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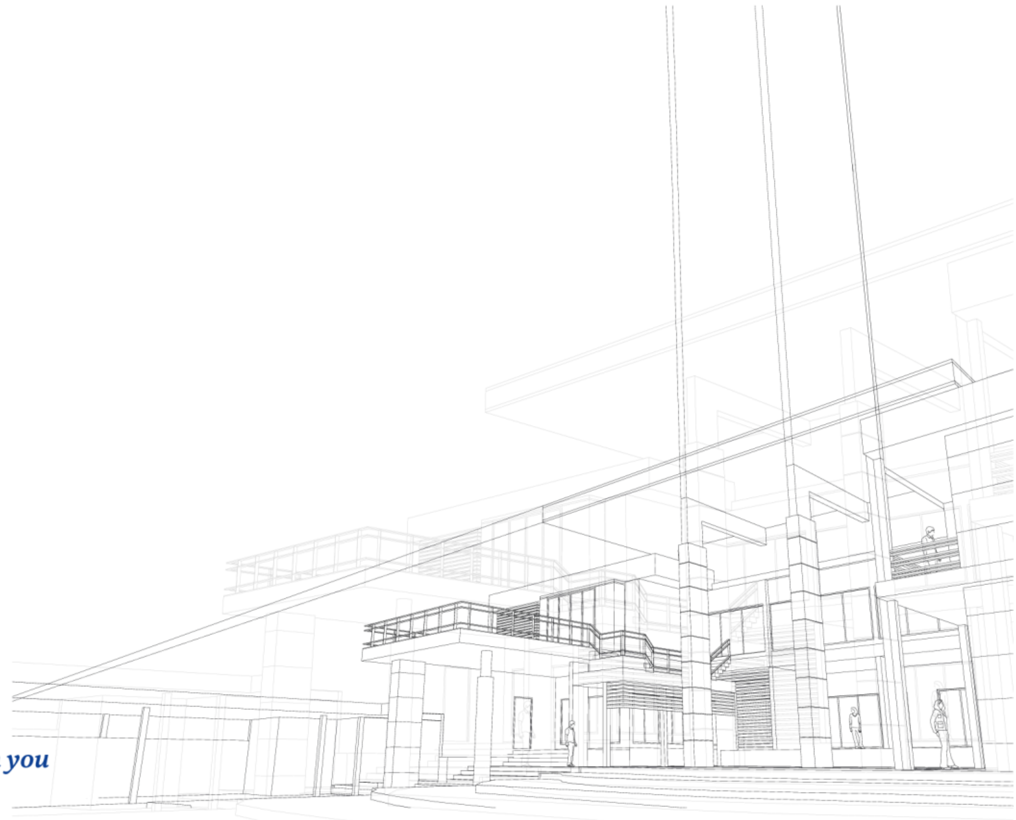

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WP3 - Product 3.1

Methodology for optimizing the technical-economic management of energy improvement processes in social housing through BIM

Interreg Sudoe

EUROPEAN UNION

Energy Push

European Regional Development Fund

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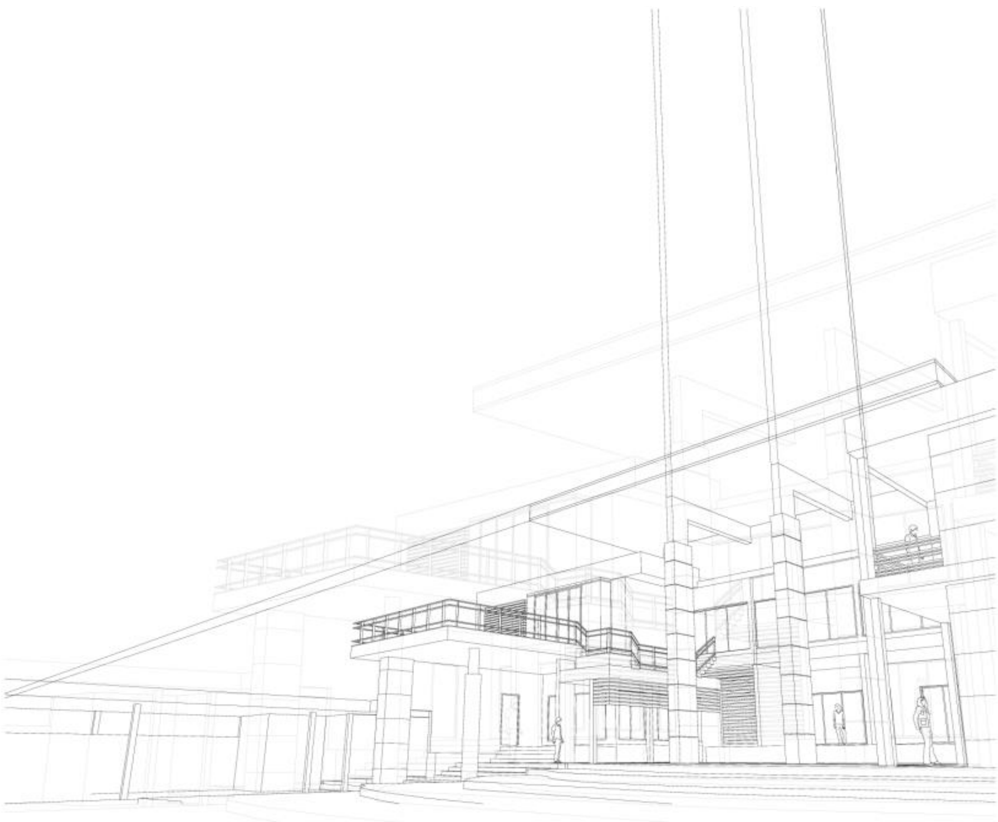


Introduction

The SUDOE ENERGY PUSH (Efficient eNERGY for PUblic Social HOUSING) project aims to implement an energy management model for Social Housing facilities located in the SUDOE territory, positioning itself as a reference in increasing energy efficiency and quality of lives of disadvantaged citizens. Based on the combination of passive renovation concepts, on the nZEB (Nearly Zero Energy Buildings) principle, and on the BIM methodology (that favours joint experimentation), adequate and targeted energy solutions will be proposed for Social Housing in the SUDOE space. In this way, ENERGY PUSH will thus achieve a double objective: on the one hand, to reduce energy consumption and to improve its thermal comfort.

The main product of this project is a decision-making methodology for technical-financial optimization through BIM, which will allow the connection of alternatives and renewal scenarios with databases to assess the profitability of these and achieve efficient buildings, as well as their subsequent monitoring. This methodology has been sketched out through three main steps, namely:

1. The **description** of the building
2. The **design** phase of the refurbishment
3. The **post-occupancy** evaluations phase

The details of each of these steps are recalled on Figure 1.

