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Abstract. The purpose of the master degree project «Living in the time of crisis: Unitè d'habitation 2.0» designed by Eleonora Barsanti and tutored by Luca Lanini and Sergio Russo Ermolli aims to offer a possible definition for a new housing model based on concepts like affordability and social living, but above all of flexibility, adaptability, versatility, energetic sustainability and/or production: a prototype that can be placed in any context and adapted to meet specific needs as being a node in a smart city grid. In our opinion, this process would allow us to accomplish diversity within the same building, attaining a kind of chameleon-like organism which is flexible, adaptable, versatile and an active energy hub.

Keywords: Social housing, Hybrid building, Energy hub, Social condenser, Smart city

An unpleasant Scenario: an introduction

The great recession of 2008-2013 involved industrialized western countries and dragged the middle class down, affecting family stability and causing growing housing poverty (Forest, 2016). The increasing number of families on the brink of poverty, the reduction in the number of family members, the growing rate of unemployed young people, new immigration flows and the problem of increasingly older population have challenged housing needs (Demirkan, 2017). The quality of housing is globally undermined by city congestion caused by flows of population from the rural areas to the cities: for the first time in human history urban areas have become more populated than the rural ones (United Nations, 2006).

Furthermore, data show how «more than 35% of the world energy consumption is absorbed by contemporary housing, to cool, to heat and light homes» (Casamonti, 2011); in this sense, it is necessary to achieve a new designing process able to reduce, if not eliminate, this level of energy consumption.

Housing models like the ones built in the late Modernist Era now seem unable to satisfy the new needs of a society which is no longer static. Projects like Park Hill in Sheffield or Robin Hood Gardens in London have established innovative but flawed guidelines on collective dwellings, which nowadays need to be implemented and integrated with new paradigms and technologies (Fernández, Mozas, Ollero, 2013).

To rethink our residential stocks with low cost/high performance buildings is a crucial, gigantic task for architects, engineers and urban planners.

The heritage of a fascinating (and failed) artifact of the First Modern Age - Le Corbusier's Unitè - is analyzed in the first section of the paper (Object: a flawed genealogy); its chance of an update in the second (New Features for an Unitè d'Habitation 2.0); its role in the smart city in the third (Unitè 2.0 as Smart Node for a Smart City); an experimental typology is provided in the conclusions.

Object: a flawed genealogy

Solving problems of urban living with a unique and powerful architectural gesture is not a novelty in the history of architecture and has its ancestors in egalitarian prototypes studied and

designed since the Age of Enlightenment, from the *Falansteri* to the *Alberghi de' Poveri* to the Soviet collective housing (*Dom Kommuna*)¹. Programs rooted in utopia as well as in error.

In the past century, Le Corbusier's Unitè d'Habitation acted as the ultimate «social condenser»², a building conceived as a «hub» trying to define a new way of living and a new form of society as well as architectural and urban landmark in the European cityscape and mindscape. It was a hybrid building, integrating its main residential function with all the facilities (gyms, swimming pools, kindergartens etc.) the community of its inhabitants needs. It was obviously brilliantly designed and cleverly merchandised: an innovative, massive building instead of a mere cheap «container» for poor people, a sort of ocean liner suspended on *beton brut* pillars, quietly floating in the European Countryside, presented like a sort of almost logical and direct aftermath of a series of diagrams concerning density, plot areas and ground consumptions. The critical success of the Unitè quickly fell after the 50s to the point of becoming the infamous inspiration for the dreadful and omnivorous Ballard's *High-Rise*.

But, after the great recession of 2008-2013, the quest for a low cost/high performance mixed use housing building, instead of carpets of suburban detached single family houses, seems to have returned in fashion. It is paradoxical that for many of us the shape of things to come would resemble Le Corbusier's Unitè d'Habitation, reappearing from the architectural subconscious as a benevolent blueprint for a new concept of mass housing.

