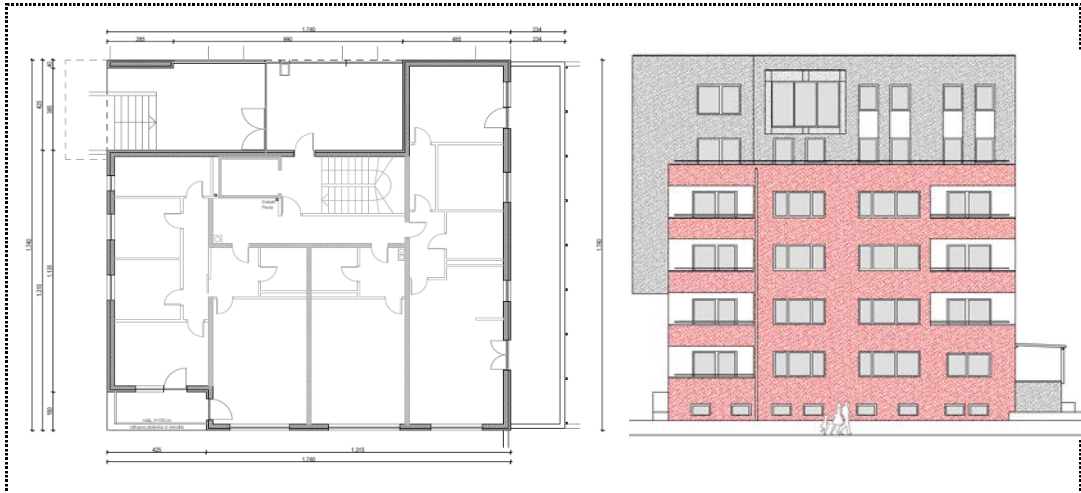


PHPP-Energy balance calculation



Architecture:	HGB d.o.o.	
Street:	Plečnikova ulica 22	
Postcode/City:	3000	Celje
Province/Country:	Slovenija	SI-Slovenia
Energy consultancy:	Eutrip, d.o.o.	
Street:	Kidričeva ulica 24	
Postcode/City:	3000	Celje
Province/Country:	Slovenija	SI-Slovenia
Year of construction:	2008	
No. of dwelling units:	1	
No. of occupants:	54,0	

Building:	Vila blok	
Street:	Pokopališka 46	
Postcode/City:	1000	Ljubljana
Province/Country:	Slovenija	SI-Slovenia
Building type:	11220 Tri ali večstanovanjski objekt	
Climate data set:	ud---01-Ljubljana, weather station	
Climate zone:	3: Cool-temperate	Altitude of location: 293 m
Home owner / Client:	Stanovanjski Sklad Republike Slovenije	
Street:	Poljanska cesta 31	
Postcode/City:	1000	Ljubljana
Province/Country:	Slovenija	SI-Slovenia
Mechanical engineer:		
Street:		
Postcode/City:		
Province/Country:		
Certification:		
Street:		
Postcode/City:		
Province/Country:		2-User determined
Interior temperature winter [°C]:	20,0	Interior temp. summer [°C]: 25,0
Internal heat gains (IHG) heating case [W/m²]:	4,0	IHG cooling case [W/m²]: 1,6
Specific capacity [Wh/K per m² TFA]:	132	Mechanical cooling: x

Specific building characteristics with reference to the treated floor area

				Alternative criteria		Fullfilled? <sup>2</sup>
		Criteria				
Space heating	Treated floor area m²	1392,0				
	Heating demand kWh/(m²a)	43,0	≤	-	-	
	Heating demand kWh/(m³a)	15,81				
Space cooling	Heating load W/m²	25,4	≤	-	-	
	Cooling & dehum. demand kWh/(m²a)	2,8	≤	-	-	
	Cooling load W/m²	11,9	≤	-	-	
	Frequency of overheating (> 25 °C) %	-	≤	-	-	
	Frequency of excessively high humidity (> 12 g/kg) %	0,2	≤	-	-	
Airtightness	Pressurization test result n <sub>50</sub> 1/h	1,5	≤	-	-	
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	208	≤	-	-	
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	110	≤	-	-	
	Generation of renewable energy (in relation to projected kWh/(m²a) building footprint area)	0,0	≥	-	-	

