REPORT
PUBLIC

GR CS2: Papagos, Athens

RENOVATION APPROACH DOCUMENT

outPHit
Deep retrofits made faster, cheaper and more reliable

Call: H2020-LC-SC3-2018-2019-2020 / H2020-LC-SC3-EE-2020-1

Deliverable D5.2

Last updated: 7 October 2022 by Nektarios Tsakoumakis

CONTACT

Nektarios Tsakoumakis
Hellenic Passive House Institute
+30.211.4081109 | n.tsakoumakis@eipak.org

OUTPHIT – DEEP RETROFITS MADE FASTER, CHEAPER AND MORE RELIABLE
outPHit pairs such approaches with the rigour of Passive House principles to make deep retrofits cost-effective, faster and more reliable. On the basis of case studies across Europe and in collaboration with a wide variety of stakeholders, outPHit is addressing barriers to the uptake of high quality deep retrofits while facilitating the development of high performance renovation systems, tools for decision making and quality assurance safeguards.
outphit.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957175. The presented contents are the author's sole responsibility and do not necessarily reflect the views of the European Union. Neither the EASME nor the European Commission are responsible for any use that may be made of the information contained therein.

GR CS2_PAPAGOS_ATHENS

Renovation Approach Description

TABLE OF CONTENTS

1. Executive Summary

Single family house in Papagos, in the northern area of Athens. The single family house is constructed with one floor, roof and pilotis, in 1960. The building needed to be renovated because it was too expensive to maintain proper inside temperatures during winter and summer period. So the decision to make the renovation by EnerPHit standard was easy. The owners knew about the Hellenic Passive House Institute as the offices are located near the renovated house as well as the son of the owner knew Dimitris Pallantzas in personal.

For the renovation of the house everything will be calculated and the renovation will take place holistically. So, the thermal envelope is going to be upgraded with the adequate insulation. This will include the façade, the roof and the insulation of the pilotis. The windows are going to be replaced with high quality PVC frames, triple glazing with argon and plastic spacers. The EnerPHit standard will be completed by the installation of the mechanical ventilation with heat recovery.

What made this renovation a fast, cheap and reliable was the time spend during the designing and the implementation study that took place. Everything was calculated in order to follow a streamlined renovation method. This resulted in a fast renovation with minimum gaps between the necessary phases, the installation of the insulation, then the windows replacement and in the end the installation of the MVHR.

In this project the RES will be limited in a solar hot water collector with integrated hot water tank.

The biggest challenges in this project were the need for the users to stay inside the house during the whole renovation , the limitation of the thermal bridges, as there were a lot of columns connected to the pilotis of the apartment, as well as, the increased cost of the materials and the high rates of inflation.

Figure 1 Photo taken during the installation of the roof insulation

2. Description of the existing building

The existing building was a very bad efficiency building that needed too much oil to be heated in an adequate, but out of the thermal standard, temperature. The same happed also during the cooling period where the roof and the walls of the single family house where quite warm. This resulted in a nonstop operation of the cooling systems that they were struggling to bring the temperatures inside the house even at 30^{o}C. The building had to use 3.5 tons of oil every year (3.500€ then and now about 6300€) for heating and almost 15.000 kWh (1000€ then, and now these amount of kWh would cost about 2700€) for cooling.

After the renovation the demand will be for heating and cooling less than 4500kWh, which means a cost of 810€ per year!

GR CS2_PAPAGOS_ATHENS

Renovation Approach Description

Figure 2 The existing building before the renovation

2.1. Building data

Year of construction:	1960
Treated Floor Area:	147.9m^2
Number of floors:	1
Number of apartments:	1
Building typology (residential / other):	Residential
Main construction type (e.g. massive)	massive

2.2. Owner data

Name:	Aristidis Stavropoulos
City:	Athens, Greece
Type (private / housing association):	Private

2.3. Location description

The house is located in the northern part of Athens, in Papagos area. Near the house there is the Hymettus mountain which makes the climate a bit colder than the rest of the near regions. The house is located in 224m altitude. The climate is considered warm with 181 days/year of heating and 153 days/year with data from the monthly balance.