Would it be possible to radically update Le Corbusier's model and mend its many errors, giving a new identity and appeal to the concept of density and critical mass in residential architecture? Would it be conceivable to transform a sixty-year-old flawed masterpiece in a fascinating and true alternative to suburban living?

Could such a complex, dense and massive architectural typology be withdrawn from the Le Corbusier's fabled countryside and inserted in European town fabrics, inside urban lifestyles, public infrastructure and cultural networks? How can we transform a stroke of genius, clearly designed for faceless, generic inhabitants tied in the binary loop of Rest-Work of the First Machine Age, into the realm of identity and freedom? Furthermore, would it be a feasible answer to the radical change in the demographics of our society, strongly modified by the increasing number of elderly people, emigrants and refugees? How can we rethink those breathtakingly conceived residential units (voids, double heights, *maisonettes*), clearly tailored for a family of the 50s, in a house for one of the many subgroups our society is currently divided in: mononuclear families, singles, dinkies (two people, two incomes, no children), extended families coming from different countries with different ethics and cultural backgrounds? Could a building conceived as advanced social and architectural experiment be implemented as energy hub and/or node («energy condenser»

Design concept:

1. Design guidelines: double facing, central spine (green), living spaces, loggias (purple)
2. Unitè 2.0 could be expanded both vertically or horizontally
3. Crossed ventilation
4. Section

instead of «social condenser»?) for forthcoming «smart cities»? Could it be as relevant in shaping forms of global living environment as it was sixty years ago?

As architects, are we ready to design a Unitè d'Habitation 2.0?

New features for a Unitè d'Habitation 2.0

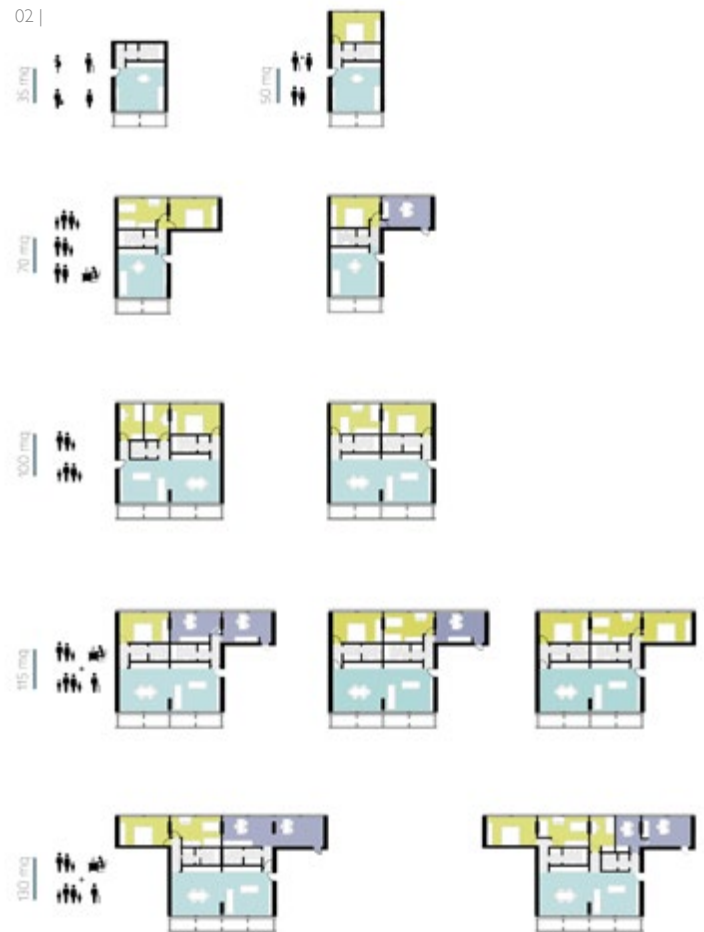
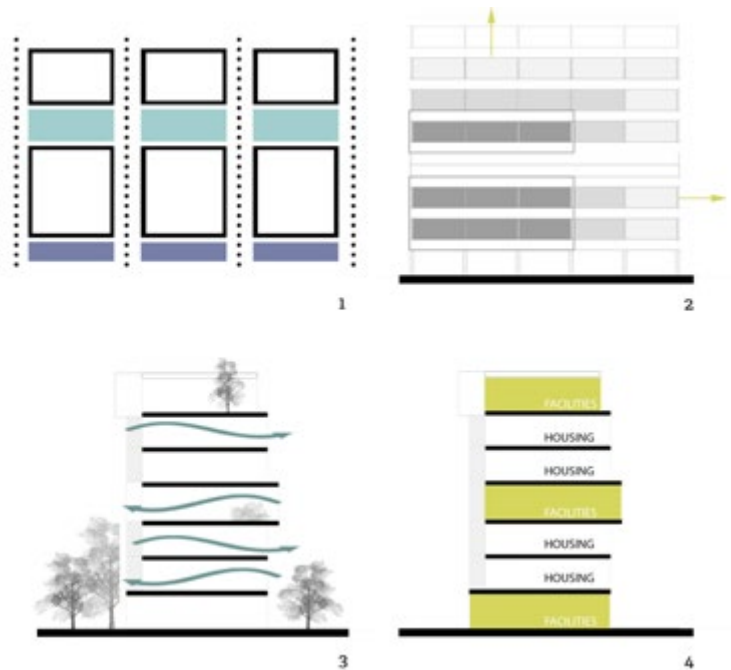
One of the most important features in contemporary debate on housing is defining flexible and adaptive unities and typologies, ready to satisfy the needs of inhabitants in every peculiar moment: this is the case of the Carabanchel 06 project (2002) by Aranguen y Gallegos in Madrid, in which movable walls inside dwellings allow to enlarge or reduce day and night living spaces.

