

A METHOD FOR THE RETROFITTING OF PRE-1914 WALLOON DWELLINGS WITH HERITAGE VALUE

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CONTEXT

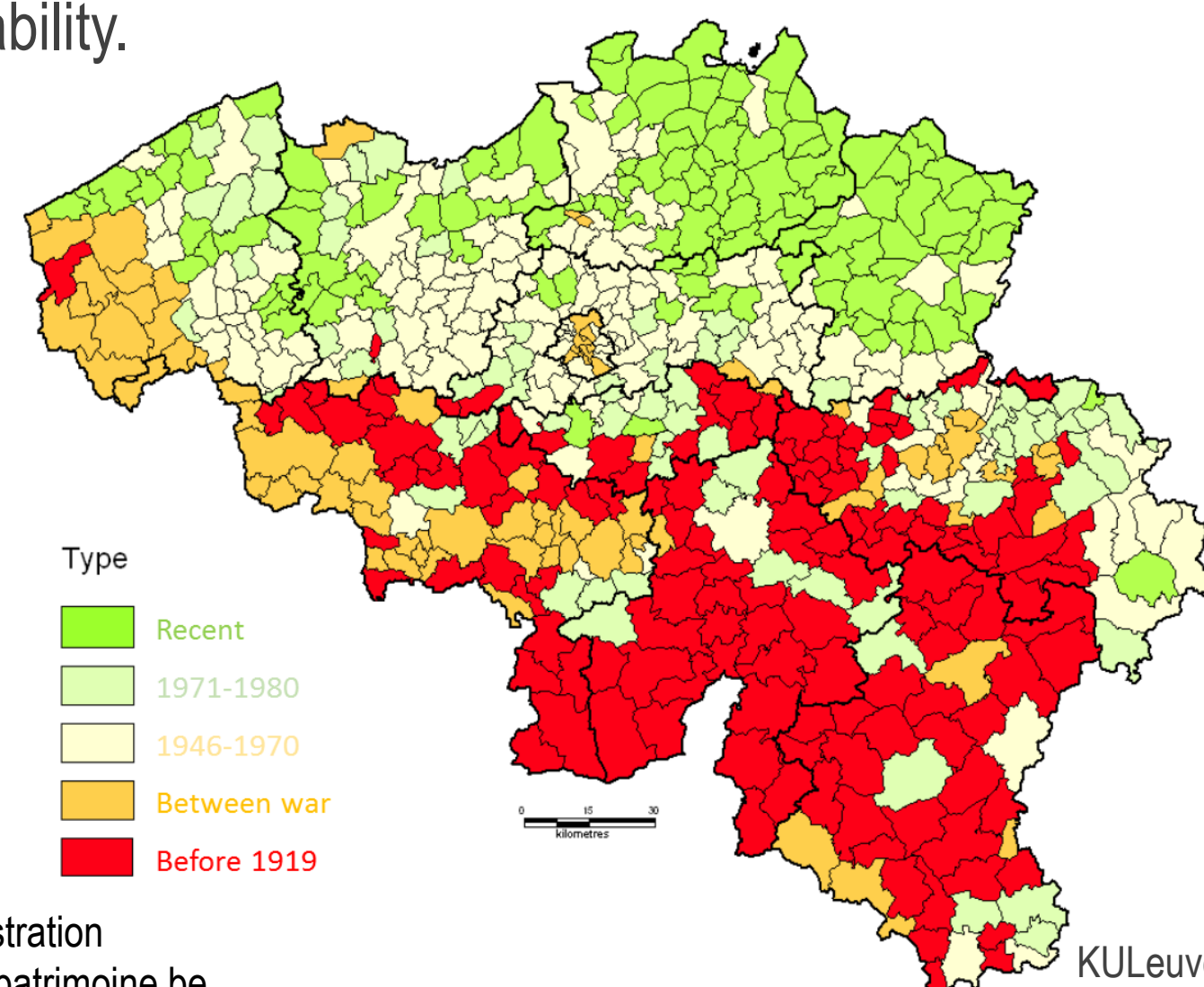


P-RENEWAL

Rénovation énergétique du bâti wallon d'avant-guerre (1914)
à valeur patrimoniale.

