Single Family House, Ovria, Patras, Greece

Project Documentation
Έγγραφα έργου

1. Abstract / Περίληψη

Single family house in Ovria, Patras, Greece

1.1 Data of building / Δεδομένα κτηρίου

Year of construction/ Έτος κατασκευής	2021	**Space heating / Θέρμανση χώρου**	**13,75** **$kWh/(m^2a)$**
U-value external wall ambient (30cm width)/ Τιμή-U εξωτερικού τοίχου	0,176 $W/(m^2K)$		
U-value floor slab/ Τιμή-U εδαφόπλακας	0,537 $W/(m^2K)$	**Primary Energy Renewable (PER) / Πρωτογενής Ενέργεια από Ανανεώσιμες πηγές (ΠΕΑ)**	36 $kWh/(m^2a)$
U-value Flat roof slab/ Τιμή-U δώματος	0,121 $W/(m^2K)$	**Generation of renewable energy / Παραγωγή ανανεώσιμης ενέργειας**	9 $kWh/(m^2a)$
U-value Inclined roof/ Τιμή-U στέγης κλιμακοστασίου	0,127 $W/(m^2K)$		
U-value window/ Τιμή-U κουφώματος	0,85 $W/(m^2K)$ including thermal bridges	**Non-renewable Primary Energy (PE) / Πρωτογενής ενέργεια από μη Ανανεώσιμες Πηγές (PE)**	65 $kWh/(m^2a)$
Heat recovery/ Ανάκτηση θερμότητας	88%	Pressure test n_{50} / Τεστ πίεσης n_{50}	0,60 h^{-1}
Special features/ Ειδικά χαρακτηριστικά	Solar collectors for hot water generation		

1.2 Brief Project Description

Single Family House, Ovria, 26500, Patras

The project concerns the construction of a detached house, with a **TFA=159,70 m²**, which was designed to reduce the requirement for a conventional heating or air conditioning system. The property is located in Ovria - province of Patras city. It consists of a ground floor, a 1st floor and a basement accessible by external stairs. The building is located within the NE-SW axis, with main openings to the northeast and southwest. The main functions are developed in the ground floor area which includes living room, dining room, kitchen, one bathrooms and one guestroom. The 1st floor consists of three bedrooms and one bathroom.

The basement is divided into a small heated area (future small apartment) and a non-heated area used as a garage.

1.2 Σύντομη περιγραφή του έργου

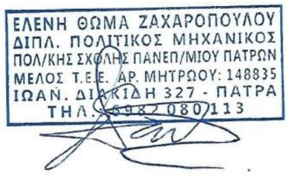
Μεζονέτα με υπόγειο και τμήμα στέγης, στην Οβρυά, 26500, Πάτρα

Το έργο αφορά την αποπεράτωση υφιστάμενης (στο στάδιο του σκελετού από Ο.Σ.) 2/όροφης μονοκατοικίας, επιφάνειας **TFA 159,70 m²**, η οποία σχεδιάστηκε με σκοπό να μειωθεί η απαίτηση συμβατικού συστήματος θέρμανσης ή κλιματισμού. Το ακίνητο βρίσκεται στην Τ.Κ. Οβρυάς, στον Νομό Αχαΐας σε μικρή απόσταση από το κέντρο της Πάτρας. Αποτελείται από ισόγειο, Α’ όροφο και υπόγειο χώρο προσβάσιμο με εξωτερική σκάλα. Ο άξονας του κτηρίου είναι στην διεύθυνση ΒΑ – ΝΔ μέσα στο οικόπεδο, με κύρια ανοίγματα στο νότο και στην ανατολή. Οι κύριες λειτουργίες αναπτύσσονται στον χώρο του ισογείου που περιλαμβάνει σαλόνι, τραπεζαρία, κουζίνα, ένα μικρό μπάνιο και ένα δωμάτιο φιλοξενίας. Στον Α’ όροφο που αποτελείται από τρία υπνοδωμάτια και ένα μεγάλο μπάνιο. Το υπόγειο αποτελείται από ένα θερμαινόμενο χώρο (μελλοντική γκαρσονιέρα) και μη θερμαινόμενο χώρο (γκαράζ).

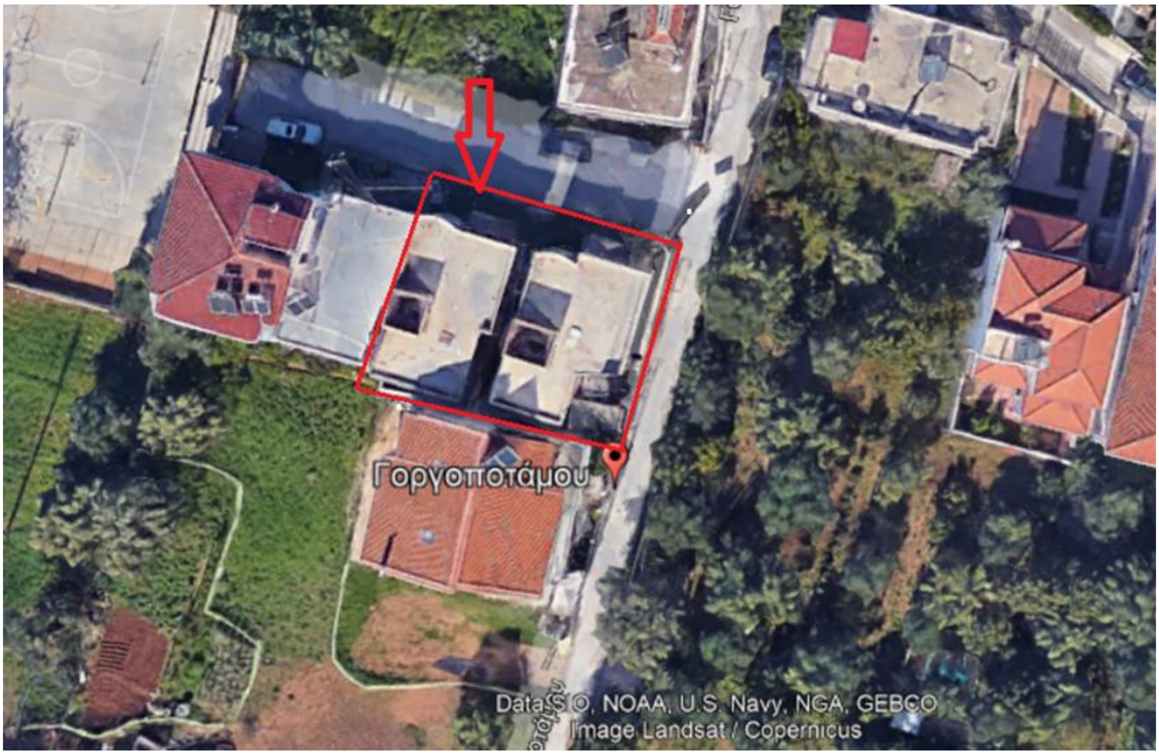
1.3 Responsible project participants / Συμμετέχοντες υπεύθυνοι για το έργο

