EuroPHit

D3.9_Overall Refurbishment Plan

Project: 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 refurbishment and 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
Project Coordinator	Jan Steiger Passive House Institute, Dr. Wolfgang Feist Rheinstrasse 44/46 D 64283 Darmstadt jan.steiger@passiv.de
Project Duration	1 April 2013 – 31March 2016 (36 Months)

Deliverable No.	D3.9
Dissemination Level	PU
Work Package	WP3_Practical Implementation
Lead beneficiary	04_MosArt
Contributing beneficiary(ies)	07_PEP
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Co-author(s)	Mercedes Sánchez Mateos
Date	31 03 2016
File Name	EuroPHit_3.9_CS16_CentonHouse.doc

EnerPHit Retrofit Plan

#¡REF!

EuroPHit

Object:	Casa Centón		
Street:	Camarreal		
Postcode/city:	39011	End-of-terrace Passive House	
Province/country:	Asturias	Passivhaus-Reihenendhaus	
Object type:	Single home refurbishment		
Climate data set:	ES0032a-Santander		
Climate zone:	4: Warm-temperate	Altitude of location:	100

Owner:	Rufino Blanco Pérez	
Street:	C/Camarreal nº67	
Postcode/city:	39011	Santander
Province/country:	Asturias	ES-Spain

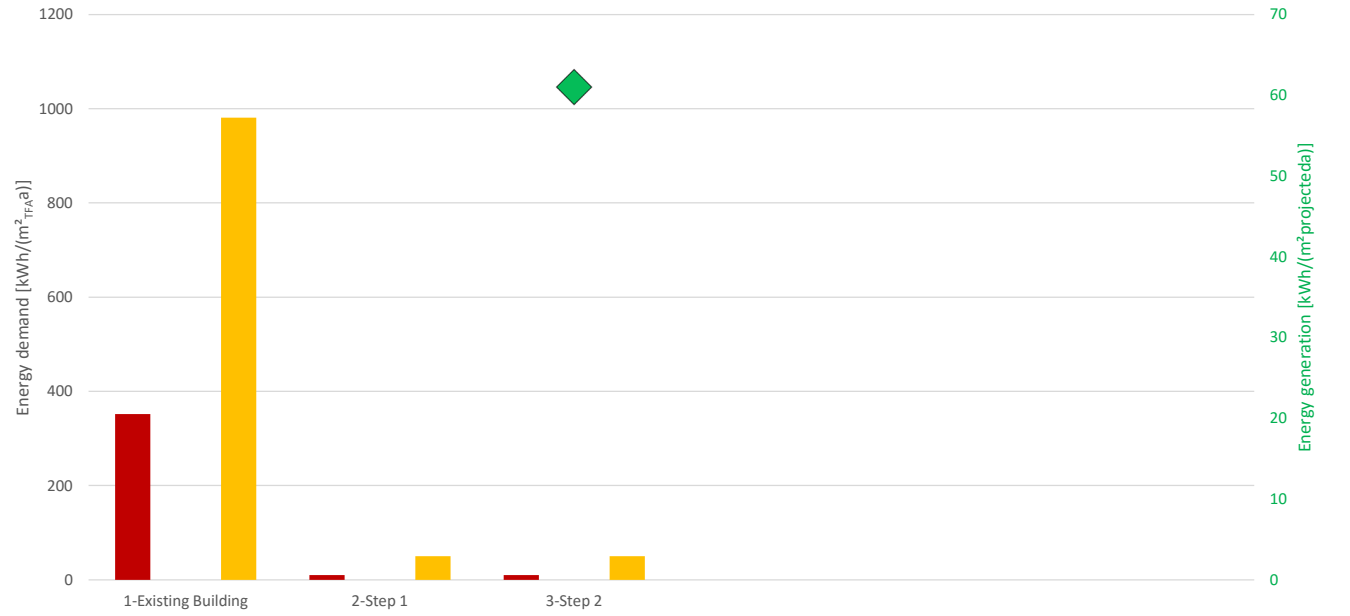
Architecture:		
Street:		
Postcode/city:		
Province/country:		

Tech. systems:	Cesar Blanco	
Street:		
Postcode/city:		Santander
Province/country:	Asturias	ES-Spain

Energy consulting:	VAND Arquitectura	
Street:	C/ Villablanca, 85	
Postcode/city:	28032	Madrid
Province/country:	Madrid	ES-Spain

Certification:		
Street:		
Postcode/city:		
Province/country:		

Year of construction:	1950	Interior temp. winter [°C]:	20,0	Interior temp. summer [°C]:	25,0
Number of dwelling units:	1	Treated floor area:	75,8	No. of occupants	1,9



I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

First name	Last name	Signature

Company	Issued (date)	City

, 0.1.1900

Dear building owner,

in the next few years you intend to modernise your building and to improve stepwise its level of thermal protection. This "EnerPHit Retrofit Plan" will help you to make the right decisions at each step.

