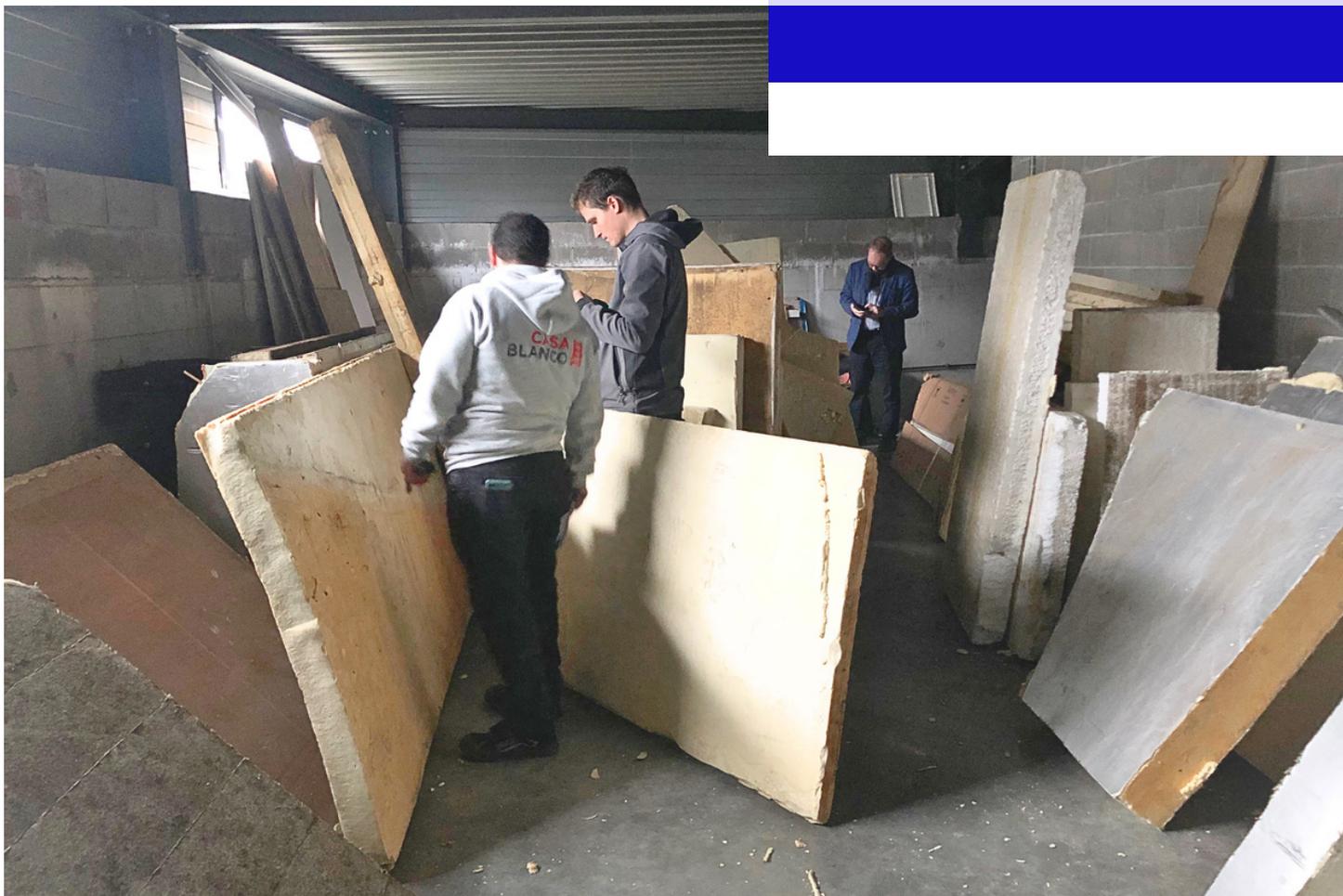


# RENOVATION REPORT

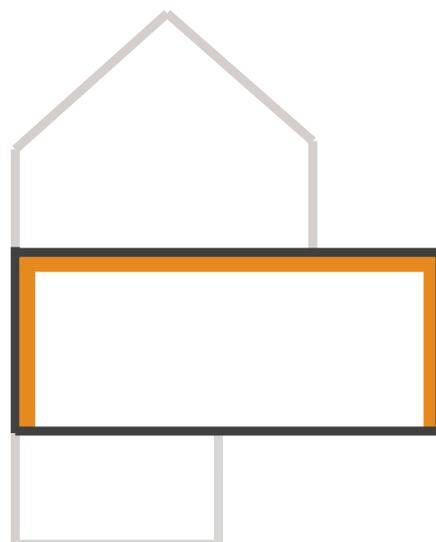
The renovation reports are grounded in the findings of the pilot projects conducted as part of the ISOL'ution project. They synthesise practical lessons learned and identify key considerations for the reuse of insulation materials in various building typologies and material types.



## EXISTING SITUATION

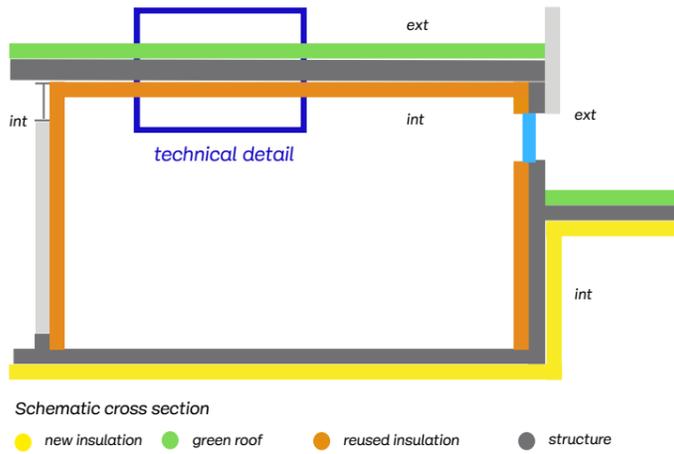
A storage space is converted into a communal room for a residential complex. The room is located above a commercial space, under an existing green roof.

Location of intervention	communal room
Affected floors	1
Housing units	20
Year of construction/major renovation	2019
Type of construction	Industrial construction using metal structures
Component to be insulated	roof and walls
Surface area of the envelope	200 M2
Points to consider	complexity of insulating corrugated steel roofing combined with a green roof



