

Interreg
Sudoe



Energy Push

– **GUIDE** –
Good practice

Energy Push

**SUSTAINABLE ENERGY MANAGEMENT
SOLUTIONS FOR SOCIAL HOUSING**

A project approved under the
Interreg V-B South West Europe Cooperation Programme (Interreg Sudoe),
co-financed by the **European Regional Development Fund (ERDF).**





SUDOE ENERGY PUSH

A project involved in the struggle against climate change and social exclusion through innovation and the use of renewable energy in the framework of transnational cooperation in the Sudoe region.



THE CHALLENGES



Carbon
neutrality



Energy
performance



Comfort
and health



Overall
cost

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CONTEXTUAL ELEMENTS OF SOCIAL HOUSING IN THE SUDOE FROM A SUSTAINABLE DEVELOPMENT POINT OF VIEW

Europe aims to become the first climate neutral continent. In 2019, the European Commission has therefore presented the Green Deal, a sectoral roadmap to achieve carbon neutrality by 2050. Within this framework, the renovation of social housing presents an important issue that addresses several of the EU's sectoral strategies.

The circular economy has emerged as a major focus for sustainable growth in the EU. The building sector, and housing in particular, has a key role to play in addressing energy and raw material consumption and waste production. In addition, renovation programs for existing buildings should be encouraged rather than the current trend of urban expansion with the construction of new buildings.

The issues of quality of life, comfort and biodiversity in the context of sustainable renovation are also levers for sustainable development and European ambitions.

The Sudoe region is characterized by a social housing stock that was mostly built before the economic crisis that affected the southern European countries, and before the thermal regulations or the new directives on energy efficiency came into force.

The social housing stock in the SUDOE region is generally not sufficiently efficient from an energy point of view. This adds to the problem of fuel poverty, the low use of renewable energy, the lack of comfort and the lack of global management methods, making it difficult to implement sufficiently efficient energy policies.

In the long term, the housing stock will have to be made up of nearly zero-energy buildings - NZEB¹ or sustainable. However, current renovation rates are insufficient and citizens affected by fuel poverty are the most vulnerable. It is therefore necessary to guarantee the cost-effectiveness of the actions and investments to be implemented.

The guide presents the measures developed by the Energy Push partners, at all stages of a renovation, constituting an innovative methodology for the overall management of social housing. They have been tested on 4 pilot projects in France, Spain and Portugal.

1 - The European Commission's official definition of NZEB is : a building that has a very high energy performance. The amount of near-zero or very low energy required should be covered to a very large extent by energy from renewable sources, including energy from renewable sources produced on site or nearby.



WHY ENERGY PUSH ?

SUDOE ENERGY PUSH proposes an innovative solution for the global management of social housing in the SUDOE territory, which could be used as a model to improve the energy efficiency of public buildings and the quality of life of the most vulnerable citizens.

By combining passive rehabilitation, renewable energies (fuel cells) and BIM² (Building Information Modeling) methodology, the project has a double objective :

- **To reduce energy consumption** and greenhouse gas emissions from buildings
- **To improve the comfort** of the inhabitants in their homes.

TOTAL BUDGET

1.849.943, 51 €

ERDF BUDGET

1.387.457, 64 €

EXPECTED OUTCOMES

- **Considering the energy performance** of social housing as an essential element for the management of sustainable cities.
- **Transferring innovative methodologies** such as the passive approach (NZEB) and BIM to integrate them in social housing rehabilitation projects.
- **Developing a technical and economic optimization method** based on BIM to select the best rehabilitation scenarios.
- **Introducing hydrogen** produced by renewable energies and PEMFC technology to ensure the sustainable energy supply of social housing.
- **Disseminating best practices** and carry out innovative pilot projects to improve the performance of buildings, thus reducing the risk of fuel poverty.
- **Strengthening the exchange networks**

PROJECT PARTNERS

A transnational and multidisciplinary team with the technical skills and knowledge to develop the project



2 - BIM is a digital representation of the building and management of an asset that allows for a radical improvement in project management and optimization of the benefits for the client including the operation of the building, by combining technology, process improvements and digital information.

02 — Needs assessment



THIS WORK HAS BEEN TO INVENTORY, CHARACTERISE AND COMPARE THE SOCIAL HOUSING STOCK IN 4 TERRITORIES OF THE SUDOE AREA.

To this end, a methodological proposal is made that has facilitated the inventory and characterisation of public social housing parks, especially in the case of those located in urban environments with vulnerable populations. Besides, the methodology described has allowed the identification of the complexity and heterogeneity that these parks present, as a consequence of their different physical, social and technical characteristics, which makes their energy evaluation and management difficult.

The methodological proposal developed collects homogenises and codifies those parameters that allow the improvement of the managers' capacities and the energy and social results of the interventions. To this end, a package of 220 management indicators has been generated, classified on three scales (regional, local and building) which: efficiently characterise a public housing stock, can be integrated into the BIM and allow the latest European advances in energy efficiency to be incorporated into Level(s). Of the total number of indicators proposed, 42 have been considered relevant to be included in the definition of the TG3 BIM development protocols. Given the high number and wide range of categories in which the indicators are integrated, this tool can be reproduced and implemented to manage any public social housing stock, at any scale.