EnerPHit Standard

In the case of refurbishments of existing buildings, it is not always possible to fully achieve the Passive House Standard with reasonable effort. The reasons for this lie e.g. in the unavoidable thermal bridges due to existing basement walls. For such buildings, the Passive House Institute has developed the EnerPHit Standard. With the use of Passive House components, EnerPHit retrofitted buildings offer almost all the advantages of a Passive House building with optimum cost-effectiveness at the same time:

• Comfortable living with uniformly warm walls, floors and windows
• Draughts, condensation and mould growth are no longer a problem
• Permanent supply of fresh air with a pleasant temperature
• Independence from energy price fluctuations
• Financial profits from the very first year on due to up to 90 % reduced heating costs
• Climate protection due to decreased CO2 emissions of the same scale

EnerPHit Retrofit Plan

Most buildings are modernised in a step-by-step way when the respective building component needs to be renewed. Advantage can be taken of such opportunities to carry out future-oriented improvements to the thermal protection of the building. For example, if the façade already needs to be renewed anyway, the extra effort for thermal protection of the exterior wall to the Passive House quality at the same time will be manageable. Nevertheless, many interdependencies exist between individual energy efficiency measures, so that a good standard of thermal protection can only be achieved cost-effectively if an overall concept is prepared for the entire building prior to the first modernisation step. With the modernisation route planner, such an overall concept will be worked out for you by your Passive House Designer or energy consultant. This offers you the following advantages:

• Preparing for future steps already with today's measures will save costs on the whole and will ensure an optimal final outcome.
• An excellent final outcome can only be achieved if each individual step is implemented with the appropriate quality (EnerPHit-Standard).
• Once the overall concept has been prepared, it is available for every further step and thus facilitates the planning process (you don't have to start from the beginning every time).
• The energy demand is stated for each step.
• The approximate time points for upcoming refurbishment measures are stated in the general plan. This serves as a valuable aid for personal finance planning.

The modernisation route planner as well as other relevant documents can be checked by a PHI accredited certifier for additional quality assurance. If the examination shows that the EnerPHit Standard will be achieved with the implementation of all planned measures, then the first step can be carried out. After this a preliminary EnerPHit certificate can then be issued for the building. If quality assurance is continued accordingly for each step, then the full EnerPHit certificate will be issued for the building upon completion of the last step. A preliminary certificate increases the value of your building because its potential is clearly demonstrated. It also increases the credibility of the refurbishment concept in the context of talks with the bank e.g. because the achievable cost saving is available in a reliably calculated way. Apart from that, you can demonstrate to the outside world that you are committed to climate protection.

I wish you every success with your retrofit project!

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Scheduler

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Retrofit steps:		1													2		3									
Assemblies	Last renewal	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2016	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065
Render facade	2016																								
Facade decoration	2016																								
Balconies/Loggias	2016																								
Exterior door	2016																								
Pitched roof covering	2016																								
Flat roof	2016																								
Roof weatherings	2016																								
Window	2016																								
Blinds / sun screens	2016																								
Floor slab	2016																								
Boiler	2016																								
Ventilation	2016														X										
PV	2025																								
Airtightn. test: X, Leakage search: (X)																									

