D3.9_Overall Refurbishment Plan

CS06_Auby

SIA Habitat Auby

INTELLIGENT ENERGY – EUROPE II

Energy efficiency and renewable energy in buildings

IEE/12/070

EuroPHit

[Improving the energy performance of step-by-step refurbishment and integration of renewable energies]

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Technical References

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Abstract

This overall refurbishment plan provides an overview of the retrofit steps of a step-by-step refurbishment to EnerPHit standard to be undertaken for the project Auby.

First, the existing building will shortly be described, including building component and component conditions. In addition, the existing energy efficiency performance of the building will be described.

In a second step, the overall refurbishment plan will describe the retrofit steps to be undertaken until the refurbishment will finally be completed. The first step will be to install new windows and doors. The second step will be to airtight and insulate roofs and install a MVHR unit. The third steps will be to apply exterior insulation on walls along with airtightness, and insulate the garage slabs from the inside. A final step will add solar thermal to the existing boiler.

Include a pictures or drawings typical for the project.

1 General Project description

Each EuroPHit deliverable / report / documentation should follow the same formatting style and editing rules. The present document follows these styles and rules which are summarised below.

1.1 Motivation

Initial choice for the client was to retrofit an old mining housing sector in Liévin as shown by the initial site selection. However the client decided finally to retrofit that mining housing sector one shot, in order to get the adequate financing.

These 24 houses in the nearby city of Auby are well fit to step by step retrofit with enhanced energy efficiency with the aim of attaining the EnerPHit standard. The objective is tough though as envelope are poorly compact and not well oriented.

1.2 Existing Building

There are 24 buildings to be refurbished. They are composed of mid-terraced houses and semi-detached houses. They are 2 storey houses, with one toilet, one bathroom, 4 bedrooms, a kitchen and a living room. A garage is attached.

1.3 Refurbishment steps

1.3.1 Retrofit steps within EuroPHit

Short description of the works to be carried out until March 2016.

Step 1: phA new windows in the insulation layer.

Step 2: Insulation on existing rafters and existings ceilings with maximum thickness (20 to 25 cm) + Installation of a MVHR with 94% heat recovery ratio

1.3.2 Further retrofit steps

Short description of the works to be carried out in the future.

Step 3: interior insulation of slab with thin insulation material + External insulation and airtightness of walls

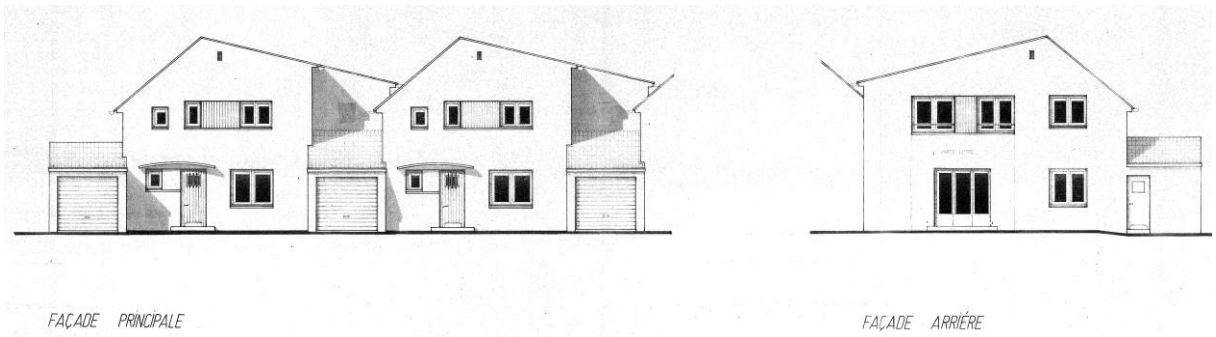
Step 4 : Integration of solar thermal panels on roof to cover at least 60% of DHW demand