MOST RELEVANT MANAGEMENT INDICATORS



Ownership



Density of social housing supply



Age of the buildings



Conservation status



Size of dwelling



Household resources ceiling



Rental prices



Energy

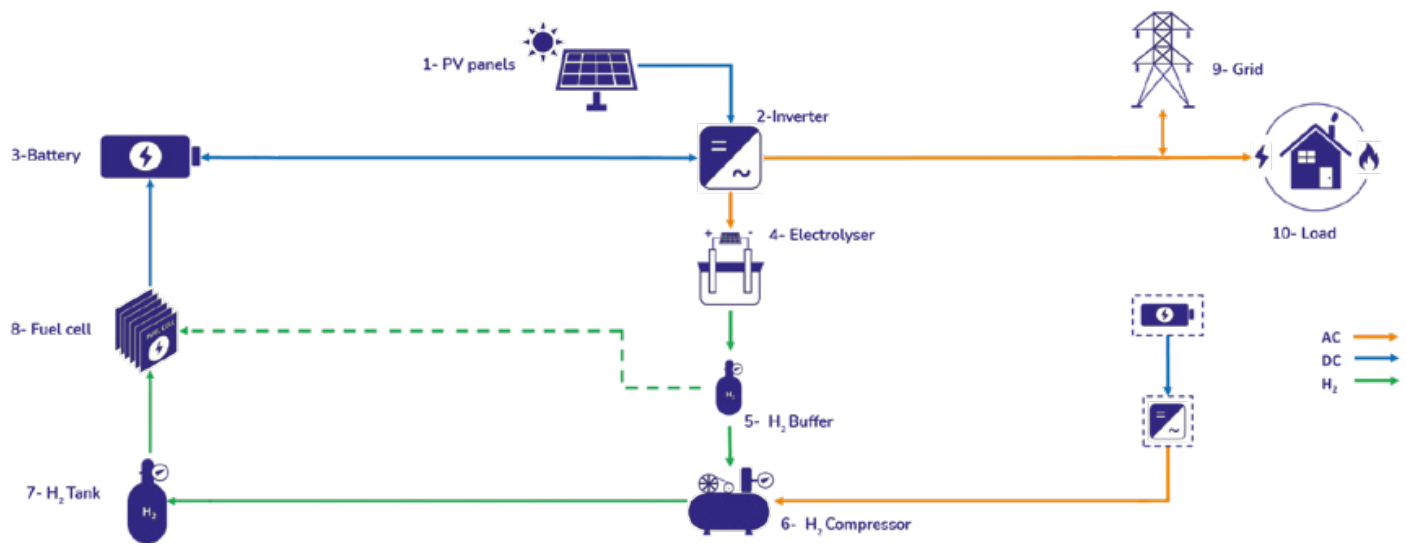


Investments in energy efficiency improvements

With regard to the data obtained from the evaluation of the indicators on the pilot territories, it can be seen that there is no single vision concerning the concept or framework of action of social housing; in fact, each territory focuses its social housing policy under different criteria and applies them according to its particular objectives and instruments. Thus, there are differences between the

ownership of housing, where rent is more important than a sale; between the annual income of the tenants, with the French region being the one with the highest income in its social population; and between the price per square metre, with Andalusia standing out as the region with the cheapest rents.

03 — Solution to secure energy supply: Hydrogen



« Schematic diagram and real pictures of the pilot plant, » © University of Cantabria Department of Chemical and Biomolecular Engineering

The energy renovation of social buildings has traditionally focused exclusively on the rehabilitation of the thermal envelope and interior insulation of dwellings in search of greater comfort for the inhabitants. However, this type of passive actions does not eliminate the problems derived from the scarcity of resources of the most disadvantaged population. To address energy poverty in vulnerable housing, it is necessary to implement innovative solutions and alternatives that guarantee users access to clean and sustainable energy.

In this context, the ENERGY PUSH project proposes the use and combination of renewable energies and hydrogen energy storage systems to ensure uninterrupted energy supply to social housing. To demonstrate the technical feasibility of these technologies, the University of Cantabria has carried out the design and implementation of a pilot plant combining solar panels and hydrogen fuel cells in the town of Novales (municipality of Alfoz de Lloredo, Cantabria, Spain). This prototype aims to achieve energy self-sufficiency of a social housing provided by GESVICAN, without the need to resort to the electricity grid or fossil fuel-based support generators..

The system will operate in such a way that the primary energy source is solar photovoltaic. To combat its intermittency and take advantage of periods of energy surplus, different storage technologies will be installed: lithium-ion batteries for short-term energy storage and hydrogen-based technologies for seasonal energy storage. Hydrogen technologies, also known as hydrogen chain, consist of the following elements :

Electrolyzer : this device makes it possible to obtain hydrogen from water and the use of surplus production from renewable energies.

Compressor : the purpose of this equipment is to raise the pressure of the stored hydrogen so that larger quantities can be stored in smaller volumes.

Storage : the hydrogen generated in the electrolyzer is stored in tanks that can be based on different technologies. In this case, storage in 50-litre steel cylinders.

Proton exchange fuel cell (PEMFC) : this equipment is responsible for the re-electrification of hydrogen, so that, by combining it with oxygen, this

device generates direct current that is injected into the supply system of the house. The fuel cell will produce water as the only waste during its operation that can be reused for hydrogen generation again.

References :

1. Maestre VM, Ortiz A, Ortiz I. 2021. Challenges and prospects of renewable hydrogen-based strategies for full decarbonization of stationary power applications. *Renewable and Sustainable Energy Reviews* 152:11628.
2. Maestre VM, Ortiz A, Ortiz I. 2021. The role of hydrogen-based power systems in the energy transition of the residential sector. *Journal of Chemical Technology and Biotechnology*.

