

DELIVERABLE REPORT

WP2 Stakeholders' engagement

D2.8

URBAN GEO-DATASET OF POTENTIAL e-SAFE TARGET

Due date

M48 30.09.2024

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PROJECT DETAILS

PROJECT ACRONYM

e-SAFE

PROJECT TITLE

Energy and Seismic AFFordable rEnovation solutions

GRANT AGREEMENT NO:

893135

FUNDING SCHEME

H2020-EU.3.3.1. - Reducing energy consumption and carbon footprint by smart and sustainable use. LC-SC3-EE-1-2018-2019-2020 - Decarbonisation of the EU building stock: innovative approaches and affordable solutions changing the market for buildings renovation

START DATE

01.10.2020

WORK PACKAGE DETAILS

WORK PACKAGE ID

WP2

WORK PACKAGE TITLE

Stakeholders' engagement

WORK PACKAGE LEADER

Denisa DIACONU (BPIE)

DELIVERABLE DETAILS

DELIVERABLE ID

D2.8

DELIVERABLE TITLE

Urban geo-dataset of potential e-SAFE target

DUE DATE

M48 30.09.2024

ACTUAL SUBMISSION DATE

22.10.2024

LEAD PARTNER

UNICT

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DISSEMINATION LEVEL

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TYPE

- ☒ R - Report
- ☐ DEM - Demonstrator
- ☐ DEC Websites, patents filling, videos, etc.
- ☐ OTHER
- ☐ ETHICS – Ethics requirement
- ☐ OPRP - Open Research Data Pilot
- ☐ DATA – Data sets, microdata, etc.

REPORT DETAILS

ACTUAL SUBMISSION DATE	NUMBER OF PAGES
22.10.2024	25
VERSION	FILE NAME
1.0	e-SAFE_D2.8_Urban geo-dataset of potential e-SAFE_v1.0.docx

DOCUMENT HISTORY

VER.	DATE	DESCRIPTION AND FILE NAME	AUTHOR(S) NAME
0.1	15.09.2024	Creation of the document e-SAFE_Urban geo-dataset of potential e-SAFE target_D2.8_V0.1.docx	Giulia LI DESTRI NICOSIA (UNICT)
0.2	10.10.2024	Update of the document after reviewers' feedback e-SAFE_Urban geo-dataset of potential e-SAFE target_D2.8_V0.2.docx	Giulia LI DESTRI NICOSIA (UNICT)
0.3	22.10.2024	Further review e-SAFE_Urban geo-dataset of potential e-SAFE target_D2.8_V0.3.docx	Gianpiero EVOLA (UNICT)
1.0	22.10.2024	Submitted version e-SAFE_Urban geo-dataset of potential e-SAFE target_D2.8_V1.0.docx	Giuseppe MARGANI (UNICT)

DOCUMENT APPROVAL

VER.	NAME	POSITION IN THE PROJECT	BENEFICIARY	DATE	VISA
1.0	Gianpiero EVOLA	Technical Manager	UNICT	22.10.2024	GE
1.0	Giuseppe MARGANI	Project Coordinator	UNICT	22.10.2024	GM

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EXECUTIVE SUMMARY

This report presents a preliminary urban geo-dataset aimed at identifying buildings suitable for renovation using **e-SAFE** technologies, which are designed to enhance energy efficiency and seismic safety in non-historic buildings with Reinforced Concrete (RC) structures. The **e-SAFE** project combines innovative materials and systems – such as customizable **e-PANELS**, cross-laminated timber panels (**e-CLT**), metal exoskeletons (**e-EXOS**) – and advanced thermal systems (**e-THERM**) to achieve market-ready deep renovation solutions that promote decarbonization and improve indoor comfort.

Stakeholder engagement is pivotal to the **e-SAFE** project, fostering collaboration among local authorities, organizations, and communities to facilitate effective implementation. The urban geo-dataset, developed in Catania, Italy, reflects local stakeholder inputs and aims to raise awareness about the importance of decarbonization and seismic resilience in public housing.

The report details:

1. Stakeholders' Engagement Activities: Engaging local stakeholders through co-productive strategies, focusing on the public housing sector's challenges and opportunities.
2. Building Analysis Protocol: A two-stage assessment identifies buildings that can utilize **e-SAFE** technologies, evaluating structural characteristics and conditions. Approximately 30% of the selected public housing stock (253 out of 838 buildings) was identified as immediately suitable for deep renovation by applying **e-SAFE**.
3. Urban-scale Prioritization: Recognizing that many buildings requiring renovation are in distressed neighborhoods, the report emphasizes the need for integrated urban regeneration strategies that address socio-economic challenges while promoting deep renovations.

The findings highlight a specific subset of 58 buildings (23% of the eligible buildings) that meet key criteria for intervention, providing a roadmap for future renovations and establishing IACP Catania's role in facilitating these efforts. Overall, the report underscores the importance of a collaborative, stakeholder-driven approach to address urban renovation challenges effectively and sustainably.