Section schématique de la typologie

## TECHNICAL DECISION

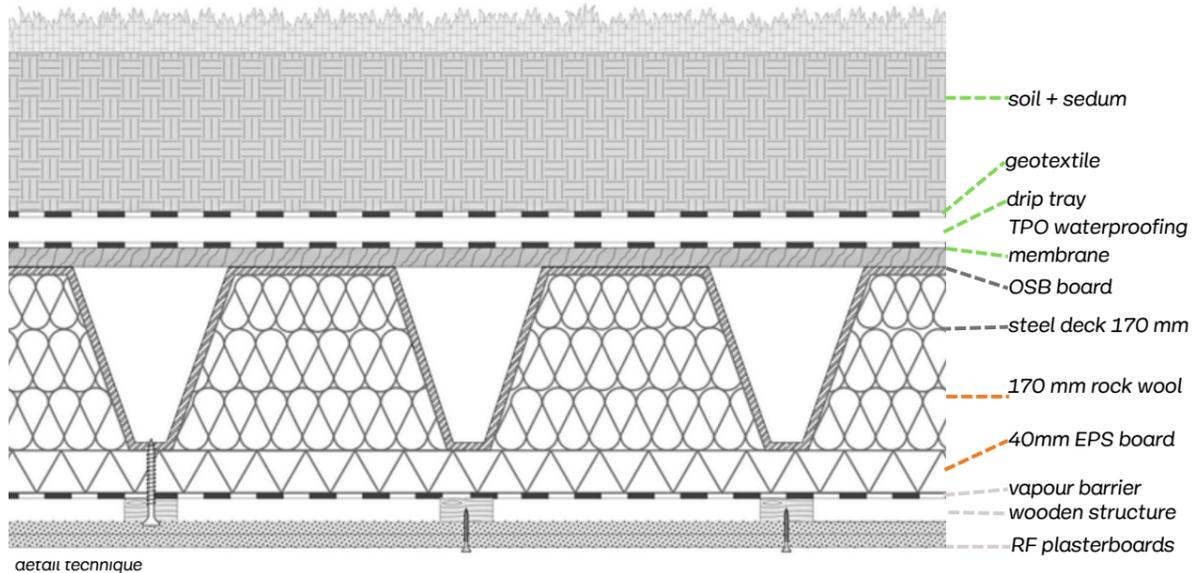


Elements to be insulated	flat roof and walls
Side of insulation	interior
Surface to be insulated	53 + 87 m <sup>2</sup>
Anchoring method	PU adhesive and screws
Type of insulation used	rigid synthetic panels and wool insulation
Execution by	Casa Blanco: Ceiling + wall with windows Self-build: 3 other walls

### Explanation of technical details

It is not generally recommended to insulate a flat roof from the inside, but in this case a green roof was already present, so it was not possible to insulate from the outside. Several preventive measures were taken to avoid issues with humidity in the roof composition. To avoid air pockets in the roof structure, rockwool was inserted between the grooves of the

steel sheet. Underneath the steel deck structure EPS boards of 40mm were placed. These were secured to the structure using a wooden frame. Due to the public nature of the space, double layered fire-resistant panels were used for the interior finishing, which were then plastered.



## REUSED INSULATION MATERIAL USED

Both synthetic panels and mineral wool insulation were used in this project. The panels were donated by the non-profit organisation In Limbo. These panels vary greatly in size and have many irregularities. The EPS panels were recovered during the renovation of an industrial

warehouse. These thin sheets often need to be applied in several layers. However, they are quite large and have uniform dimensions, making the installation easier. In addition, two batches of rock wool were used. One is in relatively poor condition, the other in fair condition.



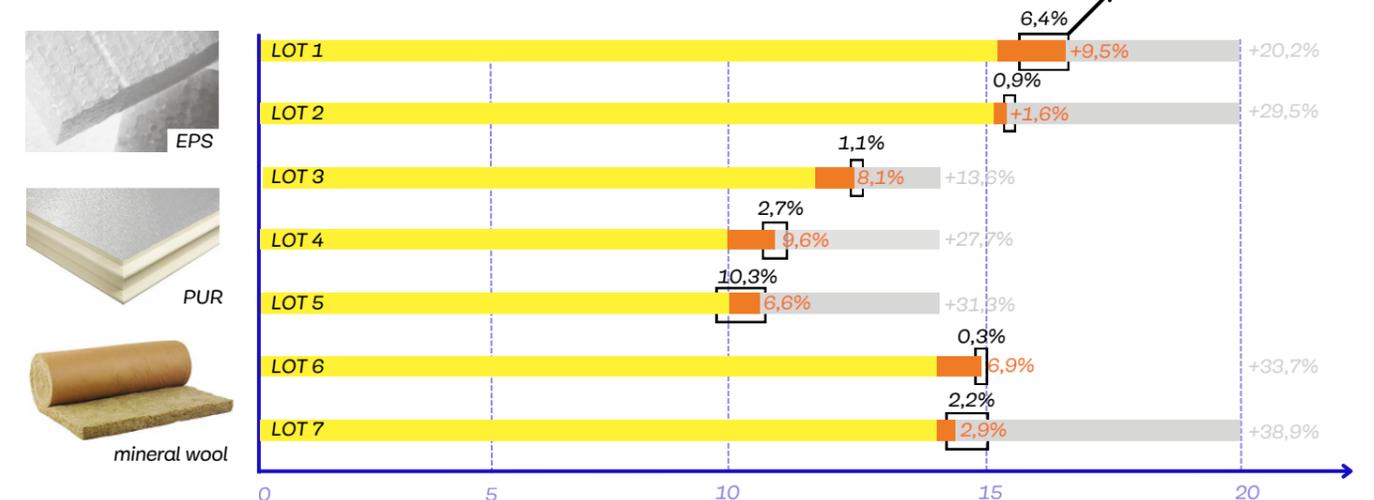
### Test results of the thermal conductivity

