EuroPHit

D3.9_Overall Refurbishment Plan

CS16

House Centón, Santander

INTELLIGENT ENERGY – EUROPE II

Energy efficiency and renewable energy in buildings

IEE/12/070

EuroPHit

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

Contract N°: SI2.645928

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Technical References

Project Acronym	EuroPHit
Project Title	Improving the energy performance of step-by-step refurbishment and integration of renewable energies
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Project Duration	1 April 2013 – 31March 2016 (36 Months)

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Co-author(s)	
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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 House Centón, located in Santander, Cantabria.

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.

This step by step refurbishment will be undertaken component by component until the EnerPHit standard will be achieve.

Project Location

C/Camarreal nº 36, 39011 Santander (Cantabria)

Figure 1: Location of the building

Figure 2: Aerial view of the building

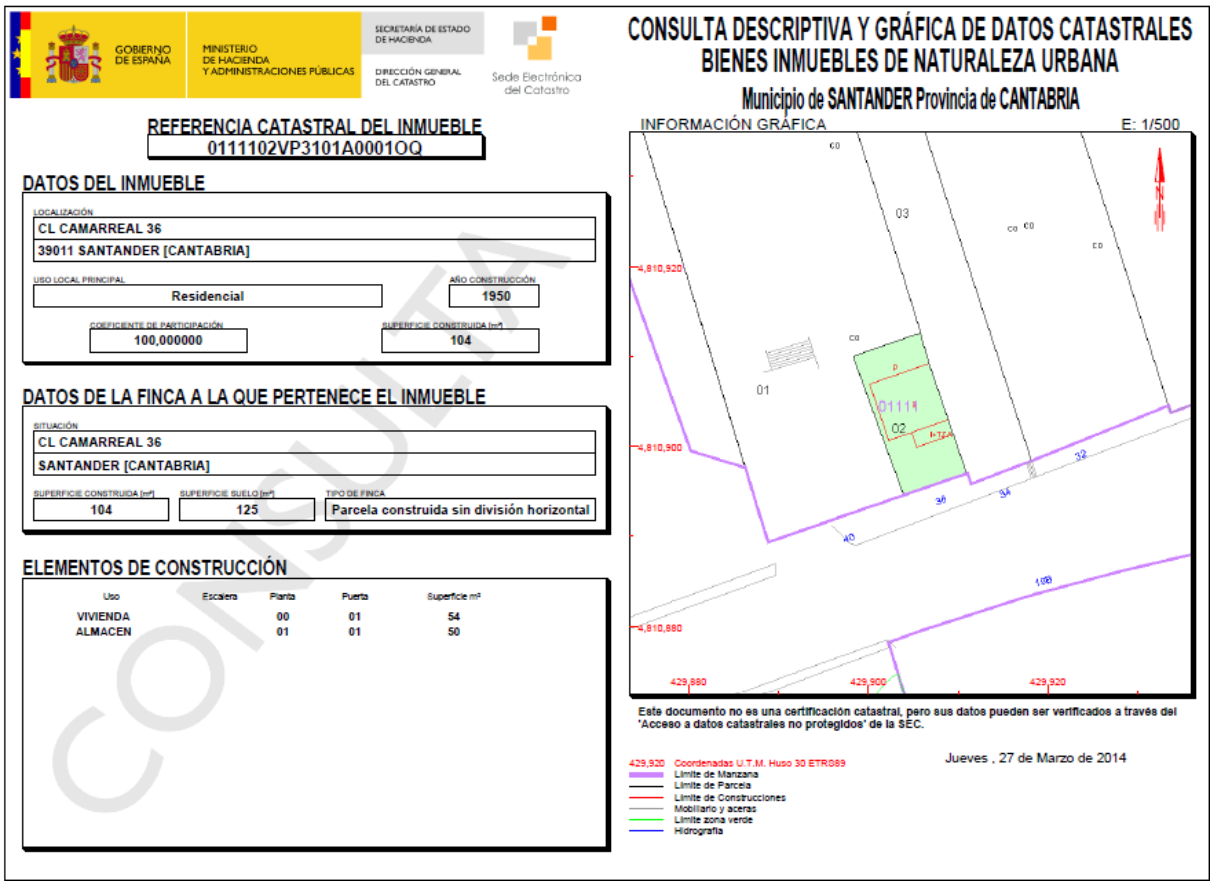


Figure 3: Cadastral reference of the building

1 General Project description

1.1 Motivation

The House Centón is empty since the death of the old couple who used to live there. The relatives who inherited the property have the intention of doing a refurbishment to prepare it for their necessities in the present and in the future: first as an office and later as a family home.

It will be a low budget refurbishment and part of the construction works will be undertaken by the owner (self-construction refurbishment)

1.2 Existing Building

House Centón is a small single house with walls made of brick and a light wooden structure of the floor and roof. The thermal envelope has no insulation. Ventilation is natural, using opening window sections. Heating and hot water system uses coal as energy source. Windows have single glazing and different types of bad quality frames.

The building is in very poor condition. First, it will be necessary a minimal refurbishment to achieve basic living conditions.

1.3 Refurbishment steps

1.3.1 Retrofit steps within EuroPHit

The retrofit works that will be undertaken within EuroPHit include the first two steps of the refurbishment plan:

Step 1: Foundation reinforcement and insulation under the basement (if possible)

Roof improvement (structure, insulation and airtightness)

Exterior wall insulation

Passivhaus windows installation and connexions with walls.

Ventilation intermediate step (natural impulsion and extraction)

Conditioning of the interior spaces to use them as a work place or office

Step 2: Airtightness improvement (final step)

Installation of the mechanical ventilation heat recovery system (MVHR)

1.3.2 Further retrofit steps

The last step of the refurbishment plan will be the implementation of renewable energy sources.

Future works will be undertaken in case the owners decide to use the building as a family house preparing the building for this new use: house services (like kitchen and bathrooms) and finishings. The boundary conditions of use and internal heat gains will be different.

1.4 EnerPHit standard

The project intends to achieve the EnerPHit standard at the end of the works. This will be a component by component refurbishment.