Architect/ Αρχιτέκτονας	Technical Office Zacharopoulos (ECODOMI) www.ecodomi.gr
Implementation planning/ Σχεδιασμός υλοποίησης	Eleni Zacharopoulou www.ecodomi.gr, https://www.linkedin.com/in/eleni-zacharopoulou-a03777b6/
Building systems/ H/M	PROJECT15 Τζαννή Αλεβιζάτου 64,15669 Παπάγου, Greece
Structural engineering/ Στατική Μηχανική	Technical Office Zacharopoulos (ECODOMI) www.ecodomi.gr
Building physics/ Φυσικός Κτιρίου	Eleni Zacharopoulou www.ecodomi.gr, https://www.linkedin.com/in/eleni-zacharopoulou-a03777b6/
Passive House project planning/ Ενεργειακός Σχεδιασμός Passive House	Eleni Zacharopoulou www.ecodomi.gr, https://www.linkedin.com/in/eleni-zacharopoulou-a03777b6/
Construction management/ Διαχείριση Κατασκευής	Technical Office Zacharopoulos (ECODOMI) www.ecodomi.gr

Certifying body/ Φορέας Πιστοποίησης	Stefan Pallantzas, Hellenic Passive House Institute
Certification ID/ ID Πιστοποίησης	**42317_HPHI_PH_20240402_SPA**
Project-ID (www.passivehouse-database.org) ID Έργου (www.passivehouse-database .org)	6945

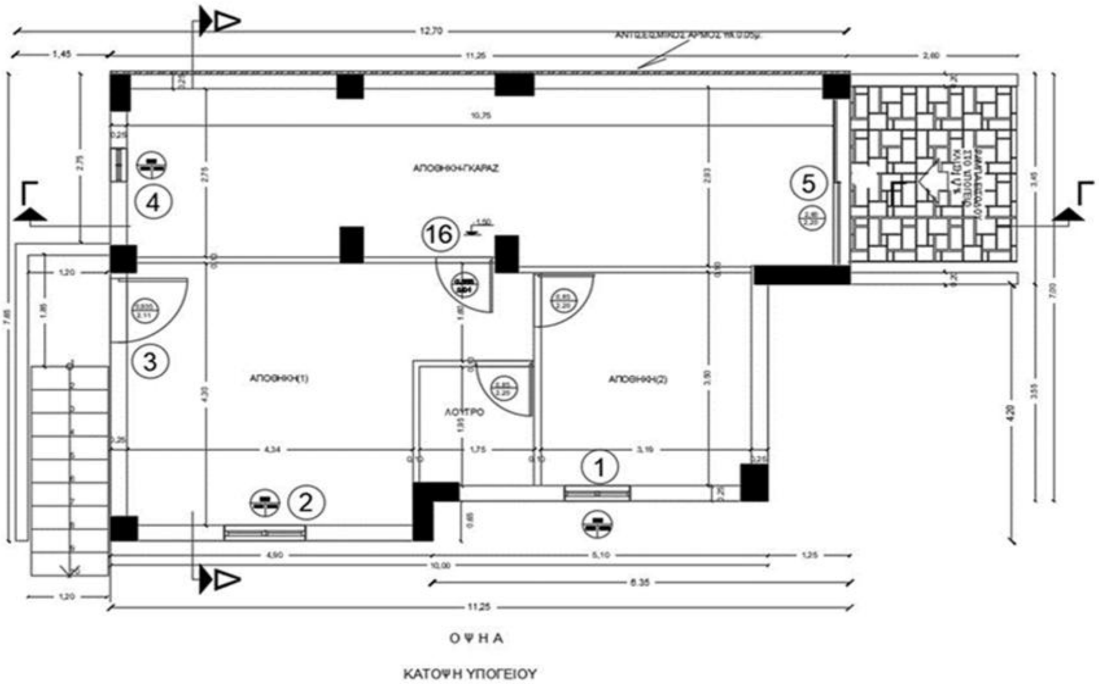
Author of project documentation / Συντάκτης του παρόντος εγγράφου 	Eleni Zacharopoulou , Patras, 10/05/2024

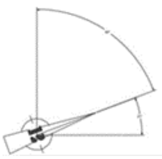
2. Geographical location of the Passive Single Family House in Ovria, Patras



