

DELIVERABLE REPORT

WP2 Stakeholders' engagement

D2.9

FINAL e-SAFE ENGAGEMENT PROTOCOL

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EXECUTIVE SUMMARY

Besides technical innovations for energy efficiency and seismic resilience, **e-SAFE** aims to test process innovations regarding stakeholder engagement. In **e-SAFE**, stakeholder engagement takes place at three levels:

1. **Building scale** – co-design activities with residents of the three pilot buildings
2. **Urban scale** – engagement with stakeholders at the city level where pilots are located
3. **European scale** – EU stakeholder Forum and the Advisory Board

Deliverable D2.9 “Final e-SAFE Engagement Protocol” focuses on the **urban scale**, and it belongs to the *Task 2.8 - Urban engagement with local platforms*, being developed based on the previous Deliverable D2.3 “Preliminary e-SAFE Engagement Protocol”.

At the EU scale, the EU stakeholder Forum has been set up, comprising so far 181 members and the Advisory Board with experts. The EU stakeholders are informed about the progress of the project, and the experts provide regular feedback. The EU stakeholder Forum and other EU stakeholders are engaged in providing inputs and feedback regarding EU and national policies, incentives and business models through online surveys, webinars, clustering events, workshops, and other project activities.

The protocol aims to provide guidelines for stakeholders’ engagement at the urban scale, using the lessons learned during the implementation of the pilot projects in Catania, Timisoara and Bucharest and engaging with the Local Platforms created. This final version of the stakeholder engagement protocol has the goal to scale up energy and seismic renovation of buildings, using the **e-SAFE** system, by engaging with local stakeholders in cities located in seismic-prone areas across Europe.

Deliverable D2.9 is based both on a theoretical part (literature review) and an applied part (activities carried out with the local platforms in Catania, Timisoara and Bucharest). The literature review provided an array of possible stakeholders’ engagement methods, which were presented to the stakeholders of Catania Local Platform (CLP) during the Workshop in October 2021 and later to the local platforms in Timisoara and Bucharest.

The elaboration of these guidelines represented an iterative process, first based on the theoretical part, then on the lessons learnt from CLP, and finally, informed by lessons learnt from the upcoming two Local Platforms in Timisoara and Bucharest.

GLOSSARY OF TERMS

ACRONYM	DESCRIPTION
AB	Advisory Board
CA	Consortium Agreement
CLP	Catania Local Platform
EC	European Commission
NGO	Non-Governmental Organization
PC	Project Coordinator
PR	Periodic Report
TM	Technical Manager
UNICT	University of Catania
WP	Work Package
WPL	Work Package Leader

1. INTRODUCTION

While there is a general agreement that stakeholder engagement in the construction and renovation sector is essential for the successful completion of projects, whom it should engage and how it should be carried out is still at the centre of the debate. Stakeholder engagement is important for **e-SAFE** in aspects related to testing, adjusting and validating the technology, besides being crucial for generating interest and scaling up the implementation of the system on the renovation market. The goals of stakeholder engagement within **e-SAFE** project are two-fold:

- To support the research activities during the project with the aim to enhance the quality of the project outcomes and enlarge the audience that is reached;
- To support the development of engagement protocols that will accompany the **e-SAFE** technology in its after-project life.

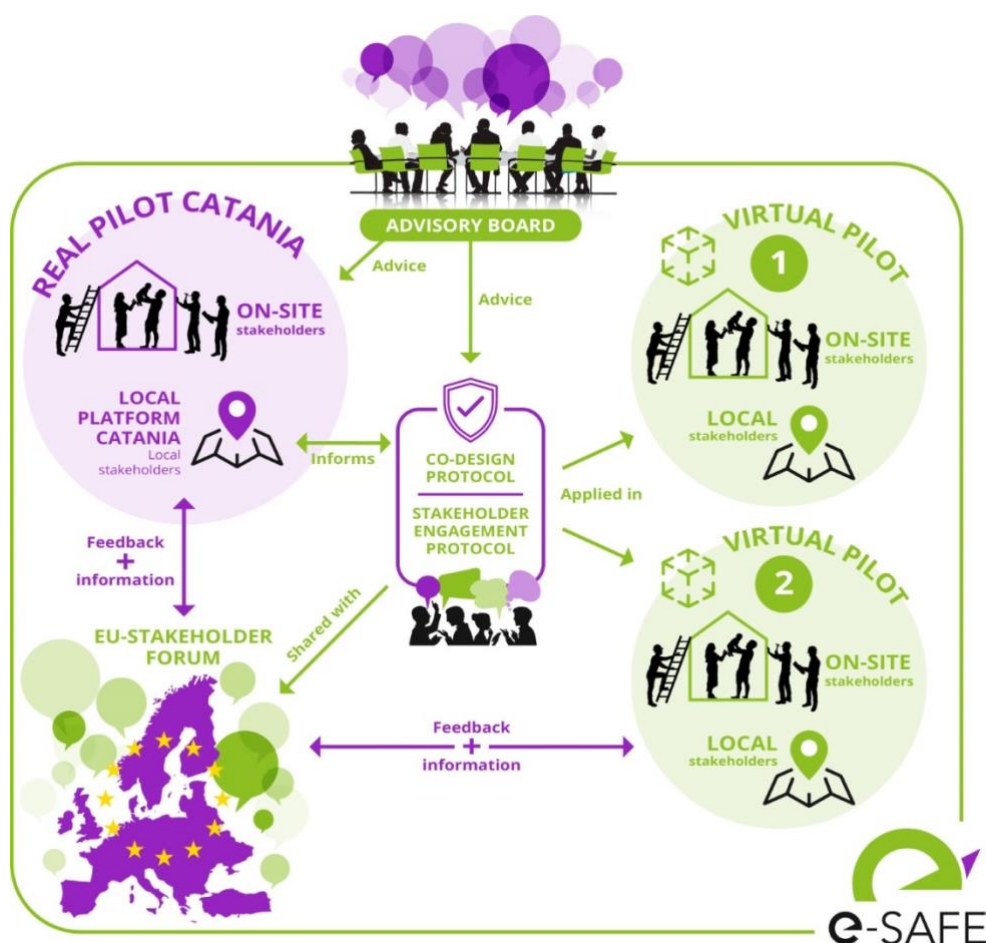


Figure 1: e-SAFE stakeholder engagement

The **e-SAFE** project stakeholder engagement strategy operates at three levels (see Figure 1):

1. **Building scale** – co-design activities with residents of the three pilot buildings
2. **Urban scale** – engagement with local stakeholders at the city level where pilots are located
3. **European scale** – EU stakeholder Forum and the Advisory Board

Deliverable 2.9 regards the **urban scale** and aims to provide guidelines for the setup and the activities of the upcoming Local Platforms, engaging local stakeholders of the cities where the **e-SAFE** virtual pilots will be located. **Local platforms engage representatives of local authorities, organizations, businesses, and social groups that have a direct or indirect**

interest in boosting deep retrofitting at the local scale. Every time **e-SAFE** technology is applied to a specific site, the Local Platform can be established in the city as a demonstration activity a spur interest in **e-SAFE**, and deep retrofitting in general, more broadly within the local community.

The final version of stakeholder engagement protocol provides guidelines on how to involve local stakeholders every time **e-SAFE** is implemented to scale up combined energy-efficient and anti-seismic deep renovation in a city.

The preliminary version of the protocol was based on the literature review and lessons learnt from Catania Local Platform (CLP), which is located in the city where the actual **e-SAFE** pilot is being renovated, using the **e-SAFE** system. The building is a public housing apartment block and the UNICT researchers involved residents in co-design activities. In parallel with the co-design activities of the pilot, UNICT researchers have set up and tested the **e-SAFE** local engagement strategy with stakeholders of the CLP. Urban stakeholders interested in energy efficiency and seismic safety such as universities, professional associations, public authorities and NGOs were engaged over the past two years and the current report summarises the main activities and lessons learnt. The protocol was then tested during the implementation of two virtual pilots in Timisoara and Bucharest (Romania). The virtual pilots provided the opportunity to test the stakeholder engagement strategy that was used in Catania with the purpose to develop a general engagement protocol that can be replicated when the **e-SAFE** solution is applied, independently of climatic, social and economic conditions. This is key point to scaling up the solution on the renovation market and improving the energy efficiency and seismic safety of the EU building stock.

This document includes a theoretical literature review (Section 2) with stakeholder engagement methods tested in case studies in similar contexts to **e-SAFE**, such as in renovation projects and urban planning. Secondly, it describes the setup and the main activities of the CLP (Section 3). The findings of the literature review were presented to the CLP stakeholders in October 2021, with the purpose to co-produce together with **e-SAFE** partners the work plan of CLP. Subsequently, the protocol further describes the stakeholder engagement activities carried out with the local platforms in Timisoara and Bucharest (Section 4). Lastly, the report presents a set of general guidelines for urban stakeholder engagement (see Section 5) derived from the lessons learned engaging with the local platforms in Catania, Timisoara and Bucharest.

2. THEORETICAL FRAMEWORK – LITERATURE REVIEW

2.1 Overview of stakeholder engagement methods

Stakeholder engagement and public participation have received increasing attention in the field of strategic planning and sustainable development (Raciti and Saija 2010). Particularly in the field of spatial planning, stakeholder engagement can help to tackle issues faced by communities while ensuring inclusive planning processes (Albrechts 2013). Stakeholder engagement at its core deals with the question of which people are involved in planning processes, how they relate to one another, and which technology is involved. While a broad variety of different engagement methods and possible relations between planner and stakeholder exist, there seems to be a tendency to generalize these under the label of 'citizen participation'. Due to this oversimplification, participation processes do not always provide a reciprocal or equal relation between the state or planner on the one hand, and the citizen or stakeholder on the other (Albrechts 2013). Others refer to participation as a 'contested concept', which can be interpreted in numerous ways (Callahan 2007). It is therefore important to define stakeholder participation and engagement. This exploratory theoretical framework reviews several widely applied stakeholder engagement methods in strategic urban planning and building renovation projects.

The process of identifying and engaging with key stakeholders in construction projects is described regularly in academic literature, whereby terms for the target group (public, residents, stakeholders) and the interactive process (engagement or participation) are used interchangeably. What stakeholder engagement (Cuppen et al. 2016), resident/tenant participation (Saija 2013) (Hong 2018) (Boess et al. 2016), community engagement (Saija 2013), and co-production (Albrechts 2013) have in common is their involvement of stakeholders in the (strategic) planning, development and delivery of (public) goods and services in urban contexts, such as building renovations. Stakeholder engagement can be organised at several scales, ranging from single construction or renovation projects to urban scale engagement and even national or EU scale. The envisioned scope of this literature review and protocol is urban scale engagement.

To create construction and renovation practices that contribute to sustainable development, cross-disciplinary work with several stakeholders is required. Stakeholders *"are individuals and organizations that 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). *Internal stakeholders* are members of the coalition implementing the project or providing finance, whereas those affected by the outcomes can be considered *external stakeholders* (Persson and Olander 2004). The main challenges in engaging stakeholders consist in identifying all essential stakeholders and satisfying their at times competing interests and needs (Aapaoja and Haapasalo 2014)(Persson and Olander 2004).

Prominent authors such as Sherry Arnstein, or more recently institutions like the International Association for Public participation, differentiate between 'degrees' of stakeholder participation or engagement. These degrees concern the depth of involvement of stakeholders and their influence on decision making, which they rate on a scale ranging from informing (as a bare minimum) to empowerment (as a maximum) (IAP2 2018)(Arnstein 1969). Stakeholder engagement in e-SAFE strives to activate powerful and powerless actors to stimulate them to take action, in particular energy and seismic deep renovations. The methods discussed below have the potential to

contribute to mutual learning between stakeholders and can be subdivided based on the step or phase of the stakeholder engagement process in which they can be best applied.

A general five-step stakeholder engagement framework is suggested by Bal et al., based on a global stakeholder engagement standard (AA1000SES) developed by AccountAbility (Bal et al. 2013). This framework includes the following steps:

1. **Stakeholder identification:** Identifying key stakeholders and identifying their interests, prioritizing action
2. **Analysis of stakeholder interests and objectives:** Analyse stakeholder interests and set stakeholder objectives (e.g. social or sustainable)
3. **Strengthen engagement capacities:** internally and externally (e.g. among stakeholders)
4. **Engagement process design and implementation:** Design the process and identify the most effective engagement approach
5. **Monitoring and review:** Plan follow-up activities, review engagement and report to stakeholders

This exploratory review mainly focuses on stakeholder identification (step 1), analysis of stakeholder interests, setting stakeholder objectives (step 2) and designing the most effective engagement approach (step 3). These three steps are essential to developing the stakeholder engagement guidelines for the e-SAFE project, which will be tested within the Local Platforms of the virtual pilots. These three steps will therefore support the categorization of stakeholder engagement methods presented below. A concise description of approaches and methods is provided in Table 1. A more in-depth analysis of each method can be found in Appendix 1 - Overview Methods.

Generally speaking, stakeholder engagement strategies can include several of the methods mentioned in Table 1. For example, a stakeholder engagement plan can include methods related to stakeholder identification (e.g. mapping), analysis of their interests (e.g. Delphi method) and involvement in the co-production of the work plan (e.g. focus groups). These methods are therefore not mutually exclusive but rather complementary and can be tailored to the needs of the stakeholders, the Local Platforms and the project.

Table 1 Brief overview of stakeholder engagement methods

		Approach	Methods / Techniques	Advantages/Limitations	Source
Step 1	Stakeholder Identification	Stakeholder Circle Methodology / Social Network Analysis	Stakeholder Circle: <i>Workshop, focus group, stakeholder circle diagram</i> Social Network Analysis: <i>Snow-ball sampling, interviews, questionnaires</i>	Provides two alternative approaches to identify stakeholders, analyses their role in a project and the relations between stakeholders. This information is essential to develop suitable engagement strategies and proper stakeholder identification is beneficial for the success of a project.	(Yang 2013)
		Stakeholder mapping	Stakeholder identification, determination of stakeholder concerns, stakeholder impact	Determining the objectives of stakeholders provides insights where potential conflicts of interest can arise, in particular when external stakeholders are involved. The power interest	(Berardi 2013)

			analysis (power interest grid)	grid can be repeated over time to assess to what extent stakeholder interest and influence have changed.	
Step 2	Analysis of stakeholder interests and setting objectives	Q-methodology	Stakeholder identification techniques, individual interviews, ranking of statements/images, factor analysis	<p>The benefit of Q-methodology is that it provides insight in the <i>variety of perspectives</i> about specific projects. This method allows important stakeholders to indicate their concerns and issues in an unbiased way.</p> <p>The method does not indicate what share of all stakeholders adheres to specific perspectives.</p>	(Cuppen et al. 2016) (Lobinger and Brantner 2020)
		Storytelling	Story-spine technique, discourse analysis, concordant analysis, story genres	<p>Storytelling is an effective tool to understand the human element in energy use and can help to learn about cause-effect relationships important for participants or developing shared goals and visions. An advantage is that it has the potential to empower end-users who are influenced by projects. The method focuses on the macro level of a project and linkages between complete project elements.</p> <p>This makes storytelling an inclusive method that allows less technical stakeholders to engage with a topic and to share their own views without being prescribed by a moderator what to say, but makes it difficult to discuss technical details.</p>	(Rotmann 2018)
		(Modular) Participatory backcasting (workshops)	Descriptive statistics, causal-loop diagrams, stakeholder analysis, brainstorming, storytelling, why-question technique, criteria/sensitivity testing, modelling, project management techniques, interviews	Participatory backcasting is a scalable and adaptable methodology that can help overcome social barriers and facilitate institutional change. A great benefit is the flexibility to adapt the method to the local context and action-oriented outcomes.	(Pereverza, Pasichnyi, and Kordas 2019) (Svenfelt, Engstrom, and Svane 2011) (Quist 2007)
		Focus groups	Stakeholder identification techniques, moderation techniques, content	Focus groups are widely applied in the building and construction sector and are ideal tools to analyse key concerns from important stakeholders.	(Caporale et al. 2020) (O.Nyumba et al. 2018) (HIRL,