<sup>2</sup> 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.			-
Task:	First name:	Surname:	Signature:
	Primož	Praper	
Issued on:		City:	
10.12.18		Celje	

Climate data

Energy balance calculation with PHPP Version 9.6a

Vila blok / Climate: Ljubljana T1996-2005/J1981-2000 / TFA: 1392 m² / Heating: 43 kWh/(m²a) / Cooling: 2,8 kWh/(m²a) / PER: 109,8 kWh/(m²a)

Selection of climate data

Country: ud-User Data

Region:

2-Sorting: BY ID

Climate data set: ud---01-Ljubljana T1996-2005/J1981-2000

Climate zone: 3: Cool-temperate

Altitude

Weather station: 299,0

Building location: 293

Result overview

Annual heating demand 43,0 kWh/(m²a)

Heating load 25,4 W/m²

Frequency of overheating - %

Sensible cooling 2,8 kWh/(m²a)

Latent cooling 0,0 kWh/(m²a)

Cooling load 11,9 W/m²

PER demand 109,8 kWh/(m²a)

Data for heating

Annual method

Heating / cooling period 184

Heating / cooling degree hours 68

Radiation North 90

Radiation East 191

Radiation South 369

Radiation West 215

Horizontal radiation 309

Data from monthly balance

Heating

Cooling

d/a

kKh/a

kWh/(m²a)

kWh/(m²a)

kWh/(m²a)

kWh/(m²a)

kWh/(m²a)

200

180

160

140

120

100

80

60

40

20

0

kWh/(m²month)

1

2

3

4

5

6

7

8

9

10

11

12

25

20

15

10

5

0

-5

°C

Radiation North

Radiation East

Radiation South

Radiation West

Horizontal radiation

Exterior temperature

Dew point temperature

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	31	30	31	Weather 1	Weather 2	Weather 1	Weather 2	
ud---01-Ljubljana, weather station	Latitude °	46,1	Longitude °	14,5	Altitude [m]	299	Daily temperature swing Summer [K]				10,1		Radiation: [W/m²]		Radiation: [W/m²]		
° C	Exterior temperature	0,2	2,5	6,7	11,3	16,5	20,0	21,4	20,8	15,6	11,7	6,7	-5,9	-2,1	24,9	23,2	2,50
kWh/(m²month)	Radiation North	10	14	24	34	46	50	49	38	27	19	11	13	9	84	51	1,00
kWh/(m²month)	Radiation East	22	29	54	79	100	100	113	87	69	37	21	34	11	217	172	1,00
kWh/(m²month)	Radiation South	55	65	88	96	89	85	93	93	92	73	48	83	24	181	242	2,50
kWh/(m²month)	Radiation West	23	35	58	81	95	101	103	91	70	45	24	30	15	211	177	2,50
kWh/(m²month)	Horizontal radiation	31	48	88	132	163	173	183	146	107	63	33	44	21	354	266	
° C	Dew point temperature	-2,6	-1,9	1,1	5,0	9,6	13,1	14,2	14,7	10,9	8,4	3,7			16,6	14,0	
° C	Sky temperature	-11,3	-10,3	-6,5	-2,4	3,5	7,1	8,5	9,2	4,4	2,0	-3,2			13,9	14,0	
° C	Ground temperature	11,8	11,0	11,3	12,6	14,4	18,1	19,7	20,5	18,5	17,2	15,4	11,0	11,0	20,5	20,5	
Comment:																	