1.5 Pictures

Figure 4: ***External view of the existing building. Front façade.***

Figure 5: ***External view of the existing building. Back façade.***

2 Existing building

2.1 General description

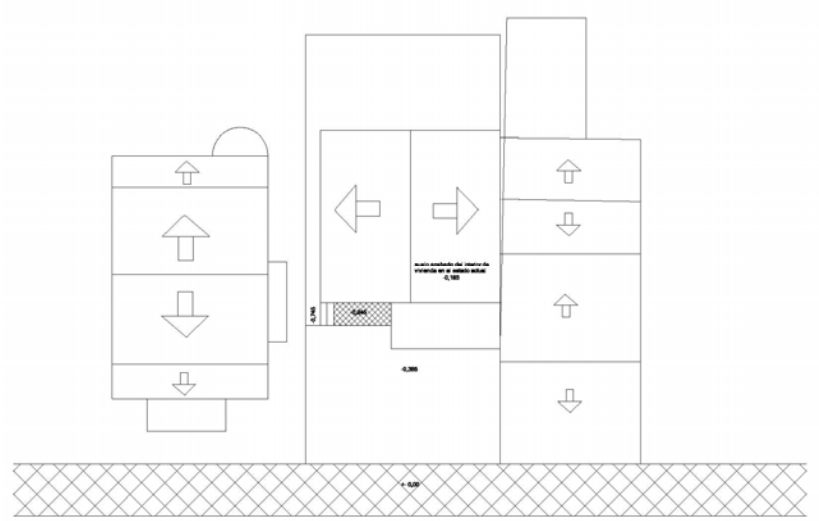


Figure 6: ***Location plan***

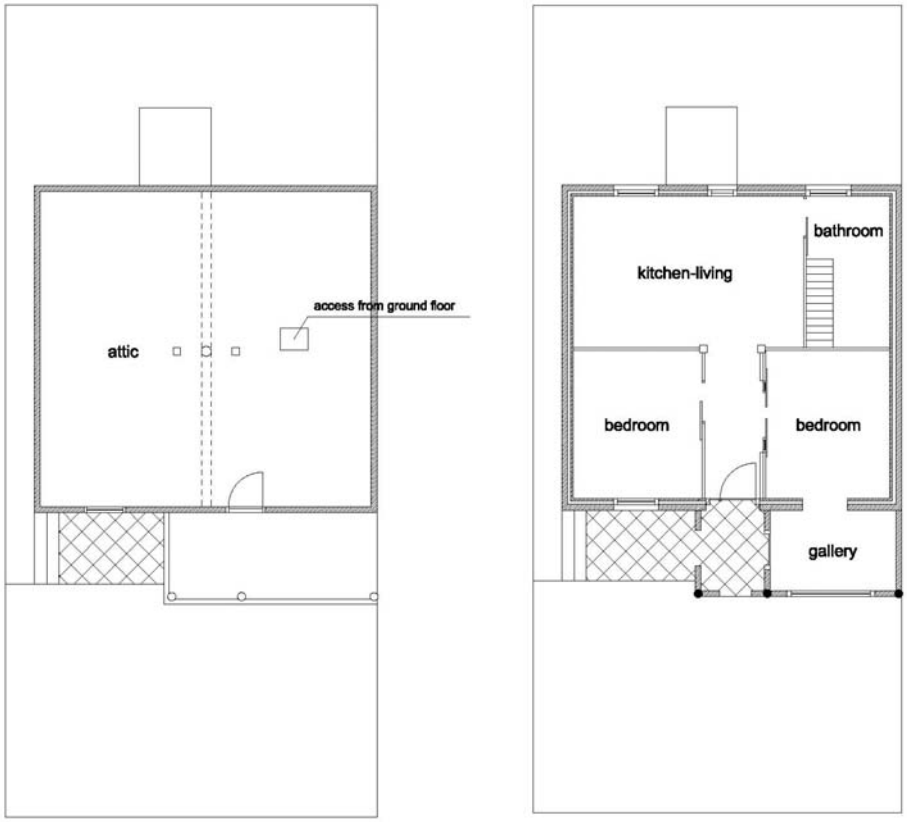


Figure 7: ***Ground and first floor***

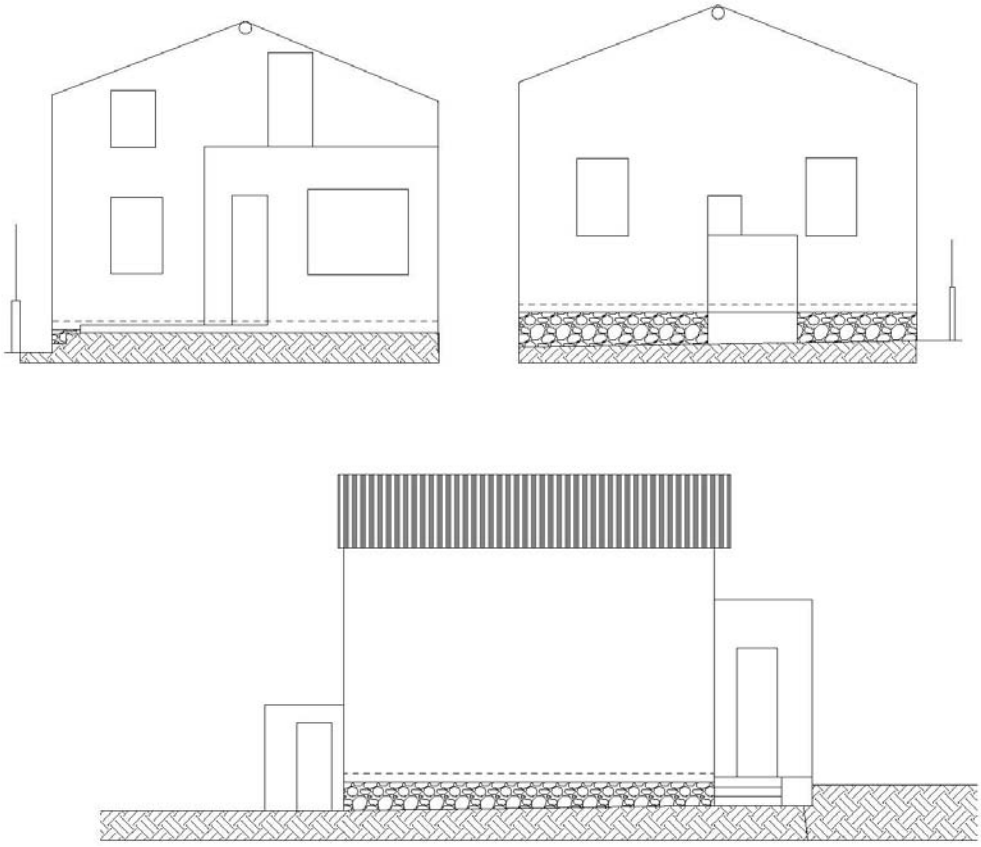


Figure 8: ***Elevations***

2.1.1 Building data

Construction Time	:	1950
Last retrofit	:	none
Building use	:	Residential
General condition	:	Poor
Occupancy	:	No
Treated floor Area	:	75,78 m2
Other	:	

2.1.2 Client

Name / Company	:	Rufino Blanco Pérez
Address	:	C/Camarreal nº67
Email	:	cesarblancosancibrian@hotmail.com
Other	:	

2.2 Envelope of the existing Building

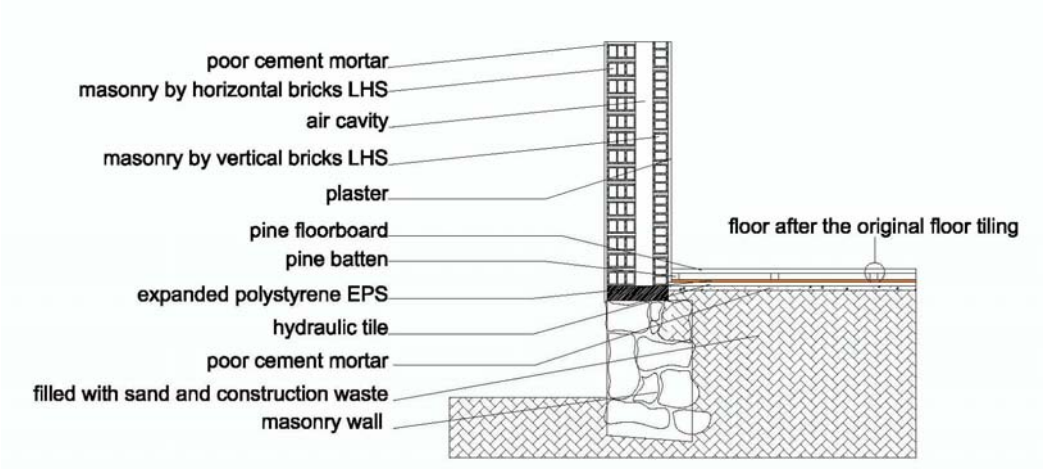


Figure 9: Connection between exterior walls and floor slab.

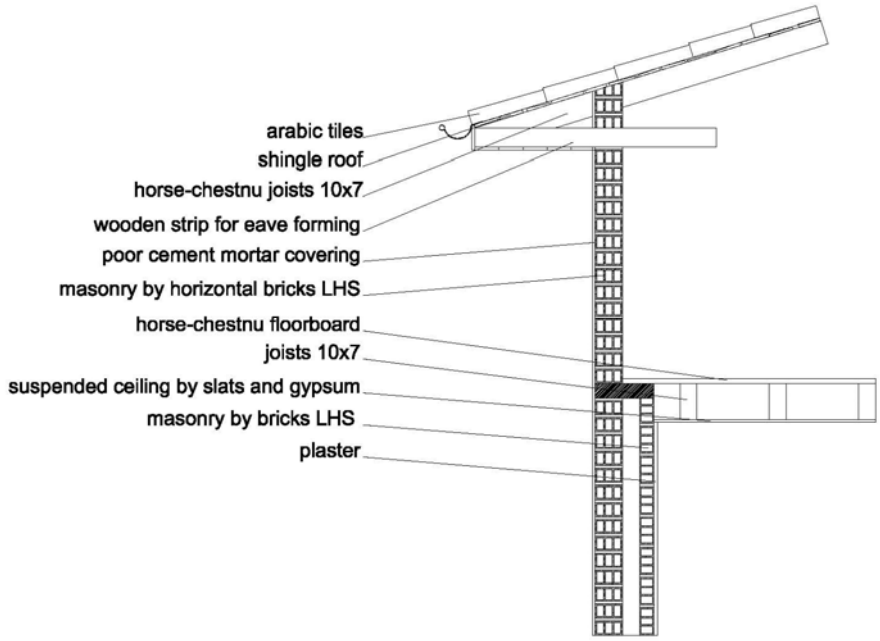


Figure 10: Roof and intermediate floor connection.

