



# EuroPHit



## D3.9\_EnerPHit Retrofit Plan



### **Project: OP24 – Community Center, La Providenza, Pergine Valsugana (TN), Italy**

#### **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

# EnerPHit Retrofit Plan

# EuroPHit

## Target standard: Passive House Classic



<b>Object:</b>	Community Center, La Provvidenza		
Street:	Via Ravensburger		
Postcode/city:	38057	End-of-terrace Passive House	
Province/country:	TN	Passivhaus-Reihenendhaus	
Object type:	Non-Residential / Community Center		
Climate data set:	ud---01-Pergine		
Climate zone:	4: Warm-temperate	Altitude of location:	495
<b>Owner:</b>	Parish "Natività di Maria" of Pergine Valsugana		
Street:	Via Ravensburger		
Postcode/city:	38057	Pergine-Valsugana	
Province/country:	TN	IT-Italy	

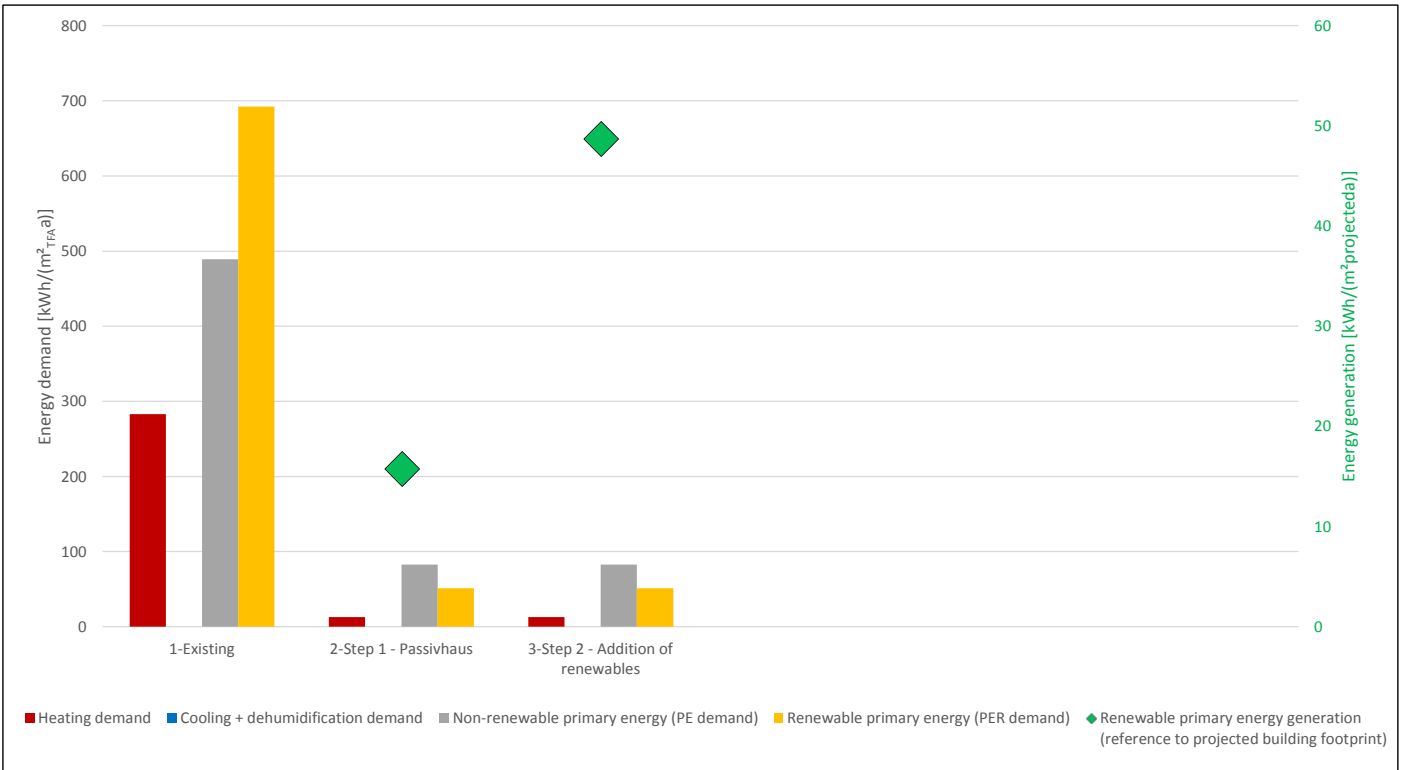
<b>Architecture:</b>	Studio Bombasaro		
Street:	Via al Compet, 8		
Postcode/city:	38057	Pergine-Valsugana	
Province/country:	TN	IT-Italy	