The research project "P-RENEWAL" is integrated within the framework of the Walloon Energy and IEA project Call. It aims to develop a **methodological tool for retrofitting historical Walloon dwellings built before 1914** in order to enhance the heritage value and combine it with a suitable energy and environmental performance. Indeed, approximately 25 % of the Walloon stock was built during this period [1] and gives Wallonia its identity as well as its architectural and historical legacy.

The originality of this research consists in considering energy, environmental and heritage aspects in a complementary way, in order to help designers to achieve a greater sustainability.



[1] Listed heritage administration
<https://agencewallonnedupatrimoine.be>

KULeuven-UCL (2001)

OBJECTIVES

Facing and answering the sustainable development issues

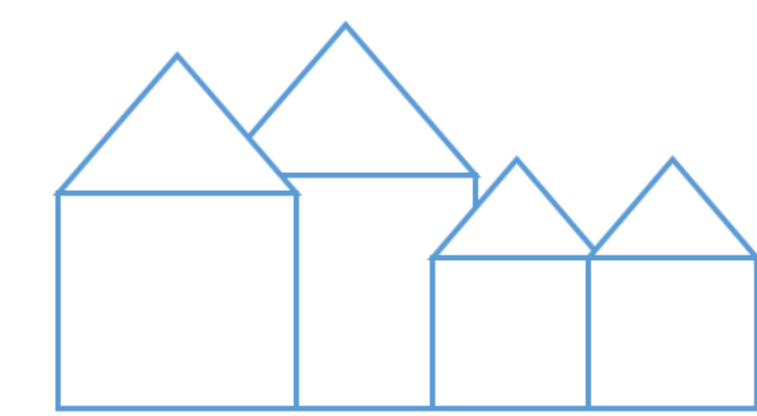
Old dwellings retrofitting must take into account:

- Rational use of resources (energy and other) ;
- Water and waste management ;
- Health and well-being of occupants.

Facing and answering energy performances

Energy retrofit of old dwellings:

- Must take into account heritage value of buildings ;
- Eliminate all the risks of degradation for the building itself.



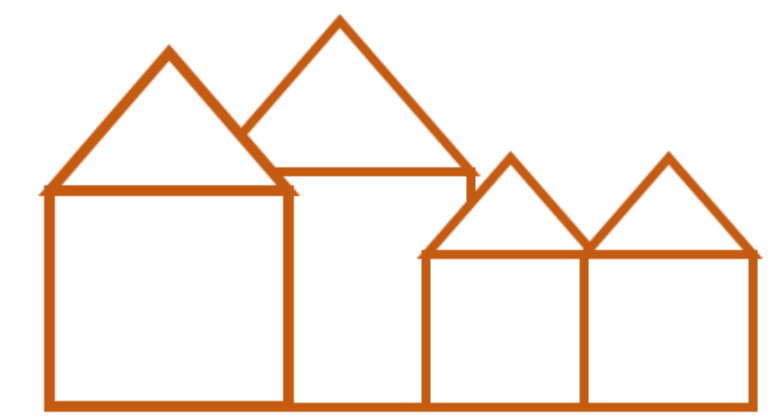
Walloon dwellings
listed or with patrimonial character
built before 1914

Witnesses of our past
Added value for our cities
Cultural attractiveness

> 25 % of the Walloon dwelling stock

Retrofitting

Sustain and pass on old
dwellings to future
generations
Make it comfortable and
"livable" with regard to
needs of today's and of
tomorrow



Old dwellings with heritage value = Building specificities

- Specific thermal behaviour ;
- Strong thermal inertia ;
- Specific building materials and assemblies (elements).

The understanding of the thermal behavior of materials and building is often incomplete and/or it is difficult to transpose in terms of hygrothermal model.