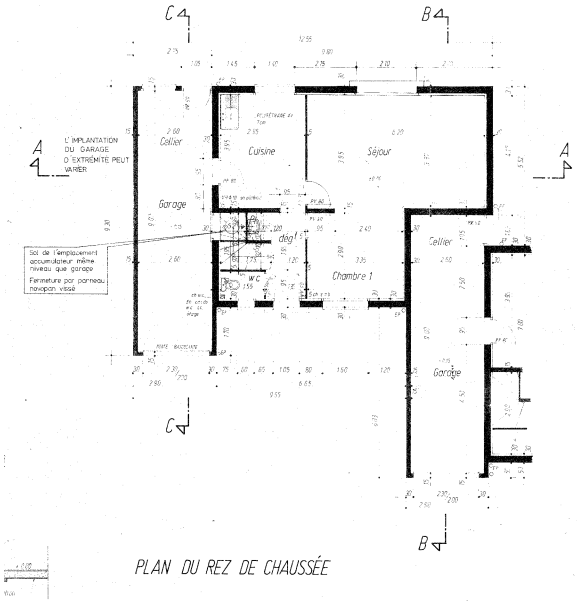
1.4 EnerPHit standard

Short description of the final retrofit step to EnerPHit standard

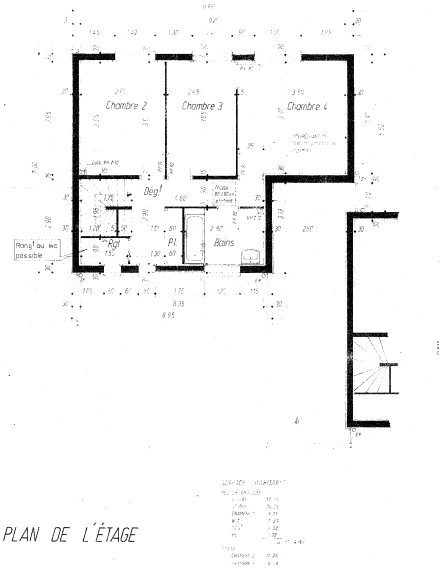
The EnerPHit standard can be reached after the slabs have been insulated and the solar thermal panels have been installed.