Initial condition

X Retrofit dates

Main-tenance

Smaller Repairs

Extensive Repairs

Immediate replacement

Overview of measures

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Retrofit step No.		1-Existing Building	2-Step 1	3-Step 2				Criteria	Alternative criteria
Year		Until 2014	2015	2025					
Measures									
Occasion ("anyway measure")	1		New foundation	None					
Energy-saving measure			Floor slab insulation	PV					
Occasion ("anyway measure")	2		Pitched roof - new structure and covering						
Energy-saving measure			Pitched roof insulation						
Occasion ("anyway measure")	3		Exterior wall - new render						
Energy-saving measure			External wall - insulation						
Occasion ("anyway measure")	4		Windows - replacement						
energy-saving measure			Windows - Passivhaus						
Occasion ("anyway measure")	5		None						
energy-saving measure			Heat recovery ventilation						
Occasion ("anyway measure")	6		Heating systems replacement						
energy-saving measure			High efficiency heating systems						
Occasion ("anyway measure")	7								
energy-saving measure									
Occasion ("anyway measure")	8								
energy-saving measure									
Component characteristics									
Wall to ambient air, ext. insulation (U-value)	[W/(m²K)]								
Roof (U-value)	[W/(m²K)]								
Building envelope to ambient (U value)	[W/(m²K)]	2,39	0,16	0,16				#¡REF!	-
Wall to ground, ext. insulation (U-value)	[W/(m²K)]								
Basement ceiling / floor slab (U-value)	[W/(m²K)]								
Building envelope to ground (U-value)	[W/(m²K)]	1,05	0,34	0,34				#¡REF!	-
Wall, int. insulation to ambient air (U-Value)	[W/(m²K)]							#¡REF!	-
Wall, int. insulation to ground (U-Value)	[W/(m²K)]							#¡REF!	-
Flat roof (solar reflection index, SRI)	[W/(m²K)]	122,00	122,00	122,00				#¡REF!	-
Inclined and vertical external surface (SRI)	[W/(m²K)]	122	122	122				#¡REF!	-
Windows / doors ($U_{installed}$)	[W/(m²K)]	4,25	1,03	1,03				#¡REF!	-
Windows ($U_{W,installed}$)	[W/(m²K)]							#¡REF!	-
Windows ($U_{W,installed}$)	[W/(m²K)]		1,10	1,10				#¡REF!	-
Glazing (g-value)	[]	0,87	0,49	0,49				#¡REF!	-
Glazing/sun protection (max. solar load)	[kWh/(m²a)]	286	78	78				#¡REF!	-
Ventilation (effective heat recovery efficiency)	[%]	0	88	88				#¡REF!	-
Ventilation (effective humidity recovery efficiency)	[%]							#¡REF!	-
Airchange at press. test n_{50}	[1/h]							#¡REF!	-
Building characteristics									
Heating demand	[kWh/(m²a)]	352	10	10				#¡REF!	#¡REF!
Heating load	[W/m²]	109	7	7				#¡REF!	#¡REF!
Cooling + dehumidification demand	[kWh/(m²a)]							#¡REF!	#¡REF!
Cooling load	[kWh/(m²a)]							#¡REF!	#¡REF!
Frequency of overheating (> 25 °C)	[%]	0	0	0				#¡REF!	-
Frequency of exc. high humidity (> 12 g/kg)	[%]							#¡REF!	-
Non-renewable primary energy (PE demand)	[kWh/(m²a)]							#¡REF!	-
Renewable primary energy (PER demand)	[kWh/(m²a)]	981	50	50				#¡REF!	#¡REF!
Renewable primary energy generation (reference to projected building footprint)	[kWh/(m²a)]	0	0	61				#¡REF!	#¡REF!
#¡REF!									
Costs									
Energy-related invest. (interest+repayment)	[€/year]								
Expected energy costs (total of all energy use in the building)	[€/year]								
Total cost (investment+energy)	**[€/year]**								