			analysis (coding, discourse analysis, conversation analysis, ranking).	Within the research papers analysed focus groups mainly involve expert stakeholders, but the method has the potential to be used with other types of stakeholders as well. The method fosters debate but involving groups also entails risks on group biases.	n.d.) (California Energy Commission 2016) (Straub and Frankena 2018) (Kamari, Corrao, and Kirkegaard 2017)
		Delphi method	Stakeholder identification techniques, survey techniques (predictions, prioritization, ratings), statistical analysis	The Delphi method helps to circumvent group biases and gain insights into the complexity of construction projects. The benefit of Delphi method, for example compared to focus groups, is that there is a smaller chance of group bias effects because stakeholders fill in the survey independently and get the chance to revise their answers after results are aggregated. This method is suitable for the quantification of results. A disadvantage is that the technique is mostly used in literature to collect expert advice, rather than broader stakeholder groups. The quantitative nature of Delphi methods does not allow for in-depth discussions.	(Flostrand, Pitt, and Bridson 2020) (Li et al. 2018) (Kermanshachi and Safapour 2019)
Step 3	Engagement process design and implementation	VR-Renovation	Individual VR-viewings of the renovation process with tenants, explanation of the renovation process.	Using virtual reality to let people see different options they can choose from in the building renovation, how the process will go and what their home will look like	(van Oel et al. 2020)
		Acceptability process & demand response	Open and transparent communication of project information with tenants, familiarising tenants with new design through mock-up building models, co-creation of design solutions, semi-structured	Approach to find out key concerns of tenants in social housing living in dwellings to be renovated with the benefit that it focuses on how tenants experience home, what they do at home and why. Information was obtained based on interviews and the use of a mock-up building model to simulate scenarios, that were used to adapt the renovation solution design by the building	(Guerra-Santin et al. 2017)

			interviews	designers. The benefit is a human-centric approach to renovation and highlights key concerns for tenants during the renovation.	
		Relational project delivery methods (RPDMs)	RPDM Project definition techniques, feasibility assessment, stakeholder identification, face-to-face interviews, snowball sampling	Relational project delivery methods have the benefit that they aim for early stakeholder engagement, collective responsibility, a focus on optimal outcomes and joint project control. Case studies indicate potential value for overcoming barriers in renovation and potential for co-creation.	(Aapaoja, Haapasalo, and Söderström 2013)
		Co-creative design process / design participation	Personal interviews, 3D BIM model (WoonConnect) + workshop on how to use it, surveys	Co-creative design processes generate deep insights into concerns and issues of building end-users, and can provide a feeling of co-ownership of the final solutions implemented. Co-creative design processes can require more resources than a conventional design, although it can prevent issues later on in the renovation process.	(Fernandez et al. 2020) (Lee 2008) (Guerra-Santin et al. 2017) (Boess et al. 2016)
		Community-based ownership models (Financial)	Co-operatives, partnerships, non-profits, community trusts, housing associations	Community ownership models can bring concrete financial and social benefits from on-site renewable energy projects for building owners and communities.	(IRENA 2020) (Roberts, Bodman, and Rybski 2014)

2.1.1 Step 1: Stakeholder Identification

Stakeholder Circle Methodology / Social Network Analysis

To develop suitable engagement strategies, stakeholder identification and is crucial for urban renewal projects (Yang 2013). Different conceptual approaches exist about which actors can be considered. Empiricism builds on the assumption that knowledge in the form of professional experience is required, usually only focussing on 'core' stakeholders in the project team (referred to as 'internal stakeholders' in 2.1), whereas rationalism defines and involves a much broader set of stakeholders to get a less subjective and more rational or objective view on the stakeholders. This can be valuable because it allows identifying 'hidden or invisible' stakeholders that are not known (well) by the project team and might have little apparent influence but could have disruptive influence, unexpected relationships with stakeholders, or unseen power. Stakeholder Circle Methodology (empiricism) and Social Network Analysis (rationalism) are methods to identify, prioritise and engage stakeholders, based on different assumptions belonging to rationalism or empiricism (Yang 2013).

Stakeholder Circle Methodology collects stakeholders based on the professional experience of the core stakeholders in the project team, using interviews and snowball sampling. Subsequently,

stakeholders are prioritised based on influence, proximity and urgency that stakeholders experience in relation to the project. The influence of stakeholders is visualised in a circular diagram, with a weighting attributed to each stakeholder. Stakeholders are closer to the centre of the diagram based on their power to influence the project, their proximity to the project (are they closely associated or not) and their urgency (how far are they willing to go to achieve their outcomes). (Yang 2013). An important distinction remains whether there will be mainly professional stakeholders involved, or also laypersons because this will impact the choice for specific stakeholder engagement strategy development later on in the process.

Social Network Analysis starts with identifying the boundaries of a network based on snowball sampling combined with interviews or surveys. Afterwards, relationships between the stakeholders are analysed. Relationships are divided into four categories:

1. collaborative relationships,
2. information sharing potential,
3. rigidity and decision-making relationships,
4. wellbeing and supportive relationships.

The relationships between different stakeholders are visualised using computer software and can be followed by a quantitative analysis often looking at cohesion (the number of links to reach other stakeholders in the network) and density (the number of potential relationships that are actually relationships) (Yang 2013).

Both methods have been applied in complex redevelopment projects of a district and an infrastructure project in Australia, illustrating the effectiveness of both methods. Depending on the available resources, both methods can be applied in projects.

Stakeholder mapping

Stakeholder mapping is a process in which relevant stakeholders for a project are identified, classified and categorised based on their interest and impact on the project (Berardi 2013). Because it is difficult to distinguish between identifying and analysing interests, stakeholder mapping is included in the identification step.

Stakeholder identification entails selecting the most important internal and external stakeholders for a given construction project. This can be based on desk research, interviews, or other techniques like those described in the previous subsection.

Stakeholder classification determines the focus of a specific group of stakeholders and individual objectives for each stakeholder related to the project. For example, 'building clients can be defined as a stakeholder category, consisting of the building owner and financier. This category includes internal stakeholders (e.g. the financier and the building owners) but is different from external stakeholders (building users), whereby both groups have distinct interests that might only partially overlap. Especially in renovation projects for social housing, it is important to differentiate between building owners and financiers and the building users. Clients will be mainly interested in the quality and successful completion of the construction project. The 'design' category stakeholders, e.g., architects and engineers, will be mostly concerned with practical design choices and choices for construction products. Objectives differ per stakeholder category but can also vary within stakeholder categories. Conflicting interests between internal stakeholders are a main cause of tension during project development (Berardi 2013). Stakeholder mapping can help to anticipate such tensions.

The final step entails the ranking of the interest and the power of stakeholders in the decision-making process related to the project. Hereby it is essential to include the dimension of time, in the sense of analysing several stages of the project in which stakeholders have the most interest

and power over decisions that are being made (Berardi 2013). Together these insights allow a project manager to identify key issues and tailor communication and attention to the right stakeholders during the project development.

2.1.2 Step 2: Analysis of stakeholder interests and setting objectives

Q-methodology

Q-methodology is increasingly being recognized and applied more regularly in policy and urban planning research. Q methodology is a tool for analysing the variety and nature of different *perspectives* among a selected group of actors or stakeholders. There is no assumption about how many different perspectives there can be, and the results show perceptions that form the basis of stakeholder concerns in projects (Cuppen et al. 2016).

Stakeholder management should be conceived as a continuous process and should monitor relevant stakeholder perspectives throughout the duration of the project. Stakeholder management can be differentiated from stakeholder engagement based on the basic assumption that, by stakeholder management is implied that behaviour and actions can be controlled, planned or predicted, whereas with engagement is focussing on building relationships and achieving outcomes through consultation, negotiation, compromise and communication. ("Association for Project Management (APM)" 2019)

Q-methodology is a method developed to uncover the subjective viewpoints of groups of people. The methodology consists of individuals ranking a set of statements related to the project, known as the 'Q-sort' during an interview. Q-methodology differs from normal surveys in that it allows stakeholders to evaluate statements in context to a comprehensive set of other statements, rather than on an individual basis. The stakeholder can thereby cluster the statements in categories that are not pre-defined by the researcher, constituting authentic perspectives. The tool can be used to better understand the variety of existing perspectives among stakeholders, but not how often these perspectives occur in a stakeholder population (Cuppen et al. 2016). Alternative versions of Q-sort allow stakeholders to sort cards with images, rather than statements (Lobinger and Brantner 2020).

Insights obtained by applying Q-methodology can improve project management and risk governance and is a valuable tool for stakeholder participation.

(Modular) Participatory backcasting

Backcasting starts with defining the strategic problem to be solved, similar to other strategic planning approaches. However, the first subsequent step of backcasting consists of developing a future vision in which the problem is solved based on stakeholder input, rather than reasoning from the given situation and formulating solutions based on that. Backcasting analysis involves reasoning back from this ideal future and formulating concrete steps that must be taken to achieve the future. The analysis includes elaborating an agenda to tackle the problem and stimuli for stakeholders to follow up (Quist 2007). Several methodologies for backcasting exist, including several specifically tailored to buildings and heating provisions (Svenfelt, Engstrom, and Svane 2011)(Pereverza, Pasichnyi, and Kordas 2019).

While some studies focus more on formulating the desired future vision, other applications focus more on formulating concrete solutions (Svenfelt, Engstrom, and Svane 2011). This is illustrated by a study from Svenfelt aiming at reducing energy use by 50% that focuses in particular on which concrete measures should be taken and who should implement them. Rather than developing a detailed future, Svenfelt's approach used self-developed newspaper articles describing the desired future to foster discussions (Svenfelt, Engstrom, and Svane 2011). The study combines

backcasting with a range of other methods such as focus groups, group interviews and other stakeholder sessions.

This illustrates the flexibility of the method and the ease to combine it with other methods. This is also supported by another modular participatory backcasting framework developed in 2020 specifically for strategic planning in the heating sector (Pereverza, Pasichnyi, and Kordas 2019). A strong benefit of the modular methodology is that it is adaptable and scalable. Because the heating sector is often locally embedded and many different technical solutions are available, this adaptability is very useful. The study suggests 13 modules that can be combined by a facilitator depending on local needs and has been tested in a Ukrainian and Serbian city. In summary, this approach has proven its benefits for addressing social barriers and facilitating institutional change and it is easily adaptable to various scales and contexts (Svenfelt, Engstrom, and Svane 2011; Pereverza, Pasichnyi, and Kordas 2019).

Storytelling

Storytelling is a technique that can be used in a wide range of processes within stakeholder engagement (Rotmann 2018). 'Story spines' is a well-established method to collect stories from audiences that are not used to telling stories in their professional lives. A story spine is a set of questions that invite the audience to illustrate how an event unfolds in a sequence where certain events cause other events. When a facilitator lets a group of stakeholders fill in a story spine and facilitates sharing their perspectives, this illustrates the causal logic of events in a simple manner.

The benefits of using storytelling include among others that it can help enact policy recommendations, can help monitor and evaluate impact, and can foster understanding of the human aspects of energy use. Stories are a legitimate way to contribute to energy research and have the potential to help set a shared vision and common goals. Another key benefit of storytelling is that it includes and empowers the end-users whose behaviour is often meant to change but who are not experts in the field and are often not familiar with the full range of technical terms and concepts (Rotmann 2018). During workshops, storytelling is therefore an accessible method that allows the participation of non-technical participants and allows them to share their views.

Focus groups

Focus groups aim to collect qualitative data about perceptions and values from a selected group of stakeholders (O.Nyumba et al. 2018). What differentiates a focus group from interviews is the role of the researcher. During interviews, the researcher controls the dynamics, asks questions and engages with particular interviewees, whereas in a focus group the researcher functions as a facilitator or moderator fostering discussion between participants (O.Nyumba et al. 2018). Focus groups are an often-used method to foster discussion and collect opinions on specific issues and are widely applied in the building sector (HIRL, n.d.), and are applied for residential (HIRL, "Home innovation...") and non-residential buildings (California Energy Commission, "Focus Group..."). Focus groups are often used in combination with other methods within the building sector, for example in decision-making support tools for building renovation and involving stakeholders (Kamari, Corrao, and Kirkegaard 2017)(Straub and Frankena 2018) or can be used to evaluate the importance of social, economic and environmental factors of renewable energy projects (Caporale et al. 2020). The group dynamics and discussion make the focus group stand out from the interviews.

Delphi methods

The Delphi technique has been used since the 1960s for collecting, aggregating and translating expert judgments about complex questions into concrete conclusions (Flostrand, Pitt, and Bridson 2020). When the selected group of Delphi experts has been identified, each expert is individually approached with a survey about their prioritization, rating or scale, prediction, elaboration, or other questions relevant for the research purpose. After the data is collected, the researcher aggregates the results into a clear overview report and indicates the statistical tendency (mean, mode, median) and variation (e.g., standard deviation). This report is sent to each panellist, sometimes including their own answers, after which they are re-invited to fill in the survey. The results are aggregated once more into an overview report. Depending on how far the opinions of experts deviate from each other, these last steps can be repeated until no significant changes occur or to an agreed level of agreement set in advance (Flostrand, Pitt, and Bridson 2020). Allowing participants to stay anonymous, the Delphi method circumvents group biases.

Studies in the construction sector using Delphi methods to engage stakeholders can be used to gain insight into the complexity of the construction project (Kermanshachi and Safapour 2019), the criteria for success and the influence that different stakeholder groups have on sustainable construction projects and (Li et al. 2018), or the development of decision-making support systems for sustainable renovation projects in Europe (Kamari, Corrao, and Kirkegaard 2017).

2.1.3 Step 3: Engagement process design and implementation

Using virtual reality to engage tenants of social housing

Using visual communication rather than language-based communication has the advantage that it does not require participants to master the language being used while giving concrete impressions of how a building could look after renovation. The VR-Renovate lets tenants of social housing look into the future by visually showing how their dwelling will look before, during and after the renovation. (van Oel et al. 2020). In a renovation project in the Dutch city of Tilburg, tenants have to temporarily leave their homes during the day when measures are taking place and sleep in their own house at night. Tenants are shown using virtual reality in all the phases of the renovation process and how their homes will look. Choices for bathrooms, kitchens and toilets are visualised based on the choices of individual tenants, so they will see how their choices will look after the renovation. It also showed tenants where to move furniture during the renovations. VR-Renovate illustrated the potential of VR applications for renovations tailored to specific tenant groups (in case of the project mostly elderly above 70 years).

Acceptability process addressing end-user behaviours

In the Netherlands, a renovation approach has been developed for building renovation for social housing companies, including a specific 'acceptability process' for tenants (Guerra-Santin et al. 2017). Tenants are required to give permission for the implementation of renovation measures. Although this is not commonly addressed in mainstream renovation approaches, tenant behaviour has a significant impact on whether the envisioned energy-efficiency improvements are achieved. To address the complexity of the renovation project an in-depth participation process is necessary to uncover how people experience their home, what they do on a daily basis and why. The acceptability process consists of two steps, first getting the green light of the tenants to renovate, and secondly a co-creative design process allowing tenants to co-shape their home experience with the building and building systems (Guerra-Santin et al. 2017).

The acceptability process took place in a mock-up building representing a dwelling after renovation. The core focus of the acceptability process was to introduce the participants to the new building design, the installations and the renovation process. Afterwards, participants were invited to play out scenarios of how a normal day would be, indicating how participants behave in

the renovated home and what concerns and questions they would have. This was followed by a semi-structured interview. This allowed identifying key concerns of participants related to the building systems and the renovation process. These considerations were in turn communicated to the designers, who devised mock-up case studies for specific building systems deemed important (windows, balconies, ventilation systems) to test the solutions and co-create design choices for tenants (Guerra-Santin et al. 2017). The results of the process showed key parameters which important to participants related to trust, fairness and threat reduction, household ideals from tenants, support of lifestyles and control over health and comfort.

Relational project delivery methods (RPDMs)

Relational project delivery methods (RPDMs) in the construction sector differ from traditional project delivery in how interactions are facilitated between stakeholders in the value chain (designers, construction professionals, building maintenance experts and end-users) (Aapaoja, Haapasalo, and Söderström 2013).

Conventional project delivery usually entails a project definition that, once it is finished, is given to a designer. The designer finished a design and gives this to a construction company, who builds the asset and involves technical service providers that install buildings heating, water, and electric systems. Finally, the completed project is transferred to the end-user. RPDMs pursue a relational approach in which building designers, building professionals, building owners and other non-owner stakeholders work together collaboratively rather than independently. RPDMs aim to integrate the insights and talents of all stakeholders to improve efficiency, reduce waste, increase value, optimise the project results during the fabrication, design and construction phases (Aapaoja, Haapasalo, and Söderström 2013).