GLOSSARY OF TERMS

ACRONYM	DESCRIPTION
AB	Advisory Board
CLP	Catania Local Platform
EC	European Commission
IACP	Autonomous Institute for Public Housing
RC	Reinforced Concrete
SUNIA	National Union of Public Housing Tenants
WP	Work Package

1. INTRODUCTION

This report aims to provide a preliminary urban geo-dataset of buildings that can potentially be renovated using the **e-SAFE** technologies. Specifically, the **e-SAFE** project defines and develops a market-ready deep renovation system for non-historic buildings with RC structures, that combines decarbonization goals with earthquake safety, indoor comfort, reduced implementation time and costs, reduced occupants' disturbance, and increased aesthetic and functional attractiveness.

From a technological point of view, the **e-SAFE** system could be implemented through a combination of the elements described below:

- **e-PANEL**: the customizable, prefabricated, multifunctional panels with low environmental impact, made of a timber structure combined with local insulating biomaterials and the desired finishing to be added to the outer wall.
- **e-CLT**: the cross-laminated timber (CLT) panel, connected to the existing reinforced concrete (RC) frame via seismic energy dissipation devices (dampers) to be add to the outer wall.
- **e-EXOS**: the metal exoskeleton, made of bidimensional bracings equipped with seismic dampers and connected to the existing RC frame.
- **e-THERM**: the centralized thermal systems with high-efficiency and low-GWP heat pumps fed by PV modules, where storage tanks and suitable control logics will help maximising self-consumption rate.
- **e-TANK**: the innovative thin and easily integrable decentralized hot water tanks that include a plug-and-play hydraulic unit.

Moreover, the **e-SAFE** technologies are accompanied by stakeholder engagement strategies, methods, and tools to involve relevant stakeholders at both the building and urban scales. As a result, the **e-SAFE** project includes the development of guidelines to support this effort, including:

- **The e-SAFE Co-design Protocol** (see D2.10 - Final **e-SAFE** Co-design Protocol [1]) which provides guidance for the effective implementation of the renovation process. This protocol ensures that the needs, priorities, and preferences of all stakeholders at the building scale – such as end-users, designers, and other professionals – are considered as they collaborate to select the optimal design solution for each specific building.
- **The e-SAFE Engagement Protocol** (see D2.9 - Final **e-SAFE** Engagement Protocol [2]), which aims to offer guidelines for engaging stakeholders at the urban scale, such as local authorities, organizations, businesses, and other social groups with a direct/indirect interest in promoting deep renovation at the local level.

The urban geo-dataset presented in this report is the result of stakeholder engagement, dissemination, and communication activities conducted as part of the **e-SAFE** Project (Task 2.8) in the city of Catania (Sicily, Italy), where the technology has been tested in a building owned by the local Public Housing Authority, IACP Catania, which is also a partner of the **e-SAFE** project.

The purpose of these activities was twofold: firstly, to raise local awareness about decarbonization and seismic preparedness in the building sector; and secondly, to generate interest in the **e-SAFE** system as a set of effective technologies and guidelines to scale up energy-efficient and anti-seismic deep renovation throughout the city.

Taking into account both the technological aspects of the **e-SAFE** system, as well as the social, cultural, and economic factors emerging from stakeholder engagement activities in Catania, this document is structured as follow:

- **Section 2** will briefly present the stakeholder engagement activities carried out in Catania, showing what questions and decisions have emerged during the process. This context-based

overview underlines the preliminary criteria identified by local stakeholders for the construction of the geo-dataset presented in this document.

- **Section 3** will present the protocol developed and used to identify, on a preliminary basis, the buildings that could potentially be renovated using the **e-SAFE** technologies. The protocol takes into account construction characteristics of the buildings (e.g., structural system, number of floors etc.), their state of conservation, and the ownership status.
- **Section 4** will present the criteria identified for the urban-scale analysis that will be carry out to identify one or two priority areas of intervention in the city of Catania, and to incorporate the urban dimension when addressing seismic and energy renovation issues.

2. CO-PRODUCTION OF THE e-SAFE GEO-DATASET

2.1 Urban engagement with local stakeholders

This section focuses on the work carried out by the e-SAFE team with the e-SAFE Local Platform in Catania (CLP). The CLP is a group of local stakeholders (such as representatives of local authorities, organizations, businesses, etc.) who are “*actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or project completion*” (Project Management Institute 2000 [3]).

As the literature corroborates (Aapaoja et al, 2013 [4]; Aapaoja et al, 2014 [5]; Bal et al., 2013 [6]; Boess et al, 2016 [7]; Fernandez et al, 2020 [8]; Guerra-Santin et al, 2017 [9]), to create construction and renovation practices that effectively contribute to sustainable development and decarbonization, cross-disciplinary work with several stakeholders is required. Therefore, stakeholder engagement in e-SAFE strives to involve and stimulate local actors to take action in the particular field of energy and seismic deep renovations.

