 87'398 | 31.9% |
| Mountain | 18'089 | 6.6% |
| Plains | 168'249 | 61.5% |

# Estimation Model

If not available, we will use internal models to estimate both the building's value and EPC label.

## Automated Valuation Model

The **Cerved AVM (Automated Valuation Model)** is a tool designed to estimate the value of real estate properties across Italy. It relies on three main pillars: **high-quality nationwide data**, an **interpretable predictive model**, and **validated performance against European standards**. The AVM uses detailed property appraisals, comparables from real estate market platforms like Idealista, aggregated price data, and socio-economic factors such as tourism attractiveness and proximity to points of interest to ensure a comprehensive and accurate evaluation.

The model integrates two main approaches: the **Hedonic Model** and the **Comparable Model**. The **Hedonic Model** estimates a property's intrinsic value based on its physical and qualitative attributes, location, and environmental scores. The **Comparable Model** evaluates market similarity by comparing a property to nearby or market-relevant similar properties in an up-to-date database. These two models are combined to compute the final estimated value, expressed as a range with a minimum and maximum value.

To ensure both **accuracy** and **interpretability**, the AVM focuses on maintaining linearity in its modelling approach while benchmarking against non-linear techniques such as boosting algorithms and neural networks. This allows the AVM to compete with complex models while remaining comprehensible to users. Furthermore, the model's validation involved collaboration with market stakeholders and real estate experts to ensure both logical accuracy and practical relevance.

## EPC Estimation

**EPC**

The model leverages a suite of Machine Learning models to estimate the Energy Performance Certificate (EPC) label of buildings. It incorporates a diverse set of features across three main categories:

- **Building Information**:
  Includes characteristics like EPC category, commercial area, rooms, floor

classifications, region, segment, heating degree days, and year of construction. These features describe the building's physical attributes and context.

- **Geographical Data**:
  Utilizes Cerved's internal proprietary scores (e.g., extra cell, family, social, strategic, mobility, health-related scores, building quality etc), providing insights into the building's surrounding environment and strategic positioning.
- **Announcement (asking price) data**:
  Aggregated statistics on EPC values from Announcement Data Base further enrich the model by reflecting market-level trends and benchmarks.

This integrated feature set ensures a comprehensive evaluation of both the building's intrinsic characteristics and its environmental and market context for accurate EPC label predictions.

**$CO_2$ & EP_gl_NREN**

To estimate $CO_2$ emissions and EP_gl_NREN (non-renewable energy performance index), the methodology distinguishes between residential and non-residential buildings. Here's the summary:

**Residential Buildings:** Provincial data categorized by climate zone is used as the basis for the analysis, with detailed analysis to guarantees smooth and consistent results across all provinces.

**Non-Residential Buildings - General Approach**: Like residential buildings, using provincial data by climate zone and applying smoothing to maintain monotonicity.

**Non-Residential Buildings – Specific Categories**: For certain building types like offices, restaurants, and industrial facilities, a refined approach is used:

$$\frac{\text{Provincial Data for Climate Zone} \cdot \text{National Data for Specific Category}}{\text{National Data for Climate Zone}}$$

This formula combines provincial and national data to produce accurate estimates for these specific building categories. An approach like the one used for residential and general non-residential buildings cannot be applied in this case. This is primarily due to the lack of sufficient data at the provincial level for each specific sub-category. Consequently, alternative methods must be employed to ensure accurate estimations while addressing these data gaps.

# Eligibility Criteria

## Italian Regulation

The Energy Performance Certificate (EPC), or Attestato di Prestazione Energetica (APE) in Italy, is a mandatory document designed to evaluate and classify the energy efficiency of buildings. It is governed by Legislative Decree No. 192/2005, which implements the EU Energy Performance of Buildings Directive (EPBD), and further refined by Legislative Decree No. 48/2020 to align with the revised EPBD. The EPC assigns a building an energy efficiency rating on a scale from A4 (highest efficiency) to G (lowest efficiency) and provides detailed information about energy consumption, recommendations for improvement, and environmental impact. It is required in several scenarios, including property sales, rentals, new constructions, major renovations, and public buildings. Additionally, the energy class must be included in property advertisements.

