

Project Documentation Gebäude-Dokumentation

Abstract | Zusammenfassung



Ellanion Villa – Aegina, Greece

Data of building | Gebäudedaten

Year of construction Baujahr	2021	Space heating Heizwärmebedarf	15.15 kWh/(m ² a)
U-value external wall U-Wert Außenwand	0,199	Space cooling Kühlbedarf	11.77 kWh/(m ² a)
	W/(m ² K)		
U-value ground slab U-Wert Bodenplatte	0,517	Primary Energy Renewable (PER) Erneuerbare Primärenergie (PER)	45
	W/(m ² K)		kWh/(m ² a)
U-value roof U-Wert Dach	0,115	Generation of renewable Energy Erzeugung erneuerb. Energie	148
	W/(m ² K)		kWh/(m ² a)
U-value window U-Wert Fenster	0,94 ; 1,28	Non-renewable Primary Energy (PE) Nicht erneuerbare Primärenergie (PE)	47
	W/(m ² K)		kWh/(m ² a)
Heat recovery Wärmerückgewinnung	78 %	Pressurization test n ₅₀ Drucktest n ₅₀	0,5 h ⁻¹

Special features
Besonderheiten

Solar panels for hot water production, Photovoltaic panels for electricity production as a result the house is off grid.

Brief Description

Passive House Ellanion Villa – Aegina, Greece

The project calls for the design and construction of a single-family, off grid, passive house with a total of 149.74 sq.m. located on the Island of Aegina, Greece. The goal is to create a passive house with a light gage steel structure for fast and easy on-site construction. Also, by installing an additional solar panels, photovoltaic panels and wind turbine, to make this house work without the necessity of connecting to the local electrical grid. The house is designed to have a main room with dining and living area, large kitchen area and 3 bedrooms and 3 bathrooms, two of them are en-suite.

The house was certified as Passive House Premium by The Hellenic Passive House Institute. It was also presented on the Passive House Conference in March 2023 in Wiesbaden, Germany.



Responsible project participants Verantwortliche Projektbeteiligte

Architect Entwurfsverfasser	Arch. Vesselin Mutafchiev
Implementation planning Ausführungsplanung	Arch. Vesselin Mutafchiev
Building systems Haustechnik	-
Structural engineering Baustatik	-
Building physics Bauphysik	-
Passive House project planning Passivhaus-Projektierung	Arch. Vesselin Mutafchiev
Construction management Bauleitung	-

Certifying body Zertifizierungsstelle

The Hellenic Passive House Institute

Certification ID Zertifizierungs ID

7725

Projekt-ID
www.passivehouse-database.org/

Author of project documentation Verfasser der Gebäude-Dokumentation

Arch. Vesselin Mutafchiev

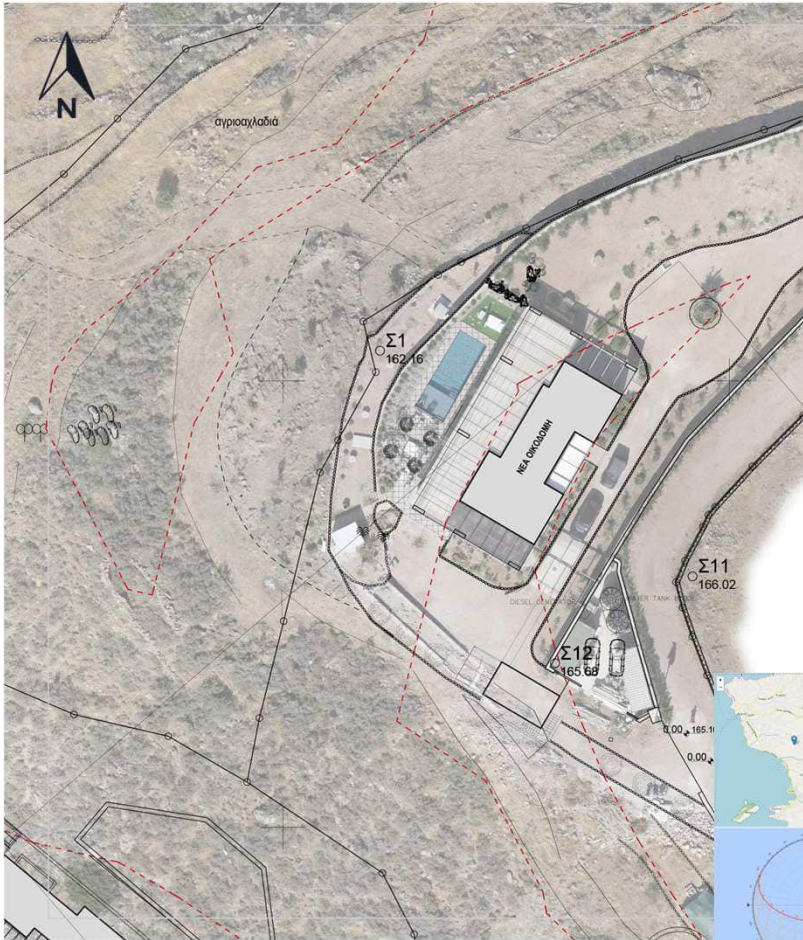
Date
Datum

14.11.2023

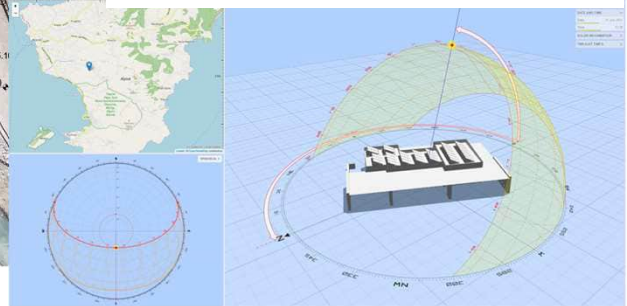
Signature
Unterschrift



Location



The house is located in Tzikides area in Aegina Island, Greece. The orientation is North-West by South-East and an analysis of the sun path has been conducted. Considering the requirements for outside living spaces and extended shading due to the West and Southern exposures, pergolas have been installed surrounding the house. On the west facade the pergola extends even further to minimise the negative effect of the afternoon sun during the summer. All windows can be opened or tilted for natural night cross-ventilation.



Climate data

Elision Villa / Climate: Athen / TFA: 131 m² / Heating: 15.1 kWh/(m²a) / Cooling: 11.8 kWh/(m²a) / PER: 45.2 kWh/(m²a)

Passive House with PHPP Version 9.0a

Selection of climate data

Country: GR-Greece
 Region: All
 Location: Aegina Island
 Climate data set: GR0002b-Athen
 Climate zone: S: Warm
 Altitude: 15.0 m
 Building location: 163 m

Result overview

Annual heating demand: 15.1 kWh/(m²a)
 Heating load: 12.8 W/m²
 Frequency of overheating: - %
 Sensible cooling: 10.4 kWh/(m²a)
 Latent cooling: 1.3 kWh/(m²a)
 Cooling load: 9.7 W/m²
 PER demand: 45.2 kWh/(m²a)

Data for heating

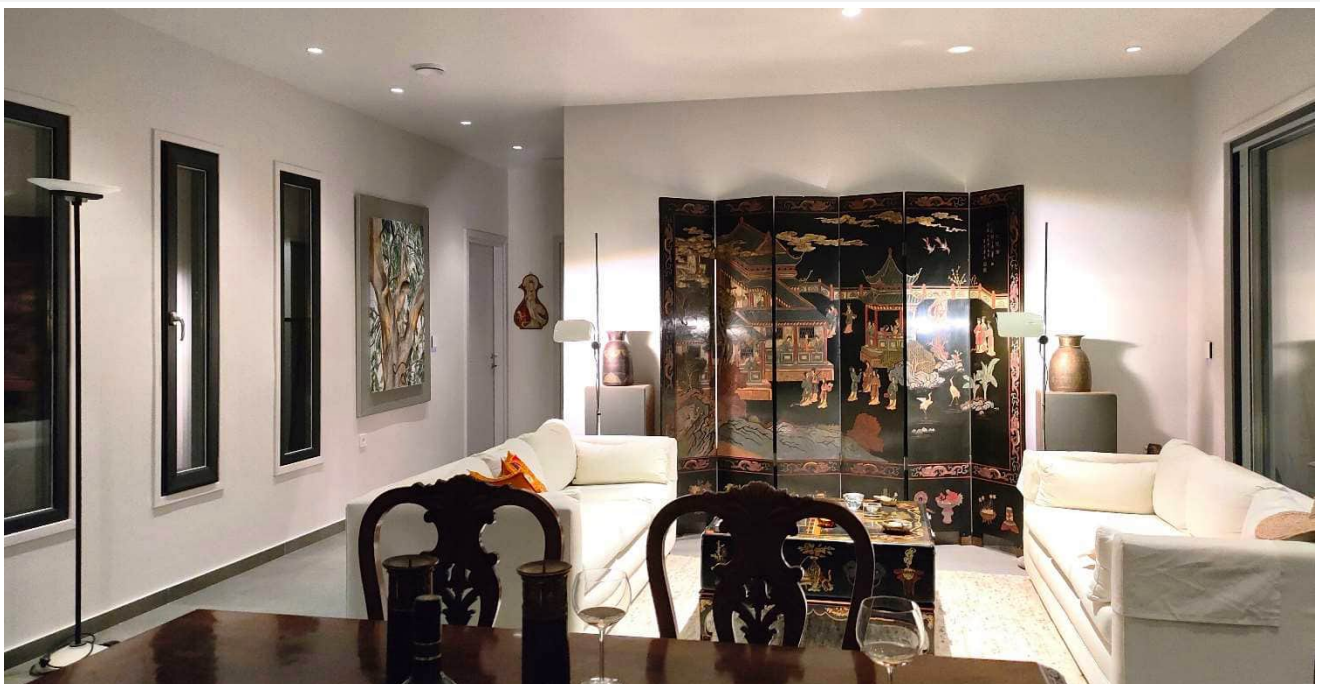
Annual method	107	181	275
Heating / cooling period	28	39	-37
Heating / cooling degree hours	63	153	408
Radiation North	158	462	959
Radiation East	320	587	963
Radiation South	194	251	670
Radiation West	256	570	1506
Horizontal radiation			

Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating load		Cooling load		PER factors	
Days	31	28	31	30	31	30	31	31	30	30	31	30	Weather 1	Weather 2	Weather 1	Weather 2		
GR0002b-Athen	Latitude °: 37.9 Longitude °: 23.7 Altitude [m]: 15 Daily temperature swing Summer [K]: 8.4																	
Exterior temperature	9.0	9.0	11.8	14.8	19.7	24.8	27.5	27.5	22.8	18.7	14.2	10.5	4.7	5.3	31.2	27.0	1.20	
Radiation North	16	20	29	36	46	51	46	39	30	26	18	15	30	25	70	55	1.20	
Radiation East	45	44	79	98	115	121	129	123	88	65	46	33	55	30	165	150	1.60	
Radiation South	108	88	120	105	82	64	51	41	112	120	114	112	85	100	40	165	220	1.50
Radiation West	43	48	79	95	115	119	124	121	92	64	54	39	50	35	165	145	2.00	
Horizontal radiation	60	70	132	168	200	224	232	210	163	109	75	53	65	55	340	265		
Dew point temperature	4.7	4.3	6.4	8.4	11.5	14.3	15.7	15.6	14.7	12.5	10.0	6.4			18.6	20.0		
Sky temperature	-2.3	-1.7	0.1	2.2	6.5	10.4	12.6	11.1	10.5	8.1	3.9	0.0			16.5	20.0		
Ground temperature	15.5	15.4	15.1	15.8	17.4	20.2	21.9	23.1	23.4	21.7	20.2	18.3	15.1	15.1	23.4	23.4		
Comment:	Source: Meteonorm V7 (Helsinki, new period). Load data by PH.																	

1. Exterior Photos



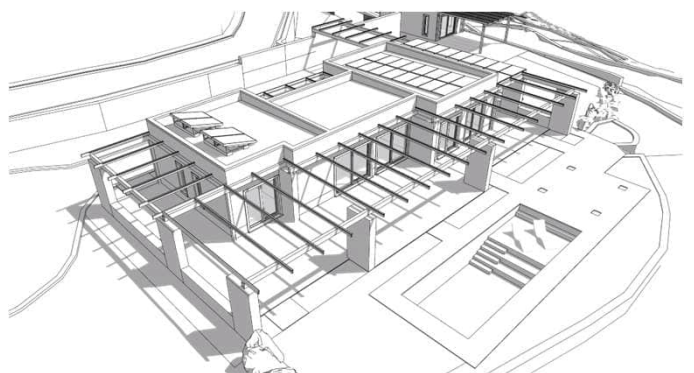
2. Interior finishing



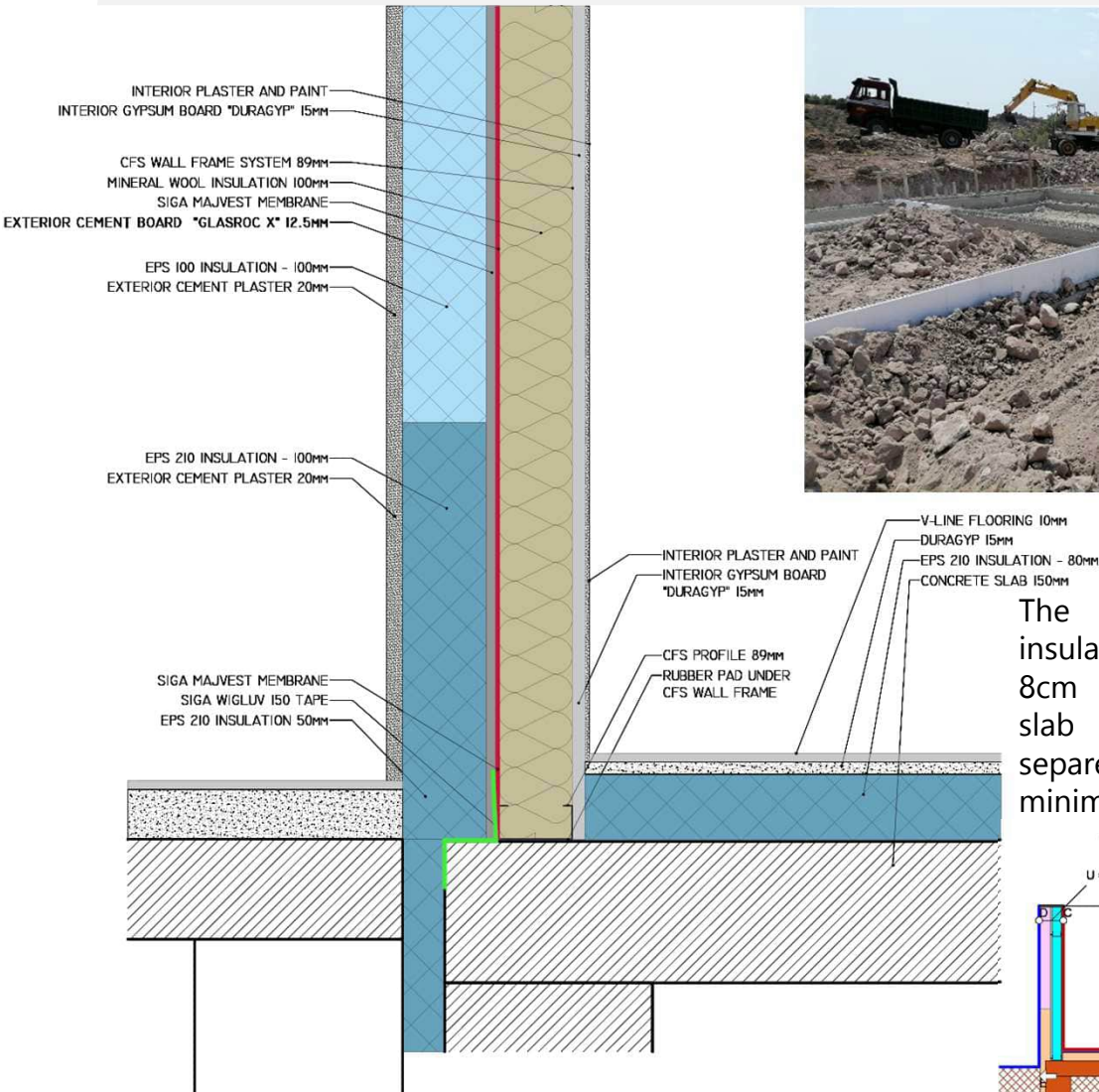
3. Floor plan



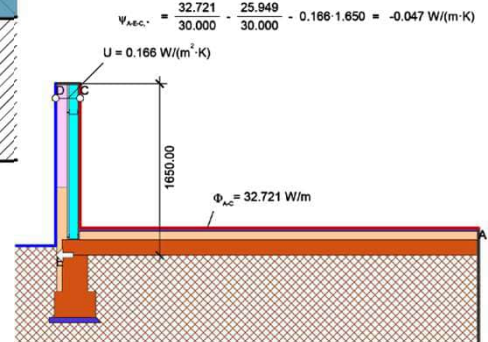
4. 3D Model



5. Construction of the floor slab

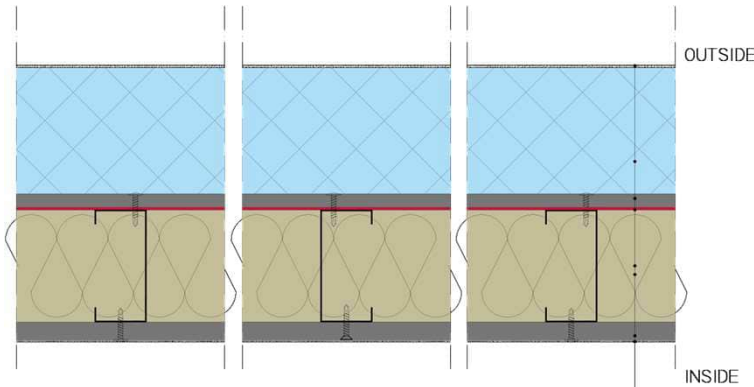


The concrete slab is insulated from the top with 8cm EPS (20 kg/m³). The slab of the veranda is separated in order to minimise the thermal bridge