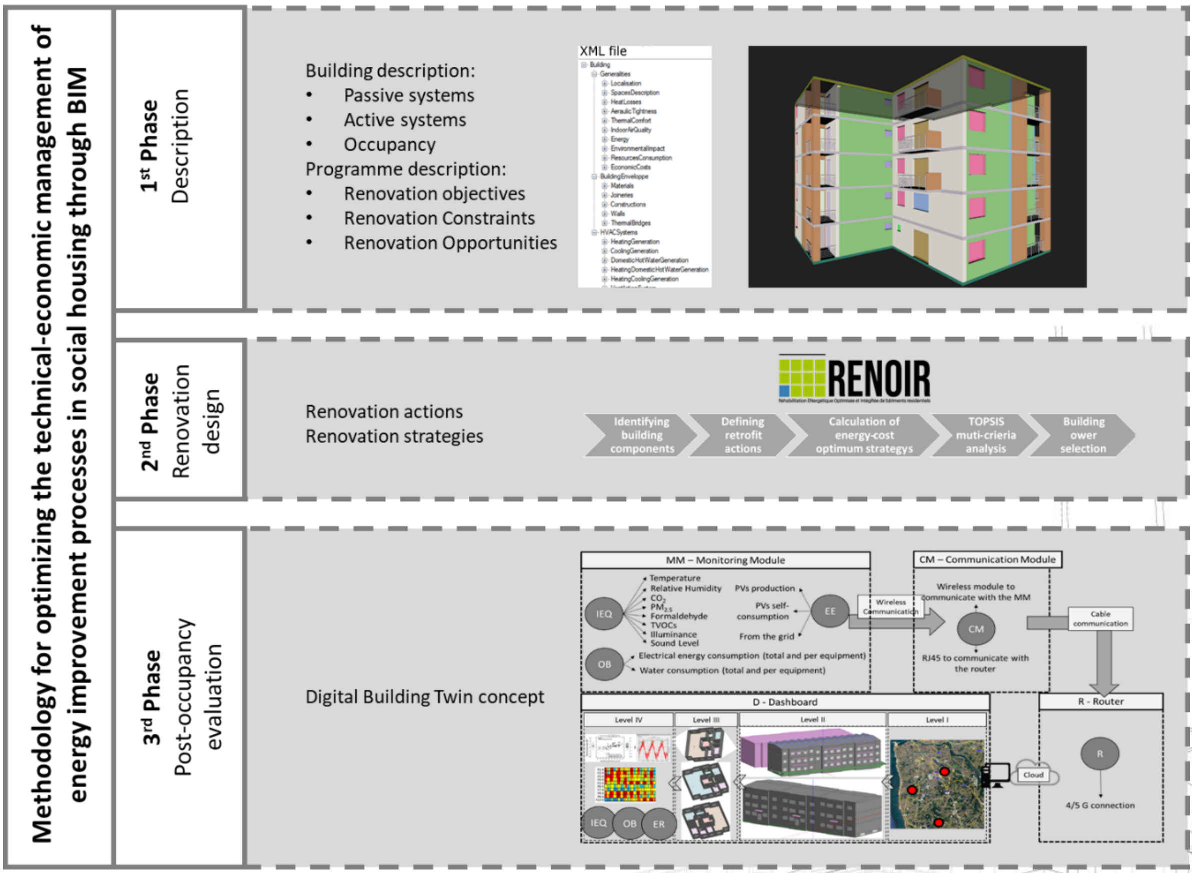


Figure 1 - Energy Push methodology workflow

Finally, phase 3 "post-occupancy evaluation" was completed with a feasibility study for a low-carbon energy manager position that could be shared between several social landlords.

1 Phase 1 and 2 of the methodology

A. Workflow

The “RENOIR” methodology objectives is 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. The Figure 2 illustrates the workflow.

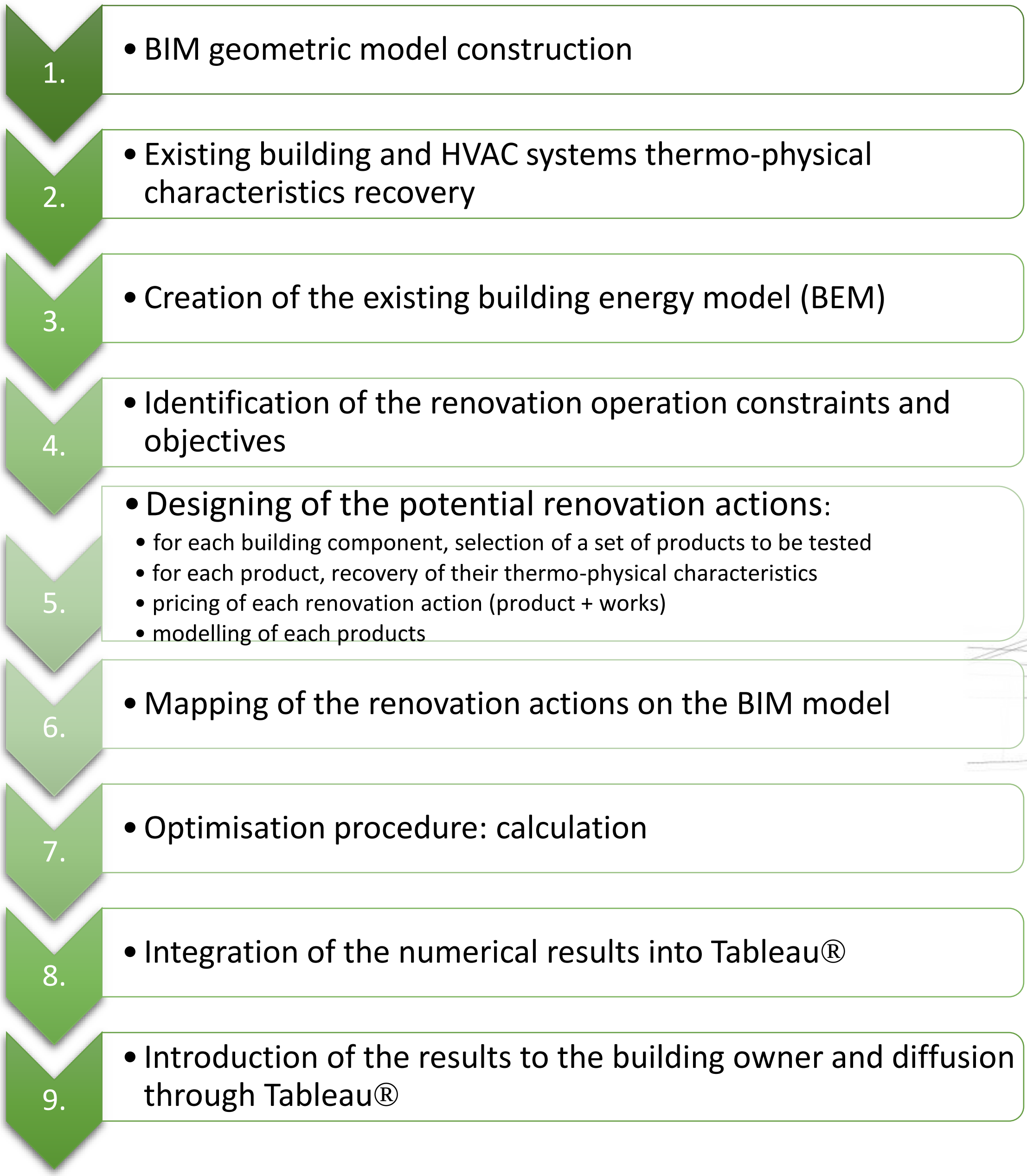


Figure 2 - RENOIR workflow - main steps

B. Getting the describing information of the existing building and the renovation project: a building data model (BDM)

One of the first reason of gathering technical information about the existing building is to be able to build and run thermal dynamic model. This model has to be fast enough to coincide with a refurbishment operation planning, but also accurate enough to supply useable information regarding energy needs and consumptions – for heating, cooling, domestic hot water - heat losses and gains, and comfort temperature exceedances. These physical quantities should be obtained at least daily or even hourly for a typical meteorological year, and will help the calculation of energy and thermal comfort indicators proposed in the next sections.

