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PROIEZIONI FUTURE PER UNA PROGETTAZIONE SOSTENIBILE

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a cura di
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Indice

CONVEGNO INTERNAZIONALE
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Co-designing sustainability: the case of via Acquicella Porto in Catania

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ABSTRACT

As it is known the dimensions of sustainability are multiple and concern several disciplines: architectural, environmental, technological, economic and social. Choosing to give preference to certain aspects would not determine a complete vision of the topic. Therefore, the proposed document describes a choral experience: the e-SAFE project financed by Horizon 2020 funds, based on a codesign process and aimed at architectural, energy and seismic redevelopment of a residential building located in Catania, within an area of considerable social vulnerability. In specific terms, it encourages cooperation and participation actions between all the stakeholders involved (designers, inhabitants, construction companies, associations). This approach refers to two related but several reasons: the first one regards the idea that the design of a construction, a neighbourhood or a city is aimed at human dwelling and consequently the relationships between people; the second one, the participatory actions induce to the dialogue between stakeholders on topics of common interest, stimulate debate and develop mutual learning. The process has shown critical aspects but also the actual implications among the inhabitants who have been able to participate in the design of every aspect of the redevelopment of the building where they themselves live in.

KEYWORDS

e-SAFE, retrofit, empowerment strategy

1. INTRODUCTION

The multidimensional valence of sustainability [1] is the measure of the complexity of the problems to deal with. Indeed, the environmental issue is almost impossible to solve from a single point of view [2], since it would always be partial and reductive with reference to reality. An approach to sustainability in terms of complexity [3] is the revolutionary horizon that still needs to be explored and that can lead to solutions to current difficulties. This approach, which some academics define as holistic[4] or integrated[5], has the characteristics of revolution and even utopia because of the difficulty, inherent in complexity, to be able to examine every aspect of the problem. However, acknowledging that the problems we face are complex is the first step toward solving them. This solution is not unique and it is part of a set of probable and workable solutions that are formed only with a complex and relational approach [6].
In this cultural background, a process of co-design has been built and is refining within the Horizon 2020 e-SAFE (Energy and Seismic AFfordablerEnovation solutions) project. It is aimed at the development and use of an innovative technology for the energy, seismic and architectural renovation of reinforced concrete (RC) framed buildings, which represent a relevant portion of the Italian building stock [7].
The co-design protocol [8] for the experimentation of the e-SAFE retrofit technology is being applied to a pilot building located in the city of Catania (Sourthern Italy).

Consequently, this document aims to present the application of the co-design protocol highlighting the first results in terms of complexity and the limits that have emerged during the initial stages of the process.
After a brief description of the co-design process as a tool of research and awareness raising for participants, we will describe the conditions in which the pilot building is located. The innovative technology underlying the entire process will be illustrated below, as it has been shared with stakeholders and co-design participants. The awareness and involvement of the latter were the actions of social activation, as described below, that started the co-design process.
The first results are represented in the project of sustainability, in the co-design and its social and architectural consequences.
In the conclusion, we will illustrate the reflections following the first results and the limits of the process as well as the actions that we intend to refine for their overcoming aimed at the realization of the work, as provided for by the e-safe project, by 2024.