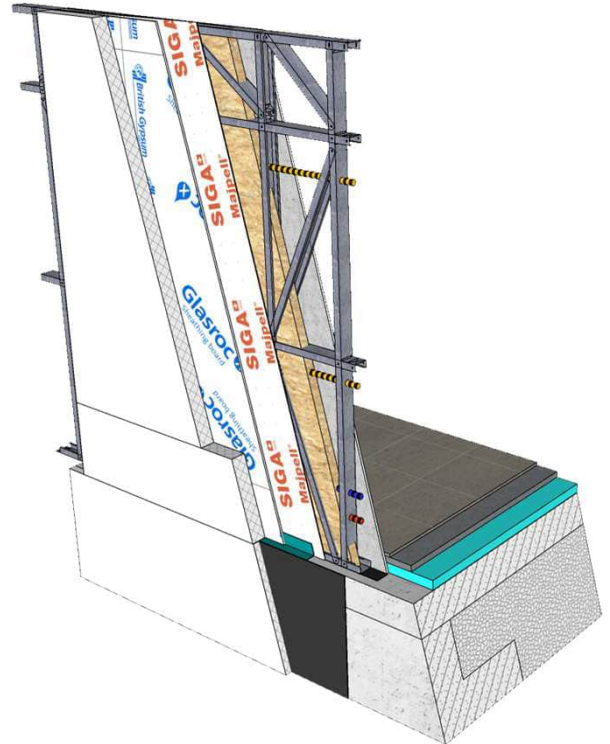


Assembly no.		03ud				Ground Slab		Interior insulation?	
Orientation of building element		3-Floor		Heat transmission resistance [m ² K/W]		interior R _{si}		0.13	
Adjacent to		2-Ground		exterior R _{se}		0.00			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]			
Concrete Slab	2.500					150			
Cement Screed	1.400					20			
V-Line Flooring	0.300					10			
EPS Insulation 27-30	0.030					50			
Percentage of sec. 1		Percentage of sec. 2		Percentage of sec. 3		Total			
100%						23.0 cm			
U-value supplement		W/(m ² K)		U-value:		0.517 W/(m ² K)			

6. Construction of the external walls



EXTERIOR CEMENT PLASTER 20MM
 EPS 100 INSULATION 100MM
 EXTERIOR CEMENT BOARD *GLASROC X* 12.5MM
 SIGA MAJPEL MEMBRANE
 METAL C-FRAME CONSTRUCTION 89MM
 MINERAL WOOL INSULATION 100MM
 INTERIOR GYPSUM BOARD DURAGYP 15MM
 INTERIOR PAINT IN COLOR

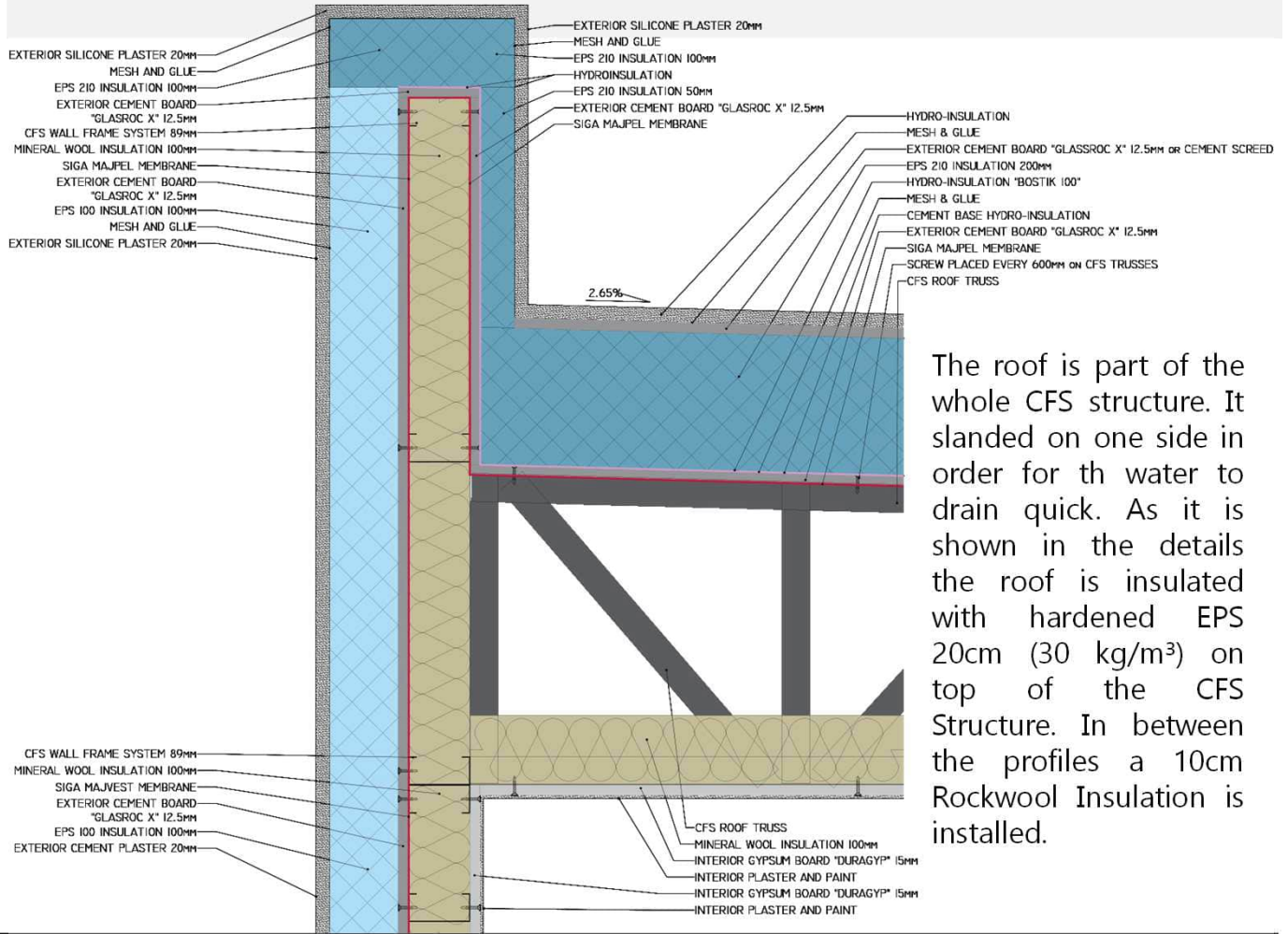


The walls system is CFS (cold formed steel) structure with 10cm Rockwool inbetween the ribs, and Glasroc-X gypsum board for outside in combination with 10cm EPS (20 kg/m³) as an exterior insulation. The system was chosen from the investor due to its fast assembly, off site production, clean construction process and better on-site project management. The installation of the CFS structure took 2 days.



