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A passive house as the seed for a new building model.

Energy retrofit of a 20th century house in El Poblenou neighbourhood of Barcelona.

Type of intervention

[ ] *Restoration* [X] *Rehabilitation / Renovation*

Concerned elements on the intervention project

[ ] *1. Foundations and underground structures*
[ ] *2. Vertical structures*
[ ] *3. Horizontal structures and vertical connections*
[X] *4. Roof and terraces*
[X] *5. Façade and building envelope*
[X] *6. Finishes and completion elements*
[X] *7. Integrate services*
[X] *8. General strategies for building recovery*

Site	Passatge del General Bassols 19, Barcelona, Spain
Objectives	Energy retrofit (EnerPhit) of a house from the beginning of the 20th century, carried out in 2 phases: EnerPHit-Step by Step. In Phase 1, both the thermal envelope and the active system of Ground and First Floor has been done.
Property	Private
Designer	ENERGIEHAUS EDIFICIOS PASIVOS Archs. Micheel Wassouf & Angelika Rutzmoser
Date	Project: 2020 Works: 2021

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Background to the intervention

ENERGIEHAUS is a pioneering entity in the design of buildings with very low energy consumption, adapted to the climatic and social conditions of the Mediterranean. It is based on the traditional strategies of vernacular architecture, combining them with current technological solutions.

Currently, it proposes to demonstrate and disseminate the viability of EnerPhit energy rehabilitation in the Mediterranean as a reference standard, to mitigate the effects of climate change and at the same time offer users a very high level of comfort and health.

The ShowPass project summarizes the experience and philosophy of the company, betting on a radical solution, according to the context and the climatic emergencies with which we are confronted with today. Its objective is to respond to the same need of the current housing market by putting into practice a sustainable and affordable model: apply the European guidelines of "Almost Zero Energy Buildings", mandatory since 2018, in the field of reforms and rehabilitation of the building stock of our cities.

Specifically in Barcelona, according to the results of the latest survey by municipal services, 44% of citizens are not happy with their current home and are considering changing their residence. Because a new home in the city is unaffordable and does not meet the quality and comfort expectations required, many decide to leave, and many others continue living in inefficient homes.

The Showpass building shows and disseminates the feasibility of converting urban centers into sustainable, affordable and high-quality alternatives for living, as well as contributing to the recovery of healthy living and strengthening the identity of the urban fabric.

Description of the building

This building from 1900 is located in the emblematic Poblenou (22@) district of Barcelona. A terraced house typology built in traditional masonary walls with a private small courtyard corresponds to the typical structure of residential buildings where the working class lived in earlier times. The building has three floors, each one used as housing.

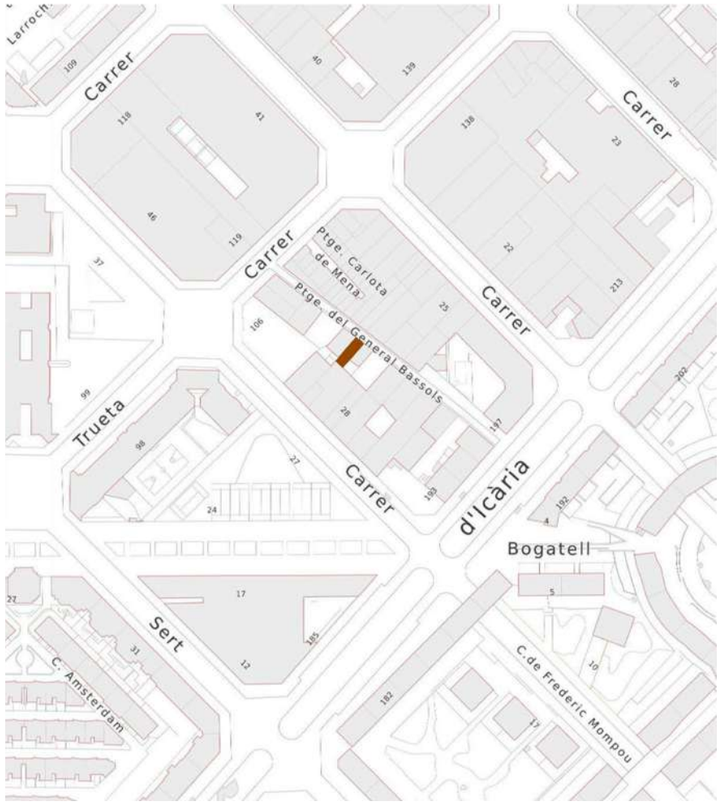

Fig.1: Site plan, the building is represented by a burgundy rectangle on the center of the map.