The other reason of retrieving information regarding the existing building is to validate for every component that they still meet the initial requirements of the construction. Furthermore, other kind of information could be recovered to have a more and more detailed picture of the building, considering for instance economic aspects (via for instance the maintenance cost of the existing systems or the removal cost) or the environmental consideration.

To that aim, the information to be recovered, the potential source of data, and the requirement level respectively for the building walls and openings, the building HVAC systems and the general information has to be clarified. A methodology is thus proposed in this document to achieve these goals, and the product of this methodology will be called in what follow the **Building Data Model (BDM)**. The description of this BDM is the object of the three next subsections.

In other words, the proposition here is to develop a new building data description formalism that will be used by the social housing building owners of the SUDOE zone. This standardized data model has several objectives:

- To gather all the useful data to describe a social housing building,
- To homogenize the data to be recovered,
- To make the existing building description easier,
- To make the existing building assessment regarding various criteria intelligible.

The data to be recovered concerns the building envelope, the Heating, Ventilation and Air Conditioning (HVAC) systems, and general information about the building such as localization, using of building rooms, building heat losses and air tightness, energy needs and consumptions. All of these have been detailed in WP1. Synthesis about the **BDM.**

All the descriptive data are not necessarily required. The required or optional state of data has to be determined according to the objectives of the **BDM.**

Some of the data recovered can be used to calculate (or set) some other data of the **BDM**. For instance, if all the thermal conductivity and thicknesses of the layer of a wall are given, the thermal resistance of the wall can be calculated. If the thermal conductivities are not supplied, the thermal resistance has to be set by another method. The use of a construction standards and/or material database combined with the description of material nature may be a solution. In this case too, a function (or a "module") uses as input data the information from the **BDM** to calculate values to be stored into the **BDM**. Some more sophisticated examples can be given. Generally speaking, the **BDM** is at the same time the input and the output file of some "module" to be defined. Some module can be developed for instance:

- to calculate statistic data from the **BDM** and to write the results into the **BDM**,
- to help the data entry (from the building audit for instance) through a user interface,
- to instantiate and modify the structure of the **BDM** (possibly from an .ifc BIM model).

The final objective of the **BDM** – in the framework of Energy Push – is to define the key aspects of the refurbishment strategy. To that aim, getting information regarding the existing state is not sufficient. The constraints, the objectives and the opportunities of the renovation project has to be considered to build the set of renovation actions. These aspects can be seen as input data or parameters of the module gravitating around the **BDM**. The key data to be recovered regarding the renovation projects are gathered in Table 1.

Using both the descriptive information from the current **BDM**, it could be possible to supply useful input data to a set of expert rules. Among all the possible renovation actions, such rules will remove the not applicable ones for this operation.

The organization of what could be the finalized BDM is shown on Figure 3

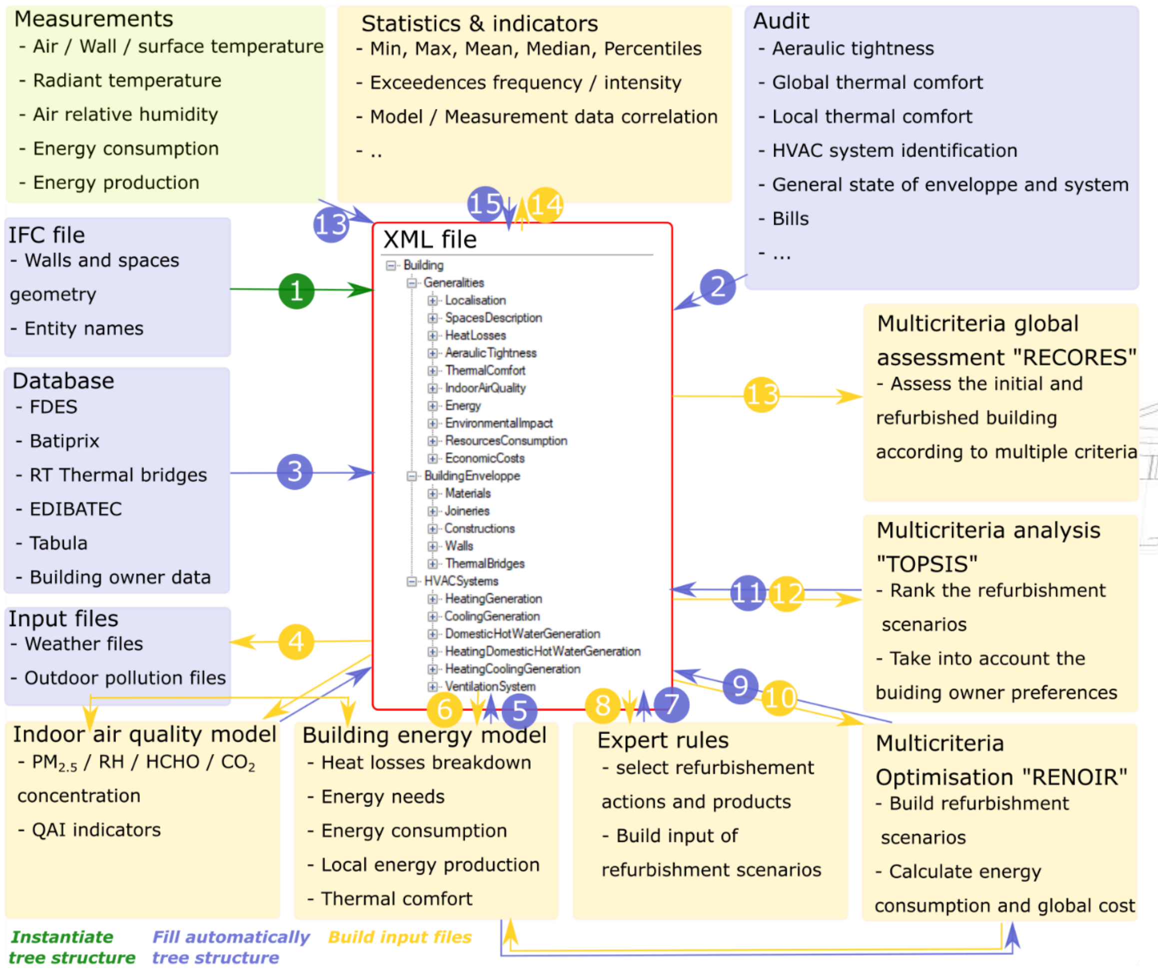


Figure 3 - Structure and workflow of the Building Data Model and its module

Table 1 - Extrinsic factors influencing the refurbishment actions selection

1. Constraints

1.a. Constraints linked to the refurbishment operation specificities

Budget
Works on an occupied site
Work period

1.b. Constraints linked to the building envelope specifications

Urban rules: no modification allowed of the roof / façade appearance
No available roof / façade surface
No available land near to the building
Shadings or masks from neighboring building, relief or vegetation
Size of the housings
Limited possibilities of drilling the outdoor walls

1.c. Constraints linked to the building envelope specifications

No available passage for ducts/pipes
No available / not enough space in common technical rooms
No available / not enough space in flat technical rooms
Building wall not accessible

2. Opportunities

2.a. Opportunities linked to the refurbishment operation specificities

High energy consumption for heating / cooling / DHW
High energy needs for DHW
Poor winter / summer thermal comfort
Poor indoor air quality for some rooms / flats / commons spaces