2.2.1 Floor slab

Description	:	Poor concrete slab with EPS and hydraulic tiles
U-Value [W/(m²K)]	:	1,051
Installation date	:	1950
Condition	:	Poor
Next replacement	:	2014
Other	:	Looks horrible as well

2.2.2 External walls

Description	:	Composed of two layers of brick and air chamber in the ground floor and a single layer of brick in the first floor.
U-Value [W/(m²K)]	:	1,702
Installation date	:	1950
Condition	:	Poor
Next replacement	:	2014
Other	:	

2.2.3 Windows

Description	:	Single glazed and different kind of frames (wooden and PVC). PVC roller shutter for shading.
U-Value [W/(m²K)]	:	4,66 W/(m²K) (average installed)
Installation date	:	1950
Condition	:	Broken glass
Next replacement	:	2014
Other	:	

2.2.4 Roof / Top floor ceiling

Description	:	Wooden joists and arabic tiles
U-Value [W/(m²K)]	:	3,403
Installation date	:	1950
Condition	:	Poor (big leakages)
Next replacement	:	2014
Other	:	

2.3 Technical equipment of the existing building

2.3.1 Heating

Description	:	Coal boiler
Performance ratio of heat generation [%]	:	No information
Installation date	:	No information
Condition	:	Bad
Next replacement	:	2014
Other	:	

2.3.2 Domestic hot water

Description	:	Electric boiler
Performance ratio of heat generation [%]	:	No information
Installation date	:	1990
Condition	:	Good
Next replacement	:	
Other	:	

2.3.3 Ventilation

Description	:	Natural ventilation
HR Efficiency[%]	:	
El.Efficiency [Wh/m³]		
Installation date	:	
Condition	:	
Next replacement	:	Intermediate step (2015)
Other	:	

2.4 Energy efficiency of the existing building

The energy efficiency properties of the existing building were calculated with PHPP 8. The results show that the energy performance of the building is very poor due mainly to the lack of insulation and leakages in the thermal envelope and to the bad quality technical systems for heating and domestic hot water.

2.4.1 Modelled efficiency parameters

PHPP: specific heating demand [kWh/(m²K)]	:	342
PHPP: specific cooling demand | Overheating frequency [kWh/(m²K) | %]	:	0
PHPP: specific primary energy demand [kWh/(m²K)]	:	567

2.4.2 Available consumption parameters

Annual Gas/Oil consumption | bills [kWh/a | €]	:	No information
Annual Electricity consumption | bills [kWh/a | €]	:	No information
Other	:	

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.

Comprobación Passivhaus

Edificio:	Casa Centón				
Calle:	Camarreal				
CP / Ciudad:	Santander				
País:	España				
Tipo de edificio:	Single home refurbishment				
Clima:	[ES] - Bilbao, Bizkaia C1	Altitud del sitio del edificio (en [m] sobre el nivel del mar):	100		
Propietario / cliente:	Rufino Blanco Pérez				
Calle:	C/Camarreal nº67				
CP / Ciudad:	Santander				
Arquitectura:					
Calle:					
CP / Ciudad:					
Instalaciones:					
Calle:					
CP / Ciudad:					
Año construcción:	1950	Temperatura interior invierno:	20,0 °C	Volumen exterior V_e m³:	270,6
Nr. de viviendas	1	Temperatura interior verano:	25,0 °C	Refrigeración mecánica:	
Nr. de personas:	2,2	Cargas internas de calor invierno:	2,1 W/m²		
Cap. específica:	132 Wh/K por m² SRE	ídem verano:	2,1 W/m²		

Valores característicos del edificio con relación a la superficie de referencia energética y año

				Requerimientos	¿Cumplido?*
	Superficie de referencia energética	75,8	m²		
Calefacción	Demanda de calefacción	342	kWh/(m²a)	15 kWh/(m²a)	no
	Carga de calefacción	108	W/m²	10 W/m²	no
Refrigeración	Demanda total refrigeración		kWh/(m²a)	-	-
	Carga de refrigeración		W/m²	-	-
	Frecuencia de sobrecalentamiento (> 25 °C)	0,0	%	-	-
Energía primaria	Calef., ref., deshum., ACS, elect. auxiliar, ilum., aparatos eléct.	567	kWh/(m²a)	120 kWh/(m²a)	no
	ACS, calefacción y electricidad auxiliar	527	kWh/(m²a)	-	-
	Ahorro de EP a través de electricidad solar		kWh/(m²a)	-	-
Hermeticidad	Resultado ensayo de presión n_{50}	15,0	1/h	0,6 1/h	no

EnerPHit (rehabilitación): valores característicos de los elementos constructivos

Envolvente térmica	Aislamiento hacia el aire exterior	2,34	W/(m²K)	-	-
Valor-U medio	Aislamiento contra el terreno	1,05	W/(m²K)	-	-
	Aislamiento interior hacia aire exterior		W/(m²K)	-	-
	Aislamiento interior contra el terreno		W/(m²K)	-	-
	Puentes térmicos ΔU	0,00	W/(m²K)	-	-
	Ventanas	4,66	W/(m²K)	-	-
	Puertas exteriores	1,20	W/(m²K)	-	-
Sist. de ventilación	Eficiencia recuperación de calor	0	%	-	-

* Campo vacío: faltan datos; '-': sin requerimiento

Passivhaus?	no

Figure 11: Specific energy efficiency values of the existing building modelled with PHPP 8

2.5 Pictures / Drawings

These pictures or drawings illustrate the condition of the existing building.

Figure 12: Existing roof

Figure 13: Existing window

3 Retrofit steps

3.1 Overall refurbishment Plan

3.1.1 Retrofit steps:

Short description of the overall refurbishment plan. Include information of the components to be exchanged or the building parts to be retrofitted and the estimated dates for the measures according to the plan.

Work in progress

Step No.	Year	Measures	Specific Heating Demand	Specific Primary Energy	Additional Specific PV Gains
0	1950	Existing Building	342	567	
1	2014	Foundation reinforcement and insulation under the basement (if possible) Roof improvement (structure, insulation and airtightness) Exterior wall insulation Passivhaus windows installation and connexions with walls. Ventilation intermediate step (natural impulsion and extraction)			
2	2016	Airtightness improvement (final step) Installation of the mechanical ventilation heat recovery system (MVHR)	24	84	
3	2025	Renewable Energy			

Figure 14: Overview refurbishment steps

3.1.2 Efficiency Improvements

Work in progress

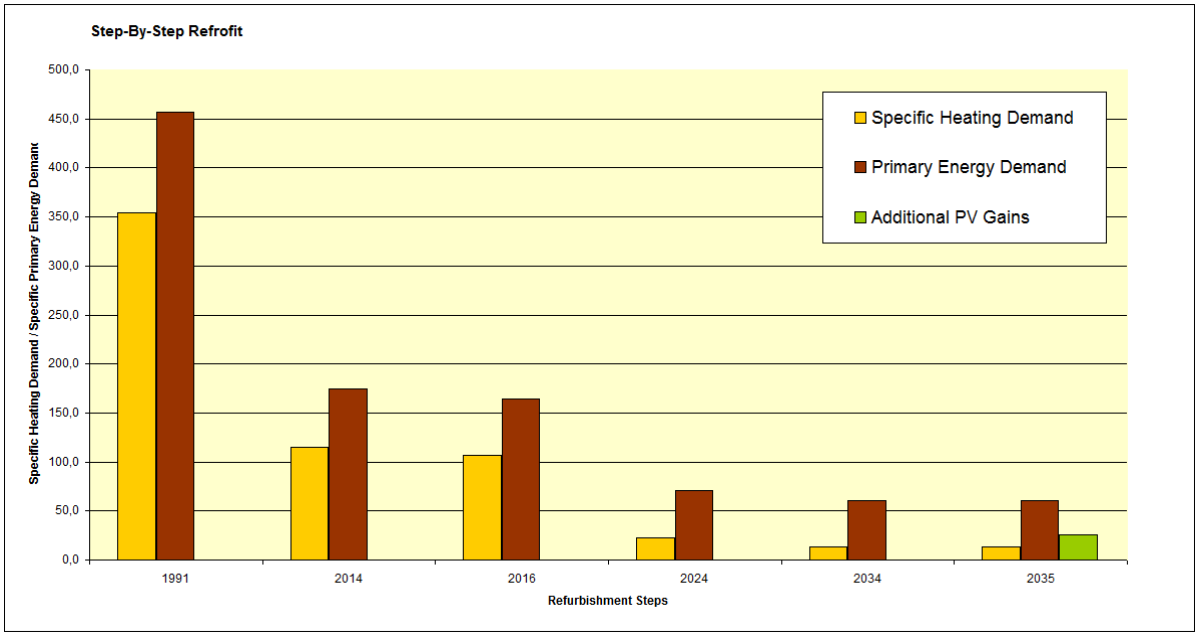


Figure 15: Overview energy efficiency improvement according to the overall refurbishment plan

3.2 Retrofit steps within EuroPHit

3.2.1 Retrofit step 1:

Foundation reinforcement and insulation under the basement (if possible)

Roof improvement (structure, insulation and airtightness)

Exterior wall insulation

Passivhaus windows installation and connections with walls.

