D3.4_PHPP Result Sheets

DRAFT

CS11 Primary school “Tsanko Dustabanov”

Gabrovo

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

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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
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Author(s)	Iglika Lutzkanova
Co-author(s)	
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List of tables and figures

Abstract

This document provides a short overview of the efficiency improvement of a step-by-step refurbishment to EnerPHit standard to be undertaken for the project CS11.

First, the result sheet of the project´ s current status will present the calculated energy consumption of the existing building.

The PHPP result sheet of the completed EnerPHit retrofit will present the energy demand estimated for the completion of the project according to the overall refurbishment plan

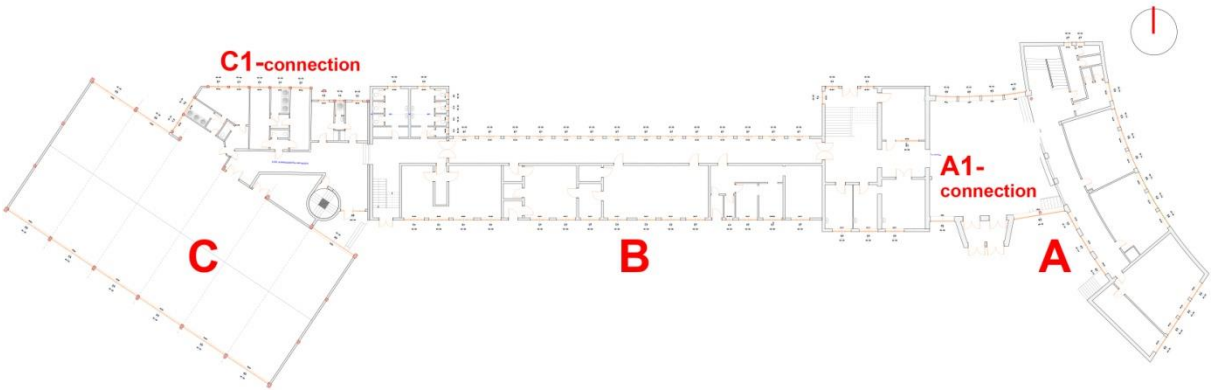


Figure 1: Ground floor plan, not to scale

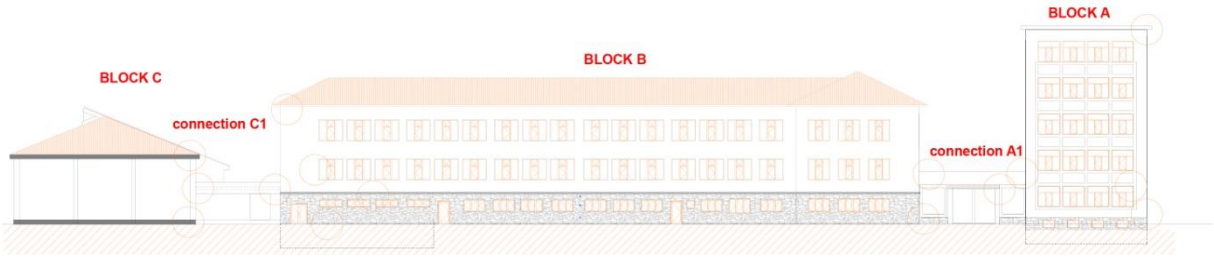


Figure 2: Elevation, not to scale

1 Existing building: PHPP Result Sheet

1.1 PHPP Result sheet of the existing building, Block A

EnerPHit verification

Building:	School "Tzanko Diustabanov"-Block A
Street:	25 Hristo Smirnenski blv.
Postcode/City:	Gabrovo
Country:	Bulgaria
Building type:	School
Climate:	Велико Търнов PHI
Altitude of building site (in [m] above sea level):	382
Home owner/client:	Municipality of Gabrovo
Street:	3 Vazrazhdane square
Postcode/City:	Gabrovo

Architecture:		Mechanical System:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Energy consulting:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	

Year of Construction:	2014	Interior temperature winter [C°]	20,0	Interior temp. summer [C°]	25,0
Number of dwelling units:	1	Internal heat gains winter [W/m²]	2,8	IHG summer [W/m²]	2,8
Number of Occupants:	225,0			Spec. capacity [Wh/K per m² TFA]	204
Exterior vol. V_e:	6224,4 m³			Mechanical cooling:	

Specific building demands with reference to the treated floor area

				Requirements	Fulfilled?*
	Treated floor area	1303,5	m²		
Space heating	Annual heating demand	**250**	**kWh/(m²a)**	25 kWh/(m²a)	no
	Heating load	**105**	**W/m²**	-	-
Space cooling	Overall specific space cooling demand		**kWh/(m²a)**	-	-
	Cooling load		**W/m²**	-	-
	Frequency of overheating (> 25 °C)	10,5	%	-	-
Primary Energy	Heating, cooling, dehumidifying, DHW, auxiliary electricity, lighting, elect.		**kWh/(m²a)**	402 kWh/(m²a)	
	DHW, space heating and auxiliary electricity		kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	**4,0**	**1/h**	1 1/h	no

* empty field: data missing; "-": no requirement

I confirm that the values given herein have been determined following the PHPP methodology and were determined based on the characteristics of the building. The PHPP calculations are attached to this application.

