

The nZEBoffice+

The first office with the EnerPHit Unit Certification



home@grid®



João Gavião

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homeGrid®



- Architect, consultant and trainer at Homegrid.
- Founding Member and board member of Passivhaus Portugal Association.
- Certified Passive House Designer and Passive House trainer.

Index / chronology

2014 – start using the office

2017 – the renovation project

2018 – the renovation work

2019 – concluding the process

2020 – learning with the operation

2024 – the certification

2014

Initial situation

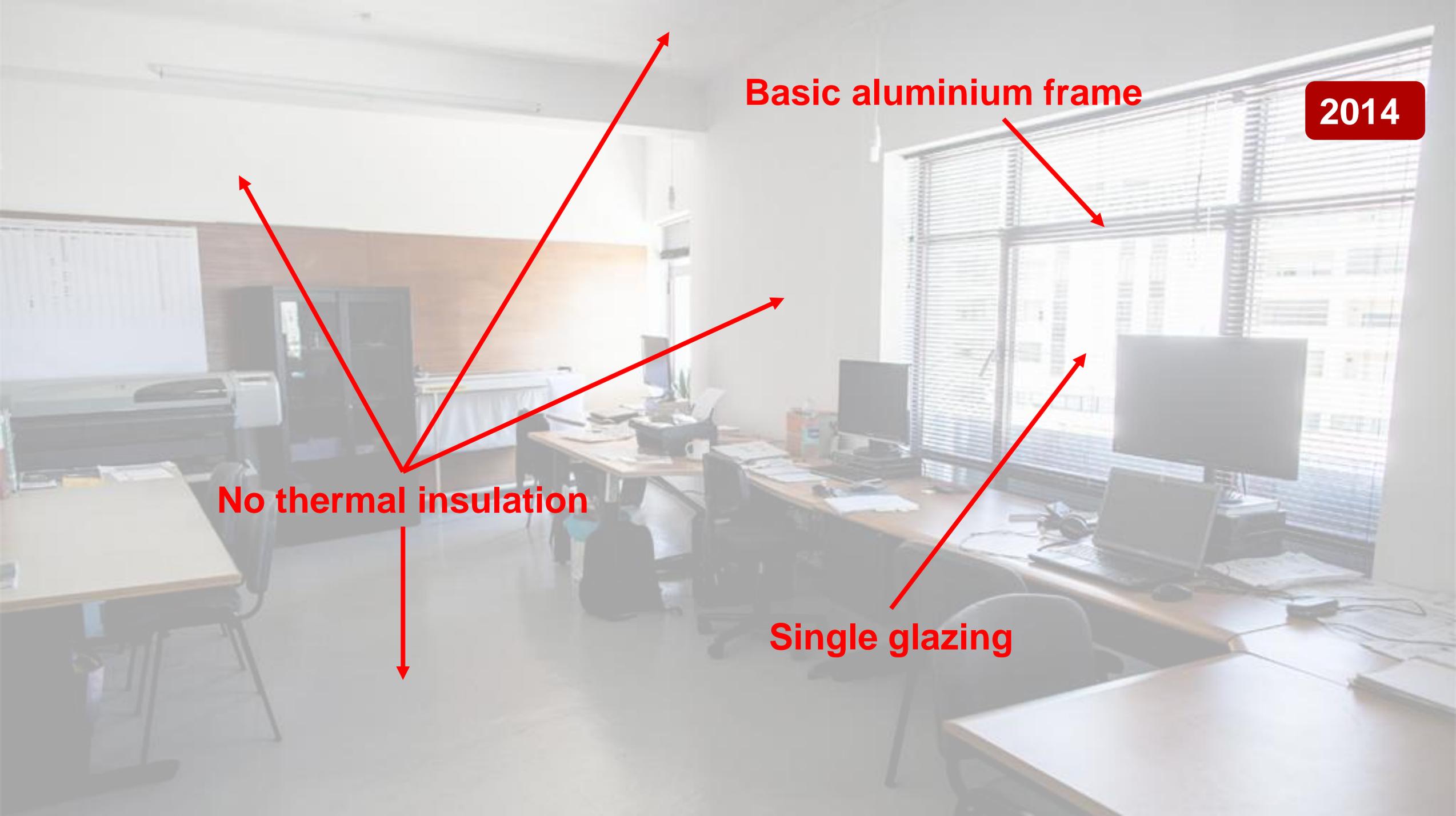
2014



- Typical services building of the mid 90's;
- Located in the center of Ílhavo, Portugal;
- Treated floor area: 52 m²
- We moved to that office in 2014