2.b. Opportunities linked to the building envelope specifications

High energy needs for heating / cooling / lighting
Poor air/ water tightness of windows / doors / outdoor walls
Poor aesthetical aspect of windows / doors / outdoor walls / indoor walls
Non-compliant windows / doors / outdoor walls / indoor walls with the fire standard
Poor structural function / crack of the outdoor walls / indoor walls
Poor thermal properties of windows / doors / outdoor walls
Poor functionality of the shutters / blinds
Urban rules: modifications allowed of the roof / façade appearance
No shading / masks from neighboring building, relief or vegetation
Size of the housings
Possibilities of drilling the outdoor walls

2.c. Opportunities linked to the building HVAC systems specifications

Cf Tables with descriptions of existing systems for heating only, existing systems for domestic hot water generation only, existing systems for heating & DHW, for the cooling only and for the heating and cooling, and existing systems for ventilation only, for heating and ventilation and for heating, cooling and ventilation and previously introduced xml file

3. Objectives

Improve the aesthetical aspect of the building
Reduce the building energy needs
Reduce the building energy consumption
Reach certification or label requirements
Reduce the environmental footprint
Improve the thermal comfort of the occupants

Improve the HVAC systems-occupant interactions
Carry out routine maintenance operation
Reduce the rental costs
Make the maintenance operation easier
Design a reproducible refurbishment strategy
Design a custom-made refurbishment strategy

C. Techno-economic optimization tool for social housing energy refurbishment projects

The second step of the Energy Push methodology aims at designing the best refurbishment strategies; a strategy being a set of renovation action on building components. The main questions are: how to determine the best strategies, i.e., which building component(s) should be renovated? At what price? What energy savings can be expected?

The traditionally used methodology relies on simulating the energy savings achieved by renovating arbitrarily chosen building components by means of simulation software. The related cost is also estimated (usually from database or quotations). The building owner can then simply select a strategy among a few proposals, usually two or three. The range of strategy is therefore narrow. Hence the designer cannot ensure that the chosen solution is optimal one.

The current proposed methodology consists in identifying which building components should be renovated and providing the best technical solutions by optimizing energy savings and life-cycle costs using metaheuristic genetic algorithms. To do so, the suite of tools RENOIR is implemented. RENOIR stands for optimized and integrated energy rehabilitation of residential buildings ("Réhabilitation énergétique optimisée et intégrée des bâtiments résidentiels" in French). It has been first developed by La Rochelle University, CNRS, CSTB and TIPEE. Given a set of possible retrofit actions for each building component, this tool calculates the energy-cost optimum strategy. A multi-criteria analysis tool called TOPSIS enables to make the final choice among the large range of possible strategies, and takes into account the building owner preferences for the selection. The whole methodology is illustrated on Figure 4.

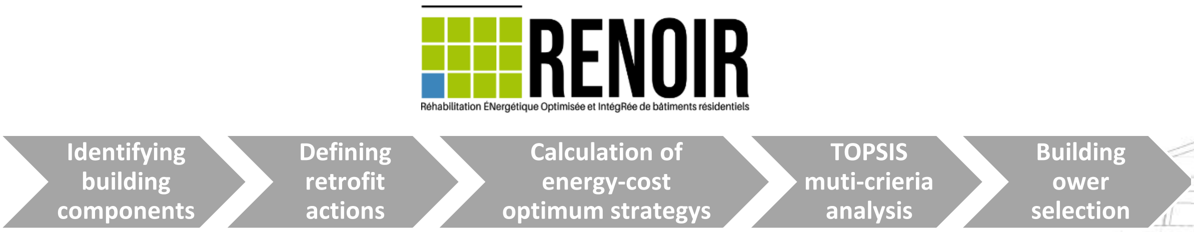


Figure 4 – RENOIR methodology

In this chapter, the definition of refurbishment strategies is explained. Then, RENOIR and its genetic algorithm are presented by describing the calculation of indicators and the main steps: definition of refurbishment Finally, a multi-criteria analysis tool called TOPSIS is detailed.

a. *Refurbishment strategies*

Table 2 gathers the technical solution than can be studied in case of a building retrofit. The first step of the RENOIR methodology is thus to select, among all the technical solutions, the one that they consider appropriate for the building. This has to be made jointly with the building owner. Indeed, some of them can be excluded according to different types of constraints. For example, not reducing the total surface can be a constraint. In this case, internal insulation of the walls could not be planned, so these solutions should be discarded. Technical solutions involve changes in the characteristics of the building envelopes and/or HVAC systems and especially their physical quantities as listed in Table 2. The information contained in the **BDM** are updated for each strategy.

Table 2 - Examples of building component renovation for building retrofit

Building part	Component	Example of renovation	Impact on characteristics
Building envelope	Joinery	Replacement	Thermal insulation, airtightness, control of solar gains
	Walls	ETI, ITI, ETI+ITI	Thermal insulation, airtightness, aesthetics (if ETI)
	Ceiling	Insulation	Thermal insulation, airtightness
	Unheated basement	Insulation	Thermal insulation, airtightness
	Floor slab	Insulation	Thermal insulation, airtightness
	Roof	Replacement of covering, insulation	Thermal insulation, airtightness, aesthetics (if ETI)
	Stair case	Insulation	Thermal insulation, airtightness
HVAC systems	Heating system	Change of energy source	Energy efficiency of building systems, renewable energy source
	Cooling system	Installation	Comfort
	Domestic Hot Water production	Change of energy source	Energy efficiency of building systems, renewable energy source
	Ventilation system	Replacement	Energy efficiency of building systems
	Electric generation	Replacement	Energy efficiency of building systems, dynamic energy control

ETI : External Thermal Insulation, ITI, Internal Thermal Insulation

The different technical solutions enable the construction of a large number of strategies by mixing them together. For instance, we can imagine a case for which there are 2 solutions for joineries, 6 solutions for the walls (for each orientation), 2 for the roof, 2 for the floor slab, 3 for the heating system and 2 for the ventilation system. We obtain 1 152 strategies (2x6x4x2x2x3x2) and this considering only one set of specifications for each action. But it could also be considered several alternatives for each actions. For instance, two insulating products, each one with three thicknesses, could be undertaken for ETI, while three heating systems could be considered simultaneously. The number of strategies is thus multiplied by 18 (2x3x3). It thus becomes more and more difficult to assess all the strategies in terms of energy savings and life-cycle cost. The optimization algorithm NSGA-II implemented in RENOIR makes it possible to get closer to the optimal strategy regarding both criteria, without assessing every possible combinations.

b. *Multi-criteria optimization tool*

Once the refurbishment strategies have been defined, the optimization algorithm can be launched. It required the definition of objective functions or “indicators”. Two indicators are considered in the framework of the Energy Push methodology. Their calculation has been already detailed in the WP1.

The optimization algorithm yields a set of optimal strategies called “Pareto front”. This is illustrated on Figure 5. Each point on this graph is a strategy, i.e. a combination of several renovation actions. The left blue border of the cloud of points is the Pareto front. Each solution of this border is a non-dominated strategy, which means that there is no other solution better at the same time on the energy and cost criteria.

Since there is not only one but several optimal strategy, it is necessary to make a choice among all these possibilities. It is therefore relevant to use multicriteria analysis methods such as TOPSIS.

