



Fiscal Policies for the Energy Transition of Italian Residential Heritage: Challenges, Risks, and Opportunities

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Abstract

Among all fiscal incentives, the Italian “SuperEcobonus” has been the most polarizing in recent public debate. Several analyses have pointed out its contradictions and criticalities, both as a tool for revitalizing the national economy and as a means of combating climate change. On the one hand, early warnings helped prevent its uncritical application to residential architectures that have long been subject to widespread criticism. On the other hand, in some cases, retrospective evaluations have acknowledged applications that resulted in the alteration or loss of architectural significance. Less explored, however, are the impacts and implications of the ‘ordinary’ Ecobonus, introduced in 2007 and modified several times since, particularly regarding the conservation of residential architecture built during the second half of the 20th century. This paper aims to highlight both the risks and the potential of this incentive—scaled back by the 2025 Budget Law but still in effect—when applied to non-listed residential heritage. The analysis draws from ENEA’s annual reports on the use of tax deductions for energy efficiency upgrades and compares the outcomes of two different energy retrofit projects. In the first case, a multi-family building designed by Giancresce Battaini in Milan (1961–1968), the energy efficiency intervention led to a loss of meaning and alteration of the building, exacerbated by poor preservation and lack of awareness of its architectural value. In contrast, in the second case—a multi-family building designed by Gian Leo Salvotti in Trento (1971–1973)—the energy retrofit was combined with conservation efforts aimed at preserving the prefabricated façade elements forming the building’s second skin. This contribution seeks to provide an informed assessment of the risks tied to the specific nature of this incentive, while also outlining future development paths for a tool that could meaningfully contribute to the decarbonization targets shared within the latest European directive on Energy Performance of Buildings.

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Keywords

Energy retrofit; Fiscal Incentives; Ordinary EcoBonus; Unlisted Residential Heritage; Building Envelope; Architectural Conservation

1. Introduction

The contribution presented here originates from a doctoral thesis, in which the author investigated the effects that fiscal incentives for energy efficiency improvements may have on the conservation of residential heritage built in the second half of the twentieth century with prefabricated elements (Magri, 2025). This heritage is particularly fragile

due to issues related to experimental construction techniques and the materials employed (Mellano, 2019), the difficulties connected with its institutional protection (Dore, 2024), and a highly fragmented form of private ownership (Bassanelli, 2022). This heritage has been placed at particular risk by a recent period, that began in 2020 with Decree Law 34/2020 and ended with the 2025 Budget Law, a law, that is published yearly and that, among other objectives - defines the percentages of tax deduction in different sectors, which was undoubtedly the most generous in terms of fiscal policies for interventions in the construction sector, especially for improving and upgrading existing buildings (Ascione & De Falco, 2024). A period, the one just concluded, that represents the Italian transposition of the objectives and guidelines contained in the European plans of the New European Bauhaus and the programmes connected to it. If in Italy, this fiscal period will certainly be remembered in Italy for introducing a tax incentive that polarized public debate (Aquaro et al., 2023; Corsello & Ercolani, 2024), the “Superbonus 110%,” which not only covered the full cost of energy and/or seismic upgrades for residential buildings but also the financing costs of the operation, it was also marked by a significant strengthening of an already existing fiscal incentive, the so-called “ordinary” Ecobonus (Law No. 296 of 2006). This paper aims to explore the possible impacts that the “ordinary” Ecobonus incentive may have on a segment of the architectural heritage, that of residential buildings, which is largely unprotected and, for the reasons mentioned above, particularly vulnerable to transformation and loss (Tagliacollo & Vittorini, 2023). Two case studies will be analyzed: residential buildings built in the late Sixties, one in Milan and one in Trento, for the middle to middle-high class. These two cases have been chosen because they can be considered comparable under different aspects: on the one hand they were built in a similar moment of economic and demographic growth, addressed to the same target of Italian families of the time, as well as in both cases the same fiscal scheme have been adopted to enhance energy efficiency of the envelope, with different kind of results in relation to conservation. The analysis is based on direct and indirect sources. On the one hand, the original projects have been investigated through documentary and archival sources (Civic Archive of Trento and Milan), the projects of energetic upgrades have been investigated through archival sources (Sportelli Unice per l’edilizia of the municipalities of Trento and Milan), as well as by interviewing the professionals in charge of the projects. Although both cases share certain contextual factors, such as the need to improve the buildings’ thermal performance, the presence (or absence) of an awareness of the cultural and architectural meanings embodied in the two buildings led to different interpretations of the possibilities offered by the fiscal instrument, resulting in outcomes that varied in their degree of respect for the existing qualities and characteristics.