In construction and renovation projects, most issues occur during the project definition phase, when the needs of stakeholders and project developers must be met. RPDMs, therefore, aim for stakeholder engagement as early as possible when innovative solutions for issues can be found and not many costs have been made. The framework for early stakeholder engagement divides the project definition into two steps (Aapaoja, Haapasalo, and Söderström 2013). When the customer of the project agrees, key internal stakeholder are selected based on snowball sampling, after which the feasibility, project initiation, procurement strategy and suppliers and designers are selected and involved in the first phase. In the second a share agreement gets negotiated about the outcomes and objectives of the project and the constraints linked to the objectives. The final agreement usually involves shared risk and benefits for project stakeholders, collective responsibility, focus on the best project outcome, open-book accounting, and joint project control. The application of the method to a renovation project in Finland showed that RPDM has the potential to overcome construction challenges and increase project value through co-creation by involving the right stakeholders early in the project definition phase. Stakeholders should still be managed based on their roles and liabilities (Aapaoja, Haapasalo, and Söderström 2013).

Co-creation or co-production in design process

Co-creation and co-production are terms that are sometimes used interchangeably because both terms are used in settings where end-users of services are involved in the development of final products or outcomes. The difference is mainly related to the extent to which end-user is involved, whereby co-creation is mainly focused on the initiation and the strategic planning, whereas with co-production the end-users are involved in the design and implementation as well (Brandsen, Steen, and Verschuere 2018). Participatory design processes for the refurbishment of buildings or complete districts can also benefit from digital tools (Fernandez et al. 2020). This is illustrated by a study in a Dutch district, where a new software tool and a BIM-tool allowed tenants of a housing association to select pre-determined renovation solutions based on their preferences. The ICT

tools also allowed the tenants to see the impact their behavioural change (e.g. heating, showering) would have on the energy performance of the building, and contrast this with the effects of a renovation (Fernandez et al. 2020). The research indicated that personal kitchen table conversations with all tenants remained crucial for the success of the project, even though the digital tools were also effective. Moreover, the authors recommend district level promotion of the participatory processes by existing social groups, illustrating that personal interaction stays essential when digital tools are developed.

Community-based ownership models

According to the International Renewable Energy Agency (IRENA) over 4000+ community-ownership initiatives existed in primarily Australia, North-West Europe and the USA. (IRENA 2020) Their report presents several community-ownership models that are applicable to buildings and renovation. For construction and renovation, particularly interesting examples include community-owned electricity generation from renewable energy sources (PV plants, biomass plants, or wind plants), community-owned district heating systems (biomass, geothermal, solar), and community energy efficiency programs (reducing consumption or fostering retrofitting through investments, advice, or education).

A project can be considered community-based when it meets two of the following elements:

1. Local stakeholders partially or completely own a renewable energy project.
2. Local stakeholders have the majority of voting rights about company decisions
3. A majority of economic and social benefits are distributed at the local level (e.g. profits shared with the community, power supplied to the community or jobs created locally).

Several legal community-ownership models exist with specific characteristics. This includes co-operatives, partnerships, non-profit organizations, community trusts and housing associations. Community-based ownership models can lead to lower upfront investment costs, larger employment of decentralized renewable power plants and foster solidarity and cooperation at the local level. This is illustrated in several case studies, for example in Denmark (Hvidovrebo Section 6) where 'tenant democracy' led to install solar thermal and solar electricity installations on roofs in need of renovation (Roberts, Bodman, and Rybski 2014). The success of community-owned projects depends on a broader enabling framework, sufficient access to finance and clear regulations relating to community-ownership projects and participation in the energy market (IRENA 2020).

2.1.4 Insights relevant for the e-SAFE project: the co-production approach

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**.

Co-production shares with both participatory and collaborative approaches the main idea of the importance of stakeholder engagement. However, this paradigm differs substantially from both, since:

- **Participatory approaches** emphasize both internal and external stakeholders' *contribution* to decision-making processes: actors are engaged for the purpose of giving inputs and expressing a preference but not necessarily are given responsibility over the outcome of the process (Arnstein 1969). Most participatory processes have primarily a consultative value.
- **Collaborative approaches** imply participants' sharing some *responsibility* over the decision-making process: by participating in the process, actors partake in defining outcomes. In this case, actors manage the process as far as they are personally and formally responsible for both the inputs that shape the process and some of its outcomes (Healey 2002).

- **Co-production** implies that participants do not only share inputs and ideas with each other, do not only partake in responsibility for outcomes, but they also 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 others (Albrecht 2013) (Brandsen, Steen, and Verschuere 2018).

Since each of the previous tools can be adapted to different paradigms, as far as the establishment of Local Platforms is concerned, the e-SAFE team has used a subset of the tools that have been described in the previous paragraph within a co-production perspective. In what follows, the use of each tool is described with a focus on what makes such a use 'co-productive' in practice.

3. URBAN ENGAGEMENT WITHIN CATANIA LOCAL PLATFORM

This section focuses on the work carried out by the **e-SAFE** team, and specifically the UNICT research group, to establish and boost an **e-SAFE** Local Platform in Catania (Sicily, Italy), i.e. the city where **e-SAFE** is renovating a public housing apartment block for improving energy efficiency and seismic safety (real pilot).

The section is organized into two subsections:

- Section 3.1 outlines the methods and tools employed to set up and launch through a Kick-Off Meeting, the CLP;
- Section 3.2 describes the methods and tools being used after Kick-off by the platform to advance **e-SAFE**'s local objectives, namely spurring awareness about energy-seismic renovation and boosting the retrofitting market with a specific but not exclusive focus on the **e-SAFE** technology.

The work carried out in Catania described in this section will then be used to develop preliminary engagement guidelines (see Section 4) that will be tested in two other European locations, during the development of virtual pilots' activities. The testing will provide evidence to finalize an '**e-SAFE** Engagement protocol' (Deliverable 2.9), i.e. general guidelines to all actors interested in using a co-productive approach to spur deep renovation at the urban scale.

3.1 Catania Local Platform set up

The first steps carried out in Catania were undertaken for a twofold purpose:

1. identifying and engaging local stakeholders interested in addressing energy-seismic renovation issues as potential CLP members, while
2. using every interaction as an occasion to lay the groundwork for triggering co-production approach (see subsection 2.1.4).

Each step outlined below is designed to combine both aims.

3.1.1 The Local Stakeholders List

As a first step, UNICT researchers identified actors with a potential interest in energy and seismic renovation of buildings at the local level. The identification process of local actors has involved three distinct phases:

- i. identification of general "Stakeholder categories";
- ii. preliminary brainstorming within the **e-SAFE** team aimed at identifying names for each category;
- iii. Identification of gaps (categories with not enough names) and search for more names, to ensure the broadest representation of interests at stake.

i. Stakeholder identification

Each "stakeholder category" was identified as corresponding to a specific type of direct or potential - public, private, or civic interest in energy and seismic renovation, taking into account the idea of involving a wide arena of stakeholders inclusive of all the complex challenges posed by energy-seismic renovation. With this aim, the list includes stakeholders whose interests are related to socio-cultural issues, financial challenges, ecological goals, technological innovation, regulations

and procedures, territorial governance, etc. The complete list is summarized in the following table:

Table 2. Stakeholders' categories

Primary category	Secondary categories	Potential interest at stake
Local public authorities	Elected Officials Appointed Officials External Consultants	To meet decarbonization goals set by national and European policies. To increase seismic safety in non-historic public buildings (public housing, public schools, etc.). To ensure seismic safety of all public and private buildings through plans, policies, and codes imposing standards of structural safety To enhance public works performance (possible interest in reducing implementation time, cost, and occupants' disturbance in case of renovation of public buildings). To spread urban regeneration across the city, addressing both technological and socio-economic challenges.
Renovation Professionals	Architects Engineers Surveyors Association of Architects Association of Engineers Association of Surveyors	To satisfy clients in proposing a technology that reduces implementation time, cost, and occupants' disturbance. To simplify their work through the combination in one renovation technology that performs on both energy efficiency and seismic safety. To increase awareness among clients on both energy efficiency and seismic safety. To upgrade professional skills and expertise through training.
Building owners and managers	Public agencies Big private property owners Flat owners Building managers	To employ a system that combines reduced implementation time, cost, and occupants' disturbance. To increase the energy and seismic quality of buildings. To save on energy bills and tackle energy poverty To actively participate in the urban regeneration process. To raise and address "right to [quality] housing" issues. (For owners) To increase the property value.
Research & Education	STEM researchers Social scientists School/education representatives	To investigate how to improve the technological aspects of energy-seismic renovation at the building scale. To investigate engagement strategies and community-based practices in the field of energy transition. To investigate the relationships between the "right to [quality] housing" issues and the EU strategy for decarbonizing the European building stock. To increase awareness about both energy efficiency and seismic safety among youth. To increase seismic safety and energy efficiency of educational facilities.
Financial actors	Banks Foundations Insurances Other	To design more effective and accessible funding and business models for renovation. To design and implement financial services that increase low-income people access to housing.
Social actors	Public agencies Unions (e.g., tenants' unions)	To push for an approach to urban regeneration able to address socio-economic challenges. To increase awareness among low-income and vulnerable residents

	Social cooperatives Non-profits /charities Local grassroots Environmental groups/ NGOs Tenants	on both energy efficiency and seismic safety. To raise and address "right to [quality] housing" issues. To promote community-based practices in the field of energy transition. To access low-interest funding options. To alleviate energy poverty To achieve, locally, National and EU decarbonization goals.
Economic actors in the building sector	Developers/building contractors Manufacturers Real estate agencies Other	To employ a system that combines reduced implementation time, cost, and occupants' disturbance. To increase awareness among clients on deep renovation. To upgrade professional skills and expertise through training. To spread a system leveraging on local raw materials and resources. To increase properties' values through renovation.

In the table, primary categories refer to an "ideal type" of local actor, while secondary categories provide further specifications of such "type." The third column contains the interests at stake, i. e. the reasons why e-SAFE system is potentially attractive for each group of actors. It is worth noticing that the table was developed with a specific reference to Catania and it is likely to need adjustments if used in other locations since categories (especially secondary ones) are highly dependent to the socio-economic characteristics of the context.

ii. Preliminary brainstorming

After the identification of stakeholders' categories, members of the UNICT research team brainstormed and identified a first list of names based on their own social capital. This first list, however, was heavily (and inevitably) biased toward professionals and high-tech researchers, who represented about 60% of the identified actors (fig. 2). This was mainly due to the characteristic of the UNICT research group, mostly consisting of technical experts in the field of energy-seismic renovation.

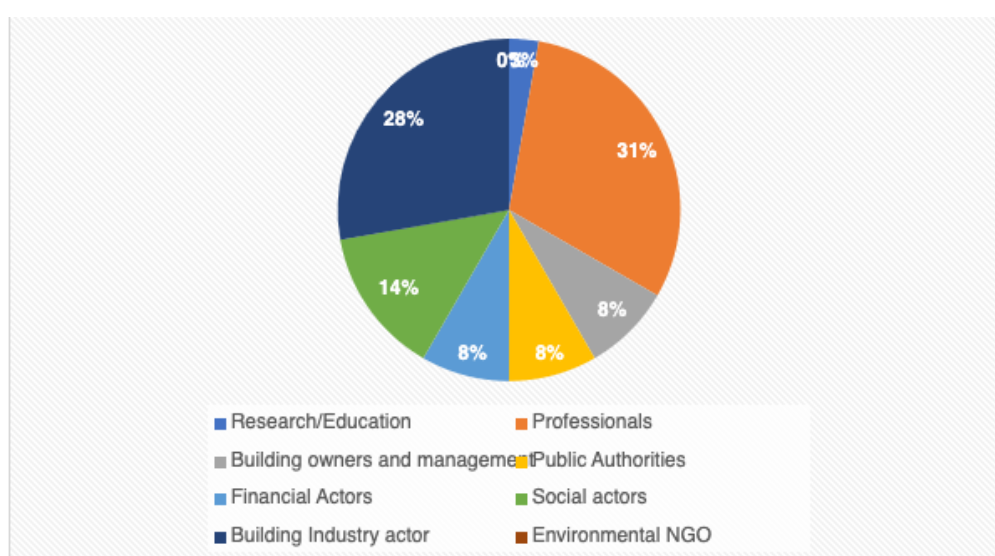


Figure 2. Composition of the first stakeholders' list

iii. Filling the gaps

With the aim of balancing the list and filling gaps, the team searched for more actors ascribed to poorly represented categories, especially social actors and public authorities (in general, the identification of local stakeholders must be considered as a highly recursive process, to such an extent that can also lead to the revision of the categories, creating new or merging existing ones). Additional names were identified through an online search by using as keywords both the “stakeholder categories” as well as words indicating their potential interests (e.g., right to housing, renovation incentives, urban regeneration, social innovation, etc.). In so doing, the **e-SAFE** team realized a second more ‘balanced’ version of a list made of 57 contacts (Fig.3).

To be compliant with the **e-SAFE Research Ethics Protocol**, each **e-SAFE** team member reached out to his/her personal contacts and asked them to sign an informed consent to have personal data (names and contact info) included in the list. Those contacts without any personal relationship with members of the UNICT **e-SAFE** team were listed using exclusively already public records.

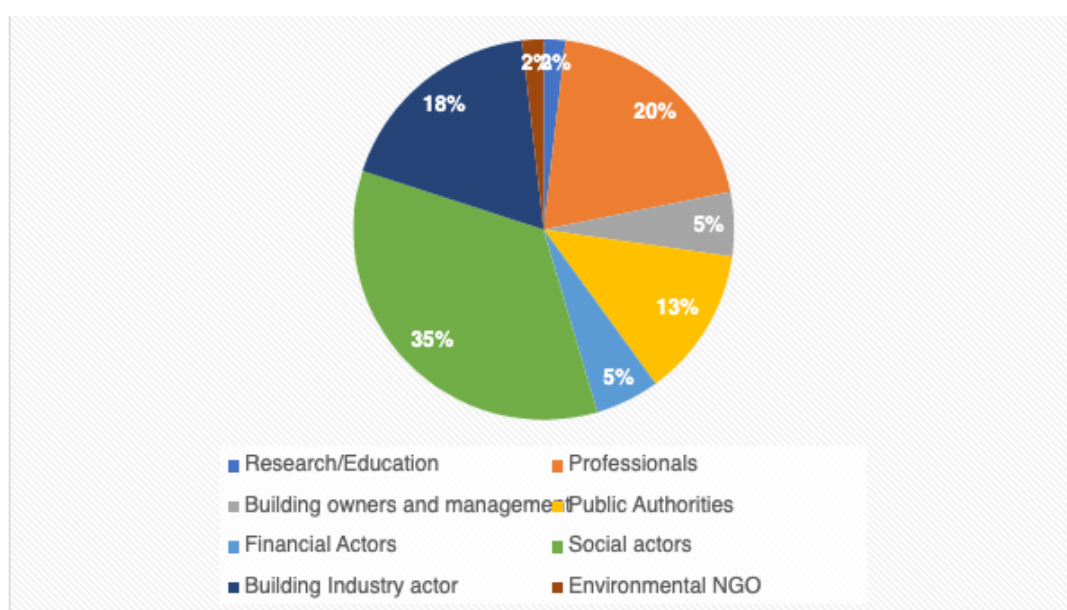


Figure 3 Composition of the second stakeholders' list

3.1.2. Mapping of interests with semi-structured interviews

As a second step, UNICT researchers have asked all the listed stakeholders to be interviewed as a way to make a first ‘personal’ contact with each one of them as well as collect data on their interest in seismic and energetic renovation while giving them the opportunity to learn about **e-SAFE**. Researchers decided to use a semi-structured interviewing approach using a pre-determined protocol (see Appendix 2) made of a combination of:

- Multiple-choice questions, aimed at obtaining comparable data in terms of expression of preferences and for quantitative analysis.
- Open-ended questions, i.e. clearly avoiding yes/no answers, aimed at encouraging free-flowing conversation providing an opportunity to spontaneously explore topics that are relevant to the interviewee.

Due to the restrictions imposed during the first phase of the COVID-19, the **e-SAFE** team implemented safety measures in terms of public and personal health. So, the team chose to meet stakeholders individually. Depending on the preference of the interviewee, interviews were

conducted either in-person with the use of appropriate distances and safety measures (masks, gloves, etc) or remotely, both via phone or web-based video calls. During this phase, focus groups and online surveys were not employed because they would have not allowed the development of a direct relationship with each interviewee.

