EuroPHit

D2.7 Output file of an overall refurbishment plan / English

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

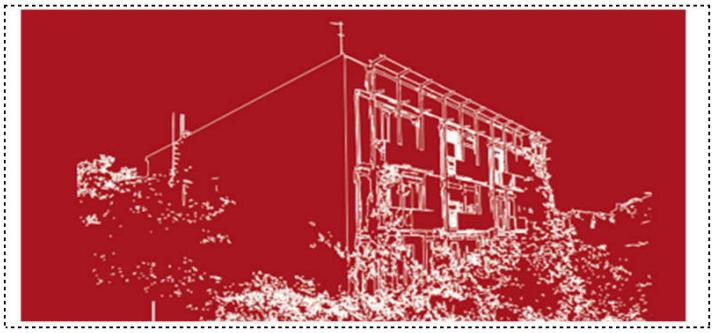
Co-funded by the Intelligent Energy Europe Programme of the European Union

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan

Target standard: EnerPHit Premium

Co-funded by the Intelligent Energy Europe Programme of the European Union



Object:	**End-of-terrace Passive House**
	Example Street 99
	99999 Passivhaus-Reihenendhaus
	Example Province DE-Germany
	Row house
Climate data set:	DE-9999-PHPP-Standard
Climate zone:	3: Cool-temperate Altitude of location:

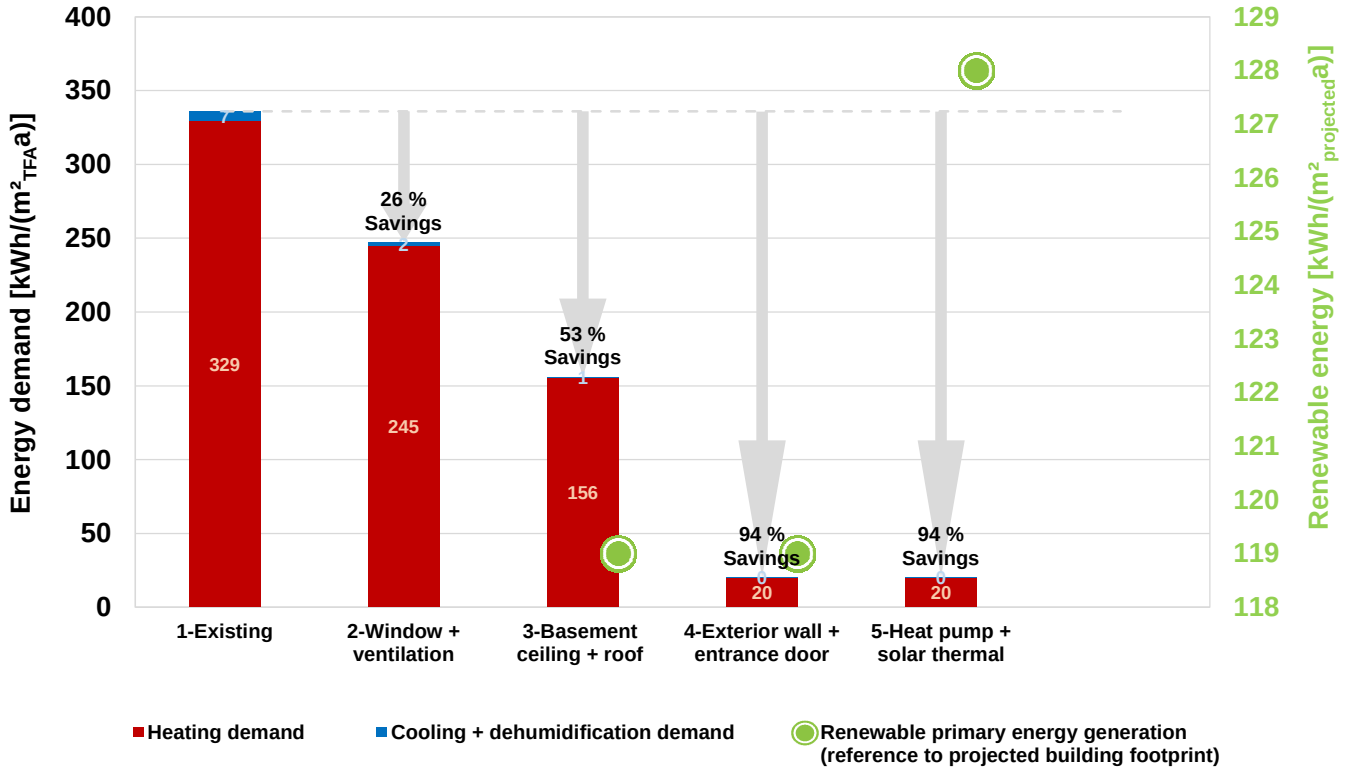
Owner:	**Passivhaus Association of Owners**
	Example Street 99
	99999 Example City
	Example Province DE-Germany