2. The “Ordinary” Ecobonus: An Evolving Incentive

Useful for reconstructing the scope and characteristics of the fiscal incentive examined in this paper, the so-called “Ecobonus”, are the yearly reports published by the National Agency for Energy Efficiency (ENEA, 2023). In 2020, the energy savings achieved through this incentive amounted to 1,362.14 GWh, increasing to 2,652 GWh in 2021 and then decreasing to 2,135.8 GWh in 2022. Considering the period between 2014 and 2022, of the total energy savings obtained through this incentive, 24% derived from insulation of the building envelope, 31% from window replacement, and 33% from upgrades to winter heating systems. In 2022, with the spread of the “Super Ecobonus 110%” fiscal incentive, only 11% of the energy savings achieved through the “ordinary” Ecobonus came from interventions on the building envelope; similarly, the share resulting from window replacement decreased to 23%, while that from upgrades to winter heating systems rose to 59% (ENEA, 2023). It is interesting to compare the percentage distribution of energy savings with that of the investments made: 45% of the investments were directed toward heating system upgrades, 35% toward window replacement, 9% toward building envelope insulation, and 7% toward solar shading. In addition, smaller percentages are associated with other types of interventions: comprehensive energy retrofitting, which in 2022 accounted for 1.81% of the total energy savings achieved; solar panels for domestic hot water (DHW), which contributed 0.97% of the total; and building automation systems, which accounted for 0.32% of the total (ENEA, 2023). The comparison between the investments made, and the corresponding energy savings by type of intervention highlights that the most efficient measures in terms of cost–benefit ratio are those involving building envelope insulation and window replacement (**Table 1**): 9% of the investment for insulation produces 24% of energetic savings. The tendency to suggest predetermined pathways to achieve performance compliance - exacerbated in 2020 by the SuperEcobonus incentive - originated with the “standard” Ecobonus, which promoted the replacement of individual technological components, as well as an approach that improves performance in a

piecemeal way, without considering the overall energy balance, viewing the building as a collection of parts rather than in its full complexity. While the quantitative assessment of the energy savings achieved through this incentive over the years is relatively straightforward (despite the limitations arising from the lack of a full life-cycle analysis of the buildings), the evaluation of its broader impact on the unprotected residential architectural heritage of the late twentieth century is far less immediate. Data from the 2022 reporting year, as presented in the ENEA 2023 annual report and consistent with the trends observed in the 2021 and 2020 reports, show that the type of buildings for which the “ordinary” Ecobonus fiscal incentive was most frequently used are buildings with more than three floors, constructed between 1946 and 1970. The total investment for buildings with more than three floors built during this period amounted to €968.3 million, out of a total of €2,138 million spent on energy efficiency improvements for this building category (buildings with more than three floors). (ENEA, 2023).

Table 1. Agenzia Nazionale per l'Efficienza Energetica, ‘Le detrazioni fiscali per l’efficienza energetica e l’utilizzo delle fonti rinnovabili di energia negli edifici esistenti’, 2023 (data 2022), ENEA, 2023. Chart. 3-4 ‘Ecobonus: costo efficacia per comma (€/kWh), media anni 2014-2022’ graphic elaboration by the Author.

Type of intervention	Lifespan (years)	€/kWh
<i>General riqualification (Comma 344)</i>	30	0,11
<i>Façade isolation (Comma 345a)</i>	30	0,08
<i>Window replacement (Comma 345b)</i>	30	0,12
<i>Sun shading systems (Comma 345c)</i>	10	1,38
<i>Solar panels (Comma 346)</i>	15	0,09
<i>Winter heating (Comma 347)</i>	15	0,16
<i>Building Automation</i>	10	0,35

3. Efficiency without Conservation: The Transformation of a Residential Building in Milan

The story of the design, construction, and commercialization of the residential complex designed between 1961 and 1968 by Milanese architect Giancesare Battaini (1924–2022) offers valuable insight into the economic, social, and cultural dynamics that characterized the residential building sector for the middle class during the years of the Italian economic boom. In a newly developing area north of Milan, the company F.A.R.I.B.A., founded by Roberto Battaini, Giancesare’s brother, purchased in 1961 a plot of land adjacent to the Milan–Rho railway line, on which a building permit had already been issued for the construction of two residential volumes.



Figure 1. Photo of the inner courtyard taken after construction completion
Source. City of Milan, CASVA – Giancesare Battaini Professional Archive.



Figure 2. Photo of the inner courtyard taken after construction completion (City of Milan, CASVA – Giancesare Battaini Professional Archive).