The interview protocol (see appendix 2) was conceived to maximize 'bidirectional communication': on the one side, researchers' acquisition of data related to the interviewee's ongoing and future goals, agenda, and purposes relevant to e-SAFE; on the other side, interviewees' opportunity to learn about the project with a focus on the e-SAFE activities considered most interesting for each of them. Collected data provided insights on what matters to local actors, showing interviews as a powerful tool to give/obtain project-relevant information, elicit reactions and suggestions, identify issues and concerns, and – from a co-productive perspective – understand which agenda and outcomes stakeholders are willing to take responsibility for. However, this tool was rather time-consuming. The interview protocol is articulated in three different sections:

Section 1) Project presentation and privacy

In compliance with the e-SAFE ethics protocol (Deliverable 8.1), the interview began with a brief introduction of the interviewer on the project, touching on project funding and governance; project concept, technological features, and applicability; stakeholder engagement goals within the project; e-SAFE system scaling-up targets at the urban level; aims of the interview; request to sign an informed consent.

The introduction to the project is crucial to make stakeholders properly informed but also to encourage them to be more involved. Therefore, this kind of information needs to be reiterated and repeatedly stressed, so to boost local stakeholders' acceptance and awareness to take an active part in the Local Platform and have a role in co-production strategies.

Section 2) Core section

The interview continued with questions aimed at obtaining information from local stakeholders about their ongoing projects and visions, as well as priorities and resources, to spread energy and seismic renovation at the urban scale. This section was structured in six sub-sections:

- presentation of the interviewee – interviewees were asked to introduce themselves, stating their role and position within both the local context and (optional) the organization to which they belong;
- technological strengths and weaknesses related to the e-SAFE system – interviewees with specific technological skills were asked to indicate barriers and opportunities related to the e-SAFE system application with respect to the local context;
- urban regeneration and distressed urban areas – interviewees were asked to express their opinion about energy and seismic renovation as a trigger for urban regeneration processes, with a specific focus on Catania distressed urban areas. The aim was to identify ongoing and future actions, priorities, barriers, and opportunities for the use of e-SAFE in the face of socio-economic challenges;
- interviewee's potential role within the e-SAFE Local Platform – interviewees were asked to indicate what resources, tools, and skills they were willing to provide to spread energy-seismic renovation at the urban level. They were also asked to indicate potential partners with whom to collaborate.

It might be useful to note that in Catania, urban regeneration and urban distress issues were chosen as specific focuses that raise a lot of public attention in the local context. In particular, local public authorities are currently asked by a new normative framework (a new regional urban planning law approved in August 2020) to push for urban regeneration with a focus on blighted and socially-challenged urban areas.

Section 3) Practicalities

This section collected data useful to develop a realistic work plan for the platform. After the reiteration of the e-SAFE project goals, interviewees were asked about their interest in joining the CLP and, if so, about their time availability. During the interview analysis, this question allowed the e-SAFE team to draw up a preliminary work program to then be assessed by local stakeholders during the CLP Kick-off Meeting. They were also asked to indicate other local actors they thought should have been involved. The aim of this question was twofold: on one hand, it aimed at identifying important stakeholders who were not yet listed, so to strengthen the representativeness of the future CLP; on the other, the question aimed at verifying the accuracy of both primary and secondary categories previously identified, and local interests at stake related to energy-seismic renovation. The protocol closed with the possibility for the interviewee to ask questions to the interviewer.

Each interview lasted from 45 minutes to 1 hour. The interview protocol was used as a guide, rather than as a rigid scheme: therefore, free conversation was preferred by interviewers, taking care to address all topics covered by the protocol's sections. Out of 57 stakeholders identified, 42 were interviewed. Each interview was recorded and transcribed in compliance with the *e-SAFE Research Ethics Protocol*.

3.1.3 Interviews analysis

After the transcription, interviews were analysed using a thematic coding for text analysis through the software QDA Miner Light. A 'code' is a word or short phrase that symbolically assigns a salient attribute to a language-based data point (a single word or a full sentence). In doing so, overall themes and trends characterizing various texts can be identified and interpreted for the purpose of finding recursive patterns of data consistency.

A first series of codes were identified both *a priori*, based on the interview protocol co-productive aims (e.g., ongoing actions) and were then refined after thoroughly reading the interviews' transcriptions, so to pinpoint the emergence of unexpected themes more or less shared by local stakeholders. In particular, the latter was an iterative process, during which codes were subsumed by other codes, relabelled, or dropped altogether. Therefore, the coding analysis involved two phases: on one hand, the e-SAFE team worked on a "first cycle" of coding, writing analytic memos and jotting tentative ideas for topics and patterns; on the other, the team was engaged in a "second cycle" coding, going back to the data and re-analysing it, so to rearrange memos and finding a smaller number of key codes grouping several ones.

This process led to the identification of 9 "core codes", which show the main themes and central issues addressed by local stakeholders, and 28 "sub-codes". Therefore, "core codes" are the principal nodes around which sub-codes cluster. Below is a list of the codes that were employed with a description for each one of them:

Table 3 Overview of codes used for interviews' analysis

Theme	Description	Code	Description
On-going actions	On-going actions outlined by stakeholders that are directly or indirectly valuable to the spread of energy-seismic renovation	Indirect stewardship	On-going actions promoted by local actors not strictly related to energy-seismic renovation
		Direct stewardship	On-going actions promoted by local actors closely related to energy-seismic renovation
		Push public authorities (indirect)	On-going actions promoted by local actors not strictly related to energy-seismic

			renovation and requiring a takeover by local public authorities
		Push public authorities (direct)	On-going actions promoted by local actors closely related to energy-seismic renovation and requiring a takeover by local public authorities
		On-going actions (other)	Other on-going actions
Future actions	Strategic perspectives of action on Catania related to the spread of energy-seismic renovation	Geographical priorities	Proposed actions to spread energy-seismic renovation based on information strictly linked to a geographical area
		Non-geographical priorities	Proposed actions to spread energy-seismic renovation based on information not strictly linked to a geographical area
		Action ideas (other)	Other action ideas
Time & Resources	Time availability and resources to join the CLP	Stakeholders' time availability	Time availability for the CLP meetings
		Working methods	Ideas about how the CLP should work
		Financial resources	Financial resources to be used to spread energy-seismic renovation
		Non-financial resources	Intangible resources, skills, tools, and relational resources to be used to spread energy-seismic renovation
Actors	References to local actors and their involvement in the spread of energy-seismic renovation	Intermediate bodies & third sector	References to actors defined as intermediate bodies, including unions, professional associations, and third sector organizations other than cooperatives or social enterprises
		Private economic actors	References to private local subjects (collective and not) that can contribute to the spread of energy-seismic renovation from an economic-financial point of view
		Public actors	References to public actors
		Society	References to grassroots, civic organization more or less formalized, or specific residents
		University	References to the University as a local actor
Real estate	Urban issues strictly related	Direct real estate issues	Characteristics and trends of the local real estate market in

	to real estate		relation with energy-seismic vulnerabilities
		Indirect real estate issues	Characteristics and trends of the local real estate market
Urban issues	Urban issues not related to real estate	Concept of periphery	Stakeholder's conceptualization of periphery
		Concept of urban blight	Stakeholder's conceptualization of urban blight
		Public housing	Urban issues related to public housing (housing quality, socio-economic issues, management & supply)
		Hurray for e-SAFE	Urban issues that e-SAFE may address
Responsibility	Local actors' responsibility in supporting and/or hampering energy-seismic renovation	Private responsibility	Private actors' responsibility in supporting and/or hampering energy-seismic renovation
		Public responsibility	Public actors' responsibility in supporting and/or hampering energy-seismic renovation
State of the art	Information about the local building stock	Seismic vulnerability	Information about the local building stock from a seismic point of view
		Energy efficiency	Information about the local building stock from an energy point of view
Weaknesses	Main barriers and issues for the spread of energy-seismic renovation	Barriers to e-SAFE	Main barriers and issues for the spread of energy-seismic renovation
		Downtown	Main barriers and issues for the spread of energy-seismic renovation in Catania downtown

Based on the coding, interviewees share **e-SAFE** main values and concerns: 65% make an explicit reference to the need of prioritizing seismic and energy retrofitting of Catania's building stock among the actions that are taken to face socio-economic and environmental issues. More than half expressed the need to create a synergy among the local actors to create a multilevel strategy of intervention.

Through the interviews, we have intercepted two ongoing studies on the seismic performance of the urban building stock carried out by local professional associations, as well as other collaborative activities aimed at spurring awareness about the importance of deep renovation, like "Catania Si-Cura", which is a voluntary working group coordinated by the construction entrepreneurs' association; "Diamoci una scossa," a local initiative related to the national campaign on seismic preparedness promoted by professional associations; "#iosegnalo," a mapping initiative of vulnerable buildings by the local association of architects. In particular, all interviewees but one feel that **e-SAFE** could be very helpful to the local community for two main reasons:

1. A technology characterized by lower costs and shorter implementation times, with reduced disturbance for the occupants can help overcome major barriers faced by deep renovation.

Many informants share the opinion that this is truer for seismic preparedness than energy efficiency, which is usually pursued through costly and invasive retrofitting strategies. Amongst the unexpected issues raised during the interviews, there was a shared concern amongst construction entrepreneurs, engineers, architects, and public administrators about the misalignment between real estate market values and building energy-seismic vulnerabilities: several Catania well-to-do neighbourhoods were developed in the 60s and 70s without seismic concerns and under significant real-estate pressures. In these neighbourhoods, high flats' values do not reflect their actual lack of energy or, even more, structural quality.

2. The co-productive nature of the system – the fact that it embeds ways to directly engage residents in the design process (co-design protocol and DDS system) – as well as its prospect to promote 'socially inclusive' financial strategies, make "building renovation" an avenue to address the many socio-economic issues characterizing the 'bad parts' of town. Informants, mostly representatives of residents' organizations, NGOs, and social service providers, have pointed out the fact that, in distressed neighbourhoods, retrofitting has to be conceptualized as a "stone hitting multiple birds" (social inclusion, residents' education, social innovation) otherwise it will likely fail to achieve ambitious sustainable goals.

Interviews also allowed the identification of valuable working directions for the CLP, and the basic indication that different actors have a specific focus on two main categories of buildings:

- public buildings, both residential and non-residential, with an emphasis on the role and the capacity of public actors to retrofit buildings, and the link between renovation and the right to both high-quality housing and services. Here respondents have emphasized the need to focus on strategies that can enhance the capacity of public authorities, both local and regional, to fulfil their responsibilities (institutional learning). This category includes buildings characterized by mixed property, like former public housing complexes where, over the years, some of the tenants have become homeowners through rent-to-own contracts.
- Privately owned buildings, where the main focus is on the misalignment between real estate values and building quality mentioned in the previous paragraph. Here the focus is on strategies that can build on what stakeholders are already doing to enhance their capacity to spur awareness and re-align the market.

Finally, the analysis of stakeholders' availabilities to join the local platform was very satisfying. With two single exceptions – due to personal reasons – all interviewees have declared an availability to join the platform, agreeing to meet with other members at least once a month and even weekly for activities of particular interest.

The outcomes of the analysis have been used to design the agenda of the CLP Kick-off Meeting, held in July 2021. The working directions that emerged from the interviews' analysis were used to structure working groups that were planned during the event (see subsection 3.1.4).

3.1.4 Catania Local Platform Kick-off Meeting

The date of the Kick-off meeting, which was originally planned for March 2021, was postponed a couple of times due to COVID-19 restrictions. It finally took place on July 9th, 2021.

Guestlist and invitations

The organisation of the local Kick-off meeting required the development, as a first step, of a guestlist, made of twice the names already included in the local stakeholders' list. UNICT researchers invited all the interviewed stakeholders but also those not interviewed for unforeseen circumstances, as well as all names identified through snowballing (Section 3 of the interview protocol) for which there was no time to request an interview.

In particular, although some institutional representatives were already on the local stakeholders' list, the e-SAFE team deemed it appropriate to extend the invitation to a wider range of local decision- and policy-makers. As will be discussed below, this decision had several implications on the structure of the event agenda.

The first invitation was sent out via email, about one month before the event, as a "save the date" email containing minimal information about the event (day, place, time, and title); about two weeks before the event, a reminder was sent out which contained an attached brochure and link to a pre-registration form. Pre-registration was necessary to estimate the number of participants and plan accordingly (especially to make sure COVID-19 pandemic measures were respected). Through pre-registration, invitees were asked to express a first and second preference over the working group they wanted to attend.

As far as invitations are concerned, more informal communication channels – like phone calls and bilateral meetings – were also employed, relying on personal relationships between e-SAFE team members and local stakeholders. We believe the use of multiple channels is a key point to achieving a high participation rate among the invitees (about 70%).

Location

As far as the location of the event is concerned, three main criteria were considered for the selection of the venue: 1) venue size, ability to accommodate a minimum of 200 people in compliance with existing COVID-19-related regulations and restrictions; 2) venue prestige, to emphasize the potential impact of both the event and the e-SAFE project's goals at the urban scale; 3) a space distribution able to respond to multiple functions, including the organization of plenary sessions, working groups, and convivial moments among participants. A list of venues meeting the aforementioned criteria was then realized, and based on availability, the choice was the university-owned and monumental "De Carlo Auditorium" at the Benedict Monastery.

Event format and agenda

The event was characterized by a hybrid format, combining the formalities typical of a proper institutional event with more informal activities aimed at showing off the working style of the platform. While institutional rituals were essential to engage elected officials and policymakers, who are expected to play a significant role in the Platform, it was important to dedicate a portion of the event to working groups, for the engagement of both institutional representatives and other local stakeholders in mutual learning and co-production. The event, thus, had the following agenda:

Welcome & Registration

During this phase, the e-SAFE team verified that each attendee was pre-registered for the event. Due to the pandemic, unregistered attendees were welcomed subject to seat availability. Moreover, next to the registration area, the e-SAFE team placed exhibition panels and posters describing the salient features of the project. Participants had the opportunity to interact with posters and amongst them while waiting for the beginning of the first plenary session. Registered participants were 52, divided into stakeholders' categories as follows: Public Authorities – 15 people, Professionals – 9 people, Researchers – 16 people, Financial Actor – 1 person, Social Actors – 9 people, Building sector – 2 people.

First plenary

The event began with a plenary for institutional greetings by representatives from the City of Catania, the Catania Public Housing Authority, and the UNICT. Institutional greetings were followed by technical presentations from e-SAFE UNICT researchers (fig. 4) on: the relevance of the e-SAFE project for the EU and the Catania contexts; e-SAFE technological aspects and

advantages compared to existing renovation systems; the overall e-SAFE stakeholders engagement strategy; working directions emerging from interviews' analysis.



Figure 4. An initial moment of the conference

Working groups

Attendees were invited to join one of two working groups, according to the preference expressed through registration: one focused on energy-seismic renovation for public buildings, both residential and non-residential; the other group focused on deep retrofitting in the real estate market, focusing on residential buildings (which often include retail activities on the ground floor). Each group was brainstormed on relevant outcomes of the interview analysis and engaged in a facilitated conversation aimed at bringing out synergies and potential collaborations.



Figure 5. Working group on public buildings coordinated by two facilitators

Final plenary

Each working group appointed a rapporteur for sharing during the final plenary, in the presence of the President of the Sicilian Region, working groups' main outcomes, focusing mainly on actions to be immediately implemented according to priorities and resource availability (for more details on these outcomes see section 3.2). The plenary ended with a reaction by the President of the Sicilian Region, who underlined the importance of the CLP in providing inputs to the regional government in terms of both priority actions and working methods and practices to spread the energy and seismic renovation at the regional level.



Figure 6. The closing moment with Institutional representatives

Refreshments and Networking

The final step of the event was conceived as a moment of conviviality with food and beverages. Conviviality plays a key role in facilitating stakeholders' engagement and co-production because it allows people to strengthen old and establish new ties, which is the base for long-term collaborations (fig. 7). About one week after the event, a 'thank you' message was sent to all participants, together with an attached report of the event's outcomes.



Figure 7. A moment of conviviality after the event

3.2 Catania Local Platform in action

The CLP Kick-off Meeting, and the working groups, in particular, was the first occasion for local stakeholders to act as a group. They were asked what they wanted to do together and their answers, together with data collected through interviews, were used to develop a draft work plan that was presented, revised and agreed upon during a second meeting, held on November 8th. The work plan was based on the following assumptions:

- Each Platform member can carry out platform-related activities alone or with other members, but agree to coordinate as a platform through monthly meetings (frequency was defined based on time availabilities gathered through the interviews);
- To encourage the principle of shared responsibility amongst Local Platform members, monthly meetings are to be hosted taking turns, based on a rotation of locations.