2014





Basic aluminium frame

2014

No thermal insulation

Single glazing

2017

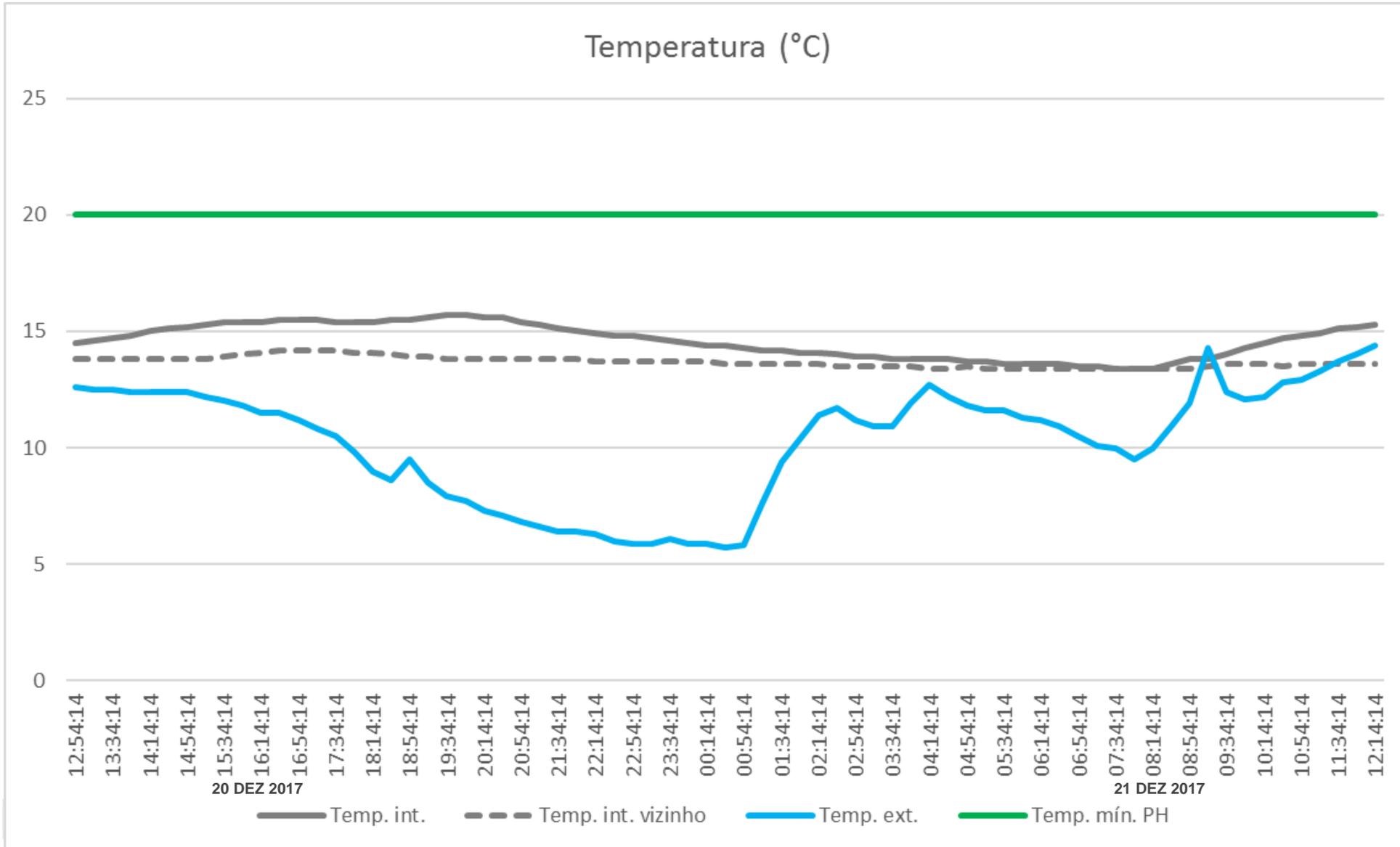
PHPP initial results

2017

Considering the neighbours average winter temperature of 15°C.

Specific building characteristics with reference to the treated floor area				The PHPP has not been filled completely; it is not valid as verification		
				Criteria	Alternative criteria	Fullfilled? ²
Space heating	Treated floor area m ²	50,0				
	Heating demand kWh/(m ² a)	231	≤	15	-	no
	Heating load W/m ²	83	≤	-	10	no
Space cooling	Cooling & dehum. demand kWh/(m ² a)	23	≤	15	15	no
	Cooling load W/m ²	17	≤	-	12	no
	Frequency of overheating (> 25 °C) %	-	≤	-	-	-
	Frequency excessively high humidity (> 12 g/kg) %	1	≤	10	-	yes
	Airtightness	Pressurization test result n ₅₀ 1/h	10,0	≤	0,6	-
Non-renewable Primary Energy (PE)	PE demand kWh/(m ² a)	209	≤	-	-	-
Primary Energy Renewable (PER)	PER demand kWh/(m ² a)	136	≤	60	75	no
	Generation of renewable energy kWh/(m ² a)	11	≥	-	12	

Initial situation – monitoring (temp. °C)