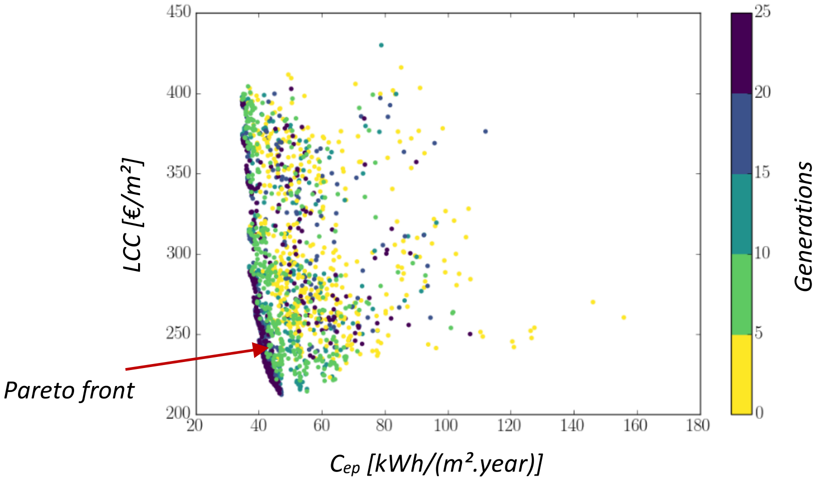


Figure 5 – Pareto front

c. *Multi-criteria analysis tools - TOPSIS*

The multi-criteria analysis is a field of study whose aim is to compare alternatives in order to provide assistance in choosing, sorting or classifying the results.

A multi-criteria analysis based on TOPSIS algorithm was chosen for being implemented in the Energy Push methodology. It allows the sorting of the strategies according to a set of criteria. The criteria for the analysis can be the same than the ones for the multi-objective optimization (energy consumption and cost) but can also be completed by other criteria such as the carbon footprint, the thermal comfort, the ease of works. The user of the tool can rank these indicators according to his preferences (from the most important for making a decision to the least important). The TOPSIS algorithm then returns a ranking of the strategies according to these criteria and their weighing.

d. *RECORES: qualitative analysis of a comprehensive building rehabilitation project*

- Objective: to provide assistance to the owner to define a global renovation strategy for a building
- A 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
- A renovation affects a multitude of aspects, so needs a multi-criteria consideration.
- An analysis method that is increasingly used today as it allows to :
  - Identify all the impacts linked to a choice; evaluate counter-performances and/or related benefits;
  - Not to neglect certain aspects considered important but not decisive; to ask the right questions and evaluate certain compromises;
  - Facilitate the comparison of scenarios with similar performance on the criteria considered most important for a decision-maker, using other criteria to separate them.

i. RECORES tools

- REhabilitation COhérente des REsidences Sociales

- First created in 2010 for the National Agency for Urban Renovation (ANRU) and upgraded in 2020 in the framework of EnergyPush.
- The purpose is to look at the evolution of a building before/after recommendations (and not to compare buildings with each other).
- The tool is to be used upstream of a renovation project, as a diagnostic and decision-making tool.
- It is an Excel spreadsheet composed of 206 questions on the quality of use and technical quality of the building. These questions are organized under 14 topics, distinguishing 38 indicators

ii. The 14 topics

Thèmes de l'analyse	Indicateurs	Questions
I. QUALITE DES ACCES & CHEMINEMENTS	1	1 à 11
II. QUALITE D'USAGE DES LOGEMENTS	2, 3, 4, 5, 6	12 à 34
III. ENERGIE & GES	7, 8, 9, 10, 11, 12, 13	35 à 56
IV. VENTILATION ET RENOUVELLEMENT D'AIR	14, 15	57 à 62
V. GESTION DE L'EAU	16, 17, 18, 19	63 à 76
VI. CONFORT ACOUSTIQUE	20, 21, 22	77 à 94
VII. QUALITE DE L'AIR INTERIEUR	23	95 à 100
VIII. SECURITE ET RISQUES	24	101 à 121
IX. PERENNITE DE L'OUVRAGE	25	122 à 127
X. TRAITEMENT DES ESPACES COLLECTIFS	26, 27, 28, 29	128 à 159
XI. IMAGE DU BÂTI	30, 31, 32	160 à 170
XII. INSERTION DANS LE QUARTIER	33, 34, 35	171 à 185
XIII. ACCESSIBILITE PMR & ADAPTATION AU VIEILLISSEMENT	36	186 à 197
XIV. GOUVERNANCE DU PROJET	37, 38	198 à 206

iii. 38 indicators

1	Qualité des accès	Topic I
2	Qualité d'usage des logements	Topic II
3	Taux d'occupation	
4	Confort d'été	
5	Equipement électrique	
6	Evolutivité des logements	
7	Consommation d'énergie	Topic III
8	Emission de Gaz à effet de serre	
9	Système technique énergétique	
10	Inertie, déphasage thermique du bâtiment	
11	Déperditions thermiques	
12	Energies renouvelables	
13	Usages électriques	
14	Renouvellement d'air	Topic IV
15	Ventilation	
16	Qualité de l'eau	Topic V
17	Consommation d'eau	
18	Eaux de pluie	
19	Réseau eaux usées	
20	Bruits intérieurs	Topic VI
21	Bruits extérieurs	
22	Bruits collectifs	
23	Qualité Sanitaire	Topic VII
24	Sécurité & Risques	Topic VIII
25	Pérennité de l'ouvrage	Topic IX
26	Gestion des déchets	Topic X
27	Parties communes	
28	Ascenseurs	
29	Espaces verts & conviviaux	
30	Etat, aspect des façades	Topic XI
31	Evolution du bâti	
32	Cohérence urbaine	
33	Attractivité du bâtiment	Topic XII
34	Proximité commerces, services	
35	Cheminements piétons, vélos et accès aux TC	
36	Accessibilité & Adaptation	Topic XIII
37	Lien social locataires - bailleur social	Topic XIV
38	Pratiques participatives	