The plan also contained a preliminary co-productive strategy for the local exploitation of the e-SAFE system, which included:

- specific research tasks to be undertaken by e-SAFE researchers in support of the work of the CLP. In detail, the tasks are: 1) in-depth analysis of urban distress in public housing neighborhoods (3.2.2); 2) preliminary analysis of the applicability of e-SAFE at the building scale (see subsection 3.2.3), and, most importantly 3) the development of a crowd-mapping protocol aimed at engaging the large public while increasing awareness about energy-seismic renovation issues in the metro area (3.2.4);
- the need to organize collaborative events on e-SAFE related topics. Two events were agreed upon: 1) a book presentation focusing on the themes of building renovation and affordable housing (3.2.5); 2) a national event on urban regeneration as a trigger for both deep renovation and community development (3.2.6).

3.2.1 Preliminary co-productive strategy

The pivotal idea of the preliminary co-productive strategy is maintaining a focus on the two types of buildings that were identified through interviews and then were used to organize the working groups during the KoM: public buildings (both residential and non-residential), and private buildings.

Regarding **PUBLIC BUILDINGS**, the strategy is informed by the evidence that public authorities face significant challenges in spending public resources despite increasing financial opportunities for deep renovation. In particular, there are:

- “internal” challenges. Poor institutional capacity is related to organizational issues like the lack of personnel, scarce training of current employees, and complex bureaucracy.
- “external” challenges, which are related to the context, like high property fragmentation and housing informality conflicting with administrative procedures. These criticalities are particularly evident when considering the public housing stock in Catania, which is concentrated in distressed neighborhoods. With this respect, during the Kick-off Meeting, stakeholders have reinforced the idea that the CLP can look at e-SAFE as the opportunity to work on public housing issues fostering both social cohesion and learning processes among the different actors involved in the topic.

To address these obstacles, the local platform has agreed on focusing on the identification of potential 'virtual pilots' in public housing buildings in the Catania metro area, so that:

- on one hand, minimum 'co-design' activities might give the CLP a chance to interact with local communities and enhance the understanding of current barriers to extensive retrofitting in such contexts;
- on the other, 'virtual pilots' in public housing buildings might represent a training opportunity for Public Housing Authorities, thanks to the support of the wide variety of local stakeholders that are part of the Platform, for improving internal skills and their overall capacity.

The CLP has also agreed on targeting 'virtual pilots' located within distressed urban areas, pursuing the maximization of social benefits of deep renovation at the neighborhood scale using an integrated approach. The term 'integrated approach' refers to a cross-functional and multi-objective process that uses co-production to face deep renovation issues while addressing other challenges such as environmental risks, social inequalities, as well as both territorial governance and decision-making challenges. In other words, environmental, socio-cultural, and economic issues can be both identified and addressed through deep renovation. Nevertheless, the notion of an 'integrated approach' could be challenging in terms of effective implementation.

The localization of priority areas is currently supported by the outcomes of the research activities described in subsections 3.2.2 (Priority areas) and 3.2.3. (Preliminary analysis of the applicability of e-SAFE at the building scale).

As far as **DEEP RETROFITTING IN THE REAL ESTATE MARKET** is concerned, the strategy is informed by the assumption that a deep gap exists between real estate values and the seismic-energy safety of private buildings (misalignment between property values and actual energy efficiency as well as seismic preparedness of private buildings). To have an impact on this market issue it is necessary to work on the behavior of two crucial players – 1) actual and potential building owners, real estate investors and 2) professionals of the deep renovation markets (engineers, designers, construction workers) –, which are the target of two main lines of actions, respectively.

The first line of action consists in the creation of synergy amongst the various communicative initiatives that are being carried out by single actors, in the form of a collective public awareness campaign on deep renovation aimed at spreading evaluation and renovation practices that focus on seismic vulnerability and energy poverty amongst private owners. Leveraging on the lessons learnt by single participants during previous initiatives, such a campaign can significantly increase its efficacy and become more engaging if it provides opportunities for interaction. For this reason, the platform has decided to associate it with two types of activities: 1) a crowd-mapping initiative, aimed at encouraging to interact with a web-based GIS platform (see subsection 3.2.4); 2) organizing face-to-face events on relevant topics, which are a necessary complement to the web-based initiative (all participants have agreed that, especially after two years of social restrictions due to COVID, human interaction remains the most effective way to advance civic learning). Some of the most interested stakeholders have taken responsibility for the organization of e-SAFE related events, all with the aim of co-producing a shared definition of 'integrated approach' to energy-seismic renovation at the urban scale, combining the two focuses of the preliminary co-productive strategy (see subsections 3.2.5 and 3.2.6).

The second line of action consists of the organization of professional training programs, aimed at raising a new generation of professionals in the building sector with specific skills and expertise that make it easier for them to keep up with national and European parameters related to energy efficiency and seismic preparedness. For this purpose, the CLP decided to leverage the specific training package planned by the project (e-TRAINING, Task 7.6) whose goal consists of engaging design professionals (building contractors, architects, engineers, structural and energy consultants) and the building industry actors (developers, construction companies, manufacturers of building components) with the purpose of enhancing their general knowledge on the deep renovation as well as specific knowledge on the e-SAFE technology. According to the CLP members, the training package should include not only technical and design aspects but also administrative procedures as well as financing systems for deep retrofitting (which can help identify current limitations to be overcome with innovative financial tools).

3.2.2 Priority areas

As mentioned in the previous subsection, CLP's focus on public housing needed to be supported by a specific analysis of the exact location and quantification of public housing in the City and an evaluation of the status of the property (with a focus on property fragmentation) compared to real estate values. To do this, UNICT researchers have engaged a group of 5 engineering students as interns, for the purpose of spurring the importance of deep retrofitting amongst the university students' population.

The analysis consisted of three phases.

1) Study area identification. In the city of Catania, the most distressed urban areas have developed around “Piani di Zona” (the Italian expression identifying urban development originated in the 50s by an initial investment by public actors committed to promoting affordable housing) and are therefore right outside the historic center. The lack of historic properties represents an advantage from the perspective of e-SAFE exploitation. For this reason, the first step of the analysis was to use archival research to generate a geodataset of all residential properties owned by the two Catania public housing providers (the Municipality and the local Public Housing Authority, which is also a partner of e-SAFE). The location of currently publicly owned properties was the basis for further archival research that led to the creation of a geodataset of the original ‘piani di zona’ boundaries, which also comprise privately owned properties that were developed either as privately-owned affordable housing, housing cooperatives, or as public housing that has been acquired – often with a rent-to-own contract – by low-income residents. Based on precise indications from the CLP, these were set to be the priority area for further steps of analysis.

2) Analysis of property ownership. This step consisted of further analysis of property fragmentation in the public housing complexes. This research is 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. Besides the obvious fact that a high number of flat owners makes collective decisions more difficult and the fact that most of them are low-income makes them less prone to investing. Property fragmentation involving owners with very different ‘spending capacities’ – which is the case of condominium 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 (fig. 8):

1. Residential buildings with two floors or fewer (not eligible for e-SAFE – colored in a shade of green)
2. Residential buildings with more than two floors where:
 - 2.1. public property is equal to or higher than 50% of the real estate value, as in the case of the Catania real pilot. 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 n° of owners. The analysis makes the distinction between properties by the IACP (the Catania Public Housing Authority – colored in red) and the Municipality (Comune di Catania – colored in dark blue).
 - 2.2. public property is less than 50% but more than or equal to 30% (colored in orange for PHA and blue for Comune di Catania). This is not an ideal scenario, but recent Italian regulations on fiscal incentives for deep renovations (called ‘sismabonus’ and ‘ecobonus’) allow a condominium to reach a decision even if only owners representing 30% of the building values agree.
 - 2.3. public property is less than 30% (colored in yellow for PHA and light blue for Comune di Catania). This is the worst scenario, where public actors have the least ability to push for deep renovation.
 - 2.4. no presence of public properties (these include buildings where all properties have been acquired through a rent-to-own contract or housing cooperatives).

3. Non-Residential public buildings (schools, public offices, etc.)
4. Other non-residential buildings

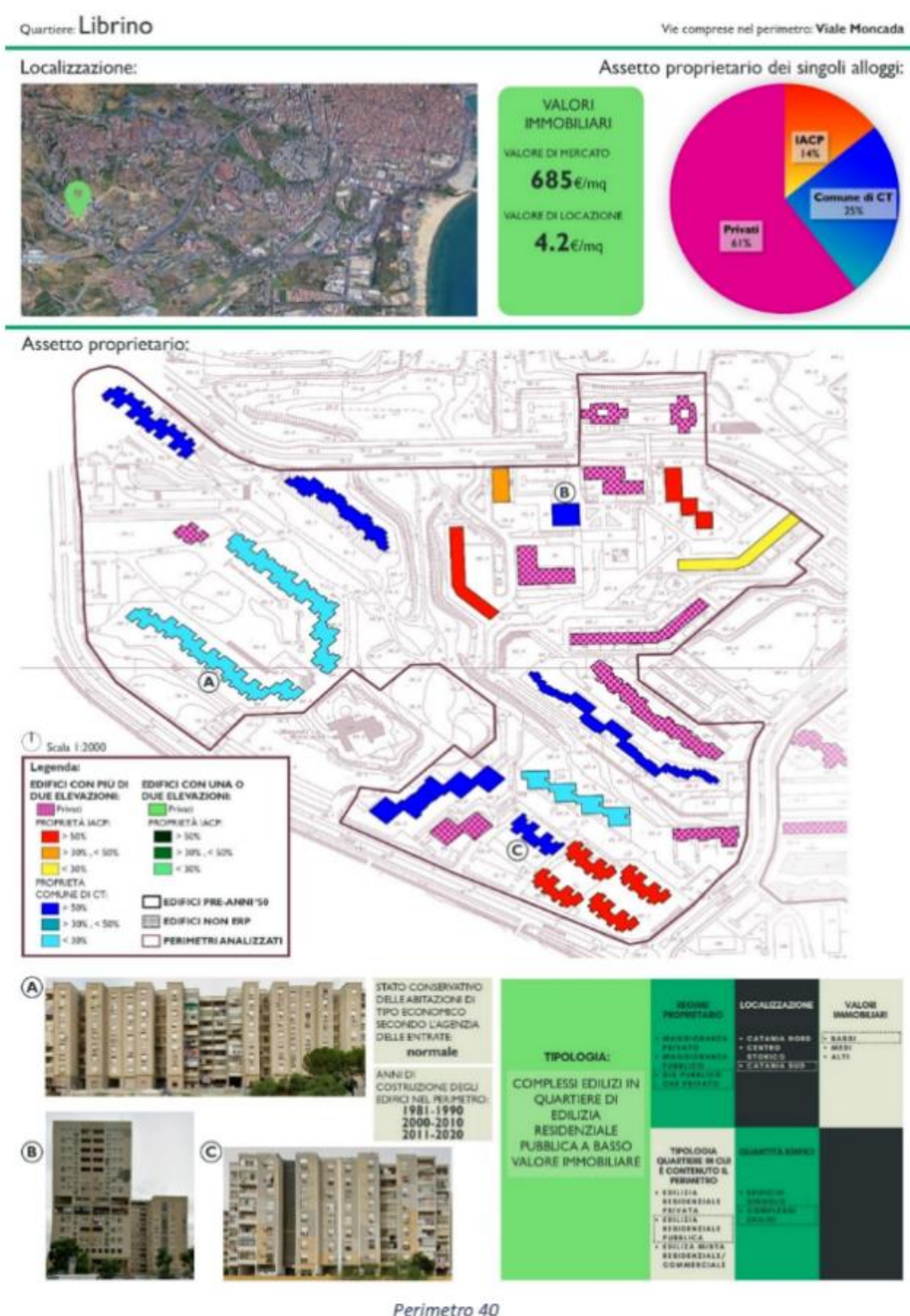


Figure 8. On the left: an example of the property fragmentation analysis developed during phase 2 in one of the Catania neighborhoods developed with a “Piano di Zona” called Librino.

To estimate the evaluation potential of buildings, the outcome of the property fragmentation analysis was compared with average real estate values based on public records used to determine property taxes compared with a sample of transactions whose data were retrieved from private real estate agencies’ websites. It was not a surprise to find out that most of the priority areas are

characterized by values that belong to the lowest category of the local real estate value spectrum. As a consequence, these are areas where investments in retrofitting can be planned based on 'use values' more than 'exchange values'. From a planning perspective, this means that it is necessary to push towards greater public investments at the neighborhood scale, also through the creation of multi-actor coalitions encompassing actors of a variety of sectors (construction, social services, etc.) that looks at the renovation of a single building within the framework of urban regeneration through an integrated approach (see subsection 3.2.6).

3.2.3 Preliminary analysis of the applicability of e-SAFE at the building scale

As we already mentioned in the previous subsections, during the meeting on November 8th researchers have taken on the task of developing a buildings analysis protocol to classify them based on their suitability for the e-SAFE technology (see appendix 3). For this purpose, researchers have identified three building types:

1. Buildings whose structural, functional, and aesthetic characters make them immediately retrofittable with the current e-SAFE technology. Isolated buildings are ideal, with a reinforced concrete framed structure, with 6 (or less than 6) stories, a window/façade ratio not exceeding 60%, with a ground floor without many garages nor windows, without bow-windows on the upper floors, located in a site where there is enough space to move the machinery required by the technology, and do not have constraints related to the change of exterior appearance.
2. Buildings whose structural, functional, and aesthetic characteristics make them suitable to the e-SAFE system, but only after further advancement of our technological knowledge. These are reinforced concrete buildings that can have up to 2 blind fronts, more than 6 stories, a window/façade ratio > 60% and/or a ground floor with windows and garages, 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.
3. 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.

Together with the parameters related to 'e-SAFE suitability', the survey protocol included the following 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.

Both sections of the protocol, allow the identification of priority buildings, where high suitability is combined with bad building conditions. The protocol uses graphic schemes and simple language since it is conceived as a tool that can be used by everyone interested in it.

In this first phase, the survey protocol has been tested and refined in a couple of Catania public housing neighborhoods, on residential buildings and will be further implemented in the next months.

3.2.4 The crowd-mapping protocol

Crowd-mapping defines an activity that involves a large number of people in the production of a map. This mapping approach is increasingly popular due to the spread of web-based GIS technologies, which are today largely used through smartphones and computers by users that more or less consciously share their data with crowd-mapping platforms (being google maps the most famous).

In the case of e-SAFE, a web-based crowd-mapping platform has been funded by the project to support an 'interactive' web-based communication campaign about the importance of deep renovation, under the assumption that people will more likely read web-based content if they have the possibility to interact with it (an assumption shared by most CLP based on previous direct experience of communication campaigns with similar goals). During the November 8th meeting, participants have revised an initial proposal by UNICT researchers, developing a crowd-mapping protocol (see Appendix 4) that consists of 3 steps:

1. **Registration.** Accessing the link to the **e-SAFE** platform – which will be located in the local platform section of the **e-SAFE** website – the user can decide to access the Catania map as a guest with view-only options or register as an active mapper. Registration required the subscription of informed consent. User personal data and urban-user data such as the city of residence and neighborhood of residence are collected during the registration phase (fig. 9).

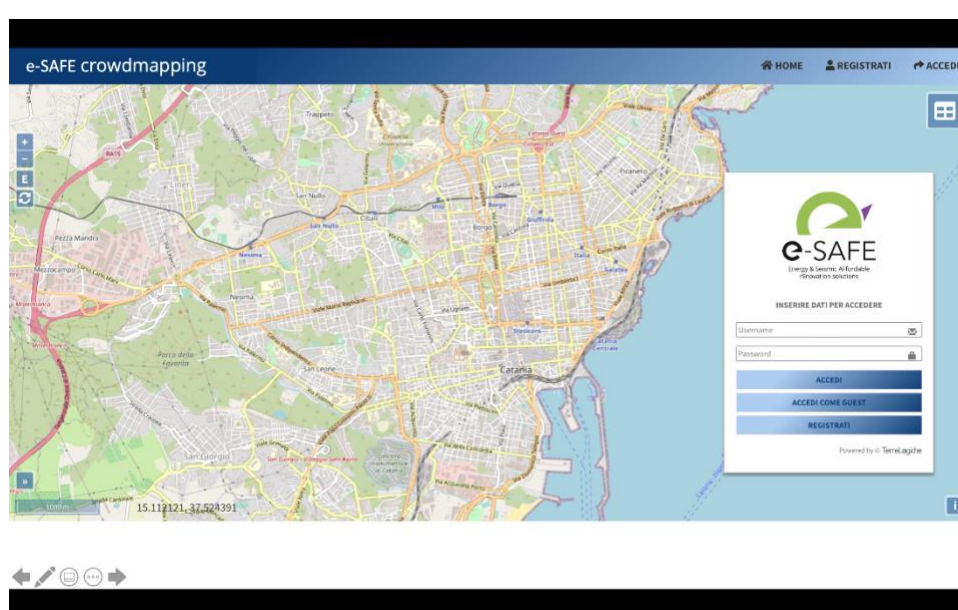


Figure 9. Registration page of the crowd mapping platform.