Within the framework of the debate about the importance of engaging stakeholders in the effort of decarbonizing the existing building stock, the e-SAFE project has selected one specific engagement paradigm: the co-production paradigm. This paradigm implies that participants:

1. share inputs and ideas with each other,
2. partake in responsibility for outcomes, and
3. take an active role in the implementation process.

This means that actors are responsible for implementing a portion of the outcomes of the decision-making process in collaboration with other stakeholders (Albrecht 2013 [10]).

The specific characteristics of the co-production paradigm are especially relevant for understanding the criteria behind the development of the geo-dataset presented in this document, specifically designed to identify buildings that could potentially become e-SAFE clients after the project’s conclusion. In fact, the e-SAFE team aimed not only to create a dataset shaped by the contributions of various local stakeholders, who shared their visions, knowledge, desires, and responsibilities in the decision-making process, but also to enable some of them to take responsibility for the future implementation of renovation projects, as in the case of IACP Catania.

2.2 Let’s look at public housing

The establishment of the CLP entailed a two-phase process:

- **Step 1 – Set up and public launch.** During this phase, local stakeholders were identified and their interests were mapped employing semi-structured interviews. Moreover, interviews were conducted and analysed in order to identify local issues, obstacles, and opportunities related to deep renovation, as well as working directions to be used during the CLP kick-off meeting. The latter was the first co-productive public event (held in July 2021) that resulted in the development of a preliminary co-productive strategy to both spur awareness about energy-seismic renovation, and boost the retrofitting market with a specific (but not exclusive) focus on the e-SAFE technology.
- **Step 2 – CLP in action.** During this phase, CLP members agreed to pursue some of the specific actions indicated in the co-productive strategy. Specifically, it was decided to proceed with the identification of priority areas for deep renovation interventions in the city of Catania. To this end, a working group was set up. Following the recommendations outlined in the strategy shared by

CLP members during the kick-off, the working group focused specifically on public residential buildings.

The group was composed by UNICT e-SAFE researchers, IACP Director, representatives from the Department of Urban Policies and Structural Funds of the City of Catania, the regional secretary of SUNIA (National Union of Public Housing Tenants), the secretary-general of the Sicilian Cooperative League, the president of “Trame di Quartiere” community-based cooperative, running a social housing project after renovating a historic building in one of the most challenging neighborhood of the city.

The focus on public housing was informed by the evidence that local public authorities face significant challenges when it comes to energy efficiency and seismic preparedness of the public residential building stock. In particular, there are challenges related to the context, like high property fragmentation and housing informality conflicting with administrative procedures. Moreover, these criticalities are particularly evident when considering that the public housing stock in Catania is mainly concentrated in distressed neighborhoods.

As a first step, the working group expressed the need to be aware of both the exact location and quantification of public housing in the city, and the status of the property with a focus on property fragmentation. To do this, UNICT researchers engaged a group of five engineering students as interns, whose work was supported by data provided by IACP Catania.

The analysis consisted of two phases.

1) Study area identification. Archival research was used to generate a geo-dataset of all public housing areas in the city of Catania (see Fig. 1). The analysis showed two different patterns of public housing districts:

- There is a great variety of detached public housing buildings or small complexes (**Pattern 1**), mostly built during the early post-World War II period, whose extension ranges from less than one hectare up to 3 to 4 hectares. Buildings and complexes are located in various areas of the city, both downtown and suburban.
- Moreover, there are 10 detailed plans in which public housing complexes are part of a planned urban fabric (**Pattern 2**). In this case, the public housing stock covers almost 560 hectares (a little more than 8% of the urbanised area of the municipality of Catania). In these areas, implementation procedures have involved various actors, including the Catania City Council for the construction of buildings to be dedicated to the management of the housing emergency, building cooperatives, building contractors in the subsidized housing sector and, above all, IACP Catania.