Energy consulting:	**Example Energy Consultant**
	Example Street 99
	99999 Example City
	Example Province DE-Germany

Pre-Certification:	**Passive House Institute**
	Rheinstr. 44/46
	64289 Darmstadt
	DE-Germany

Year of construction:	2016	Interior temp. winter [°C]:	20,0	Interior temp. summer [°C]:	25,0
No. of dwelling units:	1	Treated floor area:	156,0	No. of occupants:	2,9

Energy demand and generation over the retrofit steps



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
Paul	Passive	

Company	Issued (date)	City
Passive House Consultancy Office	30.03.2016	Passivetown

Passivetown, 30.3.2016

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!

Paul Passive (Passive House Consultancy Office)

Scheduler

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

Retrofit steps:															1	2		3		4	5			
Assemblies	Last renewal	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2016	2017	2020	2025	2030	2035	2040	2045	2050	2055
Render facade	1976																				X				
Facade decoration																									
Balconies/Loggias	1976																				X				
Exterior door	1987																				X				
Pitched roof covering	1956																		X						
Flat roof																									
Roof weatherings	1987																		X						
Window	1976																X								
Blinds / sun screens	1976																X								
Basement ceiling	2025																		X						
Boiler	2015																					X			
Ventilation	2017																X								
Solar thermal system	2040																					X			
Airtightn. test: X, Leakage search: (X)																	(X)		(X)		X				

Initial condition

X Retrofit dates

Main-tenance

Smaller repairs

Extensive repairs

Immediate replacement

Overview of measures

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

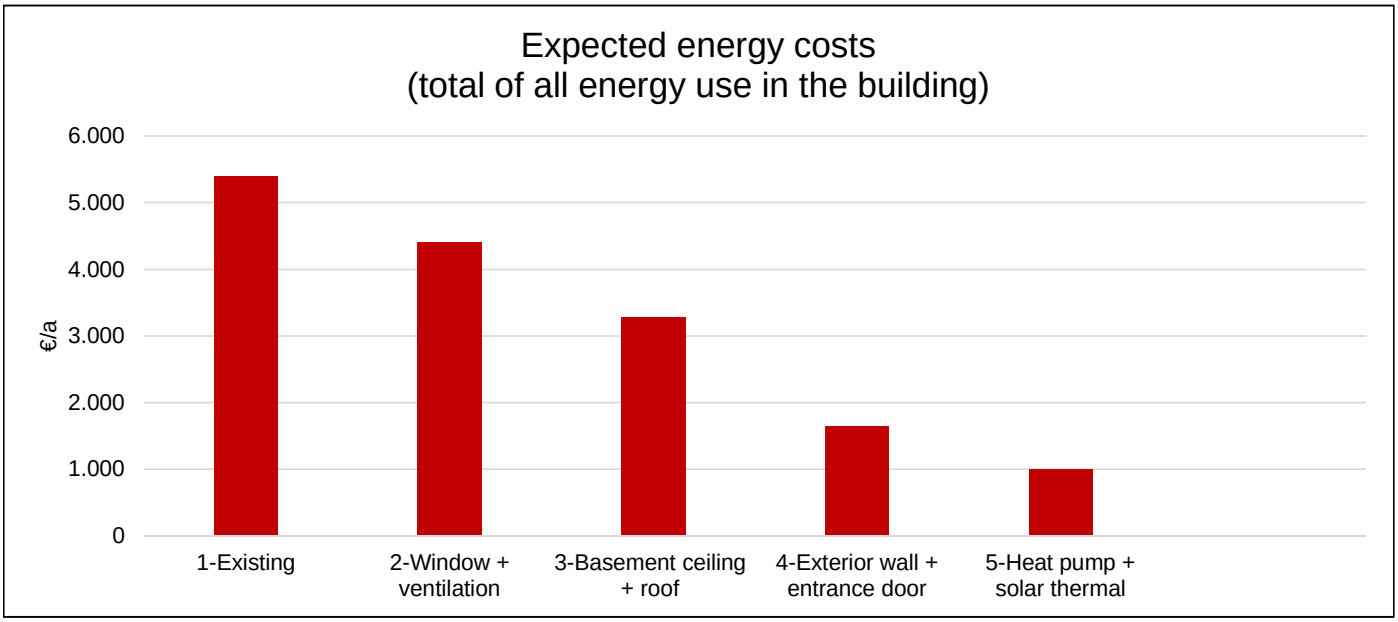
EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

