Deliverable 6.4
Report on international transferable strategies and tools for local stakeholder and consumer-tenant involvement

Part 2

SINFONIA

"Smart INitiative of cities Fully cOmmitted to iNvest In Advanced large-scaled energy"

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Executive summary

A consistent group of European projects aims at promoting the social and technological change towards Smart Cities. Some of the main interventions deal with the strengthening of urban governance for the promotion of sustainable practices and the energy refurbishment of residential buildings, especially in poorest areas. All these aspects and changes of the urban lives aim at transforming local societies into smart and low-carbon societies. The FP7 SINFONIA project is one of the projects aimed at these goals.

While the Part 1 of the report on *International transferable strategies and tools for local stakeholder and tenant involvement* focuses on the experience and activities of stakeholders' engagement in the SINFONIA project, this Part 2 of the report focuses on the analysis and assessment of the stakeholders' engagement, for promoting an engagement strategy for the future.
The aim of this report is to define a strategy for local stakeholder and tenant involvement, supporting the replicability of the involvement tools used in the SINFONIA project, and available to all the worldwide and European cities that in future will implement Smart City projects.

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THE RELEVANCE OF STAKEHOLDER ENGAGEMENT: THEORY AND PRACTICE

> "I want Europe to strive for more by being the first climate-neutral continent."
> *Ursula von der Leyen, President of the European Commission*

This report aims at defining a **strategy for local society engagement**, through the identification of **all the main actors and stakeholders** within an **urban environment** and the **actions** to be carried out. That year is relevant for the transformations towards Smart Cities, supporting the European Green Deal in achieving clean and just energy transition. The European Green Deal cites the transformation of "the EU into a fair and **prosperous society**, with a modern, **resource-efficient and competitive economy** where there are no net emissions of greenhouse gases and where economic growth is decoupled from resource use". The cities are one of the arenas, where to stress these objectives.

The **cities** are complex arenas in which several actors, sectors, and disciplines continuously interact with the change (Mora et al. 2017, Caragliu et al. 2011). The **Smart City** is a city that includes investments in human and social capital and in traditional and modern communication infrastructures (both ICT and transport), and where all these investments contribute to a sustainable economic growth, high quality of life, efficient use of resources, through participatory governance. The Smart City is the arena in which "the technological, human, social, and cultural capital of a community offers the means to generate new knowledge of urban problems and an increased capability to face them" (Mora et al. 2017, Komninos 2006). The Smart City concept crosses technical and social viewpoints.

While several conceptualizations of the Smart City concept emphasize the techno-centric vision, this report highlights the relevance of social and cultural challenges in the true development of Smart City (Mora et al. 2017, Mosannenzadeh et al. 2017). The lack of cooperation and acceptance of transformation projects are usually met in projects for Smart City (Mosannenzadeh et al. 2017). This report focuses on **a potential commitment of the energy and urban governance** actors for promoting the change towards low-carbon and smart societies.

The transformations towards Smart Cities are one of the opportunities to achieve the EU goals in terms of efficient use of resources and sustainable societies. The European Green Deal states that "The involvement and commitment of the public and of all stakeholders is crucial to the success of the European Green Deal". The **commitment and involvement of the stakeholders** are relevant for ensuring the transformations towards smart and sustainable cities. The participation of all the relevant stakeholders of the local societies contributes to **ensure the decrease of energy consumptions** based on **change of energy uses and behaviours**[1] and based on the increase of **acceptance of and contribution to technological changes**[2]. The participation and involvement of the public and all the

[1] Shove, Elizabeth. "What is wrong with energy efficiency?." Building Research & Information 46.7 (2018): 779-789.
[2] DellaValle, Nives, Adriano Bisello, and Jessica Balest. "In search of behavioural and social levers for effective social housing retrofit programs." Energy and Buildings 172 (2018): 517-524.
McCabe, Annie, Dorina Pojani, and Anthony Broese van Groenou. "The application of renewable energy to social housing: A systematic review." Energy policy 114 (2018): 549-557.

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relevant stakeholders make sure the commitment of people and the crossing of several actions towards the same smart and climate targets.

In the urban transformations, **energy efficiency in buildings** is one of the most relevant elements for achieving **decarbonization of the society** and delivering the climate goals. SINFONIA project is a Smart City project funded by the European Commission, in which one of the main changes in the urban ecosystem is the **refurbishment** of buildings. In particular, SINFONIA acts in **social-housing** buildings for meeting needs as the reduction of **energy poverty**. The energy efficiency in buildings is not only a matter of supplying more services (e.g., indoor comfort) using less energy. It is also a matter of energy consumption decrease and **efficient use of the available resources by the individuals and the society**[3].

For decarbonizing the cities in Europe, **efficiency of the heating sector** will have to make a very important contribution, "increasing renovation rates of buildings and increasing the changeover of old heating technologies towards new decarbonised heating technologies"[4]. In the transformations of cities towards Smart Cities, the SINFONIA project refurbished social-housing buildings, including technologies such as envelope, double or triple glazed windows, and mechanical ventilation. All these interventions aim at increasing the efficiency of the thermal energy system and improving the thermal indoor comfort. However, the integration of energy efficient technologies in house requires an **acceptance of the technological change and a change of the energy behaviour**.

The acceptance of the technological change can be strengthen creating **trust relationships** between the stakeholders in the **urban governance** and the **tenants**. The acceptance is an element promoting also changes in daily lifestyles and energy behaviours. The lifestyles and energy behaviours would not change without a process in which the new behaviours – more sustainable and contributing to the energy saving and efficiency – are promoted. The process to change the behaviours is possible only if promoted by a phase of **information** on how to use and maintain technologies after the refurbishment, a phase of **showing and practicing** how to use and maintain the technologies, and a phase in which the relevance of the change is **explained** and **understood** by people. All these three phases of the change process support the change in energy behaviours making effective the decarbonization (Shove 2018, Doyle & Davies 2013). However, the **priorities** of the engaged stakeholders and tenants must be considered.

Tenants can have different priorities than the decrease of **energy poverty** or, simpler, than the reduction of energy consumptions and the improvement of indoor comfort. We are experiencing the activities of the SINFONIA project in a social-housing context, in which the priorities of the families are different from the energy ones e.g., health, job, family dynamics. **Social housing** is probably one of the best setting for understanding the social consequences and the consequences related to residents' habits (Miller *et al.* 2015). On one hand, it is relevant to study energy consumption in social housing buildings since their residents are more likely to fall in energy poverty than other social groups (Llera-

Balest, Jessica, et al. "Local reflections on low-carbon energy systems: a systematic review of actors, processes, and networks of local societies." Energy Research & Social Science 42 (2018): 170-181.

[3] Shove, Elizabeth. "What is wrong with energy efficiency?." Building Research & Information 46.7 (2018): 779-789.

[4] Robert Nuij, European Commission's energy directorate, https://www.buildup.eu/en/news/housing-renovation-plan-will-be-flagship-european-green-deal

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Sastresa *et al.* 2017). On the other, since social housing is a public institution and not a private business, the study of a retrofit intervention is not limited to economic aspects of the renovation. The research can deal with priorities of the tenants.

The understanding of **tenant's priorities, preferences, behaviours, anxieties, relationships, and characteristics** are all relevant aspects to promote the **just and equal engagement of people**. In this direction, **the role of social sciences and humanities** should be strengthened to analyse and transform information collected with and on people, in useful insights for smart energy renovation. The social sciences and humanities have competences to structure the information collected in the interaction with people. This information can be transformed in knowledge that is useful for improving the technological innovation and link the technological with the cultural and social innovations. Smart energy transformation and renovation are processes based on collaboration and sharing with people living in the urban ecosystems and the renovated buildings.

All the choices of the stakeholders belonging to the urban governance, behind the refurbishment and all the other interventions, are relevant. The use of the efficient technologies within the house affects the achievement of efficient and smart goals in urban environments. In the urban transformations, the public and all stakeholders should be engaged in a governance which makes **sustainable decisions** within the urban ecosystem and in which all actors contribute to achieve the climate goals. The main objective of the **active participation**, the involvement, and the commitment of the public and all the relevant stakeholders is to achieve, consciously, the Smart Cities and climate goals.

A Smart City is a strategy, which aims at improving the quality of life and promoting sustainable changes. Considering that, the report is divided into three chapters.
The *first chapter* compares the achievements of the stakeholder's participation in the two SINFONIA demo-cities (Bolzano/Bozen in Italy and Innsbruck in Austria), proposing considerations on the social acceptance of the energy efficiency measures and the energy behaviour changes. Hopefully, this first part of the report emphasises **the reasons why the participation and commitment of stakeholders, especially tenants, are relevant to ensure the achievement of Smart City and clean energy goals**. The chapter also emphasises the need to adapt interventions and measures to the **local contexts**, with respect to **different social and cultural environments in different countries and districts**.
The *second chapter* focuses on some specific experiences in the SINFONIA project. SINFONIA project has been the opportunity to test some engagement and information activities. First, the experience related to the design, implementation, and use of a display showing energy consumptions in Bolzano-Bozen is reported here. This is relevant for two main reasons. First, the considerations on display support the understanding of the usefulness of social comparison feedback to change energy behaviours for reducing energy consumption. Second, this chapter defines some concerns for promoting the use of the display in the social-housing apartments in other cities and contexts.
Finally, the *third chapter* proposes a strategy for stakeholder's involvement in the urban ecosystem transformations towards smart and sustainable features. This chapter is composed by several actions that the worldwide and the EU cities could apply for promoting sustainable and Smart Cities.

This report focuses on why and which kind of **stakeholders' participation** is relevant in the refurbishment projects, looking on the Smart City experience in the **SINFONIA** project. We are

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proposeing an **international transferable strategy for local society engagement**, available to all worldwide and EU cities. This report, as well as the first part of this report (D6.4 – Part 1), is dedicated to all the actors in the cities that are elaborating activities, interventions, and changes for promoting Smart Cities. This report is also dedicate to all the Early Adopter Cities, which have accepted to apply all or some of the measures tested in the SINFONIA project. To these actors and cities, we dedicate a sharing of **the SINFONIA experience**, linked with other past experiences, research theories, and applied research found in scientific literature.

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1. STAKEHOLDER AND TENANT ENGAGEMENT

Stakeholders living and acting in an urban environment play a fundamental role in the effective implementation of Smart City projects. The stakeholder engagement is relevant to ensure the acceptance of the interventions e.g., the acceptance of the energy renovation and the energy behaviour change (McCabe *et al.* 2018, Middelkoop *et al.* 2017). Furthermore, the engagement is a relevant process for achieving feedback and information useful to improve and adapt the interventions to the local context.

It is not automatic that people interpret renovations or other changes in the city as benefits, both economic and social ones (Boerenfijna *et al.* 2018), **accepting changes in houses and neighbourhoods as positive changes**. For promoting the acceptance and the contribution to the energy renovations, stakeholders must be engaged in the renovation process and, sometimes, in the urban governance which includes several urban actors (e.g., public authorities, building owners, neighbourhood associations).

The engagement is a process of active involvement of several stakeholders of the urban governance. All the participants can give input and discuss, in terms of knowledge, opinions, funding resources and activities. The engagement process is not simply a provision of information from one side to all the other stakeholders and the participation arena should guarantee similar opportunities to a decision or action.

The engagement process is complex, and it needs to be assessed for making improvements in future actions. For this reason, we propose a method and some aspects to be assessed, in order to understand what was working and was not working in the SINFONIA project and promote knowledge about the best experiences and the most challenging activities.

This chapter aims at **evaluating the stakeholders and tenants' engagement** in the SINFONIA project, using a re-arranged analytical framework of McCabe *et al.* (2018), and focusing on the **energy renovation interventions**.

1.1 METHOD AND ASPECTS FOR THE EVALUATION OF THE ENGAGEMENT

Success factors, barriers, and motivations, for the implementation of renewable energies and energy efficient projects, promote or get slower clean and just energy transitions. It exists already experience in energy renovations in social houses around the world. **This chapter analyses the past experiences**, based on the first evaluations of McCabe's *et al.* (2018), **and evaluates the engagement process in the SINFONIA project**. This chapter emphasizes the links among energy renovations and stakeholders and tenants' engagement processes. It creates the basis for a strategy for local societies engagement, included in the last chapter of this report.

The acceptance and the collaboration of stakeholders and tenants in the energy renovation process is built on several phases: **planning and modelling of the renovation**; **renovation work phase**; **improvement and adjustment of the renovation interventions** (e.g., make sure all technologies are

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working properly); **adaptation of daily habits to the new and retrofitted house** (e.g., correct maintenance system, energy uses coherent with the new technologies). All these phases require an interaction among the actors involved in the renovation project, such as tenants, building owners, and renovation firms.

Since the beginning of the renovation project, the actors involved in the project must be sure to **provide and get information to and from residents**. Even if the first phase of the project is the most important, the engagement process with all the stakeholders must continue along all and after the renovation process, to be sure that all the goals will be achieved (e.g., energy savings, clean energy, high quality of life). If the engagement is not continuous, it will enhance the risk of disengagement. Therefore, it is relevant to ask: **how often meetings are organised during the project with all the actors involved? Are other initiatives for the engagement of tenants, enterprises, social-housing owners, etc, organised along the SINFONIA project?**

In these meetings and initiatives, all the benefits of the project should be communicated to the stakeholders and residents of the neighbourhood and building, avoiding to "oversell" them (McCabe *et al.* 2018). When the information about renewable energy and energy efficiency installations is not correctly conveyed to stakeholders and residents, frustration and disengagement can appear, dealing with incorrect energy and technology uses. Especially where the involved households have low purchasing power due to energy poverty, it is important that residents know the real gains, including economic ones (Boerenfijna *et al.* 2018). It is important to create and maintain trusty relationships with the residents and, for ensuring that, positive aspects must not be exaggerated. Therefore, an important question is: **are the reported benefits of the project consistent with reality?** Furthermore, when giving information to tenants along the project, make sure also that "residents are aware costs will be divided equally where possible" (McCabe *et al.* 2018). Tenants must have the perception that they are all treated in the same (economic and social) way. **Are the costs evenly split? Is this explicitly communicated?** Benefits can also deal with energy poverty reduction.