2.4. Original situation

The existing building has a massive construction with pillars and columns from reinforced concrete and brick-concrete walls. The envelope was completed non insulated. The situation of the building was moderate as there were many building elements with mold and bad external surfaces.

2.5. Plans and pictures of the existing building

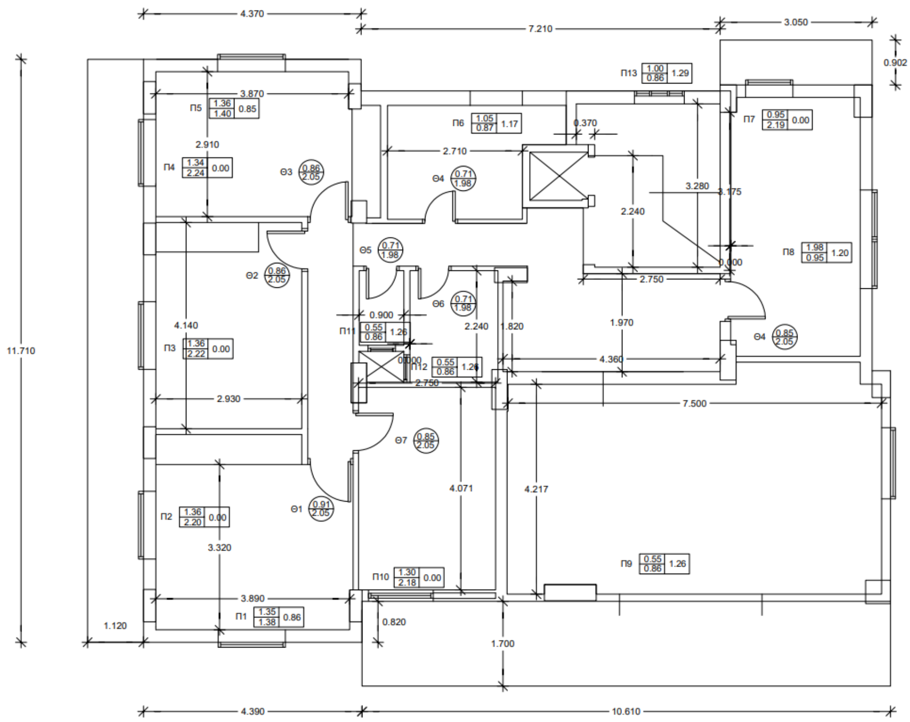

Figure 3 Groundfloor plan of the existing building

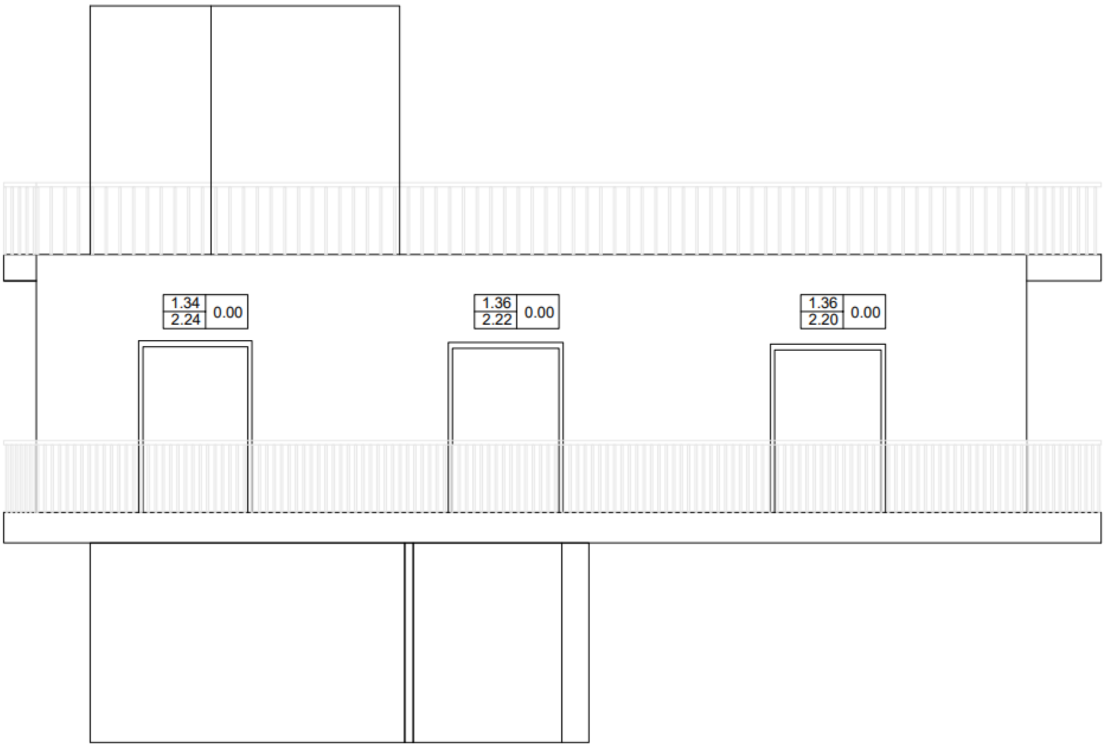

Figure 4 Southeast elevation of the existing building

Figure 5 The southeast and southwest elevations of the building

2.6. Envelope of the existing building

External walls

Material:	85%Brick / 15%Concrete
Thickness:	26.5[cm]
Surface (Render / Brick / Cladding):	Plaster-Brick/Concrete
U-Value:	2.078[W/(m²K)]

Floor slab Ground

Material:	Reinforced Concrete
Thickness:	21[cm]
Surface (Render / Brick / Cladding):	concrete-cement plaster-tiles
U-Value:	4.326[W/(m²K)]

Floor slab Ambient

Material:	Reinforced Concrete
Thickness:	18[cm]
Surface (Render / Brick / Cladding):	concrete-cement plaster-tiles
U-Value:	4.004[W/(m²K)]

Roof / Top floor ceiling

Material:	Reinforced Concrete
Thickness:	15[cm]
Surface (Render / Brick / Cladding):	concrete-cement plaster-tiles
U-Value:	4.348[W/(m²K)]

Windows

Material:	Aluminium
Thickness:	5[cm]
Material (Wood / Plastic / Aluminium):	Aluminium