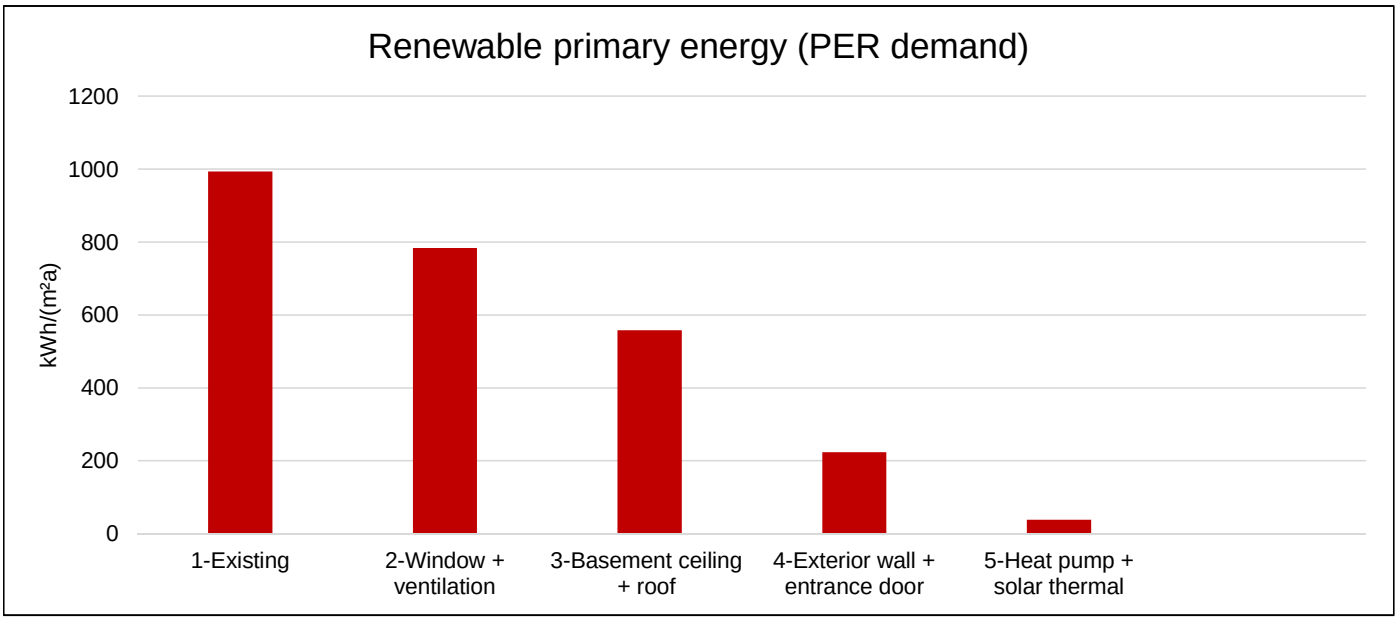
Retrofit step No.		1-Existing	2-Window + ventilation	3-Basement ceiling + roof	4-Exterior wall + entrance door	5-Heat pump + solar thermal		Criteria	Alternative criteria
Year		2016	2017	2025	2035	2040			
Measures									
Occasion ("anyway measure")	a		New windows	none	New render	New boiler			
Energy-saving measure			Passive House windows	Basement ceiling insulation	External wall insulation	Heat pump			
Occasion ("anyway measure")	b		Exhaust air system	New roof covering	New entrance door	New hot water tank			
Energy-saving measure			Heat recovery ventilation system	Roof insulation	Passive House door	Solar thermal system + stratified storage tank			
Occasion ("anyway measure")	c			New roof covering					
Energy-saving measure				Photovoltaic system					
Occasion ("anyway measure")	d								
Energy-saving measure									
Occasion ("anyway measure")	e								
Energy-saving measure									
Occasion ("anyway measure")	f								
Energy-saving measure									
Occasion ("anyway measure")	g								
Energy-saving measure									
Occasion ("anyway measure")	h								
Energy-saving measure									
Component characteristics									
Wall to ambient air, ext. insulation (U-value)	[W/(m²K)]	1,57	1,57	1,57	0,15	0,15			
Roof (U-value)	[W/(m²K)]	1,84	1,84	0,14	0,14	0,14			
Building envelope to ambient (U value)	[W/(m²K)]	1,65	1,65	1,12	0,14	0,14		0,15	-
Wall to ground, ext. insulation (U-value)	[W/(m²K)]								
Basement ceiling / floor slab (U-value)	[W/(m²K)]	0,72	0,72	0,26	0,26	0,26			
Building envelope to ground (U-value)	[W/(m²K)]	0,72	0,72	0,26	0,26	0,26		0,27	-
Wall, int. insulation to ambient air (U-Value)	[W/(m²K)]	-	-	-	-	-		0,35	-