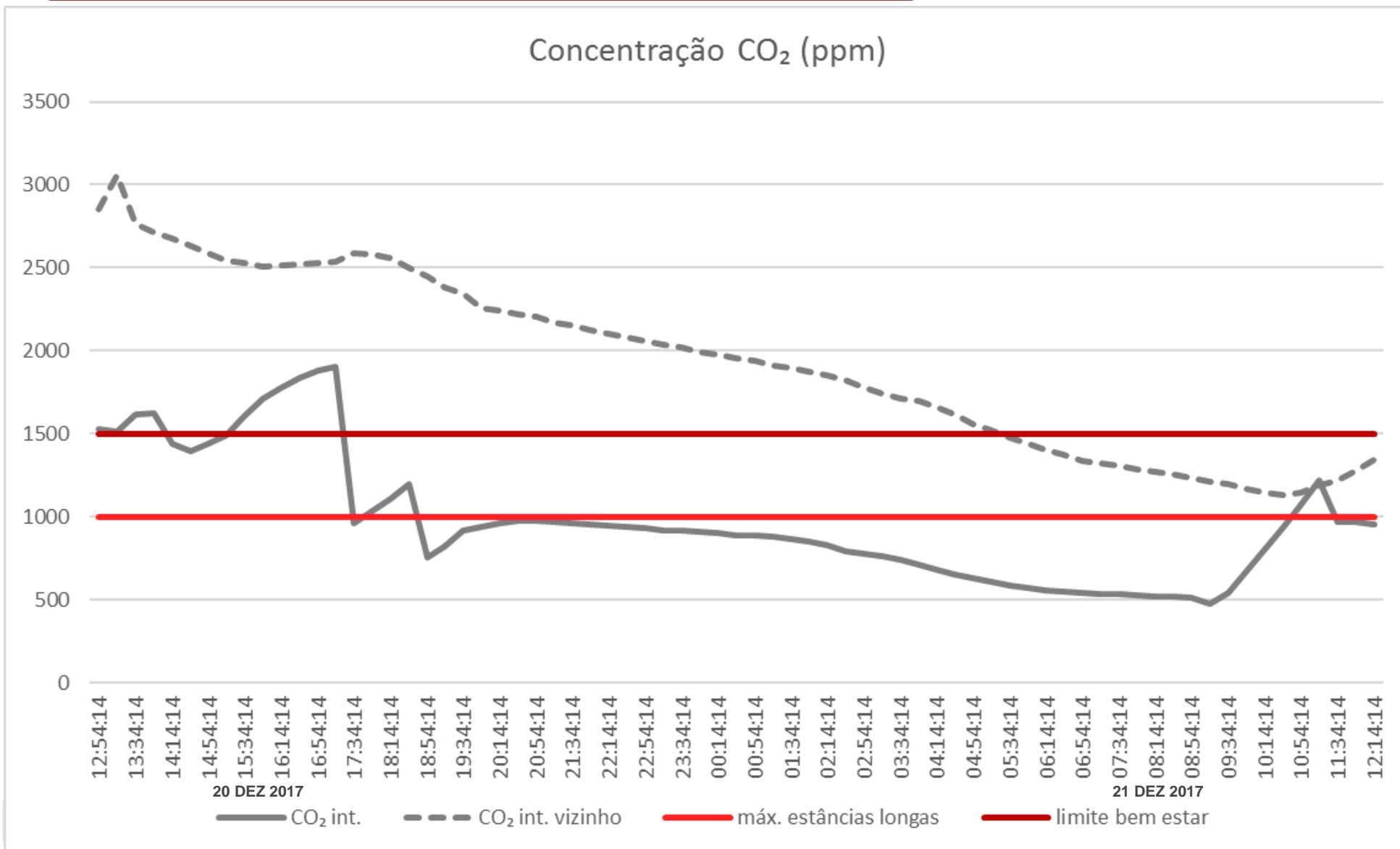
2017

The heating supply was realized by 2 electrical radiators (2 kW + 1,5 kW).

During the coldest periods the higher internal temperature only reached 16°C.

Initial situation – monitoring (CO₂ %)

2017



The ventilation was realized by regular windows opening.

Renovation project

2017





PHPP final results

2017

Considering the neighbours average winter temperature of 15°C.

Specific building characteristics with reference to the treated floor area						
				Criteria	Alternative criteria	Fullfilled? ²
	Treated floor area m ²	50,0				
Space heating	Heating demand kWh/(m ² a)	56	≤	15	-	no
	Heating load W/m ²	22	≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m ² a)	6	≤	15	15	yes
	Cooling load W/m ²	8	≤	-	12	
	Frequency of overheating (> 25 °C) %	-	≤	-	-	
	Frequency excessively high humidity (> 12 g/kg) %	0	≤	10	-	
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	≤	0,6	-	yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m ² a)	108	≤	-	-	-
Primary Energy Renewable (PER)	PER demand kWh/(m ² a)	71	≤	60	71	yes
	Generation of renewable energy kWh/(m ² a)	22	≥	-	9	

PHPP final results

2017

Considering no thermal losses through the neighbours.

Specific building characteristics with reference to the treated floor area

		Treated floor area m ²		Criteria	Alternative criteria	Fullfilled? ²
Space heating	Heating demand kWh/(m ² a)	50,0	≤	15	-	no
	Heating load W/m ²	12	≤	-	10	no
Space cooling	Cooling & dehum. demand kWh/(m ² a)	8	≤	15	15	yes
	Cooling load W/m ²	8	≤	-	12	yes
	Frequency of overheating (> 25 °C) %	-	≤	-	-	-
	Frequency excessively high humidity (> 12 g/kg) %	0	≤	10	-	yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	≤	0,6	-	yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m ² a)	87	≤	-	-	-
Primary Energy Renewable (PER)	PER demand kWh/(m ² a)	57	≤	60	60	yes
	Generation of renewable energy kWh/(m ² a)	22	≥	-	-	yes

PHPP final results

2017

EnerPHit performance – component criteria method

EnerPHit (refurbishment): Component characteristics

Building envelope to exterior air ¹ (U-value) W/(m ² K)	-	≤	0,5	-
Building envelope to ground ¹ (U-value) W/(m ² K)	-	≤	0,31	▼
Wall w/int. insulation in contact w/external air (U-value) W/(m ² K)	0,41	≤	0,75	yes
Wall w/interior insulation in contact w/ground (U-value) W/(m ² K)	-	≤	0,58	▼
Flat roof (SRI) -	7	≥	-	-
Inclined and vertical external surface (SRI) -	65	≥	-	-
Windows/Entrance doors (U _{W/D,installed})  W/(m ² K)	1,24	≤	1,30	yes
Windows (U _{W,installed})  W/(m ² K)	-	≤	1,35	▼
Windows (U _{W,installed})  W/(m ² K)	-	≤	1,45	▼
Glazing (g-value) -	0,34	≥	-	-
Glazing/sun protection (max. solar load) kWh/(m ² a)	88	≤	-	-
Ventilation (effective heat recovery efficiency) %	80	≥	-	-
Ventilation (humidity recovery efficiency) %	0	≥	-	-

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

2018

Initial situation – electrical bill

2018

HOMEGRID LDA
AVENIDA 25 DE ABRIL , 33 3
3830-044 ILHAVO

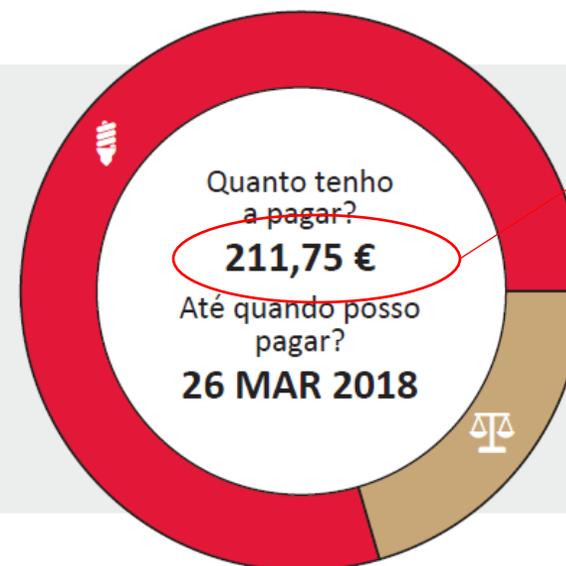
Documento emitido a: **8 de março 2018**
Período de faturação: **9 de fevereiro a 8 de março 2018**


ELETRICIDADE
168,34 €


GÁS
NATURAL
ADERIR


SERVIÇOS
ADERIR


TAXAS E
IMPOSTOS
43,41 €

**4 €/m²**

**This value
represents a 2nd rent**

**In 2018, in Ílhavo, the
average office rental was
around 5€/m² per month**

2018



2018



Temos de celebrar a vida,
a natureza, a abundância humana.
As pessoas não são felizes porque não têm tempo para celebrar.
Estão sempre ocupadas,
vivem demasiado depressa.



wefi

NAVIGATOR 80



2018



2018



2018



2018



Component	Building assemblies	U-value W/(m ² K)
External wall	Existing wall, 60 mm extruded polystyrene insulation boards + wooden beams, plaster board	0,38
Roof	Existing roof, 60 mm extruded polystyrene insulation boards + wooden beams, plaster board	0,42
Floor	Existing floor, 20 mm extruded polystyrene insulation boards, composite cork flooring	0,65
Window	Existing window + new window (PVC frame: U_f : 1,30 W/(m ² K), double glazing: U_g : 1,00 W/(m ² K); g: 0,38, warmedge spacer	1,19

Entrance door

2018



Additional wooden threshold
(from the inside)



We kept the existing wooden door with additional cork insulation boards on both sides.