In a newly developing area north of Milan, the company F.A.R.I.B.A., founded by Roberto Battaini, Giancesare's brother, purchased in 1961 a plot of land adjacent to the Milan–Rho railway line, on which a building permit had already been issued for the construction of two residential volumes. With the aim of starting construction quickly, Battaini submitted a proposal for a variant of the approved project, maintaining the same volumetric parameters but modifying the internal layout and facade design. While Battaini retained the existing project's structural and systems design as defined in the approved permits, in his facade modifications, he sought a solution that—despite the limited resources available—embodied the aspirations and values of a middle class that viewed its home as the tangible expression of its socio-economic achievements. On the courtyard-facing sides, the facades of the raised ground floors display dark brown klinker brickwork, transitioning to lighter terracotta tones from the first floor upward (**Figure 1** & **Figure 2**). The balcony fronts, in worked concrete, evolve into gray plastered string courses set against wall sections finished in light terracotta, white, and dark gray plaster. Breaking the symmetry and chromatic continuity of the internal facades, alongside asymmetric iron balcony frames concealing frosted glass partitions, Battaini introduced prefabricated reinforced brick elements painted green, housing the rolling shutters of the window frames. Although Battaini's variant did not radically alter the project previously approved by S.A.G.I.L., it offered a critical reinterpretation of the site's conditions, proposing volumes that, while freely placed in space, respond precisely to the site's spatial and environmental cues. Both buildings are oriented toward the internal courtyard, thereby minimizing exposure to the railway line. This design choice is reflected in the differing morphologies of the facades: on the courtyard sides, French windows open onto continuous balconies, while on the outer and railway-facing elevations, smaller openings and balconies were used.



Figure 3. Photograph of the residential complex as seen from Via Rosa Luxemburg (Laura Magri, 2024).

In an effort to achieve the dual objectives of façade maintenance and improved thermal performance, the residential complex underwent an energy efficiency project between 2019 and 2020, financed through the ordinary Ecobonus tax incentive, which focused on the building envelope. The project, initiated to counter the progressive deterioration of the exterior plaster, involved the installation of a new insulating layer of 14 cm-thick sintered expanded polystyrene panels, extended into the window reveals with a 3 cm-thick polystyrene sheet. In locations where technical feasibility prevented the installation of the polystyrene layer, specifically at the terraces, the project provided for 5–7 cm-thick panels, with the reduction compensated by blowing insulating material into the existing air cavity between the two rows of hollow bricks. The limited awareness of Battaini's design intentions and of the building as a material testimony to the architectural and technical culture that produced it, combined with the desire to address observed degradation, led to the choice of using the new insulation as a base for a new plaster layer, despite the possibility of intervening, for technical reasons, partially implemented at the terraces, within the existing cavity. In Battaini's design, the façades were conceived to respond differently to the distinct conditions of the site: on one side, the inner courtyard with condominium entrances and green areas; on the other, the railway line. The façades facing the courtyard, featuring a continuous balcony welcoming visitors, were intended to open inward, in contrast to the more introverted façades facing outward, designed to mitigate noise from the railway. The original materials and color schemes, the dark klinker and light exposed brick, as well as the prefabricated green brick transom elements characterizing the courtyard façades, and the plastered brick of the exterior façades, were flattened and homogenized in a renovation that alternated sand-colored and taupe plaster indiscriminately across all façades, negating the complexity of Battaini's design and flattening its relationship with the context, which had previously guided material choices in the 1960s project (**Figure 3**). The case of this residential complex highlights several critical issues related to established practices in energy-efficiency interventions. On the one hand, the building, constructed at the moment of the economic boom, has undergone transformations of various scales and types that have partially obscured its inherent values and meanings. The complex belongs to a body of middle-class residential architecture that, according to a high-quality architectural project, responded to functional requirements while seeking durability and aesthetic decorum. The meanings carried by the residential complex, progressively forgotten over time, appear not to have been considered in the energy-efficiency project, which also neglected any conservation-oriented interventions. The transformation of the Baldinucci Street residential complex exemplifies the risk of homogenizing interventions on residential architectural heritage, driven on one hand by regulations governing access to tax incentives and, on the other, by the implications of the residential function, which entails continuous use of the architectural asset and poorly tolerates interventions conducted from within the occupied buildings.