Wall, int. insulation to ground (U-Value)	[W/(m²K)]	-	-	-	-	-		0,51	-
Flat roof (solar reflection index, SRI)	[W/(m²K)]	-	-	-	-	-		-	-
Inclined and vertical external surface (SRI)	[W/(m²K)]	33	33	33	33	33		-	-
Windows / doors ($U_{installed}$)	[W/(m²K)]	2,87	0,78	0,78	0,78	0,78		0,85	-
Windows ($U_{W,installed}$)	[W/(m²K)]	-	-	-	-	-		1,00	-
Windows ($U_{W,installed}$)	[W/(m²K)]	-	-	-	-	-		1,10	-
Glazing (g-value)	[]	0,77	0,50	0,50	0,50	0,50		0,36	-
Glazing/sun protection (max. solar load)	[kWh/(m²a)]	404	125	107	51	13		-	-
Ventilation (effective heat recovery efficiency)	[%]		82	82	82	82		75	-
Ventilation (effective humidity recovery efficiency)	[%]							-	-
Airchange at press. test n_{50}	[1/h]	5,0	1,0	1,0	1,0	1,0		1,0	-
Building characteristics									
Heating demand	[kWh/(m²a)]	329	245	156	20	20		-	-
Heating load	[W/m²]	142	98	67	16	16		-	-
Cooling + dehumidification demand	[kWh/(m²a)]	7	2	1	0	0		-	-
Cooling load	[kWh/(m²a)]	33	17	10	5	4		-	-
Frequency of overheating (> 25 °C)	[%]	-	-	-	-	-		-	-
Frequency of exc. high humidity (> 12 g/kg)	[%]	0	0	0	0	0		10	-
Non-renewable primary energy (PE demand)	[kWh/(m²a)]	506	405	296	134	46		-	-
Renewable primary energy (PER demand)	[kWh/(m²a)]	994	784	559	224	39		36	39
Renewable primary energy generation (reference to projected building footprint)	[kWh/(m²a)]	0	0	119	119	128		120	126
Criteria fulfilled for EnerPHit Premium?			no	no	no	yes			
Annual energy-related extra costs									
Energy-related invest. (interest+repayment)	[€/year]	0	328	606	1100	1448			
Expected energy costs (total of all energy use in the building)	[€/year]	5390	4400	3280	1640	1000			
Total costs	**[€/year]**	**5390**	**4728**	**3886**	**2740**	**2448**			