Household electric

Domestic hot wat

Heating

Cooling

Dehumidification

Summary						Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/a]	Radiation-load cooling period [kWh/a]
Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment				
	Treated floor area	1	1392,00	m²	Treated floor area according to PHPP manual				
A	North windows	2	58,58	m²	Results come from the 'Windows' worksheet. Window areas are subtracted from individual opaque areas. which is displayed in the 'Windows' worksheet.	North windows	1,365	3107	5658
A	East windows	3	100,59	m²		East windows	1,336	6440	16905
A	South windows	4	86,46	m²		South windows	1,377	21878	25753
A	West windows	5	29,50	m²		West windows	1,429	1595	2731
A	Horizontal windows	6	0,00	m²		Horizontal windows			
A	Exterior door	7	0,00	m²	Please subtract area of door from respective building assembly	Exterior door			
A	External wall - Ambient	8	825,59	m²	Temperature zone "A" is ambient air	External wall - Ambient	0,218	-61	366
B	External wall - Ground	9	0,00	m²	Temperature zone "B" is the ground	External wall - Ground			
A	Roof/Ceiling - Ambient	10	363,25	m²		Roof/Ceiling - Ambient	0,234	600	1382
B	Floor slab / Basement ceiling	11	240,92	m²		Floor slab / Basement ceiling	0,546		
		12	0,00	m²	Temperature zones "A", "B", "P" and "X" may be used. NOT "I"				
		13	0,00	m²	Temperature zones "A", "B", "P" and "X" may be used. NOT "I"				
X		14	0,00	m²	Temperature zone "X": Please provide user-defined reduction factor ( 0 < ft < 1):				
						Thermal bridges - Overview	Ψ [W/(mK)]		
A	Thermal bridges Ambient	15	0,00	m	Units in m	Thermal bridges Ambient			
P	Perimeter thermal bridges	16	641,90	m	Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)	Perimeter thermal bridges	0,200		
B	Thermal bridges FS/BC	17	0,00	m	Units in m	Thermal bridges FS/BC			
I	Building element towards neigh	18	0,00	m²	No heat losses, only considered for the heating load calculation	Building element towards neighbour			
Total thermal envelope				1704,88	m²	Average therm. envelope	0,528		

[Go to building components list](#)

Area input																1-Sorting: AS LIST									
Area no.	Building assembly description	To group No.	Assigned to group	Quantity	x (	a [m]	x	b [m]	+	User determined [m²]	-	User subtraction [m²]	-	Subtraction window areas [m²]	) =	Area [m²]	Selection building assembly / Building system	U-Value [W/(m²K)]	Deviation from North	Angle of inclination from the horizontal	Orientation	Reduction factor shading	Exterior absorptivity	Exterior emissivity	
	Projected building footprint	0	Projected building footprint	1	x (		x		+	240,92	-		)		=	240,9									
	Treated floor area	1	Treated floor area	1	x (		x		+	1392,00	-		)		=	1392,0									
	Exterior door	7	Exterior door		x (		x		+		-		)	-	=	0									
1	Ravna streha STR01	10	Roof/Ceiling - Ambient	1	x (		x		+	240,56	-		)	-	0,0	=	240,6	03ud-ST1 - Ravna streha	0,133	180	0	Hor	0,70	0,80	0,90
2	Ravna streha STR02	10	Roof/Ceiling - Ambient	1	x (		x		+	70,30	-		)	-	0,0	=	70,3	04ud-ST2-Tlak loža	0,612	180	0	Hor	0,70	0,80	0,90
3	Ravna streha STR03-bakelit	10	Roof/Ceiling - Ambient	1	x (		x		+	7,65	-		)	-	0,0	=	7,7	10ud-ST3-Tlak loža - bakelit	0,351	180	0	Hor	0,70	0,80	0,90
4					x (		x		+		-		)	-	0,0	=									
5	Fasada Z1 - JV	8	External wall - Ambient	1	x (		x		+	82,71	-		)	-	25,3	=	57,4	01ud-F1 - fasada	0,295	135	90	East	0,70	0,40	0,90
6	Fasada Z1 - JZ	8	External wall - Ambient	1	x (		x		+	75,18	-		)	-	13,8	=	61,4	01ud-F1 - fasada	0,295	225	90	South	0,70	0,40	0,90
7					x (		x		+		-		)	-	0,0	=									
8					x (		x		+		-		)	-	0,0	=									
9					x (		x		+		-		)	-	0,0	=									
10	Tla nad zunanjim zrakom	10	Roof/Ceiling - Ambient	1	x (		x		+	15,63	-		)	-	0,0	=	15,6	06ud-T2 - Tla nad zunanjim zrakom	0,207	0	0	Hor	0,00	0,00	0,00
11	Tla nad zunanjim zrakom	10	Roof/Ceiling - Ambient	1	x (		x		+	29,11	-		)	-	0,0	=	29,1	09ud-T3 - Tla nad zunanjim zrakom - bakelit	0,147	0	0	Hor	0,00	0,00	0,00
12	Tla proti neogrevani kleti	11	Floor slab / Basement ceiling	1	x (		x		+	240,92	-		)	-	0,0	=	240,9	05ud-T1 - Tla proti neogrevani kleti	0,546	0	0	Hor	0,00	0,00	0,00
13					x (		x		+		-		)	-	0,0	=									
14	Fasada Z3 - JV	8	External wall - Ambient	1	x (		x		+	175,06	-		)	-	75,3	=	99,8	07ud-F3 - nova fasada	0,205	135	90	East	0,70	0,40	0,90
15	Fasada Z3 - JZ	8	External wall - Ambient	1	x (		x		+	146,09	-		)	-	72,7	=	73,4	07ud-F3 - nova fasada	0,205	225	90	South	0,70	0,40	0,90
16	Fasada Z3 - SV	8	External wall - Ambient	1	x (		x		+	305,43	-		)	-	58,6	=	246,9	07ud-F3 - nova fasada	0,205	45	90	North	0,70	0,40	0,90
17	Fasada Z3 - SZ	8	External wall - Ambient	1	x (		x		+	316,24	-		)	-	29,5	=	286,7	07ud-F3 - nova fasada	0,205	315	90	West	0,70	0,40	0,90
18					x (		x		+		-		)	-	0,0	=						0,70	0,40	0,90	
19					x (		x		+		-		)	-	0,0	=									
20					x (		x		+		-		)	-	0,0	=									
21					x (		x		+		-		)	-	0,0	=									
22					x (		x		+		-		)	-	0,0	=									
23					x (		x		+		-		)	-	0,0	=									
24					x (		x		+		-		)	-	0,0	=									
25					x (		x		+		-		)	-	0,0	=									
26					x (		x		+		-		)	-	0,0	=									
27					x (		x		+		-		)	-	0,0	=									
28					x (		x		+		-		)	-	0,0	=									
29					x (		x		+		-		)	-	0,0	=									
30					x (		x		+		-		)	-	0,0	=									