Additional wooden threshold
(from the outside)

Building services

2018

Ventilation system

- Zehnder ComfoAir Q350 HRV
- Average air change rate: 0,6 1/h
- Average power: 16 W
- Annual electricity cost: 35 €

Heating/Cooling

- 2 kW split unit
- Daikin Premium +

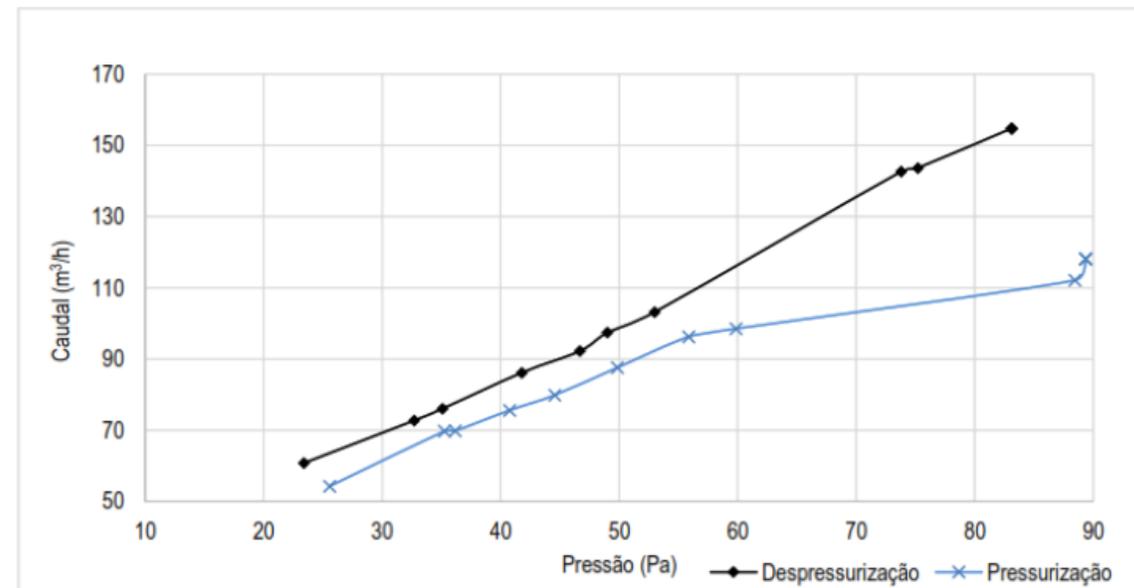


Blower door test

2018



Curva de infiltração/exfiltração de ar:



Conclusões / Resultados combinados:

	Resultado	Intervalo confiança 95%	
		Min	Max
q_{50} [m ³ /h]	93.4	89.8	97.3
n_{50} [h ⁻¹]	0.65	0.63	0.68
q_{E50} [m ³ /(h·m ²)]	0.37	0.35	0.38
q_{F50} [m ³ /(h·m ²)]	1.84	1.76	1.91