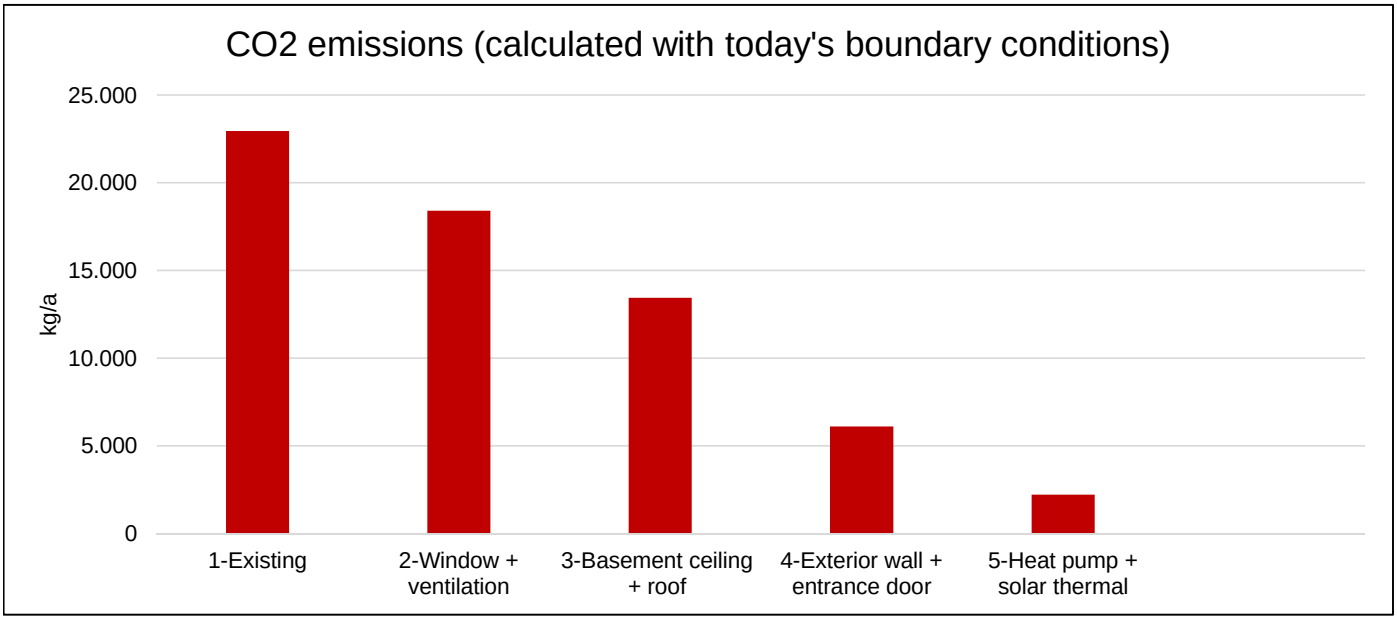
Diagrams

ırce file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany







Investment and maintenance costs

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

	Retrofit step No.	1-Existing	2-Window + ventilation	3-Basement ceiling + roof	4-Exterior wall + entrance door	5-Heat pump + solar thermal	
	Year	2016	2017	2025	2035	2040	
a	**Occasion ("anyway measure")**		**New windows**	**none**	**New render**	**New boiler**	
	Investment costs		**11.180 €**	**0 €**	**6.440 €**	**12.000 €**	
	Maintenance costs		**0 €**	**0 €**	**0 €**	**320 €**	
	Energy-saving measure		**Passive House windows**	**Basement ceiling insulation**	**External wall insulation**	**Heat pump**	
	Investment costs		**16.770 €**	**2.160 €**	**23.920 €**	**16.000 €**	
	Financial support (present value)		**1.677 €**	**216 €**	**2.392 €**	**1.600 €**	
	Maintenance costs		**0 €**	**0 €**	**0 €**	**100 €**	
	Service life [years]		**40**	**50**	**50**	**20**	
	Invest. costs (energy related)	0 €	3.913 €	1.944 €	15.088 €	2.400 €	0 €
	Maintenance costs (energy related)	0 €	0 €	0 €	0 €	-220 €	0 €
	Present value factor (service life)	0	27	32	32	16	0
	Annuity factor (service life)	0,00%	3,64%	3,17%	3,17%	6,10%	0,00%
	Annuity (total)	0 €	550 €	62 €	682 €	979 €	0 €
	Annuity (energy related only)	**0 €**	**143 €**	**62 €**	**478 €**	**-74 €**	**0 €**
b	**Occasion ("anyway measure")**		**Exhaust air system**	**New roof covering**	**New entrance door**	**New hot water tank**	
	Investment costs		**4.680 €**	**5.810 €**	**1.000 €**	**1.000 €**	
	Maintenance costs		**50 €**	**0 €**	**0 €**	**0 €**	
	Energy-saving measure		**Heat recovery ventilation system**	**Roof insulation**	**Passive House door**	**Solar thermal system + stratified storage tank**	
	Investment costs		**8.580 €**	**11.620 €**	**1.600 €**	**7.500 €**	
	Financial support (present value)		**858 €**	**1.162 €**	**160 €**	**750 €**	
	Maintenance costs		**100 €**	**0 €**	**0 €**	**70 €**	
	Service life [years]		**30**	**50**	**40**	**20**	
	Invest. costs (energy related)	0 €	3.042 €	4.648 €	440 €	5.750 €	0 €
	Maintenance costs (energy related)	0 €	50 €	0 €	0 €	70 €	0 €
	Present value factor (service life)	0	22	32	27	16	0
	Annuity factor (service life)	0,00%	4,45%	3,17%	3,64%	6,10%	0,00%
	Annuity (total)	0 €	444 €	331 €	52 €	482 €	0 €
	Annuity (energy related only)	**0 €**	**185 €**	**147 €**	**16 €**	**421 €**	**0 €**
c	**Occasion ("anyway measure")**			**New roof covering**			