04 — Solution for technical and economic optimisation : Renoir



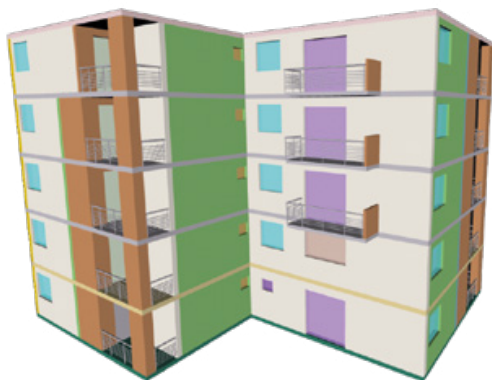
THE “RENOIR” METHODOLOGY ENABLES TO OPTIMIZE THE CONCEPTION OF THE REFURBISHMENT IN TERMS OF ENERGY AND GLOBAL COST CONSIDERING BOTH THE SPECIFICITIES OF A GIVEN BUILDING AND THE BUILDING OWNER PREFERENCES. IT IS THEREFORE A CUSTOM-MADE PROCEDURE.

Contrary to technical offices that most of the times simply proposes two or three renovation alternatives, this tool simulates thousands of refurbishment strategies, each combining different renovation actions, and are assessed in terms of energy and global cost.

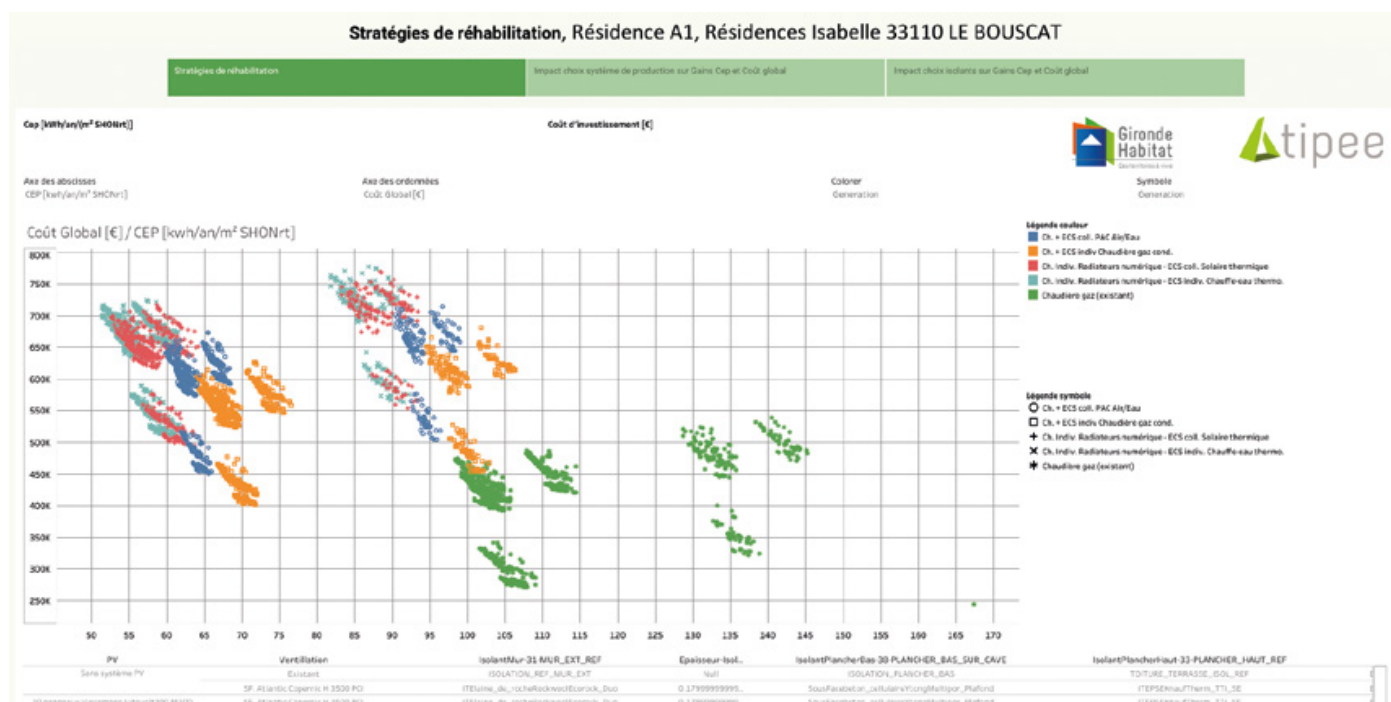
This large set of data is then used to highlights the trends to understand which actions yield the highest energy and cost saving at the same time. The information is finally used to propose recommendations to the building owner.

The methodology workflow consists into six steps :

1. Gathering the descriptive information of the existing building and the operation constraints and opportunities. The geometry of the building, among other information, is recovered thanks to a BIM model ;
2. Development of the existing building energy model ;
3. Designing of all the potential renovation actions ;
4. Implementation of the renovation actions into the RENoir tool via the BIM model ;
5. Optimization calculation ;
6. Analyzing and introduction of the results to the building owner.



3D BIM modelling - Tipee



05 — Solution of multi-criteria analysis for global renovations – Recores



Renovation is a system in which the improvement processes interact with each other, but also with the existing building, its occupants and its immediate environment. Renovation therefore affects multiple aspects and involves a multi-criteria analysis.

The method allows to :

1. **Identify** all the impacts related to a choice; evaluate counter-performance and/or related benefits
2. **Not to neglect** certain aspects considered important but not determinative; to ask the right questions and evaluate certain compromises
3. **Facilitate** the comparison of scenarios with similar performance on the criteria considered most important to a decision-maker, using other criteria to decide between them.