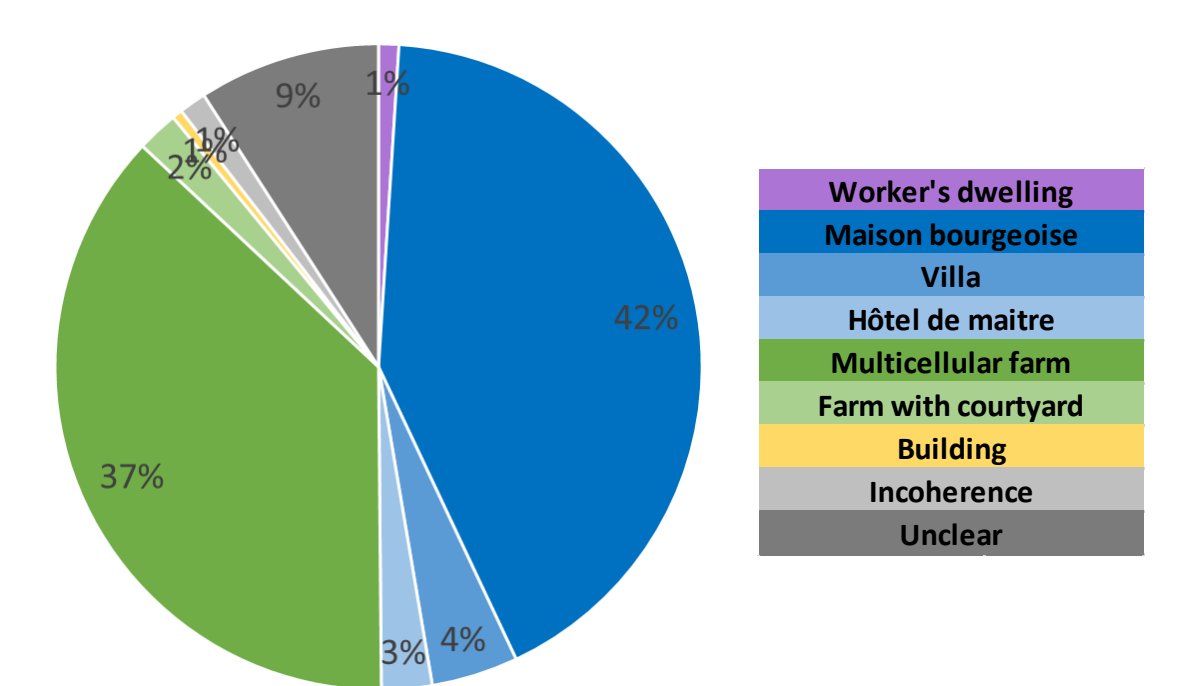
METHOD & RESULTS

1 Typological analysis

The **main types of pre-war dwellings in Wallonia** were defined.



The **statistical distribution** of the main dwellings subtypes was determined using the "Regional 2016 property register".

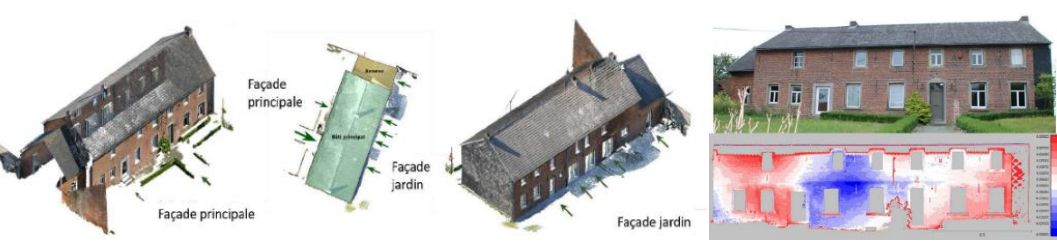


Forageur	Number of dwellings	0 < m² ≤ 50	50 < m² ≤ 100	100 < m² ≤ 150	150 < m² ≤ 200	200 < m² ≤ 250	250 < m² ≤ 300	300 < m² ≤ 350	350 < m² ≤ 400	400 < m² ≤ 450	450 < m² ≤ 500	500 < m² ≤ 550	550 < m² ≤ 600	600 < m² ≤ 650	650 < m² ≤ 700	700 < m² ≤ 750	750 < m² ≤ 800	800 < m² ≤ 850	850 < m² ≤ 900	900 < m² ≤ 950	950 < m² ≤ 1000	> 1000 m²
2 forageurs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3 forageurs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4 forageurs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

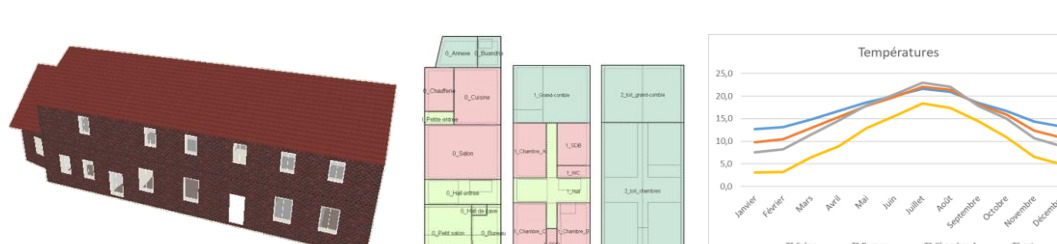
Representative occupied buildings were selected as "case studies" based on the main dwelling types.