Photos after conclusion

2018



nZEBoffice+

2018



2018







EXI BV
pops

EXI BV
pops

EXI BV
pops

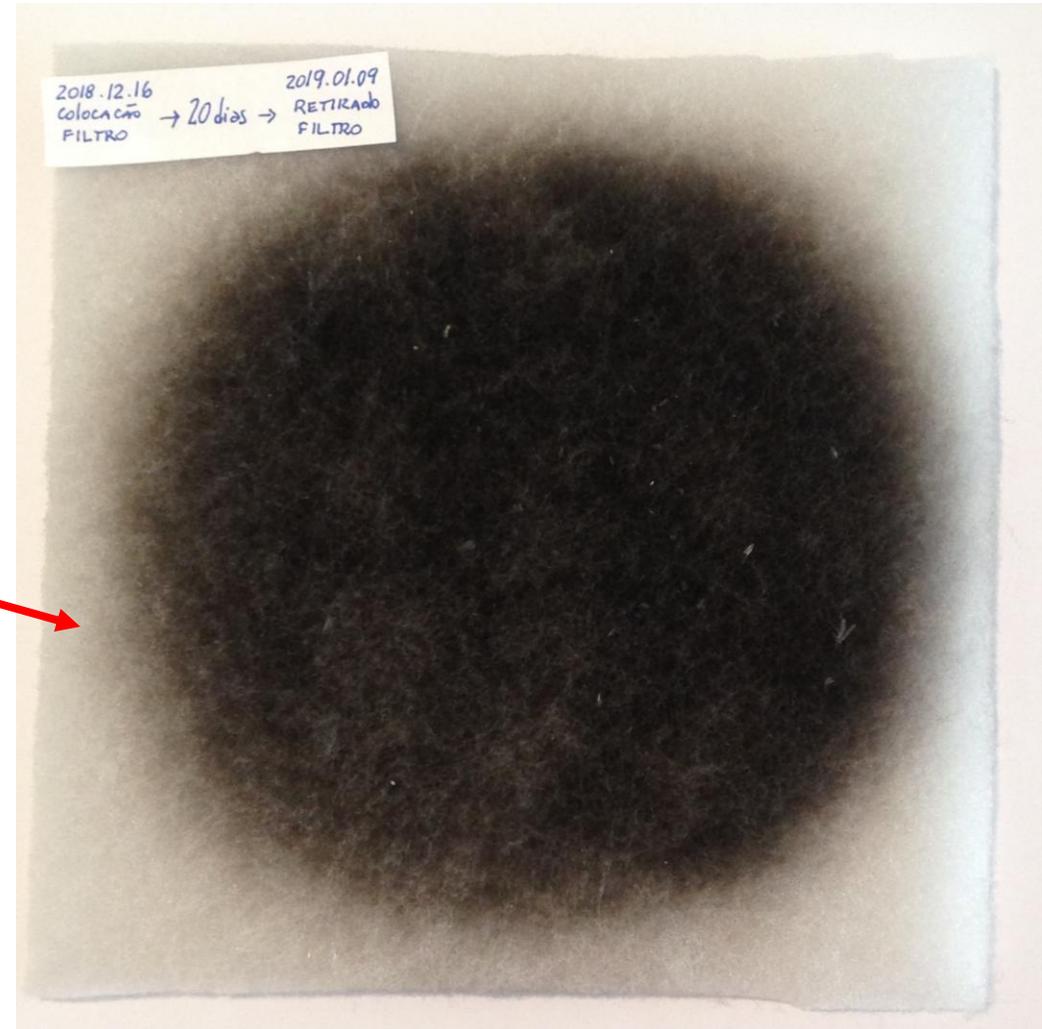
nZEB office+

2019

The importance of air filters

2019

... or “visualize what we breathe if there aren’t any filters”

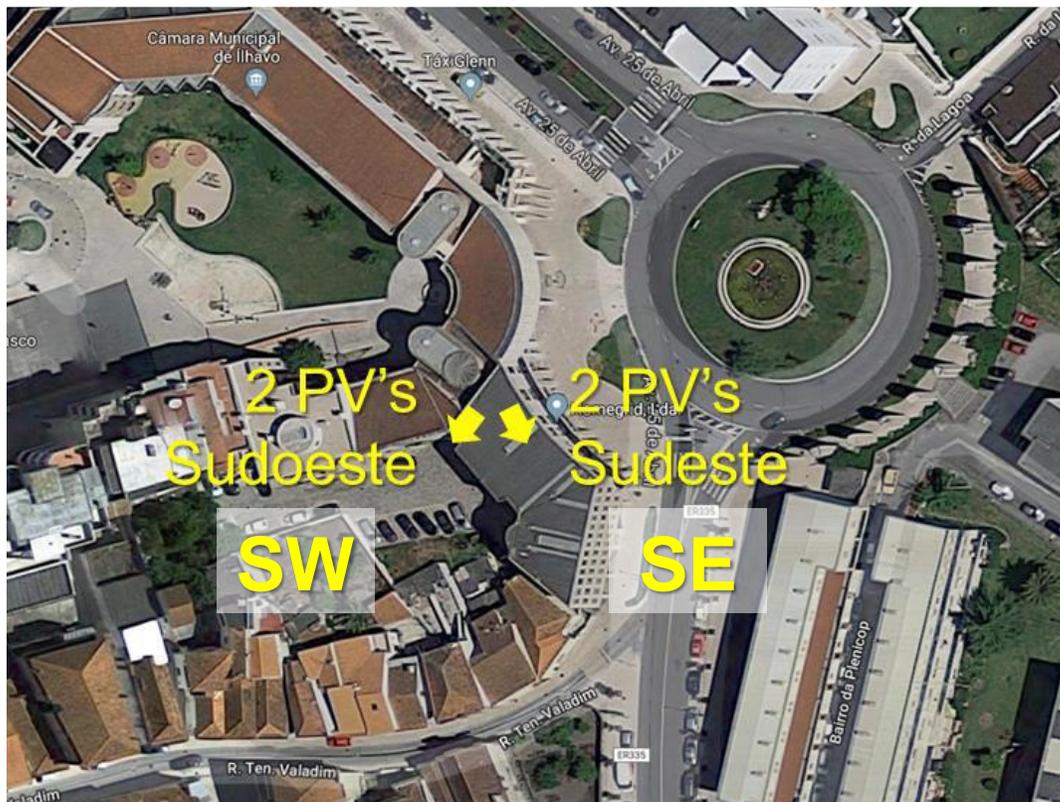


Energy production

2019

4 PV panels

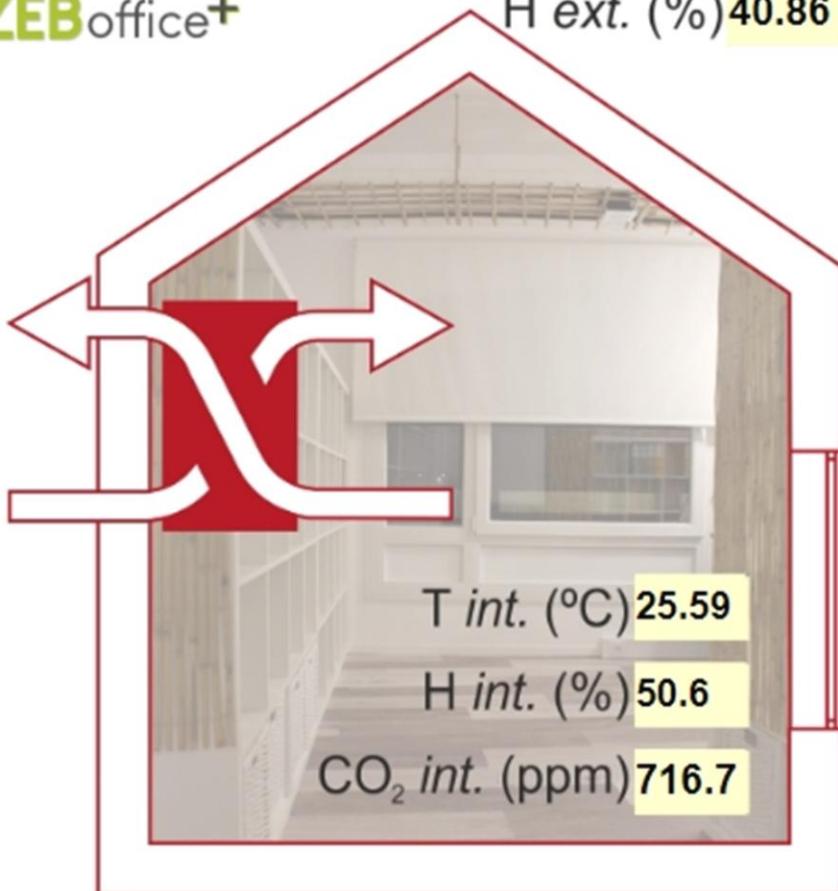
- Power: 1040 W



Start of the monitoring

2019

homeGrid®
 NZEBoffice+



Instantâneo / instantaneous

Consumo total de energia	0.78	kW
<i>Total energy consumption</i>		
Consumo de energia (aquec & arref)	0.526	kW
<i>Energy consumption (heating & cooling)</i>		
Produção de energia	0.782	kW
<i>Energy production</i>		
Balanco de energia	0	kW
<i>Energy balance</i>		