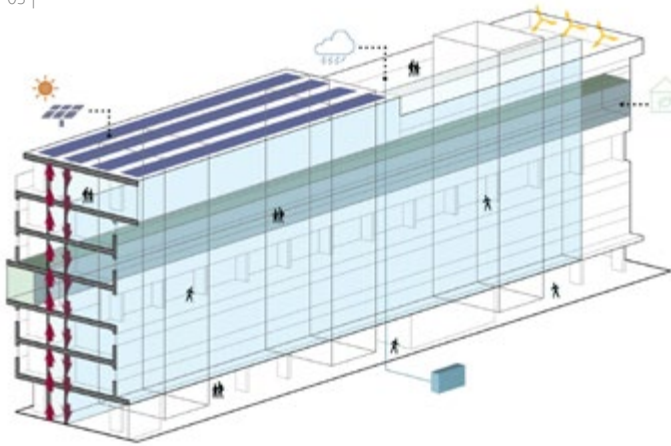
The problem of increasing older population has led to projects like Torre Julia (2011) by Pau Vidal, Sergi Pons e Ricard Galiana in Barcelona which offer an integrated typology of protected residential buildings and social housing, promoting a new sense of community. The fear of losing identity and fading bonds with personal roots, which contemporary society seems to be prone to, have led municipalities and designers to integrate residential spaces with those dedicated to social, commercial and other activities, with the purpose of sharing resources among inhabitants of the whole neighborhood. This is the sense of projects like Sargfabrik (1998) by BKK in Vienna and Sugar Hill (2014) by Adjaye Associates in New York.

New social housing operations should guarantee not only social, but also economic and environmental sustainability: experiences like Moho (Modular Homes) (2004) by ShedKM in Manchester and Eda Knivsta (2015) by Andreas Martin-Löf in Stockholm are opening new possibilities for prefab and modular systems in the residential building field, guarantying high performance in terms of accessibility and affordability.