U-Value (Uw, installed):	5[W/(m²K)]

2.7. Technical equipment of the existing building

Ventilation

Ventilation concept:	Window Ventilation

Heating, Cooling and DHW

Heating:	Oil boiler with radiators
Cooling:	Three split unit A/C per apartment
Domestic hot water: storage	Small system of solar DHW with integrated tank

2.8. Energy efficiency of the existing building

Passive House Planning Package (PHPP)

PHPP calculation:	PHPP_9.6
Space heating demand:	531 [kWh/(m²a)]
Heating Load:	239 [W/m²]
Overheating frequency:	- %
Cooling demand:	101.15 [kWh/(m²a)]
Cooling Load:	111 [W/m²]
Primary Energy Demand:	777[kWh/(m²a)]
PER Demand:	1386[kWh/(m²a)]

Final Energy demand

Final energy demand gas:	- [kWh/(m²a)]
Final energy demand oil:	577.5 [kWh/(m²a)]
Final energy demand electricity:	10 [kWh/(m²a)]
Final energy demand other:	53.9 [kWh/(m²a)]

Available consumption before renovation

Annual energy consumption gas:	- [kWh/(m²a)]
Annual energy consumption oil:	274 [kWh/(m²a)]
Annual energy consumption electricity:	150 [kWh/(m²a)]
Annual energy consumption other:	- [kWh/(m²a)]

GR CS2_PAPAGOS_ATHENS

Renovation Approach Description

Available energy costs before renovation

Annual energy costs gas:	- [€/(m²a)]
Annual energy costs oil:	23.65 [€/(m²a)]
Annual energy costs electricity:	15 [kWh/(m²a)]
Annual energy costs other:	- [kWh/(m²a)]