The table below consists of two parts. First, it lists the materials used and their technical characteristics. Secondly, their thermal resistance is compared using different lambda (thermal conductivity) values and different thicknesses. The thickness of the insulation panels is calculated based on the thermal resistance of an equivalent new insulator (orange), the average measured value (yellow) and the default value (grey). If the technical information on an insulation material is

unknown or unavailable, a default thermal conductivity value from Annex A of Belgian standard NBN B 62-002 is used to calculate the thermal resistance. The thickness is calculated based on an R-value of 4m<sup>2</sup>.kW (this is the minimum thermal conductivity that applies in the Brussels RENOLUTION subsidy-scheme for roof insulation). The black box indicates the tolerance of the test-device to take into account for the results.

Materials	type	lot	quantity	thickness	average lambda test	new lambda	default value	supplier
EPS polystyrene	synthetic	1	230 m <sup>2</sup>	4cm	0,0416	0,038	0,050	Demolition contractor
		2	22 m <sup>2</sup>	10 cm	0,0386	0,038	0,050	In Limbo
PUR polyurethane	synthetic	3	12 m <sup>2</sup>	14 cm	0,0308	0,0285	0,050	In Limbo
		4	15 m <sup>2</sup>	6 cm	0,0274	0,025	0,050	In Limbo
		5	2,5 m <sup>2</sup>	10 cm	0,0266	0,025	0,050	In Limbo
mineral wool	mineral	6	30 m <sup>2</sup>	5 cm	0,0374	0,035	0,050	Particulier
		7	20 m <sup>2</sup>	6 cm	0,036	0,035	0,050	Batiterre
					*1	*2	*3	

### Insulation thickness in cm to achieve a thermal resistance of R: 4 m<sup>2</sup>.K/W

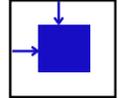
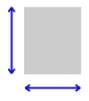
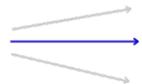
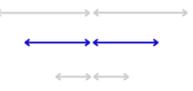
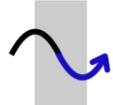
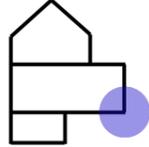


## RENOVATION SCENARIOS

This table compares several scenarios: the original situation, a renovation with reused insulation materials, and a renovation with new materials. It examines various aspects: the wall composition, thermal conductivity of the insulation, price, overall environmental score, the share that insulation represents in the climate impact, the impact on climate change, and the thermal performance of the element. The TOTEM tool was used for these analyses. This table enables an informed decision to be made on whether or not to use reused materials for the insulation of a building element.