Assembly no.	Building assembly description					Interior insulation?
01ud	Exterior Wall					
Heat transmission resistance [m ² K/W]						
Orientation of building element: 2-Wall		interior R _{si} : 0.13				
Adjacent to: 1-Outdoor air		exterior R _{se} : 0.04				
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Interior Plaster	0.870					10
Gyproc DuraGyp	0.250					15
Mineral Wool INS.	0.034	CFS Wall Profile	50.000			89
GlassRoc X	0.250					13
EPS Insulation 18-20	0.032					100
Percentage of sec. 1		Percentage of sec. 2		Percentage of sec. 3		Total
100%		0.0%				22.7 cm
U-value supplement: 0.03 W/(m ² K)		U-value: 0.199 W/(m ² K)				

7. Construction of the roof



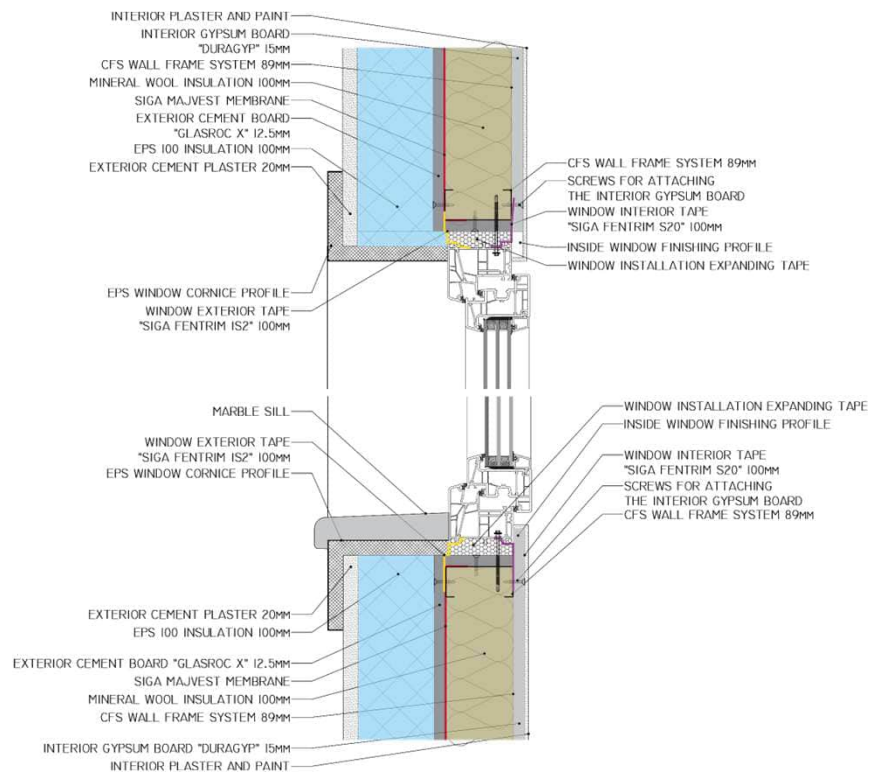
The roof is part of the whole CFS structure. It slanted on one side in order for the water to drain quick. As it is shown in the details the roof is insulated with hardened EPS 20cm (30 kg/m³) on top of the CFS Structure. In between the profiles a 10cm Rockwool Insulation is installed.

Assembly no.		02ud Roof Slab				Interior insulation?
Orientation of building element		1-Roof		Heat transmission resistance [m ² K/W]		
Adjacent to		3-Ventilated		interior R _s	0.13	
				exterior R _s	0.13	
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Interior Plaster	0.870					10
Gyproc DuraGyp	0.250					15
Air Cavity	1.420	CFS Wall Profile	50.000			300
Mineral Wool INS.	0.034	CFS Wall Profile	50.000			95
GlassRoc X	0.250					13
EPS Insulation 27-30	0.030					200
Percentage of sec. 1		Percentage of sec. 2		Percentage of sec. 3		Total
100%		0.0%				63.3 cm
U-value supplement		0.02 W/(m ² K)		U-value:		0.115 W/(m ² K)



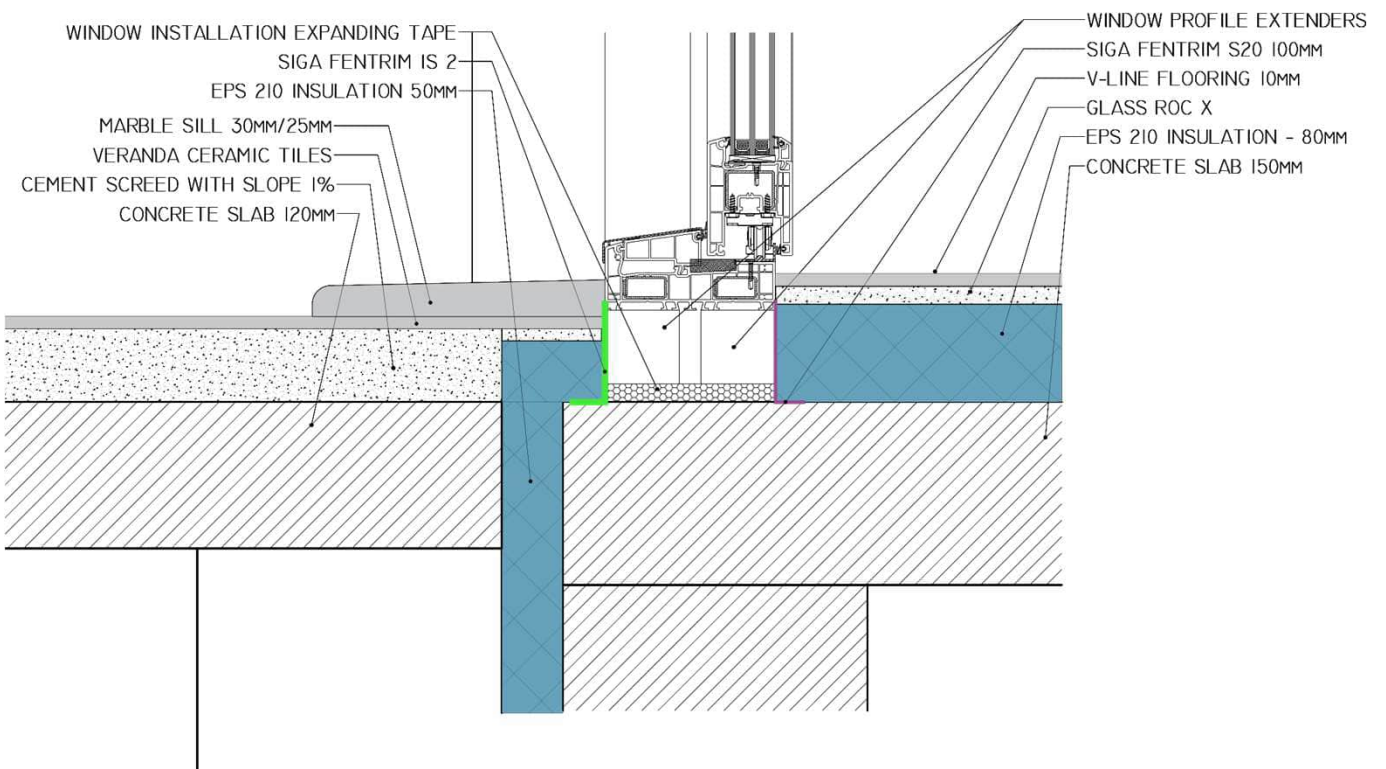
8. Windows and window installation

Description of window (frame), manufacturer	Aluplast GmbH
Window make (frame; product name)	Aluplast GmbH - Energeto 8000
Frame U-value U_f	0,94 W/(m ² K)
Glazing	Guardian - ClimaGuard nrG (4:/15/4/15/:4 Ar 90%)
Glass U-value U_g	0,60 W/(m ² K)
g-value of the Glazing	0,384



8. Windows and window installation

Description of window (frame), manufacturer	Aluplast GmbH
Window make (frame; product name)	Aluplast Smart Slide System
Frame U-value U_f	1,28 W/(m ² K)
Glazing	Guardian - ClimaGuard nrG (4:/15/4/15/:4 Ar 90%)
Glass U-value U_g	0,60 W/(m ² K)
g-value of the Glazing	0,384



9. Description of the airtight cover

The blower door test was performed after installing the airtight layer – SIGA Majpel membrane, installed on the outside of the metal structure. The test was passed and the average n50-value of the entire building was 0.5 /h at 50 Pa.