A critical component of the EPC is the Primary Energy Demand (PED), which represents the total energy required for heating, cooling, ventilation, hot water, and lighting. PED is calculated using technical standards such as the UNI/TS 11300 series, which ensure consistency across evaluations. PED thresholds play a pivotal role in determining a building's energy class and compliance with energy efficiency regulations, including Italy's Nearly Zero-Energy Building (NZEB) framework. NZEB requirements mandate that all new buildings meet strict PED limits and derive a portion of their energy from renewable sources.

Italy's regulations also consider the country's climatic diversity, dividing the territory into six zones (A to F) based on average heating degree days. These zones influence energy performance requirements by accounting for regional variations in heating, cooling, and insulation needs, ensuring that PED calculations are contextually accurate.

## European Regulation

The **EU taxonomy for sustainable activities** (European Commision, 2024) is a classification system designed to help investors, companies, and policymakers identify environmentally sustainable economic activities. It supports the European Green Deal by establishing technical screening criteria (TSC) to assess whether economic activities contribute to climate change mitigation or adaptation without causing significant harm to other environmental objectives (DNSH).

The **real estate sector** is a key focus of the EU Taxonomy due to its significant role in climate change mitigation, adaptation, water use, circular economy, and pollution prevention.

Key real estate activities covered by the taxonomy include:

1. **Construction of new buildings**:

- Must achieve a primary energy demand at least **10% lower** than national NZEB standards.
- Can support climate change adaptation by improving resilience against physical climate risks like floods, heat waves, and storms.

2. **Renovation of existing buildings**:
   - Must achieve **30% energy savings** compared to baseline scenarios.
   - Contributes to climate change mitigation by improving energy efficiency and emissions reduction and to climate change adaptation by enhancing resilience to climate risks.
3. **Individual building ownership**:
   - Can contribute to climate change mitigation through meeting specific energy performance or emissions intensity standards.
   - Contributes to climate change adaptation by addressing resilience to physical climate risks.

These criteria aim to ensure real estate activities align with sustainability goals by reducing emissions, improving energy performance, and increasing climate resilience.

For this analysis, the main legislative reference considered is the **Technical Screening Criteria** (Supplementing Regulation (EU) 2020/852). Which identifies the following criteria for buildings:

*Technical screening criteria* (Supplementing Regulation (EU) 2020/852)

| Type of building | Criteria |
|---|---|
| *Buildings < 2021* | For buildings built before 31 December 2020, the building has at least an Energy Performance Certificate (EPC) class A. As an alternative, the building is within the top 15 % of the national or regional building stock expressed as operational Primary Energy Demand (PED) and demonstrated by adequate evidence, which at least compares the performance of the relevant asset to the performance of the national or regional stock built before 31 December 2020 and at least distinguishes between residential and non-residential buildings. |
| | For buildings built after 31 December 2020, the building meets the criteria specified in Section 7.1 of this<br>Annex that are relevant at the time of the acquisition. |

*Section 7.1* (Supplementing Regulation (EU) 2020/852)

| Type of building | Criteria |
|---|---|
| *Buildings > 2021* | The Primary Energy Demand (PED) ( 281 ), defining the energy performance of the building resulting from the construction, is at least 10 % lower than the threshold set for the nearly zero-energy building (NZEB) requirements in national measures implementing Directive 2010/31/EU of the European Parliament and of the Council ( 282 ). The energy performance is certified using an as built Energy Performance Certificate (EPC). |

| | |
|---|---|
| | For buildings larger than 5,000 $m^2$ (283), upon completion, the building resulting from the construction undergoes testing for air-tightness and thermal integrity (284), and any deviation in the levels of performance set at the design stage or defects in the building envelope are disclosed to investors and clients. As an alternative; where robust and traceable quality control processes are in place during the construction process this is acceptable as an alternative to thermal integrity testing. |

Based on this classification, we will proceed to classify buildings as follows.