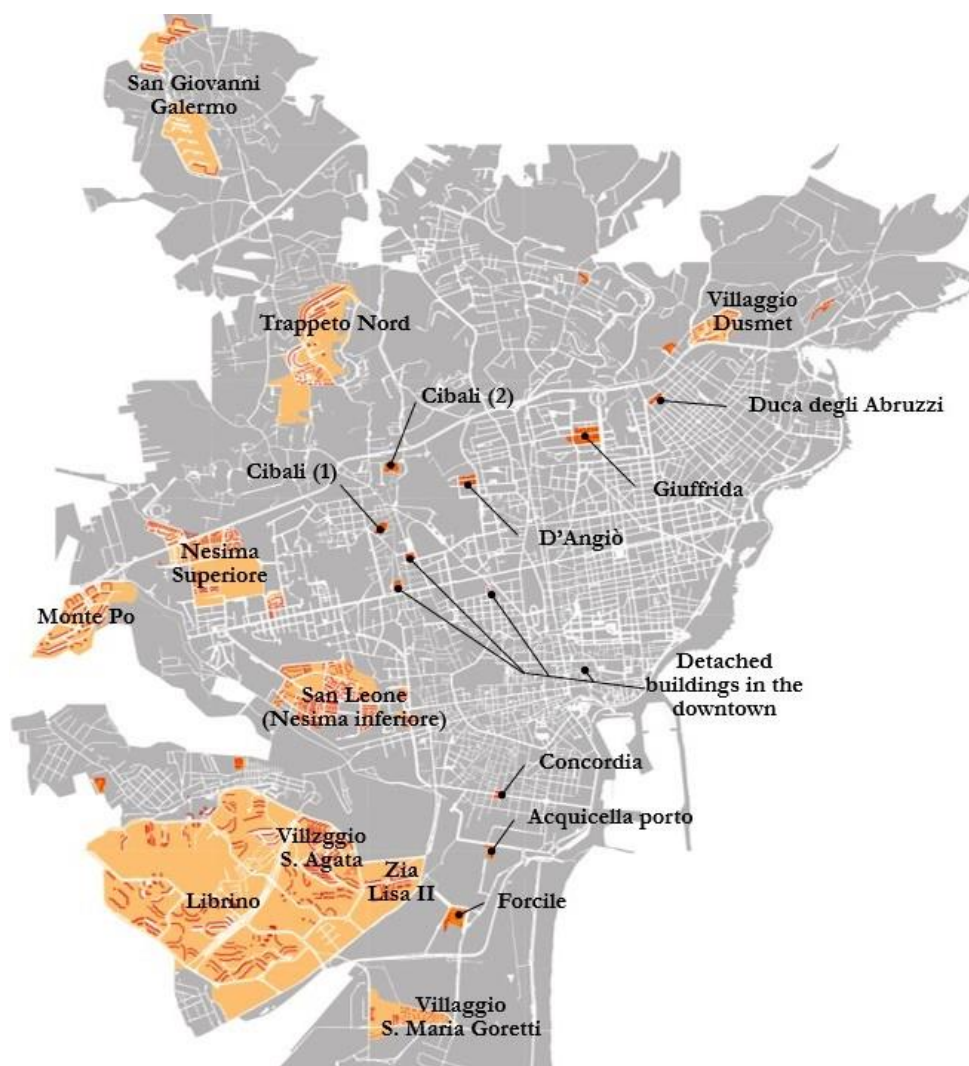


Figure 1. The location of public housing areas in the city of Catania. In addition to small complexes and individual buildings, it is possible to locate ten large public housing complexes: (from the top) San Giovanni Galermo, Trappeto Nord, Villaggio Dusmet, Nesima Superiore, Monte Po, San Leone, Villaggio Sant'Agata, Librino, Zia Lisa, and Villaggio Santa Maria Goretti.

2) Analysis of property ownership. This step consisted of further analysis of property fragmentation in the public housing stock (see Fig. 2). This research was needed since, in the Italian context, tenants can buy at an off-market price the flat where they live. This implies that, within the same building, some flats may stay public while others may become private. This factor leads to a combination of high property fragmentation and low-income property ownership, making deep renovation very challenging.

Moreover, besides the obvious fact that a large number of flat owners makes collective decision-making more difficult, most of them are low-income and, therefore, less inclined to invest. Property fragmentation involving owners with very different 'spending capacities' – which is the case of buildings involving both public and private ownership – is also at the origin of increasing imbalances inside the same building. Further challenges come from the recurrent phenomena of illegal building modifications – made by both flat owners and long-term tenants – which are legal barriers to the paperwork needed to get formal approvals for renovation.

In this perspective, the analysis of property fragmentation has been developed based on the following typology:

1. Public property is **equal to or higher than 50%** of the real estate value. From an exploitation perspective, this is the ideal scenario for deep renovation, since it is easier to intervene with public funds. According to national regulations on condominiums, decisions on proceeding with the deep renovation can be made by the 'condominium assembly' through a vote where enough participants express their agreement in the representation of the majority of building values as well as the number of owners.
2. Public property is **less than 50% but more than or equal to 30%**. This is not an ideal scenario, but recent Italian regulations on fiscal incentives for deep renovations allow a condominium to reach a decision even if only owners representing 30% of the building values agree.
3. Public property is **less than 30%**. This is the worst scenario, where public actors have the least ability to push for deep renovation.
4. **No presence** of public properties (these include buildings where all properties have been acquired through a rent-to-own contract).