Volume for pressurization test

Sample building in city XY

Tips for calculation

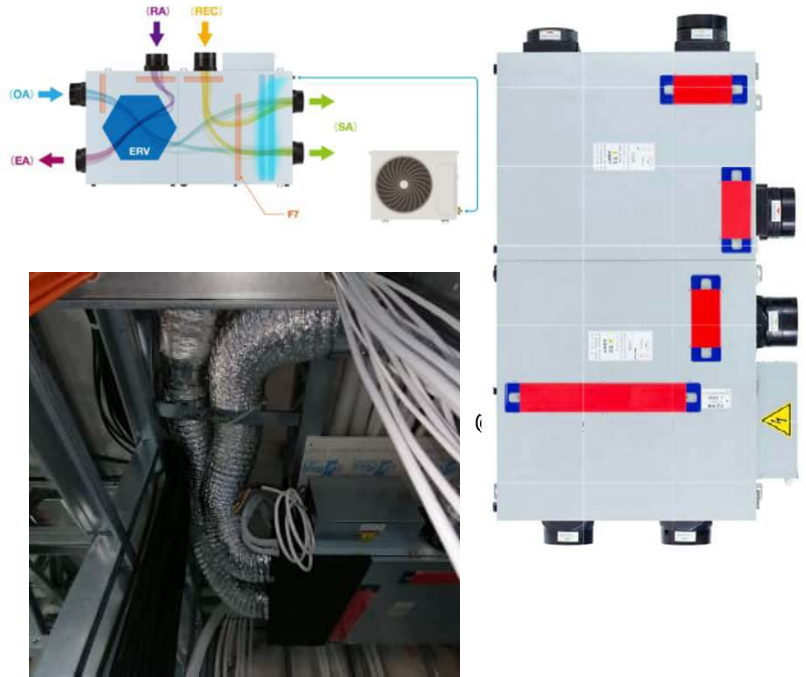
Floor	0.0
1	465.8
-	0.0
-	0.0
-	0.0
-	0.0
Total	465.8

Room name	Floor	Factor for Vn50	Room height m ²	Vn50 (Volume for press. test) m ³
1 - Main room	1	1.137	3.24	159.7
1 - Kitchen	1	1.1	3.24	35.3
1 - Bedroom 1	1	1.1	3.24	85.8
1 - Bathroom 1	1	1	3.24	16.2
1 - Bedroom 2	1	1.1	3.24	55.2
1 - Bathroom 2	1	1	3.24	16.2
1 - Bedroom 3	1	1.1	3.24	62.8
1 - Bathroom 3	1	1	3.24	16.2
1 - Technical Room	1	1	3.24	18.3
-	0			0.0



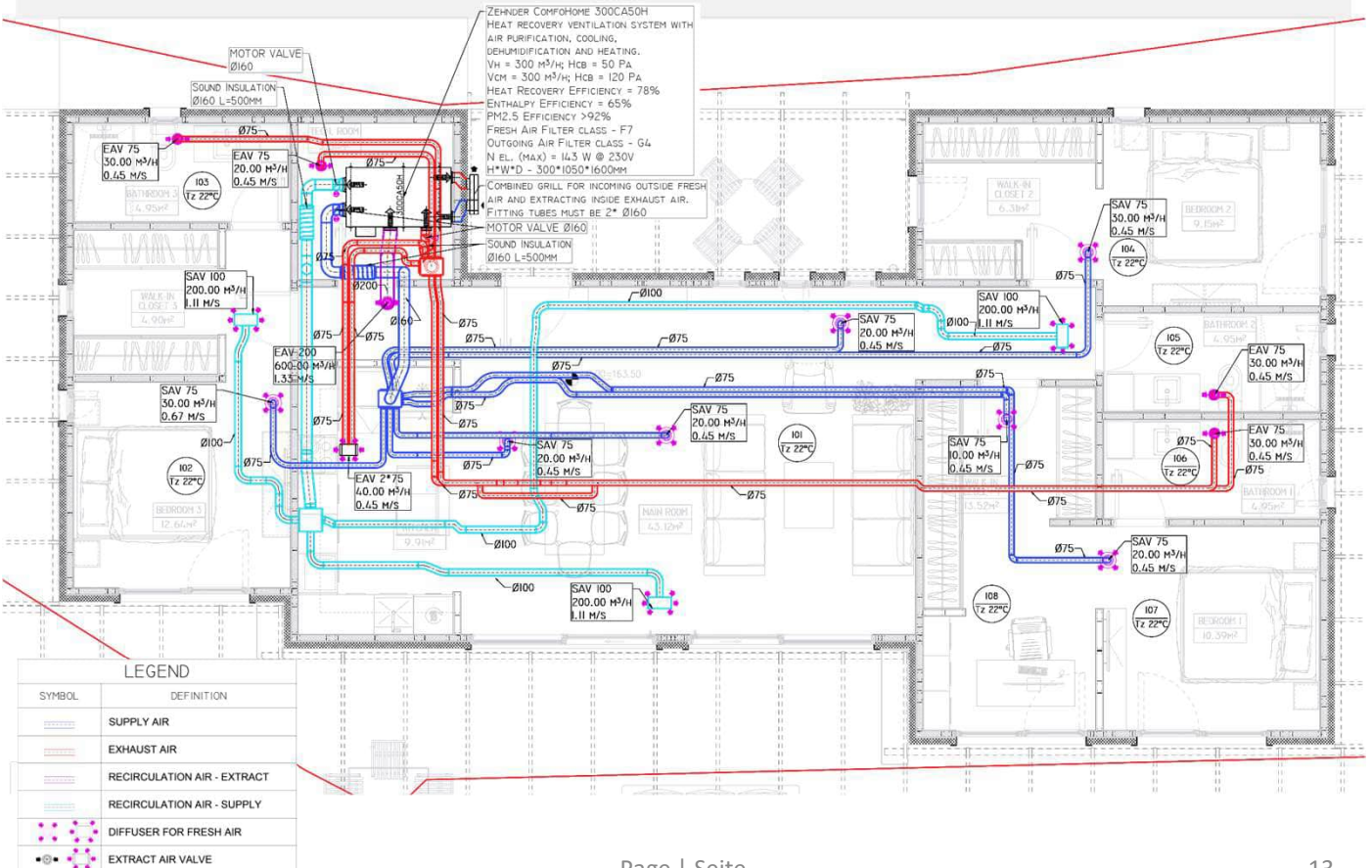
10. Ventilation system

An HRV system unit is used throughout the house. The unit itself is Zehnder ComfoHome and it is a combination of an HRV and Air to Air Heat Pump providing the necessary heating and cooling, which is centralized and achieving constant temperatures of 20°-22° C in the winter and 25°-27° C during the summer. The supply/exhaust air-flow range is 135~300 m3/h for the ventilation and up to 900 m3/h for heating/cooling using additional recirculation air. The Heat Pump has a rated heating capacity of 5.5 kW and rated cooling capacity of 5.0 kW. The HRV unit has also an enthalpy efficiency of 65%