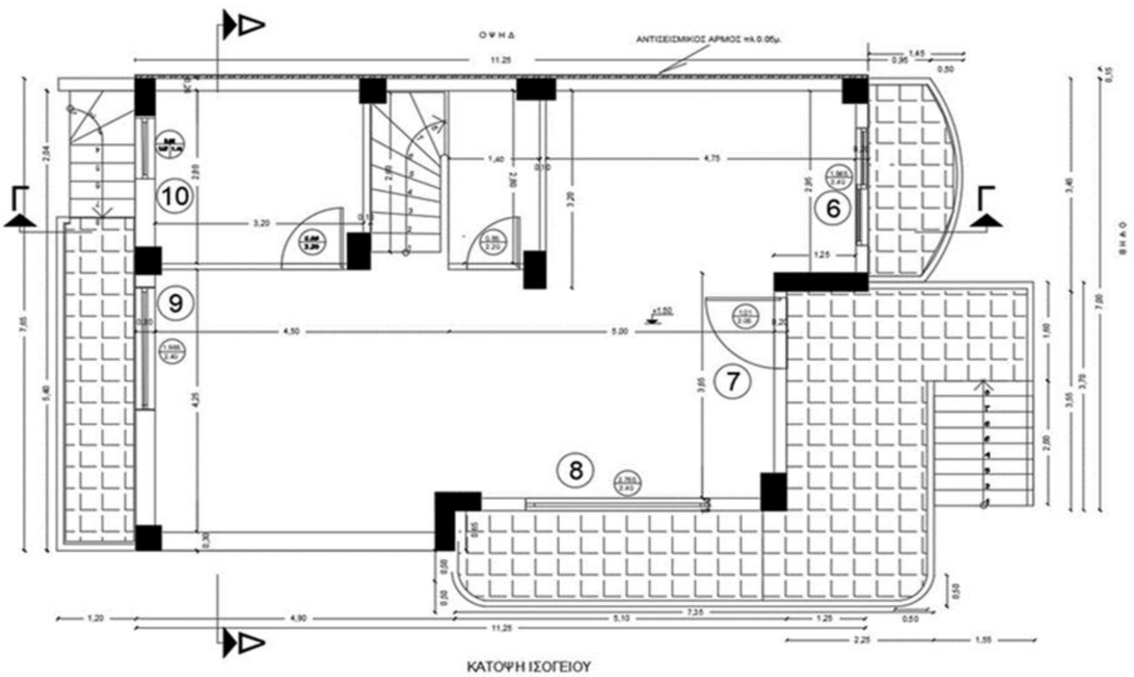
Picture 1. The location of the Passive House from Google maps

3. Floor plans of the Passive Single Family House in Ovria, Patras

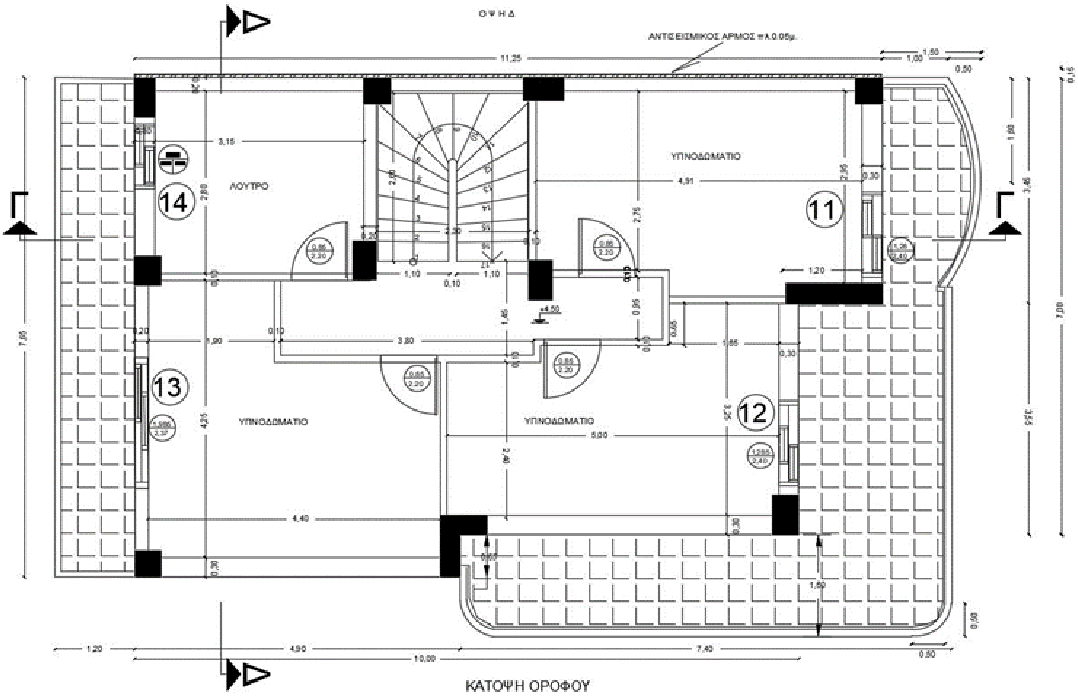




Picture 2. Floor plan of the basement



Picture 3. Floor plan of the ground floor



Picture 4. Floor plan of the 1st floor

The detached house consists of 3 floors, the ground floor, the first floor and the basement. The basement floor plan is shown on Picture 2 and it includes two bedrooms, the utility room and storage areas. The ground floor plan is shown on Picture 3 and consists of the living room, the dining room, the kitchen, a guest room and one bathroom. The first floor is shown on Picture 4 and consists of 3 bedrooms and one bathroom. The main entrance of the building is located on the northeast. The two floors are connecting with interior stairs. The house has large areas of balconies, which implies an increased thermal insulation demand due to extra losses through the envelope.