	Element composition	Area to be insulated (m²)	Thermal resistance of insulation R (m²·K/W)	Cost comparison	Environmental impact per life cycle stage (mPt/FU)	Impact per component (mPt/FU)	Impact on climate change (kg CO <sub>2</sub> eq./FE)	Thermal performance (W/m²·K)
<b>roof</b>								
<i>initial state</i>	green roofs steel deck	0m <sup>2</sup>				materials: 1,15 energy: 187,15 Total: 188,3	3845kgCO <sub>2</sub> eq/m <sup>2</sup>	2,76 W/m <sup>2</sup> .K
<i>reused insulation</i>	INSIDE + 17 cm rock wool insulation (2/3) + 4 cm EPS insulation + vapour barrier	56 m <sup>2</sup>	lambda: 0,0374*2/3 + 0,0417 R: 4,0	PRICE: 127,8€/m <sup>2</sup> : 7160€ I: 8€/m <sup>2</sup> : 424€ M: 42€/m <sup>2</sup> : 2226€ L: 85€/m: 4505€ transport 570€	maintenance: 1,5 waste: 0,4 energy: 12,3 production: 0,8	materials: 2,7 energy: 12,3 insulation: 1,55 Total: 15,0	289 kgCO <sub>2</sub> eq/m <sup>2</sup>	0,61 W/m <sup>2</sup> .K
<i>new insulation</i>	INSIDE + 17 cm rock wool insulation (2/3) + 4 cm EPS insulation + vapour barrier	56 m <sup>2</sup>	lambda: 0,036*2/3 +0,038 R: 4,2	PRICE: 132,5€/m <sup>2</sup> : 7420€ I: 21€/m <sup>2</sup> : 1113€ M: 55 €/m <sup>2</sup> : 2915,00€ L: 85€/m: 4505€	maintenance: 1,5 waste: 0,4 energy: 11,9 production: 1,8	materials: 3,7 energy: 11,9 insulation: 2,55 Total: 15,6	292 kgCO <sub>2</sub> eq/m <sup>2</sup>	0,60 W/m <sup>2</sup> .K
<b>wall</b>								
<i>initial state</i>	Concrete stone wall, partly in the heated volume	0m <sup>2</sup>				materials: 9,45 energy: 18,65 Total: 28,1	410 kgCO <sub>2</sub> eq/m <sup>2</sup>	5,80 W/m <sup>2</sup> .K
<i>reused insulation</i>	INSIDE + 4cm x 2 EPS insulation + vapour barrier	87 m <sup>2</sup>	lambda: 0,0395 R: 2,1	PRICE: 125,6€/m <sup>2</sup> : 10932€ I: 4,5€/m <sup>2</sup> : 391,5€ M: 36,5 €/m <sup>2</sup> : 3175€ L: 78€/m <sup>2</sup> : 6786,00€ waist 970€	maintenance: 10,0 waste: 1,2 energy: 7,71 production: 0,33	materials: 11,42 energy: 7,71 insulation: 0,94 Total: 19,24	214 kgCO <sub>2</sub> eq/m <sup>2</sup>	0,475 W/m <sup>2</sup> .K
<i>new insulation</i>	INSIDE + 8 cm EPS insulation + vapour barrier	87 m <sup>2</sup>	lambda: 0,035 R: 2,3	PRICE: 109€/m <sup>2</sup> : 9483 € I: 12€/m <sup>2</sup> : 1044 € M: 44€/m <sup>2</sup> : 3828€ L: 65€/m: 5655€	maintenance: 10,0 waste: 1,2 energy: 7,53 production: 0,83	materials: 12,03 energy: 7,53 insulation: 1,5 Total: 19,56	222 kgCO <sub>2</sub> eq/m <sup>2</sup>	0,428 W/m <sup>2</sup> .K