Unitè d'Habitation 2.0 should implement those guidelines and outline new ones, such as:

- a higher residential density compared to that used in their original settings. European low density suburbs are nightmarish entities of traffic, pollution, alienation, land and energy consumption and poor spatial qualities often translating in a very poor quality urban life. The compactness of the Unitè should be economically, socially and politically affordable, an outstanding architectural landmark thus saving land, infrastructure and maintenance costs. It needs to reach a critical mass to include economies of scale in a noteworthy metaphor of the size attainable by the building. A sort of advanced urban artifact stacking layers of houses and public services.
- Energy self-efficiency. The trend, strictly regulated in the EU, is towards a «Class A» and a «Carbon Neutral» building, favoring buffer systems for insulation and solar systems for wa-





ter and energy: the building is more and more conceived as an energy hub, as the radiant surface is clearly favored by its massive dimensions. High inertia architectural skin is often coupled with radiant floors and/or ceilings to make the overall systems of installations more energetically efficient. The architectural aftermath is that the façade is conceived as heavily layered, gaining a transitional width, filtered by sliding shutters, panels or blinds, loggias conceived as climate buffers. The building gets a new blurred and luminous aspect, in a process that is apparently deeply rooted in contemporary architectural sensibility and languages.

- Residential Flexibility. This happens to be the main point, attaining the general design strategy for the building: flexibility of typologies as well as of dimensions of the residential units to encounter the fluctuation of the survey and variations of the users; interior flexibility of the unit to modify it just-in-time and custom-made apartments; flexibility in the cost of the different units to assure a mixed class and cultural environment, resulting in groups of residents of different ages, origins, interests and resources. Flexibility should be attained from scratch, from the design process to promptly react to a new economic situation in the relatively long time which is necessary to develop a housing project. Flexibility rather than specialization, which means a new versatility of residential spaces. And it can be obtained with technical (great span structures, concentration of the technical modules and diffusion of the energetic and plants network) and conceptual strategies (great open isotropic spaces, ready for different interior lay-outs). A more fluid and transformable residential space can be obtained with improved division systems based on industrial and serial elements, typical of the architecture of office interiors, a lay-out which improves accessibility and adaptability for people affected by physical or psychological diseases, in a peculiar conceptual update of the *Plan Libre*. A good contemporary space is a big neutral space, with few fixed areas. The fewer, the better. As Atelier Kempe clearly stated: «Developers think that the job of an architect is to organize the floor plan according to the building rules and to design the facade. And they are right. Because of the global economy this is a very logical process. Labor is expensive in the western world and that is why it is reduced to a minimum. The next step will

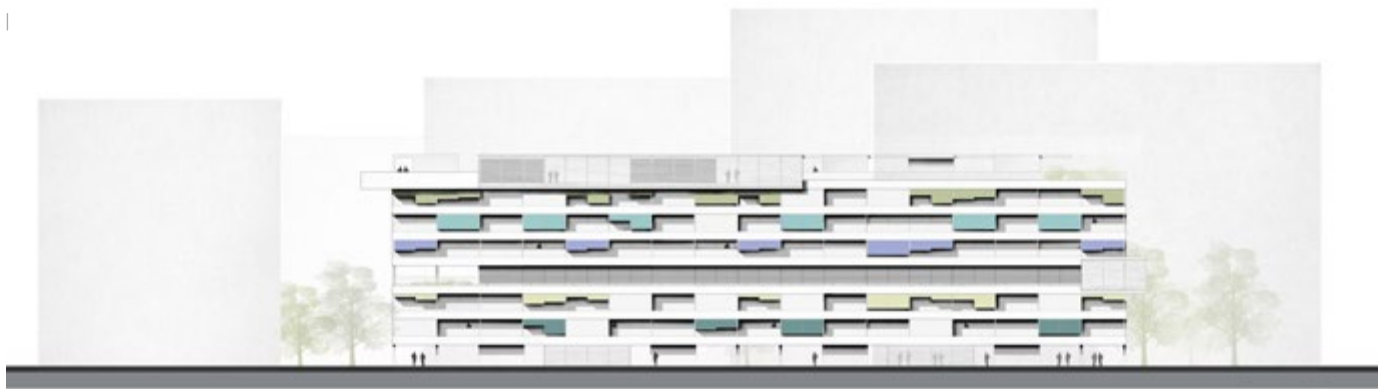
be that the interior as such, will completely disappear. Hence, the apartment becomes a single empty room without anything except a cable shaft and a meter. The inhabitants become self-builders who create their own living environment according to taste and budget. The Ikea concept is extended towards the complete interior. [...]. The new typology of the 21st century is the loft. Sixty years after the shock of the Farnsworth House this became the most desired typology. [...] We think the loft is more of an enclosed outside space than a classical room. It is a platonic internal landscape, a piece of emptiness in the city. Its success is on one hand a sign of a more personal and individualized way of living. [...] The loft is a mix of public and private; it can be home, office or both. In former times, people went on the street now they prefer to stay at home» (Atelier Kempe-Thill, 2008). The contemporary house is not the «machine for living» imagined by Le Corbusier; it is a solid infrastructure built for different purposes and functions, a slab measured (and paid for) in square meters, available to all the fluctuations generated by markets and/or life.