EnerPHit building retrofit (acc. to heating demand)?

Name:	Company:	Registration number PHPP:
Surname:	Issued on:	
		Signature

Figure 3: Specific energy efficiency values of the existing building modelled with PHPP 9 Beta, Block A

1.2 PHPP Result sheet of the existing building, Block B

EnerPHit verification

Building:	Primary School 3 "Tzanko Diustabanov"		
Street:	25 Hristo Smirnenski blv.		
Postcode/City:	Gabrovo		
Country:	Bulgaria		
Building type:	School		
Climate:	Велико Търнов		
		Altitude of building site (in [m] above sea level):	382
Home owner/client:	Municipality of Gabrovo		
Street:	3 Vazrazhdane square		
Postcode/City:	Gabrovo		
Architecture:		Mechanical System:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Energy consulting:	EnEffect Group	Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Year of Construction:	2014	Interior temperature winter [C°]	20,0
umber of dwelling units:	1	Internal heat gains winter [W/m²]	2,8
Number of Occupants:	240,0		
Exterior vol. V_e:	6224,4 m³		

Interior temp. summer [C°]	25,0				
IHG summer [W/m²]	2,8				
Spec. capacity [Wh/K per m² TFA]	204				
Mechanical cooling:					

Specific building demands with reference to the treated floor area

				Requirements	Fulfilled?*
	Treated floor area	1624,7	m²		
Space heating	Annual heating demand	**155**	**kWh/(m²a)**	25 kWh/(m²a)	**no**
	Heating load	**67**	**W/m²**	-	-
Space cooling	/erall specific space cooling demand		**kWh/(m²a)**	-	-
	Cooling load		**W/m²**	-	-
	Frequency of overheating (> 25 °C)	2,9	%	-	-
Primary Energy	Heating, cooling, dehumidifying, DHW,	**179**	**kWh/(m²a)**	288 kWh/(m²a)	**yes**
	DHW, space heating and auxiliary electricity	139	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	**4,0**	**1/h**	1 1/h	**no**

* empty field: data missing; '-': no requirement

Figure 4: Specific energy efficiency values of the existing building modelled with PHPP 9 Beta, Block B

1.3 PHPP Result sheet of the existing building, Block C

EnerPHit verification

Building:	Primary School 3 "Tzanko Diustabanov" -
Street:	25 Hristo Smirnenski blv.
Postcode/City:	Gabrovo
Country:	Bulgaria
Building type:	School
Climate:	Велико Търнов PHI
Altitude of building site (in [m] above sea level):	382
Home owner/client:	Municipality of Gabrovo
Street:	3 Vazrazhdane square
Postcode/City:	Gabrovo

Architecture:		Mechanical System:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Energy consulting:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	

Year of Construction:	2014	Interior temperature winter [C°]	18,0	Interior temp. summer [C°]	24,0
Number of dwelling units:	1	Internal heat gains winter [W/m²]	2,8	IHG summer [W/m²]	2,8
Number of Occupants:	50,0			Spec. capacity [Wh/K per m² TFA]	204
Exterior vol. V_e:	6224,4 m³			Mechanical cooling:	

Specific building demands with reference to the treated floor area

				Requirements	Fulfilled?*
	Treated floor area	848,4	m²		
Space heating	Annual heating demand	**121**	**kWh/(m²a)**	25 kWh/(m²a)	**no**
	Heating load	**69**	**W/m²**	-	**-**
Space cooling	Overall specific space cooling demand		**kWh/(m²a)**	-	**-**
	Cooling load		**W/m²**	-	**-**
	Frequency of overheating (> 24 °C)	7,9	%	-	-
Primary Energy	Heating, cooling, dehumidifying, DHW, auxiliary electricity, lighting, elect.	**197**	**kWh/(m²a)**	248 kWh/(m²a)	**yes**
	DHW, space heating and auxiliary electricity	132	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	**4,0**	**1/h**	1 1/h	**no**

* empty field: data missing; "-": no requirement

EnerPHit building retrofit (acc. to heating demand)? **no**

I confirm that the values given herein have been determined following the PHPP methodology and were determined based on the characteristics of the building. The PHPP calculations are attached to this application.