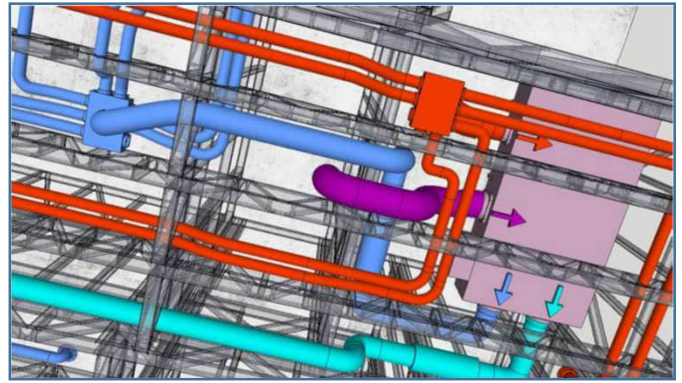
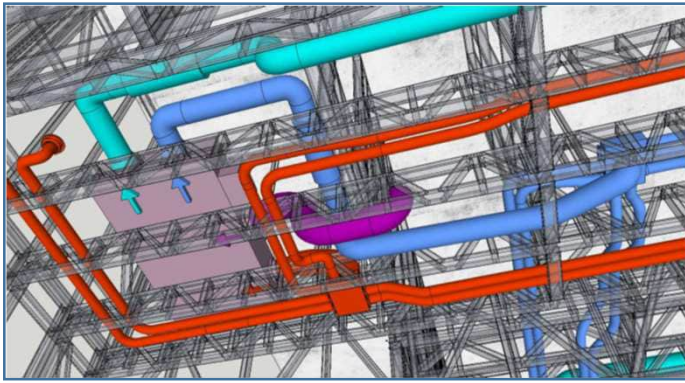
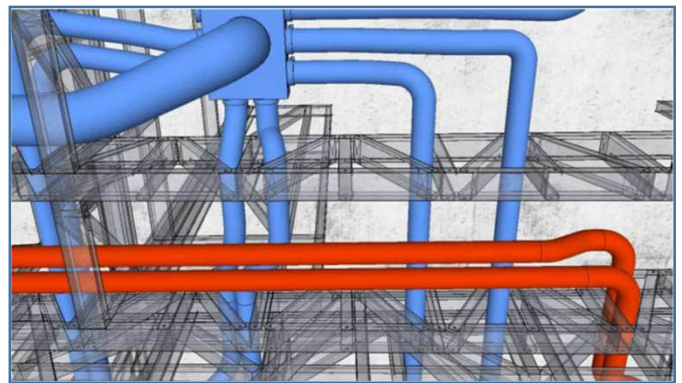
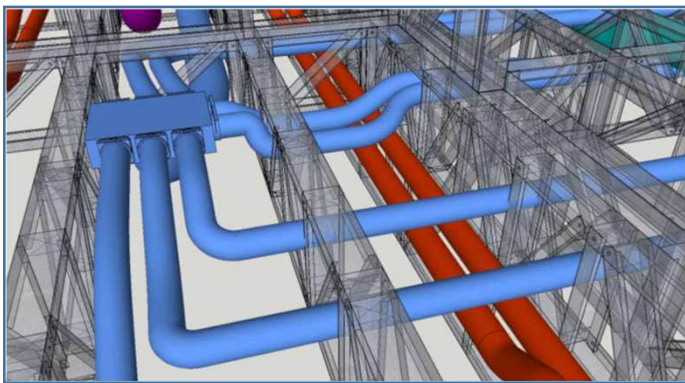
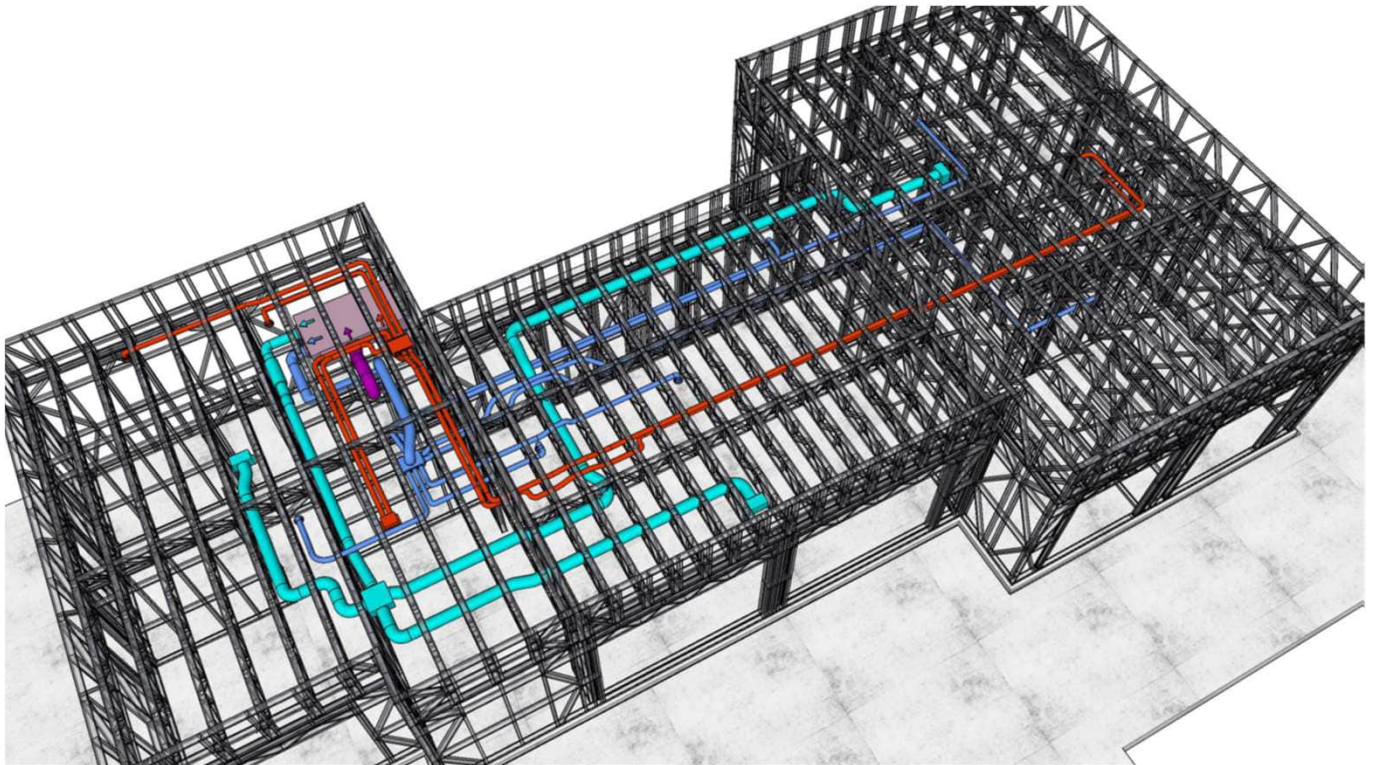
Ventilation System Make	Zehnder ComfoHome 300CA50H
Heat Recovery Efficiency	78 %
Specific Efficiency	0,45 Wh/m ³

11. Ventilation system - piping



11. Ventilation system - piping

Room no.	Amount a	Room name	Allocation to ventilation unit (No.)	Area A m ²	Clear height h m	Room vol. A x h m ³	V _{RAU} m ³ /h	V _{RAU} m ³ /h	V _{TRANS} m ³ /h	Air chng. rt. per room n 1/h	Utilisation times n/d h	Duration of holidays d	Reduction factor 1	Operation red. 1	Reduction factor 2	Operation red. 2	Reduction factor 3	Operation red. 3	
1	1	Main room	1	43.36	2.80	121	60			0.49	24	7	15	75%	100%				
2	1	Kitchen	1	9.91	2.80	28		40		1.44	24	7	15	75%	100%				
3	1	Bedroom 1	1	24.07	2.80	67	30			0.45	24	7	15	75%	100%				
4	1	Bathroom 1	1	5.90	2.80	14		30		2.14	24	7	15	75%	100%				
5	1	Bedroom 2	1	15.49	2.80	43	30			0.69	24	7	15	75%	100%				
6	1	Bathroom 2	1	5.90	2.80	14		30		2.14	24	7	15	75%	100%				
7	1	Bedroom 3	1	17.63	2.80	49	30			0.61	24	7	15	75%	100%				
8	1	Bathroom 3	1	5.90	2.80	14		30		2.14	24	7	15	75%	100%				
9	1	Technical Room	1	5.64	2.80	16		20		1.27	24	7	15	75%	100%				



12. Solar Heat & Electrical supply

As mentioned this house is off-grid and it generates it's own energy, by harvesting both wind and solar. Two solar panels are used for the direct use of the DHW, and a total of 44 PV panels are used in the production of the electricity. In addition a small wind turbine is installed near the house, capable of producing up to 5500 W.

Primary Energy Renewable PER Passive House with PHPP Version 5.6a

Selection of heat generation system(s)		Contribution margin (useful energy)		Addit. input in following worksheets		Building type: One Story Single Family House	
Primary heat generation type	Heating	DHW	Heating demand incl. distribution & hydr. frost protection	HP, possibly HP ground	Cooling energy dem. incl. dehumidification	DHW demand including distribution:	Treated floor area: 131 m ²
2-Heat pump(s)	100%	100%					Projected building footprint: 150 m ²
Secondary heat generation type (optional & different)	0%	0%					Heating demand: 15 kWh/m ²
							Cooling energy dem.: kWh/m ²
							DHW demand: 21 kWh/m ²

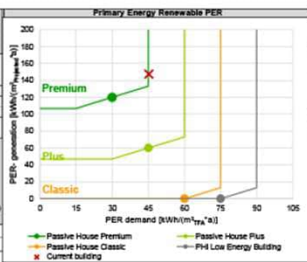
Energy demand Reference: Treated floor area	Efficiency Calculated on	User defined value	Final energy			PER			PE		CO ₂				
			Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq)	CO ₂ eq emissions				
			kWh/m ² a	kWh/m ² a	kWh/kWh	kWh/m ² a	kWh/m ² a	kWh/kWh	kWh/m ² a	kg/kWh	kg/m ² a				
2-PE factors EnEV 2014 (non-renewable)												1-CO2 factors GEM10 (Germany)			
45.2												46.9		14.5	
Heating															
Electricity (HP compact unit)			100%		1.18	10.1	1.80	16.4	1.80	16.4	4.6				
Electricity (heat pump)	2.00		100%	7.7	1.80	1.13	8.7	1.80	13.9	6.02	4.1				
District heating: 1-None					2.8(4.6)(3.3)					6.02					
Wood and other biomass					1.10										
Natural gas / RE gas					1.76			1.10	1.10	0.269					
Heating oil / RE methanol					2.30			1.10	1.10	0.320					
Solar thermal system					0.68			0.00	0.00	0.046					
Electricity (direct)					1.80			1.80		6.02					
Aux. electricity (heating, wintertime ventilation)				0.8	1.80	1.60	1.4	1.80	1.5	6.02	0.5				
Cooling and dehumidification															
Electricity cooling (heat pump)	6.00			3.1	1.60	4.7	1.80	5.6	1.80	5.6	1.7				
Auxiliary electricity cooling, ventilation summer				2.1	1.60	3.1	1.80	3.7	1.80	3.7	1.1				
Electricity dehumidification (heat pump)					2.00			1.80		6.02					
Auxiliary electricity (dehumidification)					2.00			1.80		6.02					
DHW generation															
Electricity (HP compact unit)			100%		1.20	0.61	11.8	0.14	2.8	1.80	1.8				
Electricity (heat pump)	12.88		16%	0.3	1.20	1.20	0.3	1.80	0.5	6.02	0.1				
District heating: 1-None					2.8(4.6)(3.3)										
Wood and other biomass					1.10										
Natural gas / RE gas					1.76			1.10	1.10	0.269					
Heating oil / Methanol					2.30			1.10	1.10	0.320					
Solar thermal system			84%	17.8	0.68	0.56	9.9	0.00	0.00	0.046	0.799				
Electricity (direct)					1.20			1.80		6.02					
Aux. electricity (DHW + solar DHW)				1.2	1.20	1.20	1.4	1.80	2.2	6.02	0.6				
Household electricity															
Electricity (household or non-residential lighting, etc.)				8.3	1.20	1.20	11.1	1.80	16.7	6.02	4.9				
Auxiliary electricity (other)				8.3	1.20	1.20	11.1	1.80	16.7	6.02	4.9				
Gas / RE gas drystove				2.6	1.76	1.76	4.6	1.10	2.8	0.270	0.7				