2 Selection and investigation of case studies

A **technical analysis** of case studies was carried out (deep analysis and monitoring).



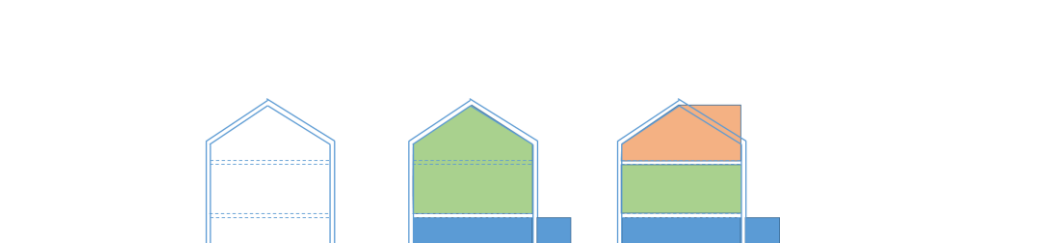
For each case study, **dynamic energy models** were developed with DesignBuilder software and calibrated based on the results of the monitoring phase.



Heritage specificities were identified to elaborate appropriate retrofitting strategies.

Specificities	Uniqueness of the building or of a constructive technique	Authenticity	Integrity	Representativeness
Archaeological				
Architectural				
Artistic				
Aesthetic				
Historic				
Landmark memory				
Scientific				
Social				
Technical				
Urbanistic				

Furthermore, a discussion of the **livability potential** was made to suggest alternative options.



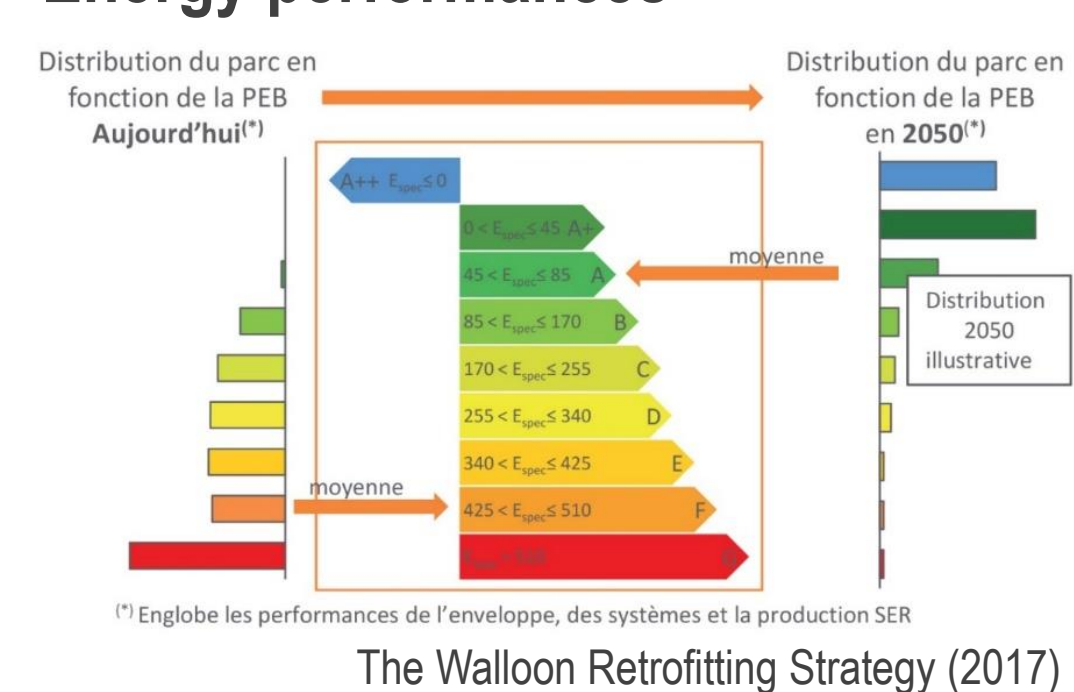
3 Discussion of retrofitting objectives

For each case study, theoretical retrofitting objectives were discussed to improve :

Comfort

According to the criteria of the Walloon Housing Code, strengths and weaknesses related to comfort objectives were identified for each case study.