	Investment costs			**0 €**			
	Maintenance costs			**1.500 €**			
	Energy-saving measure			**Photovoltaic system**			
	Investment costs			**28.200 €**			
	Financial support (present value)			**2.820 €**			
	Maintenance costs			**20 €**			
	Service life [years]			**20**			
	Invest. costs (energy related)	0 €	0 €	25.380 €	0 €	0 €	0 €
	Maintenance costs (energy related)	0 €	0 €	-1.480 €	0 €	0 €	0 €
	Present value factor (service life)	0	0	16	0	0	0
	Annuity factor (service life)	0,00%	0,00%	6,10%	0,00%	0,00%	0,00%
	Annuity (total)	0 €	0 €	1.569 €	0 €	0 €	0 €
	Annuity (energy related only)	**0 €**	**0 €**	**69 €**	**0 €**	**0 €**	**0 €**
	Total Invest. costs (annual interest+repayment) [€/a]						
	Total (per step)	0 €	994 €	1.962 €	735 €	1.461 €	0 €
	Energy related (per step)	0 €	328 €	278 €	494 €	347 €	0 €
	Total (incl. previous steps)	**0 €**	**994 €**	**2.956 €**	**3.691 €**	**5.152 €**	**5.152 €**
	Energy related (incl. previous steps)	**0 €**	**328 €**	**606 €**	**1.100 €**	**1.448 €**	**1.448 €**

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

Average energy price (during service life): Electricity 0,25 € Natural gas / Oil 0,07 € Wood 0,07 €

Building assemblies (U-values)

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

Assembly: **01ud-External wall** Area: 184,3 m²

Areas with this assembly: **External wall south, External wall north, External wall west**

Retrofit step: **1-Existing**

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Interior plaster	0,350					15
Lime sand brick	0,900					360
Polystyrene	0,000					0
Exterior Render	0,800					20

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total
100%	0%	0%	**39,5** cm

U-value supplement: 0 W/(m²K) **U-value: 1,568** W/(m²K)

Retrofit step: **4-Exterior wall + entrance door**

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Interior plaster	0,350					15
Lime sand brick	0,900					360
Polystyrene	0,032					200
Exterior Render	0,800					20

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total
100%	0%	0%	**59,5** cm

U-value supplement: 0 W/(m²K) **U-value: 0,145** W/(m²K)

preparation for subsequent steps:

8-PERIMETER INSULATION	**No metallic base profiles (thermal bridge)**
10-BOILER	**If necessary, decrease the forward flow temperature**

Assembly: **01ud-External wall**

Advice

Plan / sketch / image

Before the wall insulation can be applied, move the windows from the brick wall layer to the outside.