4. Construction details of the envelope

1. Exterior wall assembly

The building is constructed with reinforced concrete frames (slabs, columns and beams) and 30cm thick brick walls, lime plastered from the inside. The building is thermally insulated, with external insulation of 15 cm thick EPS80 with λ=0,031W/mK, all around its perimeter. The exterior brick wall assembly has a U-value= 0,176 W/m2K and the concrete sections a U-value= 0,149 W/m2K.

Picture 5. Placement of the exterior insulation of the thermal envelope

2. Basement exterior wall and floor slab assembly

The insulation of the basement walls and the basement floor slab has been placed internally, with EPS80 that had a thickness of 5 cm in the walls and 5 cm on the slab. The external wall insulation of 12 cm thickness covered up the 30% of the external basement walls. The U-value of the external concrete wall of the basement is 0,543 W/(m2K) and for the basement slab (ground) is 0,537 W/(m2K).

Picture 6. Basement wall and slab insulation

3. Roof/ Ceiling

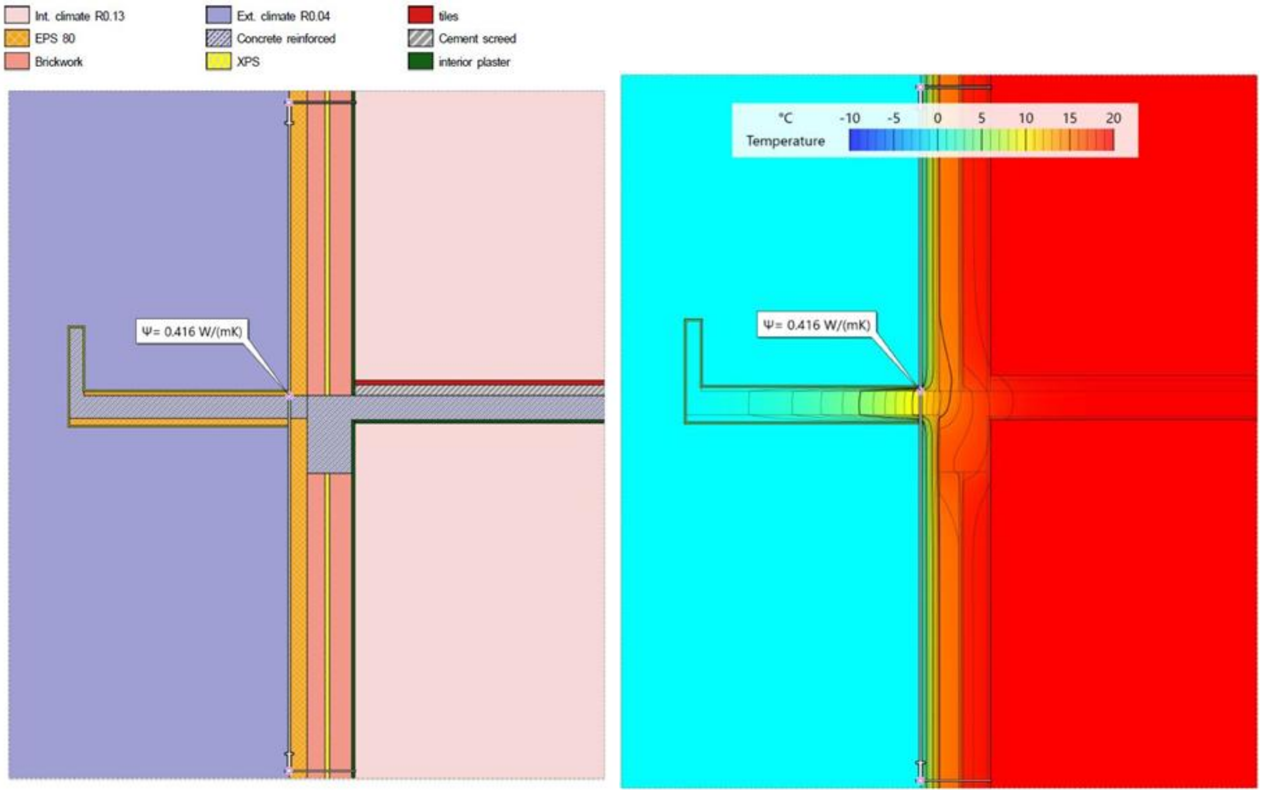
The roof consists of two independent parts: the flat roof slab and an inclined slab that covers the internal stairs which leads from the 1st floor to the flat roof slab. The flat roof part consists of the concrete ceiling slab, the insulation layer and a final waterproof ceiling. The inclined slab is consisted of a steel roof construction with panels with λ=0,026 W/(mK) as coverage and an insulation layer of 20 cm within the panels. The insulation layer for the flat roof slab is EPS 200 with λ=0,030W/mK and 20 cm thickness. The roof assembly has a U-value = 0,121 W/(m2K) and the inclined roof a U-value = 0,127 W/(m2K).

Picture 7. Flat ceiling roof and inclined roof details

4. Thermal Bridges

All existing thermal bridges have been calculated and designed to have the least impact on heating or cooling demand of the building and the ψ -values are entered in PHPP.
For example, the up and down surfaces of the balconies were covered with EPS200 with 5cm thickness and the thermal bridge ψ-value is calculated 0,416 W/mK.