Energy performances



The potential to achieve the level "PEB-A" of the Walloon Retrofitting Strategy was evaluated (primary energy consumption between 45 and 85 kWh/m².year). This goal is optimistic for old buildings with heritage value.

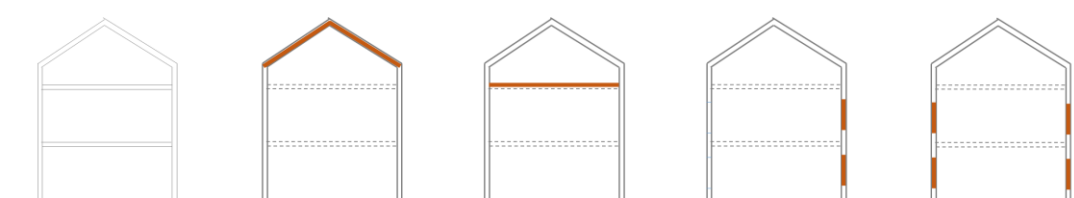
Environment



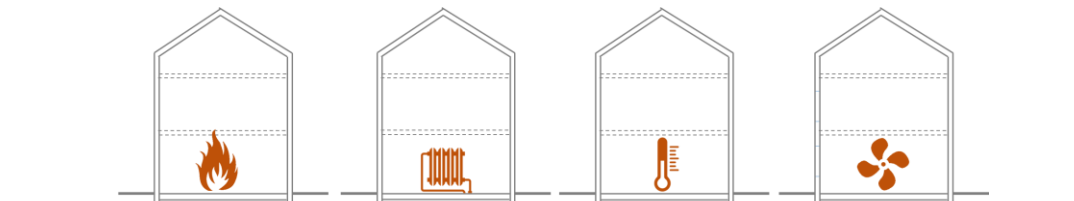
4 Listing of retrofitting measures

An inventory of all possible retrofitting measures on the envelope and the technical systems was developed. The most relevant for each case study were compiled and described.