2. THE CO-DESIGN PROCESS AS A TOOL FOR RESEARCH AND SUSTAINABLE "REVOLUTIONARY" ACTIONS

The idea that those non-expert people that are likely to be impacted by a design process, like residents of a residential building under renovation, could or should be directly involved in the design process does not come as a novelty for designers and it is largely motivated by 'utilitarian' concerns: engaging design users in the creative process has the utility to increase design's responsiveness to their needs and preferences. E-SAFE co-design approach takes into account such a perspective, but it is also influenced by another 'co-design' tradition, rooted in the theorizations and practical applications which have originated from the 1960's political wave contrasting modern rationalities and praising human freedom and creativity. The renown Goodman's Guerrilla Design approach [9] was mostly based on a political critique against traditional expert-driven design approaches, criticized as 'technocratic' and 'top-down,' and an Heideggerian emphasis on the importance for every human being to actively shape their own dwelling environment [10]. Many have followed in his footsteps, especially designers focusing on landscapes and public spaces (see [11] for a good overview). This tradition has evolved, as a niche within the international design debate, with a focus on 'co-design' as an empowerment strategy, i. e. as an activity that, opportunely guided by expert designers, can help people to develop critical awareness and knowledge about their situation, as well as long lasting capacities to participate and shape their own environment beyond the confines of a particular project [12].
Drawing from both the utilitarian as well as the empowerment perspectives, e-SAFE research team has developed a co-design protocol that prioritizes 'mutual learning:' both residents and designers learn from each other through their cyclical interaction during the creative process. Designers learn from residents about their needs and preferences while sharing their expertise on what can or should be done, which is learned by residents. Both develop a better understanding on what is important to address through that particular design, comparing their often different perspectives. In the case of e-SAFE, the "what" has been centered around the concept of building decarbonization and seismic preparedness, and the co-design process has allowed an inquiry on what these two concepts mean for both e-SAFE designers and the residents of a public housing building facing renovation.
First outcomes of the co-design process provides an account of how sustainablity can be practiced in what can be considered a revolutionray approach, where revolutionary means drastcally changing sustaiiniability paradigms exclusively led by technological concerns and solutions. Indeed, the most common mistake in the definition of sustainable actions is targeting only specific objectives (energy, economic, technological) unrelated to each other that could be solving the problem. In this sense, we believe that the e-SAFE project can be the test of both the high technology used and the co-design process that integrates multiple disciplines.
The aim is to solve the structural, energy and architectural problems of the pilot building by associating them with the social and cultural aspects of the users and beneficiaries of the improvement interventions.
The recognition of the different dimensions of the theme of sustainability and their procedural combination transforms the current linear approach into circular: it thus passes from the linearity of the design phases of

knowledge-project-realization to the circularity of the process of knowledge-project-realization-knowledge. The first and last term and therefore the conjunction of the process is always the knowledge that underlies the awareness of the problems that you intend to solve, which is the first step towards their solution. With knowledge and culture, finally, you build the citizen of the future that in turn will build the architecture, neighborhoods and cities that lives.

3. THE CASE OF VIA ACQUICELLA PORTO IN CATANIA

3.1 The unsustainable current state of the case study

The building selected as case study (Fig. 1) is located in a suburban area of the city of Catania – named via Acquicella Porto - and belongs to a residential complex erected in the 1960s by the public housing authority IACP (Istituto Autonomo Case Popolari) of Catania, that currently owns 70% of the building's properties. Several factors have dictated the choice of this building as pilot.

On the one hand, the typological and constructive features of the building make it representative of most of the existing residential buildings in Southern Italy that require deep renovation interventions since they were realized at a time when normative frameworks did not impose restrictions on new constructions to enhance seismic resistance and energy efficiency.

The building is a 5-storey apartment block having a roughly rectangular footprint and a total number of 10 apartments. Two residential units for each storey are arranged symmetrically around a central stairwell and are characterized by the same distribution of the internal spaces. The symmetric configuration of the apartments provides the regularity of the openings in the building fronts. Most of the openings are arranged in the two longitudinal fronts of the building and overlook balconies. The balconies occupy the entire longitudinal fronts and are closed on their short sides by vertical fins made of concrete blocks to form typical loggias. The above typological features are most common in the buildings erected in Southern Italy between the 1960s and 1980s by both public and private authorities.

At structural level, the building is characterized by a RC framed structure having the typical deficiencies affecting the existing buildings. Indeed, the structural elements have been designed considering gravity loads only, according to old national standard. Furthermore, their mechanical characteristics are on overage below the limit imposed by law at the time of their construction. Accordingly, the building results considerably vulnerable to seismic excitation, especially considering the high level of seismicity of the city of Catania.

At energy level, the building is highly energy-intensive, without satisfactory conditions of indoor thermal comfort. One of the main causes is related to the poor thermal performance of the envelope components. Indeed, the external walls (hollow concrete blocks infills), as well as the ground floor and the roof (RC and hollow tiles mixed slabs) have high thermal transmittance values since thermal insulation materials are not included, according to the construction techniques of that period. Thermal losses also occur due to the presence of low-performing windows (e.g. windows with aluminum frame and/or single glazed), although most of the originary windows has been recently replaced by more performing ones (e.g. windows with PVC frame and double glazed).

At architectural level, many alterations carried out by the inhabitants to the building façades have significantly changed its original image (Fig. 2). The main alterations include: (i) the use of plaster of different colors for the external walls of each apartment; (ii) the use of different cladding materials (e.g. stone, ceramic etc.) as further decorative cladding for the external walls; (iii) the replacement of the originary windows with new ones that differ in type, material of the frame and shading device; (iv) the construction of many "verandas" on the south balconies, which differ in size and configuration and reflect the common need of the inhabitants to increase the internal space of their apartments.