PHPP verification sheet before retrofit

Specific building characteristics with reference to the treated floor area

			Value		Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	147,9				
Space heating	Heating demand	kWh/(m²a)	531,00	≤	-	-	-
	Heating load	W/m²	239	≤	-	-	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	101,15	≤	-	-	-
	Cooling load	W/m²	111	≤	-	-	
	Frequency of overheating (> 25 °C)	%	-	≤	-		-
	Frequency of excessively high humidity (> 12 g/kg)	%	0,1	≤	10		yes
Airtightness	Pressurization test result n_{50}	1/h	8,0	≤	1,0		no
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	777	≤	-		-
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	1386	≤	1268	1283	no
	Generation of renewable energy (in relation to projected building footprint area)	kWh/(m²a)	2	≥	-	14	

EnerPHit (retrofit): Component characteristics

Building envelope to exterior air[1] (U-value)	W/(m²K)	3,20	≤	0,5	no
Building envelope to ground[1] (U-value)	W/(m²K)	4,29	≤	0,52	no
Wall w/int. insulation in contact w/exterior air (U-value)	W/(m²K)	-	≤	0,75	-
Wall w/interior insulation in contact w/ground (U-value)	W/(m²K)	-	≤	0,97	-
Flat roof (SRI)	-	72	≥	-	-
Inclined and vertical external surface (SRI)	-	72	≥	-	-
Windows/Entrance doors ($U_{W/D,installed}$)	W/(m²K)	4,94	≤	1,25	no
Windows ($U_{W,installed}$)	W/(m²K)	-	≤	1,30	-
Windows ($U_{W,installed}$)	W/(m²K)	-	≤	1,40	-
Glazing (g-value)	-	0,70	≥	-	-
Glazing/sun protection (max. solar load)	kWh/(m²a)	269	≤	100	no
Ventilation (effective heat recovery efficiency)	%		≥	-	-
Ventilation (humidity recovery efficiency)	%		≥	-	-

[1] Without windows, doors and external walls with interior insulation
[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.

EnerPHit Classic? no

Task: First name: Surname: Signature:

Issued on: City:

3. Renovation approach description

This renovation will be fast, cheap and reliable due to the time spend during the designing and the implementation study that took place. Everything was calculated in order to follow a streamlined renovation method. This resulted in a fast renovation while minimizing the performance gap of the building designed.

The necessary improvements consist of the installation of the insulation, the windows replacement and the installation of the MVHR.

In this project the RES will be limited in a solar hot water collector with integrated hot water tank.

3.1. EnerPHit standard approach

EnerPHit standard target (class):	Classic
Climate Zone	Warm
EnerPHit verification method :	Component method

3.2. Design / Consultancy teams

Name:	Hellenic Passive House Institute
City:	Athens
Type (private / housing association)	Private

3.3. Design / Construction periods

Design period:	01.03.2021 – 30.06.2021
Construction period:	1.09.2021 – ……….