1

Evaluation of the building in its initial situation

2

Proposals / recommendations that will change the indicators

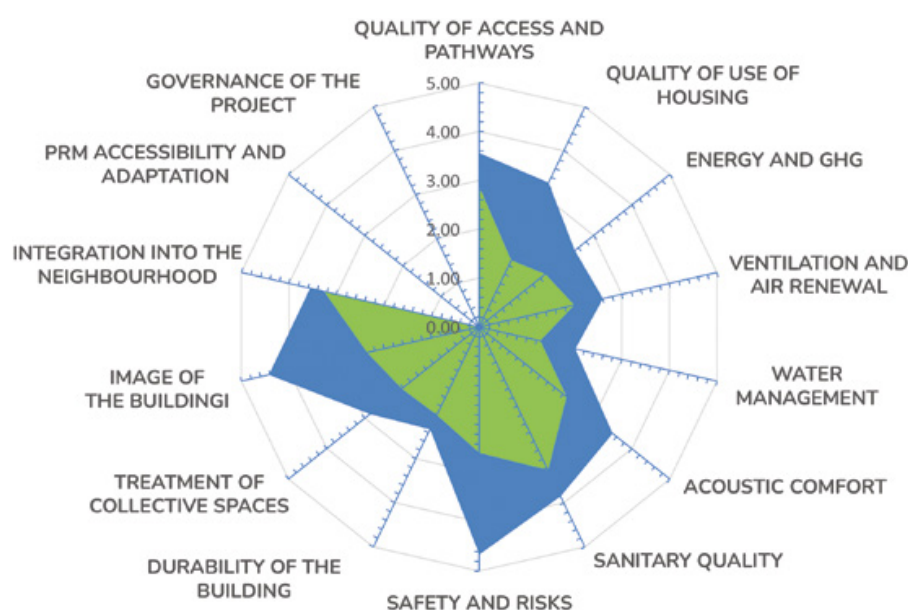
RECORES REhabilitation Cohérente des RESidences Sociales (coherent rehabilitation of Social Housing)

The aim is to look at the evolution of a building before/after recommendations (and not to compare buildings between them). The tool should be used prior to a renovation project, as a diagnostic and **decision support tool**. It allows to define a **global renovation** strategy

- Excel spreadsheet with **206 questions** on the quality of use and technical quality of the building. These questions are grouped under 14 themes, distinguishing 38 indicators.
- The answers are either qualitative (mostly) with a score from 1 to 5 and a written justification, or binary (yes/no), or quantitative.
- Aggregation rules are then used to summarise the responses, by indicator and then by theme.

■ SCENARIO

■ DIAGNOSTIC



RECORES chart – Refurbishment proposal © Carbone BET



Easy to use.

A tool for dialogue and consultation to highlight areas for progress.

Modular and adaptable to local contexts and to the evolution of sustainable and urban planning policies.



The same person should fill in the table (initial state/ after work).

Several skills are needed: thermal engineering office and architect at least.

No economic dimension.

06 — Solution for monitoring of consumption



ONE OF THE MAIN ISSUES IN ENERGY EFFICIENCY IS MEASURE THE IMPACT OF THE REFURBISHMENT ACTIONS IN TERMS OF ENERGY AND ECONOMICS SAVINGS AND IN COMFORT CONDITIONS OF ITS INHABITANTS.

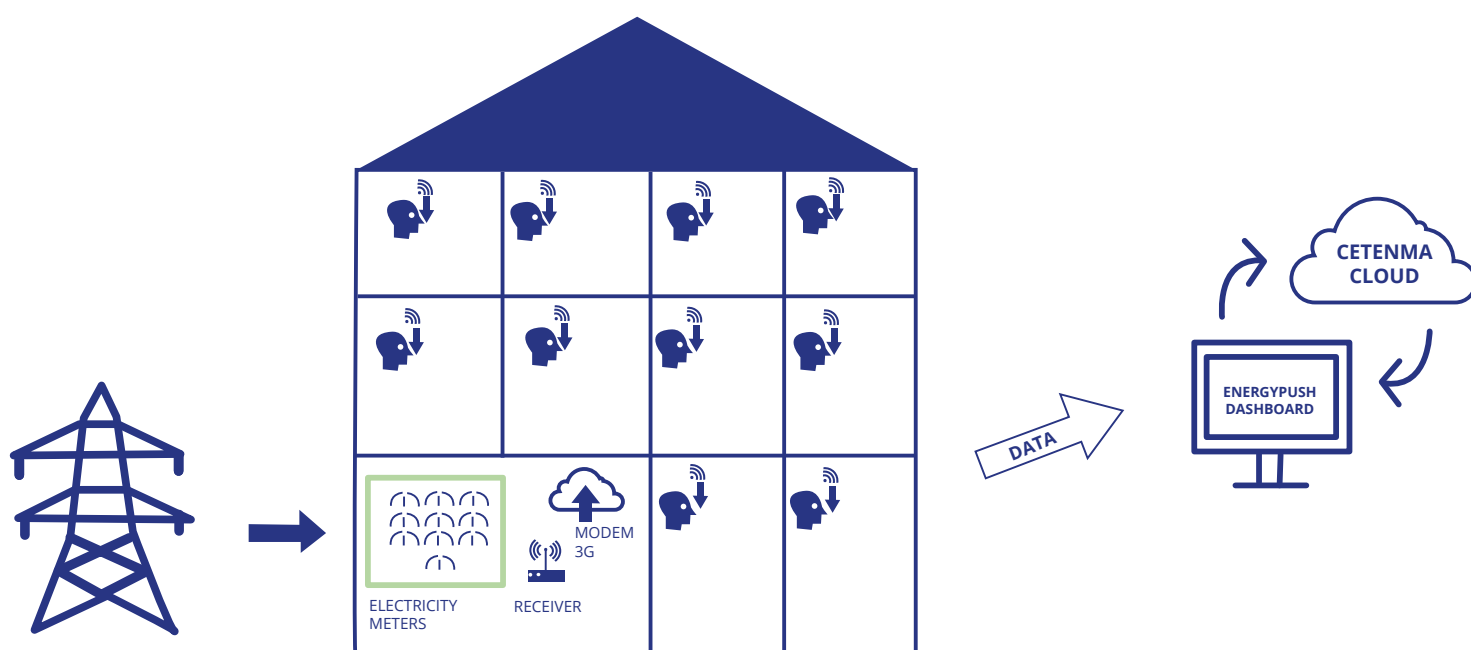
The Sudoe Energy Push project proposes a different approaches of monitoring solutions in each pilot.