Thermal bridge inputs																<a href="#">Change order</a>
No.	Thermal bridge - denomination	Group No.	Assigned to group	Quan- tity	x (	Length [m]	-	Subtraction length [m]	)=	Length $\ell$ [m]	User determined psi value [W/(mK)]	User determined $f_{Rsi=0,25}$ (optional)	or	Selection building system	$\Psi$ -Value [W/(mK)]	$f_{Rsi}$ -Requirement met?
1					x (		-		)=				or			
2					x (		-		)=				or			
3	Okna	16	Perimeter thermal bridges	1	x (	641,90	-		)=	641,90	0,200		or		0,200	
4					x (		-		)=				or			
5					x (		-		)=				or			
6					x (		-		)=				or			
7					x (		-		)=				or			
8					x (		-		)=				or			
9					x (		-		)=				or			
10					x (		-		)=				or			
11					x (		-		)=				or			
12					x (		-		)=				or			
13					x (		-		)=				or			
14					x (		-		)=				or			
15					x (		-		)=				or			
16					x (		-		)=				or			
17					x (		-		)=				or			
18					x (		-		)=				or			
19					x (		-		)=				or			
20					x (		-		)=				or			
21					x (		-		)=				or			
22					x (		-		)=				or			
23					x (		-		)=				or			
24					x (		-		)=				or			
25					x (		-		)=				or			
26					x (		-		)=				or			
27					x (		-		)=				or			
28					x (		-		)=				or			
29					x (		-		)=				or			
30					x (		-		)=				or			
31					x (		-		)=				or			
32					x (		-		)=				or			
33					x (		-		)=				or			
34					x (		-		)=				or			
35					x (		-		)=				or			
36					x (		-		)=				or			
37					x (		-		)=				or			

# U-value of building assemblies

Energy balance calculation with PHPP Version 9.6a

Vila blok / Climate: Ljubljana T1996-2005/J1981-2000 / TFA: 1392 m² / Heating: 43 kWh/(m²a) / Cooling: 2,8 kWh/(m²a) / PER: 109,8 kWh/(m²a)