4. Efficiency and Conservation: The Transformation of a Residential Building in Trento

The figure of Giovanni Leo Salvotti de Bindis, born in Trento in 1931, has been the subject of a recent critical rediscovery (De Pilati et al., 2017). Salvotti's work was characterized by constant experimentation, not merely formal. During the 1970s and 1980s, the architect focused on the construction of residential buildings in Trento, a city experiencing rapid demographic and urban growth. At the beginning of his career, Salvotti looked to the architecture of Mies van der Rohe (Franceschini, 2021), as evidenced by the compositional experiments and choices in the residential complexes along Corso III Novembre 1918 (1960–1963) and Via Milano (**Figure 4**). Subsequently, however, Neoplasticism increasingly influenced his work, as demonstrated by the complex at Via Grazioli 7 and the 'Italia 68' condominium on Via Torre Verde (1968), where transparent elements alternate with glass components, lightening the load-bearing structure (**Figure 5**).



Figure 4. Condominium at 116 Via Milano.
Source. Laura Gobber. Landscape Observatory (2023).



Figure 5. Italia 68' condominium (1968).
Source. Laura Gobber. Landscape Observatory (2023).

A further transitional moment in Salvotti's compositional style is exemplified by the condominium "Il Rosso e il Nero," a residential building conceived as a striking sculptural operation, capable of balancing volumetric and coloristic effects. Situated on Corso Buonarroti, the complex was designed by Salvotti between 1971 and 1973 (Odorizzi et al., 2022) in an area urbanized since the late nineteenth century, between the railway line and the Adige River, west of the historic center. Salvotti observed that this location represented "an area of Trento's immediate periphery determined by amorphous buildings, laid out on a neoclassically inspired street grid." He noted that "it was important to introduce a lively and subversive presence that, even if confined to a limited spatial context and

essentially restricted to the general layout, could testify to contemporary culture with all its conflicts and vitality.” (“Brutalismo-cromatismo,” 1979). The building consists of a single rectangular block, developed over seven above-ground floors and a basement used as a garage. Its load-bearing structure is a reinforced concrete frame with brick masonry infill, while the façades are characterized by the use of prefabricated reinforced concrete panels that create a continuous, perforated surface. This residential building marks a new phase in Salvotti’s design research, where, despite employing abstract symbolism, he explores a nearly “surrealist” compositional approach (Salvotti De Bindis, 1987). The search for volumetric and chromatic balance gave rise to a façade based on the theme of a continuous ribbon, in which the dialectics of opposites contribute to an overall sculptural effect. “The building develops the theme of the two-colored continuous ribbon through a series of balconies defining its envelope. This balcony continuity wraps the entire façade zone, descends to the ground to form the entrance and stairwell conduit, and finally extends onto the roof, creating chimneys and technical volumes (“Brutalismo-cromatismo,” 1979). Color plays a central role (**Figure 6**), treated in relation to symbolism evoking the conflict between communism and fascism (Giovinazzi, 2017; Campolongo, 2017). In 2019, the residential building “Il Rosso e il Nero” underwent an energy-efficiency intervention affecting both the building envelope and the existing systems. At the start of the works, the prefabricated panels serving as parapets showed some superficial degradation, and the residential units were connected to a centralized system for winter heating and domestic hot water production. The condominium’s boiler room, located on the ground floor between the two entrances, had undergone an efficiency upgrade in 2006. The hot water system comprised two gas-condensing boilers, a domestic hot water tank with a circulation pump, and a plate heat exchanger. The energy-efficiency project included minor interventions on the systems and substantial interventions on the envelope. The perimeter walls were insulated with an external thermal insulation composite system (ETICS). For the new insulating layer, graphite-enhanced expanded polystyrene (EPS) was used, with a thickness of 16 cm. The insulating layer was finished with a fine-grained, scratched siloxane plaster, colored to match the existing façade. To address the thermal bridge created by the reinforced concrete balcony slabs, a new layer of thermal insulation was applied both on the extrados with graphite-enhanced extruded polystyrene (XPS, 4 cm thick) and on the intrados with graphite-enhanced EPS (12 cm thick). The project also implemented a new control and regulation system with an external climate sensor and a system for neutralizing acidic condensates. The interventions on the envelope and the revamping of the boiler room, funded through the “Ordinary Ecobonus”, enabled an improvement of one energy class (from D to C), as measured by the Energy Performance Certificate before and after the works. In addition to extraordinary maintenance works on the balconies, including the application of a new waterproofing layer and the replacement of the tile flooring, conservation interventions were carried out on the reinforced concrete parapets of the balconies to passivate exposed and corroded reinforcement, repair cracks, and restore detached concrete cover. These conservation works were financed through the “facade bonus (2019)”, which allowed for the preservation of the building’s exterior envelope, specifically the prefabricated parapets, through cleaning and joint pointing, as well as the restoration of deteriorated plaster. In addition, efficiency interventions were carried out on the interior envelope, less visible but treated in a way that reintroduced the chromatic characteristics of Salvotti’s original design (**Figure 7**). In this case, the ordinary Ecobonus instrument became a pretext for a broader intervention, which included applying a new layer of plaster over the insulation as well as conservation work on the prefabricated parapet sections. This was made possible by the combined use of multiple tax incentives, aimed not only at supporting energy upgrades but also at promoting other types of improvements and conservation measures.