Fig.2: Main façade of the passatge del General Bassols, after the intervention.

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The Diagnosis of the building (values and state)

The ShowPass project was born with the desire to promote solutions in accordance with the complex reality of our cities. In addition to responding to environmental challenges, the project is committed to efficient rehabilitation to improve the precarious living conditions that characterize the existing housing stock.

It is an EnerPhit demonstrative rehabilitation, that is, the energy solutions are exposed to demonstrate them to the promoters and technicians of the sector through open days. The ShowPass project, therefore, consists of an energy efficiency action with a broader focus on the sector. On the one hand, it proposes to demonstrate and disseminate the viability of EnerPhit energy rehabilitation in the Mediterranean as a reference standard to mitigate the effects of climate change. On the other hand, it promotes a type of rehabilitation to reconvert the real estate stock of our cities towards a healthy and resilient housing model in the face of future social challenges.

The Showpass building, according to the calculations of the PHPP tool, contributes to a reduction of 77% of its CO2eq emissions (heating and cooling) compared to the initial state. To guarantee the environmental impact in the total cycle of the building, the building has also been subject to a life cycle impact audit (Ecómetro-CO2Nulo), where a saving in total emissions of 91% was certified with respect to the original state.

ShowPass was certified under the EnerPhit-Step by Step seal. It is an international protocol to reach an optimal cost rehabilitation by adding the cost of executing the work and the operating costs over 50 years.

ShowPass also obtained the Ecometro-CO2Nulo seal, a standard that analyzes the environmental impacts of the building, from the preparation of the materials to the end of the building's life.

Restoration and rehabilitation works

PASSIVE PART

A wide variety of low ecological impact material solutions have been used to demonstrate and disseminate the feasibility of these technologies.

For example, on the street façade, thermal insulation with calcium-silicate was chosen on the inside, since it was not possible to install an external ETICS to respect the original façade. This allows the humidity to be managed by capillarity of the subsoil and avoids the need for a steam brake inside. The street façade is cleaned up with natural hydraulic lime, respecting the aesthetics and original solution. It is decided to mark the refinished surfaces, creating nuances of colors that give the building its own character.

Instead, the courtyard facade has been designed as a ventilated wooden facade, installing fire-retardant glass wool insulation. It is a facade with a larch wood structure, minimizing the use of metal profiles. On the inside, a 7 cm thick installation cavity is added, this time with recycled cotton insulation, which turns out to be a material of great potential and interest due to the high consumption of the textile industry.

The facade of the courtyard annex has wood fiber insulation. The interior of this room is covered with clay tiles to achieve an intelligent and passive management of excessive humidity in summer.

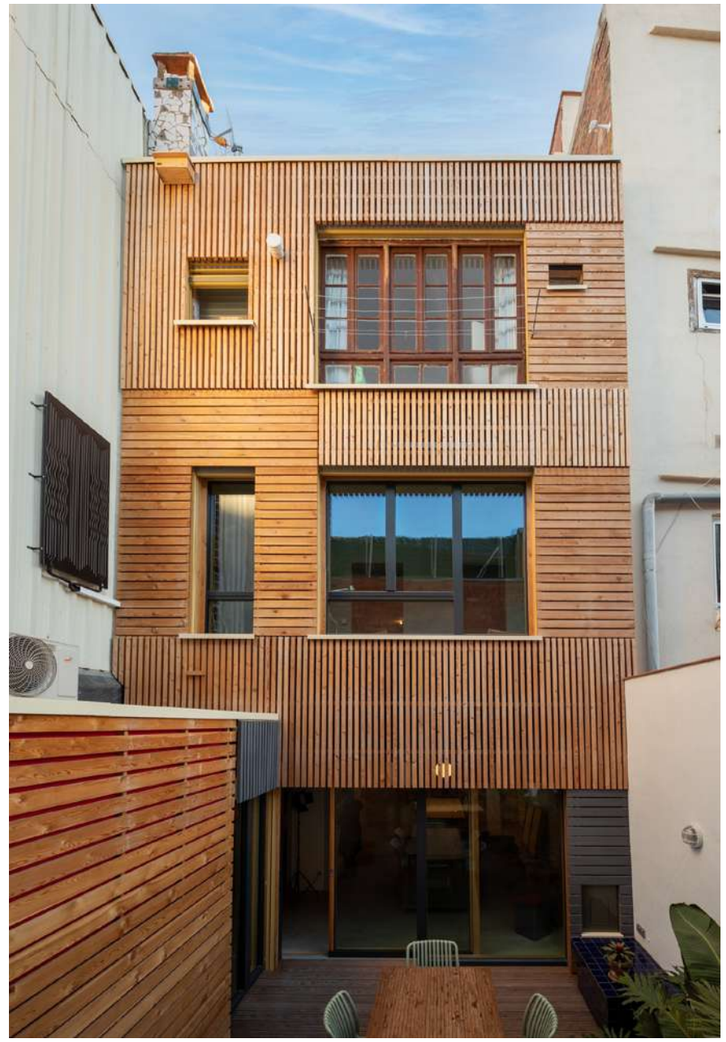

Fig.3: Courtyard's façade, designed as a ventilated wooden façade.