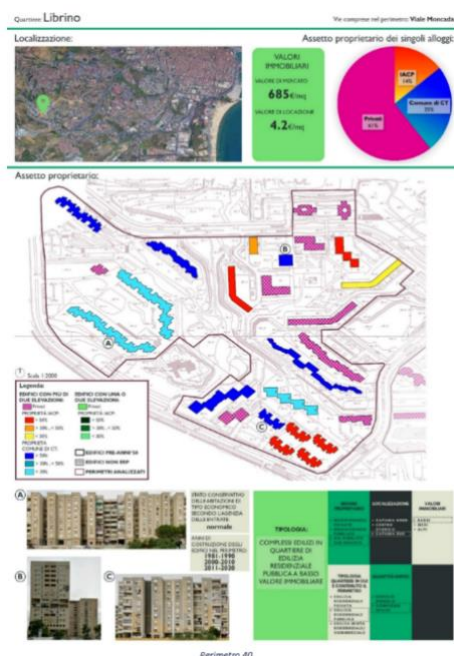


Figure 2. An example of the property fragmentation analysis in Librino, one of the Catania public housing neighborhoods.

Looking at the public housing areas in Catania, it is possible to point out that:

- **Pattern 1** patrimony is largely privatised; IACP Catania, with only a couple of exceptions (e.g., Cibali 1 and Acquicella Porto), owns little more than 1% of the housing units.
- As for **Pattern 2**, IACP Catania is still an important real estate actor: except in a couple of cases, the local public housing provider is the owner of 20-30% of the units, a percentage that rises to 60-70% in the northern part of the city (see Table 1).

Based on the property fragmentation typology mentioned above, within the public housing areas listed in Table 1, it was possible to identify individual buildings where IACP ownership was more than or equal to 30%. However, it was necessary to complement this information with an analysis of the applicability of the e-SAFE system at the building scale.

Table 1. Public housing areas where IACP ownership is 20% or more

Location	Hectare	Property units owned by IACP out of the total
Villaggio S. Maria Goretti	15,3	96/350 (27%)
Villaggio Dusmet	9	56/284 (20%)
Acquicella Porto	1	39/110 (35.5%)
Monte Po'	30	373/1316 (28%)
Cibali 1	1	52/140 (37%)
Librino	280	1745/9277 (20%)
Zia Lisa	25	263/978 (27%)
Trappeto Nord	48	833/1163 (72%)
S. Giovanni Galermo	26	365/615 (59%)

3. PRELIMINARY ANALYSIS OF e-SAFE APPLICATION AT THE BUILDING SCALE

After identifying and quantifying the public housing stock in the city, UNICT researchers undertook the development of a building analysis protocol to classify buildings based on their suitability for the e-SAFE technologies.

The protocol was developed by designing a two-stage assessment:

1. At first, exclusionary criteria were identified, i.e., criteria that assess the building as either suitable or unsuitable for the application of the e-SAFE system according to the current technological advancement (see Table 2).

Table 2. The table shows the criteria that make a building either suitable or unsuitable for e-SAFE application

e-SAFE APPLICABILITY CRITERIA	APPLICABILITY
Structural system	
Reinforced Concrete Frame	Yes
Other (e.g., Unreinforced Masonry, Reinforced Masonry, Steel Frame, etc.)	No
Type of building	
Detached Building	Yes
Linked Building (1 blind front)	Yes (to be confirmed according to the specific case)
Linked Building (2 or more blind fronts)	No
N° of floors above ground	
≤ 6	Yes
> 6	No
Presence of a free offset area around the building	
≤ 3 meters	No
> 3 meters	Yes
Presence of constraints related to the change of the exterior (e.g. listed building)	
Yes	No
No	Yes

2. As a second step, once the suitability for the use of the e-SAFE system was established, preliminary criteria were identified to evaluate the application of the specific technology, e.g., e-CLT and/or e-EXOS for seismic preparedness (see Table 3). Both technologies can be combined with e-PANEL, which ensures energy efficiency.

Table 3. The table shows the criteria to assess the application of e-CLT and/or e-EXOS

e-CLT / e-EXOS APPLICABILITY CRITERIA	APPLICABILITY
Window to wall ratio	
≤ 60 %	e-CLT and e-EXOS
> 60 %	e-EXOS
Presence of large openings at ground floor (e.g., garages, shop windows)	
Yes	e-EXOS
No	e-CTL and e-EXOS
Presence of pilotis at ground floor:	
Yes	e-EXOS
No	e-CLT and e-EXOS
Presence of a common open area, measuring at least 8 m x 3 m, that can be used to hold the technical systems	
Yes	e-EXOS and e-CLT
No	e-CLT

By implementing the protocol through physical and virtual surveys using GIS (Geographic Information System) software program, it was possible to identify three types of buildings:

1. Buildings whose structural, functional, and aesthetic characteristics make them **immediately retrofittable with the current e-SAFE technology**. Isolated buildings are ideal, with a reinforced concrete framed structure, with six (or less than six) stories, located in a site where there is enough space to move the machinery required by the technology, and without constraints related to the change of exterior appearance.
2. Buildings that are not and **never will be suitable for the e-SAFE system**, like buildings that do not have a reinforced concrete structure and/or buildings whose exterior appearance cannot be modified (like historic or modern buildings with specific aesthetic qualities) or do not have enough space around the building for operating the machinery needed by the technologies.
3. Buildings whose structural, functional, and aesthetic characteristics make them **suitable to the e-SAFE system, but only after further advancement of the technological knowledge**. These are reinforced concrete buildings that can have up to 2 blind fronts and more than 6 stories, but still do not have constraints related to the change of exterior appearance and have enough space around the building for operating the machinery needed by the technologies.