<b>Tech. systems:</b>	Studio Bombasaro		
Street:	Via al Compet, 8		
Postcode/city:	38057	Pergine-Valsugana	
Province/country:	TN	IT-Italy	

<b>Energy consulting:</b>	New Engineering s.r.l.		
Street:	Via Brennero 139, Trento		
Postcode/city:	38121	Trento	
Province/country:	TN	IT-Italy	

<b>Certification:</b>	ZEPHIR s.r.l.		
Street:	Loc. Fratte 18/3		
Postcode/city:	38057	Pergine-Valsugana	
Province/country:	TN	IT-Italy	

Year of construction:	2014 - 2016	Interior temp. winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
Number of dwelling units:	1	Treated floor area:	1480.3	No. of occupants:	100.0



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	Francesco	Last name	Nesi	Signature
Company	ZEPHIR - Passivhaus Italia	Issued (date)	25/03/2016	City
			Pergine-Valsugana	

## 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.

### **Pre-certification**

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!**

**Francesco Nesi (ZEPHIR - Passivhaus Italia)**



# Overview of measures

EnerPHit Retrofit Plan: Community Center, La Providenza, Pergine-Valdagno, IT-Italy

Retrofit step No.	1-Existing	2-Step 1 - Passivhaus	3-Step 2 - Addition of renewables			
Year	1998	2014-2016	2025			
<b>Measures</b>						
Occasion ("anyway measure")	1		Roof - EPS Insulation 100 mm (minimal requirement) Ceilings - PUR Insulation 60 mm (minimal requirement)			
Energy-saving measure			Roof - Additional EPS Insulation up to 340 mm + Thermal Bridge Correction Ceilings - Additional PUR Insulation up to 200 mm	PV Integrated Facade + Roof PV		
Occasion ("anyway measure")	2		Exterior Wall - EPS insulation 100 mm (minimal requirement) + Exterior Plaster + Glue + Fixing + Plasterboard			
Energy-saving measure			Exterior Wall - Additional EPS Insulation up to 250 mm + Additional Mineral Wool Internal Insulation			
Occasion ("anyway measure")	3		Ground Wall - XPS insulation 100 mm (minimal requirement)			
Energy-saving measure			Ground Wall - Additional XPS Insulation up to 300 mm			
Occasion ("anyway measure")	4		Windows - Standard Windows and skylight			
energy-saving measure			Windows - Passivhaus Windows and skylight			
Occasion ("anyway measure")	5		Ventilation and heating - Radiators + District Heating Connection + Heating Distribution Pipes			
energy-saving measure			Ventilation and heating - Additional Costs for: Ventilation Units + Distribution ventilation ducts + District Heating Connection + Heating Distribution Pipes + Pre/Post Heating Coils + Ventilation System Assessment			
Occasion ("anyway measure")	6	-	-			
energy-saving measure			Airtightness - Additional measures + BD Test			
Occasion ("anyway measure")	7		-			
energy-saving measure			Floor Slab - PUR Insulation 150 cm			
Occasion ("anyway measure")	8		Other Costs			
energy-saving measure						
<b>Component characteristics</b>						
Wall to ambient air, ext. insulation (U-value)	[W/(m²K)]	1.40	0.12	0.12		
Roof (U-value)	[W/(m²K)]	1.94	0.10	0.10		
Building envelope to ambient (U-value)	[W/(m²K)]	1.53	0.11	0.11		
Wall to ground, ext. insulation (U-value)	[W/(m²K)]					
Basement ceiling / floor slab (U-value)	[W/(m²K)]	4.59	0.17	0.17		
Building envelope to ground (U-value)	[W/(m²K)]	3.23	0.16	0.16		
Wall, int. insulation to ambient air (U-Value)	[W/(m²K)]	-	-	-		
Wall, int. insulation to ground (U-Value)	[W/(m²K)]	-	-	-		
Flat roof (solar reflection index, SRI)	[W/(m²K)]	45.20	45.20	45.20		
Inclined and vertical external surface (SRI)	[W/(m²K)]	45	49	49		
Windows / doors (U <sub>weighted</sub> )	[W/(m²K)]	3.62	0.95	0.95		
Windows (U <sub>W, installed</sub> )	[W/(m²K)]	-	-	-		
Windows (U <sub>W, installed</sub> )	[W/(m²K)]	-	-	-		
Glazing (g-value)	[ ]	0.87	0.54	0.54		
Glazing/sun protection (max. solar load)	[kWh/(m²a)]	172	59	59		
Ventilation (effective heat recovery efficiency)	[ % ]	0	81	81		
Ventilation (effective humidity recovery efficiency)	[ % ]		0	0		
Airchange at press. test n <sub>50</sub>	[1/h]	10.0	0.3	0.3		0.6
<b>Building characteristics</b>						
Heating demand	[kWh/(m²a)]	283	13	13		15
Heating load	[W/m²]	127	9	9		10
Cooling + dehumidification demand	[kWh/(m²a)]	-	-	-		-
Cooling load	[kWh/(m²a)]	-	-	-		-
Frequency of overheating (> 25 °C)	[ % ]	0	7	7		10
Frequency of exc. high humidity (> 12 g/kg)	[ % ]	0	0	0		20
Non-renewable primary energy (PE demand)	[kWh/(m²a)]	489	83	83		-
Renewable primary energy (PER demand)	[kWh/(m²a)]	693	51	51		60
Renewable primary energy generation (reference to projected building footprint)	[kWh/(m²a)]	0	16	49		-
<b>Criteria fulfilled for Passive House Classic?</b>						
		no	yes	yes		
<b>Costs</b>						
Energy-related invest. (interest+repayment)	[€/year]	0	4978	10666		
Expected energy costs (total of all energy use in the building)	[€/year]	30000	10100	10100		
<b>Total cost (investment+energy)</b>	[€/year]	<b>30000</b>	<b>15078</b>	<b>20766</b>		