Secondary calculation: Equivalent thermal conductivity of still air spaces -> (on the right)

Wedge-shaped assembly layer -> (on the right)

Unheated / uncooled attic -> (on the right)

Assembly no.		Building assembly description				Interior insulation?	
01ud		F1 - fasada					
		Heat transmission resistance [m²K/W]					
Orientation of building element		2-Wall		interior R <sub>si</sub>		0,13	
Adjacent to		1-Outdoor air		exterior R <sub>se</sub> :		0,04	
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
AB stena	1,510					200	
Stiropor	0,039					120	
zaključni omet	0,700					7	
Percentage of sec. 1		Percentage of sec. 2		Percentage of sec. 3		Total	
100%						32,7 cm	
U-value supplement				U-value:		0,295 W/(m²K)	

Assembly no.		Building assembly description				Interior insulation?	
02ud		F2 - cokel					
		Heat transmission resistance [m²K/W]					
Orientation of building element		2-Wall		interior R <sub>si</sub>		0,13	
Adjacent to		1-Outdoor air		exterior R <sub>se</sub> :		0,04	
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
AB stena	1,510					200	
hidroizolacija	0,190					4	
XPS	0,035					120	
Percentage of sec. 1		Percentage of sec. 2		Percentage of sec. 3		Total	
100%						32,4 cm	
U-value supplement				U-value:		0,267 W/(m²K)	

Assembly no.		Building assembly description				Interior insulation?	
03ud		ST1 - Ravna streha					
		Heat transmission resistance [m²K/W]					
Orientation of building element		1-Roof		interior R <sub>si</sub>		0,13	
Adjacent to		1-Outdoor air		exterior R <sub>se</sub> :		0,04	
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
AB plošča	1,510					160	
Bitumenski premaz	0,190					1	
Bitumenska zapora	0,190					3	
PIR plošče	0,025					120	
PIR plošče	0,025	v naklonu				60	
Sika folija	0,190					2	
Prodec	1,500					50	
Percentage of sec. 1		Percentage of sec. 2		Percentage of sec. 3		Total	
100%						39,6 cm	
U-value supplement				U-value:		0,133 W/(m²K)	



Assembly no.

04ud

ST2-Tlak loža

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

1-Roof

interior R<sub>si</sub>

0,13

Adjacent to

1-Outdoor air

exterior R<sub>se</sub>:

0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Zaključna obloga	0,700					15
AB estrih	1,510					50
EPS	0,039					50
hidroizolacija	0,190					4
AB plošča	1,510					160
Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total
						27,9 cm

U-value supplement

W/(m²K)

U-value:

0,612

W/(m²K)

Assembly no.

05ud

T1 - Tla proti neogrevani kleti

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

3-Floor

interior R<sub>si</sub>

0,13

Adjacent to

3-Ventilated

exterior R<sub>se</sub>:

0,13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
AB plošča	1,510					160
XPS	0,035					50
Cementni estrih	1,400					50
Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total
						26,0 cm

U-value supplement

W/(m²K)

U-value:

0,546

W/(m²K)

Assembly no.

06ud

T2 - Tla nad zunanjim zrakom

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

3-Floor

interior R<sub>si</sub>

0,13

Adjacent to

3-Ventilated

exterior R<sub>se</sub>:

0,13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Cementni estrih	1,400					25
XPS	0,035					50
AB plošča	1,510					160
Stiropor	0,040					120
Zaključni sloj	0,700					7
Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total
						36,2 cm

U-value supplement

W/(m²K)

U-value:

0,207

W/(m²K)

Assembly no.

07ud

F3 - nova fasada

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

2-Wall

interior R<sub>si</sub>

0,13

Adjacent to

1-Outdoor air

exterior R<sub>se</sub>:

0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
AB stena	1,510					200
Kamena volna	0,035					160
Zaključni sloj	0,700					7

Percentage of sec. 1

100%

Percentage of sec. 2

Percentage of sec. 3

Total

36,7

cm

U-value supplement

W/(m²K)

U-value:

0,205

W/(m²K)

Assembly no.