The energy poverty could be challenged by energy renovation, which could **improve the quality of life**. Involving social-housing buildings, the renovation works in SINFONIA project are carried out in areas where tenants do not belong to a high social class and where tenants spend high share of their income on energy costs (Santangelo and Tonelli 2017). A participatory approach, which guarantees to tenants all the information needed to correctly use the new installed technologies, can improve their quality of life (e.g., indoor comfort) and reduce the share of energy costs. The improvement of quality of life due by energy renovation is higher when a participatory process involves tenants within the planning of the renovation (Rossio and Seo 2020), reducing the disparities of power within the urban governance.

The renovation process should promote **appropriate engagement and not simply advisement** (McCabe et al. 2018). Therefore, in the evaluation of the SINFONIA project, we asked: **have information material been provided about the energy efficiency technologies and what to expect, the optimal usage patterns, and potential troubles? Were interactions with tenants organised for collecting feedback and ideas?** In the past, where social-housing residents were not engaged in the

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renovation implementation process, the project did not achieve energy savings. There are some information channels that could be used, to ensure an effective achievement of energy savings:

- Community information events
- Information leaflets outlining key information on the technology and what to expect
- Additional leaflets, once the system is installed, that highlights technical aspects, optimal usage patterns, and potential troubles

Since the beginning of the renovation project, it must be clear **who are the stakeholders to be involved** in a renovation and Smart City project. The methodology to understand who the relevant actors in the urban environment are, is explained in the Deliverable 6.4 – part 1, while this report highlights **the relevance to know who the people are, to be involved in the project**. It is important to understand which are their main socio-demographic characteristics of these actors and "pay particular attention to the demography and potential skill level of social housing residents" (McCabe et al., 2018).

Demography and pre-existing skills play a large role in how the technologies and the energy are used (Mills & Schleich 2012). In general, households with young children are more likely to accept or adopt energy efficient technologies and place primary importance on energy savings for environmental reasons. By contrast, households with a high share of older adults place more importance on financial savings, and have lower levels of technology adoption, energy saving practices, and knowledge about energy topics. Older participants showed little knowledge of energy efficiency at home and the cost of energy was relatively unknown (Boerenfijna *et al.* 2018).

The residents naturally gravitate towards "familiar" patterns of daily practices and daily use of energy and technologies. The **characteristics of the residents,** their **needs,** their **interactions with the neighbours,** and the **household dynamics** are important elements for a sustainable urban regeneration (Lee *et al.* 2017). "Domestic energy consumption is a social and collective rather than individualised process" (Hargreaves *et al.* 2010, p. 6118). Future projects should focus more on the household and less on the individual energy consumer, having the leading role in the change process towards Smart Cities. Therefore, a socio-demographic could enhance the quality of the project activities, addressing communication, promotion of energy behaviour change, and other needs than the mere energy efficiency.

Along the entire process, it is important to **create a trust network between the actors involved in the energy renovation**. The relationships among the stakeholders of the urban governance determine the success or failure of some renovation projects (Ripamonti 2006). Some classical sociological studies (Park & Burgess 1925) believe that two neighbourhoods with the same socio-demographic characteristics can actually be different according to the quality of social relationships (Jorgensen 2010). Higher is the sense of place and belonging to the neighbourhood, due to good social relationships, higher is the quality of life. A participatory approach can support this positive social environment and promote its contribution to the energy renovation activities.

When strong relationships in the neighbourhood do not exist, what a project as SINFONIA could create, is trust among people who usually would not have any type of relationships. The created trust among

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tenants and the other actors of the urban governance can serve as a basis for the development of a **reference community also for future actions** (Rabinowitz 2017). Certainly, the trust can be built only when opinions, interests, and needs are met by all the involved actors e.g., owners, tenants, renovation firms. The participatory process does not involve all the actors and tenants every time, but leaders can be identified for being a bridge among all the involved actors and tenants.

In this sense, if possible, **appoint a tenant representative or committee to liaise with the other social actors of the urban governance** (McCabe *et al.* 2018). This would promote a peer-to-peer communication that could deal with a deeper understanding of the process and the communicated information. This would avoid the misunderstanding between technicians and residents, due to different languages and objectives. In past experiences, tenant representatives correspond to a higher acceptance of the renovation process as well as a wider spread of learning through peer communication (McCabe *et al.* 2018). At the housing level, it has been noted that a good connection between neighbours is positively correlated with environmental conservation actions, energy savings, and active participation in the community (von Bock 2015). The relationships with the renovation companies are relevant as well.

Where possible, **engage local and well-known construction or renovation companies** (McCabe *et al.* 2018). When the company is already known by the residents and when the residents have a trusting relationship with the company, it is much more likely that the renovation project will have positive results. Therefore, it is important to investigate the quality of **the relationship among tenants and construction or renovation companies.**

The last relevant phase of a renovation process is the adaptation of tenants' habits to the new technologies and the retrofitted house. The new energy uses and habits, through the new and energy efficient technologies, is the focus for ensuring energy savings and higher quality levels in house. People living in the renovated houses play a fundamental role in the correct use of technology, based on their habits that very often can be connected to their age, their family composition (Mills *et al.* 2012), and family dynamics (Outcault *et al.* 2018). When a renovation process is concluded, people should change their daily habits to fit better with the new technologies (e.g., mechanical ventilation). **Changing energy behaviour** can be very difficult, especially for some age groups. The change of energy behaviour requires an involvement process of tenants. People who belong to a higher age group, such as over 60s, develop a very strong bond with the house in which they live (Boerenfijna *et al.* 2018). These feelings can be traced back to a sense of ownership that does not allow them to objectively analyse the indications that a monitor, as in the SINFONIA project, can give them. Working together to be able to offer more information to tenants becomes essential, in order for tenants to accept the change and for us to improve the interventions, such as the features of the monitor.

The central role of occupants in achieving energy savings is increasingly recognized and is even more important in the social-housing sector, where the environmental value is combined with the social purpose of reducing inequalities and energy poverty (Santangelo & Tonelli 2017). A very interesting work, done by Delzendeh *et al.* (2017), compares several researchers, demonstrating the gap between the predicted and actual consumption in buildings, up to a 300% gap in some cases. The main problem encountered was a lack of attention to the role of tenants and their energy behaviours (Delzendeh et

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al. 2017). Very often, if not properly informed, people can believe that a building, with high energy performance, automatically leads to a decrease in consumption. In recent years, research showed that households, starting from the assumption that an increase in energy efficiency leads to savings, take less attention to the energy behaviour. Using participation events, where all the installed equipment is showed and how to use the new technologies is explained, can be of fundamental importance to change the energy behaviour of tenants (Santangelo and Tonelli 2017). Furthermore, the **energy behaviours are collective rather than individual behaviours** (Hargreaves *et al.* 2010). Therefore, household and neighbourhood dynamics and relationships must be considered when promoting energy behaviours change and sustainable and saving energy habits (Balest & Magnani forthcoming; Outcault *et al.* 2018).

Another aspect, better explained in the chapter 2, is the **visible energy-use monitoring** (McCabe *et al.* 2018). The energy monitoring equipment enhances energy awareness and proper use of energy efficient technologies, showing information on consumptions and indoor comfort (McCabe *et al.* 2018). Smart metering, consumption-feedback systems, in-home displays, and smart thermostats usually increase user knowledge and ability to deal with energy consumptions and indoor comfort (Boerenfijna *et al.* 2018). It is important that tenants feel part of the change in their house and can use and understand the monitors installed inside the apartments. For evaluating the engagement process in SINFONIA, there are some relevant questions to answer: **are the retrofitted apartments equipped with visible energy-use monitoring? How is the monitor assessed by the tenants (e.g., easy operation, useful information, etc)? Is there an impact of the visible energy-use monitoring on the energy consumptions and uses?** Behind the answers to these last questions, the chapter 2 is going to explain, in detail, which could be the contribution of in-house displays for the success of energy renovation.

All the previous questions can support the planning of engagement processes and should be considered by any actor planning to implement a Smart City and energy renovation project. Considering all the previous questions, the next paragraphs try to evaluate the engagement process of stakeholders and tenants in the SINFONIA project.

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1.2 EVALUATION OF THE ENGAGEMENT PROCESS IN THE SINFONIA PROJECT

The engagement process in the SINFONIA project is evaluated based on the criteria included in Table 1. This section reports a qualitative analysis of the engagement process, which will support the writing of a strategy for local societies engagement. The questions included in this section can support the organization of an engagement process within Smart City projects.

	Innsbruck	Bolzano/Bozen
Provide information to residents	✔	✔
Organize an engagement process that is incessant in all the phases	✔	✔
Ensure that the residents are aware about the benefits and do not oversell those benefits	✔	✔
Ensure that the residents are aware that costs are equally divided	✔	
Work for improve quality of life of people	✔	✔
Organize an appropriate engagement and not simply advisement	✔	
Consider socio-demographic characteristics and pre-existing skills	✔	✔
Look at interactions of tenants with neighbours and household dynamics		
Create a trust network or, better, between involved actors e.g., …		
… appointing a tenant representative or committee		✔
… engaging local and well-known construction or renovation companies	✔	
… make people and actors leaders of the renovation		
Work together for changing energy behaviours e.g., …		
… making aware people on their energy consumptions and the best energy behaviour patterns	✔	✔
… analysing social relationships and family dynamics		

TABLE 1 – ELEMENTS AND ACTIVITIES TO BE INCLUDED IN A TENANT'S ENGAGEMENT PROCESS FOR ENSURING THE EFFECTIVENESS OF ENERGY RENOVATION.

1.2.1 ORGANIZE AN INCESSANT ENGAGEMENT PROCESS

How often meetings were organised during the project with all the actors involved? Were other initiatives for the engagement of tenants, enterprises, social-housing owners, etc, organized along the SINFONIA project? Were people engaged at the first stages of the project?

All the stakeholders identified for the SINFONIA project, in Innsbruck and Bolzano/Bozen, were involved in events and meetings, while wider information campaigns were organized to reach all the citizens at the national, regional, and local scales. The stakeholders, such as investors, tenants, banks, enterprises, civil society organizations were invited to attend **stakeholder event panels** to exchange ideas, feedback, and information on the SINFONIA project and the two urban contexts. These events were organized all along the five years of the project. In this way, several actors in Austria and Italy currently know the SINFONIA project, have their own ideas on how the project is going and its effectiveness to achieve smart and low-carbon cities. In Bolzano, events focused on **technicians**, using the strong trust in CasaClima energy agency (DellaValle *et al.* 2018), which promoted these activities. Differently, in Innsbruck the most engaged actor was composed by **students**, with the aim to achieve families in the SINFONIA neighbourhoods. Both in Innsbruck and Bolzano/Bozen, tenants were strongly involved in the SINFONIA project, since they live in the renovated houses.

The activities dedicated to tenants were organized using two **different approaches** in Innsbruck and Bolzano/Bozen. The **different social, cultural, economic, and institutional contexts** required different strategies in the two cities. The approach used in Bolzano is mainly based on the role of the tenant

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representative, who ensured a bridge among those who managed the renovations, the building owners, and the tenants. The engagement of all the tenants could sometimes be counterproductive and the **informal relationships and the trusted person living in buildings** could be a bridge among workers, social-housing owners, and tenants. In Innsbruck, all tenants were regularly involved through meetings, brochures, workshops and customized renovations. In both cases, tenants attended visits in demo-apartments, for seeing the results of the energy renovation in advance and got information on what to expect in their daily lives after the energy renovation.

FIGURE 1 – DRAW OF THE USER MANUAL (SOURCE: IDM SOUTH TYROL).

1.2.2 ORGANIZE ENGAGEMENT AND NOT SIMPLY ADVISEMENT

Was information material provided to tenants about the energy efficiency technologies and what to expect, the optimal usage patterns, and potential troubles? Was an interaction with tenants organized for collecting feedback and ideas? Were all the stakeholders engaged and not simply advised?

At the beginning of the project, several meetings and activities were organized to **collect feedback and ideas from tenants**. In Innsbruck, the energy renovation project was customized, and each tenant had the opportunity to refuse the renovation. In order to gain acceptance for the renovations, tenants were involved in the renovation process by regular assemblies, information brochures, magazines, demonstration apartments, interactive seminars, customized renovations, newspapers, a folder with all planned and technical measures, regular notices in the stairwell about upcoming measures, timelines and appointments. An individual consulting and constant information flow aimed at convincing tenants about the advantages of refurbishments (e.g., mechanical ventilation systems).
In Bozen, the renovation projects were presented by the architects and social-housing owners to the tenants, at the beginning of the project. Furthermore, a first survey was administered to tenants for collecting some information. Tenants were asked if they had needs or preferences to specific interventions in the buildings (e.g., lifts, painting the walls in a particular colour).

The **planning of the interventions** and a **clear agenda** of the renovation activities could increase the acceptance of interventions. This planning has not always been done in advance and, in particular in Bozen, it has led to discontent of some tenants. In some cases, the building owners had no clear ideas what the timing could be, due to several reasons. This led to poor information for tenants, decreasing the quality of interaction among the building owners, renovation enterprises, and tenants.