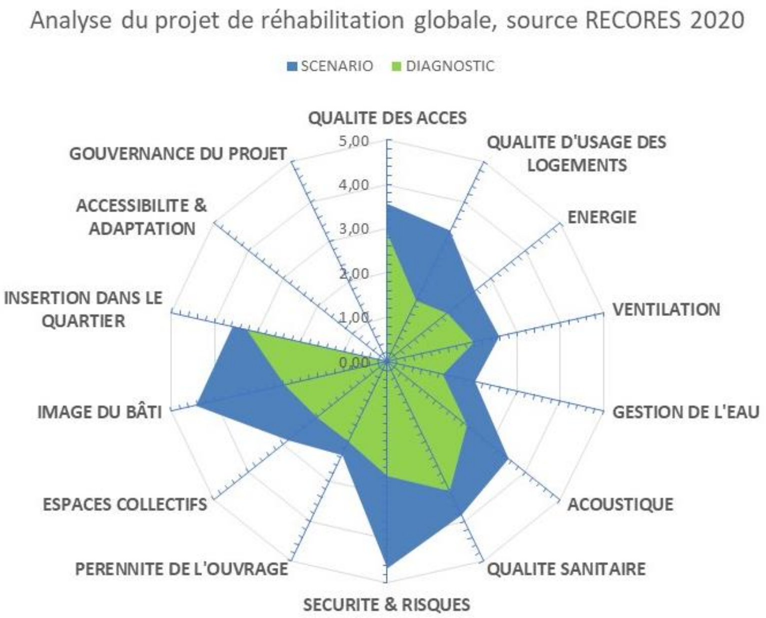
iv. 206 questions

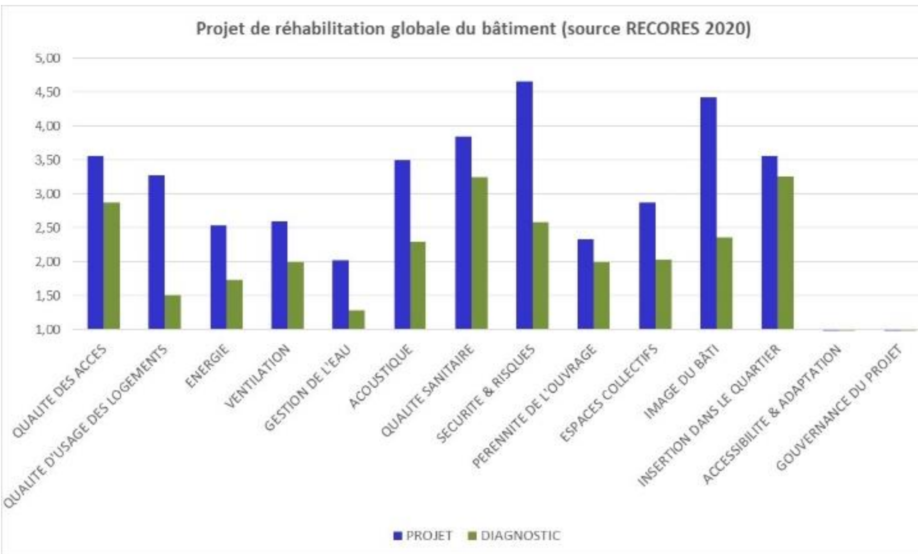
- Answers either:
  - Qualitative (mostly): score from 1 to 5, with a written justification. An instruction manual explains how to score in the most pragmatic way possible.
  - Binary: yes / no
  - Quantitative
  -
- Aggregation rules then allow the answers to be summarized, by indicator and then by topic.

Evaluation du bâtiment dans sa situation initiale

⇩

Préconisations / recommandations qui vont faire évoluer les indicateurs





- Exemple : Topic Energy and GhG : 7 indicators, 22 questions

	III. ENERGIE		Unité de mesure
7,1	Consommation d'énergie pour le chauffage, ECS, refroidissement		Etiquette ENERGIE
7,2	Consommation d'énergie pour le chauffage		kWhef/m² shab
7,3	Consommation d'énergie pour l'eau chaude sanitaire		kWhef/m² shab
7,4	Part des ménages en précarité énergétique		1 à 5
8	Emission de gaz à effet de serre pour le chauffage, l'eau chaude sanitaire et le rafraîchissement en kg eq. CO_2 / m² Shab		Etiquette CLIMAT
9,1	Système de chauffage	Efficacité, vétusté, pollution, contrat de maintenance	1 à 5
9,2	Fourniture d'eau chaude sanitaire	ECS : efficacité, vétusté	1 à 5
9,3	Distribution, émission de chaleur	Calorifugeage des canalisations de chauffage et ECS	1 à 5
9,4	Gestion de l'énergie	Gestion du système de chauffage, chaufferie, logements	1 à 5
10,1	Matériaux	Inertie thermique du bâtiment	1 à 5
10,2		Déphasage thermique (choix des isolants)	1 à 5
11	Déperditions thermiques	Murs donnant sur l'extérieur ou sur des locaux non chauffés	1 à 5
		Planchers bas du bâtiment sur cave, terre-plain ou locaux non chauffés	1 à 5
		Toiture (toiture terrasse ou combles)	1 à 5
		Menuiseries extérieures, parois vitrées et portes d'accès	1 à 5
		Isolation des cages d'escalier	1 à 5
		Portes palières des logements	1 à 5
12	Energies renouvelables (EnR)	% EnR dans la consommation de chauffage et ECS	%
		Production photovoltaïque	kWhef/m² shab
13	Electricité parties communes et domestique	Consommation d'électricité des parties communes (kWh/m² Shab)	1 à 5
		Bornes électriques pour le rechargement des véhicules (2roues et voitures	oui/non
		Electricité dans les logements (efficacité des équipements électriques)	1 à 5

v. *Advantages and disadvantages*

☺ Easy to use

☺ A tool for dialogue and consultation with the project management team, enabling the identification of possible margins for improvement

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

☹ The same person must fill in the table (initial state / after works)

☹ Several skills are required: thermal engineering office and architect at least

☹ No economic dimension for the moment

2 BIM-base monitoring and energy management of SUDOE social housing buildings

A. Introduction

The third part of the methodology applies to the operation phase and aims to specify the management and monitoring process that allows interpreting the results of energy renovation actions and relating them to the variables that define the levels of indoor environmental quality (IEQ) and energy efficiency.

This activity will involve the completion and adaptation of the methodology applied in the typical buildings of the SUDOE space to integrate the entire process of renovation of a building throughout its life cycle.

The growing development of Digital Building Twins (DBT) is an opportunity for deepening the control and management of energy efficiency and IEQ. In this project the Digital Building Twin concept will be applied and the sensors will create and continually update the virtual replica of the real building. The data collected will be transformed and mined to predict future building states. This way, housing stock managers will have the capacity to anticipate maintenance operations, assess the energy performance gap between the design values and the operation values, control and inform the occupants about the IEQ and program future refurbishments supported by long term monitoring of the built environment and energy consumptions.

B. Management system architecture

a. *Components*

The monitoring system architecture was divided in four main parts:

- Monitoring system hardware: IEQ module; PV and grid electrical electricity module; and occupants consumptions module (water and electrical energy),
- Communication between monitoring modules, the middle access points, the router and the cloud,
- Data warehouse and the cloud,
- Dashboard.

DBT will demand the deployment of a large number of sensors and low-cost solutions are the only way to achieve that. In this project, low-cost Arduino-compatible sensors were tested considering the indoor environment of Southern European countries. The results show that IEQ low-cost sensors showed good accordance with reference instruments.

The system final architecture are presented in Figure 6 and presents the proposed Building Digital Twin Concept.