Totais desde o início da monitorização 20 / 2 / 2019

Totals since the beginning of monitoring

Consumo de energia	488	kWh
<i>Energy consumption</i>		
Consumo de energia (aquec & arref)	94.88	kWh
<i>Energy consumption (heating & cooling)</i>		
Produção de energia	815	kWh
<i>Energy production</i>		
Balanco de energia	327	kWh
<i>Energy balance</i>		
Balanco médio de energia (por dia)	2.319	kWh/d
<i>Average energy balance (per day)</i>		

Research works

MEIO ANO DE DESEMPENHO DO NZEB OFFICE+

MARTA OLIVEIRA PANÃO
mopanao@fc.ul.pt



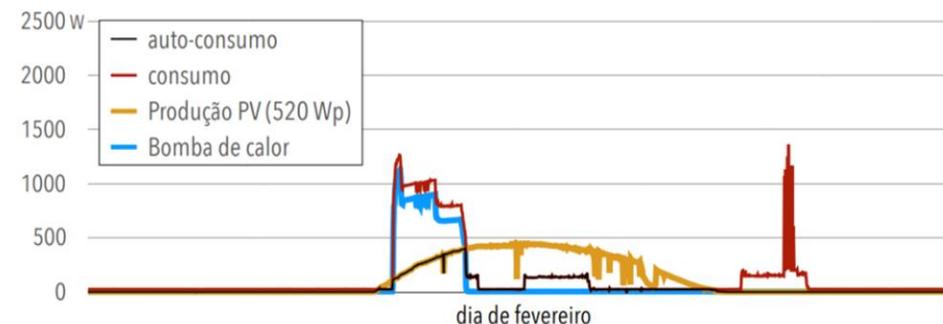
organização:




Aveiro, 28 novembro 2019

Monitorização – trabalhos de investigação

2019



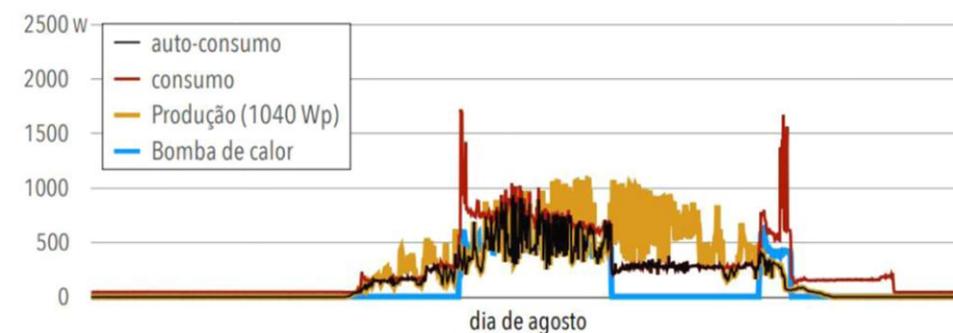
Auto-consumo:

- 37% da produção PV
- 32% do consumo total

Produção PV:

- 88% do consumo total

Monitorização – trabalhos de investigação



Auto-consumo:

- 71% da produção PV
- 64% do consumo total

Produção PV:

- 90% do consumo total

Media coverage – national radio

2019



Paulino Coelho
10:00h - 12:45h

Já pode ouvir a Renascença e todos os podcasts também no seu carro

Participe na Meia Maratona de Lisboa

1ª Peregrinação Internacional Renascença a Roma, 'Cidade Eterna'

Renascença ▶ NO AR ÚLTIMAS VÍDEOS V+ OUVIR AS TRÊS DA MANHÃ NUNCA É TARDE BOLA BRANCA OPINIÃO

As Três da Manhã De 2^a a 6^a Entre as 7h e as 10h

É o primeiro escritório sustentável em Portugal e produz mais energia do que consome

28 fev, 2019 - 10:20 - Mariana Freitas

Localizado em Ílhavo, este espaço foi reabilitado segundo os princípios da construção ecoeficiente e sustentável. O resultado é uma poupança na ordem dos 75%.



O nZEBoffice+ é o novo escritório da Homegrid e também sede da Associação Passivhaus Portugal. Foto: Homegrid

Trabalhar num escritório com necessidades quase nulas de energia. É o que faz João Gavião há cerca de dois meses. O primeiro escritório sustentável em Portugal fica em Ílhavo, Aveiro, e está em pleno funcionamento desde dezembro do ano passado.