2. **Home-related mapping.** The user is given the possibility to map his/her own home on the map, and then is asked to:
 - Specify whether he/she is a tenant or an owner and the number of families living in the building (both this information can provide further data that are interesting to evaluate property fragmentation, which is one of the main obstacles to retrofitting);
 - describe their perception of the seismic preparedness, energy efficiency, and aesthetic quality of their home
 - share data in the case of the current or eventual use of incentives for deep renovation or on potential obstacles;

It is very important to underline that, being this highly-sensitive information able to alter public perceptions and real estate values, in order to reduce associated risks only mapped points will be publicly displayed while related data on perceptions will only be analyzed and presented in a non-geographic and aggregated manner.

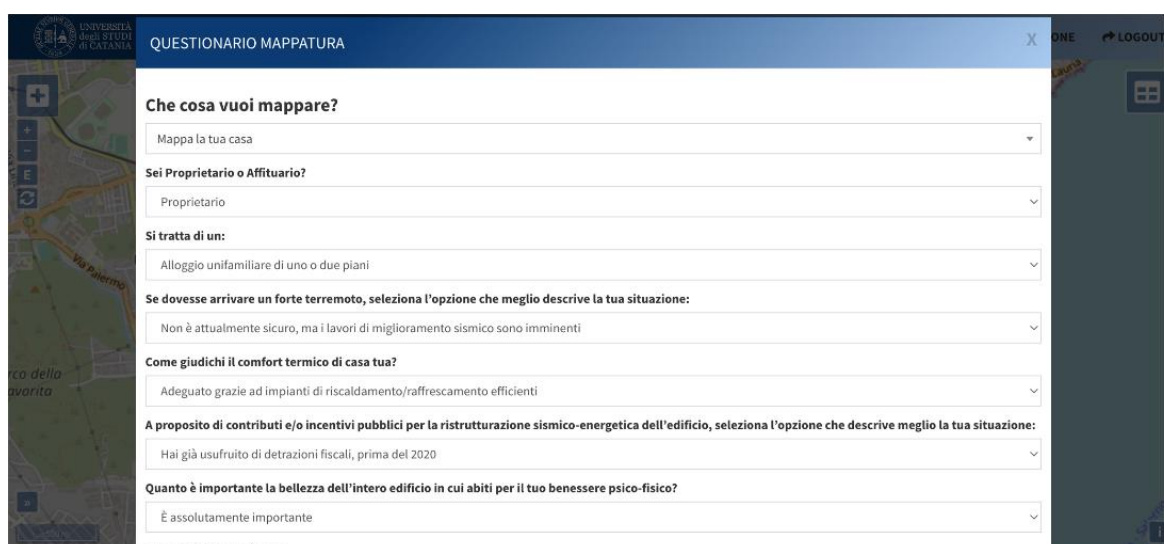


Figure 10. Home-related questions as they appear into the platform

3. **Mapping of public buildings in need of renovation.** As a third step, the user is given the possibility to map non-residential and highly symbolic public buildings (schools, public services, etc.) in urgent need to be retrofitted, sharing the reason why that specific building is considered a priority for the city. Here the platform integrates 'social media' functions since it allows each user to comment on buildings that others have mapped.

The protocol has been digitalized and will be practically tested by the local platform members on March 25th, before the official lunch of the mapping initiatives. Each partner has committed to the spread of the crowd-mapping link through their own social media channel and will encourage participants to face-to-face events in participating in the initiative.

3.2.5 The 'public housing' working group

A subset of local platform members – under the leadership of UNICT researchers and the director of ICAP (the Catania Public Housing Authority, which is also an e-SAFE partner) – have agreed on meeting periodically to focus on how to advance an integrated approach to public and affordable housing. This group is currently 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)
- Secretary-general of the Sicilian Cooperative League
- President of the "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 working group faces the incoming availability of public funds and fiscal incentives due to recovery policies that can be used to advance the renovation of public housing. However, it appears evident that there are still many obstacles to the actual implementation of deep renovation, especially an approach to renovation that can really benefit local residents.

As a first step, we have identified the need to study national best practices that can inspire local action. For this purpose, a group of public housing experts from Politecnico of Milan – prof. Massimo Bricocoli, director of the City and Regional Planning and urban studies Department at the Politecnico di Milano, and his collaborators Marco Peverini and Anna Tagliaferri – have come to

Catania on February 28th, 2022 to present their book on the case of 'the Stadera Neighborhood', in Milan (fig. 11). The case is of particular interest for the local debate, since it is a pioneer example of an integrated approach to the deep renovation of public housing that was carried out in the late 90s on the basis of an agreement between the Public Housing Agency and two local cooperatives. Unlike other cases involving a public-private partnership, Stadera did not imply the permanent alienation of public property or the financialization of the housing stock but has engaged the non-profit sector in an effort of enhancing the housing quality as well as housing services while keeping the public agency as a property owner.

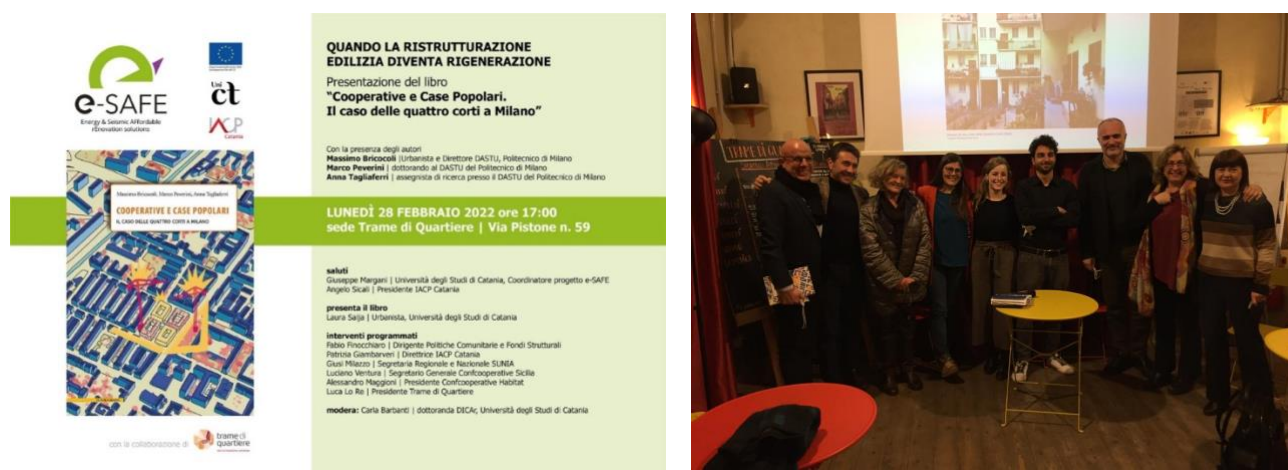


Figure 11. On the left: the flyer of book presentation; On the right: a closing moment of the event

The book presentation has been organized as a public event in the cafeteria of the Trame di Quartiere housing coop and was followed by a round table discussion that has involved all members of the e-SAFE CLP public housing working group. On the same day, experts from Politecnico di Milano have also been invited to share their knowledge on public housing renovation during a specific meeting with CLP members. During the meeting each member has shared his/her perspective and projects on the issue, referring to the particular obstacles that are being faced. In particular, from the conversation has emerged the fact that IACP is currently aggressively submitting renovation projects for funding to the Region and for the use of the Ecobonus 110 (through a project financing mechanism). However, the director has expressed the need to parallel renovation with a case-management approach that can help address significant obstacles: the legalization of *status* of those residents that are in a condition of occupier or in arrears, as well as property fragmentation. One of the main problems for the management of the public housing stock is the fact that management responsibility is shared with the Catania Municipality, which is currently significantly understaffed. While cooperatives and the union could provide support like in the case of Milan, still the regional normative framework can create some barriers.

Listening to the participants, experts from Politecnico di Milano have pointed out the fact that other cities in Italy are facing very similar issues and have suggested a series of other best practices that are currently under examination. The most interesting for the local audience is the C.A.S.A. Aler project (<https://aler.mi.it/socialita/progetto-casa/>), where renovation is associated with the establishment of a local 'multi-service' presidium, where social service, the public authority and sanitary assistance coexists and support residents with a one-stop-shop logic.

The public housing working group is planning to meet by the end of March to examine possibilities of action further.

3.2.6 A national event to frame deep retrofitting through urban regeneration

As part of the collaborative events to be planned by the local platform, one of the CLP members, the Catania chapter of the National Association of Construction Building Companies (ANCE – Associazione Nazionale Costruttori Edili) has expressed interest in engaging all members in the organization of a national event that can allow to frame ‘deep renovation’ within the broader framework of Urban Regeneration: this comes from the evidence that both e-SAFE and other technological systems for deep renovation do not spread out and impact the retrofitting market for a variety of obstacles and barriers that overcome the scale of the single building but relate to the urban scale, i. e. can only be addressed through urban policies and programs. The urban regeneration framework is also particularly relevant for the local debate, where the approval of a new Regional Urban Planning Law on 19th August 2020 refers to the term ‘urban regeneration’ to push local municipalities to revise their comprehensive plans and building codes with the aim of reducing land-consumption and prioritizing interventions on the existing urban areas.

For these reasons, ANCE is promoting the organization of a CLP sponsored national event on urban regeneration planned for September 2022, made of a combination of national speakers from various sectors (public, private, and non-profit and grassroots, paralleling the composition of the CLP) and workshops engaging participants from the city and guest speakers into practical activities that look at urban regeneration prospects in various Catania neighborhoods. The September event is conceived as a final step of an ongoing process that will imply meetings with stakeholders operating in specific Catania neighborhoods that are currently under consideration to become urban regeneration targets within the future City of Catania Comprehensive Plan.

3.3 Criticalities and future prospects

This deliverable was due at a time when a lot of co-productive activities are still ongoing and we cannot assess whether the strategy adopted is entirely successful. However, it is possible to share some critical reflections on the actions taken, their effects, and how to enhance the efficacy of the next steps. The first steps up to the KoM and the development of a preliminary co-production strategy were relatively effective, despite the limitations deriving from the COVID pandemic: we were able to establish a fairly representative CLP and the preliminary work plan was easily shared by members. However, the implementation of the co-productive strategy has not been as effective and straightforward. The heterogeneity of the components of the Local Platform and the difference between their interests makes implementation complex and time-consuming. In his current status two main interest groups could be identified in the Local Platform:

1. Members such as Developers, Professionals, and other representatives of the construction sector are strongly interested in the deep renovation of private real estate, as an opportunity to increase their volume of affairs. Although there is a focus on raising citizens' awareness of the theme of seismic energy improvement, this interest is projected towards private housing and especially in those areas of the city characterized by social groups with relatively high capacity of accessing current governmental incentives (i.e. super bonus 110%).
2. Members such as the Catania Public Authority (IACP), tenants unions, appointed and elected officials, and social scientists have a greater interest in the recovery of public real estate, with particular attention to Public Housing, where renovation issues cannot be detached from other socio-economic and cultural issues. These actors can easily collaborate with civic associations and non-profit organizations that, in general, are committed to pushing toward urban regeneration as an occasion to support the rise of active citizenship.

We have realized, during this first eight months of work with the local platform, that, even if it is important to push for an ‘encounter’ of a different perspective, implementation was made easier

within these two parallel streams of actions, but always challenging members to work within a shared vision.

Finally, in the coming months, thanks to communication activities, crowd-mapping and local virtual pilots, the direct involvement of tenants (especially those who live in distressed areas) will also be enhanced. The aim is to better understand how the Local Platform can act to push retrofitting in these areas, especially in terms of financial tools, funds and multipurpose strategy, adopting an integrating approach.

4. STAKEHOLDER ENGAGEMENT: TIMISOARA AND BUCHAREST LOCAL PLATFORMS

The **e-SAFE** project selected two virtual pilot buildings through a competitive, two-stage selection process, aimed at testing innovative technologies for energy efficiency and seismic retrofitting (described in D2.4 and MS6 – selection of virtual pilots). A total of 32 applications were received from seven countries, with Romania contributing the largest number. Following a detailed evaluation of technical compatibility and stakeholder engagement, two buildings were chosen: the Sports Banatul High School in Timișoara (Romania) and a residential building in Bucharest (Romania). Both sites were selected for their strong commitment to co-design, their diverse socio-economic and functional contexts, and their potential to demonstrate **e-SAFE** technologies across different building types, climates, and end-user groups.

These pilot buildings and communities served as key testbeds for the **e-SAFE** stakeholder engagement process, involving active collaboration with key local actors and stakeholders to tailor renovation solutions to the specific needs of each site.

4.1 Timisoara Local Platform

The Sports Banatul High School in Timișoara was one of the two buildings selected as part of the **e-SAFE** project's pilot phase following a rigorous two-stage selection process. In total, 32 applications were submitted across seven countries, and after careful evaluation of technical suitability and stakeholder engagement, the school was chosen for its potential to showcase a range of **e-SAFE** technologies. The building serves a diverse group of students aged 6-19 years and features a total surface area of 806 m². The school's heating system was district-based, with radiators for heating, and there were no existing cooling systems, making it an ideal candidate for implementing energy-efficient and anti-seismic renovation solutions.

The pilot aimed to empower the local community by actively involving them in the stakeholder engagement activities. This hands-on approach allowed students and teachers to understand the importance of energy-saving measures and to contribute to the aesthetic and functional aspects of the building design. The collaboration between municipal authorities and the local educational system was essential for addressing the immediate renovation needs while also fostering long-term educational benefits for the students involved.

BPIE together with UNICT and strong support from local contacts (president of the Romanian Association of Building Services Engineers), organized a public event on the 30th of March on green and safe schools for Timisoara, being a perfect opportunity to learn, discuss and imagine how to build greener and safer schools for all. Several key stakeholders coming from the Mayor's office, a representative from the financing and renovation programs in Timisoara, and the buildings in the heritage of the Timis County Council but also representatives of the consortium, formed the agenda. There was a great participation in the event and the event was positively evaluated by several stakeholders. BPIE and UNICT representatives were also features in Timisoara's national TV highlighting the importance of the project.

Lessons Learned

The Timișoara pilot demonstrated the need for a comprehensive approach to complex renovations that combines technical solutions with stakeholder engagement. Key lessons include:

Effective stakeholder collaboration: A successful renovation involves more than just technical expertise. Actively involving local communities and other relevant stakeholders can ensure the

project meets the needs and aspirations of those it will serve. The final event brought together about 50 stakeholders, and the project was featured in local news – highlighting that co-design can in fact be an incredibly powerful ‘sales’ tool raise wider awareness and create demand for renovation programmes.

Long-term impact on education and urban development: A key message coming from a range of stakeholders during the final event was that the co-design process was a transformative educational experience for students. By participating in the design of their own school, students learned that they could make a difference in their environment. This instilled a sense of empowerment and a long-term commitment to positive change, which can extend beyond the school renovation to other areas of their lives. This intersection of education and urban renewal offers a unique opportunity to shape the next generation of engaged citizens and professionals.

Municipal decision-making and challenges: During the final event, Carmen Proteasa, Counsellor of the Municipality of Timișoara, emphasized the complexity of municipal decision-making. Local authorities are tasked with balancing technical needs with broader community priorities. This requires careful decision-making and resource allocation to meet both immediate and long-term needs. Timișoara’s municipality has initiated 13 school renovation projects, marking a shift toward a more active and coordinated approach to urban renewal. However, securing adequate funding remains a significant challenge.