# Residential Buildings

## Built before 2021

To identify the top 15% of buildings within this stock, we will focus on buildings built before 2021 and we will interpolate the number of observations using the EP_GL_NREN parameter (Non-Renewable Global Energy Performance). This approach ensures compliance with the requirement to assess the operational Primary Energy Demand (PED) against the national or regional building stock, distinguishing between residential and non-residential buildings, and aligns with the criteria specified in the EU Taxonomy.

## Built after 2021

Based on the specified criterion that the Primary Energy Demand (PED) must be at least 10% lower than the threshold set for the Nearly Zero-Energy Building (NZEB) requirements in national measures implementing Directive 2010/31/EU, we will adopt the following approach:

For each climatic zone, we will calculate the PED threshold using the formula:

$$PED\_threshold = MAX(NZEB) \times 90\%$$

Here, MAX(NZEB) represents the maximum allowed PED value under the NZEB requirements for buildings in the respective climatic zone. By reducing this value by 10%, we align with the regulation's stipulation for new constructions. This methodology ensures compliance while accounting for the diverse energy performance requirements across different climatic zones in Italy.

# Non-Residential Buildings

## Built before 2021

Here, the same approach of residential building is adopted, using the top 15% approach.

## Built after 2021

For specific categories of non-residential buildings (e.g., offices or schools), where distinct thresholds are needed, the PED threshold is computed proportionally based on the energy performance relationship observed in buildings constructed before 2021. The calculation follows the ratio:

$$Generic\ non\ residential\ PED < 2021 : Category\ PED < 2021$$

$$=$$

$$Generic\ non\ residential\ PED > 2021 : Category\ PED > 2021$$

By solving for the unknown category threshold ($Category\ PED > 2021$), we establish a proportional relationship, allowing for consistent and category-specific PED thresholds that reflect historical energy performance trends while complying with post-2021 standards.

# Summary Tables

Here, we provide the comprehensive tables for the threshold applied to the portfolio.

| | Climatic Zone | | | | | | |
|---|---|---|---|---|---|---|---|
| | **A** | **B** | **C** | **D** | **E** | **F** | |
| Residential | *100* | *100* | *104* | *110* | *114* | *121* | |
| Other non-residential (hotels, cinemas, theaters, gyms, museums, and others) | *216* | *216* | *231* | *255* | *270* | *284* | |
| *Offices and similar* | *149* | *149* | *148* | *177* | *192* | *206* | ***< 2021*** |
| *Bars, restaurants, dance halls, and similar* | *306* | *306* | *356* | *394* | *424* | *453* | |
| *Industrial, artisanal, and similar activities* | *174* | *174* | *208* | *214* | *219* | *223* | |
| Residential | *42* | *42* | *49* | *55* | *76* | *84* | |
| Other non-residential (hotels, cinemas, theaters, gyms, museums, and others) | *76* | *76* | *104* | *132* | *162* | *183* | |
| *Offices and similar* | *52* | *52* | *67* | *92* | *114* | *133* | ***> 2021*** |
| *Bars, restaurants, dance halls, and similar* | *108* | *108* | *160* | *204* | *260* | *292* | |
| *Industrial, artisanal, and similar activities* | *61* | *61* | *94* | *111* | *140* | *144* | |