- Common areas and residential facilities: pool, gyms, kindergartens, workshops, Wi-Fi areas, 24-hour laundry facilities etc. to build a new sense of community and civic conscience: «the new qualities, the specific, can come out of the extra pro-





05 | Hybrid Building as Social and Energy
Hub for Smart Cities: a Prototype.
Vertical version, elevation

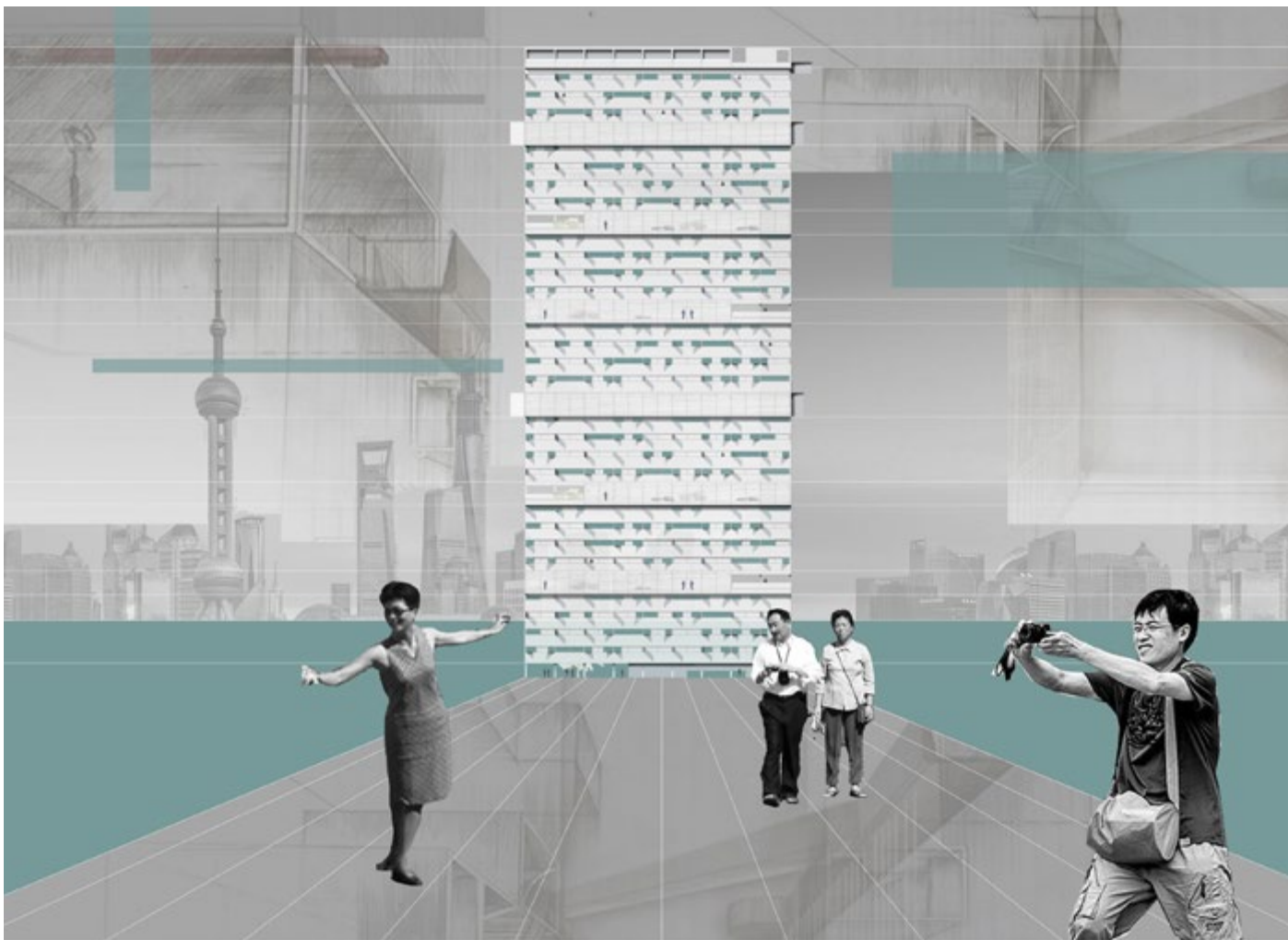


06 | Hybrid Building as Social and Energy
Hub for Smart Cities: a Prototype.
Horizontal version, elevation

grams and spaces related to apartment buildings. Living hotels, the housing visions of the Russian constructivists come closer. [...]. Service can mean on one hand persons that can eventually help like a porter; a cleaning service or a craftsman but also extra programs such as a bar, a swimming pool, a fitness club or a doctor's practice. [...]. The hotel can be a perfect model for a big collective housing project» (Atelier Kempe-Thill, 2008).

- Prefab constructive systems and new, highly performant materials to cut construction and housing expenses. A contemporary constructive system optimizes the value of repetition but does not deny the identity of the individual user, eliminating debris in the construction and reducing execution time, allowing more precision, versatility and rapidity in the construc-

tion process. «Light» prefab systems based on the tactic use of modules for plants and networks instead of «hard» prefab systems based on the repetition of complete cellular modules. Traditional «heavy» enclosures based on massive wall systems have been replaced by «light» ones based on «dry» materials, such as metal sandwich or multilayered wood derived panels as well as cement-based, and/or fiber-composite ones (Landolfo, Russo Ermolli, 2012). The repercussions on construction costs have