1.5 Pictures


FAÇADE PRINCIPALE
FAÇADE ARRIÈRE



PLAN DU REZ DE CHAUSSÉE



PLAN DE L'ÉTAGE

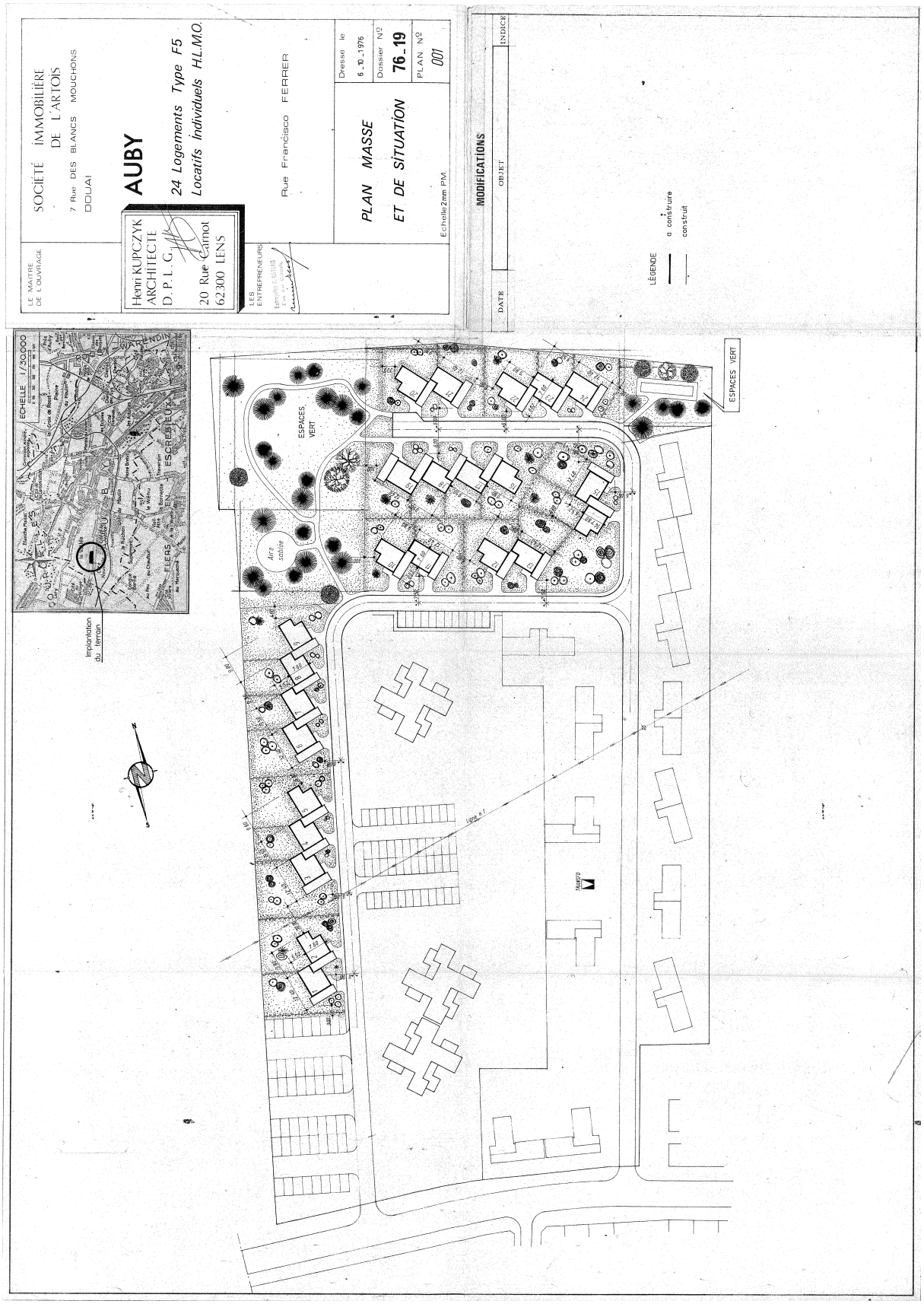


Figure 1: ***Pictures / drawings of the project Source : SIA Habitat***

2 Existing building

2.1 General description

Add a more detailed description of the existing building including specific properties (building geometry, general quality, temporary use), challenges (balconies, foundations, basement walls, ecc) or building regulation and monument protection issues.

2.1.1 Building data

- Construction Time: 1978
- Last retrofit:
- Building use: Residential
- General condition:
- Occupancy:
- Treated floor Area: 255.44 m²
- Other:

2.1.2 Client

- Name / Company
- Address 15 rue Maurice Thorez, Residence de La Vallée, 59950 Auby
- Email

2.2 Existing Building components

2.2.1 Floor slab

- Description Concrete slab on grade. Composition: 100 mm concrete, 50 mm cement screed.
- U-Value 3.796 W/(m²K)
- Installation date: 1978
- Condition:
- Next replacement:
- Other:

2.2.2 External walls

- Description Interior insulation with polyurethane (70 mm), 10 mm still air space, 200 mm concrete hollow bricks, 20 mm cement render.
- U-Value 0.30 W/(m²K)
- Installation date: 1978
- Condition:

- Next replacement: Air tightness before 2016, cement render in 2018.
- Other:

2.2.3 Windows

- Description: Single glazing, with a 68 mm timber frame
- U-Value: 3.93 W/(m²K)
- Installation date: 1978
- Condition:
- Next replacement: Before 2016
- Other: Garage door to be replaced

2.2.4 Roof / Top floor ceiling

- Description: Ceiling on unheated attic. Mineral wood (100 mm) between rafters.
- U-Value: 0.425 W/(m²K)
- Installation date: 1978
- Condition:
- Next replacement: Before 2016
- Other:

2.2.5 Heating

- Description: Individual gas boilers
- Efficiency: Low temperature gas boilers
- Installation date: 2012
- Condition: Good state
- Next replacement: 2020/2030
- Other:

2.3 Energy efficiency of the existing building

Short description of the energy efficiency properties of the existing building.