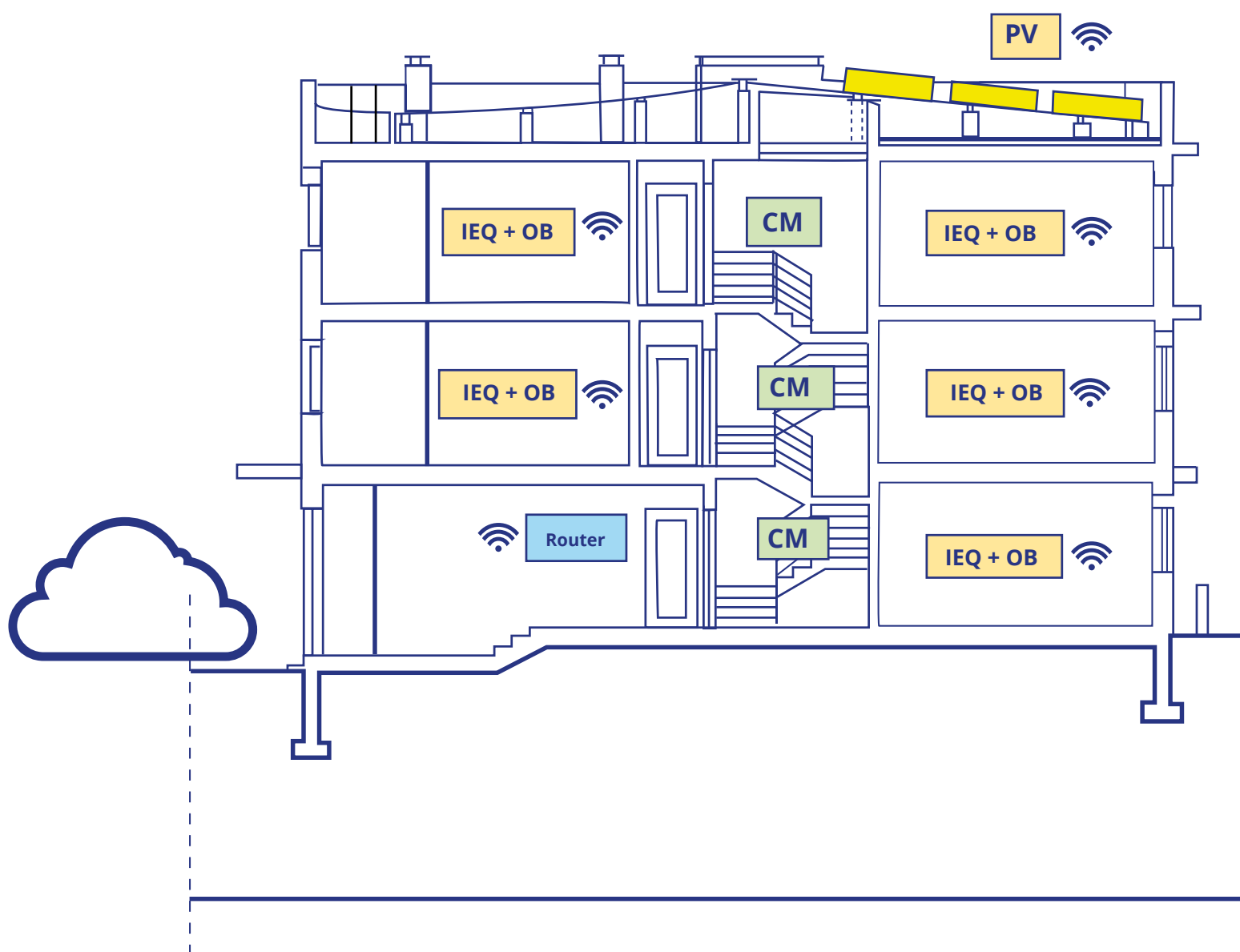
The pilot case of Andalucía includes the refurbishment of a social building in Alpujarra de la Sierra (Granada, Spain). In this case AVRA and CETENMA had worked using BIM methodology to simulating refurbishment alternatives on the 3D model to get a higher energy performance and improve results and optimize resources.

To measure the impact of the actions on energy consumption and indoor comfort conditions in the 10 houses of the building, new monitoring system had been designed and installed. This system includes a centralized energy measurement system with 10 power analysers installed beside the utility meters and 10 wireless sensors to measure temperature, relative humidity, and CO₂ concentration on each flat.

A similar approach is proposed in Cantabria Pilot. In this case, the power analyser and the comfort conditions sensors will be installed in the main board of the house sending the information to the same platform.

In the pilot of Vila Nova de Gaia, Portugal, an indoor environmental quality (IEQ) monitoring system was developed to help the social housing stock managers knowing the indoor conditions and have a data-driven support in future renovation works. The IEQ monitoring system as the following type of sensors: temperature, relative humidity, CO₂, TVOCS, PM_{1.0/2.5/10}, formaldehyde, illuminance, sound pressure level. The energy and water consumptions were also included on the monitoring system to register the pre and post consumptions. The data collected is mined and is presented on a dashboard.





07 — 7. Solution for managing towards low carbon operations



In France, the future 2020 Environmental Regulations, preceded by the E+C- experiment, have introduced the consideration of the carbon footprint of projects. In fact, social housing organizations are facing a major technical challenge, which consists in carrying out massive renovation in an efficient manner while integrating the carbon issue, when practices have changed very little in recent years.

Social housing organizations are therefore obliged to rapidly change their habits and organization in a very constrained financial context. The main challenge is therefore to support social housing companies in this change.