been calculated in about a 10% decrease, allowing an increase in the interior surface or higher quality finishings (Gausa, 2002). Such cost-cutting and efficiency increasing program of the complete construction process could be heavily implemented by the extensive use of Building Information Modeling Technologies (B.I.M.).



07 | Hybrid Building as Social and Energy Hub for Smart Cities:
a Prototype. Unitè 2.0 in a Shanghai location

Unitè 2.0 as Smart Node for a Smart City

Furthermore, the «critical mass» attained by those building would identify them at urban levels as «cornerstones, smart nodes, to promote transition towards the smart cities» (Clerici Maestosi, 2017). As Paola Clerici Maestosi points out: «One explored pathway is the one related to *energy consumption profiles of non-industrial and/or noncommercial end-users* - over the period day/week/month/year - thus considering different building types such as residential ones, buildings for maternal/child health care and schools for the first cycle (6-13 years):

- elderly or fragile end-users, for whom technological innovation relating to smart objects can promote a substantial improvement in their quality of life but also a more effective organization of the services that flow around them, resulting in the rationalization of energy consumption;
- families, single-parent or single-income families, young couples, students away from home for whom technological innovation relating to smart objects can promote sustainable energy life models using innovative urban services as facilitators in everyday life;
- infants and children as end-users of maternal/child services,

First Education Cycle students for whom technological innovation can act both directly and indirectly promoting virtuous effects on families and urban lifestyles.