- Modelled specific heating demand:
- Modelled specific cooling demand / overheating frequency:
- Modelled specific primary energy demand:

Average annual Gas/Oil bills (if available):

Average annual Electricity bills (if available):

For an overview of the energy efficiency of the existing building, see the verification spreadsheet of the PHPP 9 beta version [PHI 2013] on the next page.

Specific building demands with reference to the treated floor area			
	Surface de référence énergétique:	255,4	m²
Chauffer	Besoin de chaleur de chauffage	**186**	**kWh/(m²a)**
	Puissance de chauffage	**72**	**W/m²**
Refroidir	Demande totale de refroidissement		**kWh/(m²a)**
	Puissance de refroidissement		**W/m²**
	Fréquence de surchauffe (> 25 °C)	0,0	%
Energie prima	Chauffer, refroidir, Déshumidification, ECS, éclairage, électricité domestique	**322**	**kWh/(m²a)**
	ECS, chauffage et électricité auxiliaire	253	kWh/(m²a)
	Réduction énergie prim. par la prod. d'élec. solaire		kWh/(m²a)
Etanchéité à l'air	Test d'infiltrométrie n_{50}	**5,0**	**1/h**

EnerPHit (Rénovation): caractéristiques des éléments de construction			
Enveloppe bât.	Isol. ext. paroi contact avec ext.	**0,81**	**W/(m²K)**
valeur U moy.	Isol. ext. paroi contact avec sol	**1,44**	**W/(m²K)**
	Isol. int. paroi contact avec ext.		**W/(m²K)**
	Isol. Int. paroi contact avec sol		**W/(m²K)**
	Ponts thermiques ΔU	0,11	W/(m²K)
	Fenêtres	**2,62**	**W/(m²K)**
	Portes extérieures	**3,00**	**W/(m²K)**
Unité de ventilation	Taux eff. de dispo. therm.	**0**	**%**

Figure 2: Specific energy efficiency values of the existing building modelled with PHPP 9 Beta

2.4 Pictures / Drawings

These pictures or drawings illustrate the existing building.

Figure 3: Pictures / drawings of the existing building

3 Retrofit steps

3.1 Overall refurbishment Plan

3.1.1 Retrofit steps:

The first step is the installation of new passive house windows and doors : this can reduce by 25% the heating demand. Ceiling insulation and the installation of a MVHR can reduce the existing heating demand in a second step by another 28%. Further heat reduction will be reached with external wall and slabs insulation (75%). The last step regards grey water recovery and solar thermal installation, which can reduce specific primary energy demand.

Step 1: phA new windows in the insulation layer.

Step 2: Insulation on existing rafters and existings ceilings with maximum thickness (20 to 25 cm) + Installation of a MVHR with 94% heat recovery ratio

Step 3: interior insulation of slab with thin insulation material + External insulation and airtightness of walls

Step 4 : Integration of solar thermal panels on roof to cover at least 60% of DHW demand

Step	Year	Measure	Specific Heating Demand	Specific Primary Energy Demand	Additional Specific Renewable Energy Gains
0	2013	Existing Building	186	322	0
1	2015	Windows + doors	139	267	0
2	2015	Roofs + ventilation	100	222	0
3	2016	External insulation + slabs	25	137	0
4	2018	Grey water recovery + Solar Thermal	25	114	16 (Solar thermal + 16 (PV)