Energy generation Reference: Projected building footprint area	Final energy		PER		PE		CO ₂	
	Final energy generation	Final energy generation	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ eq emissions
	kWh/a	kWh/m ² footprint a	kWh/kWh	kWh/m ² footprint a	kWh/kWh	kWh/m ² a	kg/kWh	kg/a
147.6								
PV electricity	15298	102.2	1.00	102.2	0.00	0.0	0.130	1888.7
Solar thermal system	2328	16.6	0.68	8.7	1.22	18.0	0.046	194.8
Onshore wind power	6690	58.7	1.00	58.7	0.00	0.0	0.008	48.6

PE demand requirement in case of verification through PE (non-renewable) [kWh/m²a] Requirement met?

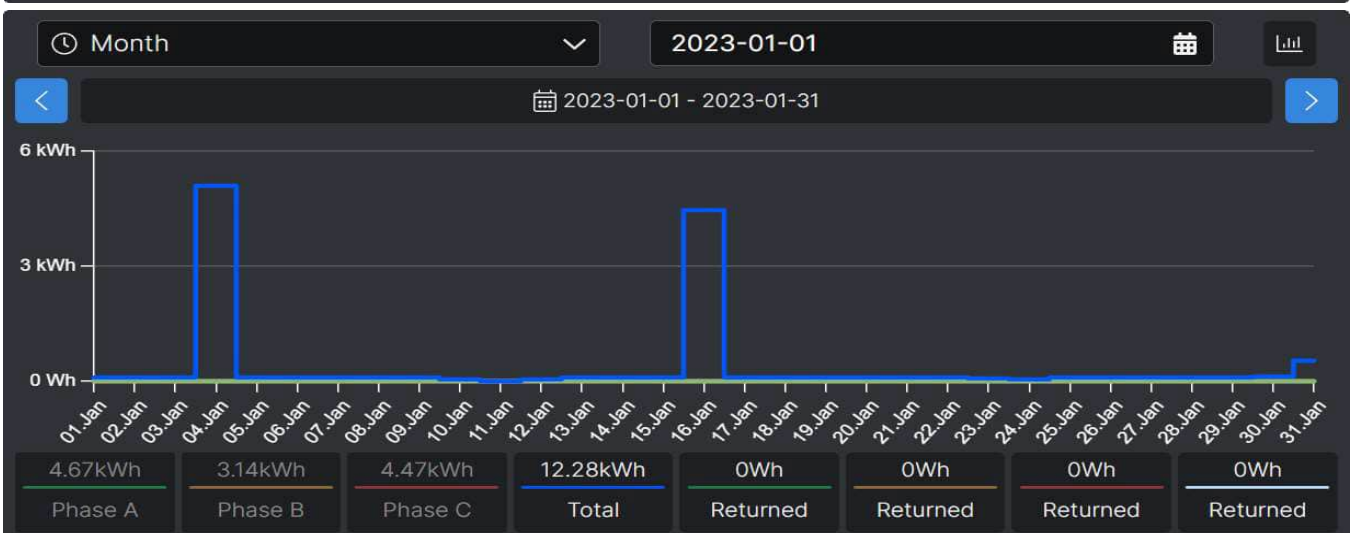
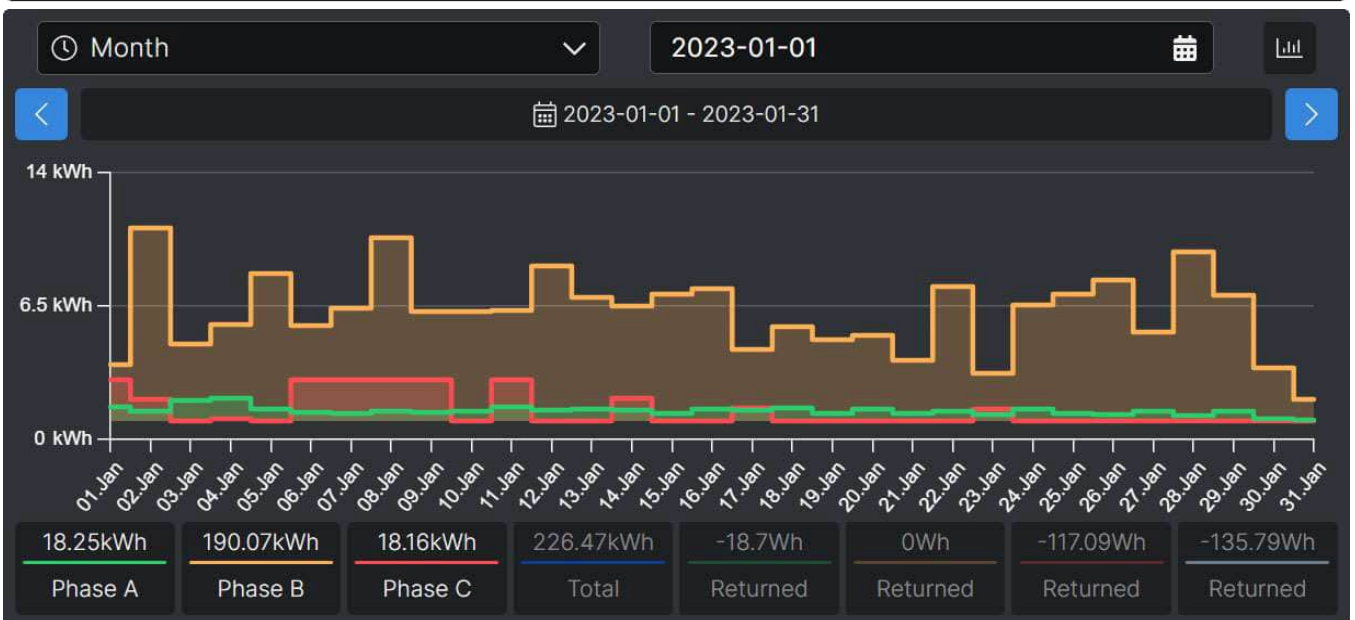
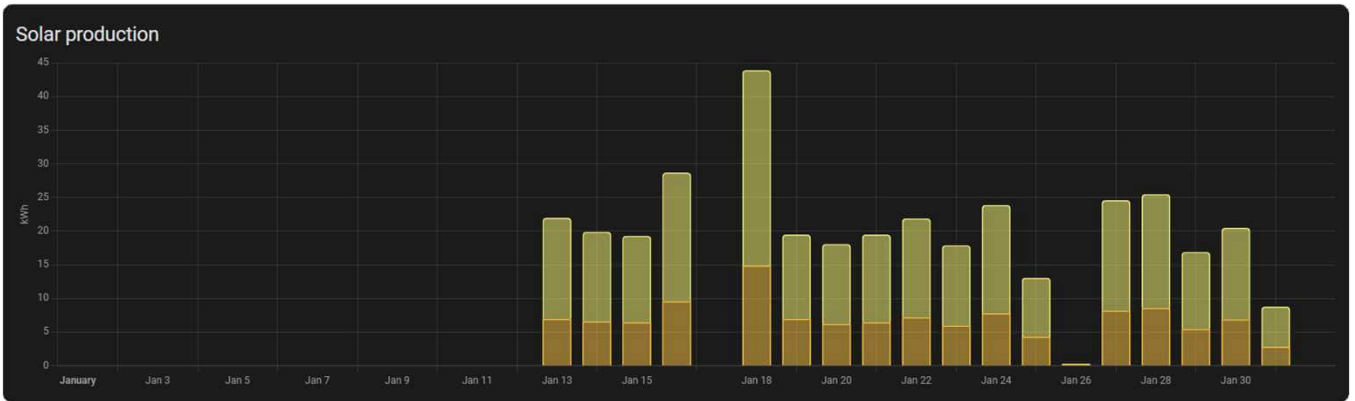
Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy, performance			Airtightness n ₅₀ t/h
	Annual heat. dem. Treated floor area	Heating load Treated floor area	Useful cool. energy Treated floor area	
	kWh/m ² a	W/m ²	kWh/m ² a	
Requirement Passive House Premium	15	10	16	0.60
Requirement Passive House Plus	30	20	31	1.00
Requirement Passive House Classic	30	20	31	0.5
Requirement PHI Low Energy Building	30	20	31	0.5
Current building reaches following class for aspect	15	Premium	13	Premium