Criteria  
Alternative criteria

**Investment and maintenance costs**

Source file: PHPP\_V9.3a\_EN\_OP24\_Providenza\_ZEPHIR.xlsm (PHPP version: 9.3)

EnPHI Retrofit Plan: Community Center, La Providenza, Perino-Valsusani, IT-Italy

Retrofit step No.	1-Existing 1998	2-Step 1 - Passivhaus 2014-2016	renewables 2025			
1	<b>Occasion ("anyway measure")</b>		100 mm (minimal requirement) Ceilings - PUR Insulation 60 mm			
	Investment costs		4,869 €			
	Maintenance costs					
	<b>Energy-saving measure</b>		Roof - Additional EPS Insulation up to 340 mm + Thermal Bridge Correction Ceilings - Additional PUR Insulation up to	PV integrated Facade + Roof PV		
	Investment costs		17,340 €	104,800 €		
	Financial support (present value)					
	Maintenance costs					
	Service life [years]		65	25		
	Present value factor	0 €	32 €	18 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €
Annuity ("anyway measure")	0 €	152 €	0 €	0 €	0 €	
Annuity (Energy saving measure)	0 €	542 €	5,688 €	0 €	0 €	
Annuity (energy-related)	0 €	390 €	5,688 €	0 €	0 €	
2	<b>Occasion ("anyway measure")</b>		Exterior Wall - EPS Insulation 100 mm (minimal requirement) + Exterior Plaster + Glue + Fixing + Plasterboard			
	Investment costs		126,087 €			
	Maintenance costs					
	<b>Energy-saving measure</b>		Exterior Wall - Additional EPS Insulation up to 250 mm + Additional Mineral Wool Internal Insulation			
	Investment costs		157,481 €			
	Financial support (present value)					
	Maintenance costs					
	Service life [years]		60			
	Present value factor	0 €	31 €	0 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €
Annuity ("anyway measure")	0 €	4,079 €	0 €	0 €	0 €	
Annuity (Energy saving measure)	0 €	5,095 €	0 €	0 €	0 €	
Annuity (energy-related)	0 €	1,016 €	0 €	0 €	0 €	
3	<b>Occasion ("anyway measure")</b>		Ground Wall - XPS Insulation 100 mm (minimal requirement)			
	Investment costs		4,077 €			
	Maintenance costs					
	<b>Energy-saving measure</b>		Ground Wall - Additional XPS Insulation up to 300 mm			
	Investment costs		12,230 €			
	Financial support (present value)					
	Maintenance costs					
	Service life [years]		60			
	Present value factor	0 €	31 €	0 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €
Annuity ("anyway measure")	0 €	132 €	0 €	0 €	0 €	
Annuity (Energy saving measure)	0 €	396 €	0 €	0 €	0 €	
Annuity (energy-related)	0 €	264 €	0 €	0 €	0 €	
4	<b>Occasion ("anyway measure")</b>		Windows - Standard Windows and skylight			
	Investment costs		81,875 €			
	Maintenance costs					
	<b>Energy-saving measure</b>		Windows - Passivhaus Windows and skylight			
	Investment costs		104,285 €			
	Financial support (present value)					
	Maintenance costs					