Investment and maintenance costs

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

	Retrofit step No.	1-Existing Building	2-Step 1	3-Step 2			
	Year	Until 2014	2015	2025			
1	**Occasion ("anyway measure")**		**New foundation**	**None**			
	Investment costs		90 €				
	Maintenance costs		0 €				
	Energy-saving measure		**Floor slab insulation**	**PV**			
	Investment costs		648 €				
	Financial support (present value)		0 €				
	Maintenance costs		0				
	Service life [years]		50				
	Present value factor	0 €	0 €	0 €	0 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €	0 €
	Annuity ("anyway measure")	0 €	0 €	0 €	0 €	0 €	0 €
	Annuity (Energy saving measure)	0 €	0 €	0 €	0 €	0 €	0 €
	Annuity (energy-related)	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**
2	**Occasion ("anyway measure")**		**Pitched roof - new structure and covering**				
	Investment costs		6.300 €				
	Maintenance costs		0 €				
	Energy-saving measure		**Pitched roof insulation**				
	Investment costs		8.384 €				
	Financial support (present value)		0 €				
	Maintenance costs		0 €				
	Service life [years]		50				
	Present value factor	0 €	32 €	0 €	0 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €	0 €
	Annuity ("anyway measure")	0 €	200 €	0 €	0 €	0 €	0 €
	Annuity (Energy saving measure)	0 €	266 €	0 €	0 €	0 €	0 €
	Annuity (energy-related)	**0 €**	**66 €**	**0 €**	**0 €**	**0 €**	**0 €**
3	**Occasion ("anyway measure")**		**Exterior wall - new render**				
	Investment costs						
	Maintenance costs						
	Energy-saving measure		**External wall - insulation**				
	Investment costs		15.823 €				
	Financial support (present value)		0 €				
	Maintenance costs		0 €				
	Service life [years]		50				
	Present value factor	0 €	32 €	0 €	0 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €	0 €
	Annuity ("anyway measure")	0 €	0 €	0 €	0 €	0 €	0 €
	Annuity (Energy saving measure)	0 €	501 €	0 €	0 €	0 €	0 €
	Annuity (energy-related)	**0 €**	**501 €**	**0 €**	**0 €**	**0 €**	**0 €**
4	**Occasion ("anyway measure")**		**Windows - replacement**				
	Investment costs						
	Maintenance costs						
	Energy-saving measure		**Windows - Passivhaus**				
	Investment costs		9.624 €				
	Financial support (present value)		0 €				
	Maintenance costs		0 €				
	Service life [years]		40				
	Present value factor	0 €	27 €	0 €	0 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €	0 €
	Annuity ("anyway measure")	0 €	0 €	0 €	0 €	0 €	0 €
	Annuity (Energy saving measure)	0 €	351 €	0 €	0 €	0 €	0 €
	Annuity (energy-related)	**0 €**	**351 €**	**0 €**	**0 €**	**0 €**	**0 €**
5	**Occasion ("anyway measure")**		**None**				
	Investment costs						
	Maintenance costs						
	Energy-saving measure		**Heat recovery ventilation**				
	Investment costs		4.565 €				
	Financial support (present value)		0 €				
	Maintenance costs		100 €				
	Service life [years]		30				
	Present value factor	0 €	22 €	0 €	0 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €	0 €
	Annuity ("anyway measure")	0 €	0 €	0 €	0 €	0 €	0 €
	Annuity (Energy saving measure)	0 €	303 €	0 €	0 €	0 €	0 €
	Annuity (energy-related)	**0 €**	**303 €**	**0 €**	**0 €**	**0 €**	**0 €**
6	**Occasion ("anyway measure")**		**Heating systems replacement**				
	Investment costs						
	Maintenance costs						
	Energy-saving measure		**High efficiency heating systems**				
	Investment costs						
	Financial support (present value)						
	Maintenance costs						
	Service life [years]						
	Annuity (energy-related)	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**
7	**Occasion ("anyway measure")**						
	Investment costs						
	Maintenance costs						
	Energy-saving measure						
	Investment costs						
	Financial support (present value)						
	Maintenance costs						
	Service life [years]						
	Annuity (energy-related)	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**
8	**Occasion ("anyway measure")**						
	Investment costs						
	Maintenance costs						
	Energy-saving measure						
	Investment costs						
	Financial support (present value)						
	Maintenance costs						
	Service life [years]						
	Annuity (energy-related)	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**
	Total annuities (energy-related)	0 €	1.221 €	0 €	0 €	0 €	0 €
	Cumulated sums	**0 €**	**1.221 €**	**1.221 €**	**1.221 €**	**1.221 €**	**1.221 €**

Boundary conditions: Nominal interest rate 3,0% Inflation 1,0% Real interest rate 2,0%

Building assemblies (U-values)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Assembly: **05ud-Floor slab** Area: #¡REF! m²

Areas with this assembly:

Retrofit step: **1-Existing Building** Until 2014

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Floating board	0,150					15
Air layer	0,110					20
EPS	0,040					10
Ceramic tile	0,080					20
	0,000					0

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total	
100%	0%	0%	**6,5**	cm

U-value supplement: 0 W/(m²K) **U-value:** **3,403** W/(m²K)

▼ subsequent steps

Retrofit step: **2-Step 1** 2015

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Floating board	0,130					22
Air layer	2,300					30
EPS	0,034					80
Ceramic tile	2,300					30
	0,450					100

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total	
100%	0%	0%	**26,2**	cm

U-value supplement: 0 W/(m²K) **U-value:**

▼ subsequent steps

preparation for subsequent steps:

current measure:

7-Basement ceiling/floor slab insulation

Assembly: **05ud-Floor slab**

Advice

Plan / sketch / image

STEP 1 C(Inside - Outside): 22 mm Floating board + 30 mm mortar + 80 mm XPS + 30 cm mortar

Building assemblies (U-values)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Assembly: **01ud-Exterior wall** Area: #¡REF! m²

Areas with this assembly: **E2 AIR, N1 AIR, O1 AIR, O2 AIR**

Retrofit step: 1-Existing Building Until 2014

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Brick	0,667					115
Air layer	0,270					50
Brick	0,667					40
	0,000					0
	0,000					0
	0,000					0
	0,000					0

Fraction subarea 1: 100% | Fraction subarea 2: 0% | Fraction subarea 3: 0% | Total: **20,5** cm

U-value supplement: 0 W/(m²K) **U-value:** W/(m²K)

▼ subsequent steps

Retrofit step: 2-Step 1 2015

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Brick	0,031					120
Air layer	2,300					15
Brick	0,667					115
	0,039					50
	0,130					10
	0,230					50
	0,250					10

Fraction subarea 1: 100% | Fraction subarea 2: 0% | Fraction subarea 3: 0% | Total: **37,0** cm