Summary	Final energy		PER		PE value		CO ₂ eq emissions		CO ₂ eq substitution balance	
	Demand	Generation	MWh/a	MWh/a	2-PE factors EnEV 2014 (non-renewable)	1-CO2 factors GEM10 (Germany)	1-CO2 factors GEM10 (Germany)	kg/a	kg/a	kg/a
Demand	4.9	4.9	6.15	1904	1904	1904	1904	1904	1904	1904
Generation	-23.1	-22.1	-2.85	2143	-2.85	2143	-9510	-9510	-9510	-9510
Demand, cumulative generation (annual balance)	-17.24	-16.17	3.31	4047	3.31	4047	-7606	-7606	-7606	-7606
Demand w/o household electricity	4.7	4.6	3.97	1259	3.97	1259	1259	1259	1259	1259
Demand w/o household electricity, cum. generation	-18.46	-17.62	1.12	3452	1.12	3452	-9251	-9251	-9251	-9251



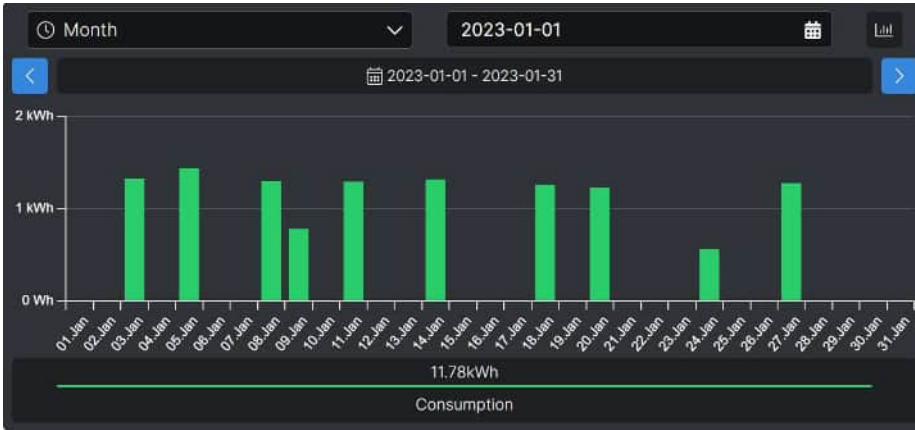
13. System monitoring

In addition, based on client desire, an electrical monitoring system is installed. Based on that the owner can monitor all electrical consumptions in addition to the generative power of the PV panels. Some of the graphs are listed below. The measurement of the electrical consumption and the solar production graph of the PV panels are taken for January of 2023.

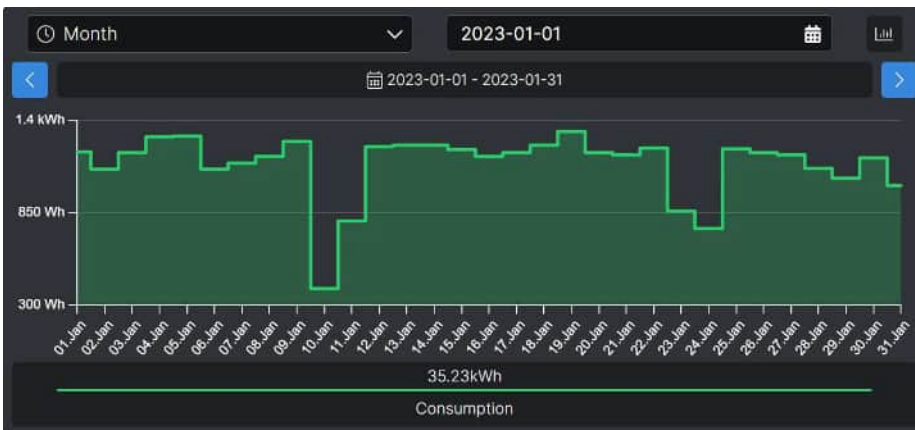


- Water Pressure Pump
- HRV
- Pool Recirculation Pump
- Water Well Pump

13. System monitoring



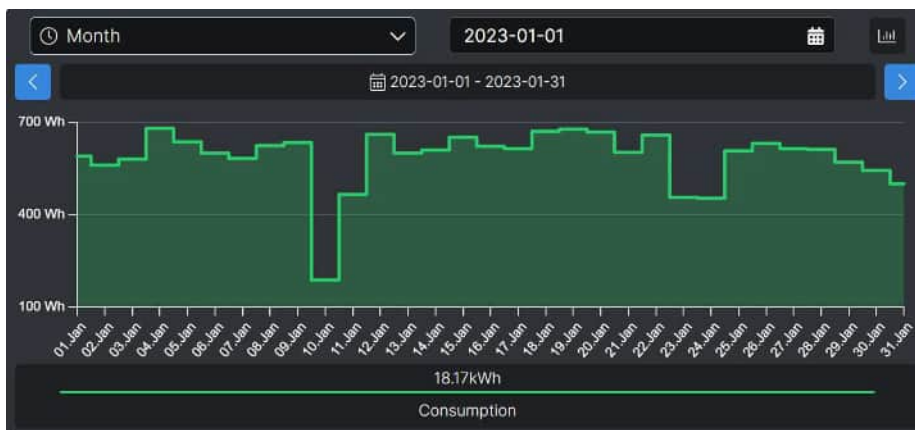
Dishwasher



Refrigerator 1 at 2C°




Washing machine



Refrigerator 1 at 6C°

15. PHPP-Results

Passive House Verification



Architecture: **Vivacitas Homes - Vesko Mutafchiev**
 Street: _____
 Postcode/City: **1000** **Sofia**
 Province/Country: **Sofia** **BG-Bulgaria**

Energy consultancy: **Vesko Mutafchiev**
 Street: _____
 Postcode/City: **1000** **Sofia**
 Province/Country: **Sofia** **BG-Bulgaria**

Year of construction: **2021**
 No. of dwelling units: **1**
 No. of occupants: **2.8**

Building: **Ellanion Villa**
 Street: _____
 Postcode/City: _____
 Province/Country: **Aegina** **GR-Greece**
 Building type: **One Story Single Family House**
 Climate data set: **GR0002b-Athen**
 Climate zone: **5: Warm** Altitude of location: **163 m**

Home owner / Client: **George Tsagaris**
 Street: _____
 Postcode/City: _____
 Province/Country: **Aegina** **GR-Greece**

Mechanical engineer: _____
 Street: _____
 Postcode/City: _____
 Province/Country: _____

Certification: _____
 Street: _____
 Postcode/City: _____
 Province/Country: _____

Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
Internal heat gains (IHG) heating case [W/m²]:	2.5	IHG cooling case [W/m²]:	3.0
Specific capacity [Wh/K per m² TFA]:	84	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area						
				Criteria	Alternative criteria	Fullfilled? ²
Space heating	Treated floor area m²	131.1				
	Heating demand kWh/(m²a)	15.13	≤	15	-	yes
	Heating load W/m²	13	≤	-	10	yes
Space cooling	Cooling & dehum. demand kWh/(m²a)	11.77	≤	16	16	yes
	Cooling load W/m²	10	≤	-	10	yes
	Frequency of overheating (> 25 °C) %	-	≤	-	-	-
	Frequency of excessively high humidity (> 12 g/kg) %	4	≤	10	-	yes
Airtightness	Pressurization test result n ₅₀ 1/h	0.5	≤	0.6	-	yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	47	≤	-	-	-
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	45	≤	30	45	yes
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	148	≥	120	133	

² Empty field: Data missing; '-': No requirement

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.

Passive House Premium? **yes**

Task: _____ First name: _____ Surname: _____ Signature: _____

Issued on: _____ City: _____