	Service life [years]		35			
	Present value factor	0 €	23 €	0 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €
Annuity ("anyway measure")	0 €	3,537 €	0 €	0 €	0 €	
Annuity (Energy saving measure)	0 €	4,925 €	0 €	0 €	0 €	
Annuity (energy-related)	0 €	967 €	0 €	0 €	0 €	
5	<b>Occasion ("anyway measure")</b>		Ventilation and heating Radiators + District Heating Connection + Heating Distribution Pipes			
	Investment costs		91,482 €			
	Maintenance costs					
	<b>Energy-saving measure</b>		Ventilation and heating Additional Costs for: Ventilation Units + Distribution ventilation ducts + District Heating Connection +			
	Investment costs		119,017 €			
	Financial support (present value)					
	Maintenance costs					
	Service life [years]		20			
	Present value factor	0 €	16 €	0 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €
Annuity ("anyway measure")	0 €	5,868 €	0 €	0 €	0 €	
Annuity (Energy saving measure)	0 €	7,635 €	0 €	0 €	0 €	
Annuity (energy-related)	0 €	1,766 €	0 €	0 €	0 €	
6	<b>Occasion ("anyway measure")</b>	-	-			
	Investment costs					
	Maintenance costs					
	<b>Energy-saving measure</b>		Airtightness - Additional measures + BD Test			
	Investment costs		3,467 €			
	Financial support (present value)					
	Maintenance costs					
	Service life [years]		40			
	Present value factor	0 €	25 €	0 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €
Annuity ("anyway measure")	0 €	0 €	0 €	0 €	0 €	
Annuity (Energy saving measure)	0 €	138 €	0 €	0 €	0 €	
Annuity (energy-related)	0 €	138 €	0 €	0 €	0 €	
7	<b>Occasion ("anyway measure")</b>					
	Investment costs					
	Maintenance costs					
	<b>Energy-saving measure</b>		Floor Slab - PUR Insulation 150 cm			
	Investment costs		13,951 €			
	Financial support (present value)					
	Maintenance costs					
	Service life [years]		65			
	Present value factor	0 €	32 €	0 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €
Annuity ("anyway measure")	0 €	0 €	0 €	0 €	0 €	
Annuity (Energy saving measure)	0 €	436 €	0 €	0 €	0 €	
Annuity (energy-related)	0 €	436 €	0 €	0 €	0 €	
8	<b>Occasion ("anyway measure")</b>		Other Costs			
	Investment costs		1,331,117 €			
	Maintenance costs					
	<b>Energy-saving measure</b>					
	Investment costs		1,331,117 €			
	Financial support (present value)					
	Maintenance costs					
	Service life [years]		40			
	Present value factor	0 €	25 €	0 €	0 €	0 €
	Annuity factor	0 €	0 €	0 €	0 €	0 €
Annuity ("anyway measure")	0 €	53,027 €	0 €	0 €	0 €	
Annuity (Energy saving measure)	0 €	53,027 €	0 €	0 €	0 €	
Annuity (energy-related)	0 €	0 €	0 €	0 €	0 €	
Total annuities (energy-related)	0 €	4,978 €	5,688 €	0 €	0 €	0 €
<b>Cumulated sums</b>	0 €	4,978 €	10,666 €	10,666 €	10,666 €	10,666 €