Figure 4: Overview refurbishment steps

3.1.2 Efficiency Improvements

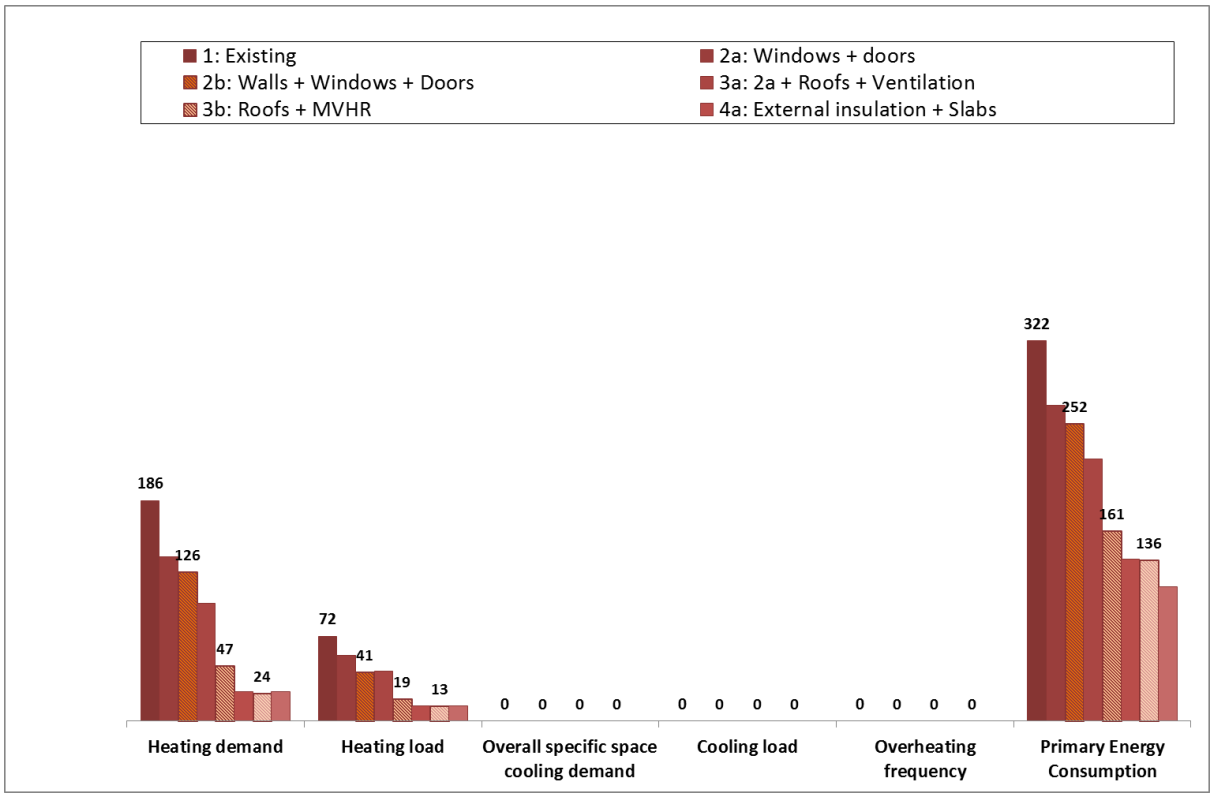


Figure 5: Overview energy efficiency improvement according to the overall refurbishment plan

3.2 Retrofit steps within EuroPHit

3.2.1 Retrofit step 1:

Windows and door, passive house quality.