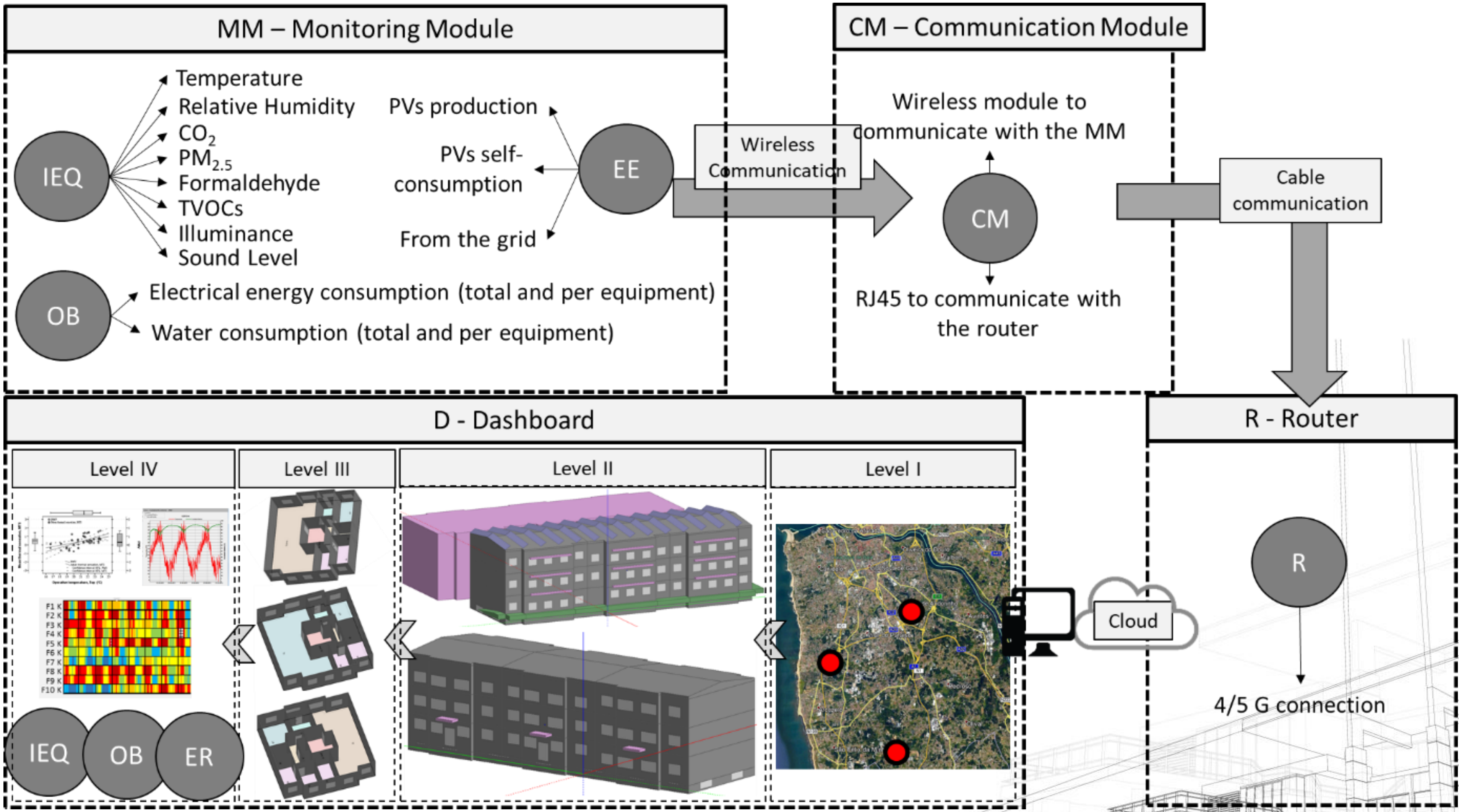


Figure 6 – Monitoring system architecture (Digital Building Twin Concept).

b. *Features*

The SUDOE Energy Push – Application of the Digital Building Twin Concept will have the following main features:

- Level I – maps where the monitored buildings can be displayed,
- Level II – inclusion of an application programming interface (API) to visualise each building BIM model;
- Level III – possibility to change the views of the BIM models and edit the monitoring systems placement;
- Level IV – have some indexes resuming the main data of the indoor built environment. At this level, machine-learning techniques will be used in order to discover knowledge from the databases. The Digital Building Twin Concept should will have predictive capabilities in order to anticipate the knowledge of future events. An app will be developed to be used in the occupants smart phones with some of the outputs of the Level IV and some warning and advices related to the monitored parameters and its thresholds.

Figure 7 presents the intended predictive features of the Digital Building Twin that will be performed in the Level IV presented in Figure 6.

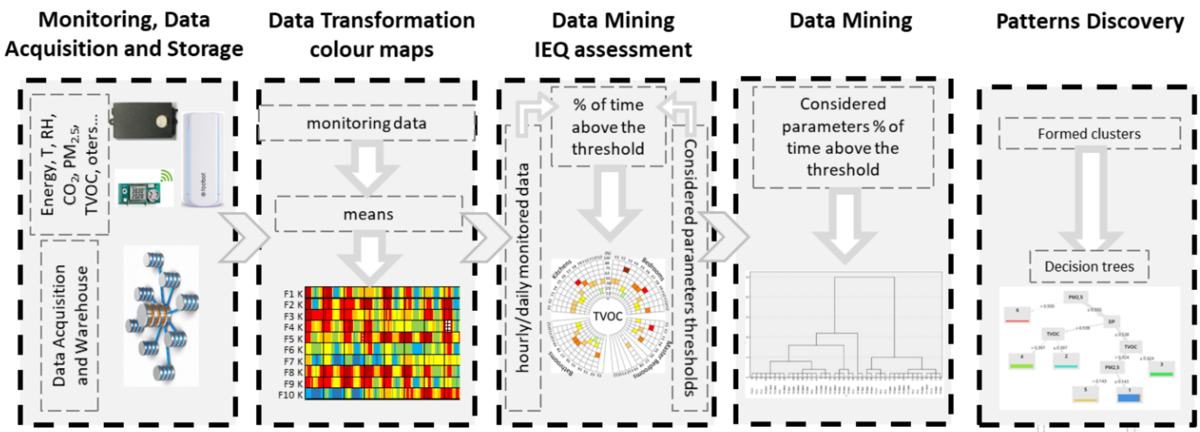


Figure 7 –Digital Building Twin main features.

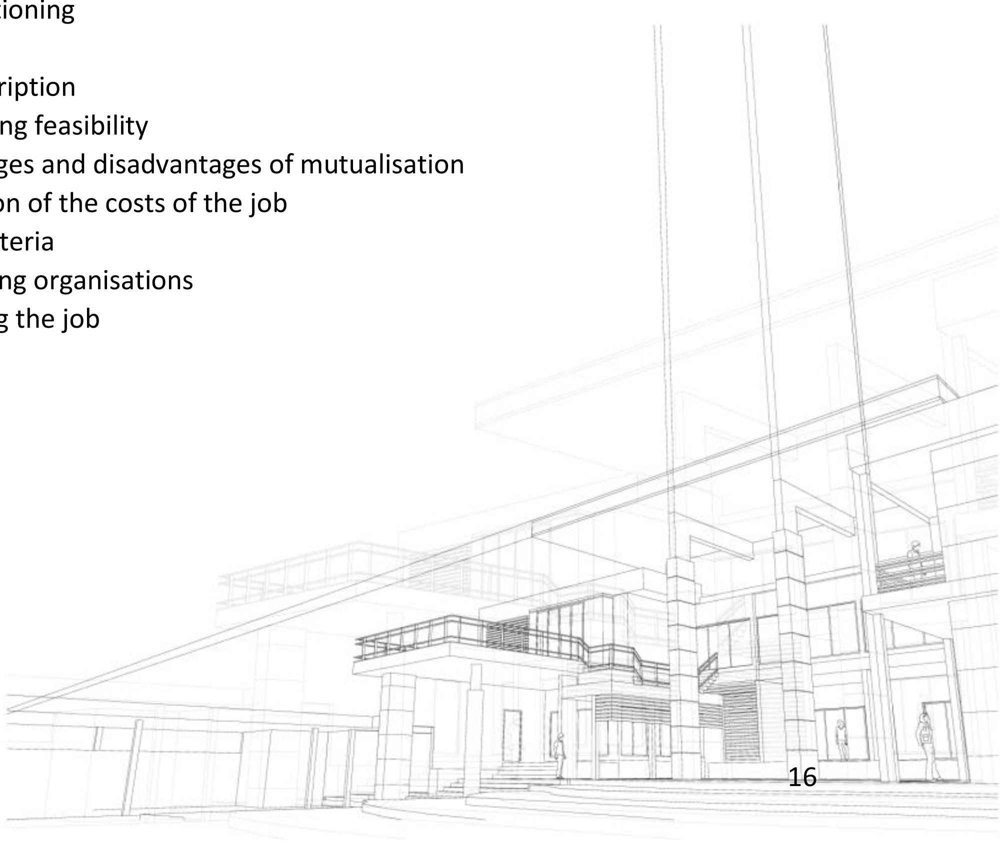
3 Feasibility study on shared low carbon energy manager