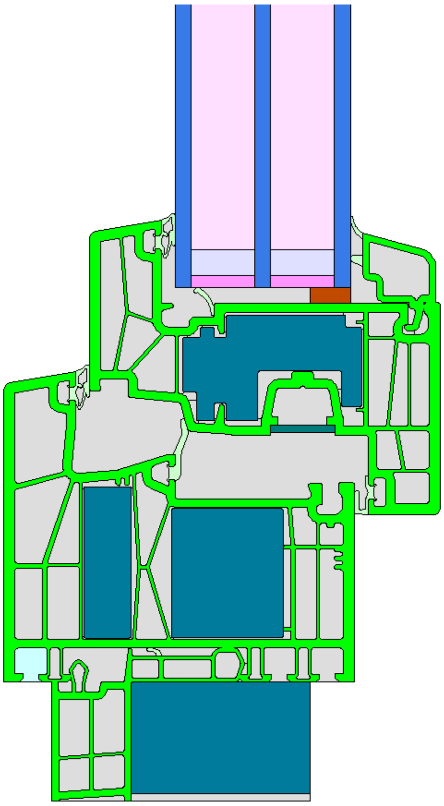
Picture 8. Balcony insulation



Picture 9. Balcony thermal bridge

5. Windows installation details

The placement of the windows was designed to minimize thermal bridges to achieve the Passive House Standard. Windows were hung on the external side of the brick walls, inside the insulation layer. The frames are **Kömmerling 88MD** foam inside with Uf=0,95 W/(m²K) and triple insulated glazing 4+4solar-14-4+4 with Argon THERMIX as glazing spacer and with Ug=0,6 W/(m²K) and g- value=0,54.



Picture 10. Details of the installation of the windows

Picture 11. Window installation

5. Description of the airtight envelope; documentation of the pressure test result

The airtightness is essential in the construction of a passive house, so that the uncontrolled heat losses are minimized. The basic blower door test system includes three components: a calibrated fan, a door panel system, and a pressure measuring device. The blower door fan is used to blow air into or out of the building, creating either a positive or negative pressure differential between the inside and outside of the building. This pressure differential forces air through all holes and penetrations in the building enclosure. The tighter the building (e.g., fewer holes), the less air is needed from the blower door fan to create a change in building pressure. For a Passive House project, the goal is to achieve n_{50}= 0,60h^{-1} or lower at a pressure of 50 Pa.

The blower door test was performed after finishing the internal airtightness layer (plastering) and it showed the average performance of **n_{50}=0,59 1/h.**

ΕΛΛΗΝΙΚΟ ΙΝΣΤΙΤΟΥΤΟ ΠΑΘΗΤΙΚΟΥ ΚΤΙΡΙΟΥ

BUILDING LEAKAGE TEST

Hellenic Passive House Institute
Anastaseos 112
Papagou , Attika 15669
Email: info@eipak.org Website: www.eipak.org

Date of Test: 14/2/2022 Test File: Georgoulopoulos
Technician: Stefan Pallantzas
Project Number: 009

Customer: Popi Michalopoulou, Nikos Georgoulopoulos, Gorgopotamou, Ovria, Patras, Achaia 26500, Phone:, Fax:

Building Address: Single Family House, Gorgopotamou, Ovria, Patras, Achaia 26500

	Depressurization	Pressurization	Average
Test Results at 50 Pascals:			
V50: m³/h50 (Airflow)	239 (+/- 1.1 %)	213 (+/- 1.2 %)	226
n50: 1/h (Air Change Rate)	0.63	0.56	0.59
w50: m³/(h·m² Floor Area)	1.94	1.72	1.83
q50: m³/(h·m² Envelope Area)	0.53	0.47	0.50
Leakage Areas:			
Canadian EqLA @ 10 Pa (cm²)	92.0 (+/- 2.2 %)	82.3 (+/- 2.3 %)	87.1
cm²/m² Surface Area	0.20	0.18	0.19
LBL ELA @ 4 Pa (cm²)	48.4 (+/- 3.6 %)	43.5 (+/- 3.9 %)	46.0
cm²/m² Surface Area	0.11	0.10	0.10
Building Leakage Curve:			
Air Flow Coefficient (Cenv) m³/(h·Paⁿ)	17.9 (+/- 5.8 %)	16.2 (+/- 6.3 %)	
Air Leakage Coefficient (CL) m³/(h·Paⁿ)	17.9 (+/- 5.8 %)	16.2 (+/- 6.3 %)	
Exponent (n)	0.662 (+/- 0.016)	0.658 (+/- 0.018)	
Correlation Coefficient	0.99955	0.99945	

Test Standard: EN 13829
Test Mode: Depressurization and Pressurization
Type of Test Method: B
Regulation complied with: PASSIVE HOUSE n50 ≤ 0.6 1/h