3.4. Plans and pictures of the renovation

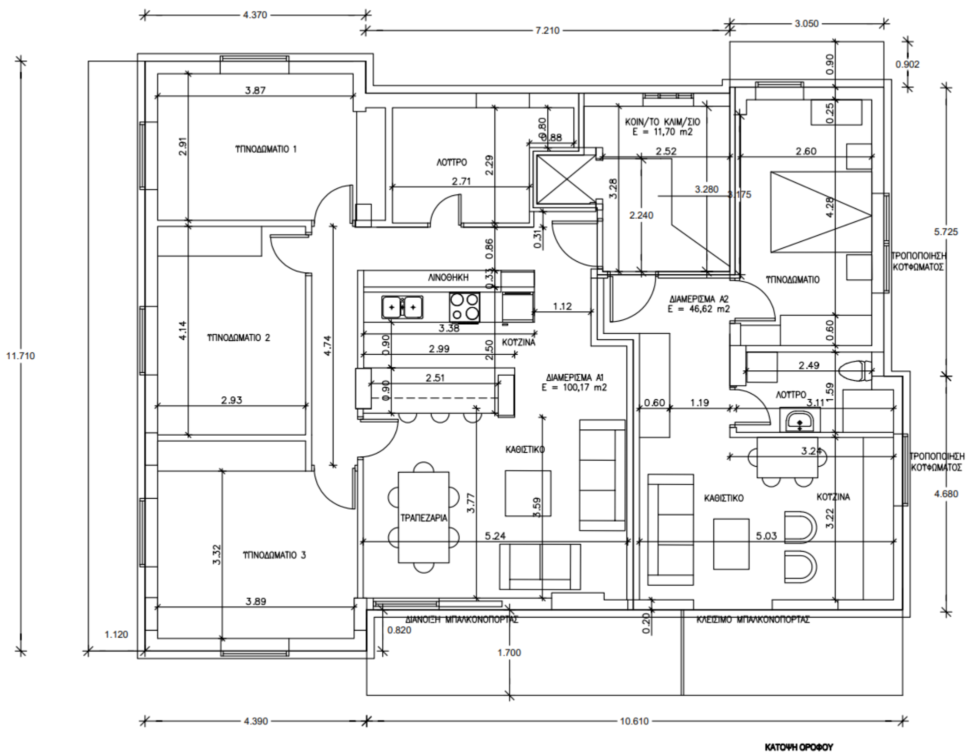

Figure 6 Post renovation groundfloor plan with the two separated apartments

There are not available connection details

Photos during the construction phase

Figure 7 Installation of airtighness tapes

Figure 8 Installation of insulation in the down side of the extended roof

Figure 9 Installation of the MVHR and the air pipes

Figure 10 Eliminating the thermal bridges between the pillars and the pilotis

Envelope of the renovated building

External walls

Material:	85%Brick / 15%Concrete
Thickness:	36.5[cm]
Surface (Render / Brick / Cladding):	Plaster-Brick/Concrete-EPS
U-Value:	0.269[W/(m²K)]

Floor slab Ground

Material:	Reinforced Concrete
Thickness:	29[cm]
Surface (Render / Brick / Cladding):	EPS-concrete-cement plaster-tiles
U-Value:	0.345[W/(m²K)]

Floor slab Ambient

Material:	Reinforced Concrete
Thickness:	28[cm]
Surface (Render / Brick / Cladding):	EPS-concrete-cement plaster-tiles
U-Value:	0.288[W/(m²K)]

Roof / Top floor ceiling

Material:	Reinforced Concrete
Thickness:	35[cm]
Surface (Render / Brick / Cladding):	EPS-concrete-cement plaster-tiles-EPS
U-Value:	0.152[W/(m²K)]

Windows

Material:	PVC
Thickness:	8.8[cm]
Material (Wood / Plastic / Aluminium):	Plastic
U-Value (Uw, installed):	0.89[W/(m²K)]

3.5. Technical equipment of the renovated building

Ventilation

Ventilation concept (central / decentral)	Central MVHR
Ventilation heat recovery efficiency	82%
Ventilation specific efficiency	0.40[Wh/m³]
Ventilation standard air flow rate	185[m³/h]

Add short description if required:

Two separated central ventilation systems in order to service two separate apartments which they were created after the renovation by changing the initial plans.

Heating, Cooling and DHW

Heating:	One split unit A/C
Cooling:	One split unit A/C
Domestic hot water:	Solar DHW with integrated storage tank

3.6. Summer comfort

Summer ventilation through the windows with 0.42ach and temporary summer shading eliminating 85-95% of the solar radiation and fixed shading providing 66% reduction during the cooling period. Active cooling with the split unit A/C.

3.7. Energy efficiency of the renovated building

Passive House Planning Package (PHPP)

PHPP calculation:	PHPP_9.6
Space heating demand:	35.18 [kWh/(m²a)]
Heating Load:	21[W/m²]
Overheating frequency:	-%
Cooling demand:	17.51[kWh/(m²a)]
Cooling Load:	15[W/m²]
Primary Energy Demand:	103[kWh/(m²a)]
PER Demand:	57[kWh/(m²a)]

Airtightness n50 target:	1 [1/h]

GR CS2_PAPAGOS_ATHENS

Renovation Approach Description

Final Energy demand

Final energy demand gas: -[kWh/(m²a)]

Final energy demand oil: -[kWh/(m²a)]

Final energy demand electricity: 13.9[kWh/(m²a)]

Final energy demand other: 26.5[kWh/(m²a)]