Behind the activities to collect feedback and ideas at the beginning of the project, in the latter phases, tenants were provided to **material and events for informing** about:

- the technologies installed in the buildings and houses: what to expect after the energy renovations in terms of costs and indoor comfort

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- optimal usage patterns for ensuring the energy consumption decrease and an optimal use of the installed technologies, such as the mechanical and the natural ventilation
- potential troubleshoots due to the need to partially change the daily energy habits, such as how and when to ventilate the home using windows

This information was distributed through:

- user manuals divided into different chapters. The chapters explain the optimal behaviours along the seasons, the reasons why it is important to be aware on the consequences of the daily habits, the proper maintenance of the technologies and the house
- demo-apartments, that are events in which tenants see the output of interventions, the new technologies, and collect information on what to expect and what to do
- workshops with tenants, in which feedback were collected by tenants on the main problems in the interactions with the new technologies (e.g., mechanical ventilation, display)
- individual consulting at home, to support the best organization and behaviours for reducing energy consumptions. The “energy coach” provided coaching to the tenants, in the form of individual consultations on climate and energy consumption. He spent one or two hours in households and asked for and presented measures and distributed brochures in the form of a toolbox (e.g. water-saving shower head, LED lamps, temperature gauge for the refrigerator).

Several events and activities were organized to **collect feedback and ideas** and to **give information** on what to expect and what to do. Higher levels of participation, such as shared decisions and empowerment of tenants, were not object of the SINFONIA project and the planning of the renovations were mainly top-down decisions.

A deeper engagement process would have requested to involve people in the planning of the renovation activities, but more resources would have been planned. In the SINFONIA project, a deeper engagement in the planning phase is missing and **future projects – when objectives or activities deal with *engagement* – should think and plan, in advance, a strong and deep plan for involving tenants and stakeholders**, including more than information events. An engagement process could be very challenging, but it could also ensure a wider achievement of energy consumption decrease goals.

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FIGURE 2 – INVITATION TO A WORKSHOP, DISTRIBUTED TO THE TENANTS.

1.2.3 ENSURE THE AWARENESS ABOUT BENEFITS (AND COSTS)

Are the benefits of the project, reported to tenants, consistent with reality? Expenses related to maintenance, energy, and rent should be equally shared, if possible. Are the costs evenly split? Is this explicitly communicated? Are priorities and needs of people and other stakeholders considered along the process, behind the mere energy efficiency goal?

The project aimed at improving **quality of life at home**, increasing **energy savings** and **indoor comfort** for those who live in the renovated buildings. These do not always correspond with the priorities of the daily lives of people e.g., health, mobility issues, job. However, in-depth interviews or discussions with tenants were not included in the SINFONIA project, while a deeper understanding of the local context is highly recommended. In any case, several practical measures to meet some tenants' needs were implements e.g., lifts or community satellite systems.

The communication with tenants was based on clearness on the expected outcomes of the interventions, for not creating excessive expectations. By now, the expectations of the tenants and the presented benefits seem to be achieved in almost of the renovated buildings. In Innsbruck, a renovation could only take place with the consent of the tenants, or, depending on the legal situation, only with consent of 75 or 100% of the tenants. For this situation, the needs of the people were naturally considered e.g., installing internet connection, changing locking systems, and redesigning

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green spaces. This led to immediate perceived benefits. In Bolzano/Bozen, tenants are building ideas on the bad quality of the renovations when some problems related to technologies were met e.g., incorrect functioning of the mechanical ventilation. Tenants are currently not able to attribute the problem to the temporary situation, which could be solved in some weeks, creating dissatisfaction.

In Innsbruck, 100% of the savings benefit the tenant in the form of reduced heating costs and this was clearly communicated. Differently in Bolzano/Bozen, the social-housing owners have not decided yet how to split the costs for the energy and the technology maintenance, so people do not know exactly what to expect. This could create uncertainty for the future months.

1.2.4 CONSIDER SOCIO-DEMOGRAPHIC CHARACTERISTICS

Has a demographic analysis been conducted along the SINFONIA project? How are the socio-demographic information used for addressing the activities of the project about communication and promotion of energy behaviour change?

The socio-demographic characteristics of the tenants of two neighbourhoods – in Bolzano/Bozen and Innsbruck – were analysed, at the beginning of the project (Balest & Vettorato 2018). The information about who are the tenants and which are their main socio-demographic features dealt with the design of the display, which will be explained in Chapter 2. The socio-demographic information was used to organize the events and activities to inform tenants on the renovation projects and prepare the user manual and the demonstration apartments. This activity had made possible to reach a larger number of tenants. Considering this information, a user manual – a book explaining how to use the technologies installed in the flats – used a clear and simple language. In Bolzano, for example, the user manual is a document with illustrations, for ensuring an effective information on energy efficient technologies.

Furthermore, tenants of the SINFONIA project filled a survey aimed at better understanding their characteristics and energy behaviours. The search on energy behaviours aimed at investigating the possibility to observe a change in energy habits, after the end of the energy renovations.
Some research shows (Van Middelkoop *et al.* 2017, Boerenfijna *et al.* 2018) that renovations usually find easier acceptance in households with young children and where the average age is lower. This is confirmed by the analysis made in the SINFONIA project (DellaValle *et al.* 2018). The old people have more difficulties in changing their habits, while households with small children are more likely to commit themselves to improve their saving behaviours (Van Middelkoop *et al.* 2017; Boerenfijna *et al.* 2018).

1.2.5 LOOK AT INTERACTIONS WITHIN NEIGHBOURHOOD AND HOUSEHOLD DYNAMICS

Have the energy behaviour and the acceptance of renovation activities been considered as collective as well as individual behaviour? Have the project observed the interactions of tenants with neighbours and household dynamics?

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In the SINFONIA project, the focus was the **individual behaviour** and the **household composition**, while the household dynamics were not considered. The relevance of the **household dynamics**, for understanding the energy behaviour, is explained in the chapter 1.3. The **relationships** among tenants **within neighbourhoods** were neglected, too. However, more information on the relationships and dynamics within the households and the neighbourhood could improve the understanding of the local context and the opportunities to change energy behaviours and engage people, for improving the effectiveness of the interventions.

1.2.6 CREATE A TRUST NETWORK BEETWEEN THE INVOLVED ACTORS

Has a community of neighbourhood been created based on the SINFONIA activities?

Is it appointed a tenant as representative or committee to liaise with the organizations working for the energy renovation? Which is the role of the representative or committee? How is the relationship between tenants and the appointed representative?

Were the construction-renovation companies involved in the project local and well-known? Which was (if any) the relationship between tenants and construction-renovation companies?

No community of neighbourhood was created in the SINFONIA project. However, this project was the opportunity to discuss with neighbours and **create new relationships among tenants**, through the figure of the tenant representative, who live in the renovated buildings. The new relationships create new services for the tenants e.g., social and community ones, and the representatives are trusted by tenants.

In Bolzano, a mediator was nominated with the aim to take care of the interactions among tenants, social-housing owners, and renovation enterprises. The role of the mediator was challenged by delays in the progress of the renovation activities and wider renovation impacts than expected (e.g., noise). The mediator was not in a good position and the trust between tenants and the mediator was not excellent. Closer are the people that can support tenants in the change process of the renovation, wider is the trust in those people. E.g., the tenant representative who is living in the same building of tenants has higher trust than an “external” mediator.

Concerning the renovation entrepreneurs, some of them were local. For example, about 95% of the companies commissioned by NHT (social-housing owner in Innsbruck) were Tyrolean entrepreneurs. The relationship between residents and craftsmen was particularly important, hence the weekly consultation hours on site.

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1.2.7 WORK TOGETHER FOR CHANGING ENERGY BEHAVIOURS

Has a process for changing energy behaviour been organized and managed along the SINFONIA project?

Are the retrofitted apartments equipped with visible energy-use monitoring? How is the monitor assessed by the tenants (e.g., easy operation, useful information, etc)? Is there an impact of the visible energy-use monitoring on the energy consumptions and uses?

The process for changing energy behaviour and making concrete and optimal the use of the renovated house and technologies has just started in the SINFONIA project. Further activities should be done for ensuring the expected energy savings.
In this sense, the most important activity, carried out in SINFONIA, is the display installed in some apartments. This activity aims at making aware people on their energy consumptions and the best energy behaviour patterns. Now, 15 out of 315 apartments in Bolzano/Bozen are equipped with a system of energy monitoring and a display showing energy consumption and giving feedback. The number of flats equipped with this system will be increased by the end of the project (May 2020), if no issues related to COVID-19 will be met for the installation. The energy monitoring system registers temperature, humidity, CO_2, electric and thermal consumptions in apartments, while the display shows some elaborations of those data, using a system of feedback. The system of feedback is currently experimented using social comparison and investigating how behavioural economics can contribute to increase the understanding of social comparison. This part will be further explained in the chapter 2. In any case, a wide process to promote the change of energy behaviours, to be coherent with the installed technologies, was not done in SINFONIA. However, we propose the next chapter (1.3) to explain which could be the idea of this kind of process.

1.3 THE CHANGE OF DAILY ENERGY BEHAVIOURS – SOCIOLOGICAL PERSPECTIVE

The involvement of the tenants of the refurbished social-housing buildings avoids the conflict between tenants and all the actors of the renovation process *(*Balest *et al.* 2018). The involvement of tenants permits to **collect feedback, information and perceptions on the refurbishment process and on the correct functioning of the refurbished buildings and the installed technologies**. This feedback **improves the renovation process** and identifies malfunctioning of the installed technologies.

This engagement also promotes the **social acceptance** of new technologies and lifestyles (Balest *et al.* 2018). Especially, in the first period after the end of the refurbishment works, feedback collection is extremely relevant, and it addresses the real achievement of the energy consumption decrease goals. The tenant's involvement has a second important challenge to address, that is the change of energy behaviour for ensuring the expected energy savings.

Tenants' participation could promote **change of energy behaviours,** towards a smart use of the renovated building and an energy saving (DellaValle *et al.* 2018, Liu *et al.* 2016, Galvin 2013). A real process to promote the change of energy behaviours towards sustainable choices and habits has not started in the SINFONIA project, yet. However, this section explains how a process to change energy

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behaviours towards sustainable and saving choices could be organized and which are the main information to have, before starting an engagement process to support wider energy savings.

The technological change is not enough to ensure an energy consumption decrease. The daily habits should change for an optimal use of the installed energy efficient technologies, but this is not easy. Indeed, the daily energy habits are linked and depend on several elements (Figure 3):

- the interaction among people and technology
- the competences that people have on how to use those technologies
- the meanings that people attribute to the daily energy habits

It is relevant to also consider the relationships among people who interact with the habit (cooking the lunch for all the family, open frequently the windows because guests are at home) and the technology. All those elements should be considered for a change in energy habits that could achieve a **real decrease of energy consumptions**, after the building renovation (Shove 2018, Shove & Walker 2010).

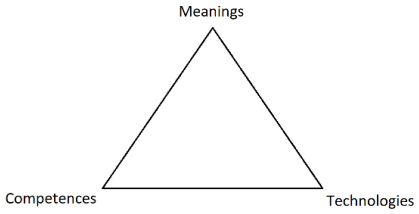

FIGURE 3 – THREE ELEMENTS THAT CONTRIBUTE TO BUILD AN ENERGY BEHAVIOUR. SOURCE: SHOVE 2012.

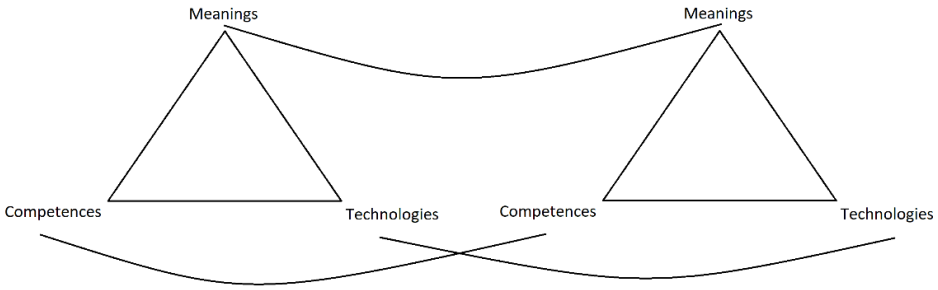

FIGURE 4 – THE CONDITIONS OF THE ENERGY BEHAVIOUR CHANGE.

Furthermore, people living in a home have different characteristics (gender and age) and there are household dynamics for deciding how to behave at home (e.g., adults decide). These aspects impact on some habits such as the temperature set up at home (Outcault *et al.* 2018, DellaValle *et al.* 2018, Mills *et al.* 2012).

The energy behaviour is an individual choice as well as a collective choice. The energy behaviour is the result of a compromise among people living in the same house, who have different comfort perceptions, preferences, and levels of knowledge on how to use the new technologies. For this reason, the attention should be done both to the individual choices (e.g., collecting information

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through a questionnaire similar to the ones proposed by SINFONIA) and the social dynamics among the household components (e.g., interviewing some families and understanding why and who decide how to behave at home).
The gender balance is one of the relevant aspects to be considered in all the worldwide cultures, for understanding the level of energy consumptions and savings (Blasch *et al.* 2018). In the spread of information about the optimal uses of the energy efficient technologies and in the promotion of the energy habit changes, the **gender balance-unbalance**, the **socio-demographic characteristics**, and the **social dynamics within the household and the neighbourhood** must be considered.

There are some relevant questions to be answered before and along an energy renovation project, for having the support of inhabitants, in achieving the energy savings.

- Which are the energy behaviours at home and which are the opportunities to change them after the energy renovation of the buildings?
- How do tenants talk about and perceive the new energy efficient technologies installed in the renovated buildings? How do tenants use these technologies?
- Are the energy habits of tenants changing in the renovated flats, addressed towards energy savings?
- Which are the ways and channels for communicating with tenants, for encouraging people in adopting saving energy behaviours and maximizing the use of the installed technologies?