Picture 12. Blower Door Test Results

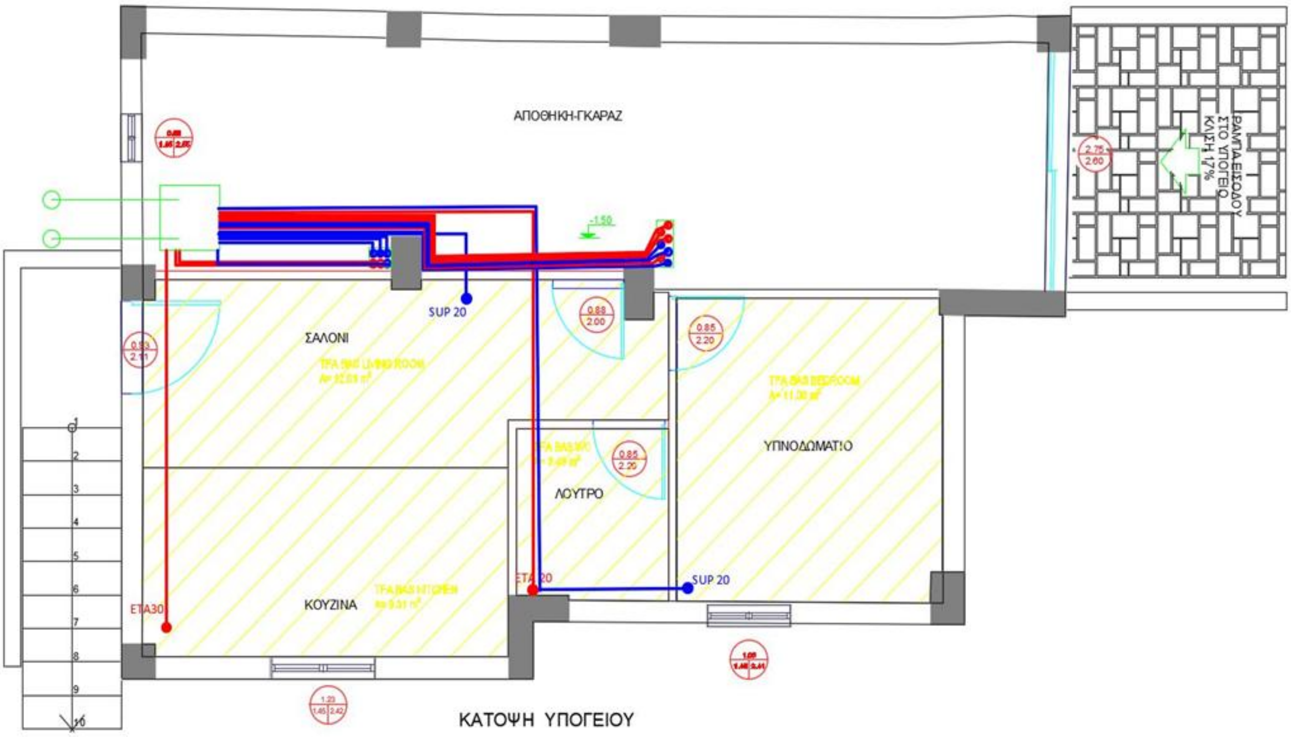
In order to achieve the airtightness goal, the airtightness layer was the internal plaster. The windows were sealed in their perimeter with special airtightness tapes, all the connections of ducts to the thermal envelope with airtightness collars and special airtight electrical junction boxes were installed.