PHPP verification sheet after retrofit

Specific building characteristics with reference to the treated floor area

		Unit	Value		Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	147,9				
Space heating	Heating demand	kWh/(m²a)	35,18	≤	-	-	-
	Heating load	W/m²	21	≤	-	-	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	17,51	≤	-	-	-
	Cooling load	W/m²	15	≤	-	-	
	Frequency of overheating (> 25 °C)	%	-	≤	-		-
	Frequency of excessively high humidity (> 12 g/kg)	%	0,0	≤	10		yes
Airtightness	Pressurization test result n_{50}	1/h	1,0	≤	1,0		yes
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	103	≤	-		-
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	57	≤	88	88	yes
	Generation of renewable energy (in relation to projected building footprint area)	kWh/(m²a)	4	≥	-	-	

EnerPHit (retrofit): Component characteristics

	Unit	Value		Criteria	Fullfilled?
Building envelope to exterior air[1] (U-value)	W/(m²K)	0,24	≤	0,5	yes
Building envelope to ground[1] (U-value)	W/(m²K)	0,34	≤	0,37	yes
Wall w/int. insulation in contact w/exterior air (U-value)	W/(m²K)	-	≤	0,75	-
Wall w/interior insulation in contact w/ground (U-value)	W/(m²K)	-	≤	0,69	-
Flat roof (SRI)	-	72	≥	-	-
Inclined and vertical external surface (SRI)	-	72	≥	-	-
Windows/Entrance doors ($U_{W/D,installed}$)	W/(m²K)	0,89	≤	1,27	yes
Windows ($U_{W,installed}$)	W/(m²K)	-	≤	1,32	-
Windows ($U_{W,installed}$)	W/(m²K)	0,93	≤	1,42	yes
Glazing (g-value)	-	0,54	≥	-	-
Glazing/sun protection (max. solar load)	kWh/(m²a)	99	≤	100	yes
Ventilation (effective heat recovery efficiency)	%	82	≥	-	-
Ventilation (humidity recovery efficiency)	%	19	≥	-	-

[1] Without windows, doors and external walls with interior insulation

[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.

EnerPHit Classic? yes

Task: First name: Surname: Signature:

Issued on: City:

3.8. Predicted energy savings

In space heating demand:	496 [kWh/(m²a)]
Primary Energy Demand:	673[kWh/(m²a)]
PER Demand:	1329[kWh/(m²a)]
Final energy demand gas:	-[kWh/(m²a)]
Final energy demand oil:	577.5 [kWh/(m²a)]
Final energy demand electricity:	-3.9[kWh/(m²a)]
Final energy demand other:	27.4[kWh/(m²a)]

3.9. RES strategy

There would not be installed PV Systems

Solar Thermal Systems

Location (Pitched / flat roof or façade):	Flat Roof
Orientation (East / South / West):	South
Technology (Flat Plate / Evacuated tube):	Flat plate
Solar collector area:	4[m²]
Solar contribution (DHW/Heating/Both):	DHW
Annual solar contribution absolute:	2054[kWh/a]

4. Project challenges and opportunities

The challenges in this project were the elimination of the thermal bridges due to the high amount of pillars, columns and the pilotis. Also the big balconies that extend through the perimeter of the building.

The above challenges were eliminated by installing insulation in all the length of the pillars, through out all the pilotis surface as well as a block of insulation in the upper side of the balcony by removing a part of the cement screed.

Figure 11 Installation of 60cm of insulation in order to minimize the thermal bridge in the balcony

Figure 12 Installation of 60cm of insulation in order to minimize the thermal bridge in the balcony

5. Current project status

At this moment the project is completed and the building has to be tested for its airtightness level. Also we need to commission the ventilation system to verify its proper operation.

The lessons learnt from this project were the fact that the owners had to stay inside during the renovation, so we had to make everything hustle free and with the higher of attention in order to avoid make the house look like a construction site.

Also a challenge was the solving of the thermal bridges of the existing house. In the balconies, the pillars and the pilotis.

6. Lessons learnt and guidelines for replication

Short description of the lessons learnt, if available

Add pictures, sketches, details, diagrams, if available

7. Pre-Monitoring description (if applicable)

Short description of the pre-monitoring, include information on

- Comfort and hygiene: conclusions
- Thermography
- Air quality measurements: conclusions
- Satisfaction questionnaires: conclusions

Number of apartments: 1

Period of pre-monitoring: xx.202x – xx.202x

Add pictures, sketches, details, diagrams, if available