A. Context

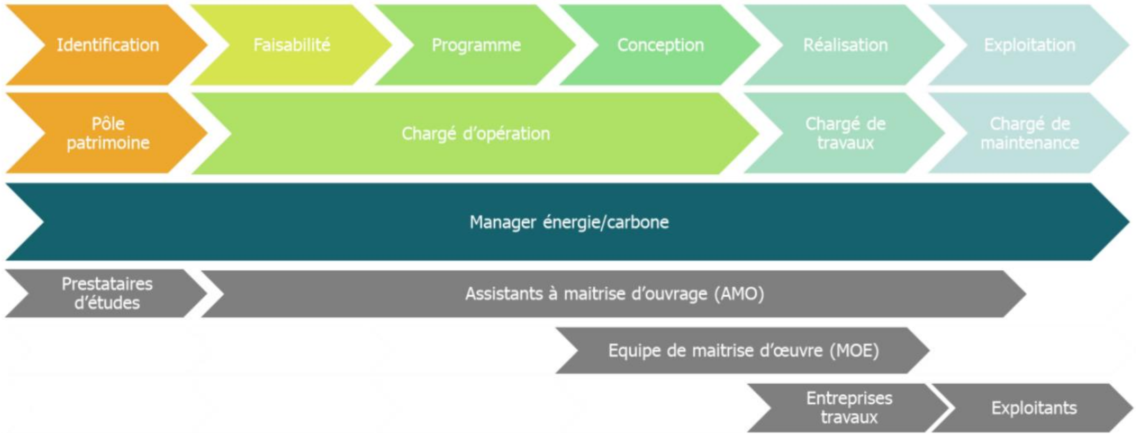
- Study on the viability of an operational solution for step 3 of the methodology, Refurbishment: operation phase.
- Solution already discussed during a workshop for social housing in the frame of the public concertation aimed to build the Regional Program for Energy Efficiency.
- Expressed from a survey and discussions organised in the framework of the local exchange groups organised in the framework of the energy push project.
- The study was subcontracted by Alec and supervised by a steering committee composed of The Nouvelle-Aquitaine Region and the Regional Union of social housing organisations.

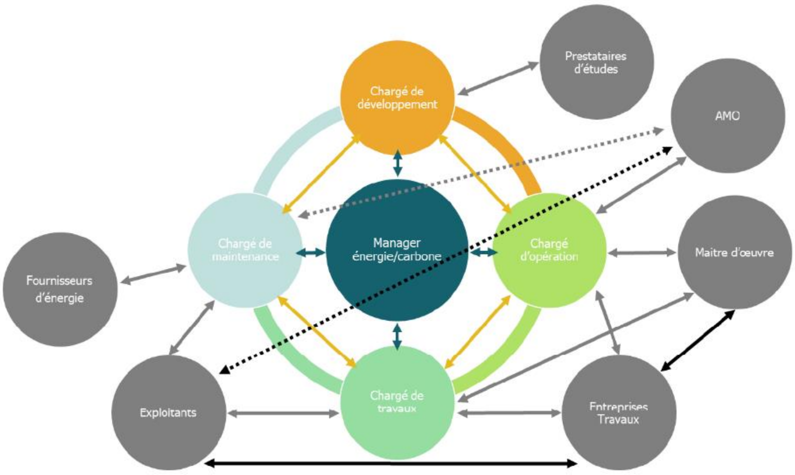
B. Assignment

- The aim of the assignment is to define the scope of this "energy efficient and low-carbon renovation manager" position, to assess the feasibility of its mutualization and to determine whether there is a sufficient need among social housing organizations in New Aquitaine to justify its creation.
- The deliverables of the mission are the following:
  - Job description and positioning diagram;
  - Existing adapted training courses and/or ad hoc training proposals;
  - Opportunity note
- Methodology :
  - Phase 1 - Establishing a shared diagnosis,
  - Phase 2 - Co-constructing the solution,
    - Services to provide
    - Job positioning
    - Missions
    - Job description
  - Phase 3 - Assessing feasibility
    - Advantages and disadvantages of mutualisation
    - Evaluation of the costs of the job
    - Sizing criteria
    - Supporting organisations
    - Financing the job



The " low-carbon and efficinet energy renovation manager" intervenes transversally on the operations, in support of the social landlords' teams.





The energy/carbon manager is not in direct contact with the external parties (AMO, MOE, etc.). It is the operational positions of the social housing organisations that retain control of the operation and provide the interface with the external parties.

The idea is not to "add another link in the chain" but rather to strengthen the existing organisation and improve the flow of information.

→ Role of facilitator

The position of "energy efficiency and low carbon renovation" manager is conceived in a logic of "doing with" or "doing" rather than simply "doing".

→ Role of facilitator

The manager is also the expert on energy and carbon issues.

→ Role of technical expert

C. Analysis

- This feasibility study identified the real difficulties that social housing organizations encounter in energy renovation projects. Through the National Low Carbon Strategy, France has adopted an ambitious roadmap for the ecological transition over the next few decades. This roadmap will have a very important impact on the assets of social housing companies, as it will oblige them to renovate their housing stock quickly and efficiently.

- The arrival of the 2012 Thermal Regulations has changed construction practices in terms of energy performance in new buildings. On the other hand, the thermal regulations for existing buildings have changed very little and the technical requirements are still very low. The future 2020 Environmental Regulation, preceded by the E+C- experiment, has introduced the consideration of the carbon footprint of projects. In fact, social housing companies are facing a major technical challenge, which consists of carrying out massive renovation in an efficient manner while integrating the carbon issue, while practices have changed very little in recent years.
- Social housing companies are therefore obliged to rapidly change their habits and organisation in a very constrained financial context. The main challenge is therefore to support them in this change. This is where the position of "Energy Performance and Low Carbon Renovation Manager" comes into its own. This position has been designed to support the existing organisation of social housing companies so as not to disrupt their habits and organisation. It will support the existing functions and strengthen the links between them while ensuring overall consistency in terms of the landlords' property strategy and renovation operations.
- This opportunity study highlighted the fact that in order to guarantee the achievement and maintenance of energy performance over time, it is imperative to have a global and coherent approach based on
    - A coherent strategy;
    - Quality operations;
    - Efficient operation;
    - Involved users.
- The role of the "energy efficient and low carbon renovation" manager is to help social housing organisations integrating this global approach and implementing concrete actions. He/she is the guarantor that no aspect is neglected in favour of another.
- The concrete implementation of this position of "Energy Performance and Low Carbon Renovation Manager" can take many forms because the reality of each social landlord 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 landlords some latitude to compose the precise content of the position themselves. This study should, in particular, open up discussions between the social landlords of New Aquitaine to explore the respective motivations of each structure and possibly define a common desire to pool skills.
- The pooling 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 merit of proposing a concrete solution that only needs to be tried out by willing social landlords. 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.