Start date	:	2015
Completion date	:	2015
Budget	:	28 k€
PHPP: specific heating demand reduction [kWh/(m².a)]	:	47
PHPP: specific cooling demand | Overheating frequency [kWh/(m²K) | %]	:	-
PHPP: specific primary energy demand [kWh/(m²K)]	:	55

3.2.1.1 New Envelope component

Description	:	Windows and doors, min phB quality
U-Value [W/(m²K)]	:	0.86 on average
Installation date	:	2015
Condition	:	
Next replacement	:	2045
Other	:	

3.2.1.2 New heating component

Description	:	
Performance ratio of heat generation [%]	:	
Installation date	:	
Condition	:	
Next replacement	:	
Other	:	

3.2.2 New ventilation component

Description	:	
HR Efficiency[%]	:	
El.Efficiency [Wh/m³]		
Installation date	:	
Condition	:	
Next replacement	:	
Other	:	

3.2.3 Retrofit step 2:

Ceiling insulation + Ventilation with heat recovery

Start date	:	2016
Completion date	:	2016
Budget	:	43 k€
PHPP: specific heating demand reduction [kWh/(m²a)]	:	40
PHPP: specific cooling demand | Overheating frequency [kWh/(m²K) | %]	:	-
PHPP: specific primary energy demand reduction [kWh/(m²a)]	:	46

3.2.3.1 New envelope component

Description	:	Ceiling insulation on unheated attics
U-Value [W/(m²K)]	:	0.09
Installation date	:	
Condition	:	
Next replacement	:	2056
Other	:	

3.2.3.2 New heating component

Description	:	
Performance ratio of heat generation [%]	:	
Installation date	:	
Condition	:	
Next replacement	:	
Other	:	

3.2.4 New ventilation component

Description	:	One ventilation unit per dwelling
HR Efficiency[%]	:	90%
El.Efficiency [Wh/m³]		0.25
Installation date	:	
Condition	:	
Next replacement	:	2045
Other	:	

EnerPHit verification

Ph

Building:	Auby (24 Houses)		
Street:	Rue Thorez		
Postcode/City:	Auby		
Country:	France		
Building type:	Semi detached Houses		
Climate:	Lille		
Altitude of building site (in [m] above sea level):	25		
Home owner/client:	SIA Habitat		
Street:	60 rue des Potiers		
Postcode/City:	Douai		
Architecture:		Mechanical System:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Energy consulting:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	

Year of Construction:	2015	Interior temperature winter [C°]	17,7	Interior temp. summer [C°]	25,0
Number of dwelling units:	2	Internal heat gains winter [W/m²]	2,1	IHG summer [W/m²]	5,0
Number of Occupants:	8,0			Spec. capacity [Wh/K per m² TFA]	180
Exterior vol. V_e:	995,4 m³			Mechanical cooling:	

Specific building demands with reference to the treated floor area

				Critères	Respectés?*
	Surface de référence énergétique:	255,4	m²		
Chauffer	Besoin de chaleur de chauffage	**100**	**kWh/(m²a)**	25 kWh/(m²a)	**non**
	Puissance de chauffage	**42**	**W/m²**	-	-
Refroidir	Demande totale de refroidissement		**kWh/(m²a)**	-	-
	Puissance de refroidissement		**W/m²**	-	-
	Fréquence de surchauffe (> 25 °C)	0,0	%	-	-
Energie primair	Chauffer, refroidir, Déhumidification, ECS, éclairage, électricité domestique	**222**	**kWh/(m²a)**	221 kWh/(m²a)	**non**
	ECS, chauffage et électricité auxiliaire	153	kWh/(m²a)	-	-
	Réduction énergie prim. par la prod. d'élec. solaire	35	kWh/(m²a)	-	-
Etanchéité à l'air	Test d'infiltrométrie n_{50}	**3,0**	**1/h**	1 1/h	**non**