The position of «Energy Performance and Low Carbon Renovation Manager» studied in the framework of Energy Push has been designed to support the existing organisation of social housing companies in order not to

disrupt their habits and organisation. It supports the existing functions and strengthens the links between them while ensuring overall coherence in terms of the property strategy of the housing organisations as well as in terms of renovation projects.

This opportunity study highlighted the fact that in order to guarantee the achievement and sustainability of energy performance over time, it is essential to have a global and coherent approach based on :



THE ROLE OF THE « ENERGY EFFICIENT AND LOW CARBON RENOVATION » MANAGER IS TO HELP SOCIAL HOUSING ORGANISATIONS TO INTEGRATE THIS GLOBAL APPROACH AND TO IMPLEMENT CONCRETE ACTIONS. HE/SHE ENSURES THAT NO ASPECT IS NEGLECTED IN FAVOUR OF ANOTHER.

that only needs to be tried out by willing social housing companies. The job descriptions drawn up as part of this opportunity study provide an initial framework for intervention, which could then evolve thanks to the feedback from the first experiments.

THE STEPS OF THE STUDY

The concrete implementation of this position of « Energy Performance and Low Carbon Renovation Manager » can take many forms because the reality of each social housing company is different. They do not all have the same assets to manage, the same human and financial resources, or the same territorial realities. This is why two versions of the position have been proposed, in order to give social housing organisations a certain amount of latitude to define the precise content of the position themselves. This study should, among other things, open up discussions between the social housing organisations in a region to explore the respective motivations of each organisation and possibly define a common desire to mutualise skills.

The mutualisation of a position of « Energy Performance and Low Carbon Renovation Manager » is certainly not the only solution to solve the problems posed by the energy performance renovation of housing. However, it does have the advantage of proposing a concrete solution





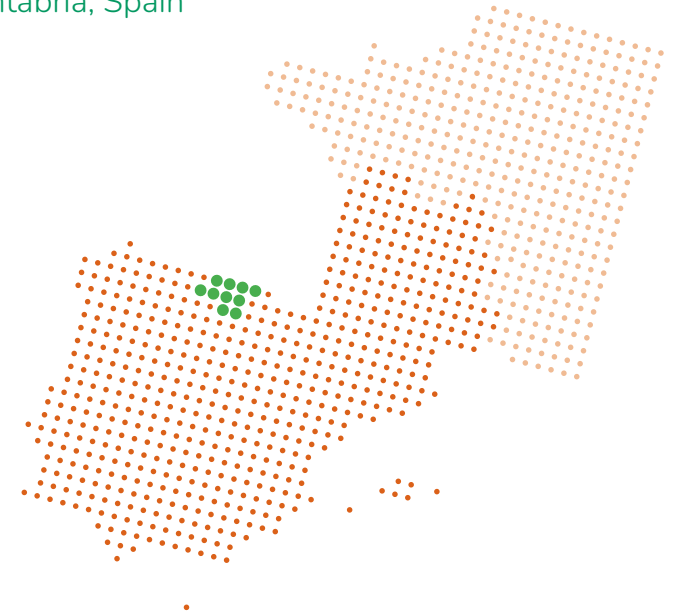
- Gestión de viviendas e Infraestructuras en Cantabria - Gesvican, Cantabria, Spain

Self-sufficient and carbon-neutral social housing using hydrogen fuel cell technology.

In Cantabria, Gesvican, the Housing Agency of the Regional Government, which manages the social housing stock in this region in northern Spain, has spent years searching for innovative ideas to ensure that social buildings are energetically and economically sustainable.

The problem of energy poverty has been accentuated in recent times due to the exorbitant increase in the price of energy and the instability in the supply. This problem is even worse in the southern countries of the Sudoe territory, traditionally dependent on foreign countries to fulfill their energy demands, and in social housing families with fewer economic resources. The search for emission-neutral buildings and the increase in comfort of its inhabitants, has therefore become an urgent and priority need.

The Sudoe Energy Push project proposes a solution based on renewable energies that will allow a social housing in the municipality of Novales to be self-sufficient and carbon neutral. Photovoltaic energy is combined with hydrogen technology enabling the storage and use of green energy whenever solar intensity does not cover the energy demand of the home. Thus, a consumption of almost 8,000 kW/year currently supplied by conventional electricity and natural gas networks will result in a zero emission of CO₂ into the atmosphere and significant savings as solar energy will be the only energy source.



A pilot project resulting from the joint work of Gesvican, the University of Cantabria, the CTL Foundation, the University of Porto, CETENMA and the French company Carbone, which will involve testing a technology in a real environment, providing a social housing with a supply of 100 % green, and a zero cost for its inhabitants. The project includes a monitoring platform to control both the production and use of hydrogen and the interior comfort of the home.



source : © GESVICAN

The installation of the new renewable energy supply system based on hydrogen technology has meant a significant improvement in our quality of life. Along with a lower cost of the electricity bill, which also favors better interior comfort in the home, we are proud to be able to participate in this innovative and pioneering project that can serve as a basis to help other families like ours.

We are showing that everyone, regardless of our resources, can do our bit to fight global warming and offer our children a more sustainable world.

