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Abstract

In accordance with the progress in the research of innovative and environmentally aware modalities procedures for the efficient Heritage recovery in the Mediterranean area, and in line with the European directives and the Italian legislation on environmental sustainability and energy efficiency, this paper aims to show an architectural experimentation in response to the three "R" and three "M" indicated by the United Nations Environment Program: Reduction of harmful emissions, energy consumption,

and resource consumption, as well as maximization of renewable resource use, durability of interventions and environmental compatibility of the components. The object of this study is an excellent example of historical minor architecture, a small eco-settlement in the town of Salve (in the district of Lecce, in the deep south-east of Italy) that from the top of the *Serra Salentina*, facing the Ionian and the Adriatic sea welcomes hot and cold winds. It starts with a careful analysis of the climatic, human and cultural components to propose an eco-friendly solution, enhancing the shape factor and the distributive and functional character of the building. The project takes advantage of the bioclimatic archetypes already part of the building, such as the existing underground oil mill, becoming a place for the pre-treatment of the air or the court and the garden, giving the complex a higher degree of porosity and opening for natural ventilation. These existing structures are integrated with new elevations constituting real wind towers for the air extraction and ducting. The example proposed, in its systemic harmony, shows a possible approach for the realization of a high energy performance, as it reduces environmental and economic costs and preserves a more complex and complete reading of the territory.

Keywords: Reuse, energy-efficiency, sustainability

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Introduction

Nowadays the architectural design faces the sustainability *issues*. In recent years, considerable progress has been done in the research on energy efficiency of new buildings, and not only theoretically. Examples of new zero energy building are present all over the world and it show that new construction configurations, morphological - technological and typological, are possible responding to significant and innovative environmental-energy and bioclimatic request and to the evolution of the needs framework and uses in contemporary urban society. More problematic is the situation for existing buildings, especially those that can boast great architectural value and constitute a inestimable historical and landscape value of which we could not do without it as it represents a heritage for future generations. This problem occurs mainly in the construction of the Mediterranean which is characterized by a shared identity, even in the plurality of the environmental and geomorphological content, combined history, people, civilizations, traditions, making to a defined building typology with common characteristics. "*Qu'est-ce que la Méditerranée* - Says Braudel - *A Thousand choses à la fois, non pas un paysage, corn innombrables of paysages, not pas une mer, mais une succession de mers, not pas une civilization, mais des civilizations entassées les unes sur les autres. Voyager en Méditerranée, c'est trouver le monde romain au Liban, the prehistory en Sardaigne, grecques les villes en Sicile, the Arab présence en Espagne, Islam turc en Yougoslavie. C'est au plus profond plonger des siècles, jusqu'aux megalithic constructions de Malte jusqu'aux pyramides ou d'Egypte. C'est très vieilles choses de rencontrer, vivantes encore, here côtoient the ultra-modern: à côté de Venise, faussement property, the lourde agglomÃ industrielle de Mestre, à côté de la barque du pêcheur, qui est encore d'Ulysse cells , the chalutier dévastateur des fonds marins ou les Enormes pétrolières. C'est tout à la fois, dans l's'immerger archaïsme insulaires et des mondes s'étonner devant l'extrême jeunesse de très vieilles villes ouvertes à tous les vents de la culture et des profits here depuis des siècles, surveillent et mangent the mer"* (Braudel, 1987). Because this cultural context the Mediterranean architecture is characterized by freschiere, yard for the warm summer period, massive walls to avoid heat loss in the winter, etc.. Such architectural cornerstones offer an excellent starting point for work on the existing buildings, taking in consideration the passive systems while integrating new active devices. The European and national regulation reference frame is increasingly oriented towards the adoption of policies that aim to reduce energy consumption and the reduction of CO2 emission. Although with some delay comparing to other countries, Italy has recently reached more stringent criteria: the old law n ° 10/1991 eventually evolved into current DM of 2009, which regulates the energy certification of buildings and subsequent additions at the regional level by promoting incentives for the application of renewable energy integrated into the building. The case study we are presenting is therefore part of this new sustainability key and it has the objective of using a set of systematic and integrated active and passive technological devices which

may result in a significant energy efficiency, a significant reduction in heat consumption, an improvement of bioclimatic comfort , an increase of the eco-efficiency in compliance with the technical and technological feasibility and in full harmony with the morphological character of the place that the project has sought to emphasize. This methodological approach has led to consider the recovery of the traditional elements beyond the purely formal aspects pointing to the identification and expression of their technological potential in a contemporary way.