Boundary conditions: Nominal interest rate: 2.5% Inflation: 0.0% Real interest rate: 2.5%









# Ventilation systems

Source file: 'PHPP\_V9.3a\_EN\_OP24\_Providenza\_ZEPHIR.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Community Center, La Providenza, Pergine-Valsugana, IT-Italy

Retrofit step	Unit no.		Ventilation unit	Heat recovery efficiency	Humidity recovery efficiency	Electric efficiency
<b>2-Step 1 - Passivhaus</b>	2014-2016					
	1		01ud-Zehnder - ComfoAir XL3300	85%	0%	0.41
	2		02ud-Zehnder - ComfoAir350, ComfoD350, WHR930	84%	0%	0.29
	3		03ud-Zehnder - ComfoAir200, ComfoD250, WHR920	92%	0%	0.42
	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\_OP24\_Provvidenza\_ZEPHIR.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: Community Center, La Providenza, Pergine-Valsugana, IT-Italy

Retrofit step:		2-Step 1 - Passivhaus		2014-2016	
Heating		Type	Type	Heating fraction	DHW fraction
	Primary heat generator	3-District heating, CGS	20-Gas CGS 70% PHC	100%	64%
	Secondary heat generator	6-Direct electrical (heating resistance / continuous flow water heater)	-	0%	36%
Cooling		used?	Seasonal performance factor		
	Supply air cooling	-	-		
	Recirculatio cooling	-	-		
	Additional dehumidification	-	-		
	Panel Cooling	-	-		
preparation for subsequent steps:					

Retrofit step:					
Heating		Type	Type	Heating fraction	DHW fraction
	Primary heat generator				
	Secondary heat generator				
Cooling		used?	Seasonal performance factor		
	Supply air cooling				
	Recirculatio cooling				
	Additional dehumidification				
	Panel Cooling				
preparation for subsequent steps:					

Retrofit step:					
Heating		Kind	Type	Heating fraction	DHW fraction
	Primary heat generator				
	Secondary heat generator				
Cooling		used?	Seasonal performance factor		
	Supply air cooling				
	Recirculatio cooling				
	Additional dehumidification				
	Panel Cooling				
preparation for subsequent steps:					

Advice Heating & cooling	
Plan / sketch / image	
Description	

# Photovoltaics

EnerPHit Retrofit Plan: Community Center, La Providenza, Pergine-Valsugana, IT-Italy

Step	Technology	Module field area [m²]	Location	Annual electricity yield after inverter	
				absolute [kWh/a]	reference to projected building footprint [kWh/(m² <sub>projected</sub> a)]
<b>2-Step 1 - Passivhaus</b>	<b>Poly-Si</b>	<b>46.95</b>	<b>Roof</b>	<b>8212.00</b>	<b>11.90</b>
preparation for subsequent steps:					

Step	Technology	Module field area [m²]	Location	Annual electricity yield after inverter	
				absolute [kWh/a]	reference to projected building footprint [kWh/(m² <sub>projected</sub> a)]
<b>3-Step 2 - Addition of renewables</b>	<b>Amorph-Si</b>	<b>204.76</b>	<b>Facade</b>	<b>8547.00</b>	<b>12.40</b>
preparation for subsequent steps:					

Step	Technology	Module field area [m²]	Location	Annual electricity yield after inverter	
				absolute [kWh/a]	reference to projected building footprint [kWh/(m² <sub>projected</sub> a)]
<b>3-Step 2 - Addition of renewables</b>	<b>Poly-Si</b>	<b>71.41</b>	<b>Roof</b>	<b>14141.00</b>	<b>20.50</b>
preparation for subsequent steps:					

## Advice Photovoltaics

Plan / sketch / image

### Description

## 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 – 31 March 2016 (36 Months)

Deliverable No.	D3.9
Dissemination Level	PU
Work Package	WP3_Practical Implementation
Lead beneficiary	04_MosArt
Contributing beneficiary(ies)	02_ZEPHIR
Author(s)	Francesco Nesi, Fabio Ferrario, Marco Larcher
Co-author(s)	
Date	25/03/2016
File Name	EuroPHit_D3.9_OP24_Providenza_ZEPHIR

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