08ud

F4 - nova fasada - bakelti

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

2-Wall

interior R<sub>si</sub>

0,13

Adjacent to

1-Outdoor air

exterior R<sub>se</sub>:

0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
AB stena	1,510					200
Weber ultra plus	0,020					100
Zaključni sloj	0,700					7

Percentage of sec. 1

100%

Percentage of sec. 2

Percentage of sec. 3

Total

30,7

cm

U-value supplement

W/(m²K)

U-value:

0,188

W/(m²K)

Assembly no.

09ud

T3 - Tla nad zunanjim zrakom - bakelit

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

3-Floor

interior R<sub>si</sub>

0,13

Adjacent to

3-Ventilated

exterior R<sub>se</sub>:

0,13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Cementni estrih	1,400					25
XPS	0,035					50
AB plošča	1,510					160
Weber ultra plus	0,020					100
Zaključni sloj	0,700					7

Percentage of sec. 1

100%

Percentage of sec. 2

Percentage of sec. 3

Total

34,2

cm

U-value supplement

W/(m²K)

U-value:

0,147

W/(m²K)

Assembly no.

10ud

ST3-Tlak loža - bakelit

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

1-Roof

interior R<sub>si</sub>

0,13

Adjacent to

1-Outdoor air

exterior R<sub>se</sub>

0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Zaključna obloga	0,700					15
AB estrih	1,510					50
bakelit	0,020					50
hidroizolacija	0,190					4
AB plošča	1,510					160

Percentage of sec. 1

100%

Percentage of sec. 2

Percentage of sec. 3

Total

27,9

cm

U-value supplement

W/(m²K)

U-value:

0,351

W/(m²K)



Heat losses through the ground

Energy balance calculation with PHPP Version 9.6a

Vila blok / Climate: Ljubljana T1996-2005/J1981-2000 / TFA: 1392 m² / Heating: 43 kWh/(m²a) / Cooling: 2,8 kWh/(m²a) / PER: 109,8 kWh/(m²a)

Building section 1

Ground characteristics				
Thermal conductivity	λ	2,0	W/(mK)	
Heat capacity	ρc	2,0	MJ/(m³K)	
Periodic penetration depth	δ	3,17	m	

Climate data				
Avg indoor temp. winter	T <sub>i</sub>	20,0	°C	
Avg indoor temp. summer	T <sub>i</sub>	25,0	°C	
Avg ground surface temperature	T <sub>g,ave</sub>	12,3	°C	
Amplitude of T <sub>g,ave</sub>	T <sub>g,^</sub>	10,6	°C	
Phase shifting of T <sub>e,m</sub>	τ	1,0	Months	
Length of the heating period	n	6,0	Months	
Heating degree hours - exterior	G <sub>i</sub>	68,2	kKh/a	

Building data									
Area of ground floor slab / basement	A	240,9	m²		U-value floor slab/basement ceiling	U <sub>f</sub>	0,546	W/(m²K)	
Perimeter length	P	69,6	m		TBs floor slab / basement ceiling	Ψ <sub>B</sub> *I	0,70	W/K	
Charact. dimension of floor slab	B'	6,92	m		U-value floor slab / basement ceiling i	U <sub>f</sub> '	0,549	W/(m²K)	
					Equivalent thickness floor	d <sub>t</sub>	3,64	m	

Floor slab type (select only one)									
<input type="radio"/>	Slab on grade								
	Perimeter insulation width/depth	D		m	Orientation of perimeter insulation	horizontal			
	Perimeter insulation thickness	d <sub>n</sub>		m	(check only one field)	vertical	x		
	Conductivity perimeter insulation	λ <sub>n</sub>		W/(mK)					
<input type="radio"/>	Heated basement or floor slab completely / partially below ground level								
	Basement wall height below ground	le z		m	U-Value wall below ground	U <sub>wB</sub>		W/(m²K)	
<input checked="" type="radio"/>	Unheated basement								
	Height aboveground wall	h	1,00	m	U-Value wall above ground	U <sub>w</sub>	0,295	W/(m²K)	
	Basement wall height below ground	le z	2,00	m	U-Value wall below ground	U <sub>wB</sub>	0,267	W/(m²K)	
	Air change unheated basement	n	0,30	h <sup>-1</sup>	U-Value basement floor slab	U <sub>fB</sub>	0,546	W/(m²K)	
	Air volume basement	V	1440	m³					
<input type="radio"/>	Suspended floor above a ventilated crawl space (at max. 0.5 m below ground)								
	U-Value crawl space	U <sub>Crawl</sub>		W/(m²K)	Area of ventilation openings	εP		m²	
	Height of crawl space wall	h		m	Wind velocity at 10 m height	v		m/s	
	U-Value crawl space wall	U <sub>w</sub>		W/(m²K)	Wind shield factor	f <sub>w</sub>		-	