The virtuous example of Salve

The project deals with architectural renovation of a rural buildings complex in Salento Region, typical exemple of a minor traditional architecture, consolidating two buildings dating back to '700, with an ancient underground oil mill dating from around 1600, with the aim of achieving a high-performance energy building. The complex is an articulation of volumes formed over time without an initial unified vision and it is result of subsequent interventions that have taken a morphological structure that develops irregularly with a play of volumes that complement, overlap and fit together as a result of functional layers which has been called to respond from time to time, generating a plurality of oblique lines constituents and stating its historical value and characterizing the peculiar expressive value of the architectural complex. From the point of view of the "form factor", the complex is configured as a compact structure that offers great potential in the objective of optimizing behavior bioclimatic, energy and the environment using the most advanced contemporary research in the design environment. In particular, the morphology presents as a significant distribution articulated volumes - typical of the consolidated fabric of the Mediterranean Area - which allows the presence of two courts and a garden that give to the architectural body an interesting character of porosity also potentially profitable from the bioclimatic point of view. Half of the intervention area consists of open spaces which take the value of intermediate spaces where the project assigns the task of operating a dynamic filter actions with external environmental factors in different seasons. It consists of one or two floors with an underground section irregularly shaped and carved into the rock. The morphological structure gives buildings the ability to protect themselves from the heat peaks using the massiveness of the housing, protecting from excess solar radiation and channeling the movements of natural ventilation through the courts and the garden. Conversely, during the winter season the characteristics of compact body ensure optimal architectural containment of the heat loss and the main ventilations movements are small. At the functional level the project takes advantage of the morphological characteristics of the volumes differently aggregated to form separate residential units providing a private space while the intermediate spaces play a role of distribution space with aggregation and socialization aim. There is also a library and a space for cultural events. The

renovation project, therefore, has respected the existing building structure enhancing the character and the articulation and the spread spirit of volume and porosity of the intermediate spaces, as well as its own distinct identity using, as much as possible, traditional and bio-ecologic materials respecting the nature aspect and enhancing aesthetic landscape coherence. The intervention on the envelope is of conservative nature, because of the thick walls present which have discouraged other radical types of intervention except for special situations which have adopted thermal coating. The variety and the articulation of pre-existing conditions made it possible to resort to making system of interesting advance and innovative technological solutions to give the building an experimental character consistent with the objectives of overall environmental sustainability. Of particular note is the significant recovery of some traditional elements, the so-called archetypes bioclimatic, valued in the project in a technological contemporary key: the reuse of ancient cisterns for rainwater harvesting, the use of underground oil mill as a reservoir of air and room temperature compensation and chimneys that are reinterpreted and used in the project as towers for extracting and ejecting the air. Note also the application of one of the chimneys of a typical terminal in terra cotta in use in the territory. Among the passive devices, the project also includes the construction of two bioclimatic greenhouses to indirect gain which in winter period maximizes the solar energy capture, while in the summer with right openings it activates a draw of hot air from inside to outside for "Venturi effect". The size and shape of the bioclimatic greenhouses are deliberately consistent with the morphologies present in the complex. The project strategies can be summarized:

- attention should be paid to rediscovery of an architecture which is anything but minor, poor in resources and materials but rich articulated and complex from the point of view of the research for solutions aimed at good living;
- the traditional formal and technology elements present on site were reused in a contemporary reinterpretation considering the environmental sustainability;
- technological devices were used to contain the energy requirements and improve the comfort conditions;
- passive and active high efficiency systems were used for heating, cooling and natural ventilation;
- the active systems such as photovoltaic and solar thermal were used for energy production needed to supplement the natural production obtained from the use of passive bioclimatic systems.