Figure 1: Pilot building in its current state

Figure 2: Detail view of the southern façade of the pilot building

On the other hand, the building is also highly representative of the many socio-economic challenges faced by most of the modern buildings in urgent need of renovation. Like many other modern buildings, especially public housing, erected as part of the post-IIWW speculative urbanization wave, original construction materials were poor and poorly assembled. In addition to this, the building has undergone decades of insufficient maintenance, due to building owners' lack of spending power – in the case of the three middle-low-income residents who are owners of their flat – or to significant organizational deficiencies – which is the case of the local public authority –. A round of interviews carried out in 2020 with both residents and IACP officials shows that: i) since construction, the building had several 'repairs' done, but, at least in the past 25 years, they were all carried out under the 'informal', small scale, non-structural, and self-funded initiatives of residents without the formal involvement of the local Public Authority; ii) there was a problematic relationship between the Authority and its renters, due to scarce communication and mutual mistrust; iii) there were also conflicts between residents over different uses of common spaces and facilities. The framework depicted above evidences the unsustainable current state of the pilot building both at performance and social level, and consequently the need of significant renovation interventions. In this regard, cooperation and participation actions between all the stakeholders (i.e. designers, inhabitants, construction companies etc.) that are generally involved in the retrofit process are essential to promote more sustainable approaches to the building renovation.

3.2 Technological innovation based on the co-design process

The current state of the pilot building reflects the state of conservation of most of the building stock located in earthquake-prone countries, thereby showing the strong need – on a large scale - of integrated (seismic, energy and architectural) retrofit interventions which can be able to meet also social and environmental needs. The social needs are that of the dwelling's owners and inhabitants, who must be the first promoters of the retrofit intervention to ensure its effective implementation. Among them, there is the need for cost-effective, time saving and low invasive retrofit solutions to make them widely accessible, especially to the low-income families. At the same time, low environmental impact retrofit solutions which are based both on the use of eco-friendly materials and the reduction of waste production are required nowadays, as a consequence of the global environmental and energy issues.

A co-design process between all the professionals involved in the design of the retrofit intervention is thus required to meet the above technical, social and environmental needs, by merging knowledges and skills in view of an interdisciplinary approach to the building renovation. Accordingly, a co-design process was the basis of the the development of the e-SAFE retrofit technology, that will be prototyped and tested for the renovation of the pilot building.

The technology consists in cladding the external envelope of the building with a new multifunctional skin that combines structural CLT-based panels (called e-CLT) to non-structural wooden framed panels (called

e-PANEL) (Figure 3). The first ones are equipped with devices for seismic energy dissipation, meanwhile the second ones host highly efficient windows.