Picture 13. Windows airtight installation

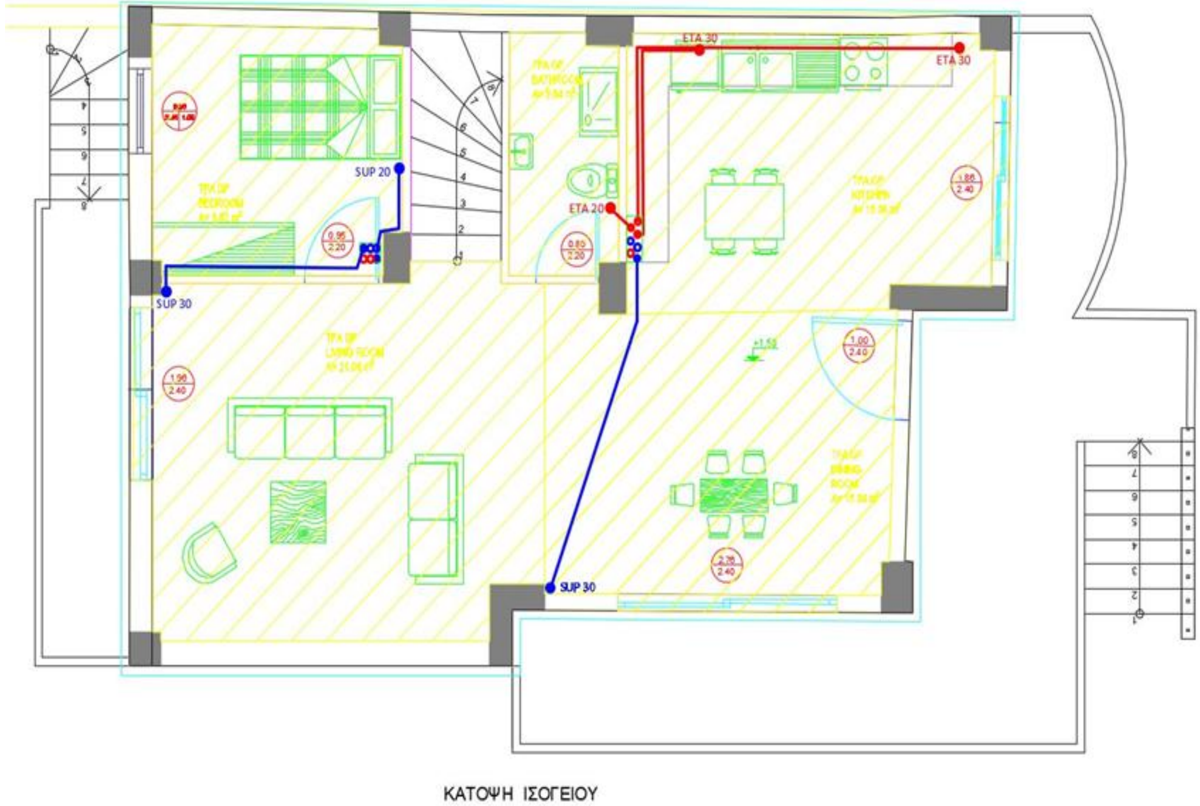
Picture 14. Sealing collars on ducts

6. Planning of ventilation ductwork

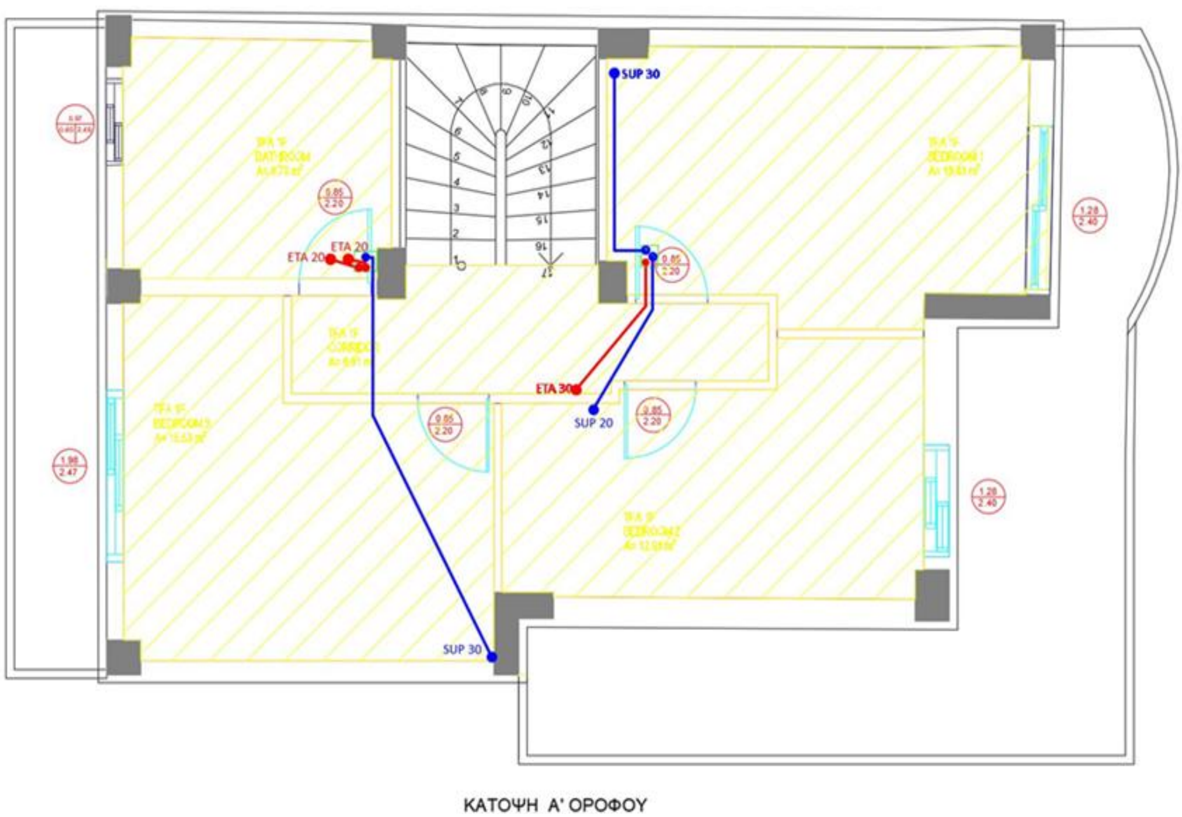
In order to reduce heat losses through ventilation, a dual-flow mechanical ventilation system with high efficiency air-to-air heat exchanger unit was installed. The normal air-flow is 140 m^3/h (annual average value). The unit is **PICHLER - LG 350 System VENTECH** with effective **heat recovery rate 89% and the humidity recovery rate is 75%.**



Picture 15. Basement ventilation plan



Picture 16. Ground floor ventilation plan



Picture 17. 1st floor ventilation plan

7. Building services (heating, cooling, DHW)

The heating and cooling demand is covered by two air conditioners split unit, DAIKIN model FDXS25F, 3,2kW each and COP=4,00. Each split unit is connected with ducts, that supply air in all rooms. One unit covers the heating needs of the 1st floor (3 bedrooms, 1, W.C, and hallway) and the second one covers the heating needs of ground floor (kitchen, dinning room, living room, guestroom and 1, W.C.)
The heating demands are alternatively covered by an airtight fireplace Lotus Unico in the living room.

For the domestic hot water, a water tank of 160lt has been installed (model MasterSOL Eco) with 8 m^2 solar panels on the roof of the building which covers all of the building DHW demands.

Picture 18. Split unit air condition at the 1st floor

Picture 19. DHW installation

8. PHPP calculations

All the building data have been imported to the PHPP v9 planning program, verifying that the Passive House Classic certification criteria are met.

Passive House Verification

		Building:	detached house
		Street:	GORGOPOTAMOU
		Postcode/City:	26500 OVRIA
		Province/Country:	PATRAS GR-Greece
		Building type:	
		Climate data set:	ud---01-GR0004a-Patras
		Climate zone:	5: Warm — Altitude of location: 66 m
		Home owner / Client:	NIKOS GEORGOULOPOULOS
		Street:	
		Postcode/City:	
		Province/Country:	
Architecture:	TECHNICAL OFFICE ZACHAROPOULOS (ECODOMI)	**Mechanical engineer:**	PROJECT 16
Street:	IOANNI CHRYSOSPATHI 6	Street:	TZ. ALEVIZATOU 64
Postcode/City:	26224	Postcode/City:	15669 PAPAGOU
Province/Country:	PATRAS GREECE	Province/Country:	ATHENS/GREECE 2-Non-residential building
Energy consultancy:	ELENI ZACHAROPOULOU (ECODOMI)	**Certification:**	STEFAN PALLANTZAS
Street:	IOANNI CHRYSOSPATHI 6	Street:	HELLENIC PASSIVE HOUSE INSTITUTE
Postcode/City:	26224	Postcode/City:	
Province/Country:	PATRAS GREECE	Province/Country:	ATHENS/GREECE

Year of construction:	2021	Interior temperature winter [°C]:	20,0	Interior temp. summer [°C]:	25,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,4	IHG cooling case [W/m²]:	2,4
No. of occupants:	3,0	Specific capacity [Wh/K per m² TFA]:	204	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

		Value		Criteria	Alternative criteria	Fulfilled?[2]
	Treated floor area m²	159,7				
Space heating	Heating demand kWh/(m²a)	13,75	≤	15	-	yes
	Heating load W/m²	14	≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	16,61	≤	19	19	yes
	Cooling load W/m²	10	≤	-	10	
	Frequency of overheating (> 25 °C) %	-	≤	-		-
	Frequency of excessively high humidity (> 12 g/kg) %	3	≤	10		yes
Airtightness	Pressurization test result n_{50} 1/h	0,6	≤	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	65	≤	-		-
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	36	≤	60	60	yes
	Generation of renewable energy (in relation to projected building footprint) kWh/(m²a)	9	≥	-	-	

[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.