4.2 Bucharest Local Platform

The Bucharest pilot focused on a residential apartment building in the heart of the city, chosen for its seismic vulnerability and energy inefficiency. The building was a concrete-frame structure built in the mid-20th century, with reinforced concrete walls and single-pane windows, contributing to poor thermal insulation and high energy consumption. The renovation aimed to address energy performance, seismic safety, and community well-being in one comprehensive package. The total net surface area of the building is 1,872 square meters, housing 20 residential units, with the ground floor dedicated to residential use. Despite the seismic risk, the building has never undergone significant renovation, making it a prime candidate for the e-SAFE project’s innovative technology and co-design process.

The local platform created in Bucharest placed a strong emphasis on the involvement of various stakeholders with the help of Municipal Administration for the Consolidation of Buildings with Seismic Risk (AMCCRS), as main local partner. By fostering collaboration between municipal authorities, residents, technical experts and construction practitioners, the Bucharest Local Platform set a precedent for how to approach the renovation of residential buildings in a way that reflects the needs of its residents.

Lessons Learned

Active stakeholder participation: The renovation process in Bucharest emphasized inclusive stakeholder involvement, with relevant experts and practitioners actively participating in the events organised. Regular workshops and meetings were held to ensure the design aligned with residents’ needs, fostering a sense of ownership and community pride. This process demonstrated that involving residents early on is crucial to creating spaces that meet their needs and ensuring long-term acceptance and success of the renovations.

Training and capacity building: In addition to physical upgrades, the project emphasized training and capacity building for both local authorities and other stakeholders. Workshops were organized to educate residents on sustainable living practices, including energy-saving habits and how to operate new building systems. This empowered residents to maintain and optimize their

energy-efficient systems, helping ensure the long-term success of the renovation. Community education emerged as a key component of the pilot's success, highlighting the importance of empowering residents with the knowledge to maintain their new, more sustainable environment.

Long-term urban strategy and urban resilience: The Bucharest pilot also played a role in a larger urban resilience strategy, contributing to sustainable urban development within the city. Public housing in Bucharest faces both energy inefficiency and seismic risks, and the pilot contributed to meeting the city's climate goals by addressing these challenges. The project highlighted how public housing renovations can be part of a broader urban sustainability strategy, helping cities become more resilient to both natural disasters and the impacts of climate change. The dual focus on energy efficiency and seismic safety provided a valuable model for similar urban renovation efforts across Europe.

Community capacity building for sustainable living: The success of the project hinged not only on technical solutions but also on community engagement and capacity building. By involving residents in co-design and providing training on sustainable practices, the project ensured that the benefits of the renovation would extend beyond the physical upgrades. This approach demonstrated the importance of creating synergies between technical innovations and social engagement, ensuring that residents could continue to benefit from the renovated building in the long term, while contributing to the city's broader sustainability efforts.

5. GUIDELINES FOR STAKEHOLDER ENGAGEMENT WITHIN LOCAL PLATFORMS

The goal of e-SAFE Local Platforms is to bring together urban stakeholders so that the topic of deep renovation can become a shared concern and a priority of the large public. Making deep renovation a central topic can help raise awareness about the necessity of decarbonizing the building stock to improve its safety, quality and energy efficiency. As previously discussed in Section 3, the specific case of the CLP has shown various possibilities to engage local stakeholders sharing a transformative will in a time frame from medium to long term. In the Catania case, it was deemed necessary to frame the topic of deep renovation within the larger framework of urban regeneration, i.e. a process in which the physical renovation of a building can be integrated with social and economic issues according to what is called an integrated approach to deep renovation.

Starting from the **literature review** of Section 2 and the **lessons learnt from the activities carried out within the local platforms in Catania, Timisoara and Bucharest** detailed in Section 3 and Section 4, this chapter contains a set of guidelines on how to set up Local Platforms in other cities. In particular, the guidelines developed in this section were conceived and tested in the e-SAFE real and virtual pilots, where the e-SAFE team tested the entire project implementation process. The testing and application of Deliverable D2.3 “Preliminary e-SAFE Engagement Protocol” in the two virtual pilots allowed transforming these guidelines into a general “Final e-SAFE Engagement protocol” (Deliverable D2.9), to be used after the project every time e-SAFE is applied in other European cities for simultaneously raising awareness and marketing purposes.

5.1. Commonalities and differences between the real and virtual pilots

Two general principles were applied within the three local platforms upon which the guidelines should be based:

- Adoption of a co-production paradigm during the entire stakeholder engagement process. Co-production implies that participants of the Local Platform do not only share inputs and ideas with each other, do not only partake in responsibilities on outcomes, but they also take an active role over the implementation, even if only of a portion of such outcomes.
- Context-sensitivity. The following guidelines are designed for replicability and include levels of flexibility so that they can be tailored to the local context. They are meant as a series of ‘general instructions’ focusing on those steps considered strictly necessary to stakeholder engagement activities and do not strive to be comprehensive.

A further specification is also needed. In Catania, the timing and working methods have been deeply affected by the COVID-19 pandemic and the consequent social restrictions. On the contrary, the following guidelines are conceived in a **scenario without** (or almost without) **social restrictions** related to the pandemic.

5.2. Initial steps of the Local Platforms

In what follows, guidelines are organized into steps to be developed in chronological order (with some overlapping in certain cases):

Step 1 - Preliminary Stakeholder identification (estimated duration: 1 week)

Local actors who are more or less directly involved in the application to the call for virtual pilots are expected to directly collaborate with e-SAFE partners in the development of preliminary sub-steps:

1. A meeting with local actors and e-SAFE partners with the aim of co-producing the goals of the Local Platform and the categories of the list of stakeholders. Reframing the general e-SAFE goals based on the key issues relevant to the local context. For CLP it was the urban regeneration whereas for Timisoara and Bucharest it was about the importance and benefits of combined seismic and energy renovation. For other sites, it can be for instance to collaboratively update local renovation targets, to collectively identify barriers and enablers for scaling up renovations in the city, to create connections and synergies between key stakeholders in the renovation sector etc. The meeting ends with the request to local actors to review the list of primary and secondary categories of stakeholders, as well as their potential interests in the project, as shown in table 2 (subsection 3.1.1); the table should be used as a template and can be modified depending on local conditions.
2. Identification of names fitting with the ideal stakeholders' categories, based on personal networks and desk research.
3. Spotting the gaps in the stakeholder list and making an extra effort to balance the percentage of different types of stakeholders (see Fig. 2 and Fig. 3 in Section 3.1.1). Based on the CLP experience, research institutions and public actors have shown more interest in playing a leadership role within the work of the platform. Thus, in this phase, it is important to give special attention to these types of stakeholders (public and private universities, research institutes, local authorities, etc.) who are expected to share an interest in fostering awareness about seismic and energy renovations, as well as provide support in the activities of the Local Platform in the medium-long term.

Sub-steps 1 to 3 can be carried out through a combination of structured working meetings that can be held both online or in presence and can also involve the use of a shared spreadsheet for the creation of the stakeholder list. It is important to keep such a list 'open' to ensure that it includes stakeholders who are directly interested in the issue and those who may be less interested in this initial phase, but who can raise issues not yet considered. The same document can also be used to monitor participation and engagement throughout the whole engagement process.

Step 2 – First round of engagement & analysis of local interests' (estimated duration: 4 weeks)

The awareness or the personal motivation about the benefits of combined seismic and energy renovation may differ among and within stakeholder groups, and some have more influence than others. Mapping of awareness and interests of the stakeholders, as well as co-defining the main barriers and enablers to scale up renovations in the city, is a key step to foster the work of the Local Platform within a co-production perspective. The aims of the first round of engagement activities targeting stakeholders are to learn about e-SAFE project and to share information (bidirectional communication) and he/she is encouraged to join the platform by the understanding that it is relevant to his/her specific interests.

In CLP this activity was based on a semi-structured interviews campaign, i.e. each name identified in the stakeholder list was interviewed following the attached protocol (Appendix 2). Based on the previous experience, this activity can be simplified by using focus groups, with groups of stakeholders that are expected to share the same types of interests and using a revised version of the protocol. In the revised version, section 3 could be less specific, and the question could be generic, such as 'What kind of problems do you think your city is facing related to deep

renovation? What you think we need to take into account to get a better city' instead of referring to the topic of 'urban regeneration', which was relevant in Catania.

This phase could be made quicker if engagement is based on the prioritization of stakeholders based on influence, proximity, urgency, or experience in relation to the project (see stakeholders circle methodology, Yang 2014). However, at this stage, this approach risks preventing the participation of less influential stakeholders who, for this very reason, might be more interested in joining the Local Platform.

At this stage:

- Data collection and analysis should be carried out not only by e-SAFE research but also with the direct involvement of several local actors, with a redistribution of responsibilities.
- Questionnaires and other forms of non-direct engagements are not suitable since they do not encourage bi-directional and in-depth communication. Personal interactions – in person, video calls, by phone – are preferable.

Step 3 - The launch of the Local Platform (estimated duration: 5 weeks)

The first round of engagement was followed by the public launch of the Local Platform. The Kick-off Meeting was conceived as a public event combining two 'blocks' aimed at two different purposes. Formal plenaries for public presentations were meant to facilitate the transfer of part of the 'process' ownership' from e-SAFE partners, especially UNICT, to key actors of the local scene (especially public authorities). Working sessions, organized around priorities emerged from the analysis of the interviews, to develop an agenda for the CLP based on co-production (making participants able to commit to working collaboratively that reflects their pre-existing plans). We believe this method can hold some validity for the virtual pilot but with limitations. Since e-SAFE partners UNICT and IACP are also key players in the renovation marked in Catania it was relatively easy for them to engage other players and use the Kick-off Meeting to begin this process of ownership transfer. In the case of virtual pilots, it is very likely that this will no longer be the case.

Therefore, it is suggested to begin this phase with not a public but only an 'internal' Kick-off Meeting with those stakeholders who are successfully engaged during step 2 (where successfully means that they were available for the interview and replied yes to the question about their interest in joining the Local Platform). This initial group of stakeholders is targeted to become a sort of steering committee that, for the process to be successful, should be interested in acquiring some ownership of the process. In this perspective, the Internal Kick-off Meeting is aimed at getting people interested in playing the role of 'steering committee' of the larger engagement process. In this perspective, the internal Kick-off Meeting agenda could be as follow:

- Greetings and visual presentation of e-SAFE
- Researchers share the main outcomes of interviews or focus groups, pointing out "shared key issues" and main differences.
- Working session for the development of a draft version of the Local Platform work plan; such a plan needs to include the organization of a public Kick-off Meeting aimed at launching officially the Platform and engaging other local stakeholders (approximately in a month).

In the week after the meeting, e-SAFE partners will collaborate remotely with the steering committee to co-organise the public Kick-off Meeting, asking each member to use their social capital to engage additional stakeholders that are relevant in relationship with actions ideas that emerged during the internal Kick-off Meeting, and, in general, helping with the engagement of the large public.

The public Kick-off Meeting can follow the schedule and format used in Catania. The working sessions can have the goal of detailing the action plan with milestones, and timing (especially dates for future meetings) based on participants' availability.

Since, parallel to the work of the Local Platforms, virtual pilots will involve e-SAFE experts in the development of a renovation project on a pilot building using the e-SAFE technology based on co-design activities (the direct engagement of residents in the design process, Task 2.7), during step 2 and 3, it might be useful to think about ways of combining the activities of the Local Platforms with co-design events. This was not possible in Catania, where COVID-19 had significantly slowed down and misaligned the pilot co-design activities and the CLP ones. On the contrary, in the context of virtual pilots could be good to create occasions of interaction between the two scales of engagement (the building and the urban scale).

5.3. Suggestions for the development of the work plan

It is important to point out that Local Platforms are voluntary aggregations of people that share an interest in deep renovation and to increase their chance of making a difference in their local contexts. Ideally, they would conceive and perform public engagement on a permanent basis, considering themselves open groups who welcome newcomers at all stages. For this reason, the work plan that is developed during the initial steps should be highly dependent on local stakeholders' specific indications and priorities but should also take into account the following general observations:

- It is essential to equip the work plan of the Local Platform with a communication plan based on the work that is eventually accomplished. This plan can streamline interaction and create a message that activates the audience. An effective communication plan must be structured for different audiences and use existing communication channels.
- It should balance online, remote activities and interactions within face-to-face events, since personal interactions are crucial when it comes to the need of fueling collaboration and co-production. Alternating face-to-face meetings once a month or every two months, with more frequent remote or online interactions, usually is a good compromise. Within CLP, it has worked well the idea of 'sponsoring' potential events that were already in the plans of local actors and using more frequent meetings for single working groups that combine deep renovation with other local key issues.
- Within CLP, there was the need to balance formal and complex meetings with quicker, ad-hoc and informal meetings around specific tasks.
- In the case crowd-mapping will be one of the activities of the Local Platforms, it is possible to use the platform developed within the project (owned by UNICT), adjustable to the local needs. However, the use of this platform cannot be guaranteed after the end of the e-SAFE project for issues related to GDPR issues. In this case, it is possible the use of already existing GIS platforms (i.e. my maps, GIS Cloud, ReTer) in combination with other platforms for the collection of non-geographic data.

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APPENDIX 1 - OVERVIEW METHODS – INSIGHTS FROM LITERATURE REVIEW

	Methods	Techniques	Description	Advantages/Limitations	Source
Stakeholder Identification	Stakeholder Circle Methodology / Social Network Analysis	Stakeholder Circle: <i>Workshop, focus group, stakeholder circle diagram</i> Social Network Analysis: <i>Snow-ball sampling, interviews, questionnaires</i>	Different approaches to stakeholder identification, analysis and prioritization.	Provides two alternative approaches to identify stakeholders, analyses their role in a project and the relations between stakeholders. This information is essential to develop suitable engagement strategies and proper stakeholder identification is beneficial for the success of a project.	(Yang 2013)
	Stakeholder mapping	Stakeholder identification, determination of stakeholder concerns, stakeholder impact analysis (power interest grid)	Method to identify and classify stakeholders based on shared interests and characteristics. The stakeholder impact analysis gives indications of how to approach them.	Determining the objectives of stakeholders provides insights where potential conflicts of interest can arise, in particular when external stakeholders are involved. The power interest grid can be repeated over time to assess to what extent stakeholder interest and influence have changed.	(Berardi 2013)
Analysing stakeholder interests and objectives	Q-methodology	Stakeholder identification techniques, individual interviews, ranking of statements/images, factor analysis	Method aimed to uncover different viewpoints among stakeholders by letting interviewees sort a broad set of statements or images about a project without prescribed order.	The benefit of Q-methodology is that it provides insight in the <i>variety of perspectives</i> about specific projects. This method allows important stakeholders to indicate their concerns and issues in an unbiased way. The method does not indicate what share of all stakeholders adheres to specific perspectives.	(Cuppen et al. 2016) (Lobinger and Brantner 2020)

	Storytelling	Story-spine technique, Discourse analysis, concordant analysis, story genres	Use storytelling techniques to learn about stakeholder concerns and values	<p>Storytelling is an effective tool to understand the human element in energy use and can help to learn about cause-effect relationships important for participants or developing shared goals and visions. An advantage is that it has the potential to empower end-users who are influenced by projects.</p> <p>The method focuses on the macro level of a project and linkages between complete project elements.</p> <p>This makes storytelling an inclusive method that allows less technical stakeholders to engage with a topic and to share their own views without being prescribed by a moderator what to say, but makes it difficult to discuss technical details.</p>	(Rotmann 2018)
	(Modular) Participatory backcasting (workshops)	Descriptive statistics, causal-loop diagrams, stakeholder analysis, brainstorming, storytelling, why-question technique, criteria/sensitivity testing, modelling, project management techniques, interviews	Formulate a strategy based on an envisioned desirable future and steps necessary to achieve it	<p>Participatory backcasting is a scalable and adaptable methodology that can help overcome social barriers and facilitate institutional change. A great benefit is the flexibility to adapt the method to the local context and action-oriented outcomes.</p>	<p>(Pereverza, Pasichnyi, and Kordas 2019)</p> <p>(Svenfelt, Engstrom, and Svane 2011)</p> <p>(Quist 2007)</p>
	Focus groups	Stakeholder identification techniques, moderation techniques, content analysis (coding, discourse analysis, conversation analysis, ranking).	Group method in which the initiator facilitates discussions between participants to learn about values and concerns	<p>Focus groups are widely applied in the building and construction sector and are ideal tools to analyse key concerns from important stakeholders.</p> <p>Within the research papers analysed focus groups mainly involve expert stakeholders, but the method has the potential to be used with other types of stakeholders as well. The method fosters debate but involving groups also entails risks on group biases.</p>	<p>(Caporale et al. 2020)</p> <p>(O.Nyumba et al. 2018)</p> <p>(HIRL, n.d.)</p> <p>(California Energy Commission 2016)</p> <p>(Straub and</p>