Name:	Company:	Registration number PHPP:
Surname:	Issued on:	
		Signature

Figure 5: Specific energy efficiency values of the existing building modelled with PHPP 9 Beta, Block C

2. Retrofit steps

2.1 Overall refurbishment Plan

2.1.1 Retrofit steps:

Table 1: Step-by-step approach by blocks:

The Project will propose refurbishment in the following steps:

Step 1 and Step 2: Thermal insulation of the roof and walls, replacement of windows, ventilation with heat recovery (depending on the condition of the roof insulation it could be done in the second step).

Step 3: RES implementation, new solar panels on the roof of the Gym. New heat sources.

Step 4: Insulation of ground floor or the walls in the basement (different solutions in each block) Replacement of the aluminium windows in the Gym.

The following tables shows the separation of the works in different blocks:

Step	Year	BLOCK A	Specific Heating Demand	Specific Primary Energy Demand
existing situation		constructed 1962, roof needs refurbishment , no insulation, old wooden windows in poor condition, heating system in poor conditions	250,1	
STEP 1	2015	Roof insulation block A, wall insulation block A1	188,6	257,8
STEP 2	2015	external wall insulation 25 cm. EPS – F, new windows, shading, airtightness, ventilation, reducing thermal bridges	24,2	128,8
STEP 3	2015	New District heating substation (the one from Gym could be used)	24,2	124,0
STEP 4	2020	Insulation under the floor slab above the unheated basement block A , New LED lighting	24,1	98,4

Figure 6: Overview refurbishment steps, Block A and A1(connection)

Step	Year	BLOCK B	Specific Heating Demand	Specific Primary Energy Demand
existing situation		constructed 1946, roof refurbished in 2005 with 10 cm. insulation, no insulation on the	163,8	221,2

		walls , old wooden windows		
STEP 1	2015	external wall insulation 25sm. EPS, change of windows, insulation of the perimeter of the foundations, airtightness , shading, ventilation	29,8	114.3
STEP 2	2015	Adding 20 sm. Mineral wool on the roof above the existing 10 cm. (above the last floor slab)	22,5	108.4
STEP 4	2015	New District heating substation (the one from Gym could be used)	22,5	105.3
STEP 5	2020	Insulation under the floor slab above the unheated basement block A , New LED lighting	19,9	86.9

Figure 7: Overview refurbishment steps, Block B

Step	Year	BLOCK C-GYM	Specific Heating Demand	Specific Primary Energy Demand
existing situation		Constructed in 1999, aluminum windows in the GYM, PVC windows in the dressing rooms	121.3	196.5
STEP 1	2015	External wall insulation, ventilation, change of old PVC windows in the dressing rooms	96.4	193.9
STEP 2	2015	Roof insulation	46.3	151.9
STEP 3	2015	New LED lighting will replace the existing mercury lamps in the Gym.Fourteen solar panels for DHW will be added in block C (for the dressing rooms in the Gym). For achieving better comfort in the summer, new heat-pump air-to water can be installed in the Gym on later stages.	46.3	127.9
STEP 4	2020	change of aluminium windows	22.5	93.4

Figure 8: Overview refurbishment steps, Block C

3. Completion of step-by-step refurbishment to EnerPHit

3.1 PHPP Result Sheet of the completed EnerPHit standard, Block A

EnerPHit verification

Building:	School "Tzanko Diustabanov"-Block A
Street:	25 Hristo Smirnenski blv.
Postcode/City:	Gabrovo
Country:	Bulgaria
Building type:	School
Climate:	Велико Търнов PHI
Altitude of building site (in [m] above sea level):	382
Home owner/client:	Municipality of Gabrovo
Street:	3 Vazrazhdane square
Postcode/City:	Gabrovo

Architecture:		Mechanical System:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Energy consulting:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	

Year of Construction:	2014		Interior temperature winter [C°]	20,0	Interior temp. summer [C°] 25,0
Number of dwelling units:	1		Internal heat gains winter [W/m²]	2,8	IHG summer [W/m²] 2,8
Number of Occupants:	225,0				Spec. capacity [Wh/K per m² TFA] 204
Exterior vol. V_e:	6224,4	m³			Mechanical cooling:

Specific building demands with reference to the treated floor area

				Requirements	Fulfilled?*
	Treated floor area	1303,5	m²		
Space heating	Annual heating demand	**24**	**kWh/(m²a)**	25 kWh/(m²a)	yes
	Heating load	**16**	**W/m²**	-	-
Space cooling	Overall specific space cooling demand		**kWh/(m²a)**	-	-
	Cooling load		**W/m²**	-	-
	Frequency of overheating (> 25 °C)	8,2	%	-	-
Primary Energy	Heating, cooling, dehumidifying, DHW, auxiliary electricity, lighting, elect.	**124**	**kWh/(m²a)**	131 kWh/(m²a)	yes
	DHW, space heating and auxiliary electricity	71	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	**1,0**	**1/h**	1 1/h	yes

* empty field: data missing; -: no requirement

EnerPHit building retrofit (acc. to heating demand)? yes

I confirm that the values given herein have been determined following the PHPP methodology and were determined based on the characteristics of the building. The PHPP calculations are attached to this application.

Name:	Company:	Registration number PHPP:
Surname:	Issued on:	
		Signature

Figure 9: Specific energy efficiency values of the completed project modelled with PHPP 9 Beta, Block A

3.2 PHPP Result Sheet of the completed EnerPHit standard, Block B

EnerPHit verification

Building:	School "Tzanko Diustabanov" -Block B
Street:	25 Hristo Smirnenski blv.
Postcode/City:	Gabrovo
Country:	Bulgaria
Building type:	School
Climate:	Велико Търнов PHI
Altitude of building site (in [m] above sea level):	382
Home owner/client:	Municipality of Gabrovo
Street:	3 Vazrazhdane square
Postcode/City:	Gabrovo

Architecture:		Mechanical System:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Energy consulting:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	

Year of Construction:	2014	Interior temperature winter [C°]	20,0	Interior temp. summer [C°]	25,0
Number of dwelling units:	1	Internal heat gains winter [W/m²]	2,8	IHG summer [W/m²]	2,8
Number of Occupants:	240,0			Spec. capacity [Wh/K per m² TFA]	204
Exterior vol. V_e:	6224,4 m³			Mechanical cooling:	

Specific building demands with reference to the treated floor area

Treated floor area: 1624,7 m²

			Requirements	Fulfilled?*
Space heating	Annual heating demand	**23 kWh/(m²a)**	25 kWh/(m²a)	yes
	Heating load	**16 W/m²**	-	-
Space cooling	Overall specific space cooling demand	kWh/(m²a)	-	-
	Cooling load	W/m²	-	-
	Frequency of overheating (> 25 °C)	6,4 %	-	-
Primary Energy	Heating, cooling, dehumidifying, DHW, auxiliary electricity, lighting, elect.	**105 kWh/(m²a)**	129 kWh/(m²a)	yes
	DHW, space heating and auxiliary electricity	53 kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity	kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	**1,0 1/h**	1 1/h	yes