These are relevant questions to understand the influence of the tenants – their characteristics, their energy behaviours, the household's dynamics, the neighbour relationships – on the performance of the installed energy efficient technologies (Outcault *et al.* 2018).

When a positive discussion, on the quality of the renovated house, on the energy efficient technologies, and on the improvement of the quality of life, **spreads among the people** of the household and the building, **there is usually more acceptance in the new technologies** (Balest & Magnani forthcoming). There are often people living in the building that are more trusted than others in a neighbourhood. Identifying and understanding the social, relational, and trusted resources already available in the building and neighbourhood permits to create effective channels of communication with tenants and **opportunities to engage** them. Distribution of information and opportunities to change energy behaviours, for more sustainable choices, through the trusted actors in an urban environment (e.g., trusted tenants, trusted local or neighbourhood associations) can be winning and promote an **effective change**.

The information for making this kind of considerations was collected in several moments of interaction with the tenants, in the SINFONIA project. For example, tenants were met when installing the displays in the flats, when inviting people to workshops, demo-apartments or other events, when administering a questionnaire. Further information, for confirming or contradicting these considerations, should be collected in face-to-face meetings with tenants, both in small or big groups of people. The COVID-19 created several challenges to meet tenants in the latter period of the SINFONIA project. Therefore, we hope to speak and work again with the tenants in future projects and activities, for finalizing what we were doing.

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1.4 QUESTIONNAIRE FOR TENANTS – A QUANTITATIVE ANALYSIS OF COMMUNICATION ACTIVITIES

In the framework of the SINFONIA project, **about 1000 apartments in 17 residential buildings was refurbished**. The SINFONIA tenants were consulted via two questionnaires, one as an *ex-ante* questioning before the starting of the renovations and one after the renovations as an *ex-post* questioning. The first survey gave insights in the tenant´s energy behaviour and allowed the social-housing owners to gather information from their tenants, who are considerable experts on their respective houses. It also gave tenants the possibility to express requests and opinions on the actual state of their building. This input, when feasible and affordable, was considered in the design of the renovations. Results of the *ex-ante* questioning were published earlier (e.g., Deliverable 6.1 - "Analysis of the tenants' questionnaire survey from a communications perspective" and in DellaValle *et al.* 2018).

In the following paragraphs, we provide a **description and analysis of the questionnaires**, in Innsbruck and Bolzano/Bozen, considering the **tenants' characteristics** and the **routine of communication** with them (information activities). The following parts will focus on the results of the *ex-post* questioning. If possible, results are compared with those of the initial survey. The second consultation of the tenants provides the possibility to further analyse questions regarding issues of communication accompanying the refurbishment activities. It is the basis for the **evaluation of the applied communication methods in the SINFONIA project** as well as of the refurbishment success from the tenants` perspective. The main question to be answered is: how important are information activities during the renovation process? Did tenants change their attitudes and behaviour towards energy savings?

Thus, the following topics are elaborated in this chapter:

- The tenants' characteristics, according to the survey.
- Tenants' satisfaction with the renovation work. Tenant's attitudes towards energy saving after the renovations. Tenant's energy behaviour after the renovations.
- Tenants' considerations about the information provided during the renovation progress. Tenant's participation to the SINFONIA events

A comparison of results of the *ex-ante* and *ex-post* questioning and a comparison of results between the two demo cities Innsbruck and Bolzano/Bozen are limited due to different questionnaire items, different possibilities of answers and difference in data acquisition. Deviations are due to different internal requirements of the individual institutions involved.

1.4.1 TENANTS' SOCIO-DEMOGRAPHIC CHARACTERISTICS

Table 2 provides an overview on the survey results of a general nature. 487 tenants participated in the *ex-ante* questioning whereas significantly less tenants took part in the *ex-post* questioning. Nevertheless, with a total number of 303 participants, the sample size is still high enough to allow representative conclusions to be drawn about the data.

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Before/after refurbishment work	City	Responses	Response rate [%]	Female [%]	Male [%]
before	Innsbruck	210	42.5	55.1	42.0
	Bolzano/Bozen	277	75,9	57.8	42.2
	Total	487	-		
after	Innsbruck	177	27.7	56.7	43.3
	Bolzano/Bozen	107	89,2	54.8	43.7
	Total	303	-		

TABLE 2 - NUMBER OF QUESTIONNAIRE RESPONSES BEFORE AND AFTER THE REFURBISHMENT IN INNSBRUCK AND BOLZANO (AS OF APRIL 2020).

When analysing **age structure and gender** of the tenants that participated in the survey, the results show that the participants of the survey are mainly over 60 (50% in Innsbruck and 54% in Bolzano/Bozen, Figure 5), whereas more than half of them are female (Table 2). Figure 5 shows the age structures of the participants in the *ex-post* questioning in Innsbruck and Bolzano/Bozen. Tenants with more than 60 years are the majority in both demo cities.

In the initial survey, 62.3% of the interviewed tenants in Bolzano/Bozen are over 60 years old. In Innsbruck, the SINFONIA apartments have slightly younger residents than in Bolzano/Bozen, with most tenants in the age span of 18-65, but still a large group is in the senior age group (over 65 years).

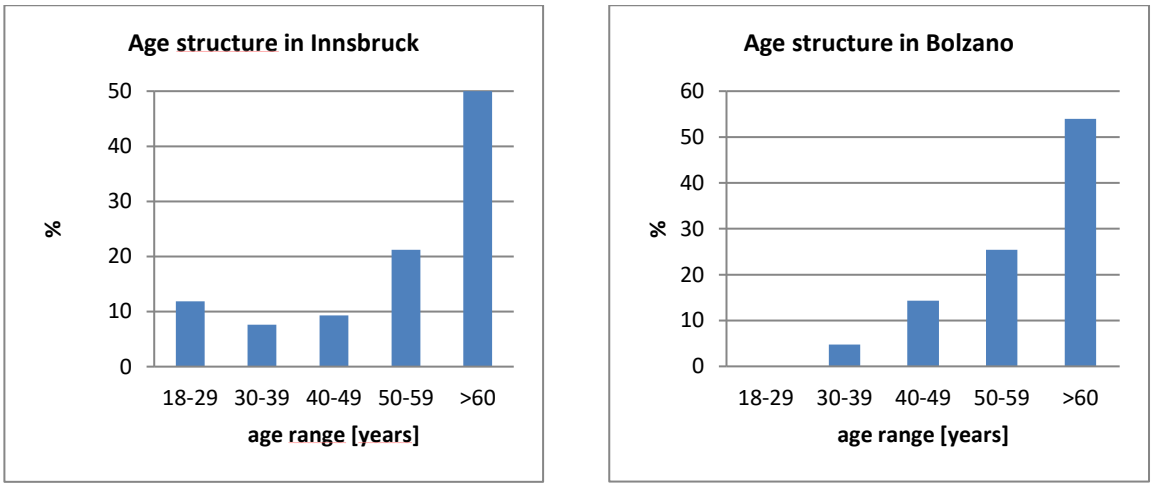

FIGURE 5 – AGE STRUCTURE OF THE RESIDENTS, WHO PARTICIPATED IN THE EX-POST QUESTIONING IN INNSBRUCK AND BOLZANO/BOZEN.

1.4.2 TENANTS' SATISFACTION, ATTITUDES, AND BEHAVIOURS AFTER THE RENOVATION

In general, **tenants are satisfied with their apartment and their building after the energy renovation**, both in Innsbruck and Bolzano/Bozen. Compared to the situation before the refurbishment, where 63% (Innsbruck and Bolzano collectively) indicated that they are pretty or very satisfied with the building they live in, numbers increased up to 94% in Innsbruck and up to about 84% in Bolzano/Bozen for several aspects of the completed refurbishment work (Table 3). These aspects include the satisfaction with the apartment, the improvement of the apartment, more comfort as well as the nicer appearance of the building as a whole.

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Topic	Innsbruck (%)	Bolzano/Bozen (%)
Satisfaction with the apartment	90.7	82.5
Improvement of the apartment	88.6	78.6
The apartment is more comfortable	74.0	84.1
The building has a much nicer appearance	94.0	83.3

TABLE 3 - SATISFACTION WITH THE REFURBISHMENT WORK IN INNSBRUCK AND BOLZANO.

Regarding **the importance of energy saving**, around 97% (Innsbruck) and 98% (Bolzano) of the survey participants indicate a very high or reasonable importance of energy saving, after completed refurbishment (Figure 6). A change in the importance of energy saving by tenants in the course of the project can be seen in Innsbruck, but not in Bolzano/Bozen. However, the majority (82%) of the participants in Bolzano/Bozen already considered energy saving to be very important in the initial survey, before the refurbishments started.

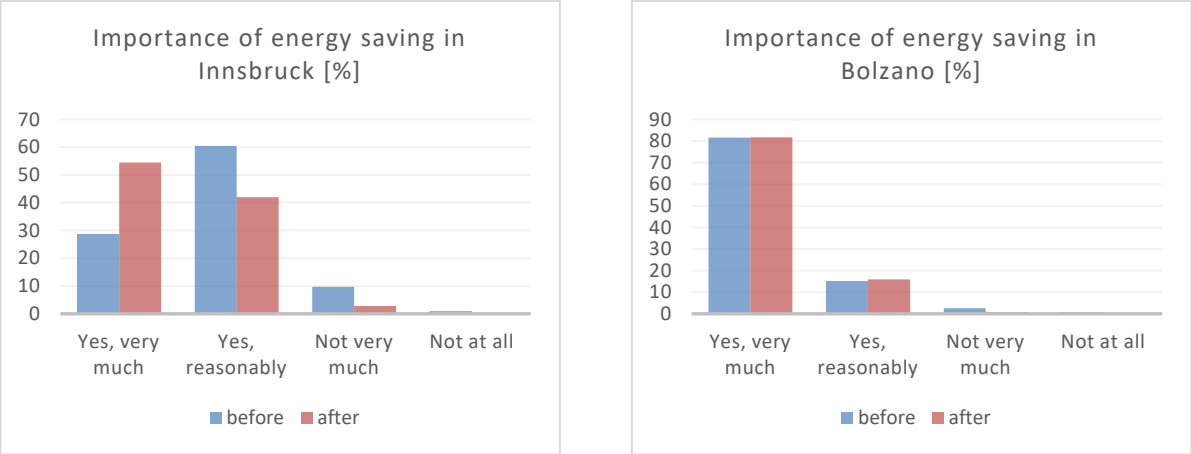

FIGURE 6 – IMPORTANCE OF ENERGY SAVINGS IN PARTICIPANTS' DAILY LIFE, BEFORE AND AFTER THE RENOVATION, IN INNSBRUCK AND BOLZANO/BOZEN.

In addition, questions about **changes of energy behaviour** after the SINFONIA refurbishment interventions were asked (Table 4). Many of the respondents answered that they use electrical devices of the energy class A+ and A++, after the refurbishment (84% in Innsbruck and 88.9% in Bolzano). A slight increase, compared to the first survey, can be seen in both cities (+6.9% in Innsbruck and +2.6% in Bolzano). While in both cities about 30% of the respondents stated that they avoid standby mode before the refurbishments, after the refurbishments the number in Innsbruck is more than twice as high (64 %). The percentage slightly increased to 36.5 in Bolzano/Bozen. 33% of the tenants use LED lights only. The question was raised in the *ex-post* questioning in Innsbruck only.

Topic	Innsbruck [%]		Bolzano/Bozen [%]	
before/after refurbishment	**before**	**after**	**before**	**after**
Use of electric devices class A+ and A++	77.1	84	86.3	88.9
Avoiding standby mode	30.5	64	30.0	36.5
Use of LED lights only	-	33	-	-

TABLE 4 - PARTICIPANTS' ENERGY BEHAVIOUR BEFORE AND AFTER THE SINFONIA REFURBISHMENTS IN INNSBRUCK AND BOLZANO/BOZEN.

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1.4.3 TENANTS' CONSIDERATIONS ABOUT THE INFORMATION AND PARTICIPATION TO THE EVENTS

The analysis of the *ex-ante* questioning indicated that 80% of the tenants would like to be informed about the energy-technical aspects of the refurbishment. Evaluating the **information flow** after the refurbishment in Innsbruck, 47% of tenants indicated that the information flow should be improved, whereas only 19% considered it to be good and 24% were neutral (Figure 7). In addition, about 10% of tenants stated, in an open questionnaire item on general suggestions, that the flow of information **should be improved**. However, when looking at the evaluation in detail, **an improvement along the SINFONIA project is visible.** The flow of information was criticized more often in buildings that had been renovated earlier.

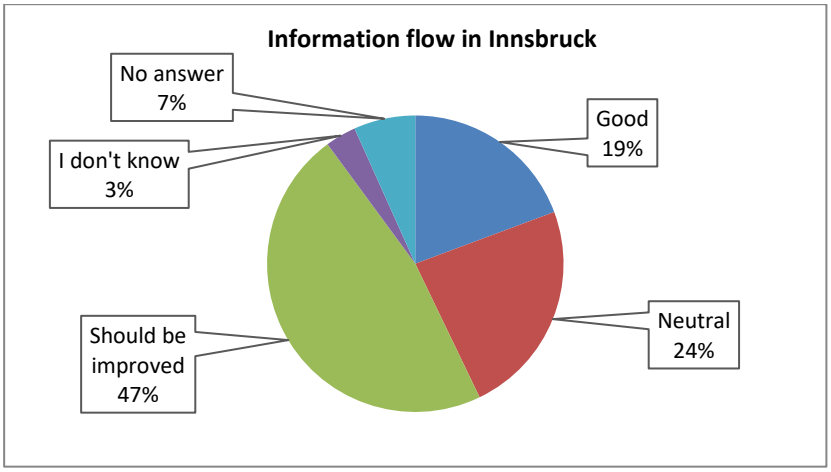

FIGURE 7 - EVALUATION OF THE INFORMATION FLOW DURING THE REFURBISHMENT PROCESS IN INNSBRUCK.