Building-scale analyses revealed that, based on construction characteristics, approximately **30% of the current public housing stock** (253 buildings out of 838) is immediately suitable for retrofitting using the current e-SAFE technology. The figures below illustrate this, with unsuitable buildings marked in red and suitable buildings marked in green.



Acquicella porto



Cibali 1



Cibali 2



Concordia



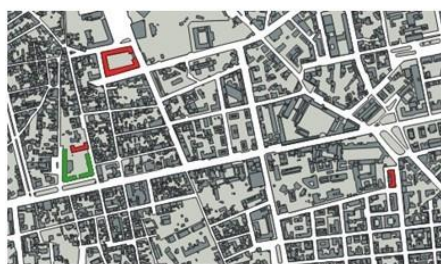
D'Angiò (left) and Giuffrida (right)



Duca degli Abruzzi



Villaggio Dusmet



Detached buildings



Forcile



Librino - Villaggio S. Agata - Zia Lisa



Villaggio S. Maria Goretti



Monte Po



Nesima Superiore



S. Giovanni Galermo



Trappeto



San Leone

Together with the parameters related to 'e-SAFE suitability', the survey protocol at the building scale included data aimed at estimating the state of conservation of buildings, based on the following parameters: status of the finishes (3 classes: good conditions; slight degradation of the surface

layer-plaster; significant degradation of the surface layer-plaster to the extent that iron is visible); presence (or not) of structural issues; evidence of persistent mold rising up from the ground.

Combined with data on proprietary fragmentation, the analysis allowed the identification of priority buildings, where 1) **high suitability** is combined with 2) **bad building conditions** as well as 3) an **ownership status** that potentially makes it easier to intervene (IACP Catania property more than or equal to 30%).

The figures below show the location of **58 buildings** (equal to 23% of the 30% of eligible buildings, and 7% of all buildings in public housing areas) that meet these three criteria marked in yellow grid. Among these buildings, the Acquicella Porto building serves as the real-pilot for the e-SAFE project.



Acquicella porto



Cibali 1



Villaggio Dusmet



S. Giovanni Galermo



Trappeto



Zia Lisa



Librino

4. DEEP RENOVATION: URBAN SCALE PERSPECTIVE

Urban planners regularly confront the reality that many buildings requiring deep renovation are situated in distressed neighborhoods (Paris & Bianchi, 2016 [11]; Monteiro et al., 2017 [12]), characterized by elevated levels of socio-economic hardship and physical deterioration. These encompass aging low-income and public housing areas as well as declining middle-class neighborhoods (Haase et al 2016 [13]). In such areas, renovation initiatives, particularly deep renovation, face significant challenges. For instance, low-income property owners may lack the economic means to undertake retrofitting endeavors, while absentee landlords may lack the motivation (Norgaard, 2009 [14]; Olazabal and Pascual, 2015 [15]). Furthermore, retrofitting efforts, when undertaken, might yield adverse outcomes for residents, and success does not inherently guarantee benefits for them. Increased indebtedness among low-income groups, rental increases, and gentrification (Baeten et. al, 2017 [16]; Bouzarovski et al., 2018 [17]; Grossmanm 2019 [18]; del Pulgar, 2021 [19]; Sander and Weissmermel, 2023 [20]), are crucial challenges in these contexts, even when it comes to regeneration projects involving public housing (Goetz 2003 [21]), especially when ownership fragmentation reaches such high levels as in the case of Catania.

Moreover, distressed neighborhoods are characterized by real estate values that belong to the lowest category within the local real estate value spectrum. This calls for increased public investment at the neighborhood level through multi-actor coalitions from various sectors (e.g., construction, social services). These coalitions would focus on renovating individual buildings as part of a broader urban regeneration strategy through an integrated approach, e.g., a cross-functional and multi-objective process to face deep renovation issues while addressing other challenges such as environmental risks, social inequalities, as well as both territorial governance and decision-making topics.

This approach is leading the CLP working group to consider not only the technical aspects concerning buildings but also the identification of shared values and criteria for analyzing and assessing the urban context. In line with the principles of the integrated approach mentioned above, the guiding goal of the working group is to identify priority areas of intervention that make it easier to maximize benefits at the urban scale, such as increasing the real estate value of a neighborhood while also considering mechanisms to prevent the displacement of current residents. Maximizing benefits is crucial not only to prevent potential adverse effects, whether directly or indirectly caused by deep renovation interventions, but also, and more importantly, to enhance the likelihood of wider adoption of such interventions.