Building assemblies (U-values)

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

Assembly: **02ud-Roof** Area: 83,4 m²

Areas with this assembly: **Roof**

Retrofit step: **1-Existing**

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Chipboard	0,130					50
Blown Mineral Wool	0,000	I-Beam	0,374			0
Gypsum Plasterboard	0,700					13

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total	
98%	2%	0%	**6,3**	cm

U-value supplement 0 W/(m²K) **U-value: 1,843** W/(m²K)

Retrofit step: **3-Basement ceiling + roof**

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Chipboard	0,130					50
Blown Mineral Wool	0,040	I-Beam	0,374			300
Gypsum Plasterboard	0,700					13

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total	
98%	2%	0%	**36,3**	cm

U-value supplement 0 W/(m²K) **U-value: 0,140** W/(m²K)

preparation for subsequent steps:

13-Photovoltaics	**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.**

Assembly: **02ud-Roof**

Advice

Plan / sketch / image

Description

Building assemblies (U-values)

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

Assembly: **03ud-Basement ceiling** Area: 80,9 m²

Areas with this assembly: **Basement floor**

Retrofit step: **1-Existing**

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Parquet	0,130					22
Screed	1,050					48
Impact sound insulation	0,040					30
Concrete	2,100					160
Polystyrene	0,000					0
Plaster Coat	0,800					10

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total	
100%	0%	0%	**27,0**	cm

U-value supplement 0 W/(m²K) **U-value:** **0,718** W/(m²K)

Retrofit step: **3-Basement ceiling + roof**

Subarea 1	λ [W/(mK)]	Subarea 2 (optional)	λ [W/(mK)]	Subarea 3 (optional)	λ [W/(mK)]	Thickness [mm]
Parquet	0,130					22
Screed	1,050					48
Impact sound insulation	0,040					30
Concrete	2,100					160
Polystyrene	0,028					70
Plaster Coat	0,800					10

Fraction subarea 1	Fraction subarea 2	Fraction subarea 3	Total	
100%	0%	0%	**34,0**	cm

U-value supplement 0 W/(m²K) **U-value:** **0,257** W/(m²K)

preparation for subsequent steps:

Assembly: **03ud-Basement ceiling**

Advice

Plan / sketch / image

Description

Window (glazing and frame)

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

Window type:	**a-Opening casement 1**	Fläche: 32,4212 m²

Retrofit step	Year	Glazing	U_g	Frame	U_f
1-Existing	2016	93ud-Double insulated glazing 4/12mm air /4	2,9	53ud-EXISTING: timber 45 mm	2,5

Retrofit step	Year	Glazing	U_g	Frame	U_f
2-Window + ventilation	2017	02ud-Triple-insulated-Kr12	0,58	quality	0,72
preparation for subsequent steps:					
1-EXTERIOR WALL INSULATION	**Prepare for subsequent thermal bridge minimised connection of the wall insulation**				
7-BASEMENT CEILING/FLOOR SLAB 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**				
12-VENTILATION SYSTEM	**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**				

Retrofit step	Year	Glazing	U_g	Frame	U_f

Advice

Plan / sketch / image

The window is first installed in the brickwall layer, as long as the wall insulation hasn´t been mounted.
As soon as the walls are going to be insulated, the windows can be moved to the ideal position in the insulation layer.
The inner reveals can be covered with wood boards, the airtight connection between window frame and walls is also hidden.