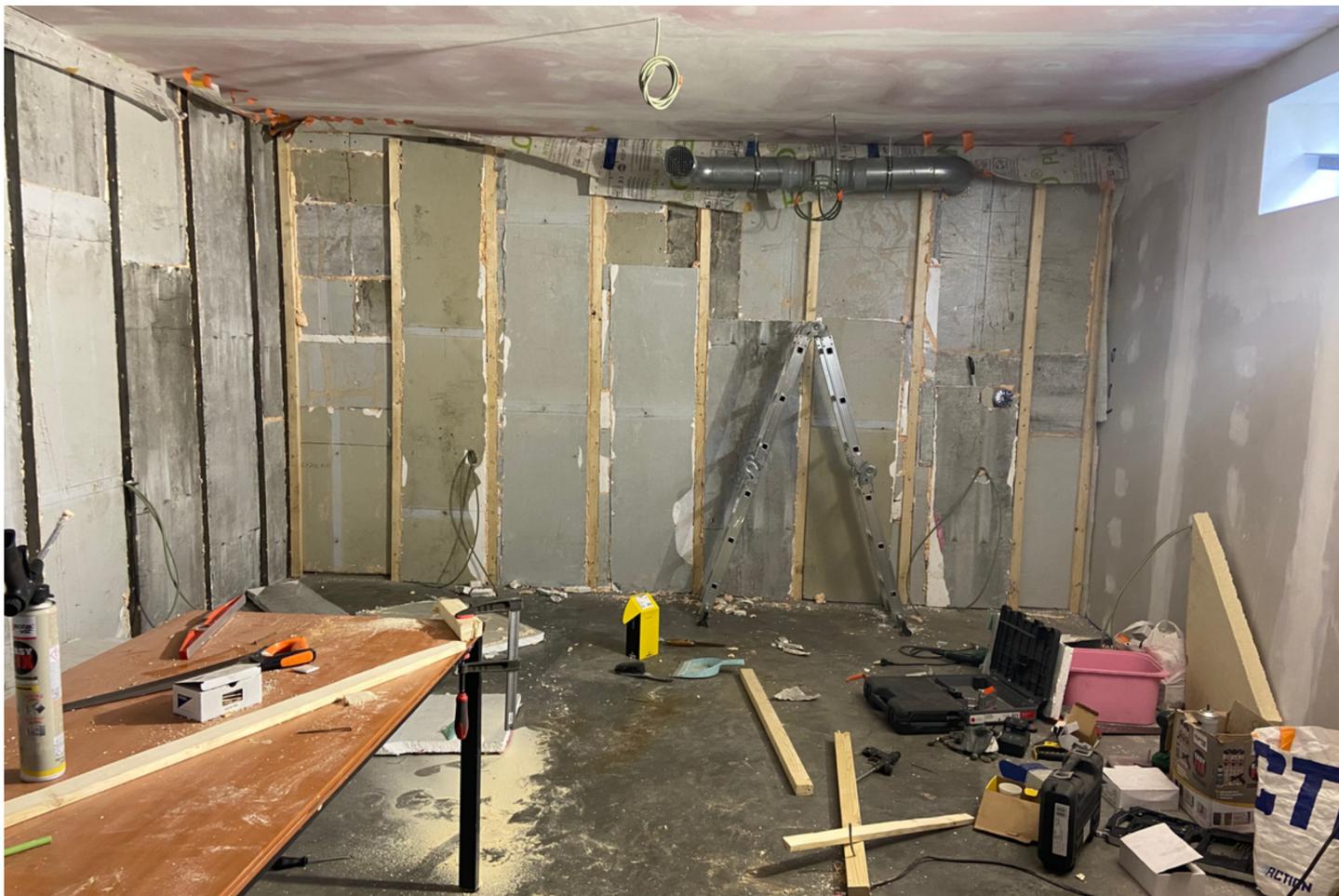
## FEEDBACK

Design	Installation	Thermal Conductivity
<p><b>side insulation</b></p>  <p>interior</p> <p>Insulating from the inside is generally not recommended for flat roofs. However, there was no other option due to the existing green roof. It was therefore necessary to ensure the airtightness with vapor barriers.</p>	<p><b>state of the insulation</b></p>  <p>low</p> <p>The presence of irregularities in the insulation panels (metal, plastic, different sizes) made installation more complex.</p>	<p><b>sample preparation</b></p>  <p>complicated</p> <p>Preparing the samples to carry out the tests is a labour-intensive task. Seven different types of insulation were recovered. Mainly the horizontal cuts and irregularities in the panels require additional work.</p>
<p><b>fixation</b></p>  <p>glue</p> <p>The insulation is stuck to the wall with PU adhesive foam. The negative aspect of this option is that it is difficult to reverse without risking damage to the insulation.</p>	<p><b>dimensions</b></p>  <p>various</p> <p>There are significant differences in the dimensions of the recovered plates.</p>	<p><b>évolution</b></p>  <p>stable</p> <p>The thermal coefficient of the insulation material has deteriorated only slightly compared to the same type of material when new. On average, the performance has deteriorated by 6.5% compared to that of a similar type of material today.</p>
<p><b>humidity</b></p>  <p>high risk</p> <p>The mechanical ventilation in the room mitigates the elevated risk of damage due to humidity when insulating on the inside. In addition, it is recommended to apply a vapor barrier using appropriate adhesive tapes.</p>	<p><b>material handling</b></p>  <p>many</p> <p>The variability and irregularity of the plates require much manipulation (sometimes adjusting the thickness, which is very complex and time-consuming).</p>	<p><b>défaut value</b></p>  <p>small</p> <p>The additional thickness calculated using the default value is relatively small for PUR panels, whereas it has a greater impact for other insulation panels.</p>
<p><b>choice of materials</b></p>  <p>synthetic + mineral</p> <p>The choice of materials used is mainly based on their availability and high thermal resistance (that allows to minimise the loss of interior space).</p>	<p><b>installation</b></p>  <p>complex</p> <p>Due to their thinness, the sheets often need to be applied in several layers, which is a lot more work. Synthetic sheets are more difficult to handle in irregular spaces.</p>	<p><b>deformation</b></p>  <p>little</p> <p>Some synthetic panels were slightly distorted. The rock wool mattresses had lost some of their thickness over time.</p>
<p><b>availability</b></p>  <p>average</p> <p>These materials were found relatively easily, but they had different characteristics and numerous irregularities.</p>	<p><b>nuisance</b></p>  <p>average</p> <p>The horizontal cuts of the panels creates a lot of dust. However, this is easy to clean up because the work is done indoors.</p>	<p><b>variations market</b></p>  <p>average</p> <p>The lambda value of old insulation panels is less efficient than that of new panels on the market today.</p>