U-value supplement: 0 W/(m²K) **U-value:** W/(m²K)

▼ subsequent steps

preparation for subsequent steps:

current measure:

1-Thermal insulation on the outside

Assembly: **01ud-Exterior wall**

Advice

Plan / sketch / image

STEP 1 (Outside-Inside): 120 mm EPS + 15 mm plaster + 115 mm brick layer + 50 mm mineral wool + 10 mm particle board + 50 mm systems + 10 mm plasterboard

Building assemblies (U-values)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Assembly: **07ud-Exterior wall (no insulation inside)** Area: #¡REF! m²

Areas with this assembly: **S1 AIR, S2 AIR**

Retrofit step: **1-Existing Building** Until 2014

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
	0,667					115
	0,270					50
	0,667					40
	0,000					0
	0,000					0

▼ subsequent steps

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total	
100%	0%	0%	**20,5**	cm

U-value supplement: 0 W/(m²K) **U-value:** W/(m²K)

Retrofit step: **2-Step 1** 2015

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
	0,031					120
	2,300					15
	0,667					115
	0,230					50
	0,250					12

▼ subsequent steps

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total	
100%	0%	0%	**31,2**	cm

U-value supplement: 0 W/(m²K) **U-value:** W/(m²K)

preparation for subsequent steps:

current measure:

1-Thermal insulation on the outside

Assembly: **07ud-Exterior wall (no insulation inside)**

Advice

Plan / sketch / image

STEP 1 (Outside-Inside): 120 mm EPS + 15 mm plaster + 115 mm brick layer + 50 mm systems + 10 mm plasterboard

Building assemblies (U-values)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Assembly: **06ud-Exterior wall (south 1st floor)** Area: #¡REF! m²

Areas with this assembly: **S4 AIR**

Retrofit step: 1-Existing Building Until 2014

Subarea 1 λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
0,667					115
0,000					0
0,000		0,130			0
0,000					0
0,000					0
0,000					0

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total	
75%	25%	0%	**11,5**	cm

U-value supplement 0 W/(m²K) **U-value:** W/(m²K)

▼ subsequent steps

Retrofit step: 2-Step 1 2015

Subarea 1 λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
0,031					120
0,130					10
0,039		0,130			100
0,130					10
0,230					50
0,250					10

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total	
75%	25%	0%	**30,0**	cm

U-value supplement 0 W/(m²K) **U-value:** W/(m²K)

▼ subsequent steps

preparation for subsequent steps:

current measure:

1-Thermal insulation on the outside

Assembly: **06ud-Exterior wall (south 1st floor)**

Advice

Plan / sketch / image

STEP 1 (Outside-Inside): 120 mm EPS + 10 mm particle board + 10 mm particle board + 50 mm systems + 10 mm plasterboard

Building assemblies (U-values)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Assembly: **02ud-Neighbour's wall** Area: #¡REF! m²

Areas with this assembly: **#¡REF!**

Retrofit step: **1-Existing Building** Until 2014

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Brick	0,667					115
	0,000					0
	0,000					0
	0,000					0
	0,000					0

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total
100%	0%	0%	**11,5** cm

U-value supplement: 0 W/(m²K) **U-value:** W/(m²K)

▼ subsequent steps

Retrofit step: **2-Step 1** 2015

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Brick	0,667					40
	0,039					40
	0,031					80
	0,230					50
	0,250					10

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total
100%	0%	0%	**22,0** cm

U-value supplement: 0 W/(m²K) **U-value:** W/(m²K)

preparation for subsequent steps:

current measure:

2-Insulation of the wall on the inside

▼ subsequent steps

Assembly: **02ud-Neighbour's wall**

Advice

Plan / sketch / image

STEP 1 (Outside-Inside): 115 mm Brick + 40 mm mineral wool + 80 mm Styrodur + 50 mm systems + 10 mm platerboard

Building assemblies (U-values)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Assembly: **03ud-Pitched roof** Area: #¡REF! m²

Areas with this assembly: **CUB 1, CUB 2**

Retrofit step: **1-Existing Building** Until 2014

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Timber board	0,130					20
	0,000					0
	0,000					0
	0,000					0
	0,000					0
	0,000					0
	0,000					0

Fraction subarea 1: 100% | Fraction subarea 2: 0% | Fraction subarea 3: 0% | Total: **2,0** cm

U-value supplement: 0 W/(m²K) **U-value:** W/(m²K)

▼ subsequent steps

Retrofit step: **2-Step 1** 2015

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Timber board	0,130					18
	0,034					100
	0,130					10
	0,031					120
	0,039					50
	0,130					15
	0,250					12