Ventilation intermediate step (natural impulsion and extraction)

Conditioning of the interior spaces to use them as a work place or office

Start date	:	2014
Completion date	:	2015
Budget	:	35.900 € only material Self-construction refurbishment
PHPP: specific heating demand [kWh/(m²K)]	:	Not available information
PHPP: specific cooling demand | Overheating frequency [kWh/(m²K) | %]	:	Not available information
PHPP: specific primary energy demand [kWh/(m²K)]	:	Not available information

3.2.1.1 New envelope component (Floor slab and foundation)

Description	:	XPS insulation and floating floorboard above an structural dome concrete slab system
U-Value [W/(m²K)]	:	0,34
Installation date	:	2014
Condition	:	Done
Next replacement	:	
Other	:	

3.2.1.2 New envelope component (exterior walls)

Description	:	New exterior insulation (120 mm EPS) and ventilated façade
U-Value [W/(m²K)]	:	0,187
Installation date	:	2014
Condition	:	Done
Next replacement	:	
Other	:	

3.2.1.3 New envelope component (pitched roof

Description	:	New roof insulation (100 mm XPS and 120 mm EPS)
U-Value [W/(m²K)]	:	0,145
Installation date	:	2014
Condition	:	Done
Next replacement	:	
Other	:	

3.2.1.4 New heating component

Description	:	Not in this step
Performance ratio of heat generation [%]	:	
Installation date	:	
Condition	:	
Next replacement	:	
Other	:	

3.2.2 New ventilation component

Description	:	Ventilation intermediate step Not available information
HR Efficiency[%]	:	
El.Efficiency [Wh/m³]		
Installation date	:	
Condition	:	
Next replacement	:	
Other	:	

3.2.3 Retrofit step 2:

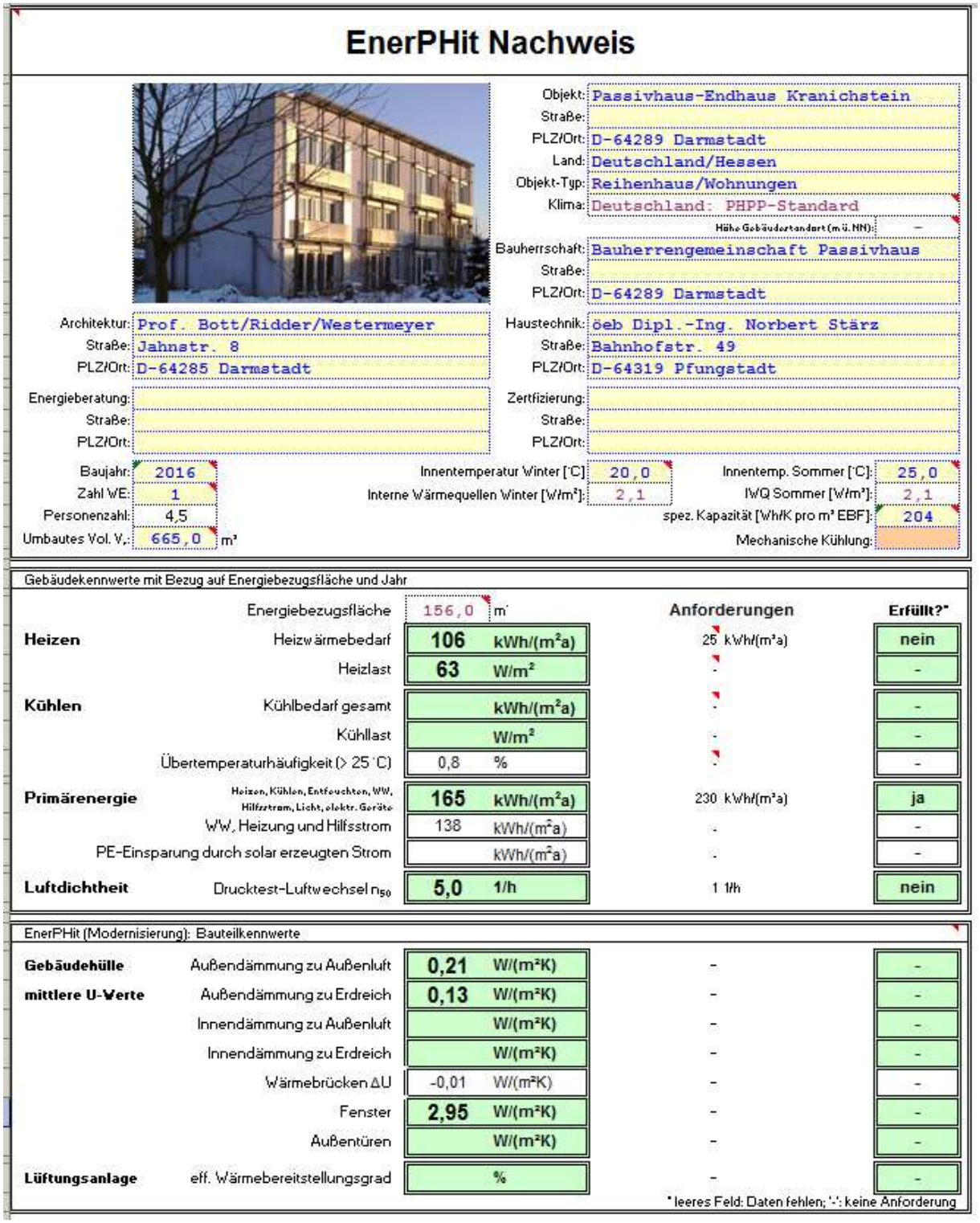
Airtightness improvement (final step)

Installation of the mechanical ventilation heat recovery system (MVHR)

Start date	:	2016
Completion date	:	2016
Budget	:	Not available information
PHPP: specific heating demand [kWh/(m²K)]	:	Not available information
PHPP: specific cooling demand | Overheating frequency [kWh/(m²K) | %]	:	Not available information
PHPP: specific primary energy demand [kWh/(m²K)]	:	Not available information

3.2.4 New ventilation component

Description	:	Not available information
HR Efficiency[%]	:	Not available information
El.Efficiency [Wh/m³]		
Installation date	:	2016
Condition	:	
Next replacement	:	
Other	:	



EnerPHit Nachweis

Objekt:	Passivhaus-Endhaus Kranichstein		
Straße:			
PLZ/Ort:	D-64289 Darmstadt		
Land:	Deutschland/Hessen		
Objekt-Typ:	Reihenhaus/Wohnungen		
Klima:	Deutschland: PHPP-Standard		
Höhe Gebäudestandort (m ü. NN):	–		
Bauherrschaft:	Bauherrengemeinschaft Passivhaus		
Straße:			
PLZ/Ort:	D-64289 Darmstadt		
Architektur:	Prof. Bott/Ridder/Westermeyer	Haustechnik:	öeb Dipl.-Ing. Norbert Stärz
Straße:	Jahnstr. 8	Straße:	Bahnhofstr. 49
PLZ/Ort:	D-64285 Darmstadt	PLZ/Ort:	D-64319 Pfungstadt
Energieberatung:		Zertfizierung:	
Straße:		Straße:	
PLZ/Ort:		PLZ/Ort:	

Baujahr:	2016	Innentemperatur Winter [°C]:	20,0	Innentemp. Sommer [°C]:	25,0
Zahl WE:	1	Interne Wärmequellen Winter [W/m²]:	2,1	IWQ Sommer [W/m²]:	2,1
Personenzahl:	4,5			spez. Kapazität [Wh/K pro m² EBF]:	204
Umbautes Vol. V.:	665,0 m³			Mechanische Kühlung:	

Gebäudekennwerte mit Bezug auf Energiebezugsfläche und Jahr

				Anforderungen	Erfüllt?*
	Energiebezugsfläche	156,0	m²		
Heizen	Heizwärmebedarf	106	kWh/(m²a)	25 kWh/(m²a)	nein
	Heizlast	63	W/m²	-	-
Kühlen	Kühlbedarf gesamt		kWh/(m²a)	-	-
	Kühllast		W/m²	-	-
	Übertemperaturhäufigkeit (> 25 °C)	0,8	%	-	-
Primärenergie	Heizen, Kühlen, Entfeuchten, WW, Hilfsstrom, Licht, elektr. Geräte	165	kWh/(m²a)	230 kWh/(m²a)	ja
	WW, Heizung und Hilfsstrom	138	kWh/(m²a)	-	-
	PE-Einsparung durch solar erzeugten Strom		kWh/(m²a)	-	-
Luftdichtheit	Drucktest-Luftwechsel n_{50}	5,0	1/h	1 1/h	nein