With this goal in mind, the group is actively working to identify principles and indicators to both guide the urban-scale analysis and select **one or two priority areas for intervention** among those where the 58 buildings are located (Cibali 1, San Giovanni Galermo, Villaggio Dusmet, Trappeto, Zia Lisa, Librino). Table 4 and Table 5 show the principles and indicators identified so far.

Moving forward, the objective of the CLP working group will be to conduct urban analyses on the six identified areas based on the reported indicators. This will aim to define priorities for action and outline a preliminary action plan.

Table 4. The principles that the CLP working group identified for the pursuit of an integrated approach to deep renovation interventions

PRINCIPLES
Contribute to climate change mitigation by converting the building stock into energy-efficient structures, while ensuring interspecies solidarity and synergy between people and ecological cycles.
Enhance adaptation to climate change by increasing resilience to events such as earthquakes, heavy rain, flooding, droughts, fires, and heat waves.
Uphold the principles of evolutionary resilience by involving inhabitants in the intervention, ensuring they understand and share the goals, and equipping them with the knowledge to respond constructively to environmental risks (e.g., in the event of flooding, heat waves, or earthquakes).
Every intervention must define and achieve specific, context-dependent objectives . These should not only aim to meet urban planning standards (as required by Italian law), but also focus on improving the quality of both people's lives and the built environment, based on shared values.
Prioritize the use value of housing over its exchange value , counteracting negative effects (e.g., the displacement of residents) that may arise from improvements in the housing market. Interventions must also include actions to help disadvantaged groups (from an economic, social, health etc. point of view) improve their quality of life.
Promote social cohesion at the urban scale, treating public housing neighbourhoods as integral parts of the urban context rather than areas of isolation or ghettoization.
Ensure a rational connection between the use of economic (and non-economic) resources and the pursuit of the public interest , with a clear link between expenditure and the achievement of the objectives outlined above. Private interests should be involved only when a clear increase in public benefit is identified, based on the previously established principles.

Table 5. The indicators that the CLP working group identified to operationalise the principles in Table 4.

INDICATORS	
Real estate values	Analysis of real estate values, number of transactions, and quality of the housing offer (both for rent and for sale) in the area, in order to assess the 'health' of the local housing market in comparison to the rest of the city.
Socio-economic distress	Analysis of the demographic profile of residents, focusing on key factors such as the number of inhabitants, the old-age index, employment rate, and levels of educational attainment. These are crucial for determining whether the area's services and facilities adequately meet the population's needs based on their demographic profile (e.g., availability of crèches and other age-appropriate services).
Housing crowding index	Preliminary analysis of housing distress by calculating the number of occupants per dwelling and the size of each dwelling. According to urban planning standards, the ideal is to allocate 100 cubic meters (about 30 square meters) of residential space per individual.
Urban standards	Analysis (quantitative and qualitative) of areas dedicated to public services and facilities in the neighbourhood. According to the Italian law (DM 1444/68), it must be ensured a minimum provision of facilities and public services that support the well-being and quality of life of residents, such as schools, hospitals, parks, green spaces, sports facilities, and mobility services. These standards are calculated based on the resident population and the specific needs of the area, taking into account different age groups and social categories.
Grassroots and civil society	Quantitative and qualitative analysis of the presence of 'self-organised' urban regeneration practices and social innovation activities with spatial impact promoted and supported by civil society organisations.
Environment	Environmental analyses by considering factors such as water supply, the percentage of permeable soil, air quality, cleanliness and upkeep of open spaces, waste management, and access to fresh food at reasonable prices.
Infrastructure and connectivity	Analysis of the neighbourhood's location concerning its proximity to public services, natural beauty and landscapes (sea, hills, countryside, etc.), and the quality of mobility and public transport.

5. CONCLUSIONS

Based on the analyses conducted in collaboration with CLP members to co-produce a geo-dataset of buildings that may potentially become e-SAFE clients after the project's conclusion, the following inferences can be made:

- of the entire public housing stock owned by IACP Catania, 30% of the buildings (totalling 253) possess structural characteristics that, according to preliminary analysis, make them suitable for the application of e-SAFE technologies;
- within this 30%, 23% of the buildings (totalling 58) exhibit favorable ownership conditions (with IACP ownership at or above 30%) that suggest interventions can be implemented with relative immediacy as far as the decision-making process is concerned;
- however, the data gathered thus far must be further analyzed within a framework that considers the urban dimension of the specific areas where buildings are located; this perspective is essential not only for designing and implementing deep renovation interventions into an integrated approach to urban regeneration but also for facilitating and enhancing opportunities for exploitation.

It is important to note that the analyses conducted thus far, particularly those at the building scale, are preliminary and warrant further investigation from a structural perspective.

ACKNOWLEDGEMENTS

This deliverable was carried out in the framework of the *Energy and seismic affordable renovation solutions (e-SAFE)* project, which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 893135. We would like to show our gratitude to the stakeholders of CLP who engage in the activities of the project in an active manner.