On the ground floor, a floating screed is installed, on high-density rock wool plates, with a thickness of 10 cm. Between the plates are placed the ventilation, sanitation, water

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Assessment of the results

and electricity ducts. To break the resulting thermal bridge, a continuous 2 cm high-density wood fiber board is added.

Finally, to acoustically and thermally seal the building's construction joints, sheep's wool, supplied by a local manufacturer, has been used.

Air infiltrations are minimized with Passivhaus certified products, such as low VOC emission sealing tapes. The good result obtained in the BlowerDoor test guarantees the optimal functioning of the building in terms of air infiltrations.

ACTIVE PART

An aerothermal system with a passive evaporator has been installed, thus eliminating the electrical consumption of the fan in the outdoor unit and improving the seasonal performance of the system.

For the generation of heat and cold, a compact machine with integrated recirculation is installed. This machine has an integrated direct expansion heat pump. Special attention will be paid to the dehumidification capacity of the machine, since it is the main challenge for these regions and the project's commitment to promoting efficient rehabilitation in this climate.

To minimize hot water consumption, passive shower water recuperators are installed, and a simple DHW consumption monitoring system is installed, to make the user aware of the challenge of water resources.

CONTRIBUTION IN THE CONTEXT OF THE CLIMATE EMERGENCY

The commitment of the Barcelona City Council for the year 2030 is to reduce equivalent CO2 emissions by 50% compared to 1992 values. According to the calculations of the PHPP tool, the Showpass building's CO2 emissions are reduced by 14,821 kg/y (current status) to 5,293 kg/a after the first step of the reform, and to 3,170 kg/a after finishing the reform (2nd phase). That equates to a 62% reduction in step 1, and a 77% reduction in step 2.

The Showpass project aims to demonstrate to society a rehabilitation technology, based on passive strategies, that improves health and comfort conditions in homes. Implementing this model at a national level would reduce the energy bills to which many families are exposed in the current political context.

ShowPass achieves the most demanding energy indexes, certified through two independent entities, which have audited the building under the EnerPhit and Ecometro standards.
Currently, buildings obtain levels of well-being from the implementation of active installations. ShowPass wants to demonstrate that it is possible to reach the same levels of comfort through proper architectural measures.

The entire building is undergoing detailed energy and comfort monitoring to verify that the designed solutions effectively correspond to the lived reality of the users.

In conclusion, the ShowPass building encompasses a range of passive solutions with the intention of reducing the overall ecological impact of the building, not just limited to the phase of use. The first analysis of these impacts has shown the relevance of construction materials in EnerPhit-type buildings (red bars in the lower graph). Global warming is very marked by the use of materials in the work, which is why the commitment to work and promote the use of materials with a very low ecological impact is evident in the ShowPass project.

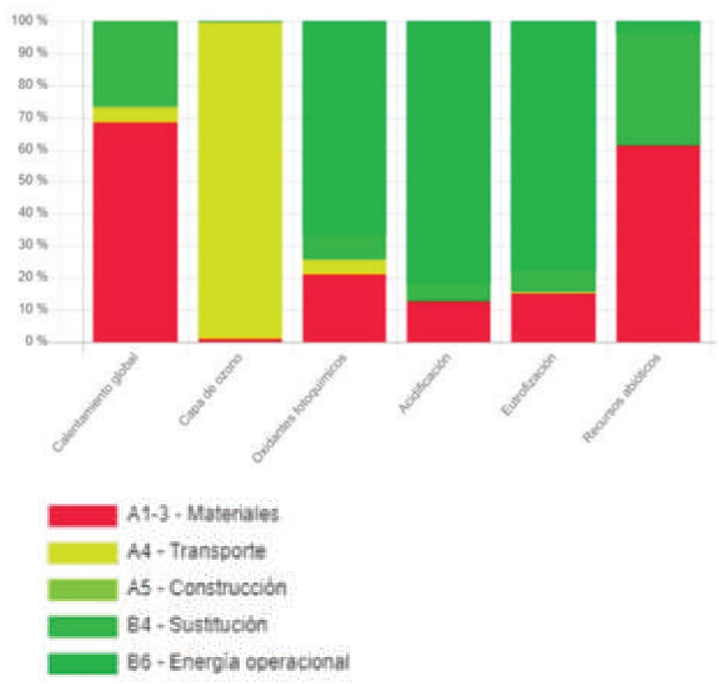

Fig.4: Analysis of the ecological impacts of the construction materials of the building [A1-3: Materials; A4: Transport; A5: Construction; B4: Substitution; B6: Operational energy].