EnerPHit (Modernisierung): Bauteilkennwerte

Gebäudehülle	Außendämmung zu Außenluft	0,21	W/(m²K)	-	-
mittlere U-Werte	Außendämmung zu Erdreich	0,13	W/(m²K)	-	-
	Innendämmung zu Außenluft		W/(m²K)	-	-
	Innendämmung zu Erdreich		W/(m²K)	-	-
	Wärmebrücken ΔU	-0,01	W/(m²K)	-	-
	Fenster	2,95	W/(m²K)	-	-
	Außentüren		W/(m²K)	-	-
Lüftungsanlage	eff. Wärmebereitstellungsgrad		%	-	-

*leeres Feld: Daten fehlen; '-': keine Anforderung

Figure 16: Specific energy efficiency values after measures within EuroPHit

3.3 Future retrofit Steps

3.3.1 Retrofit step 3:

Renewable energy implementation:

Solar energy for hot water preparation

Solar PV

(to be confirmed)

Start date	:	To be confirmed
Completion date	:	
Budget	:	
PHPP: specific heating demand [kWh/(m²K)]	:	
PHPP: specific cooling demand | Overheating frequency [kWh/(m²K) | %]	:	
PHPP: specific primary energy demand [kWh/(m²K)]	:	

3.3.1.1 New Envelope component

Description	:	Not available information
U-Value [W/(m²K)]	:	
Installation date	:	
Condition	:	
Next replacement	:	
Other	:	

3.3.1.2 New heating component

Description	:	Not available information
Performance ratio of heat generation [%]	:	
Installation date	:	
Condition	:	
Next replacement	:	
Other	:	

3.4 Pictures / Drawings

These pictures or drawings illustrate the retrofit process.

Figure 17: Insulation under the foundation

Figure 18: Roof insulation

Figure 19: Roof structure

Figure 20: Roof insulation

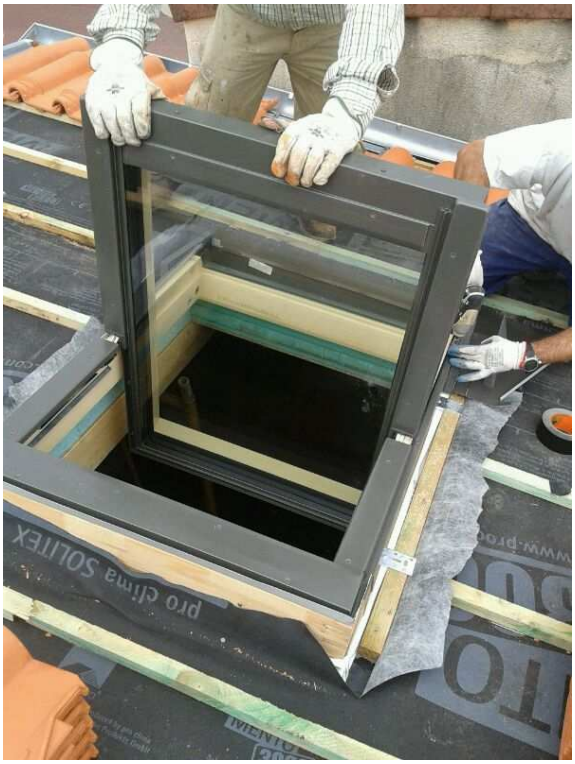


Figure 21: Roof window

Figure 22: Roof airtightness layer

Figure 23: Internal insulation of the facilities chamber

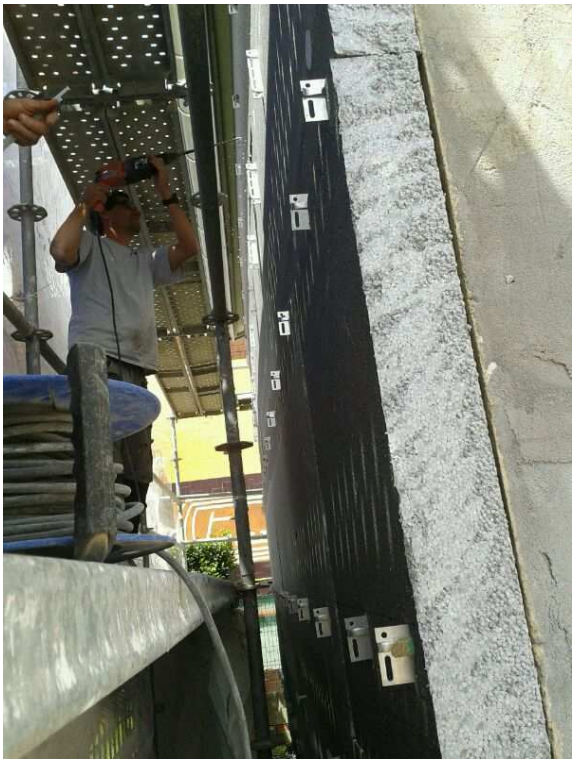


Figure 24: External wall insulation

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

Not available information yet

4.1 General description

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

Not available information yet

4.2 Retrofit steps carried out

The following figure presents the chosen efficiency improvement steps expected to be carried out after completion of the overall refurbishment plan:

Varianten: 1-Existing Building | 2-External walls | 3-Ceiling to Basem | 4-Windows +Ventil | 5-Roof Insulation | 6-PV Panels

Platzhalter

Variantenberechnung

Passivhaus-Projektierung mit PHPP 9.1

Passivhaus-Endhaus Kranichstein / Klima: Deutschland: PHPP-Standard / EBF: 156 m² / Heizen: 13,64 kWh/(m²a) / Übertemperatur: 1,5 % / PE: 60,1 kWh/(m²a)

		aktiv	1	2	3	4	5	6
	aktive Variante wählen >>	6-PV Panels	Existing Building	External walls	Ceiling to Basement	Windows + Ventilation	Roof Insulation	PV Panels
Ergebnisse	Einheit	6	1	2	3	4	5	6
Specific Heating Demand	kwh/(m²a)	13,6	354,3	114,7	106,4	22,8	13,6	13,6
Heizlast	W/m²	10,1	151,1	65,1	63,5	14,2	10,1	10,1
Kühlbedarf gesamt	kwh/(m²a)							
Kühllast	W/m²							
Übertemperaturhäufigkeit	%	1,5	0,6	0,3	0,8	1,8	1,5	1,5
Primary Energy Demand	kwh/(m²a)	60,1	457,1	174,5	164,7	70,5	60,1	60,1
Zertifizierbar als EnerPHit-Modernisierung (nach Heizwärmebedarf)?	ja / nein	ja	nein	nein	nein	ja	ja	ja
<< Additional PV Gains	kWh/a	25,33						25,3
Year of Implementation	Date	2035	1991	2014	2016	2024	2034	2035
Eingangsgrößen	Einheit	Wert	1	2	3	4	5	6

Figure 25: PHPP9 beta [PHI 2013] Variant sheet with the retrofit steps carried out

4.2.1 Building data

Construction Time :

Last retrofit :

Building use :

General condition :

Occupancy :

Treated floor Area :

Other :

4.2.2 Client

Name / Company :
Address :
Email :
Other :

4.3 Envelope of the refurbished Building

4.3.1 Floor slab

Description :
U-Value [W/(m²K)] :
Installation date :
Condition :
Next replacement :
Other :

4.3.2 External walls

Description :
U-Value [W/(m²K)] :
Installation date :
Condition :
Next replacement :
Other :

4.3.3 External walls to ground

Description :
U-Value [W/(m²K)] :
Installation date :
Condition :
Next replacement :
Other :

4.3.4 Windows

Description :
U-Value [W/(m²K)] :
Installation date :
Condition :
Next replacement :

Other :

4.3.5 Roof / Top floor ceiling

Description :
U-Value [W/(m²K)] :
Installation date :
Condition :
Next replacement :
Other :

4.4 Technical equipment of the refurbished building

4.4.1 Heating

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

4.4.2 Domestic hot water

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

4.4.3 Ventilation

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

4.5 Energy efficiency of the refurbished building

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

Work in progress

4.5.1 Modelled efficiency parameters

PHPP: specific heating demand [kWh/(m²K)]	:	24
PHPP: specific cooling demand | Overheating frequency [kWh/(m²K) | %]	:	4 / 7,7
PHPP: specific primary energy demand [kWh/(m²K)]	:	84

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.