When it comes to the preferable format in which information about the refurbishement should be delivered, in the *ex-ante* questioning tenants indicated that guidebooks and meetings are preferred, followed by information via internet. At the end of the project, it can be seen that in Innsbruck the involvement format of workshops was the most accepted (45.9%), while in Bolzano/Bozen it was the format of meetings (61.1%). A considerable number of tenants also used the possibility provided by the social-housing owners to visit a demonstration apartment, similar to their own, where they could gain an idea about how their future flats will look like and how they will be technically equipped (Figure 8).

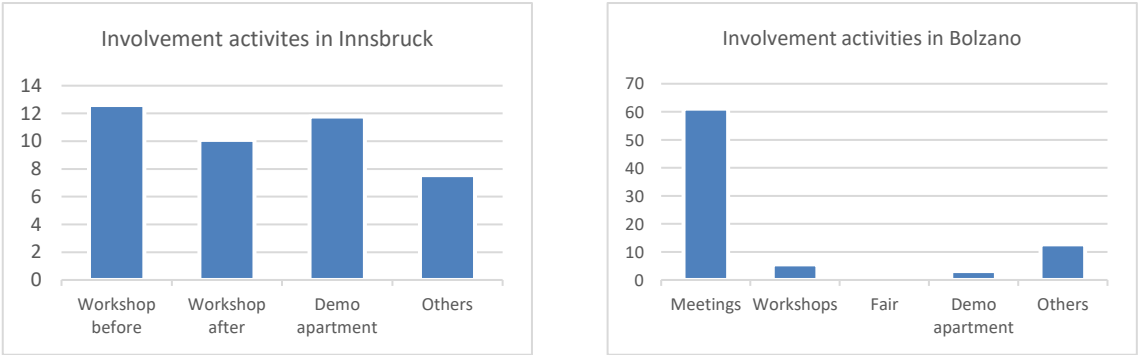

FIGURE 8 – PERCENTAGE OF TENANTS PARTICIPATING IN THE INVOLVEMENT ACTIVITIES, IN INNSBRUCK AND BOLZANO/BOZEN.

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In addition to the activities listed in the questionnaire, other formats for the provision of information were provided to the tenants. Before the refurbishment process began, all tenants were given a folder with the planned technical refurbishment measures. During the process, regular notices about upcoming measures, timelines and appointments were posted in the stairwell. Furthermore, there were four information newspapers over the renovation period, which provided information about the progress of the refurbishments. **Individual consulting and constant information flow** was necessary to convince tenants about the advantages of refurbishments, especially regarding the installation of mechanical ventilation systems. The weekly on-site consultation hours, which followed directly after the construction meeting and where the tenants had a contact point for problems and questions, were particularly busy.
Furthermore, one of the Innsbruck social-housing owner (IIG) organized a celebration event in the courtyard of a refurbishment building with a tent, a bar and a pin board where suggestions, worries and ideas of the tenants, regarding the design of the forecourt and courtyard, could be attached.

1.4.4 GENERAL ASSESSMENT OF THE COMMUNICATION ACTIVITIES

It has to be stated, that **the interpretation of the available data** of the questionnaire survey for tenants is limited due to different sample size, differences in the composition of questionnaire items for tenants of different social-housing owners and due to the mode of data acquisition. Nevertheless, one can draw conclusions for further comparable projects.

The results of the questionnaire show that **the tenants are rather satisfied with their apartment and building**, on average. The number of satisfied tenants is higher than before the refurbishments. In the same way, a larger percentage of those surveyed consider saving energy in everyday life to be important after the renovation works. This result indicates a connection between being a beneficiary of energy refurbishment and creating a positive attitude towards energy saving.

Almost every second respondent in Innsbruck thinks that **the information flow concerning the refurbishment process should be improved.** It was challenging to find a good amount of information for everyone, as "the average tenant who responded would like to be involved in some parts of the renovation, but on a general level, not too detailed, and would prefer information about the renovation to be provided through meetings with experts or through guides" (Deliverable 6.1 - Analysis of the tenants' questionnaire survey from a communications perspective, 2016). In contrast, only 19% found the flow of information good. Personal feedback of the tenants that actually participated in the informative events was consistently positive. The fact that the proportion of people who are not satisfied with the offered information on the refurbishment is high suggests that the formats were not always well-received. This may be due to the tenant structure of the SINFONIA refurbishment complexes with a high percentage of elderly people.

The flow of information was criticized more often in buildings that had been renovated earlier. That reflects the constant effort of the social-housing owners to improve and adapt their daily information routines to the tenants' requirements.

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Looking at the experiences and lessons learned throughout the project, what we can see in the gathered data and what we learned by personal contact with the tenants, a well-functioning communication between the tenants and the social-housing owners is a good base for positive attitudes and interest towards energy efficiency and refurbishment. To reach long term targets and behavioural changes, communication has an important role to play. Many of the tenants surveyed participated in several SINFONIA activities, but to be able to build comprehensive knowledge about tenants' behaviours and how we best can communicate with them, we need for many different perspectives which cannot be created by questioning alone.

1.5 CONCLUSIONS

This chapter tried to assess the engagement of stakeholders in the SINFONIA project, in Bolzano/Bozen and Innsbruck, using qualitative comparison and analysis. There are some strong results from engagement experiences, such as the clear understanding that two case studies, so different from cultural, social, economic, and institutional viewpoints, must be treated in different ways.

Both Bolzano/Bozen and Innsbruck provided information to residents and organized engagement processes involving all the relevant stakeholders, since the beginning of the project. The SINFONIA project and the engagement processes worked for improving the quality of life of people, both tenants living in the renovated houses and all the people and organizations living in the two urban areas. It is not easy to organize an appropriate engagement process, and not simply an advisement. However, the institutions involved in the SINFONIA project tried to know, as better they could, the two urban environments, understanding who is the people involved, in which neighbourhoods they live, who are the people and institutions they trust on, and which are the main stakeholders to engage.
There are also some weaknesses encountered along the project, such as a low acceptance of the interventions at the beginning (Innsbruck) or at the end (Bolzano/Bozen) of the project. Some more actions to understand better the urban environments and their characteristics could be organized. However, from weaknesses and strong points of the SINFONIA project, we define a local society engagement strategy. Before to propose it, we explain other parts of the experimented tenants' engagement in the SINFONIA project.

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2. CHANGES IN ENERGY TECHNOLOGIES AND DAILY ENERGY BEHAVIOURS

In 2050, 66% of the global population will live in **cities**. This scenario encourages urban planners to work together to guarantee an **efficient and sustainable place** to live to an increasing number of **citizens**. Indeed, the building sector is, along with transport, industry and energy, the main contributor of the CO_2 emissions into the atmosphere.

Still, the action plan should not be solely focused on designing new efficient and sustainable houses; **retrofitting the existing housing stock** must also be a priority. Living in an efficient and sustainable place is associated to several benefits, wherein the environmental ones are only an example. For instance, living in an inefficient house causes not only higher energy costs, but also increases the cost of medical expenses, since people are exposed to a higher risk of respiratory and heart problems. Therefore, retrofit interventions can make a difference, especially for those people with existing vulnerability conditions.

SINFONIA is one of the pioneer projects promoting the retrofitting of social housing in Italy. Thanks to funding from the Seventh Framework Program of the European Union for Research, researchers from the Institute for Renewable Energy of the European Academy of Bolzano (Eurac Research), in collaboration with the Municipality of Bolzano/Bozen, supported by experts from IDM Südtirol - South Tyrol, the Institute for Social Building IPES, Alperia and Agenzia CasaClima, will transform areas of Bolzano/Bozen. At the core of this transformation will be the **renovation** of several **social housing districts**, through the introduction of several technologies. These interventions aim to improve the quality of life at home, increasing energy saving and comfort for those who live there.

2.1 BEHAVIOUR MATTERS

The SINFONIA energy efficiency strategies go well beyond technological interventions. The project acknowledges that the behaviour of those interacting with the target environment makes a difference, especially the **decisions made by tenants** in regard to **energy consumption** and **use of technology**. These aspects will ultimately determine whether the expected levels of energy efficiency associated with the retrofit interventions will be achieved (or not) and, therefore, will improve their quality of life. But how would it be possible to leverage such decisions in an effective way?

The economic theory of rational choice would be a candidate model to explain and understand **how to leverage human behaviour**. According to this theory, individuals aim to maximize their interests through the choice of the best possible course of action, considering certain constraints, including income and time, prices and laws. Moreover, this theory assumes that individuals - seen as perfectly informed and rational - in order to choose the best course of action (i.e. the course of action to which the greatest utility is associated), are always able to assess the costs and benefits associated with alternative courses of action. Within the rational choice framework, preferences motivate choices and are stable over time. For this reason, preferences cannot be used as a political lever to improve behaviour. Instead, constraints and incentives can be changed. Therefore, this theory assumes that by

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changing constraints and incentives, it is possible to improve individual behaviour and align it with policy goals.

The rational choice model has been the basis of many disciplines for years and has justified the use of **restrictions and incentives** as political tools to guide decisions and achieve positive outcomes to the society. One of the main reasons such model has been extensively exploited by policy makers is that it can be well translated into mathematical formulas that are useful to explain how aggregated phenomena can be influenced by individual behaviour. However, this model does not reflect the real motivations underlying why people behave in a certain way.

Since the 1970s, decades of empirical evidence has shown that individuals decisions deviate from the assumptions of the rational choice model in a systematic way. This fact has allowed decision makers to model and predict these “irrational” deviations by integrating rational choice theory with alternative behavioural models.

2.2 THE CONTRIBUTION OF BEHAVIOURAL ECONOMICS

Behavioural economics is seen precisely as an integration to the theory of rational choice, in order to model human behaviour in a more realistic way. Using the experimental method, this field has shown that individuals can make rational decisions, but often they do not have enough mental capacity to do so. For this reason, individuals tend to make decisions automatically, influenced in a systematic way by contextual factors, such as how information is framed, loss aversion, social norms, and the tendency to underestimate the future consequences associated with decisions.

Behavioural economics does not only propose a more careful introspection to describe and predict human behaviour and the resulting economic implications; it also enriches the portfolio of useful tools to promote the well-being of a society.
Better decisions can be promoted not only by using restrictions and incentives, but also by acting on **those factors that systematically lead individuals to make “human" decisions.** A careful consideration of these factors, denoted as the process of "choice architecture" by the Nobel Prize winner for economics Richard Thaler, is also extremely important in the process of designing interventions that aim to retrofit a building. The building designer plans technological interventions, and at the same time designs implicitly the choice context, and hence, the direction of the behaviour of tenants living there.

The SINFONIA project analyses the **virtuous behaviour of tenants**, not just technological innovations. The context in which individuals decide on a daily basis **how much energy to consume and how to interact with the technological interventions** is complex. In particular, it embeds the invisible nature of energy and environmental conditions and this could lead to an unconscious waste of energy and lower quality of life. For this reason, it is necessary to provide consumption feedback to tenants once the retrofit interventions are completed in an easy and understandable way.

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2.3 TENANT INTERACTION WITH FEEDBACK APPLICATION

Providing feedback can boost effectiveness on retrofit interventions thanks to the behaviour of household occupants on the residential sector. **Consumption feedback** not only **increases awareness** on energy and indoor environmental conditions, but it also **leads to behavioural changes** that help reducing considerably energy consumption as well as improving the quality of life. Feedback is not just a matter of showing real-time values, it is also necessary to think about the medium to deliver information and also what information is relevant to engage tenants in the process of reducing energy consumption.
For instance, tenants can check on their consumption by looking at their electricity bills on a monthly basis. While they usually contain simple information, they are available usually on a monthly basis, so tenants are not able to observe their behaviour in a short term.

Another way to provide feedback is through the installation of **in-home display devices** for specific consumption and environmental conditions. Such devices are useful to deliver instantaneous values but, in some cases, tenants cannot use this information to make the best decision since data is not always understandable for them, and also previous data is usually lost.

Among the technological innovations, the SINFONIA project introduced a **monitoring system** that allows the data acquisition for energy consumption and environmental conditions inside some of the retrofitted houses on an almost real time basis. By having this amount of data available, it is possible to think about other strategies to provide feedback to tenants. For instance, by developing web applications it is possible to transform collected data into relevant information, as well as being able to navigate through previous data in terms of energy consumption. This strategy enables also to access to the system from any device connected to internet. Such applications can be more flexible and effective than solutions mentioned above. However, this only applies if tenants are engaged to access to the application.

By taking into consideration all the possible solutions, on one hand **a web application was developed to provide feedback to tenants.** This application allows to (1) visualize energy consumption (electrical and thermal energy), as well as environmental conditions (temperature, humidity, quality of air) on a real time basis; (2) based on the current situation inside houses in terms of real-time data, the application provides possible actions to take in the form of advices in order to increase awareness of tenants about consumption misbehaviour and how to fix them; and, (3) the application enables to visualize energy consumption for previous days, weeks and months. On the other hand, a mobile device was installed as an in-home display, making it possible for tenants to access to the application and provide feedback effectively.

2.4 ACTIVATION OF FEEDBACK APPLICATION

Mobile devices running the **web application were installed so far in houses from one of the refurbishment sites,** specifically in Via Passeggiata dei Castani, Bolzano/Bozen. During the installation of the mobile device, tenants who signed the house lease agreement (householders) provide the

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following information for each occupant living in the house: (1) gender; (2) birthyear; (3) mean hours at home; (4) occupation.