Paula SÁNCHEZ, Tenant



- Agencia de Vivienda y Rehabilitación de Andalucía - AVRA, Andalusia, Spain

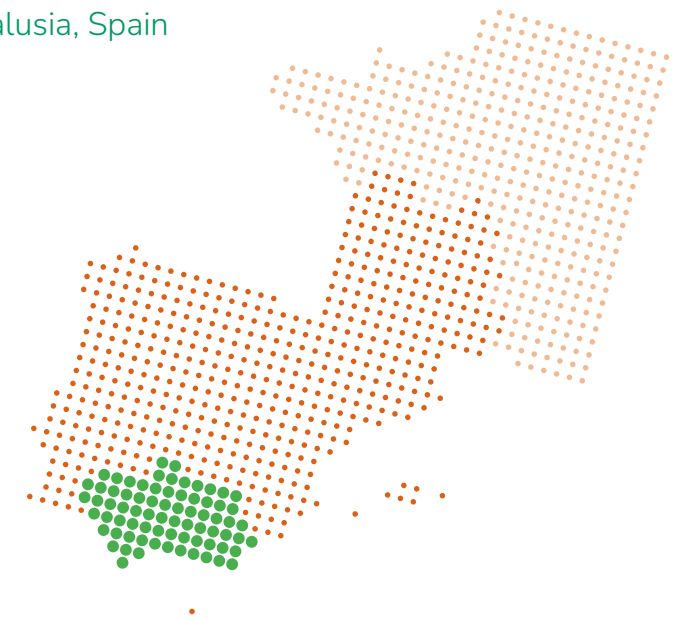
From traditional management to BIM management of the Andalusian public housing stock.

The Andalusian Housing and Rehabilitation Agency (AVRA), public entity belonging to the Ministry of Development, Infrastructure and Territory Planning, is in charge of managing the Andalusian Public Housing Stock, counting up to 73,989 dwellings housing more than 350,000 people.

To accomplish it, AVRA is working to implement a comprehensive management model that aims at responding to the housing and social needs of citizens through the execution of coordinated actions in all areas of management, including the administrative perspective, repair and maintenance of buildings and homes, energy efficiency, as well as other social issues.

Sudoe Energy Push proposes a new approach in the implementation of a comprehensive management system and a procedure for characterizing the residential stock through the BIM methodology which will enable a global management of information and the ability to make decisions on energy rehabilitation investments steering urban refurbishment policies towards priority urban areas and thus contributing to the social and energy objectives of Europe 2020.

Within the framework of the project, in order to test the resultant BIM methodology for social housing management, AVRA has implemented a pilot project to improve energy efficiency in 10 social houses in Mecina Bombarón, Alpujarra de la Sierra, Granada. The BIM 3D model was built through a point cloud obtained with a laser scanner, and the potential energy solutions have been assessed



using BIM software, selecting the one with the greatest energy impact for the tenants. BIM methodology has also been used to follow up the works and organize information flows. The energy rehabilitation action carried out by AVRA includes building envelope improvement, leading to a higher indoor comfort and habitability of the houses. The building is being monitored in order to check the impact of the energy actions

To achieve the objectives of the project, AVRA has collaborated closely with the partner CETENMA, designing the monitoring system and the requirements for the BIM model with the subsequent energy simulations to achieve optimal solutions.

The BIM methodology is going to improve our management due to its versatility and full scope of the building life-cycle; from the very conception of the project to the development of the works and the involvement of all the components of the team.

Moreover, we will have the possibility of linking the construction data with other data such as consumption, maintenance expenses, rent management, social issues, etc.

This will also improve the accessibility to this information and the management of potential actions, storing all the data in a single tool for future use and management.

Ignacio VÉLEZ, Head of the Housing Department in the Provincial Directorate of AVRA in Granada.



source : © AVRA





- Gironde Habitat - Gironde, France

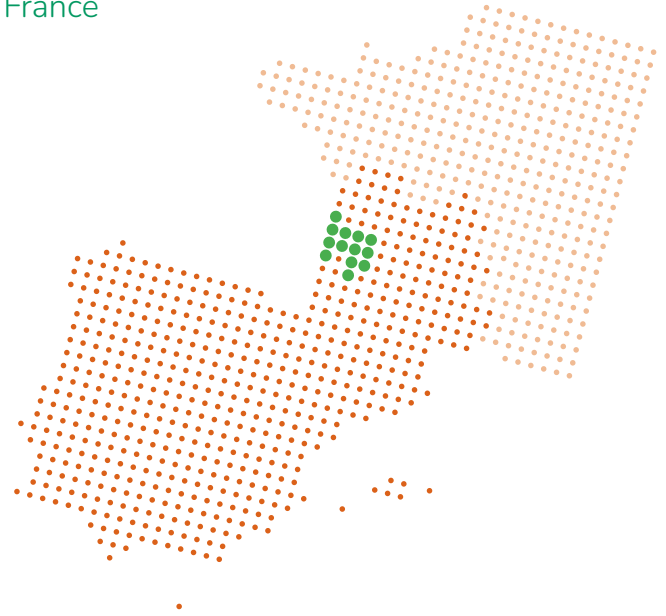
Advantages of using RECORES and RENOIR tools before refurbishment works.

Gironde Habitat is the Public Housing Office (OPH) of the Gironde department. Present in a third of the municipalities in Gironde, it currently manages 19,500 homes.

As a result of the presentations made during the local exchange groups, Gironde Habitat expressed its interest in the tools developed by the 3 French partners of the project, and proposed the realisation of a pilot operation on the ISABELLE residential building, in Le Bouscat, in order to experiment the RECORES tool for the qualitative analysis of a global rehabilitation project of a building and the RENOIR support approach for the cost-energy optimisation of the rehabilitation operation.

Based on the energy audit already carried out in 2020 and a site visit, the elements necessary for both tools were collected to carry out an analysis with a more ambitious NZEB objective.

RECORES provided profiles associated with each of the 3 scenarios considered for the 4 buildings of the residence. They highlight the positive aspects of the current situation (such as the «integration into the neighbourhood» aspect, for example) and the possible improvements. The approach made it possible to scan all the possible renovation works having an impact on each of the indicators. It thus offers the possibility of extending the analysis to additional issues. For example, in order to improve the «Governance of the project» aspect, it is possible to create a tenants' association, to carry out awareness-raising and information actions on consumption, or to consult the tenants during the presentation of the project.