					Frankena 2018) (Kamari, Corrao, and Kirkegaard 2017)
	Delphi method	Stakeholder identification techniques, survey techniques (predictions, prioritization, ratings), statistical analysis	The Delphi technique involving a group of expert stakeholders receiving a survey in which prioritization of issues, prediction of results, or elaboration of questions is filled in independently. Afterwards, the same experts receive back aggregated results and are asked if they re-consider their answer	The Delphi method helps to circumvent group biases and gain insights into the complexity of construction projects. The benefit of Delphi-methods, for example compared to focus groups, is that there is a smaller chance of group bias effects because stakeholders fill in the survey independently and get the chance to revise their answers after results are aggregated. This method is suitable for the quantification of results. A disadvantage is that the technique is mostly used in literature to collect expert advice, rather than broader stakeholder groups. The quantitative nature of Delphi methods does not allow for in-depth discussions.	(Flostrand, Pitt, and Bridson 2020) (Li et al. 2018) (Kermanshachi and Safapour 2019)
Engagement process design and implementation	Community-based ownership models (Financial)	Co-operatives, partnerships, non-profits, community trusts, housing associations	Different models in which communities can benefit socially or financially from on-site renewable energy generation	Community ownership models can bring concrete financial and social benefits from on-site renewable energy projects for building owners and communities.	(IRENA 2020) (Roberts, Bodman, and Rybski 2014)
	Acceptability process & mock-up building	Open and transparent communication of project information with tenants,	Co-creative design process allows tenants to co-shape their home	Approach to find out key concerns of tenants in social housing living in dwellings to be renovated with the benefit that it focuses on how tenants experience home, what they do	(Guerra-Santin et al. 2017)

	models	familiarising tenants with new design through mock-up building models, co-creation of design solutions, semi-structured interviews	experience, which was tested in real scale mock-buildings that give tenants an idea how their renovated home will look like.	at home and why. Information was obtained based on interviews and the use of a mock-up building model to simulate scenarios, that were used to adapt the renovation solution design by the building designers. The benefit is a human-centric approach to renovation and highlights key concerns for tenants during the renovation.	
	Relational project delivery methods (RPDMs)	RPDM Project definition techniques, feasibility assessment, stakeholder identification, face-to-face interviews, snowball sampling	Holistic and 'relational' project delivery process with more interactions between stakeholders and early stakeholder engagement during project definition	Relational project delivery methods have the benefit that they aim for early stakeholder engagement, collective responsibility, a focus on optimal outcomes and joint project control. Case studies indicate potential value for overcoming barriers in renovation and potential for co-creation.	(Aapaoja, Haapasalo, and Söderström 2013)
	Co-creative design process / design participation	Personal interviews, 3D BIM model (WoonConnect) + workshop on how to use it, surveys	Combination in-depth interviews and digital BIM tools to allow tenants to see what the impact of the renovation would be on their home and what effects of their own behavior are on building performance.	Co-creative design processes generate deep insights into concerns and issues of building end-users, and can provide a feeling of co-ownership of the final solutions implemented. Co-creative design processes can require more resources than a conventional design, although it can prevent issues later on in the renovation process.	(Fernandez et al. 2020) (Lee 2008) (Guerra-Santin et al. 2017) (Boess et al. 2016)

APPENDIX 2 – STAKEHOLDERS INTERVIEW PROTOCOL

A brief e-SAFE Presentation

This interview is conducted in the framework of the e-SAFE project, funded by EU Horizon 2020 program to a research consortium of 14 partners from 8 different European countries and coordinated by the University of Catania.

Informed consent used during the interview

You are being interviewed as part of a research study titled 'Energy and Seismic Affordable renovation solutions', aimed at the development of a market-ready deep renovation system for non-historic buildings, whose ability to uptake the EU market relies on the combination of decarbonization goals with earthquake safety (where applicable), indoor comfort, reduced implementation time and cost, affordable financial options, reduced occupants' disturbance, increased aesthetic and functional attractiveness. You are being recruited to take part in this research because you represent an organization that we expect has a direct interest in promoting deep renovation of the existing building stock within the local context.

The persons in charge of this study is prof. Laura Saija, Associate professor in city and regional planning at the University of Catania, and she collaborates with field assistants Giulia Li Destri Nicosia and Carla Barbanti, respectively post-doc researcher and PhD students at the University of Catania. By doing this study, we hope to learn about your views on the importance of deep renovation in Catania, as well as about obstacles faced by it and strategies to overcome such obstacles.

The interview consists in a list of a mix of open-ended and multiple choice questions and will be conducted by [NAME OF THE INTERVIEWER] and at [AT TIME OF YUR CHOICE/AT A CERTAIN TIME AND PLACE, ETC]. Your answer will be audio-recorded and transcribed. We expect the length of the interview to not exceed 60 minutes.

For taking part of this study, you will not receive any rewards or payment, you will not get any personal benefit and will not have any costs associated with it. To the best of our knowledge, we do not anticipate any risk associated with your participation in the study. Even if you decide to be interviewed as part of the study, you can stop at any time during the interview.

We will make every effort to keep private all research records that identify you to the extent allowed by law. Your information will be combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. You will not be personally identified in these written materials. We may publish the results of this study; however, we will keep your name and other identifying information private. We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. We will promptly erase our records from portable storage devices that are used for temporary exchange. We will store records in personal or shared drives only if they are protected by security passwords. All personal records but contact information will be deleted no

later than one year after the completion of the study.

If you have questions, suggestions or concern, do not hesitate to contact:

- Laura Saija, laura.saija@UNICT.it, office phone: 0957382517

If you have any questions or concerns about your rights as an interviewee in this research, contact the president of UNICT Ethical commission prof. Maurizio Caserta, caserta@UNICT.it

We will give you a signed copy of this consent form to take with you.

_____ (Printed name of person agreeing to take part in the study)

_____ (Signature of person agreeing to take part in the study)

_____ (Date)

Section 1 – Stakeholder presentation

Your name is [INSERT FIRST AND FAMILY NAME] and we have contacted you [INSERT ROLE AND NAME OF THE ORGANIZATION REPRESENTED BY THE INTERVIEWEE] – is this correct or need to be rectified? Is there anything else to be added?

- What is the general mission and the objectives of your organization?
- What are your precise responsibilities within your organization?

Section 2 - The patent [for professionals and designer only]*

In terms of technology, the innovative concept of e-SAFE consists to plate the exterior part of the building with the combination of modular panels for the thermal-acoustic insulation (e-PANEL) and structural system that increases the anti-seismic performance, using two basic solutions (e-CLT and e-EXOS). The panels may be used on most non-historic and concrete structure buildings and can be modulated based on seismic zone and other local conditions.

- What is your opinion on this patent? Do you think it is necessary and useful? Why?
- Where could it or should it be used and why?
- In your opinion, are there any obstacles in the use of e-SAFE technology? Do you suppose these obstacles can be overcome? How?

Section 3 – Urban Regeneration in the distressed areas of Catania

In this part, I'll ask you some questions on the concept of leveraging the exploitation of the e-SAFE patent as a trigger to stimulate the process of urban regeneration in distressed areas in Catania.

- How do you consider the issue "Regeneration of distressed urban areas" in relation to the Catania Metro Area?
 - A priority
 - It is important even though not a priority

- Scarcely relevant
- Not relevant
- Why?
- In our opinion, what should be considered a priority in the urban regeneration process and why?
- What are the main obstacles faced by Urban Regeneration in Catania?
- Who can help overcoming these obstacles and how?
- In your opinion, how can the e-SAFE technology contribute to raise the question of socio-economic gaps characterizing this Metro Area?

Section 4 – Potential role of interviewed or his/her organization

- Which role can you and/or your organization/association play to promote the importance of seismic-energetic retrofitting and urban regeneration in Catania distressed areas?
- What of your tools and skills might you bring to the process?
- Which resources can you use?
- Do you want to collaborate with others local actors? Who? (potential partner)

Section 5 - Engagement and snowball effect

- the e-SAFE project includes the establishment of a local working group made of local actors interested in boosting energy-seismic retrofitting and urban regeneration of distressed neighbourhoods; would you and/or your organization be interested to join the group?
- If so, what are your preferences and/or availabilities in terms of time?
- In the local context, which other actors (individuals, organizations, entities, public authorities, etc.) would be important to engage and why?

Last section

- Do you have any questions for us?

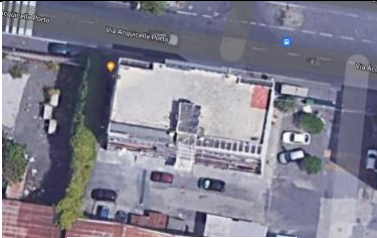

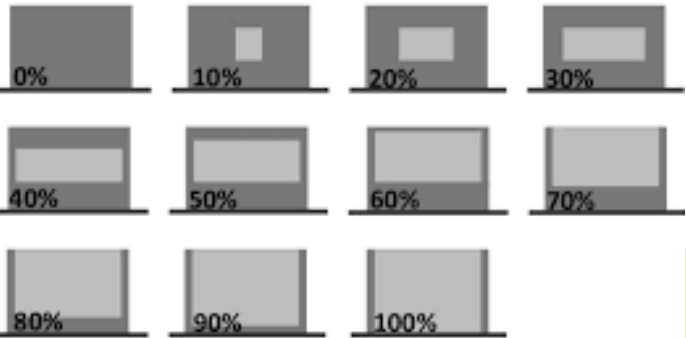
APPENDIX 3 - e-SAFE APPLICABILITY



Building Analysis Protocol

DATA

NOTE/IMAGES

YEAR OF CONSTRUCTION	
STRUCTURAL SYSTEM <input type="checkbox"/> Reinforced Concrete Frame <input type="checkbox"/> Other (es. Unreinforced Masonry, Reinforced Masonry, Steel Frame, etc. [please specify])	
USE <input type="checkbox"/> Residential <input type="checkbox"/> Commercial <input type="checkbox"/> Office <input type="checkbox"/> Mixed [please specify]	
BUILDING FEATURES	
<ul style="list-style-type: none"> • TYPE OF BUILDING: <input type="checkbox"/> Detached Building <input type="checkbox"/> Linked Building: <input type="checkbox"/> <i>Two blind fronts</i> <input type="checkbox"/> <i>One blind front</i> • No. OF FLOORS: Above ground [Please specify]:..... Underground [Please specify]: • WINDOW TO WALL RATIO: <input type="checkbox"/> ≤ 60% <input type="checkbox"/> > 60% 	<div data-bbox="772 1263 1150 1500">  </div> <div data-bbox="858 1507 1050 1534"> <p>Detached building</p> </div> <div data-bbox="1158 1263 1461 1500">  </div> <div data-bbox="1249 1507 1393 1534"> <p>Linked building</p> </div> <div data-bbox="772 1711 1461 2047">  </div>

<ul style="list-style-type: none"> • PRESENCE OF LARGE OPENINGS AT GROUND FLOOR (E.G. GARAGES, SHOP WINDOWS): <input type="checkbox"/> YES <input type="checkbox"/> NO • PRESENCE OF PILOTIS AT GROUND/FIRST FLOOR: <input type="checkbox"/> YES <i>USE OF THE SPACE:</i> _____ <input type="checkbox"/> NO • PRESENCE OF BOW-WINDOWS: <input type="checkbox"/> YES <input type="checkbox"/> NO • THERMAL INSULATION ON WALL AND ROOF <input type="checkbox"/> NO <input type="checkbox"/> ONLY THE WALLS <input type="checkbox"/> ONLY THE ROOF <input type="checkbox"/> THE ENTIRE BUILDING IS ISOLATED • PRESENCE OF THERMAL SYSTEM <input type="checkbox"/> NO <input type="checkbox"/> CENTRALIZED HEATING <input type="checkbox"/> AUTONOMOUS HEATING IN ALL DWELLINGS <input type="checkbox"/> AUTONOMOUS HEATING IN JUST SOME DWELLINGS 	
SITE CONDITIONS	
<ul style="list-style-type: none"> • IS THERE A COMMON OPEN AREA, MEASURING AT LEAST 8 M X 3 M, THAT CAN BE USED TO HOLD THE TECHNICAL SYSTEMS: <input type="checkbox"/> YES <input type="checkbox"/> NO 	

<ul style="list-style-type: none"> • PRESENCE OF A FREE OFFSET AREA AROUND THE BUILDING (MINIMUM 3 M): <input type="checkbox"/> YES <input type="checkbox"/> NO • ARE THERE ANY CONSTRAINTS RELATED TO THE CHANGE OF THE EXTERIOR (E.G. LISTED BUILDING)? <input type="checkbox"/> YES <input type="checkbox"/> NO 	
STATE OF CONSERVATION	
<ul style="list-style-type: none"> • STATUS OF THE EXTERNAL FINISHES/CLADDING <ul style="list-style-type: none"> • GOOD CONDITIONS • SLIGHT DEGRADATION • SIGNIFICANT DEGRADATION • PRESENCE OF STRUCTURAL ISSUES <ul style="list-style-type: none"> • YES [PLEASE SPECIFY] • NO • PRESENCE OF MOLD RISING UP FROM THE GROUND <ul style="list-style-type: none"> • YES • NO 	

APPENDIX 4 - CROWDMAPPING PROTOCOL

- **Registration and informed consent subscription**
- **Name and Surname**
- **Email**
- **Municipality and neighbourhood of residence.**

Map your house

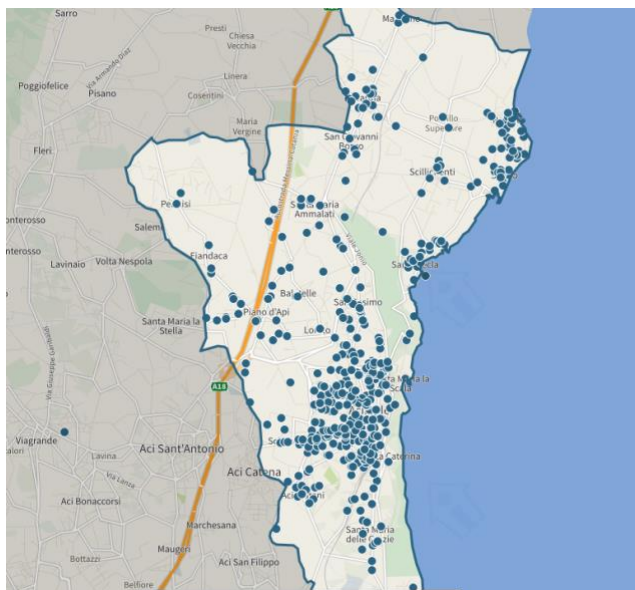


Figure 1. Example of visualisation

Possibility of uploading photos (under moderator's approval)

Are you a tenant or an owner? (compulsory)

- Owner
- Tenant

The building is for (compulsory):

- One family
- less than 5 families
- from 5 to 10 families
- more than 10 families
- Other (specify _____)

In the event of a major earthquake, select the option that best describes your situation: (compulsory):

- I think the building is safe
- It is not currently safe, but seismic improvement works are imminent
- It is not safe at all, I would like to do some work but there are more owners and not everyone agrees
- It is not safe at all, I would like to do some work but lack some necessary paperwork

- Not safe at all, I would like to do works but the costs are high
- Other (specify_____)

How do you describe the thermal comfort of your home? (compulsory)

- Suitable thanks to efficient heating / cooling systems
- Adequate but expensive (due to inefficient systems)
- Quite adequate, despite the absence of system
- Inadequate due to the absence of system

Regarding public fiscal contributions and / or incentives for the seismic-energy renovation of the building, select the option that best describes your situation (compulsory):

- I have already benefited from fiscal incentives, before 2020
- I have already benefited, in 2020, or I'm benefitting of tax deductions (eg: superbonus, ecobonus, sismabonus, 110%)
- I have not used it and I have no plans to use it in the future

How important is the beauty of the building you live in for your psycho-physical well-being? (compulsory):

- It is absolutely important
- It is as important as other aspects (energy saving and seismic safety)
- It is quite important but secondary to other aspects
- It's not important

When was it built? (compulsory)

- Before 1950
- Between 1950 and 1980
- Between 1980 and 1990
- Between 1990 and 2005
- After 2005
- I do not know

Please, map a public building that for you urgently needs to be renovated (map a point – visible to all)

Please, describe why you choose it?