The installation of mobile devices and the **activation** of the application was done in three different periods. The first activation occurred on November 22nd, 2019, having 12 mobile devices installed. In the meantime, a tenant decided not to continue using the application, removing the device a month later. The second activation occurred on February 17th, 2020, having 16 mobile devices installed. The last activation occurred on March 2nd, 2020, having 17 mobile devices installed in total.

Currently, there are **17 families** with active mobile devices running the web application; most of the families have at least 2 occupants. From these families, 8 householders are female, most distributed in the age interval from 49 to 67; while 9 householders are male, most distributed in the age interval from 52 to 68 (Figure 9). Only householders are reported, based on the assumption that they are the most interested in using the application.

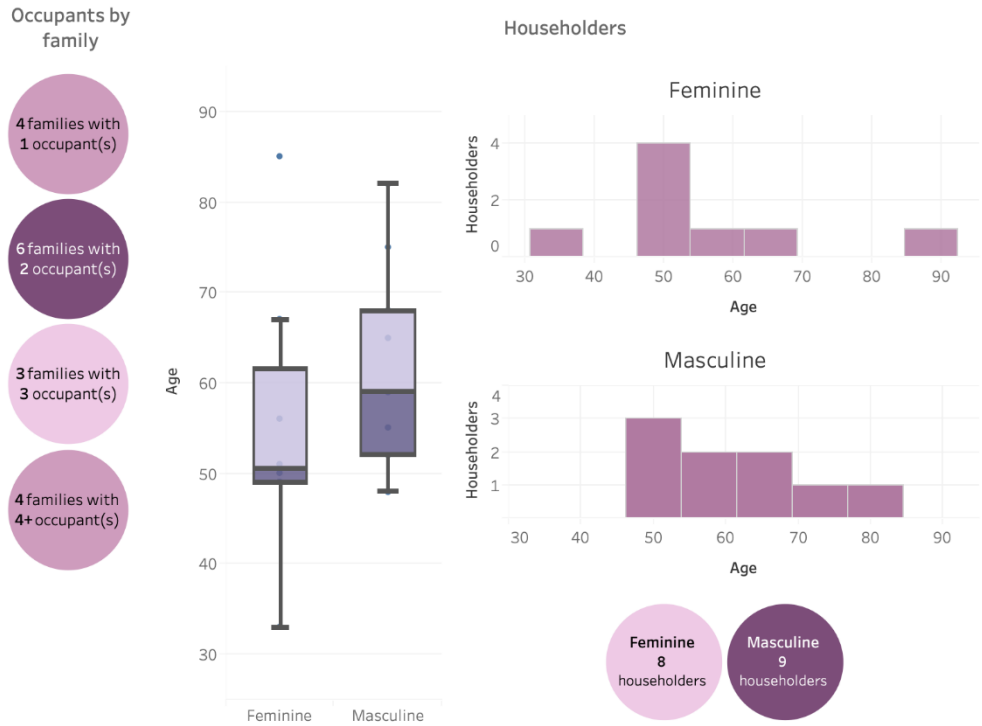

FIGURE 9 - GENERAL DISTRIBUTION OF FAMILIES AND HOUSEHOLDERS WITH FEEDBACK APPLICATION IN VIA PASSEGGIATA DEI CASTANI, BOLZANO/BOZEN.

Householders specified one of the following occupations: (a) Office employee; (b) Self-employed; (c) Operative worker; (d) Housekeeper; (e) Job seeking; (f) Retired; (g) Other. Also, householders specified one of the following range of hours in which they are usually at home: (a) from 7 to 11; (b) from 12 to 18, and; (c) from 19 to 24 hours (Figure 10). In this case, the occupation determines the range declared by householders. As a result, most of householders declared to be at most 18 hours at home due to different activities carried on during the day (work, family, etc.).

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2.5 TENANT INTERACTION THROUGH EVENT REGISTERING

Given the flexible nature of web applications to develop complex functionalities, it was possible to register the following **events when using the feedback application:** (1) tenants clicking elements for different sections in the application; (2) showing specific notifications to tenants, related to possible misbehaviours in terms of energy consumption and quality of life; (3) tenants sending a message through the Support section; and, (4) tenants editing information for tenant's profile.

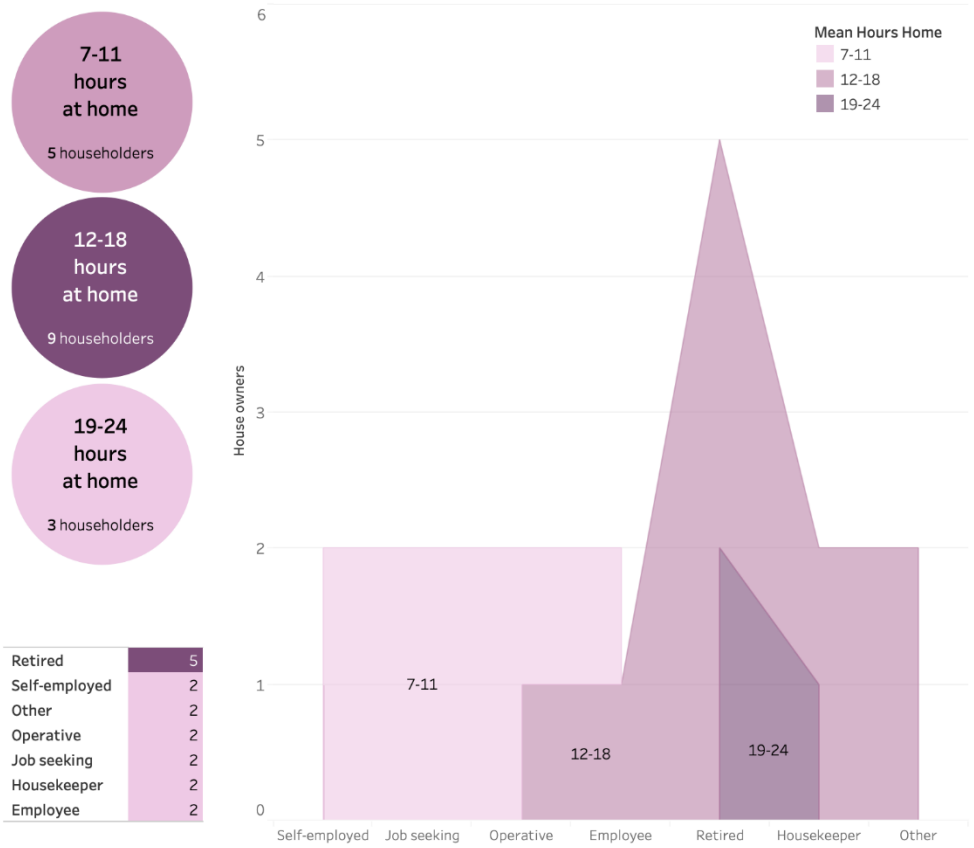

FIGURE 10 - MEAN HOURS AT HOME AND OCCUPATION FOR REGISTERED HOUSEHOLDERS IN FEEDBACK APPLICATION IN VIA PASSEGGIATA DEI CASTANI, BOLZANO/BOZEN.

In particular, to estimate **the perceived value of the feedback application as an innovation,** it was possible to register click events from tenants as an indicator of interaction (Figure 11). Such interaction can be explained through the Hype Cycle pattern[5] which is used to determine the progression and adoption of an innovation. This pattern presents the following stages:

1. Innovation Trigger: this stage occurs when a technology or innovation has been launched and there is an interest in using it.
2. Peak of Inflated Expectations: expectations rise after the introduction of a technology or an innovation, and possible adopters start exploring all the present features.

[5] Blosch M. Jackie Fenn J. Understanding Gartner's Hype Cycles. 2018. url: https://www.gartner.com/en/documents/3887767.

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3. Trough of Disillusionment: this is an inevitable stage, in which impatience for results starts replacing the initial excitement about the potential value of an innovation. This can be associated to problems with performance or slower-than-expected adoption, leading to missed expectations.
4. Slope of Enlightenment: after the initial difficulties, early adopters begin to experience benefits and commit efforts to move forward. During this stage, adopters understand more about where and how an innovation can be used and its positive effects, as well as what parts bring little or no value.
5. Plateau of Productivity: once benefits of an innovation have been demonstrated and accepted, also levels of risk have been reduced. Penetration of the innovation accelerates rapidly as a result of productive and useful value.

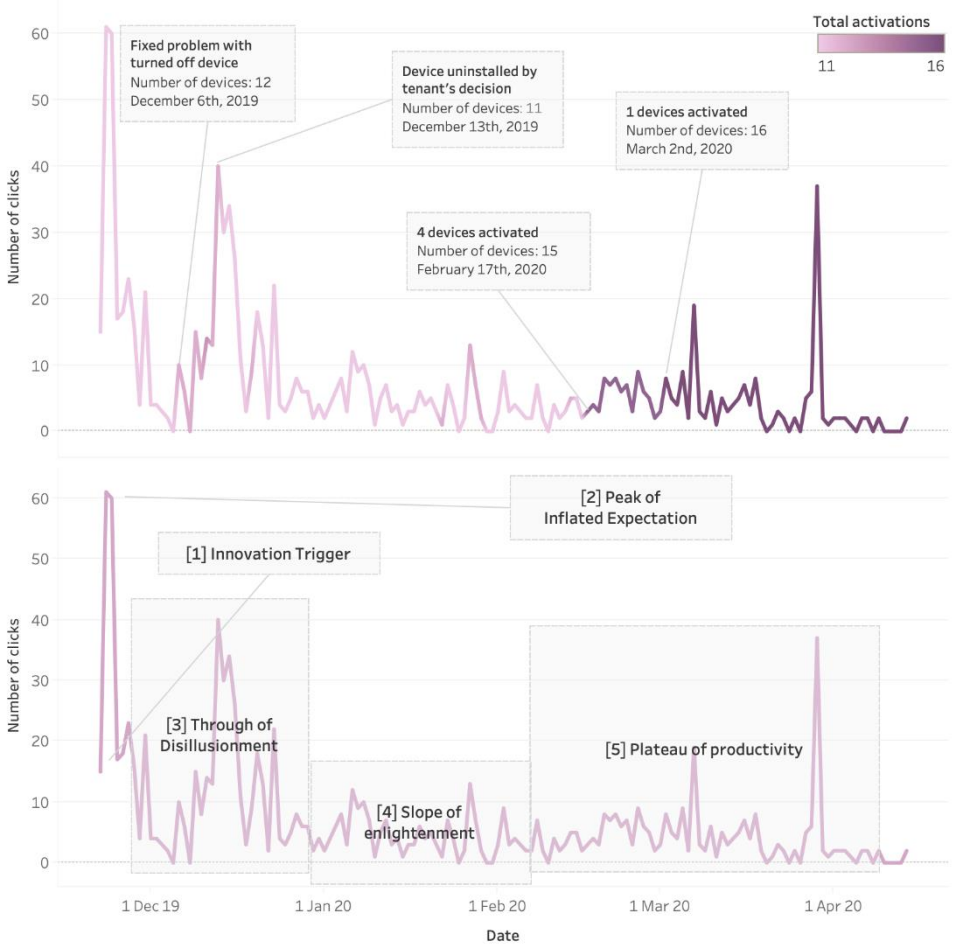

FIGURE 11 - TENANT INTERACTION WITH FEEDBACK APPLICATION IN VIA PASSEGGIATA DEI CASTANI, BOLZANO/BOZEN, AND COMPARISON TO THE HYPE CYCLE PATTERN.

The interaction with the feedback application might be influenced by **the number of hours a tenant is at home** (Figure 12). For instance, tenants declaring to be at home from 7 to 11 hours usually interact less with the application during the day; the interaction during the week is constant.

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Tenants being at home more than 11 hours interact more in the morning (6:00-9:00) and in the evenings (18:00-20:00). Instead, interaction is higher in the afternoon (16:00) for tenants declaring to be at home from 12 to 18 hours. A possible reason is that they come back home at that point of the day, having more time to interact with the application. Lastly, the interaction with the application is higher during the weekends and on Mondays.

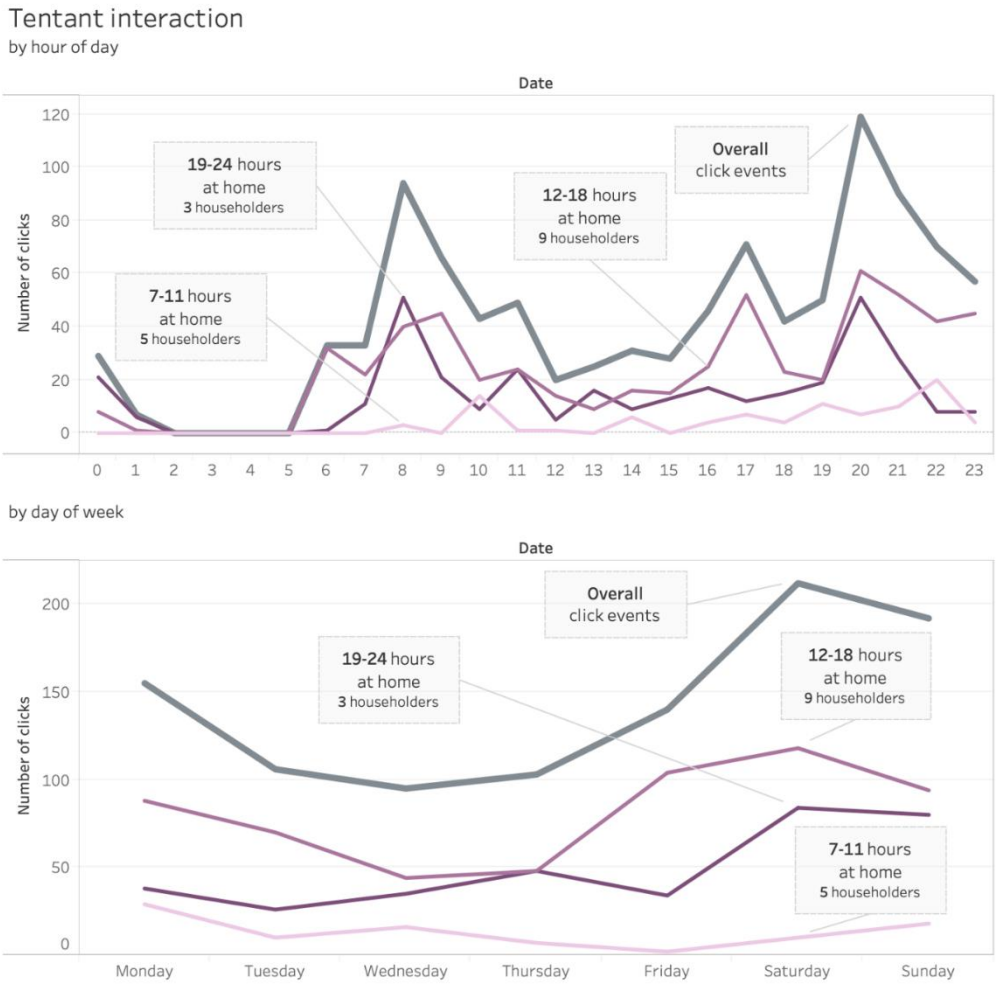

FIGURE 12 - TENANT INTERACTION WITH FEEDBACK APPLICATION IN VIA PASSEGGIATA DEI CASTANI, BOLZANO/BOZEN, DURING HOURS OF THE DAY AND DAYS OF THE WEEK.