The RENOIR tool for technical and economic optimisation allowed the identification of the best quantitative alternatives for this energy renovation project. From a panel of possible actions in rehabilitation, the digital tools calculated the best strategies in terms of cost and energy performance, taking into account the specificities of each building but also the preferences and possibilities of the client. The tool has been applied to the digital models of the building, bringing a further step in the development of the BIM methodology..

In the end, the scenario chosen by Gironde Habitat enables the BBC renovation objective of 72 kWh/m²/year (PROMOTELEC certified) to be achieved, including the creation of a collective domestic hot water heating system and heating by heat pump, the installation of photovoltaic panels, the ITE, the creation of a mechanical ventilation system, the replacement of landing doors, the creation of external lifts, etc.

A project management team will be consulted according to this scenario and the governance of the project must be defined with their local agency.

Florent BETH, Responsible for asset operations.



source : © Gironde Habitat



08 — The pilot projects



- GAIURB,EM - Vila Nova de Gaia, Portugal

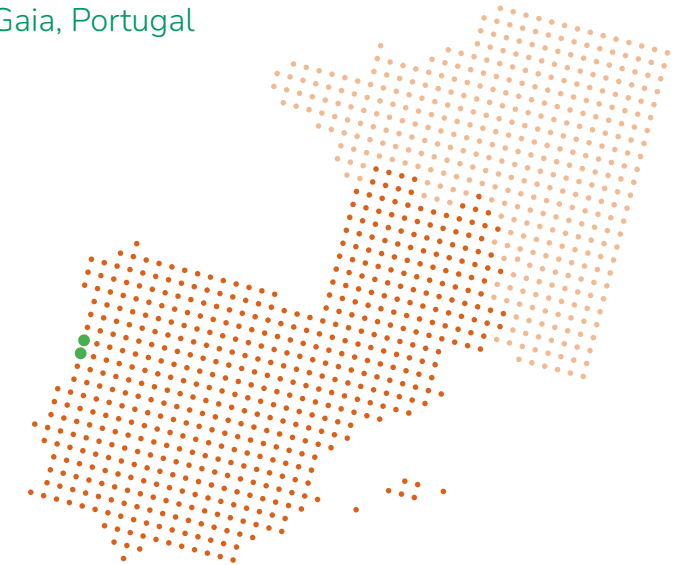
Interview with Architect Carla Pires, Head of Innovation and Sustainability in GAIURB EM

Under the framework of the Energy PUSH project, an IEQ (thermal comfort, air quality, visual comfort and acoustic comfort) and water and electricity consumption monitoring system is being installed in the Professor Carlos Alberto Mota Pinto social housing neighbourhood in Pedroso. This monitoring system will have an interface platform that will allow GAIURB to visualize in real time and alert residents of any relevant situation.

1. WHAT ARE THE MAIN ADVANTAGES THAT GAIURB SEES IN THIS PROJECT SYSTEM/PLATFORM ?

GAIURB predicts that the application of this system will create an opportunity for improving the energy and environmental performance of social housing buildings, enhancing the quality of life of its occupants. With this system it will be possible to know the real behaviour of each dwelling, collect data and information that help not only to detect energy inefficiencies, but also to improve the efficiency of buildings and their components to better adapt to the needs of the occupants and at the same time provide more sustainable environments at affordable costs.

On the other hand, as it is an interface platform that connects and interacts with the occupants of the spaces, it will make it possible to understand how the performance of buildings is related to human activity as well as how the occupants'



behaviour can influence that performance. Only in this way will occupants be able to relate to spaces, improving them and adapting them to their specificities and needs, no longer simply occupying a space in buildings, interacting directly with spaces and the environment.

2. HOW LIKELY IS IT THAT GAIURB WANTS TO INCLUDE THIS TYPE OF SYSTEM IN OTHER SOCIAL HOUSING PROJECTS ?

As is known, Gaiurb manages an extensive social housing stock. And in Professor Carlos Alberto Mota Pinto social housing neighbourhood, the execution of energy rehabilitation works are foreseen in the coming years.

With the results obtained with this project, we hope to find an opportunity to learn and improve the future design, construction and operation of social housing buildings, allowing the integration of knowledge related to the indoor Environmental Quality to optimize energy and environmental comfort, creating healthier and more suitable living spaces for their occupants.

Many of the buildings currently in existence are energy inefficient and contribute greatly to carbon emissions. According to the World Green Building Council, buildings that reduce or eliminate their negative impacts can positively contribute to improving the climate and environment, preserving resources and improving the quality of life for citizens. Therefore, it is in Gaiurb's greatest interest to incorporate some of the tools and methods developed in the SUDOE ENERGY PUSH project into the rehabilitation processes of Social Housing Projects.



source : © GAIURB



3. WHAT KIND OF INFORMATION DO YOU CONSIDER MOST IMPORTANT TO BE COLLECTED BY THESE SYSTEMS TO SUPPORT THE TECHNICAL OPTIONS IN THE REHABILITATION WORKS AND HELP WITH MAINTENANCE ACTIONS ?

The information on energy consumption is naturally one of the most important for the perspective it will give about the energy needs that residents have with the current conditions of the buildings (pre-rehabilitation). This information will also be relevant for the study of the technical solutions foreseen in the project and the effective evaluation of their effectiveness, i.e., if they will truly be the best solutions to apply.

However, all the other information existing inside the buildings is of particular importance, namely information on levels of natural and artificial lighting, ambient temperature and humidity or acoustic comfort are key factors to improve the health and well-being of the occupants. and provide an environment that is not only energy efficient, but also suitable in terms of environmental quality, sustainability and health.



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economy

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Agência para a Energia

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