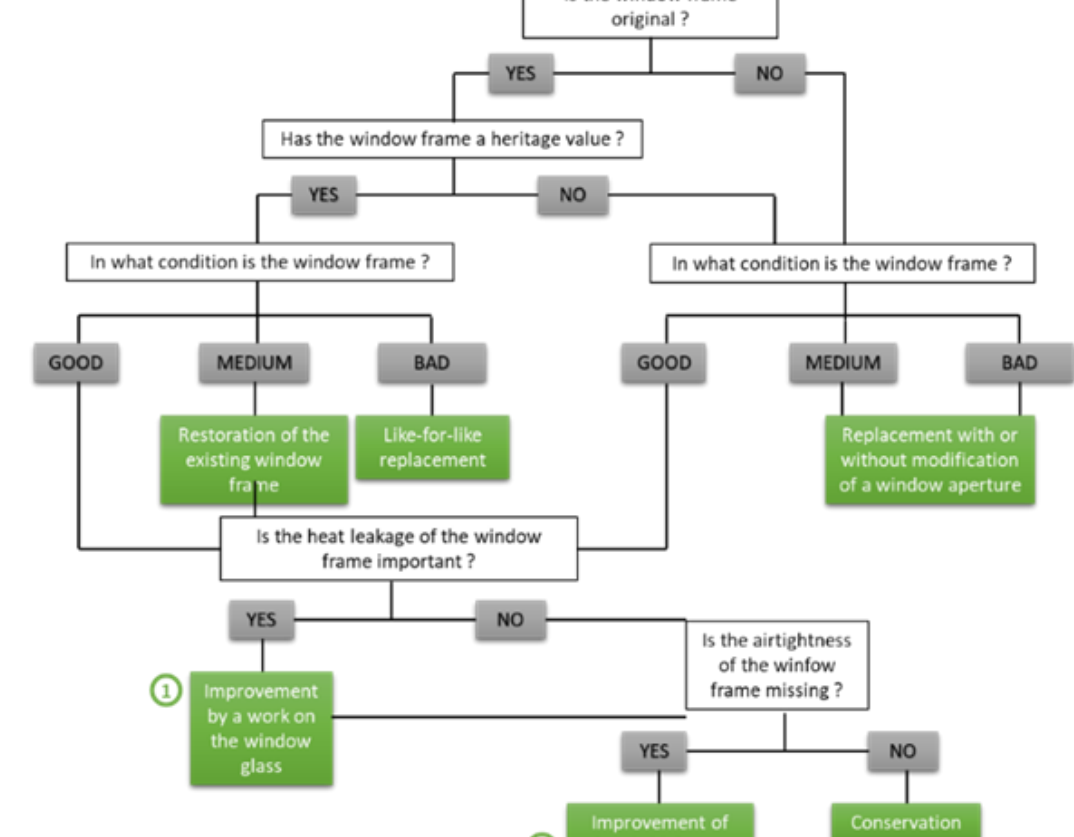
Envelope energy retrofitting measures



Technical system retrofitting measures



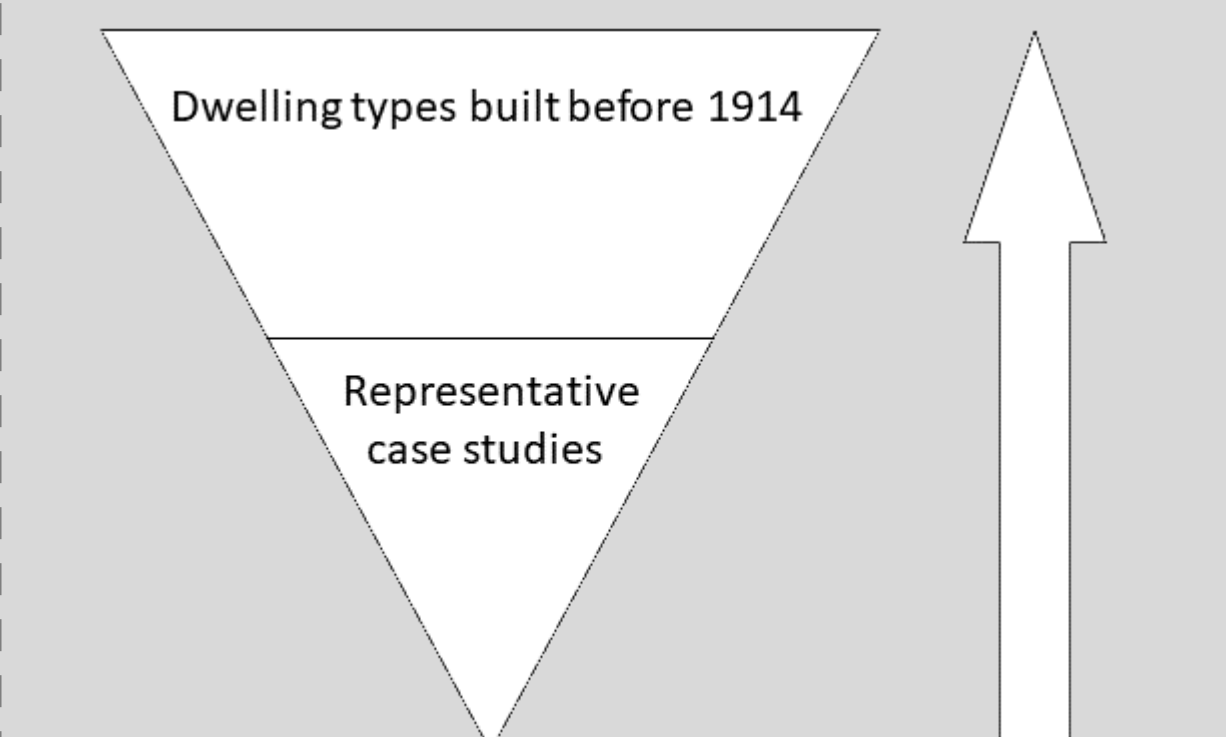
Decision tree



FURTHER WORK

5 Evaluation of retrofitting strategies

Following a **'bottom-up' approach**, various retrofitting strategies were elaborated for each case study by combining retrofitting measures (on the envelope and on the technical system).