Window (glazing and frame)

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

Window type:	**b-Opening casement 2**	Fläche: 11,04 m²

Retrofit step	Year	Glazing	U_g	Frame	U_f
1-Existing	2016	93ud-Double insulated glazing 4/12mm air /4	2,9	54ud-EXISTING: timber 68 mm	1,6

Retrofit step	Year	Glazing	U_g	Frame	U_f
2-Window + ventilation	2017	02ud-Triple-insulated-Kr12	0,58	quality	0,72
preparation for subsequent steps:					
1-EXTERIOR WALL INSULATION	**Prepare for subsequent thermal bridge minimised connection of the wall insulation**				
7-BASEMENT CEILING/FLOOR SLAB 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**				
12-VENTILATION SYSTEM	**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**				

Advice

Plan / sketch / image

Description

Ventilation systems

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

Retrofit step	Year	Ventilation type	Ventilation unit	Heat recovery efficiency	Humidity recovery efficiency	Electric efficiency
1-Existing	2016	ventilation	-	-	-	-

Retrofit step	Year	Ventilation type	Ventilation unit	Heat recovery efficiency	Humidity recovery efficiency	Electric efficiency
2-Window + ventilation	2017	1-Balanced PH ventilation with HR	01ud-HRV	0,83	0	0,4
preparation for subsequent steps:						
11-RADIATORS AND DISTRIBUTION		If the heating load is reduced to Passive House level, supply air heating may be possible (heaters can be omitted completely or in part)				

Advice
Plan / sketch / image
Description

Photovoltaics

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

Step	Technology	Module area [m²]	Location	Annual electricity yield after inverter	
				absolute [kWh/a]	related to projected building footprint area [kWh/(m²projecteda)]
1-Existing					

Step	Technology	Module area [m²]	Location	Annual electricity yield after inverter	
				absolute [kWh/a]	related to projected building footprint area [kWh/(m²projecteda)]
3-Basement ceiling + roof	**Mono-SI**	**65,90**	**Roof**	**8055,87**	**99,55**

Step	Technology	Module area [m²]	Location	Annual electricity yield after inverter	
				absolute [kWh/a]	related to projected building footprint area [kWh/(m²projecteda)]
preparation for subsequent steps:					

Advice Photovoltaics
Plan / sketch / image
Description

Heating & cooling

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

	Retrofit step:	1-Existing		2016	
Heating		Type	Type	Heating fraction	DHW fraction
	Primary heat generator	4-Heating boiler	21-Low temperature boiler oil	100%	100%
	Secondary heat generator	-	-	0%	0%
Cooling		used?	Seasonal performance factor		
	Supply air cooling	-	-		
	Recirculatio cooling	x	2,4		
	Additional dehumidification	-	-		
	Panel Cooling	-	-		

	Retrofit step:	5-Heat pump + solar thermal		2040	
Heating		Type	Type	Heating fraction	DHW fraction
	Primary heat generator	2-Heat pump	1-Standard Air/Water heat pump	100%	100%
	Secondary heat generator	-	-	0%	0%
Cooling		used?	Seasonal performance factor		
	Supply air cooling	x	3,2		
	Recirculatio cooling	-	-		
	Additional dehumidification	x	2,6		
	Panel Cooling	-	-		

preparation for subsequent steps:	
12-VENTILATION SYSTEM	Check the possibility of air heating by means of the boiler via a hydraulic post heating coil

Advice Heating & cooling
Plan / sketch / image
Description

Other advice

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

Retrofit step:		
Advice: ...		

Retrofit step:		
Advice: ...		

Retrofit step:		
Advice: ...		

Retrofit step:		
Advice: ...		

Retrofit step:		
Advice: ...		

Retrofit step:		
Advice: ...		

Attachments

Source file: 'EuroPHit_D2.4_BalancingToolforSBSRetrofits_EN_PHI.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

Page	Phase	Type	Area	Name of document/plan
1	All	DWG / PDF		Ground Floor Plan
2	All	DWG / PDF		First Floor Plan
3	All	DWG / PDF		Section
4	All	DWG / PDF		Elevations
5	Step 2	DWG / PDF		Details Windows
6	Steps 3+4	DWG / PDF		Details Wall-Roof-Connections
7	Step 5	DWG / PDF		Ventilation System
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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
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