EnerPHit (Rénovation): caractéristiques des éléments de construction

Enveloppe bât.	Isol. ext. paroi contact avec ext.	**0,60**	**W/(m²K)**	-	-
valeur U moy.	Isol. ext. paroi contact avec sol	**1,44**	**W/(m²K)**	-	-
	Isol. int. paroi contact avec ext.		**W/(m²K)**	-	-
	Isol. Int. paroi contact avec sol		**W/(m²K)**	-	-
	Ponts thermiques ΔU	0,00	W/(m²K)	-	-
	Fenêtres	**0,86**	**W/(m²K)**	-	-
	Portes extérieures	**0,80**	**W/(m²K)**	-	-
Unité de ventilation	Taux eff. de dispo. therm.	**93**	**%**	-	-

* cellule vide: données manquantes; '-': aucune exigence

Figure 6: Specific energy efficiency values after measures within EuroPHit

3.3 Future retrofit Steps

3.3.1 Retrofit step 3:

Insulation of garage slabs with 80 mm 22 mW/m.K + External insulation of walls 20 cm

- Start date: 2019
- Completion date:
- Budget: 36 k€
- Specific heating demand reduction : 75 kWh/(m².a)
- Specific primary energy demand reduction : 85 kWh/(m².a)

3.3.1.1 New Envelope component

- Description : Insulation of garage slabs and external walls
- U-Value : 0.27 W/(m².K) average slabs , 0.10 W/(m².K) average walls
- Installation date:
- Condition:
- Next replacement: 2045
- Other:

3.3.1.2 New building equipment component

- Description
- Efficiency:
- Installation date:
- Condition:
- Next replacement:
- Other:

3.3.2 Retrofit step 4:

Solar thermal 2 m²/person + Grey water heat recovery

- Start date: 2020
- Completion date:
- Budget: 11 k€
- Specific heating demand reduction: -
- Specific cooling demand / overheating frequency:
- Specific primary energy demand reduction : 17 kWh/(m².a)

3.3.2.1 New Envelope component

- Description
- U-Value
- Installation date:
- Condition:
- Next replacement:
- Other:

3.3.2.2 New building equipment component

- Description: Vacuum solar thermal panels
- Efficiency: 70% optical efficiency
- Installation date:
- Condition:
- Next replacement: 2050
- Other:

3.4 Pictures / Drawings

These pictures or drawings illustrate the retrofit process.

Figure 7: Pictures / drawings of the retrofit steps

4 Completion of step-by-step refurbishment to EnerPHit standard including RES

4.1 General description

Add a more detailed description of the completed refurbishment including specific properties, general comments, observations…

4.2 Retrofit steps carried out

	select active variants >>	5-5a: Recup Eaux Grises + Solaire Thermique	'Comparison' worksheet: "Lower Efficieny" variant	1: Existing	2a: Fenêtres + Portes	3a: 2a + Toits + Ventilation	4a: ITE + Dalles	5a: Recup Eaux Grises + Solaire Thermique
Results	**Units**	5	0	1	2	3	4	5
Heating demand	kwh/(m²a)	**24,8**	22,1	186,4	139,1	99,5	24,8	24,8
Heating load	W/m²	**13,1**	12,4	71,6	55,6	42,0	13,1	13,1
Overall specific space cooling demand	kwh/(m²a)							
Cooling load	W/m²							
Overheating frequency	%	**0,0**	9,2	0,0	0,0	0,0	0,0	0,0
Primary Energy Consumption	kwh/(m²a)	**113,6**	134,7	321,9	267,3	221,6	137,2	113,6
Certifiable as EnerPHit building retrofit (acc. to heating demand)?	yes / no	**oui**	non	non	non	non	non	oui

Figure 8: PHPP9 beta [PHI 2013] Variant sheet with the retrofit steps carried out

4.2.1 Building data

- Completion Date:
- Building use:
- General condition:
- Occupancy:
- Treated floor Area:
- Other:

4.2.2 Client

- Name / Company
- Address
- Email

4.3 Description of Building components

4.3.1 Floor slab

- Description
- U-Value
- Installation date:

- Condition:
- Next replacement:
- Other:

4.3.2 External walls

- Description
- U-Value
- Installation date:
- Condition:
- Next replacement:
- Other:

4.3.3 Windows

- Description
- U-Value
- Installation date:
- Condition:
- Next replacement:
- Other:

4.3.4 Roof / Top floor ceiling

- Description
- U-Value
- Installation date:
- Condition:
- Next replacement:
- Other:

4.3.5 Heating

- Description
- Efficiency:
- Installation date:
- Condition:
- Next replacement:
- Other:

4.4 Energy efficiency of the refurbished building

Short description of the energy efficiency properties of the completed retrofit.