Comprobación Passivhaus

Edificio:	Casa Centón				
Calle:	Camarreal				
CP / Ciudad:	Santander				
País:	España				
Tipo de edificio:	Single home refurbishment				
Clima:	[ES] - Bilbao, Bizkaia C1	Altitud del sitio del edificio (en [m] sobre el nivel del mar):	100		
Propietario / cliente:	Rufino Blanco Pérez				
Calle:	C/Camarreal nº67				
CP / Ciudad:	Santander				
Arquitectura:					
Calle:					
CP / Ciudad:					
Instalaciones:					
Calle:					
CP / Ciudad:					
Año construcción:	2014	Temperatura interior invierno:	20,0 °C	Volumen exterior V_e m³:	270,6
Nr. de viviendas	1	Temperatura interior verano:	25,0 °C	Refrigeración mecánica:	
Nr. de personas:	2,2	GIC invierno:	2,1 W/m²		
Capacidad específica:	60 Wh/K por m² de SRE	GIC verano:	4,4 W/m²		

Valores característicos del edificio con relación a la superficie de referencia energética y año

				Requerimientos	¿Cumplido?*
	Superficie de referencia energética	75,8	m²		
Calefacción	Demanda de calefacción	24	kWh/(m²a)	15 kWh/(m²a)	no
	Carga de calefacción	11	W/m²	10 W/m²	no
Refrigeración	Demanda total refrigeración		kWh/(m²a)	-	-
	Carga de refrigeración		W/m²	-	-
	Frecuencia de sobrecalentamiento (> 25 °C)	7,7	%	-	-
Energía primaria	Calef., ref., deshum., ACS, elect. auxiliar, ilum., aparatos eléct.	84	kWh/(m²a)	120 kWh/(m²a)	sí
	ACS, calefacción y electricidad auxiliar	47	kWh/(m²a)	-	-
	Ahorro de EP a través de electricidad solar		kWh/(m²a)	-	-
Hermeticidad	Resultado ensayo de presión n50	1,0	1/h	0,6 1/h	no

EnerPHit (rehabilitación): valores característicos de los elementos constructivos

Envolvente térmica	Aislamiento hacia el aire exterior	0,19	W/(m²K)	-	-
Valor-U medio	Aislamiento contra el terreno	0,34	W/(m²K)	-	-
	Aislamiento interior hacia aire exterior		W/(m²K)	-	-
	Aislamiento interior contra el terreno		W/(m²K)	-	-
	Puentes térmicos ΔU	0,01	W/(m²K)	-	-
	Ventanas	1,11	W/(m²K)	-	-
	Puertas exteriores	1,20	W/(m²K)	-	-
Sist. de ventilación	Eficiencia recuperación de calor	88	%	-	-

* Campo vacío: faltan datos; '-': sin requerimiento

Passivhaus?	no

Figure 26: Specific energy efficiency values of the completed project modelled with PHPP 9 Beta