In particular, feedback application registers the following **click events:** (1) a tenant clicks on an alert notification, meaning that he knows that something is wrong inside his house and what is the possible action to take in order to correct it; (2) a tenant clicks to visualize his previous electrical and thermal consumption; (3) a tenant navigates through different levels of visualization for previous electrical and thermal consumption (day, week, month); (4) a tenant enters to the Profile section to visualize/edit his information; (5) a tenant enters to the Support section to send a message about possible troubleshooting, errors or comments about the feedback application.

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Since the main section of the feedback application shows the notifications, almost all of the interaction occurs here (Figure 13). To open the section to **visualize previous consumption** in terms of energy and thermal conditions, tenants must click a button; inside this section it is possible also to visualize information by different levels (day, week, month) and to navigate to previous information. Less interaction occurs to edit their profile and to send messages through the Support section; both options are accessible from the main section.

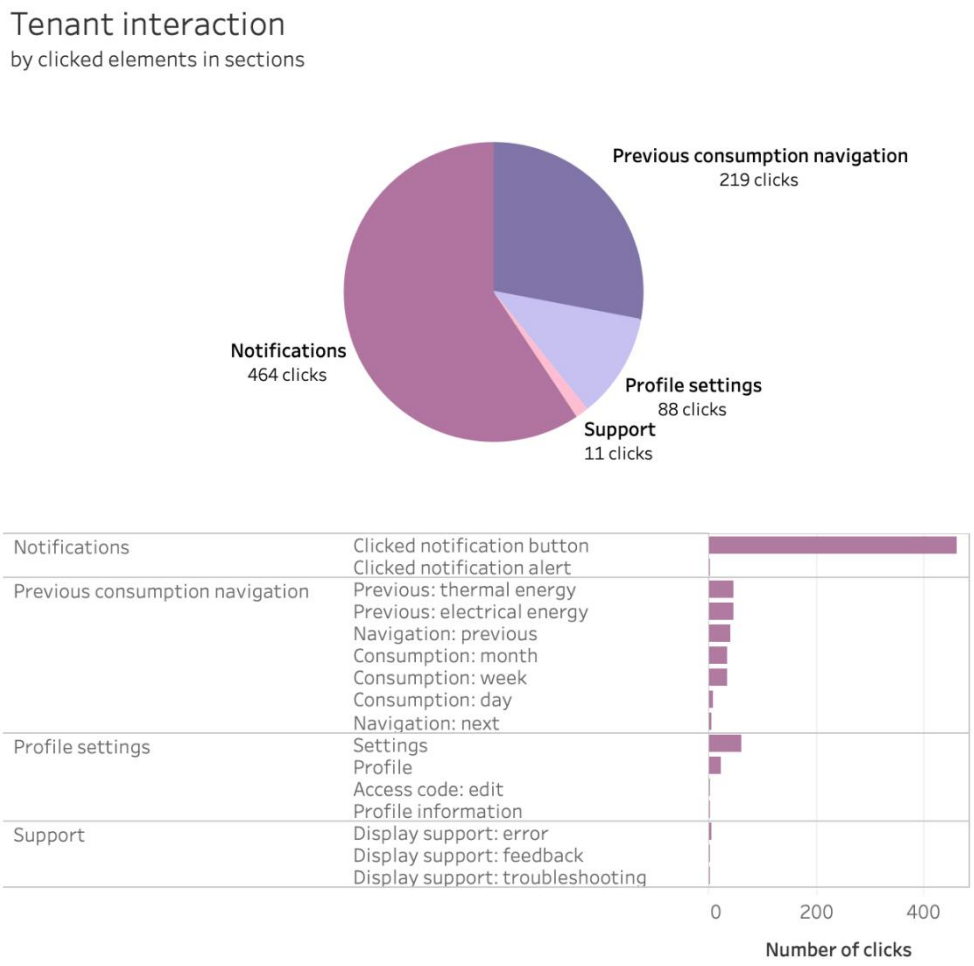

FIGURE 13 - TENANT INTERACTION WITH FEEDBACK APPLICATION BY SECTION AND BY NOTI- FICATION IN VIA PASSEGGIATA DEI CASTANI, BOLZANO/BOZEN.

2.6 TENANTS REACTING TO NOTIFICATIONS

Whenever a new notification appears in the application, also a button pops up. When only one notification is present, the button has the label “Close”; otherwise it has the label ”Next”. In any case, tenants can click the next/close button to read all the new **notifications.** By doing so, tenants acknowledge that there is something wrong inside their houses, knowing as well about the possible actions to take in order to correct any problem.

Notifications take into account the following measurements: instantaneous energy consumption for electricity and thermal conditions, temperature, humidity, quality of air. It is possible that the same notification appears for different measurements since it might affect both energy consumption and

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environmental conditions. Notifications indicate what the problem is and the possible actions to take as follows (Figure 14):

- **Set correct heating to 21°C**: this notification appears during winter, whenever the internal temperature is above 21◦C, which is the recommended indoor temperature.
- **Close windows to save energy**: heating is on and windows are open, causing an extra consumption in terms of energy. Since the rest of environmental conditions are under control, there is no need to keep the windows open.
- **Air is very stale, open windows**: having a good indoor quality of air is necessary to avoid problems as headaches, fatigue, dizziness, etc. A way to improve quality of air is by increasing the speed of ventilation. However, in some cases this is not enough, so opening windows might help.
- **Keep windows open to refresh air**: quality of indoor air is not optimal and ventilation system is not able to exchange the air fast and windows are open. Eventually, the quality of air will improve if windows are kept open.
- **Turn off a device**: in Italy, it is possible to use up to 40% more than the maximum leased electric power. However, after 10 minutes of going above this threshold, there is a power outage. By showing this notification, the tenant is aware that the power outage might occur.
- **Air inside is clean. Decrease ventilation speed**: quality of indoor air is optimal, so it is possible to decrease ventilation speed in order to save energy.
- **Air is stale, increase speed from ventilation**: by increasing the speed from ventilation the quality of indoor air can be improved.
- **Air is stale, keep ventilation on**: the quality of indoor air is not optimal, but maintaining the ventilation system working might help.

The engagement rate with the feedback application through notifications (clicked notifications/total notifications) is 1.78%. Such rate is between benchmarks reported by industry and social media applications such as Instagram (1% - 3%)[6]; to the best of our knowledge, there is no available information about engagement rate calculation on feedback applications. Tenants declaring to be at home from 12 to 18 hours report the highest engagement rate, while tenants declaring to be at home at most 11 hours report the lowest rate from the group (as expected).

[6] G. Mee. What is a good engagement rate on Instagram? url: https://www.scrunch. com/blog/what-is-a-good-engagement-rate-on-instagram.

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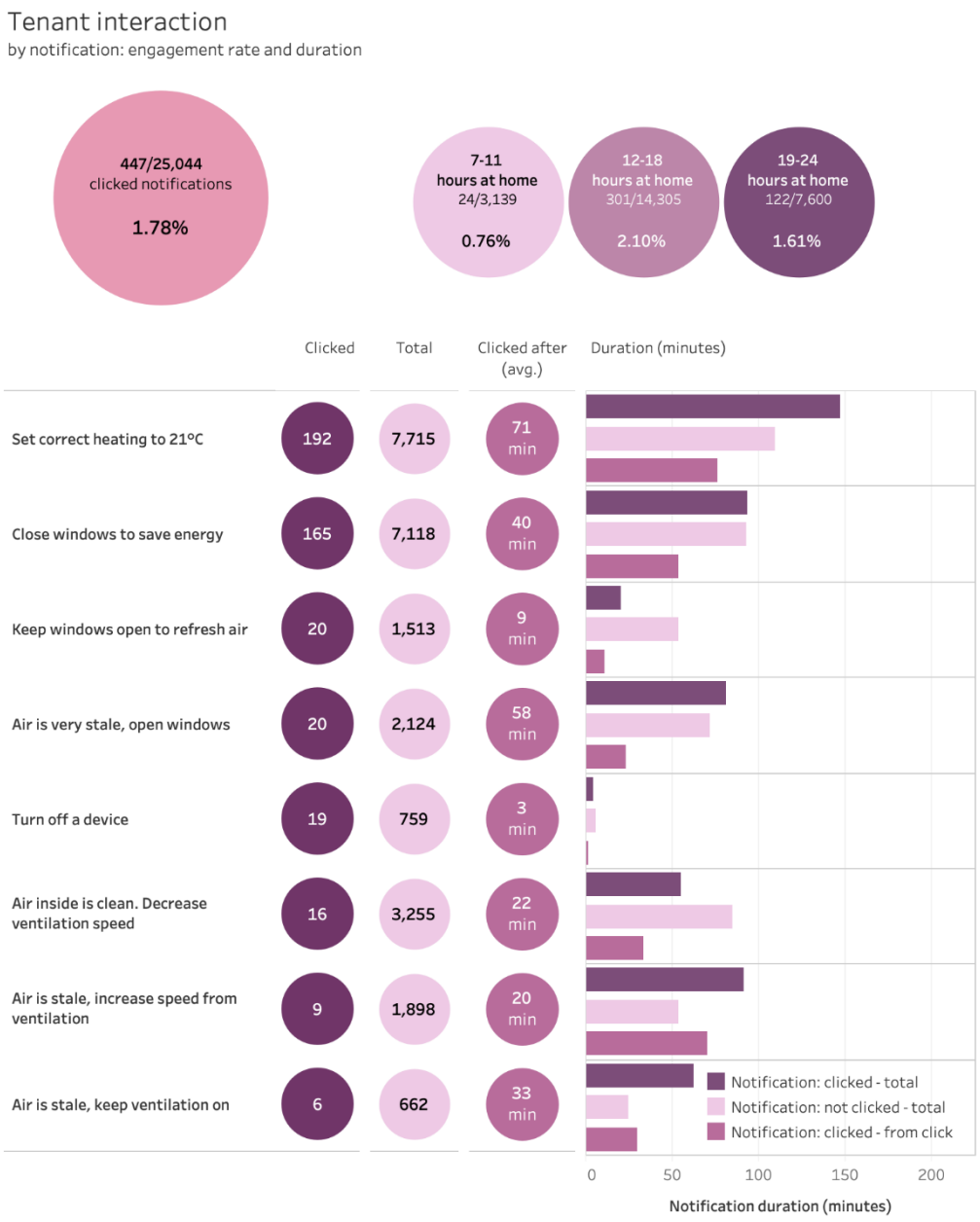

FIGURE 14 - ENGAGEMENT RATE AND DURATION OF NOTIFICATIONS FOR FEEDBACK APPLICATION IN VIA PASSEGGIATA DEI CASTANI, BOLZANO/BOZEN.

The **time of reaction** from tenants click the notification button depends on the type of message. This might be associated to the unconsciousness of how certain actions lead to energy wasting and poor environmental conditions.

By comparing the duration of a notification that was not clicked with the duration of a clicked one, the results suggest that it would be better to not interact with the feedback application because, eventually, the notification would disappear; in other words, the results indicate that clicked notifications last longer. However, if a tenant is not conscious about a problem, it is not possible to act accordingly. Hence, the duration of a notification starts when tenants click on them, acknowledging there is a problem and taking actions to solve it.

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2.7 LEVERAGING BEHAVIOUR USING INSIGHTS FROM BEHAVIOURAL ECONOMICS

Having more information available does not always translate into a willingness to change behaviour. As opposed to the rational choice model of human behaviour, evidence shows that human biases can systematically prevent us from making optimal decisions on the basis of provided information. Individuals often do not make decisions based on cost-benefit analysis as this model assumes, relying rather on the use of simple "rules of thumb", and the formation of habitual behaviours can often create a gap between how we intend to behave and how we actually behave. For this reason, **in order to leverage tenants to adopt more virtuous energy behaviours, we need to more carefully take into account the nuances of human behaviour, and use insights from behavioural sciences** to design an intervention that more closely targets the desired behavioural change.