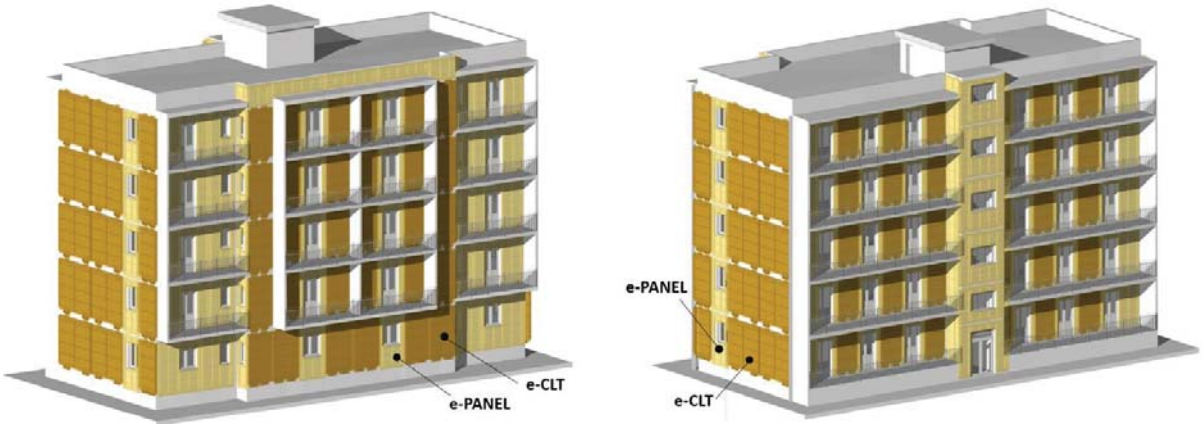

Figure 3: Application of the e-SAFE technology to the pilot building

The role of anti-seismic protection is performed by the CLT panels and dissipative devices, which aim at increasing the seismic and dissipative capacity of the existing structure to reduce its damage in the event of earthquake.
In terms of energy efficiency performance, the integration of insulation materials into both the panels together with the replacement of the existing windows with more efficient ones aim at increasing the thermal resistance of the external walls in order to reduce the building energy demand, menwhile increase the indoor thermal comfort.
Then, the design of suitable cladding solutions for each components of the e-SAFE technology can give a novel architectural image to the building.
The technological components that provide the above retrofit performance are properly designed to also ensure technical performances, such as: (i) mechanical resistance; (ii) safety in use and in case of fire; (iii) durability; (vi) hygiene, health and environment qualities; (v) high level of prefabrication; (vi) fast and easy installation.
The result of the above co-design process is thus a new seismic-resistant, energy-efficient and architectural skin for the building, that is based on the use of materials with reduced environmental impact and is installed from the outside of the building in order to significantly reduce implementation costs and times as well as the occupants' disturbance, avoiding their relocation during works.

3.3 Phase 1 of the process: outreach and engagement

Implementing a co-design approach requires an initial effort aimed at reaching out to people and stimulating their participation. The Acquicella case, the initial step, I.e. reaching out to the building residents, both tenants and home-owners, was also crucial for overcoming the lack of their trust in the IACP due to a long-term lack of mutual communication. First contacts were established just by a 'ringing the bell' strategy, relying on the establihsment of direct communication and emphaty between researchers and residents. In november 2019, we have successfully reached out all 9 families living in the complex (one apartment, at that time was empty), informed them about the project, and collected availability for participating in a first meeting with IACP and e-SAFE project representatives from Unict.

During the meeting, held in July 2020, IACP representatives and UniCT researchers officially presented the project to residents and distinguishied the role they have in project, clearing up 'who does what' and why. This clearification was of key importance because clarified roles, especially the different responsabilities between UniCT researchers and IACP representatives. In that occasion residents stressed again the importance to enance a deep collaboration to ameliorate the quality of life in the building and in the residential complex in general.

In the following months, interviews to collect initial data from residents were planned for the fall. Unfortunally, this phase coincided with the second 2020 Covid-19 lockdown, therefore interviews were conducted – which is not ideal – by phone, reaching out to one person per family, 9 in total. Interviews showed that:

- for all the families, one of the main concern is the incidence of electricity consumption for the heating system and domestic hot water. In 8 of the 9 apartments, the air conditioning system, especially for cooling, is powered by electricity. The same is domestic hot water, where 8 out of 9 families heat the water with an electric boiler and only one with a gas boiler. The prevalent use of electricity is particularly critical. After the collection of electricity bills, data showed that they affect in average about 20% of family income.
- the building is in an advanced state of degradation, mainly due the presence of water infiltrations that causes significant detachments of plaster, causes mold into some apartments and makes the building unsafe. This thing particularly worries the inhabitants for their safety and health.
- the presence of specific manners of living an apartment (licit and illicit) with design implications (e. g. the presence of verandas, 6 of which unauthorized, used as kitchens and/or laundry rooms).
- the presence of conflicts between the use of common spaces, the rooftop and the courtyard, by different residents (lack of shared rules)

On the basis of these initial data, both researchers and residents agreed on participating in the co-design activities described in the following paragraph.

3.4 Phase 2 of the process: from co-analysis to co-design

The further involvement of residents in the creative process has been pursued through the organization of an intensive co-design workshop, held between september and october 2021, also engaging local professional associations and about 20 design students from the University of Catania. Meeting were concentrated over the weekends and – with the exception of some lab time at a University classroom – were located in the pilot courtyard, with the purpose of maximizing residents' ability to participate.
Participants were organized in workgroups comprising both young and experienced designers, inhabitants and owners of the pilot building and academics from Catania university. All phases of the workshop were carried out together with the inhabitants who actively participated in the project choices, giving valuable indications, listing preferences, suggesting solutions, indicating criticalities, expressing concerns, and advising activities.
The first two weekends were dedicated to surveying all residential units.
In a first set of seminars, residents learned what data about their flats designers needed as a base for the co-design. Omn the premises of this understanding, designers (students supervised by faculty memebrs) surveyed every unit, including data on the technological devices, internal and external, for cooling and heating. They detected the verandas on the balconies and the related changes of the interior, highlighting the differences in the windows on the facade. All the fixtures and their state of preservation and function have been verified and recorded.
To make the sharing of design choices more immediate and easier to understand we used the physical model as a test and transformation of preliminary ideas. In addition, to better visualize with inhabitants these ideas