4.6 Pictures / Drawings

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

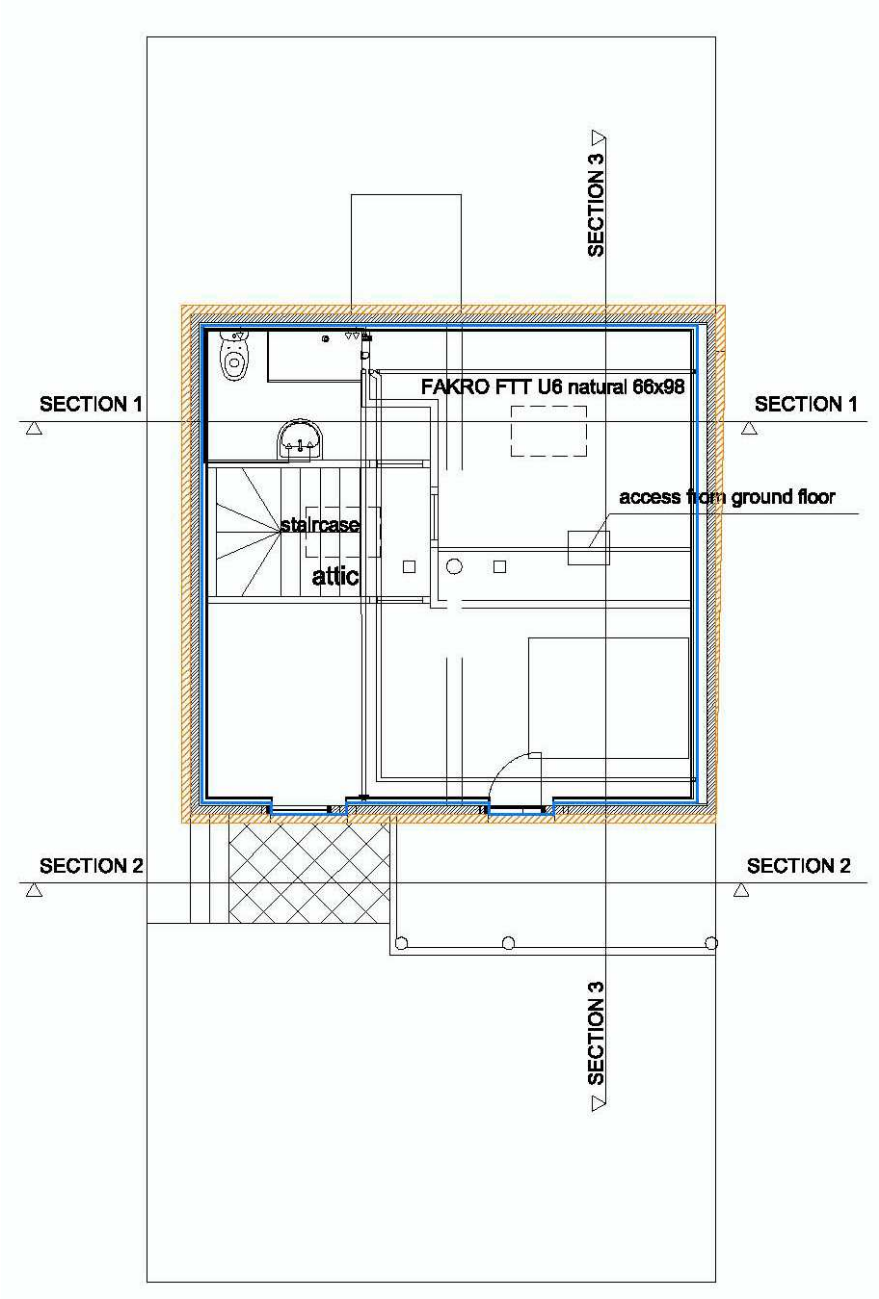


Figure 27: Ground floor

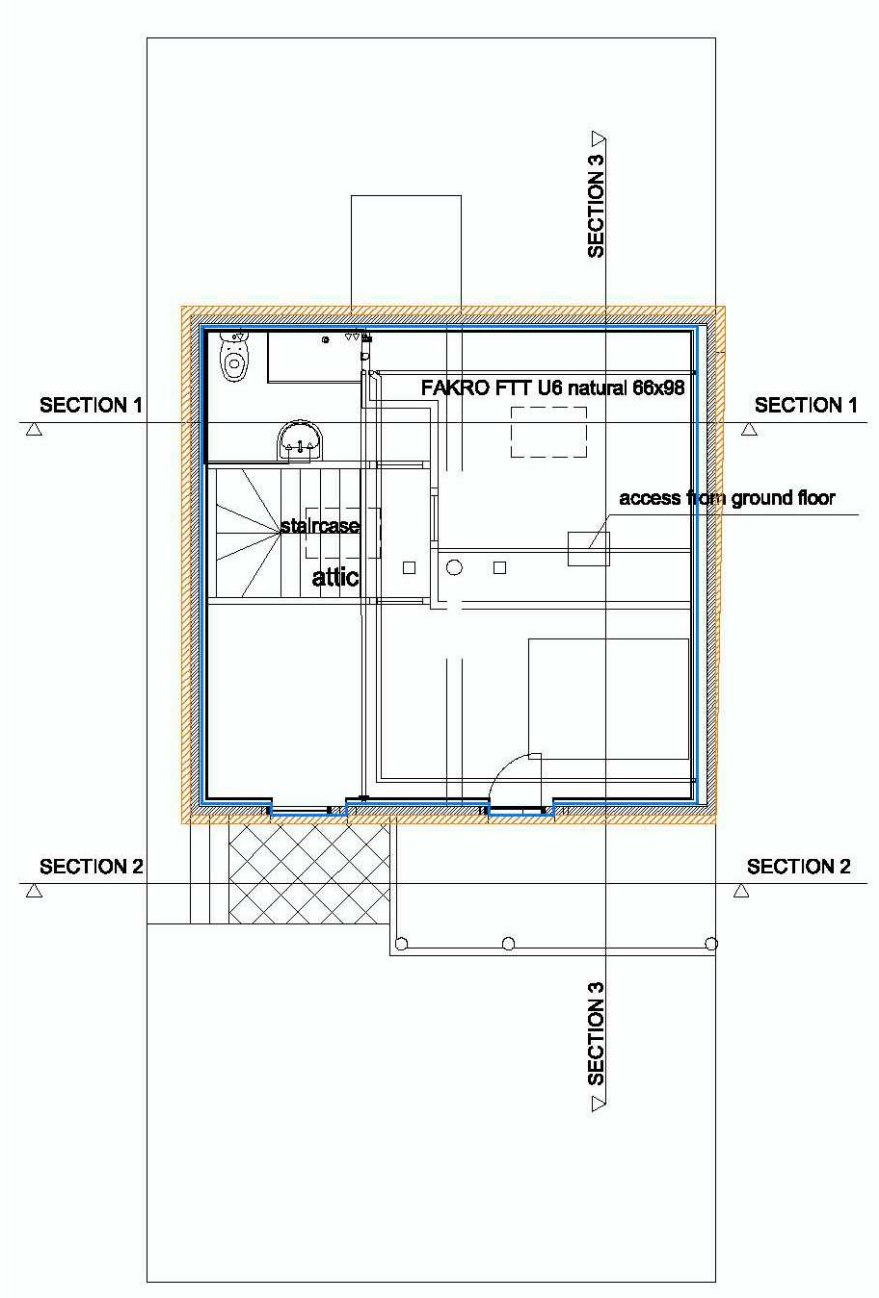
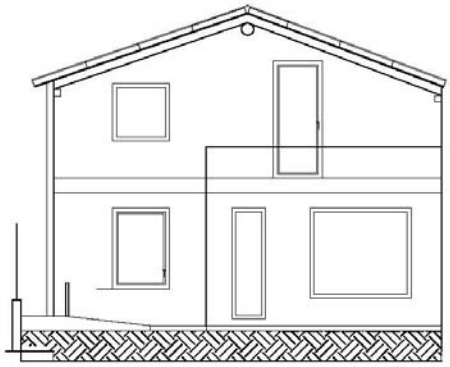
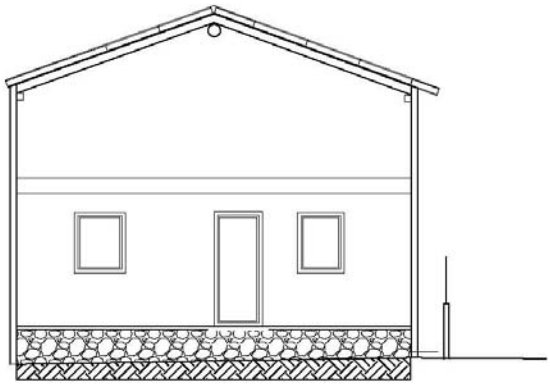


Figure 28: First floor

South



North



West

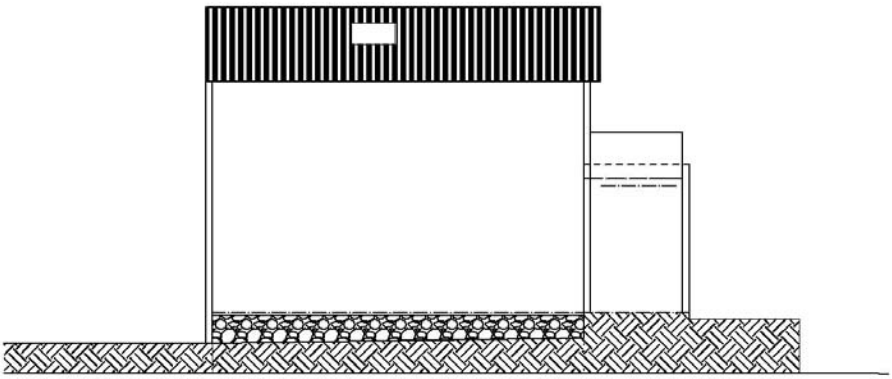


Figure 29: Elevations

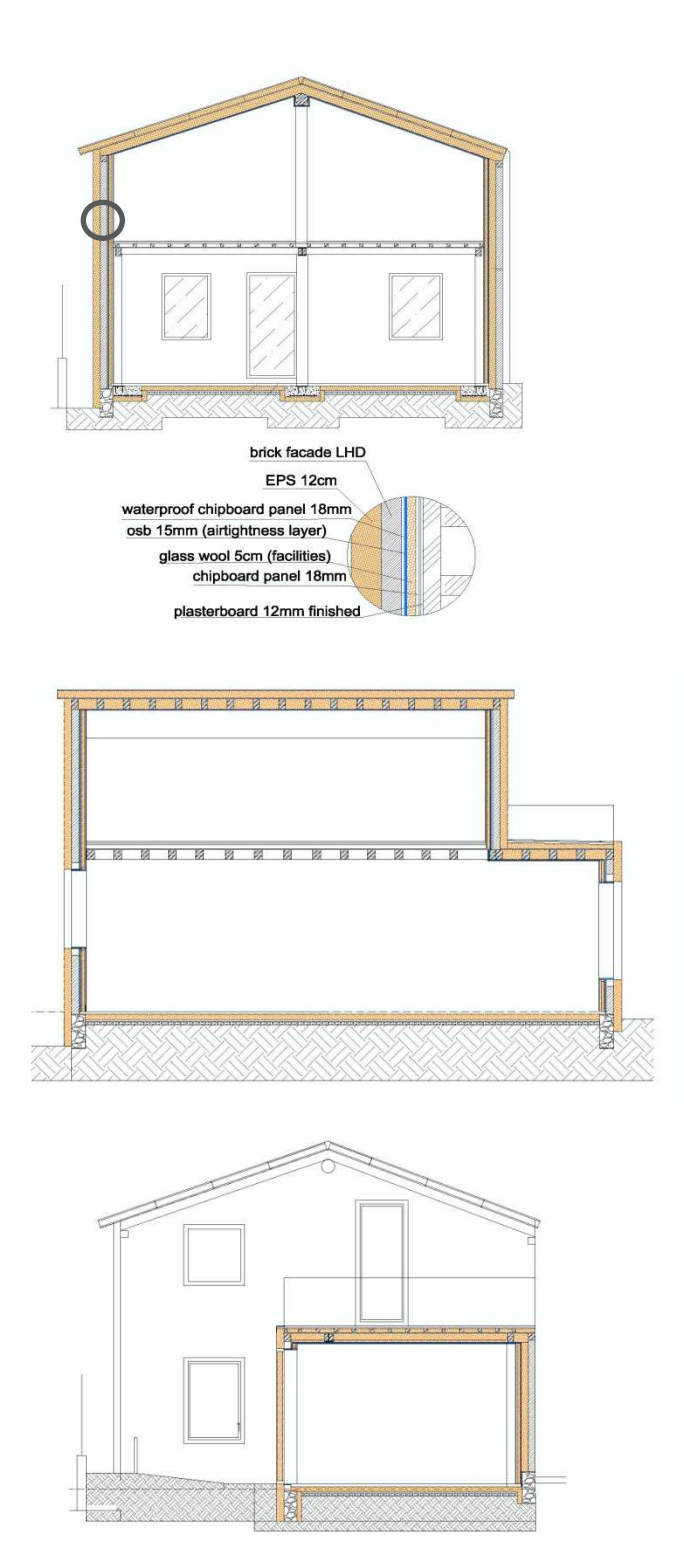
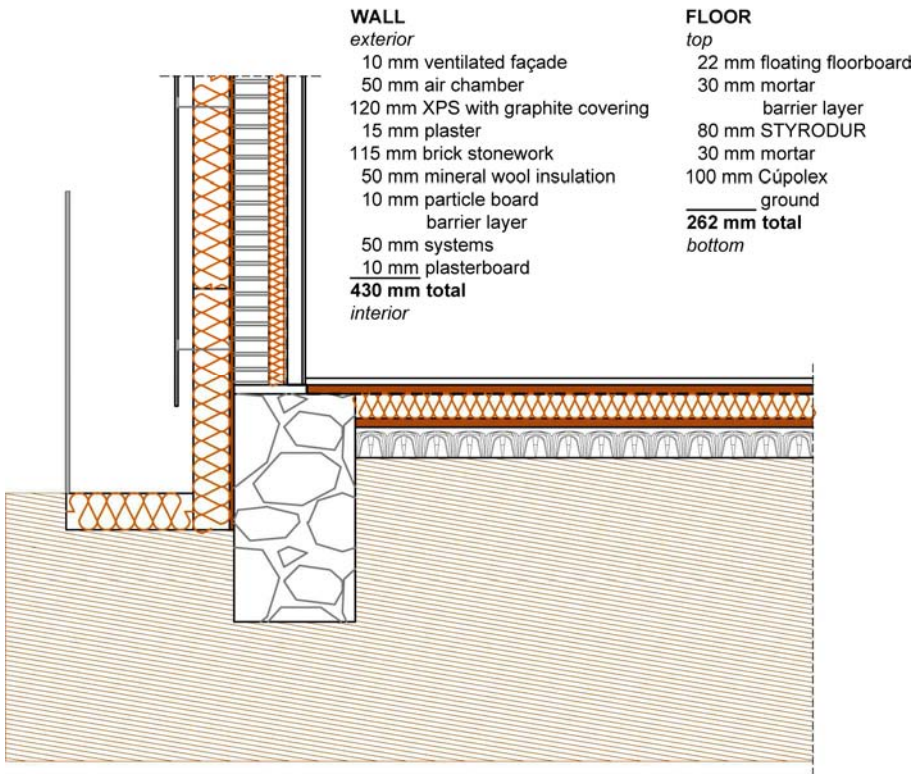
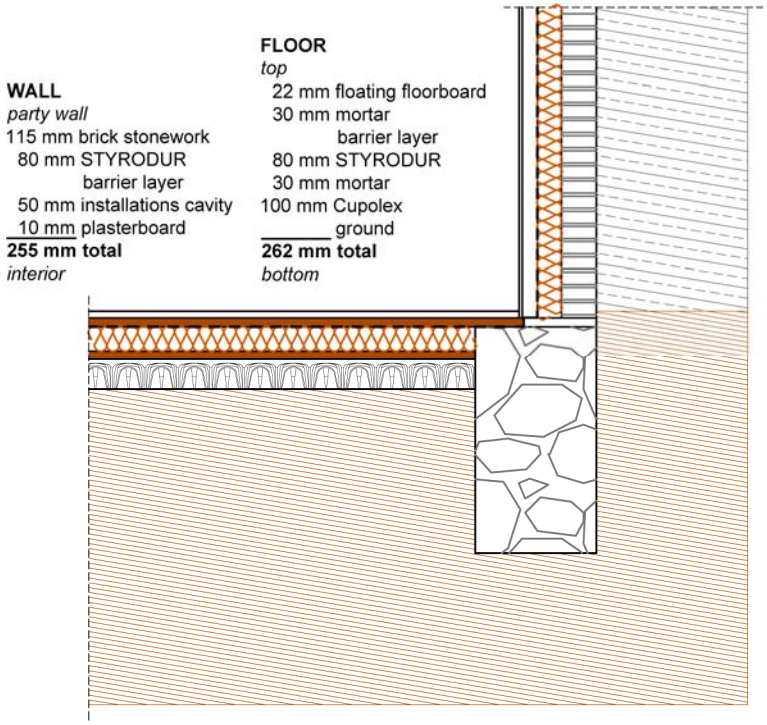