Internal References

- [1] e-SAFE Deliverable D2.10 "Final e-SAFE Co-design Protocol", *forthcoming*
- [2] e-SAFE Deliverable D2.9 "Final e-SAFE Engagement Protocol"

External References

- [3] Project Management Institute, P. 2000. *A Guide to the Project Management Body of Knowledge. American Journal of Clinical Pathology*. 2000th ed. Vol. 69. Project Management Institute Inc. <https://doi.org/10.1093/ajcp/69.5.475>
- [4] Aapaoja, Aki, Harri Haapasalo, and Pia Söderström. 2013. "Early Stakeholder Involvement in the Project Definition Phase: Case Renovation." *ISRN Industrial Engineering* 2013: 1–14. <https://doi.org/10.1155/2013/953915>
- [5] Aapaoja, Aki, and Harri Haapasalo. 2014. "A Framework for Stakeholder Identification and Classification in Construction Projects." *Open Journal of Business and Management* 02 (01): 43–55. <https://doi.org/10.4236/ojbm.2014.21007>
- [6] Bal, Menoka, David Bryde, Damian Fearon, and Edward Ochieng. 2013. "Stakeholder Engagement: Achieving Sustainability in the Construction Sector." *Sustainability (Switzerland)* 5 (2): 695–710. <https://doi.org/10.3390/su5020695>
- [7] Boess, Stella, Olivia Guerra Santin, Sacha Silverster, Peter Budde, and Hannah Frederiks. 2016. *Comparing Sustainable Renovation Processes on Tenant Participation to Foster Urban Area Transitions. Sustainable Built Environment: Transition to Zero* 2016. <https://www.smartsustainablecities.nl/publicaties/1222887.aspx>
- [8] Fernandez, T, C Diaz, ... S Stöffler - URBAN CHANGE—Livable City Regions for, and undefined 2020. 2020. "Smart Cities for Smarter Citizens: Participatory Planning in Housing Renovation Using 3D BIM Tools: The Case of Eckart Vaartbroek." *Corp.At* 8 (September): 15–18. https://www.corp.at/archive/CORP2020_77.pdf
- [9] Guerra-Santin, O., S. Boess, T. Konstantinou, N. Romero Herrera, T. Klein, and S. Silvester. 2017. "Designing for Residents: Building Monitoring and Co-Creation in Social Housing Renovation in the Netherlands." *Energy Research and Social Science* 32: 164–79. <https://doi.org/10.1016/j.erss.2017.03.009>
- [10] Albrecht, Louis. 2013. "Reframing Strategic Spatial Planning by Using a Coproduction Perspective." *Planning Theory* 12 (1): 46–63. <https://doi.org/10.1177/1473095212452722>
- [11] Paris S., Bianchi R. (2016). The architectural and environmental retrofitting of public social housing as a resource for contemporary cities. The redesign of building envelopes. In 41st IAHS WORLD CONGRESS. Sustainability and Innovation for the Future (Vol. 1, pp. 2-9)
- [12] Monteiro C. S., Causone F., Cunha S., Pina A., Erba S. (2017). Addressing the challenges of public housing retrofits. *Energy Procedia*, 134, 442-451
- [13] Haase A., Bernt M., Großmann K., Mykhnenko V., Rink D. (2016). Varieties of shrinkage in European cities. *European Urban and Regional Studies*, 23(1), 86-102
- [14] Norgaard K. (2009), Cognitive and Behavioral Challenges in Responding to Climate Change, World Bank Policy Research Working Paper No. 4940, Available at SSRN: <https://ssrn.com/abstract=1407958>
- [15] Olazabal M., Pascual U. (2015), Urban low-carbon transitions: cognitive barriers and opportunities, *Journal of Cleaner Production* 109, 336-346
- [16] Baeten G., Westin S., Pull E., Molina I. (2017) Pressure and violence: Housing renovation and displacement in Sweden. *Environment and Planning A* 49/3, 631-651
- [17] Bouzarovski S., Frankowski J., Tirado-Herrero S. (2018): Low-Carbon Gentrification: When Climate Change Encounters Residential Displacement, *International Journal of Urban and*

Regional Research 42, 845-863

- [18] Grossmann K. (2019), Energy efficiency for whom? A conceptual view on retrofitting, residential segregation and the housing market, *Sociologia Urbana e Rurale*, Issue 119, 78 – 95
- [19] del Pulgar C. (2021) Prioritizing Green And Social Goals: The progressive Vienna model in jeopardy, in Anguelovski I., Connolly J., *The Green City and Social Injustice: 21 Tales from North America and Europe*, Routledge, London
- [20] Sander H., Weißermel S. (2023) Urban Heat Transition in Berlin: Corporate Strategies, Political Conflicts, and Just Solutions, *Urban Planning* 8(1), 361–371
- [21] Goetz E. G. (2003). *Clearing the way: Deconcentrating the poor in urban America*. The Urban Institute.