we proceeded through the tool of the photo voice through which each of them was able to give voice to their aesthetic preference through the choice of one or more virtual images of building.
The workshop activities produced six design solutions realized and shared with all the participants in the process. In particular, about the architectural image and the coating material of the e-SAFE panels for each group, the following proposals were produced:
G1, group 1 solution, Perforated aluminium panels (Fig. 1a);
G2, group 2 solution, Glass Fiber Reinforced Concrete (GFRC) panels (Fig. 2a);
G3, group 3 solution, Wood Plastic Composite (WPC) panels (Fig. 3a);
G4, group 4 solution, Folded aluminium panels (Fig. 4a);
G5, group 5 solution, Glass Fiber Reinforced Concrete (GFRC) and Bricks panels (Fig. 5a);
G6, group 6 solution, Glass Fiber Reinforced Concrete (GFRC) panels (Fig. 6a).

Fig. 1a, G1: South elevation

Fig. 2a, G2: South elevation

Fig. 3a, G3: South elevation

Fig. 4a, G4: South elevation

Figure 5a, G5: South elevation

Figure 6a, G6: South elevation

All the design solutions developed during the workshop involve materials with the characteristic of being lightweight, resistant to corrosion and humidity, with easy cleaning and maintenance, having high energy and acoustic performance, high durability, fire resistant and with multiple chromatic possibilities and surface finish. The six project solutions completed at the end of the workshop have been subjected to a survey among them with the aim of collecting further information on architectural suggestions and technological solutions. They are taken into account for the subsequent phase of the co-design aimed at the drafting of the final project.

4. THE FIRST RESULTS OF THE CO-DESIGN PROCESS FOR THE VIA ACQUICELLA PORTO PROJECT

4.1 The social dimension of sustainability

As mentioned in the initial paragraph, co-design of the Acquicella porto buiding had two (related) purposes. The main one was, of course, the generation of a beautiful and effective design of how to use the new e-SAFE technology in this particular case; a design that was beautiful', effective, and responsive of residents

preferences. In simple terms, the goal was to produce a design that was satisfactory for both residents and designers (utilitarian perspective). In addition to this, a secondary purpose was the activation, through design, of a 'collective and empowering learning process,' which means, for both residents and designers, learning a new way of 'doing things' that can take to new results. From this perspective, social sustainability is achieved when – thanks to their participation in the collaborative creative process – people partake the reasons behind crucial design choices and, as a consequence, they enhance their ability to interact with the building and with each other in the future. For instance, this could mean residents' changing potentially damaging or conflictual behaviors or, more simply, an increase in their capacity to address maintenance issues.

Since the e-SAFE co-design process is still on-going, a full evaluation of its achievements in terms of social sustainability will be carried out later on. However, the process has already provided encouraging results, as shown by its ability to address at least two crucial issues.

The first issue is the incompatibility between the seismic-energy renovation of the buiding and the presence of pretend-to-be-removable 'verandas' on the balconies. At the beginning of the project, in 8 of the 10 apartments there are verandas - 6 of which unauthorized - that were very important for residents who were using them as kitchens and/or laundry rooms. On the contrary, Verandas were a problem for designers, for two reasons: 1) they prevented the designers to develop a detailed laser-scan of the building (needed because of the technological specifics of e-SAFE) and, 2) were an legal obstacle to the submission of the 'renovation paperwork' to the authorizing agencies. Co-design was key to address the need to remove current verandas and, eventually, design for new 'authorized' ones. The process that led to the removal required several meetings both to plan how minimizing inconvenience for the residents while respecting the e-SAFE project timeline. The discussion of verandas-related practical issues has triggered reflections of a more general nature, about the difficult balance between a single household's need (keeping a veranda) and the collective interest (being able to file for renovation). The result was that all verandas were taken off in April 2022, while the final design takes into account the aesthetic and functional possibilities to build, in two years, new ones.