The desired result is a high comfort level in summer and winter time, constancy and uniformity of the thermal parameters and hydrometric, significant lowering of the energy needs from active systems devices and optimal conditions of illumination and control of solar radiation. The building, by extensive usage of passive systems, is designed to hold up to the demand of heating and electricity and, in any case, the power required to

compensate for four types of needed energy: the one for heating of the spaces during the winter, the other for helping the initiation of the ventilation inside the earth pipes, the distribution through the building complex and the air extraction/ejection, the third for production of hot water and lighting and the fourth one for self-production thought active devices using renewable sources.

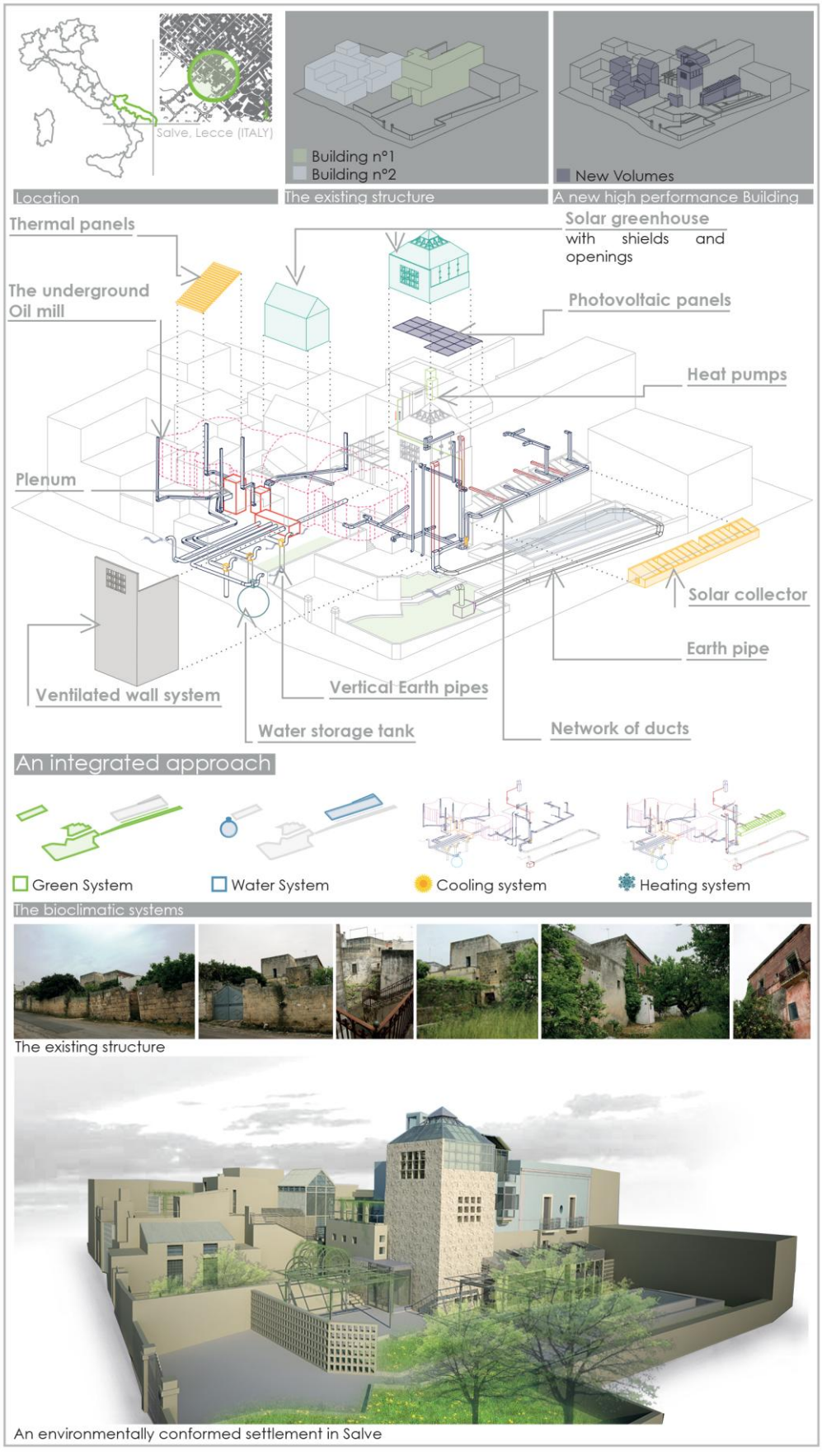
The sustainable approach: reuse of the existing structure and integration with bioclimatic systems