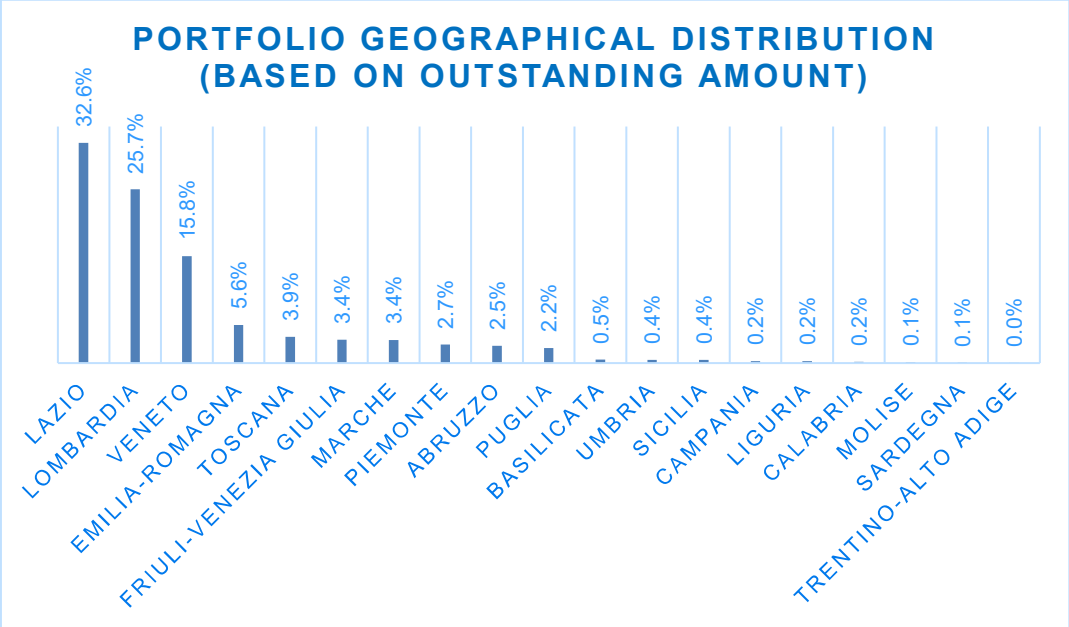
# Portfolio Analysis

The ICCREA's green building portfolio includes 11,614 mortgages up to 2024 and the current outstanding amount accounts for ~1,6 billion euros that resulted eligible given the previously described criteria.

The portfolio is composed of 80.2% buildings constructed before 2021, and 19.8% built after 2021. Not surprisingly, the distribution of the energy classes is unbalanced towards higher classes: The entire portion of buildings built after 2021 belongs to energy class A as well as most of the ones built before 2021.

| FLAG 2021 | EPC | % |
|---|---|---|
| BEFORE | A | 71.5% |
| | B | 23.4% |
| | C | 4.8% |
| | D | 0.3% |
| AFTER | A | 100% |

Regarding the geographical distribution, the portfolio is predominantly concentrated in Lazio (32.6%), followed by Lombardia (25.7%) and Veneto (15.8%), collectively representing over 70% of the portfolio's total distribution, based on the outstanding amount.



In terms of property valuation, estimation was only required in a small proportion of cases:

| PROPERTY VALUE | % |
|---|---|
| **REAL** | 86.7% |
| **AVM ESTIMATE** | 13.0% |
| **null** | 0.4% |

The portfolio's total dimension is about 133 hectares, with an average building size of 114 square meters.

The outstanding amount distribution of the buildings is as follows:

| PERCENTILE | OUTSTANDING AMOUNT |
|---|---|
| **10%** | € 64,048 |
| **20%** | € 85,087 |
| **30%** | € 101,283 |
| **40%** | € 115,356 |
| **50%** | € 128,588 |
| **60%** | € 141,812 |
| **70%** | € 158,618 |
| **80%** | € 180,470 |
| **90%** | € 215,432 |

Finally, a deeper analysis of eligibility based on the construction year flag (before or after 2021) is as follows:

| FLAG 2021 | CRITERIA | OUSTANDING AMOUNT MLN EUROS | NORM SUM MLN EUROS |
|---|---|---|---|
| BEFORE | *TOP 15%* | 1,230 € | 87% |
| AFTER | *NZEB*90%* | 363 € | 95% |

# Positive Carbon Impact

This section outlines Cerved's methodology for estimating the avoided CO2 emissions from ICCREA's green building portfolio. The assessment is based on four key components:

- Calculation of greenhouse gas (GHG) emissions for each building
- Identification of a national benchmark for emissions
- Estimation of the portfolio's positive impact on emissions
- Reporting of results

## Metrics

To calculate financed emissions from ICCREA's residential property mortgages, Cerved follows the Partnership for Carbon Accounting Financials (PCAF) standard. The process includes the estimation of:

**Attribution Factor**

The emissions attribution is determined using the Loan-to-Value (LTV) ratio:

$$AF_t = \frac{\text{Outstanding Amount}_t}{\text{Property Value}_{t0}}$$

This factor updates over time as the mortgage is paid off. The property value is fixed at the original value or the latest available value. If the property value is lower than the outstanding amount this coefficient capped at one.