The second issue relates to renovation choices on common spaces. The project included the possibility to retrofit of rooftop, where to install photovoltaic panels. When asked whether panels needed to be installed on the floor or on a pergola, so to facilitate the use of the rooftop with a shading structure, residents raised concerns. The controvesial use of the rooftop (as well as the courtyard) by two tenants had triggered in the others the idea of using the installation of the panels on the floor as a way to deny everyone the possibility of using the space and, therefore, avoid conflict. This conversation was an opportunity to discuss with the residents the importance of using e-SAFE co-design as an opportunity to develop shared rules for the use of common space, in stead of deprive everybody from a beautiful terrace with a view (this effort is still on-going).

Both the case of the verandas and the conflicting use of common spaces show how co-design can help dealing with controversies arising from the design for renovation, if designers prioritise residents learning.

4.2 The architectural dimension of sustainability

The connection of architecture with sustainable development entails important modifications in the design methods. Since the decisions made during the design phase will influence the building's performance it is important that all stakeholders understand the significance of cooperation. In the case of via Acquicella Porto the architectural design stems from the preliminary co-design process initiated during the workshop. Every component that contributes to the design of the pilot arises from aesthetic, functional, technological, productive, seismic safety and environmental sustainability qualities.

Since the same shape of the building has to be kept, the co-design proposal consists of three essential architectural signs: emphasizing the pre-existing volume by covering it with a neutral coloured material; underlining the subdivision of the five levels by the creation of stringcourses of east and west sides; introducing a different colour for loggias, frames and shading devices. As is known, colour and shapes play a key role in the perception of architecture and emphasize the structure of the building.

Between each stringcourse that participates in the horizontality sign given by the presence of the floors, the vertical rhythm is defined by ceramic panels of several sizes and shades. It is an environmentally-friendly material that achieves a contemporary and aesthetically attractive effect.
This cladding consists of tiles of rectangular shape and same height but different widths that are reinforced by underlying support formed by aluminium omega profiles. The dimensions of these cladding elements provide formal and aesthetic solutions to technical and functional issues. Similarly, the stringcourses on the east and west sides are made of light-coloured ceramic. On top, the parapet is covered with the same coating but on the short fronts, east and west, it is set back from the line of the building. This arrangement accentuates the building form and emphasizes the pilot prismatic volume.
Instead, to accentuate the protruding frame of the loggias, it was decided to apply a contrasting colour to the neutral background of the ceramic cladding. The treatment of each front was the same except for the choice of shading and blackout devices. They are not present on the north side, that of Via Acquicella Porto. On the short sides, coloured sheet metal projections frame the perimeter of the windows aligned on one side of the front. On each of these, it is installed a darkening solution with an opaque and folding panel screen. On the south side, which borders the inner courtyard, the shading devices consist of coloured sliding panels, aligned to the edge of the parapets and attached to the respective lower and upper slab floors. Since light conditions change over the course of the day and the seasons, this solution gives the building a different and vibrant appearance depending on the time of day and season.
On top, the roof terrace lends itself to the placement of photovoltaic units for turning sunlight into electricity. All these elements (neutral ceramic coating; stringcourse; the contrasting colour to paint loggias and shading devices) constitute, at this phase, the invariant elements of the project.
Once defined the invariant elements of the project, it has been possible to compare other aspects of the architectural project with residents and make additional choices together. They consist of:

1- Colours to paint loggias and shading and blackout devices (Figure 7).

As is known, colour is a significant quality of the project design both to emphasize the presence of certain elements and to influence the perception of the building and its impact on the context. Emerging from the neutrality of the prismatic volume of the pilot building, it was chosen to use colour, a design action at a negligible cost, not as mere decoration, but as an aesthetic expedient to define spaces and to stimulate the perception of the architecture. Four several virtual images were submitted to the opinion of residents: one showed the blue paint, another ochre, another red and finally dark grey colour. Each of these colours has determined a different aspect of the building that has aroused different reactions. Grey was not appreciated due to low contrast in comparison with ceramic coating. Most residents preferred a deep colour like red, but the choice of a dark colour for the loggias' frames would also require more attention during the building maintenance phase. It is more inclined to the desaturation caused by solar radiation.

Fig. 7 Virtual image on the possible colours to paint loggias and shading and blackout devices. (a) light blue; (b) ochre; (c) dark grey; (d) deep red.

2- Coplanarity of ceramic tiles coating the prismatic block (Figures 8a-8b).