Figure 6. “Il Rosso e il Nero” condominium, view of the building from Corso Buonarroti.

Source. <https://www.ufficiostampa.provincia.tn.it/Comunicati/Archivio-del-900-del-Mart.-Concluso-il-riordino-del-Fondo-Gian-Leo-Salvotti-de-Bindis>

**Figure 7.** View of the residential building from Corso Buonarroti after renovation works, in 2022.

5. Conclusions

On the one hand, the summary data presented in ENEA reports (ENEA, 2023) appear to indicate that, at least in 2022, building-envelope insulation was among the most frequently adopted strategies to improve the energy performance of residential buildings through the standard Ecobonus incentive. On the other hand, a growing body of studies and research has *drawn attention to* several critical issues associated with the application of thermal insulation to existing buildings, highlighting aspects that may warrant further consideration. First, the potentially limited environmental sustainability of many commonly used insulating materials—often synthetic and, due to their relatively short service life, destined to be treated and disposed of as special waste (Del Curto, 2022). Second, the possible impacts of new insulating layers on the hygrothermal behavior of masonry, as well as the differences, advantages, and disadvantages of applying insulation on the interior versus the exterior of façades (Lucchi & Pracchi, 2013). While the benefits of this intervention technique are well-documented—particularly in terms of low invasiveness, ease of site management, and control of thermal bridges—there remains a risk that, in residential contexts, external insulation may be favoured primarily to avoid interfering with daily activities and to ensure the effectiveness of the intervention, *potentially regardless* of the architectural significance of the buildings involved. As shown by the Milanese case study, such an approach *may* have a substantial impact on façades, contributing to a certain standardisation of interventions and, in some situations, leading to the removal of existing historical cladding. There is a risk that the increased thickness of the opaque envelope may compromise the relationships between the various elements of the façade, altering its geometry and compositional balance. The change in proportions among constructive elements, such as windows, frames, openings, and others, might lead to a misinterpretation of the material significance of this fragile and unlisted heritage. Residential buildings subject to at least one protection measure under the Italian Cultural Heritage Code (D. Lgs. 42/2004) may benefit from dedicated incentives or exemptions from existing incentives. However, no comparable provisions currently exist for unprotected residential buildings, even though their significance has been recognised in critical literature and in regional and national surveys. In this context, several contextual factors *seem to influence* how the meanings of these architectures are perceived and made explicit. One such factor is the building’s critical reception—expressed through monographs, publications, and scholarly reviews—which can raise awareness among the various stakeholders involved in decision-making, from owners and technicians to condominium administrators. This difference is evident in the two case studies examined in this contribution: in the first case, the Milanese condominium, there are no publications or critical readings of the building, nor of its architect, Giancesare Battaini, whose archive, though deposited at the Center for the Study of Visual Arts, was only recently made publicly accessible (July 2024) and remains largely unknown, despite its significance for the history of industrialized construction in Milan, even to scholars of twentieth-century architecture in the city. In contrast, Gian Leo Salvotti’s building in Trento has been the subject of several critical readings and was included in the regional survey *Atlante di Architettura Trentina 1900–2009*. In relation to this element, the interdisciplinary cooperation among all figures, from engineers to architects to historians, is crucial to the development of a project that is grounded not only in efficiency

but also in intangible values that support building conservation. A second factor influencing energy retrofit decisions is the state of conservation of the building before intervention. In the case of Battaini's condominium, for example, façades and other architectural elements had undergone interventions that altered their legibility, making it more likely that a new insulating layer would be used as a base—and pretext—for a new finishing layer, applied over deteriorated layers. Finally, the legal status of the building is also relevant. While rarely protected under Part II of the Cultural Heritage and Landscape Code (Legislative Decree 42/2004), it may be subject to protection under Part III (landscape protection) or indirectly under Article 45, making the transformation of external elements and characteristics more controllable. Overall, the issue appears twofold: on the one hand, the *potential risks* associated with this incentive, given the nature of the interventions it supports, in relation to the conservation of the existing characteristics of unprotected heritage; on the other hand, how the use of the incentive is shaped by contextual factors that help determine how the meanings of existing architecture are recognised and interpreted.

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