Fraction subarea 1: 100% | Fraction subarea 2: 0% | Fraction subarea 3: 0% | Total: **32,5** cm

U-value supplement: 0 W/(m²K) **U-value:** W/(m²K)

▼ subsequent steps

preparation for subsequent steps:

current measure:

3-PITCHED ROOF INSULATION

Assembly: **03ud-Pitched roof**

Advice

Plan / sketch / image

STEP 1 (Outside-inside): Covering + 18 mm particle board + 100 mm XPS + 10 mm particle board + 120 mm EPS + 50 mm mineral wool + 15 mm OSB + 12 mm plasterboard

Building assemblies (U-values)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Assembly: **04ud-Flat roof** Area: #¡REF! m²

Areas with this assembly: **CUB 3**

Retrofit step: **1-Existing Building** Until 2014

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Timber board	0,130					20
	0,000					0
	0,000					0
	0,000					0
	0,000					0

Fraction subarea 1		Fraction subarea 2		Fraction subarea 3	Total	
100%	STEP 1 COMPOSITION: Coverin	0%		0%	**2,0**	cm
U-value supplement: 0 W/(m²K)				**U-value:**		W/(m²K)

subsequent steps ▼

Retrofit step: **2-Step 1** 2015

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Timber board	0,130					18
	0,031					80
	0,130					15
	0,034					160
	0,250					12

Fraction subarea 1		Fraction subarea 2		Fraction subarea 3	Total	
100%		0%		0%	**28,5**	cm
U-value supplement: 0 W/(m²K)				**U-value:**		W/(m²K)

subsequent steps ▼

preparation for subsequent steps:

current measure:

1-Thermal insulation on the outside

Assembly: **04ud-Flat roof**

Advice

Plan / sketch / image

STEP 1 (Outside-inside): Covering + 18 mm particle board + 80 mm Styrodur + 15 mm OSB + 160 mm XPS + 12 mm plasterboard

Window (glazing and frame)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Window type:	**a-V1**	#¡REF! m²

Retrofit step	Year	Glazing	U_g	Frame	U_f
1-Existing Building	Until 2014	92ud-Einfachverglasung	#¡REF!	53ud-EXISTENTE: madera 45 mm	2,5

Retrofit step	Year	Glazing	U_g	Frame	U_f
2-Step 1	2015	04ud-Triple acristalamiento con argón	#¡REF!	03ud-Llodiana superconfort	0,97
preparation for subsequent steps:					

Advice
Plan / sketch / image
2-Step 1

Window (glazing and frame)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Window type:	**b-V2**	#¡REF! m²

Retrofit step	Year	Glazing	U_g	Frame	U_f
1-Existing Building	Until 2014	92ud-Einfachverglasung	#¡REF!	53ud-EXISTENTE: madera 45 mm	2,5

Retrofit step	Year	Glazing	U_g	Frame	U_f
2-Step 1	2015	04ud-Triple acristalamiento con argón	#¡REF!	03ud-Llodiana superconfort	0,97
preparation for subsequent steps:					

Advice
Plan / sketch / image
2-Step 1

Window (glazing and frame)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Window type:	c-V3	#¡REF! m²

Retrofit step	Year	Glazing	U_g	Frame	U_f
1-Existing Building	Until 2014	92ud-Einfachverglasung	#¡REF!	53ud-EXISTENTE: madera 45 mm	2,5

Retrofit step	Year	Glazing	U_g	Frame	U_f
2-Step 1	2015	04ud-Triple acristalamiento con argón	#¡REF!	03ud-Llodiana superconfort	0,97
preparation for subsequent steps:					

Advice
Plan / sketch / image
2-Step 1

Window (glazing and frame)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Window type:	**d-V4-V5-V6**	#¡REF! m²

Retrofit step	Year	Glazing	U_g	Frame	U_f
1-Existing Building	Until 2014	92ud-Einfachverglasung	#¡REF!	53ud-EXISTENTE: madera 45 mm	2,5

Retrofit step	Year	Glazing	U_g	Frame	U_f
2-Step 1	2015	04ud-Triple acristalamiento con argón	#¡REF!	03ud-Llodiana superconfort	0,97
preparation for subsequent steps:					

Advice
Plan / sketch / image
2-Step 1

Window (glazing and frame)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Window type:	g-V7	#¡REF! m²

Retrofit step	Year	Glazing	U_g	Frame	U_f
1-Existing Building	Until 2014	92ud-Einfachverglasung	#¡REF!	53ud-EXISTENTE: madera 45 mm	2,5

Retrofit step	Year	Glazing	U_g	Frame	U_f
2-Step 1	2015	04ud-Triple acristalamiento con argón	#¡REF!	03ud-Llodiana superconfort	0,97
preparation for subsequent steps:					