The existing building appears to be flat. To remediate such inconvenient a ceramic coating was adapted, consisting of rectangular tiles reinforced by a system of omega aluminium profiles. The thickness of these profiles allows perceiving the thickness of the individual ceramic elements. This expedient allowed them to distinguish the various architectural items and highlight more remarkable aspects of the building's façade. Thus, the residents were shown two virtual images, namely, two design solutions in comparison: one showed the shape of the prismatic volume, the other emphasized the compositional rhythm of the e-SAFE panels and the geometry of the stringcourses on the east and west sides.

Fig. 8a: Coplanar ceramic tiles that are all bound together through a rigid substructure.

Fig. 8b: no-coplanar ceramic tiles that are all bound together through a rigid substructure. This expedient emphasizes the compositional rhythm of the e-SAFE panels and the geometry of the stringcourses.

3- Number of performed sliding panels on the south side (Figures 9a-9b).

Another topic concerned the presence of coloured perforated sliding panels located on the southern side, aligned to the edge of the parapets and attached to the respective lower and upper floors. Designed in perforated metal sheet, these panels contribute to the aesthetic composition of the entire building and serve to shade the windows located on the south side. They are subject to high sunlight and participate in the aspect of the building if the resident will decide to restore the previous verandas. The virtual images have given to the residents two solutions: the southern front without the presence of shading screens; or with the presence of three sliding panels for each apartment, a total of six for each floor. Actually, this design solution allows responding to individual needs.

Fig. 9a: Absence of sliding panels in perforated metal sheet on the south side

Fig. 9b: Sliding panels in perforated metal sheet on the south side

During all phases of the co-design process, every decision taken to define the overall architectural image of the pilot derives from answers to questions of aesthetic, functional, technological, productive, seismic safety and environmental sustainability (Figure 10).
During the final meeting, most residents considered that this choice made the façade more vibrant. It was also preferred the light colour. Consequently, the ceramic cladding will cover the building on all sides, including the stairwell. This choice was made for several reasons:
1-Being pilot a regular prism, to emphasize the pre-existing shape;
2-Responding to the prefernce of the inhabitants;
3-Creating a greater contrast with the colouring of shading and darkening devices.

Fig. 10: Final architectural virtual image.

5. CONCLUSIONS

The process has now arrived at the results that offer the concluding reflections. It can be summarized in the form of points as follows:
- The satisfaction of the participants in the process gives good hope for the awareness campaign on the issues of sustainability and the importance of the quality of the buildings they live in both in terms of energy savings, structural security and architectural image;
- A positive verification of the co-design protocol will allow it to be applied in other similar cases;
- The co-design used as a process tool has put to the test the expressive potential of e-safe technology;
- The several images of applied technological solutions are the result of a choral experience that through architecture has given the opportunity to non-expert citizens to actively participate in the experience of the project of their own living;
- The co-design process made possible to consider the building, not just for its phycal dimension, but taking into account its complexity and stratification also as a social 'ecosystem', that affects space and its use practices.
In addition, given the circularity of the process and the current stage of its development, these conclusions are only partial and provisional. They serve to highlight two types of emerged criticality: the first type is due to the conduct of the co-design process and the difficulties of actions that rather than close solutions tend, by their nature, to always open new ones; the second type is due to the satisfaction of the demands of the stakeholders in the respect of the economic resources to disposition of the plan.
The emergence of critical issues is, like the first results of the project in co-design, one of the most significant products of the process, because of the possibility of advancing in the search for ever better solutions.

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2030 D.C. Proiezioni future per una progettazione sostenibile

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Dall'Agenda 21 all'Agenda 2030 intercorre un salto concettuale che, partendo dalla nozione di "sviluppo sostenibile" del 1992, lancia la sfida per una proiezione nel futuro della sostenibilità, negli ambiti sociale, economico ed ecologico, visti nella loro olistica interconnessione.
L'approfondimento auspicato nell'ambito del Convegno intende attraversare l'attuale momento di transizione ed esplorare, con apporti trans-disciplinari e inter-generazionali, quale potrebbe essere il contributo "sostenibile" di una progettazione rivolta tanto al patrimonio esistente quanto a quello ancora da immaginare, dalla scala urbana alle soluzioni di dettaglio, spaziando dalle esigenze dell'edificato e del territorio a quelle specifiche del Cultural Heritage, dalla innovazione tecnologica "circolare" all'analisi di vecchi e nuovi modelli dell'abitare, alla ottimizzazione delle qualità prestazionali, fino alla digitalizzazione del processo edilizio.

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