* empty field: data missing; "-": no requirement

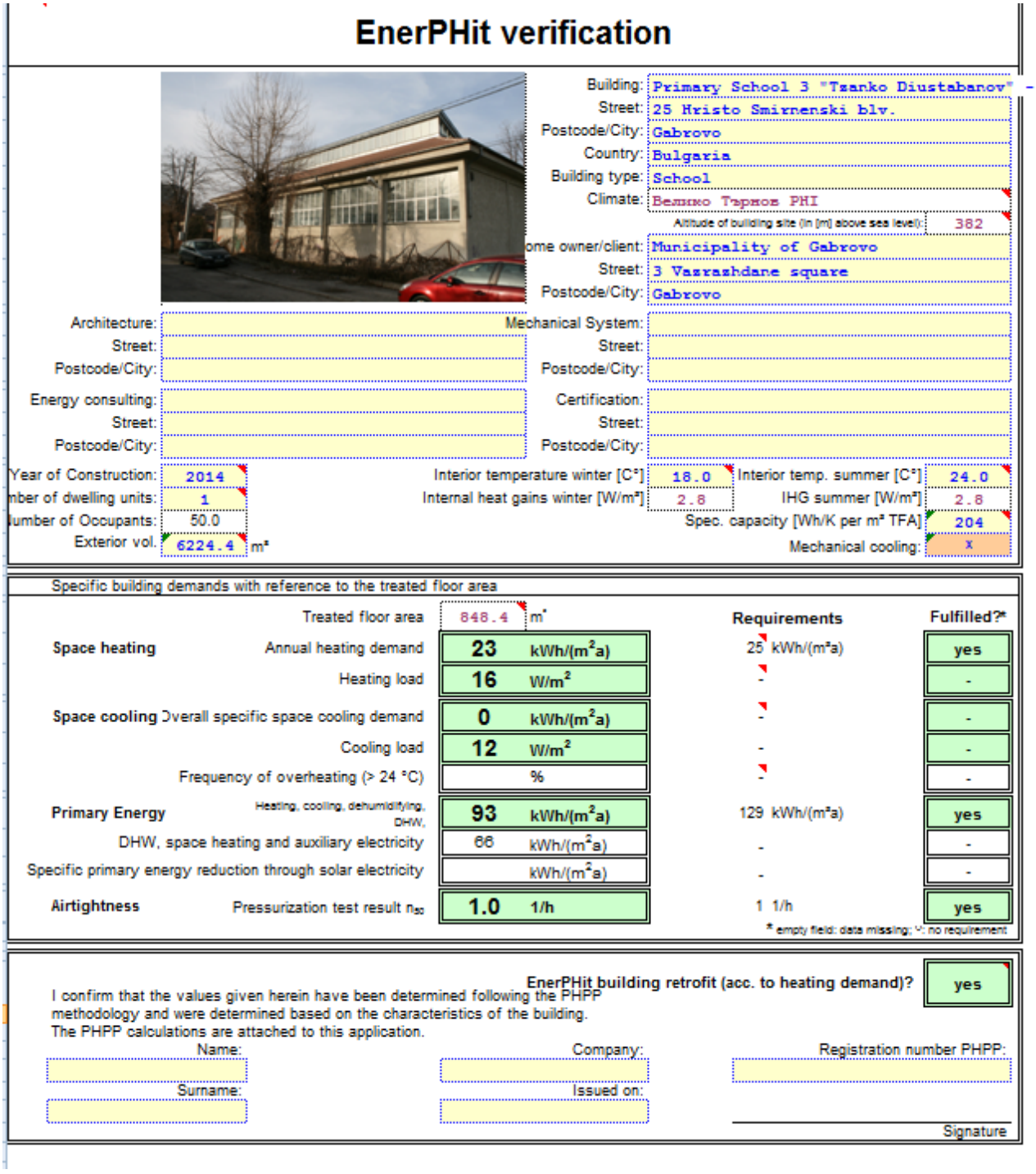
EnerPHit building retrofit (acc. to heating demand)? yes

I confirm that the values given herein have been determined following the PHPP methodology and were determined based on the characteristics of the building. The PHPP calculations are attached to this application.

Name:	Company:	Registration number PHPP:
Surname:	Issued on:	
		Signature

Figure 10: Specific energy efficiency values of the completed project modelled with PHPP 9 Beta, Block B

3.3 PHPP Result Sheet of the completed EnerPHit standard, Block C



EnerPHit verification

Building:	Primary School 3 "Tsanko Diustabanov" -		
Street:	25 Hristo Smirnenski blv.		
Postcode/City:	Gabrovo		
Country:	Bulgaria		
Building type:	School		
Climate:	Велико Търново PHI		
Altitude of building site (in [m] above sea level):	382		
ome owner/client:	Municipality of Gabrovo		
Street:	3 Vasrashdane square		
Postcode/City:	Gabrovo		
Architecture:		Mechanical System:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Energy consulting:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Year of Construction:	2014	Interior temperature winter [C°]	18.0
mber of dwelling units:	1	Internal heat gains winter [W/m²]	2.8
lumber of Occupants:	50.0	Interior temp. summer [C°]	24.0
Exterior vol.	6224.4 m³	IHG summer [W/m²]	2.8
		Spec. capacity [Wh/K per m³ TFA]	204
		Mechanical cooling:	x

Specific building demands with reference to the treated floor area

				Requirements	Fulfilled?*
	Treated floor area	848.4	m²		
Space heating	Annual heating demand	23	kWh/(m²a)	25 kWh/(m²a)	yes
	Heating load	16	W/m²	-	-
Space cooling	Overall specific space cooling demand	0	kWh/(m²a)	-	-
	Cooling load	12	W/m²	-	-
	Frequency of overheating (> 24 °C)		%	-	-
Primary Energy	Heating, cooling, dehumidifying, DHW,	93	kWh/(m²a)	129 kWh/(m²a)	yes
	DHW, space heating and auxiliary electricity	66	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	1.0	1/h	1 1/h	yes

* empty field: data missing; "-": no requirement

EnerPHit building retrofit (acc. to heating demand)? yes

I confirm that the values given herein have been determined following the PHPP methodology and were determined based on the characteristics of the building.
The PHPP calculations are attached to this application.

Name:	Company:	Registration number PHPP:
Surname:	Issued on:	
		Signature

Figure 11: Specific energy efficiency values of the completed project modelled with PHPP 9 Beta, Block C