2020

Research works



 **Ciências
ULisboa**

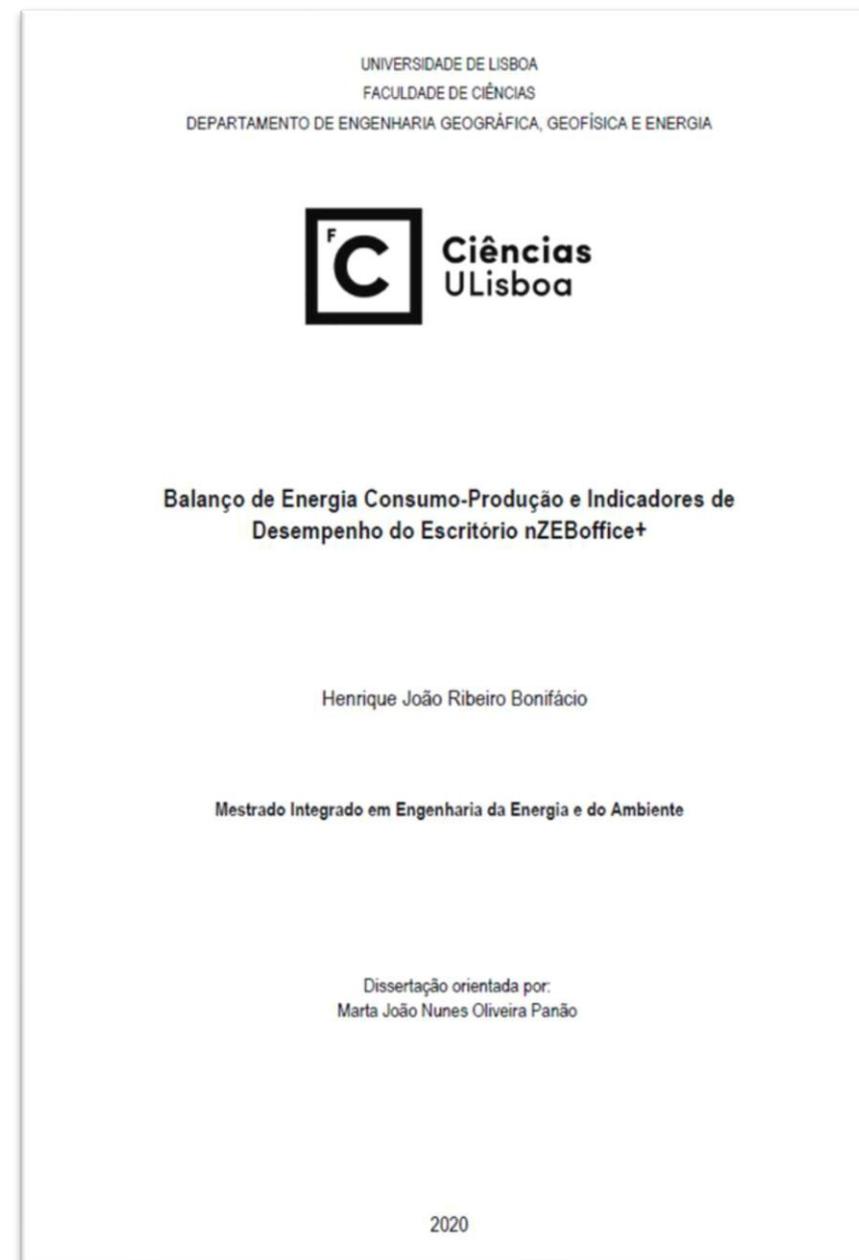
Desempenho do nZEBoffice+

Primeiros resultados da simulação com EnergyPlus 

Henrique João Ribeiro Bonifácio
Marta Oliveira Panão
20/05/2020

 **PARA TODOS
ASSIVE HOUSE
CONFERÊNCIA**

2020

UNIVERSIDADE DE LISBOA
FACULDADE DE CIÊNCIAS
DEPARTAMENTO DE ENGENHARIA GEOGRÁFICA, GEOFÍSICA E ENERGIA

 **Ciências
ULisboa**

Balanço de Energia Consumo-Produção e Indicadores de Desempenho do Escritório nZEBoffice+

Henrique João Ribeiro Bonifácio

Mestrado Integrado em Engenharia da Energia e do Ambiente

Dissertação orientada por:
Marta João Nunes Oliveira Panão

2020

Media coverage – national TV

2020



2024



PHPP10 final results

2024

Specific building characteristics with reference to the treated floor area						
				Alternative		Fullfilled? ²
				Criteria	criteria	
Space heating	Treated floor area m ²	50,0				
	Heating demand kWh/(m ² a)	17	≤	-	-	-
	Heating load W/m ²	14	≤	-	-	-
Space cooling	Cooling & dehum. demand kWh/(m ² a)	-	≤	-	-	-
	Frequency of overheating (> 25 °C) %	8	≤	10		Yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		Yes
Airtightness	Pressurisation test result n ₅₀ 1/h	0,7	≤	1,0		Yes
Moisture protection						
	Smallest temperature factor f _{Rsi=0.25} m ² K/W -	-	≥	0,19	0,00	-
Thermal comfort	All requirements fulfilled? -					Yes
	U-value W/(m ² K)		≤	1,65		
	U-value W/(m ² K)		≤	1,30		
	U-value W/(m ² K)		≤	1,40		
	U-value W/(m ² K)		≤	0,90		
Non-renewable Primary Energy (PE)	PE demand kWh/(m ² a)	124	≤	-		-
Primary Energy Renewable (PER)	PER demand kWh/(m ² a)	56	≤	64	64	Yes
	Renew. energy generation (in rel. to projected building footprint area) kWh/(m ² a)	26	≥	-	-	

PHPP10 updated initial results

2024

Considering no thermal losses through the neighbours.

86% reduction

Specific building characteristics with reference to the treated floor area

					Alternative		Fullfilled? ²
					Criteria	criteria	
<div style="border: 1px solid black; padding: 2px; width: fit-content;"> 50.0 17 14 </div>	Space heating	Treated floor area m ²	52.0				
		Heating demand kWh/(m ² a)	121	≤	15	-	No
		Heating load W/m ²	59	≤	-	-	
	Space cooling	Cooling & dehum. demand kWh/(m ² a)	-	≤	-	-	-
		Frequency of overheating (> 25 °C) %	11	≤	10	-	No
		Frequency of excessively high humidity (> 12 g/kg) %	1	≤	20	-	Yes
	Airtightness	Pressurisation test result n ₅₀ 1/h	5,0	≤	1,0	-	No
	Non-renewable Primary Energy (PE)	PE demand kWh/(m ² a)	406	≤	-	-	-
	Primary Energy Renewable (PER)	PER demand kWh/(m ² a)	232	≤	236	236	Yes
		Renew. energy generation (in rel. to projected building footprint area) kWh/(m ² a)	0	≥	-	-	Yes

PHPP10 updated initial results

2024

Considering the neighbours average winter temperature of 15°C.