- Modelled specific heating demand: 25
- Modelled specific cooling demand / overheating frequency: -
- Modelled specific primary energy demand: 114

For an overview of the energy efficiency of the completed step-by-step refurbishment, see the verification spreadsheet of the PHPP 9 beta version [PHI 2013] on the next page.

EnerPHit verification

Ph

Building:	Auby (24 Houses)		
Street:	Rue Thorez		
Postcode/City:	Auby		
Country:	France		
Building type:	Semi detached Houses		
Climate:	Lille		
Altitude of building site (in [m] above sea level):	25		
Home owner/client:	SIA Habitat		
Street:	60 rue des Potiers		
Postcode/City:	Douai		
Architecture:		Mechanical System:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Energy consulting:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	

Year of Construction:	2015	Interior temperature winter [C°]	20,0	Interior temp. summer [C°]	25,0
Number of dwelling units:	2	Internal heat gains winter [W/m²]	2,1	IHG summer [W/m²]	4,9
Number of Occupants:	8,0			Spec. capacity [Wh/K per m² TFA]	180
Exterior vol. V_e:	995,4 m³			Mechanical cooling:	

Specific building demands with reference to the treated floor area

				Critères	Respectés?*
	Surface de référence énergétique:	255,4	m²		
Chauffer	Besoin de chaleur de chauffage	**25**	**kWh/(m²a)**	25 kWh/(m²a)	**oui**
	Puissance de chauffage	**13**	**W/m²**	-	**-**
Refroidir	Demande totale de refroidissement		**kWh/(m²a)**	-	**-**
	Puissance de refroidissement		**W/m²**	-	**-**
	Fréquence de surchauffe (> 25 °C)	0,0	%	-	**-**
Energie primair	Chauffer, refroidir, Déhumidification, ECS, éclairage, électricité domestique	**114**	**kWh/(m²a)**	132 kWh/(m²a)	**oui**
	ECS, chauffage et électricité auxiliaire	45	kWh/(m²a)	-	**-**
	Réduction énergie prim. par la prod. d'élec. solaire	35	kWh/(m²a)	-	**-**
Etanchéité à l'air	Test d'infiltrométrie n_{50}	**1,0**	**1/h**	1 1/h	**oui**

EnerPHit (Rénovation): caractéristiques des éléments de construction

Enveloppe bât.	Isol. ext. paroi contact avec ext.	**0,10**	**W/(m²K)**	-	**-**
valeur U moy.	Isol. ext. paroi contact avec sol	**0,27**	**W/(m²K)**	-	**-**
	Isol. int. paroi contact avec ext.		**W/(m²K)**	-	**-**
	Isol. Int. paroi contact avec sol		**W/(m²K)**	-	**-**
	Ponts thermiques ΔU	0,01	W/(m²K)	-	**-**
	Fenêtres	**0,86**	**W/(m²K)**	-	**-**
	Portes extérieures	**0,80**	**W/(m²K)**	-	**-**
Unité de ventilation	Taux eff. de dispo. therm.	**93**	**%**	-	**-**

* cellule vide: données manquantes; '-': aucune exigence

Figure 9: Specific energy efficiency values of the completed project modelled with PHPP 9 Beta

4.5 Pictures / Drawings

These pictures or drawings illustrate the final status of the retrofit.

Figure 10: Pictures / drawings of the completed retrofit