The hypothesis traced within working groups thus goes in the direction of creating energy districts based on urban residential blocks (social housing + houses for fragile people) and schools (buildings for maternal/child care and First Education Cycle Schools) where technological innovations are capable of promoting interaction with the city defining a smart district model» (Clerici Maestosi, 2017). Unitè 2.0 merges all those typologies into one, huge, smart building.

Conclusions: a prototype

The purpose of the master degree project «Living in the time of crisis: Unitè d’Habitation 2.0» designed by Eleonora Barsanti and tutored by Luca Lanini and Sergio Russo Ermolli aims to offer a possible definition for a new housing model based on concepts like affordability and social living, but above all of flexibility, adaptability, versatility, energetic sustainability and/or production: a prototype that can be placed in any context and adapted to meet specific needs as being a node in a smart city grid.

This project could offer an answer to the topics discussed before, bending together the following qualities:

- Compactness/High Density. It's necessary for the building to be a high density one, facing the phenomenon of urban sprawl.
- Identity. Like Le Corbusier's Unitè, this model is designed to be replicated anywhere, however, the building must be a prototype with adaptable features in function of the site and neighborhood;
- Flexibility. In a fast-changing society, it is essential to offer the possibility to transform dwellings and their composition within the whole building.
- Sociality/Sociability and the neighborhood. Loosing boundaries and social references, it is important to focus on establishing social ties among inhabitants, aiming to create a feeling of connection.
- Energetic Sustainability/Smart Node. In order to reduce the energy consumption of the residential sector, the project must provide environmentally low impact solutions. The building is more and more conceived as an energy hub, as the radiant surface is clearly favored by its massive dimensions.
- Reproducibility. In this period of financial crisis, the new Unitè d'Habitation should provide the use of mass production and prefabrication systems to reduce costs and time.

The configuration of the proposal for the *Unitè d'Habitation 2.0* begins with a modular design that offers the maximum simplic-

ity in space organization, from the design phase/stage to construction through the whole/entire lifecycle, as well as the possibility to expand the building both vertically or horizontally.

The dwelling distribution follows a main guideline that permits double facing; two secondary guidelines represent the spine of the services (in the central area) and the balcony system, simulating a gallery or a loggia (Fig. 1).

Combining different types of designed dwellings offers a first «puzzle» solution, which, however, can be modified during the use of the building by merging two apartments or by redistributing rooms (Fig. 2).

With the purpose of integrating the inhabitants in the Unitè and them with the whole neighborhood, the building will accommodate spaces for activities and services and energy generation (Fig. 3): those spaces are designed to be as free as possible in order to be flexible to the requirements (Fig. 4).

The strength of the project is the ability to guarantee, on a fixed grid, the freedom to organize rooms and services that can be chosen from a sort of catalogue of potentials without representing a definitive configuration. To allow this process, it's fundamental to have new technology such as a metal dry system so that, as soon as the structure is defined, it is possible to add elements that define the building with different colors, insulation systems or spatial configurations (Figg. 5-6).

08 |



08 | Hybrid Building as Social and Energy Hub for Smart Cities:
a Prototype. Unitè 2.0 in a New York location

Along with this generic, conceptual lay-out, the external skin is the adaptive interface with the specific context and climate (Figg. 7-8). In our opinion, this process would allow us to accomplish diversity within the same building, attaining a kind of chameleon-like organism which is *flexible, adaptable, versatile and an active energy hub*.

NOTES

¹ The «usual suspect» as forefather of Le Corbusier's Unité is Mosej Ginzburg's Narkonfim.

² The term «social condenser» was invented by Russian constructivists and related to all architectural artifacts conceived as transformative machines of the social and living behavior of their inhabitants.

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