91% reduction

Specific building characteristics with reference to the treated floor area

					Alternative		Fullfilled? ²
					Criteria	criteria	
<div style="border: 1px solid black; padding: 2px; text-align: center;"> 50.0 17 14 </div>	Space heating	Treated floor area m ²	52.0				
		Heating demand kWh/(m ² a)	184	≤	15	-	No
		Heating load W/m ²	67	≤	-	-	
	Space cooling	Cooling & dehum. demand kWh/(m ² a)	-	≤	-	-	-
		Frequency of overheating (> 25 °C) %	4	≤	10	-	Yes
		Frequency of excessively high humidity (> 12 g/kg) %	1	≤	20	-	Yes
	Airtightness	Pressurisation test result n ₅₀ 1/h	5,0	≤	1,0	-	No
	Non-renewable Primary Energy (PE)	PE demand kWh/(m ² a)	568	≤	-	-	-
	Primary Energy	PER demand kWh/(m ² a)	335	≤	339	339	
	Renewable (PER)	Renew. energy generation (in rel. to projected building footprint area) kWh/(m ² a)	0	≥	-	-	Yes

EnerPHit Certification

2024



Certificate

Certified retrofit
'EnerPHit Unit'
(Climate zone: Warm)



Dr. Wolfgang Feist
6020 Innsbruck
Austria

nZEB office+
Avenida 25 de Abril, n°33, 3º esquerdo frente, 3830-044
Ilhavo, Portugal



Client	Homegrid, Lda Avenida 25 de Abril, n°33, 3º esquerdo frente 3830-044 Ilhavo, Portugal
Architect	Homegrid, Lda
Building Services	Climacom
Energy Consultant	João Gavião

Buildings retrofitted to the EnerPHit Standard offer excellent thermal comfort and very good air quality all year round. Due to their high energy efficiency, energy costs as well as greenhouse gas emissions are extremely low.

The design of the above-mentioned project meets the criteria defined by the Passive House Institute for modernization to the 'EnerPHit Unit' standard:

Building quality		This building	Criteria	Alternative criteria
Heating	Heating demand [kWh/(m²a)]	17	≤	-
Cooling	Frequency of overheating (> 25 °C) [%]	8	≤	20
Airtightness	Pressurization test result (n ₅₀) [1/h]	0,7	≤	0,0
Renewable primary energy (PER)	PER-demand [kWh/(m²a)]	56	≤	64
	Generation (reference to ground area) [kWh/(m²a)]	26	≥	-
Component quality				
Wall with interior insulation to ambient air (U-value)	[W/(m²K)]	0,40	≤	0,75
Windows/Exterior doors (U _{w,installed})	[W/(m²K)]	1,26	≤	1,28
Glazing (g-value)	[-]	0,41	≥	-
Glazing/shading (max. solar load)	[kWh/(m²a)]	68	≤	-
Ventilation (effect. heat recovery efficiency)	[%]	82	≥	-

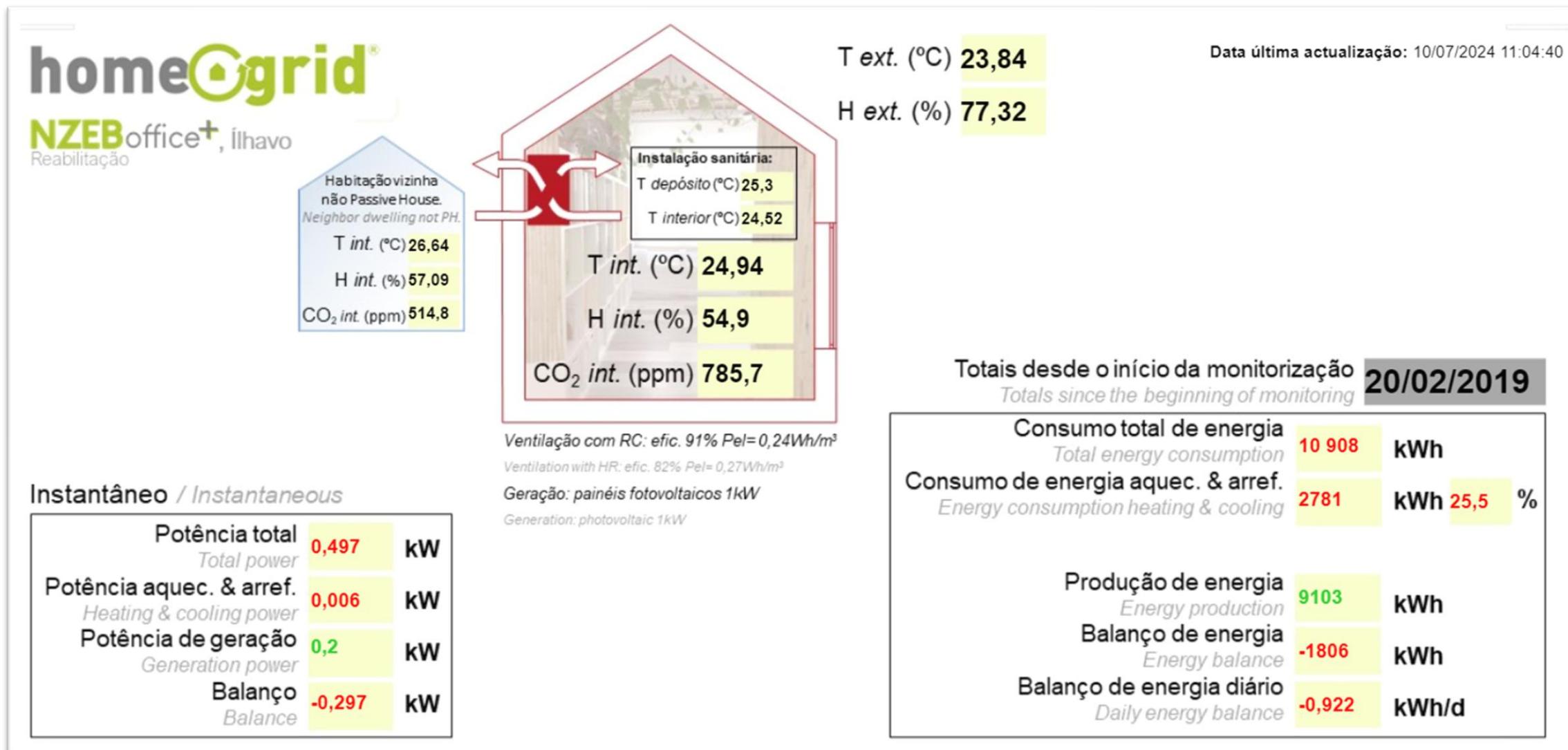
The associated certification booklet contains more characteristic values for this building.

Innsbruck
15.05.2024

Certifier: Laszlo Lepp, Passivhaus Institut

Monitoring

2024



2024





Thank you!

João Gavião

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home**grid**[®]