**Financed Emissions (kg/sq.m per year)**

To calculate financed emissions, Cerved multiplies the attribution factor by the estimated emissions for each property:

$$FE_t = \sum AF_t \times EE_t$$

Where $EE_t$ are the estimated emissions at time t.

**Positive Carbon Impact**

Cerved calculates the positive impact in terms of emission reductions, using:

$$PCI = \left[\left(\sum AF_t \times Benchmark\ Emissions\right) - FE_t\right] \times\ Building\ Surface$$

The formula calculates total savings in CO2, considering the attribution factor and a national benchmark for emissions. Here, benchmark emissions have been estimated as follows: For buildings without EPC data, CO2 emissions are estimated by assigning a benchmark value based on a weighted average of emissions per province and climate zone, where available. Each province has multiple observations, with CO2 emissions and energy class taken into

account to calculate the weighted average. In cases where this provincial data is not available, the national benchmark is used based on the climate zone only. This method ensures a more accurate and localized benchmark for emission estimation.

# Results

After calculating emissions for each building, we compare the performance of the portfolio to the national benchmark and calculate the financial impact. Among the others, key reporting measures include:

- **Avoided Emissions:** This indicates the reduction in CO2 emissions (compared to the benchmark level) and is expressed in tons per year.
- **Positive Carbon Impact per Million Euros Invested:** Measures the positive impact (in tons per year) for every million euros invested in the portfolio.

This simplified methodology ensures clarity and allows us to efficiently estimate the environmental benefits of ICCREA's green building portfolio.

The ICCREA's green building portfolio statistics are presented in the following tables, offering three different perspectives and levels of detail: the grand total, by apartment age, by region.

| Outstanding Amount (mln €) | Positive Carbon Impact (tons) | Positive Carbon Impact per Million Euros Invested (tons/mln€) | Square Meters |
|---|---|---|---|
| 1,594 | 24,913 | 15.63 | 1,330,075 |

| Building Type | Outstanding Amount (mln€) | Positive Carbon Impact (tons) | Square Meters |
|---|---|---|---|
| Eligible - Built before 2021 | 1,231 | 19,252 | 1,035,034 |
| Eligible - Built after 2021 | 363 | 5,661 | 295,041 |
| **Total** | **1,594** | **24,913** | **1,330,075** |

| Region | Outstanding Amount (mln€) | Positive Carbon Impact (tons) | Positive Carbon Impact per Million Euros Invested (tons/mln€) | Square Meters |
|---|---|---|---|---|
| Lazio | 519.34 | 6,662.02 | 12.83 | 340,608 |
| Lombardia | 409.66 | 6,163.96 | 15.05 | 334,758 |
| Veneto | 251.70 | 4,889.33 | 19.42 | 270,465 |
| Emilia-Romagna | 89.32 | 1,623.49 | 18.18 | 73,511 |
| Toscana | 61.46 | 988.60 | 16.09 | 56,343 |
| Friuli-Venezia Giulia | 54.37 | 998.67 | 18.37 | 52,928 |
| Marche | 53.87 | 807.72 | 14.99 | 47,544 |
| Piemonte | 43.21 | 817.21 | 18.91 | 43,421 |
| Abruzzo | 40.56 | 818.06 | 20.17 | 41,280 |
| Puglia | 34.77 | 489.34 | 14.07 | 30,347 |
| Basilicata | 7.63 | 111.82 | 14.65 | 7,522 |
| Umbria | 7.00 | 140.44 | 20.07 | 7,746 |
| Sicilia | 6.97 | 157.82 | 22.65 | 8,304 |
| Campania | 3.86 | 64.42 | 16.69 | 4,220 |
| Liguria | 3.82 | 40.39 | 10.59 | 3,540 |
| Calabria | 2.48 | 60.86 | 24.55 | 3,114 |
| Molise | 2.00 | 49.52 | 24.73 | 2,696 |
| Sardegna | 1.06 | 20.33 | 19.20 | 1,168 |
| Trentino-Alto Adige | 0.72 | 8.59 | 11.93 | 560 |
| **Total** | **1,594** | **24,913** | **15.63** | **1,330,075** |

# References

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