Figure 30: Sections

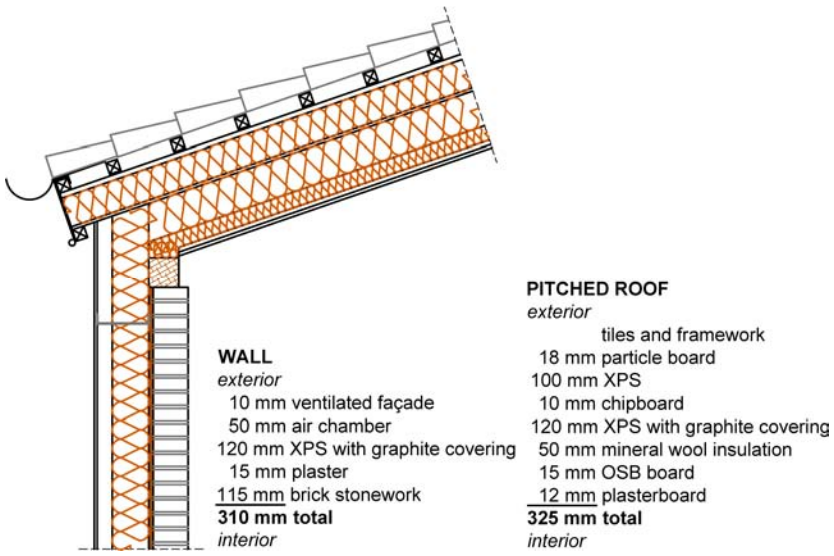
Wall and ground floor connection:



Neighbour's wall and ground floor connection:



Wall and pitched roof connection:



Neighbour's wall and concrete pillar corner connection:

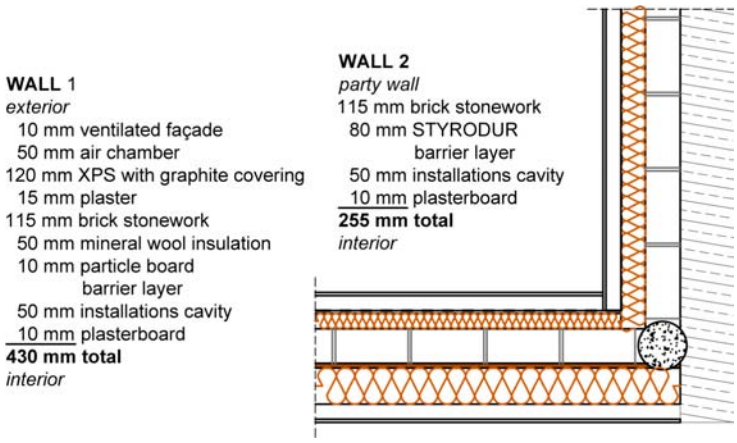


Figure 31: Construction details

5 RES Strategy / PV potential Evaluation

Not available information yet

5.1 Inhabitant's comfort and location concept

5.2 Evaluation of potential BIPV systems

5.3 Production estimation

PV type	:	Poly-Si
Location	:	On the roof
Installed PV area [m²]	:	24
Installed peak power [Wp]	:	2200
Annual RES gains [kWh]	:	1800
Other	:	

6 Refurbishment to the current National Standards

Work in progress

6.1 General Description

Add a more detailed description of the main differences between the building retrofitted according to national regulations and EnerPHit standard.

6.2 Efficiency results comparison table

	Existing building	National regulations	EnerPHit standard	Differences [%]
Space heat demand [kWh/(m²/a)]	430	62	24	9%
Primary energydemand [kWh/(m²/a)]	809	131	111	
Heat Load [W/m²]	114		12	

Figure 32: Comparison of efficiency results

6.3 Building envelope comparison table

	Existing building	National regulations	EnerPHit standard	Differences [%]
Airtightness Pressure test n50 [1/h]	5.0	5.0	1.0	20%
Building envelope				
Floor Slab [W/(m²K)]	3.77	0.18	0.12	
Walls to ground [W/(m²K)]	3.69	0.18	0.15	
Walls [W/(m²K)]	4.35	0.16	0.13	
Roof / Attic ceilings [W/(m²K)]				
Windows [W/(m²K)]	1.6	1.6	1.1	
Doors [W/(m²K)]	3	1.6	1.1	
Thermal bridging ΔU[W/(m²K)]	0.15	0.08	0.01	

Figure 33: Comparison of building envelope components

6.4 Building equipment comparison table

	Existing building	National regulations	EnerPHit standard	Differences [%]
Ventilation	**Natural**	**Natural**	**Zehnder comfoair**	
HR Efficiency [%]			84	
Electric efficiency [Wh/m³]			0,29	
Ducting				
Heating	**Boiler**		**Heat pump**	
Energy source	Gas		Electricity	
Performance ratio of heat generation [%]				
Thermal output kW				
Insulation of pipes				
Domestic hot water	**Gas**		**Heat pump**	
Energy source	Gas		Electricity	
Performance ratio of heat generation [%]				
Thermal output kW				
Insulation of pipes				
Cooling	**Gas**		**Heat pump**	
Energy source	Gas		Electricity	
Performance ratio of cooling generation [%]				
Thermal output kW				
Insulation of pipes				

Figure 34: Comparison of building envelope components

6.5 RES implementation comparison table

	Existing building	National regulations	EnerPHit standard	Differences [%]
Renewables	None	Either 10 kWh/m²/yrof Domestic hot water heating or 4 kWh/m²/yr of electrical energy – Baxi CHP meets target	Either 10 kWh/m²/yrof Domestic hot water heating or 4 kWh/m²/yr of electrical energy – Baxi CHP meets target	

Figure 35: Comparison of building envelope components