References

Energiehaus
https://www.energiehaus.es/

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Plans & drawings

Fig.5: Ground-floor

Fig.6: First-floor

Fig.7: Second-floor

Fig.8: Roof plan

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Fig.9: Longidutinal section.

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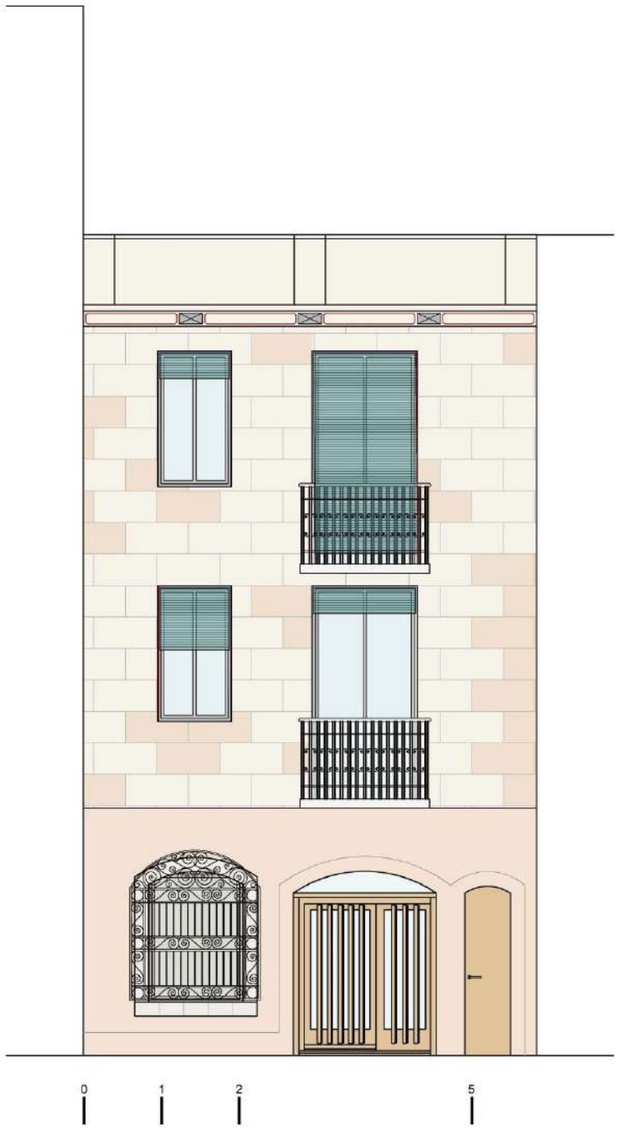

Fig.10: Main façade, toward the street.

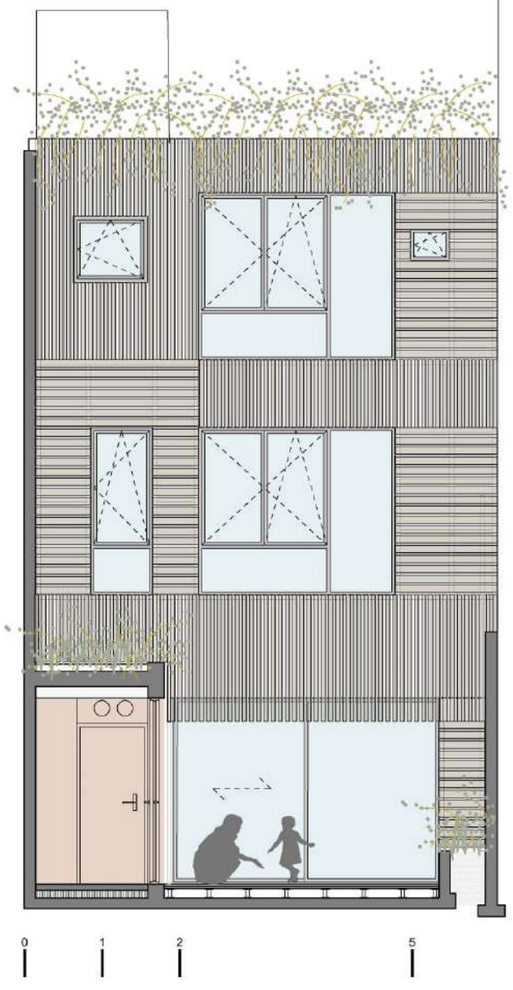

Fig.11: Courtyard's façade.