All the constituent parts of the building are designed to be integrated into the existing structure and realize a systemic harmonic project. Starting with the emergency of consistent summer heat, it has been needed to conduct a careful study on the areas subject to direct sunlight. The design choice provides, therefore, screening systems combined with passive and active systems, to ensure a constant ventilation inside the building. Specifically, vents were placed in situ, oriented in the direction of the prevailing winds (*Sirocco, Tramontana, Maestro and Greco*) that become, sometimes, vertical pipes (*Ventilgeos*) or horizontal underground pipes (Earth Pipes); both use the principle of geothermal energy. Particularly, the *ventilgeos*, on one side exploit the thermal inertia of the existing collection tank, while on the other side they are connected to pre-treated air coming from the underground space of the oil mill, through a *Plenum*. The mixed air deriving from the combination of these systems is pumped indoor, directly into the ground floor and up into the first floor. The horizontal duct works in the same way, but it is enhanced by the presence of a water tank on the top and the air rises to the upper levels, through a small wind tower. Therefore the ventilation occurs both vertically and horizontally, thanks to the presence of openings, localized and timed. Finally, the exhaust air is expelled via expulsion's chimneys placed on the top, becoming a nice façade *acroterion*. Concerning the winter situation, it was decided to design n° 2 solar greenhouses, that, properly shielded and openable, capture and transfer the heat indoor. The south-east front has a solar air collector tracing the horizontality of the façade; it accumulates heat in the winter season and transfer it indoor directly and pumped through vents to the upper floors. Indeed, it is a combined system, since it provides an inner insulated tube for the summer ventilation. These systems, combined with massive walls and thanks to presence of vaulted spaces, allow the good conservation of the interior temperatures of comfort, and prevent the loss of heat to the exterior. Additional goal of the designers was to choose eco-friendly, traditional and locally available materials, such as Cursi's stone (a tipe of *Tufo*). High recyclability, maximum self-sufficiency, but also high energy performance, thanks to the presence of photovoltaic panels on the roof (59 m2 producing 30.000Kw/h per year) and solar collectors integrated in the façade (33 m2) that contribute to the production of domestic hot water and are connected to the underfloor heating system. The green and water systems located in the two gardens, contribute to the abatement of temperatures in the

hottest periods. The water contained in the pool on one side, realizes a small phytoremediation system on the other side. The tree species were almost all existing *ante opera* and fruit trees are typical of the area. The pergola in the garden and roof become reminiscences of the typical Mediterranean *freschiera*.

Conclusions

The project with highly experimental connotations, especially in the context in which it is located, is a new reality, offering a theoretical and operational model for similar typological and contextualized cases. At the present moment, it is in the construction phase. It's clear that the volume has remained faithful to the existent structure, except for the top of the tower with the solar greenhouse and a small solarium built on the top floor. Therefore, the new project aims to propose an integrated model, from an energy and socio-cultural perspective. No demolition entails no disposal of materials, otherwise harmful for the environment. The building keeps only the form of what it was in the past, with the addition of new technological solutions. These, cleverly designed and dimensioned, create a network in the thickness of the powerful walls. This new settlement proposes a model for a building to be self-sufficient, integrated and environmentally friendly.


Salve, Lecce (ITALY)
Location
Building n°1
Building n°2
The existing structure
New Volumes
A new high performance Building
Thermal panels
Solar greenhouse
with shields and openings
The underground Oil mill
Photovoltaic panels
Heat pumps
Plenum
Solar collector
Earth pipe
Ventilated wall system
Vertical Earth pipes
Water storage tank
Network of ducts
An integrated approach
Green System
Water System
Cooling system
Heating system
The bioclimatic systems
The existing structure
An environmentally conformed settlement in Salve

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