<p><b>price</b></p>  <p>same price as new</p> <p>The materials were inexpensive, but installation took longer. This was due to the reduced thickness of the boards that required several layers, the wide variety of sizes and shapes of the materials and the high cost of adhesive tapes and foams.</p>	<p><b>logistics</b></p>  <p>high</p> <p>The insulation came from three different locations, which required additional logistics. Some panels had to be discarded due to poor quality, which required additional transport.</p>	<p>Across all aspects analysed, this implementation receives an overall negative assessment.</p> <ul style="list-style-type: none"> <li>- The <b>composition</b> is not reversible and presents a significant risk of moisture (internal insulation). However, the insulation materials are relatively affordable and readily available. This method offers little protection against heat, despite a limited number of thermal bridges.</li> <li>- The main difficulty concerns <b>installation</b>. The materials are in poor condition, with varying sizes and irregularities that make handling and installation very difficult. Their origin from different locations also complicates logistics. As the building envelope is quite irregular but due to the multiple layers the installation is relatively continuous.</li> <li>- The <b>thermal conductivity</b> has remained stable despite slight deformation of the panels, but the performance is lower than that of new materials due technical evolutions.</li> </ul>
<p><b>phase shift</b></p>  <p>low</p> <p>Interior insulation has little impact on the heat transfer in summer. Fortunately, this is largely compensated by the green roof.</p>	<p><b>building irregularities</b></p>  <p>average</p> <p>The insulation must be in direct contact with the exterior wall to prevent mould problems. This was more complex as the interior walls were uneven.</p>	
<p><b>thermal bridge</b></p>  <p>limited</p> <p>The load-bearing beams of the flat metal roof must be wrapped to prevent thermal bridges. The electrical box also constitutes a thermal bridge. Here, the wall will be insulated (with a 1 meter overlap) on the other side of the wall.</p>	<p><b>continuity insulation</b></p>  <p>very continuous</p> <p>The insulation is relatively continuous thanks to its multi-layer installation, and air cannot escape through cracks. The main thermal bridges have been eliminated.</p>	

## CONCLUSION

Despite the fact that the panels were obtained free of charge and much of the work was carried out by residents, the installation was very costly due to the irregularity and variety of the recovered materials. Despite this, quality of

the final result was not affected. The thermal conductivity of the reused insulation has remained very stable over time. All thermal bridges have been resolved and the insulation has been installed continuously.



## ISOL'UTION

UTILISONS DU RÉEMPLOI

ISOL'ution is a collaboration between the ATM department of the ULB, La Rue asbl, Casa Blanco and Batiterre. The project aims to test the reuse of insulation materials in energetic renovation projects in Brussels. Insulation materials are recovered, sorted, tested (mainly on their thermal conductivity) and reinstalled in homes.

This project is funded by Bruxelles Environnement under the RENOLAB.ID call. This report was translated as part of the Circular Building Coalition 2025 Open Call. The Circular Building Coalition is supported by the Laudes Foundation.



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