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Images of the works and completed project

Fig.12: View of the intervention works, transporting the new windows, and the existing conditions of the main façade can be seen on this image.

Fig.13: View of the restored main façade, and neigboring buildings.

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Fig.14: Previous state of the courtyard's façade.

Fig.15: Courtyard's façade after the intervention.

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Fig.16: View of the finished courtyard.

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Fig.17: View of the ground'floor's living room, looking towards the patio.

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Fig.18: Monitoring and improvement of indoor air quality.

Fig.19: Hot water consumption meter.

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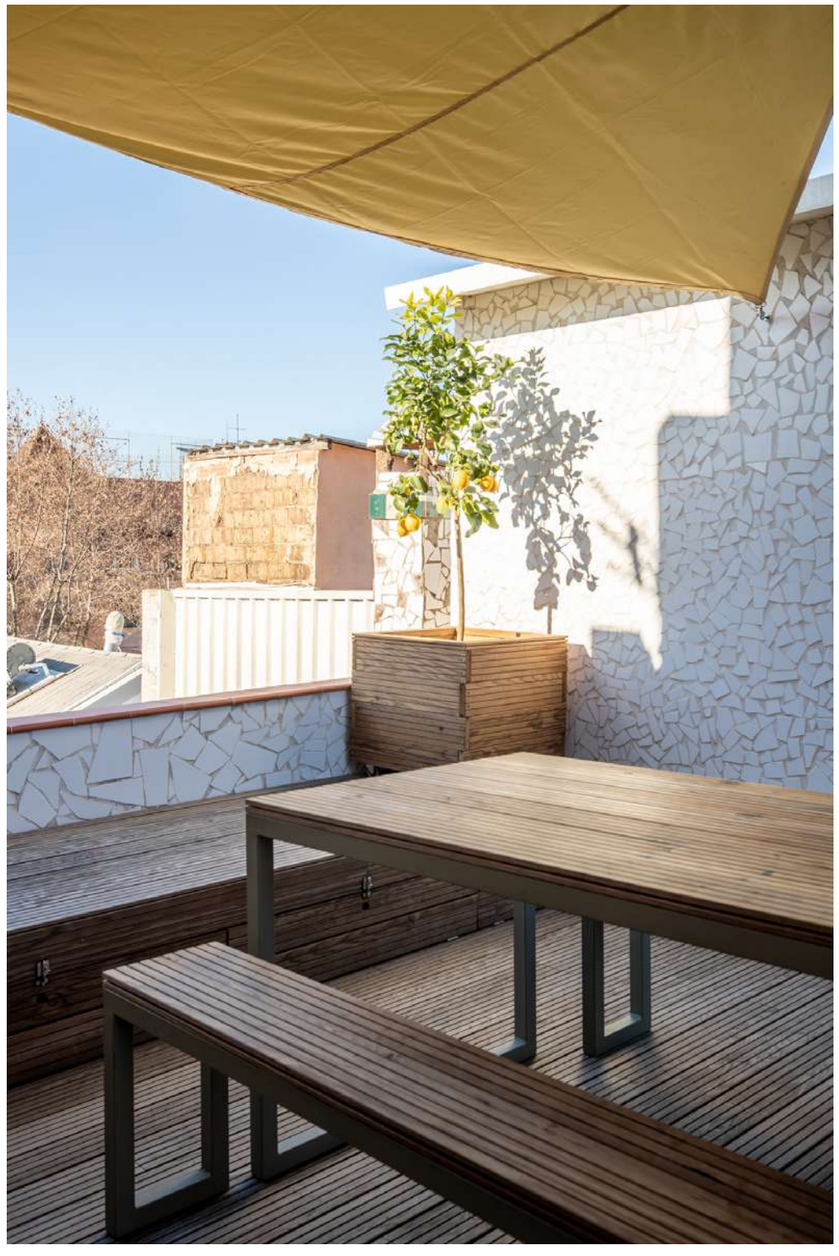

Fig.20-21: Rooftop terrace.

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Fig.22-23: Rooftop terrace.