Advice
Plan / sketch / image
2-Step 1

Window (glazing and frame)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Window type:	**h-V8**	#¡REF! m²

Retrofit step	Year	Glazing	U_g	Frame	U_f
1-Existing Building	Until 2014	92ud-Einfachverglasung	#¡REF!	53ud-EXISTENTE: madera 45 mm	2,5

Retrofit step	Year	Glazing	U_g	Frame	U_f
2-Step 1	2015	04ud-Triple acristalamiento con argón	#¡REF!	03ud-Llodiana superconfort	0,97
preparation for subsequent steps:					

Advice
Plan / sketch / image
2-Step 1

Window (glazing and frame)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Window type:	i-V9	#¡REF! m²

Retrofit step	Year	Glazing	U_g	Frame	U_f
1-Existing Building	Until 2014	05ud-Vidrio Fakro FTT U6	#¡REF!	06ud-Fakro FTT (Según PHPP arcones)	0,81

Retrofit step	Year	Glazing	U_g	Frame	U_f
2-Step 1	2015	05ud-Vidrio Fakro FTT U6	#¡REF!	06ud-Fakro FTT (Según PHPP arcones)	0,81
preparation for subsequent steps:					

Advice
Plan / sketch / image
2-Step 1

Window (glazing and frame)

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Window type:	**j-V10**	#¡REF! m²

Retrofit step	Year	Glazing	U_g	Frame	U_f
1-Existing Building	Until 2014	05ud-Vidrio Fakro FTT U6	#¡REF!	06ud-Fakro FTT (Según PHPP arcones)	0,81

Retrofit step	Year	Glazing	U_g	Frame	U_f
2-Step 1	2015	05ud-Vidrio Fakro FTT U6	#¡REF!	06ud-Fakro FTT (Según PHPP arcones)	0,81
preparation for subsequent steps:					

Advice
Plan / sketch / image
2-Step 1

Ventilation systems

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Retrofit step	Year	Ventilation type	Ventilation unit	Heat recovery efficiency	Humidity recovery efficiency	Electric efficiency
1-Existing Building	Until 2014	2-Extract air unit	97ud-Estándar	0,75	0	0,45

Retrofit step	Year	Ventilation type	Ventilation unit	Heat recovery efficiency	Humidity recovery efficiency	Electric efficiency
2-Step 1	2015	ventilation with HR	ComfoAir200,	0,84	0	0,31

Advice
Plan / sketch / image
2-Step 1

Ventilation systems

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Retrofit step	Unit no.		Ventilation unit	Heat recovery efficiency	Humidity recovery efficiency	Electric efficiency
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

preparation for subsequent steps:

Retrofit step	Unit no.		Ventilation unit	Heat recovery efficiency	Humidity recovery efficiency	Electric efficiency
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

preparation for subsequent steps:

Retrofit step	Unit No.		Ventilation unit	Heat recovery efficiency	Humidity recovery efficiency	Electric efficiency
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

preparation for subsequent steps:

Advice ventilation systems

Plan / sketch / image

Description

Heating & cooling

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

	Retrofit step:	1-Existing Building		Until 2014	
		Type	**Type**	**Heating fraction**	**DHW fraction**
Heating	**Primary heat generator**	4-Heating boiler	13-Oil condensing boiler	100%	100%
	Secondary heat generator	-	-	0%	0%
		used?	**Seasonal performance factor**		
Cooling	**Supply air cooling**	-	-		
	Recirculatio cooling	-	-		
	Additional dehumidification	-	-		
	Panel Cooling	-	-		

	Retrofit step:	2-Step 1		2015	
		Type	**Type**	**Heating fraction**	**DHW fraction**
Heating	**Primary heat generator**	2-Heat pump	0-None		100%
	Secondary heat generator	6-Direct electrical (heating resistance / continuous flow water heater)	-	#¡VALOR!	0%
		used?	**Seasonal performance factor**		
Cooling	**Supply air cooling**	-	-		
	Recirculatio cooling	-	-		
	Additional dehumidification	-	-		
	Panel Cooling	-	-		

preparation for subsequent steps:

Advice Heating & cooling

Plan / sketch / image

Description

Photovoltaics

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Step	Technology	Module field area [m²]	Location	Annual electricity yield after inverter	
				absolute [kWh/a]	reference to projected building footprint [kWh/($m^2_{projected}$a)]
1-Existing Building	**None**				

Step	Technology	Module field area [m²]	Location	Annual electricity yield after inverter	
				absolute [kWh/a]	reference to projected building footprint [kWh/($m^2_{projected}$a)]
2-Step 1	**None**				

Step	Technology	Module field area [m²]	Location	Annual electricity yield after inverter	
				absolute [kWh/a]	reference to projected building footprint [kWh/(m²projecteda)]
3-Step 2	**Poly-Si**	**20,00**	**Pitched roof**	**4620,00**	**81,80**

Advice Photovoltaics

Plan / sketch / image

Pannel instaled on both roof eaves

Other advice

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Retrofit step:	1-Existing Building	Until 2014
Advice: ...		