Therefore, an intervention drawing from behavioural economic insights is tested within the project. This intervention leverages social norms, a factor that the behavioural economic field has proven to be one of the most effective in guiding individual behaviour. The intervention involves complementing the existing information on individual energy consumption with social information on the energy consumption of a reference group of neighbours who set a good example in terms of energy consumption. **The idea behind the intervention is that, being presented with particularly virtuous social information from a closely linked social group, tenants will adapt their behaviours to better reflect the normative behaviour** (e.g. the behaviour in which similar peers engage).

There is a wealth of evidence in the psychological and sociological literature that provide explanations for why these types of interventions are successful, all centring around the idea that humans are social creatures, and we get an intrinsic benefit from knowing we are behaving according to the behaviour in which also similar peers are engaging.

In addition to receiving information about the behaviour in which similar neighbours are engaging, tenants receive smiley faces in the display if they are consuming less than the reference group of neighbours, and frowning faces otherwise. This is to signal the **social appropriateness** of their consumption level relative to their neighbours, and it has been proven to increase the success of these types of interventions by stopping those who consume less than the norm to increase their consumption.

The identification of effectiveness of this intervention will rely on how closely we can identify a causality between our intervention and the resulting behaviour. For this reason, we adopt an **experimental approach,** splitting the tenant population into control and treatment groups. The control group receive information on their own energy consumption, without the comparisons to neighbours or the provision of emoticons, while the treatment group receive this comparison and the emoticon appeals to norms.
It may seem odd to treat only half of the tenant population, but this approach is necessary to test the effectiveness of our intervention. Not providing the intervention to some tenants not only gives us an indication of what would have happened in absence of our intervention, but also allows us to establish causality between intervention and subsequent behaviour by observing differences between groups in energy consumption. By testing and understanding the effectiveness of our intervention using this

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experimental approach, we can provide robust evidence for its successfulness, thus, enabling us to confidently suggest its implementation at a larger scale.

The behavioural intervention helped to **unlock the full potential of the project,** with positive effects on both the environment and the quality of life. And the merit is due not only to the technological interventions, but especially to the virtuous behaviours of the tenants.

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3. A STRATEGY FOR LOCAL SOCIETY ENGAGEMENT

Summarizing and structuring the findings of the previous parts, this chapter will propose a strategy for promoting stakeholders and tenants' involvement. The important thing in the **local society engagement** is **to define a strategy towards shared goals** e.g., low-carbon and smart societies, **and actions involving all the relevant actors in the urban environment.** This strategy (or list of actions) will promote the transformations of urban contexts into low-carbon and Smart Cities and it is proposed to the Early Adopter Cities and all the cities that will be committed to smart and sustainable goals.

The **engagement** of all the relevant actors in a urban environment is important for transforming cities into Smart Cities. Good participatory process activates social learning opportunities and activities to promote the sharing and achievement of common goals. In a participation process, it is important to pay attention to who is participating (Cornwall 2008), which are the expectations of the involved actors, how and when to participate (Rossio and Seo 2020). The participation techniques, developed in the past, have made the participatory process increasingly important in the planning of projects. The application of a participatory approach generates several advantages, such as a stronger achievement of project goals, so it becomes important to involve. However, the participation is not easy, and several participatory processes have failed. For this reason, we are still working for understanding how to better address the involvement of the actors.

One of the first aspects to be promoted using the engagement process is the sense of belonging to the community and project. The **sense of belonging** is defined as an experience of personal involvement in an urban environment (e.g., neighbourhood) (Jørgensen 2010). People feel to be an integral part of that environment, due to the sense of history given by the connection between generations and age groups, and the sense of community that represents the relationships between the people who live in a common place (Beatley 2005). For ensuring this sense of belonging linked to a Smart City project, people should feel part of the creation of the project and the project should be transparent and accountable. In this case, people will strive to ensure that the project will have positive results, sharing greater flows of ideas (Rossio & Seo 2020). Participation generates collaboration, inclusion, and weaken unbalanced powers. In this way both organizations and the community are driven to **collaborate** with each other, develop common lines that both are going to respect. In particular, and with reference to the SINFONIA project, based on what the objectives are, we believe that three aspects play a fundamental role in participatory approaches: **create a trust network of relationships between the involved actors**, **work together**, and **prioritize common goals** e.g., the improvement of quality of life.

Tenants in renovated buildings are available to participate when the process tailors energy renovations to **people's needs**, emphasizing those aspects that deal with a wider concept of **quality of life** and **energy justice**. The decrease of energy consumptions is not a priority of people living in social-housing buildings, even if the decrease of **energy poverty** can have a positive impact on the people life. **Social sciences and humanities** should contribute more in the understanding on how to deal with other priorities and how to promote an effective urban governance. Social sciences and humanities can analyse and transform relevant information of the social and relational urban context in useful insights for smart energy renovations.

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In this sense, the ongoing experiment in SINFONIA project, explained in the chapter 2, is using behavioural economics insights to engage tenants, in their houses. For promoting the adoption of virtuous energy behaviours in house, tenants are engaged through a display device, which provides notifications and feedback on energy consumptions and indoor environmental quality. This experimental approach shows the first interesting results and could be replicated in other cities, neighbourhoods, and houses.

It is relevant to carefully watch at and understand the **urban context** in which a Smart City project is promoted. It is necessary to create community and understand the resources that could address positive achievements in terms of low-carbon and smart local societies. All these aspects guarantee an active acceptance of the changes, a contribution to the improvement of the urban environment, a greater respect to the urban and natural environment that could bring to sustainable choices. An effective involvement process deals with the belonging to a community, the capability and resources of people to speak about their needs and elaborate them, with other actors, and to achieve common goals e.g., the improvement of the quality of life in the urban environment or neighbourhood. There are several aspects in the behaviours, in the relationships among people, in people living in the urban environments. All these aspects must be considered and transformed into resources for smart and low-carbon or, widely, sustainable development.

ANALYZE the context, the social, economic, and environmental resources, the population and its socio-demographic characteristics, the stakeholders, the existence of a urban governance, etc.	DEFINE AND SHARE the goals for that urban context (city or neighbourhood) with all the stakeholders.	DEFINE AND SHARE the actions to achieve the goals and promote the contribution from all the stakeholders, including the inhabitants.	ENSURE the quality of the engagement process, promoting high level of participation, facilitations, sense of belonging to the place and the project, and commitment.	PROMOTE the change towards sustainable energy choices and behaviours, also integrating social and technological innovations.

TABLE 5 – GENERAL ACTIONS FOR THE LOCAL SOCIETY ENGAGEMENT.

Based on all the considerations included in this report, we propose a list of actions, synthetized in Table 5, aimed at promoting an effective local society engagement. The list of actions should be included in wider dictionary and guidelines of the engagement.

- **Analyse and understand the urban context** in which the project is embedded. Which are the main social and relational resources? Is there trust in institutions and among people living in the neighbourhood or in the city? Are public and private services available to meet the first needs of people in the neighbourhood or in the city? Is the energy efficiency or the Smart City

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creation a priority in the urban or neighbourhood context? There are many questions to answer before to start working in a new city or neighbourhood. There are also several actors who know very well the context, but these actors maybe know the context from a specific perspective, while integrating several perspectives could enhance the understanding of the urban dynamics and processes. Therefore, start to analyse and understand the context talking with people living in the local context and with whom know very well that context, and then enlarge the views.

- **Clarify who are the main actors in the urban environment**. All the relevant actors must be engaged when promoting activities and changes towards Smart and Sustainable Cities. The SINFONIA project promotes a methodology on how to identify stakeholders. Remember that there could be different sharing of the resources and power among actors. A good engagement process should reduce the unbalances among involved actors. It is important to contact and promote the participation of all the actors, and not only of the ones who always participate and always decide. This is challenging, but there are some disciplines and experiences that could effectively address a widely involvement.
- **Define the future and the main goals for the urban environment, according the stakeholders' perspectives**. It is not easy to define a common line and objective for the development of a neighbourhood or a city. However, when an objective is shared, stakeholders are more committed to act for achieving it (and not oppose to it).
- Define a **plan of actions with stakeholders,** aimed at implementing the previous goals in an effective way and answering to the social, environmental, and economic needs of the local context. There are several ways and techniques to involve stakeholders in defining a plan.
- Strengthen the **participation processes**, promoting a high level of participation and not a simple information flow. Engagement means an active participation, action, and commitment from all the stakeholders. In this case, there are several levels of participation, to be applied for different goals and with different stakeholders, from the simple informing to the wider empowering people and deciding all together. There are several levels between these two opposite points (Quesada-Silva *et al.* 2019).
- Ensure that the **sense of belonging** to a neighbourhood or a city will contribute to the implementation of a Smart City project and the engagement in a participatory process. The sense of belonging has several positive implications in the availability of people to participate and actively accept and contribute to changes. However, the sense of belonging does not already exist everywhere, and an effort is asked to promote it (if the context is suitable to have it).
- Promote future projects **integrating technological, social, environmental, and cultural innovations** within neighbourhoods and wider urban environments. These innovations can promote a common language and a wider understanding of the possible futures.
- **Strengthen the role of social sciences and humanities** for analysing and transforming the information collected with and on people in useful insights for the change process towards smart energy renovations and Smart Cities. The understanding of **tenant's priorities, preferences, behaviours, anxieties, relationships, and characteristics** are all relevant aspects to promote the **just and equal engagement of people.** It is not always relevant to involve all people living in a neighbourhood. Sometimes, it is enough to involve the most trusted people

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who are, sometimes, the most effective channels to spread information and acceptance in an urban environment.

- **Watch to the stakeholder engagement from different perspectives.** Some scientific disciplines focus on the individuals and the context in which they are embedded. Some other scientific disciplines consider the energy behaviours and the participation as collective, and not individual, processes. Other social and economic sectors collected experiences on how to interact with people and make effective the interaction within the urban governance. The integration among several social sciences and humanities and other disciplines and the economic and social world will contribute to in-depth understand the energy uses, practices and the opportunities to have a cleaner energy world.
- Emphasize the **integration between technological interventions and social-cultural challenges,** for promoting sustainable and smart urban transformations. This can be pursued having a wider use of the social sciences and humanities, but also looking for a deeper connection among all disciplines, emphasizing transdisciplinary in the design and implementation of interventions. The transdisciplinary does not fit only the scientific actors, but it should include all the components of the urban governance.
- Deep the analysis and the role of technologies in the change towards Smart Cities, emphasizing the **interactions** and synergies **among people and technologies**. These interactions could contribute to change daily habits and create, all together, sustainable urban environments. In particular a display, monitoring the energy consumptions and indoor environmental quality, showing information and making some forms of engagement of people, could contribute to make people aware of their contribution to a better and just life.
- The change of behaviours towards more effective decarbonization is not automatic or simply consequence of the technological change. The process to change the behaviours is possible only if promoted by a phase of **information** on how to use and maintain technologies after the refurbishment, a phase of **showing and practicing** how to use and maintain the technologies, and a phase in which the relevance of the change is **explained** and **understood** by people.
- **Considering the energy behaviour as an individual as well as a collective process.** In the lat case, the collective energy behaviour “point[s] to a strategy which focuses not on educating individuals about their energy consumption, but on fostering cooperative and energy-saving household dynamics” (Hargreaves *et al.* 2010). One part of the future projects should aim at promoting **collective energy-saving initiatives and processes**.
- The engagement process must work both on **sustainable choices** and **sustainable behaviours**. The daily energy habits are very difficult to change into more sustainable and saving habits. The process for changing energy behaviours are long and pass throughout a strong and deep participation process.
- When the participation creates initiatives and active roles of people in spreading new sustainable behaviour patterns, new energy efficiency interventions, and a spread of renewable energy, we are talking about **engagement and energy citizenship**. In this case, the citizens contribute not only to consume energy, but also produce it. How does energy citizenship be spread at international, national, and local scales? Is a growing energy citizenship able to contribute to energy savings in the Europe?

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The SINFONIA project tested some forms of participation of the main urban actors and the tenants, while a lot of work should be further done to do **energy citizenship**. Both the participation and the energy citizenship have the role to **encourage people to adopt sustainable behaviours and make sustainable choices**. In this direction, the energy citizenship includes the role of people as active participants to the energy transition and all the transformations into Smart and Sustainable Cities. People will have a wider role in promoting new initiatives and innovations, even if we do not have to expect the participation of all people at the same level of contribution. People can contribute, all based on their resources and preferences, to technological and social innovations that will be able to transform our cities into sustainable and low carbon intensive urbanities. **Technological innovation** – typical of Smart Cities – goes at the same pace as **cultural and social innovation**. The bridge to connect technological and social innovations could promote the achievement of wider goals of Smart City and, simpler, of energy savings in urban contexts. However, this bridge is not always present *a priori*. It is important that all the involved actors in the transformation of the city speak the same language, understand one each other, and match their priorities and competences. They make all the stakeholders **"speak the same language"** and match their priorities and competences, promoting a sense of belonging to the same community and project.

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CONCLUSIONS

SINFONIA project involves several activities to transform cities into Smart Cities. Testing innovative interventions in two case studies, the SINFONIA project contributes to **promote a high quality of life and sustainable choices in cities of all Europe and around the world**.
Along the SINFONIA project, the technical and technological activities were going with social and participatory activities. Describing the engagement activities of the main actors of the two urban environments involved in this project (Bolzano/Bozen and Innsbruck) and promoting a discussion on the advantages and challenges of the participation processes, there is the possibility to take example from this project. This could further push towards forms of people engagement and energy citizenship.

While other reports of the projects (e.g., D6.1, D6.4 – part I) clearly describe how, when, why, and where to organize participatory process, this report underlines some relevant elements that make the engagement of the urban stakeholders effective and winning. This report ends with the proposal of some **actions to be promoted,** in order to achieve Smart, Sustainable, and Just cities.

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Annex: DOCUMENT INFORMATION

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