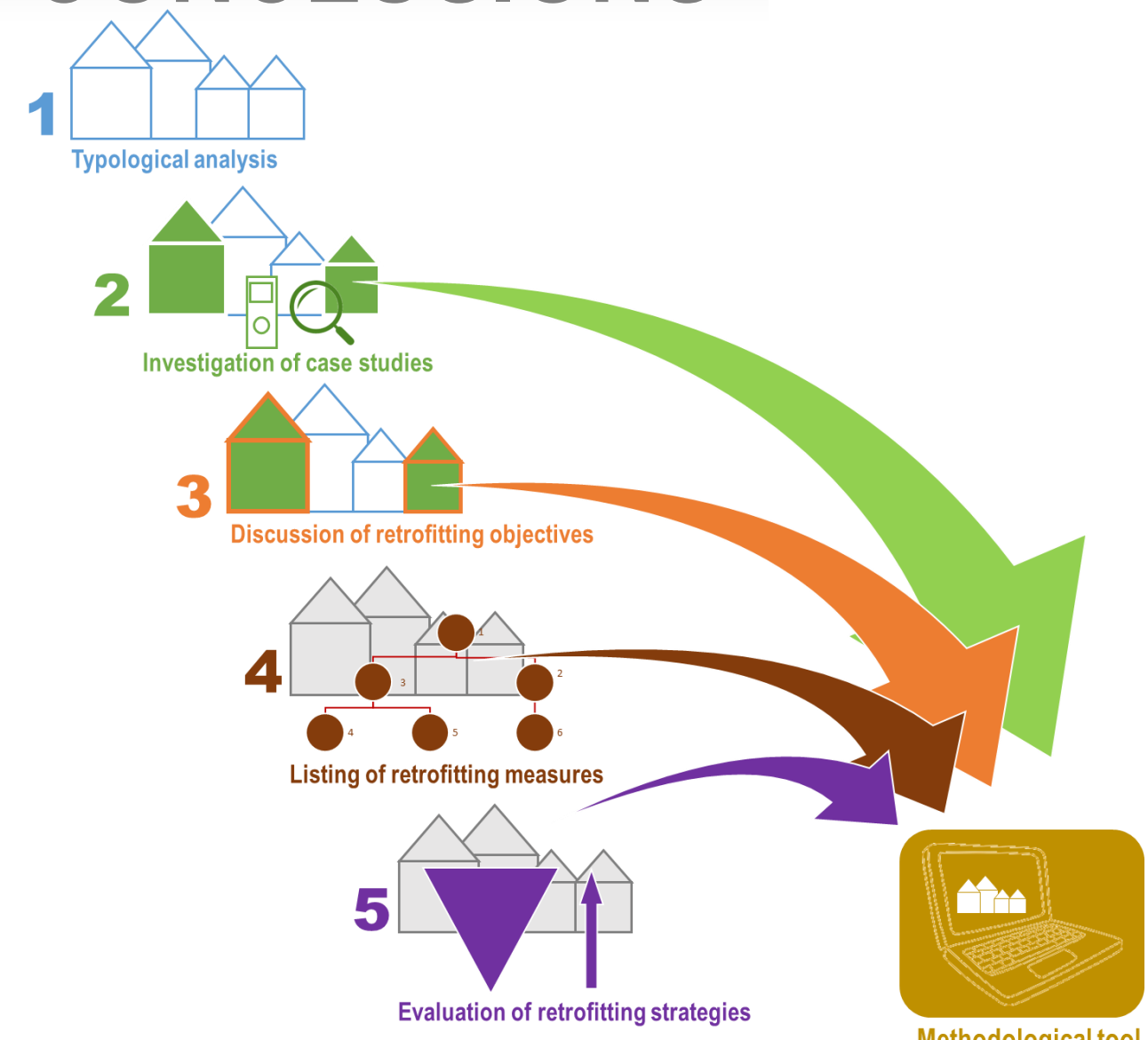
The relevant strategies will be evaluated according to several criteria:



For all aspects related to energy and comfort, the **dynamic energy models** will be used.

In a last step, and for each strategy, identification of **benefits and losses** will be weighed through the proposed multi-criteria analysis.

CONCLUSIONS



The 'P-Renewal' project has been set up to **develop a methodological tool** to support the energy retrofitting of old Walloon dwellings. This methodology highlights the need to thoroughly investigate each old building and to share a lot of informations. This would allow users to assess the benefits obtained by retrofitting strategies in terms of energy, comfort and environmental performances.

This approach could serve as an **example** and provide significant complements to current European standards. Given the substantial efforts to be made in pre-retrofitting studies, the authors point to the current lack of support offered by energy administrations to help owners and practitioners.

ACKNOWLEDGEMENT

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