Retrofit step:	2-Step 1	2015
Advice: ...		

Retrofit step:	3-Step 2	2025
Advice: ...		

Retrofit step:		
Advice: ...		

Retrofit step:		
Advice: ...		

Retrofit step:		
Advice: ...		

Attachments

Source file: 'PHPP_V9.3a_EN_CS16_ERP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

Page	Phase	Type	Area	Name of document/plan
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Interrelations

EnerPHit Retrofit Plan: Casa Centón, Santander, ES-Spain

	current step	subsequent steps									
		1-Thermal insulation on the outside	2-Insulation of the wall on the inside	3-Pitched roof insulation	4-Flat roof insulation	7-Basement ceiling/floor slab insulation	8-Perimeter insulation	9-Window/entrance door replacement	10-Boiler	12-Ventilation system	13-Photovoltaics
1	**Thermal insulation on the outside**			Provide the possibility of later connection to the pitched roof insulation without any gaps	Extend insulation over top of roof parapet, so that the roof insulation can be connected without interruption later on, and without interfering with the finished facade. Extend tin covering of the roof parapet sufficiently to the inner side, so that subsequent insulation of the roof parapet from the inner side is possible.		No metallic base profiles (thermal bridge)	Prepare for later window/door installation in a thermally optimal position (in the insulation layer).	If necessary, decrease the forward flow temperature	Possibly already create penetrations in the exterior wall for fresh air and exhaust air ducts	
2	**Insulation of the wall on the inside**							Prepair interior insulation for subsequent thermal-bridge-reduced window installation. Later on the window should be installed as close to the regular interior insulation layer as possible. Intermediate state: Insulate reveal all the way to the old window frame. Reveal insulation will have to be destroyed again for subsequent window replacement.	If necessary, decrease the forward flow temperature	Possibly already create penetrations in the exterior wall for fresh air and exhaust air ducts	
3	**Pitched roof insulation**	Provide an adequate roof overhang for later insulation of the façade. Provide temporary cladding of the underside of the roof overhang, keep in mind the thickness of the later wall insulation for connection of the downpipe to the ground						In case of insulation on rafters and roof terrace insulation, execute these preferably at the same time, as otherwise windows will have to be installed twice	If necessary, decrease the forward flow temperature	Ensure airtightness, provide for fresh air and exhaust air outlets, in case these are necessary later on	PV installation must take place after roof insulation. Pipes/cables should already be laid in the insulation layer for later installation. Penetration of the airtight layer should be executed in an airtight manner. Solar panels can replace the roof covering.

4	**Flat roof insulation**	Make horizontal covering of roof parapet already wide enough to accommodate façade insulation later on.							If necessary, decrease the forward flow temperature	Ensure airtightness, provide for fresh air and exhaust air outlets in the flat roof waterproofing in case these are necessary later on	Pipes/cables can already be laid in the insulation layer for later installation. Penetration of the airtight layer should be executed in an airtight manner. PV integrated into the roof covering can be used
7	**Basement ceiling/floor slab insulation**							In case of insulation of the basement ceiling/floor slab, doors on the ground floor may have to be replaced at the same time.	Warm pipes can be laid in the basement ceiling insulation. If necessary, decrease forward flow temperature.	Ventilation ducts can already be laid in the floor build-up	
8	**Perimeter insulation**										
9	**Window/entrance door replacement**	Prepare for subsequent thermal bridge minimised connection of the wall insulation	Prepare for subsequent thermal bridge minimised connection of the wall insulation			The installation position of casement windows and doors in the basement should leave enough head room to allow for opening the window/door, even if insulation under the basement ceiling is installed later on -- or thresholds of french windows should be high enough to allow for subsequent installation of insulation above the basement ceiling	In case of a "heated" basement, prepare for subsequent thermal bridge minimised connection to perimeter insulation		If necessary, decrease the forward flow temperature	To avoid mould formation, a ventilation system should be installed at the same time, in case sufficient ventilation (4 times a day) via windows is not possible	
10	**Boiler**			Install solar collectors only after the roof insulation.	Install solar collectors only after the roof insulation.					Check the possibility of air heating by means of the boiler via a hydraulic post heating coil	
12	**Ventilation system**										
13	**Photovoltaics**			PV installation must take place after roof insulation.	PV installation must take place after roof insulation.						