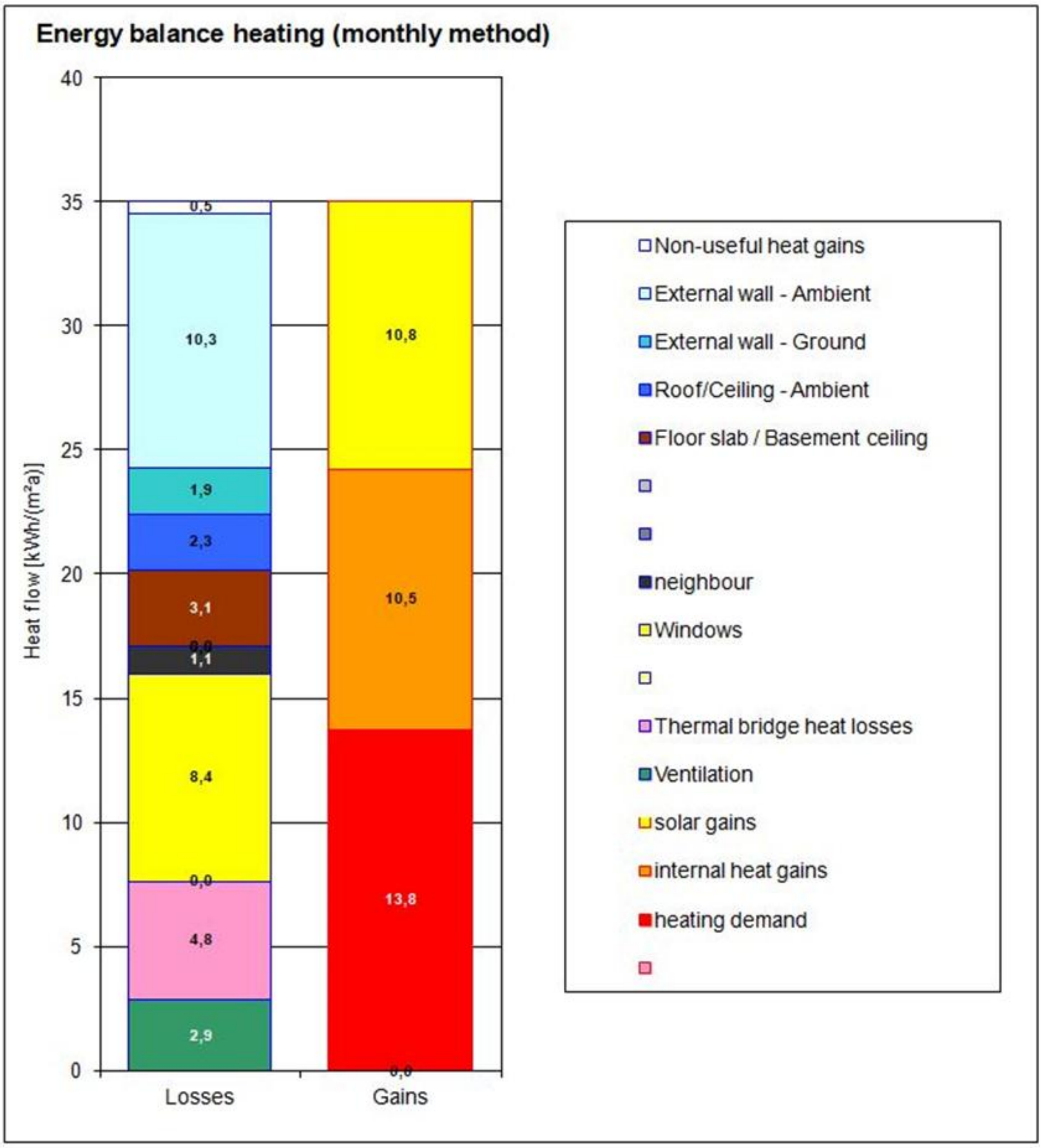
Passive House Classic? yes

Task:	First name:	Surname:	Signature:
	ELENI	ZACHAROPOULOU	

	Issued on:	City:
	15/06/24	PATRA

ΕΛΕΝΗ ΘΩΜΑ ΖΑΧΑΡΟΠΟΥΛΟΥ
ΔΙΠΛ. ΠΟΛΙΤΙΚΟΣ ΜΗΧΑΝΙΚΟΣ
ΠΟΛ/ΚΗΣ ΣΧΟΛΗΣ ΠΑΝΕΠ/ΜΙΟΥ ΠΑΤΡΩΝ
ΜΕΛΟΣ Τ.Ε.Ε. ΑΡ. ΜΗΤΡΩΟΥ: 148835
ΙΩΑΝ. ΔΙΑΚΙΔΗ 327 - ΠΑΤΡΑ
ΤΗΛ. 6942 080113

Picture 20. Verification worksheet of the PHPP v9.



Picture 21. The heating demand balance of the single-family house in Ovria, Patras,Greece calculated by the PHPP

Most of the heating losses are caused by the windows and the external walls to the ambient. On the contrary most of the heat gains come from the windows and the internal heat gains account for about one third. The remaining heating demand is about 13,8 kWh/(m2a).

9. Construction costs

Total building cost (VAT and taxes included): 120.000 €
The landscaping works are not included.
The cost for the building was only 7% more than the current standard building cost in Greece.

i. References

- Passive House Data Base:

  https://passivehouse-database.org/index.php#d_6945