Additional thermal bridge heat losses at perimeter									
Phase shift	β		Months		Steady-state fraction	Ψ <sub>P,stat</sub> *I		W/K	
					Harmonic fraction	Ψ <sub>P,harm</sub> *I		W/K	

Groundwater correction									
Depth of the groundwater table	z <sub>w</sub>	3,0	m		Groundwater correction factor	G <sub>w</sub>	1,03353783	-	
Groundwater flow rate	q <sub>w</sub>	0,05	m/d						

Interim results									
Phase shift	β	1,24	Months		Steady-state heat flow	Φ <sub>stat</sub>	674,0	W	
Steady-state transmittance	L <sub>S</sub>	87,37	W/K		Periodic heat flow	Φ <sub>harm</sub>	260,6	W	
Exterior periodic transmittance	L <sub>pe</sub>	48,73	W/K		Heat losses during heating period	Q <sub>tot</sub>	4117	kWh	
Transmittance building	L <sub>0</sub>	132,33	W/K						

Monthly average temperatures in the ground for monthly method (building assembly 1)

Month	1	2	3	4	5	6	7	8	9	10	11	12	Avg. value
Winter	11,8	11,0	11,3	12,6	14,4	16,4	18,0	18,8	18,5	17,2	15,4	13,4	14,9
Summer	13,5	12,7	13,0	14,3	16,1	18,1	19,7	20,5	20,2	18,9	17,1	15,1	16,6

Design ground temperature for 'Heating load' worksheet	11,0	For 'Cooling load' worksheet	20,5
Reduction factor for 'Annual heating' worksheet			0,46

Total result (all building parts)

Phase shift	β	1,24	Months	Steady-state heat flow	Φ <sub>stat</sub>	674,0	W
Steady-state transmittance	L <sub>S</sub>	87,37	W/K	Periodic heat flow	Φ <sub>harm</sub>	260,6	W
Exterior periodic transmittance	L <sub>pe</sub>	48,73	W/K	Heat losses during heating period	Q <sub>tot</sub>	4117	kWh
Transmittance building	L <sub>0</sub>	132,33	W/K	Charact. dimension of floor slab	B'	6,92	m

Monthly Average temperatures in the ground for monthly method (all building assemblies)

Month	1	2	3	4	5	6	7	8	9	10	11	12	Avg. value
Winter	11,8	11,0	11,3	12,6	14,4	16,4	18,0	18,8	18,5	17,2	15,4	13,4	14,9
Summer	13,5	12,7	13,0	14,3	16,1	18,1	19,7	20,5	20,2	18,9	17,1	15,1	16,6

Design ground temperature for 'Heating load' worksheet	11,0	For 'Cooling load' worksheet	20,5
Reduction factor for 'Annual heating' worksheet			0,46

## Windows

Energy balance calculation with PHPP Version 9.6a

Vila blok / Climate: Ljubljana T1996-2005/J1981-2000 / TFA: 1392 m<sup>2</sup> / Heating: 43 kWh/(m<sup>2</sup>a) / Cooling: 2,8 kWh/(m<sup>2</sup>a) / PER: 109,8 kWh/(m<sup>2</sup>a)

Window area orientation	Global radiation (main orientations) kWh/(m²a)	Shading	Dirt	Non-vertical radiation incidence 0,85	Glazing fraction	g-Value	Solar irradiation reduction factor	Window area m²	Window U-Value W/(m²K)	Glazing area m²	Average global radiation kWh/(m²a)	North East South West Horizontal	Transmission losses heating period kWh/a	Heating gains solar radiation heating period kWh/a
Standard values →		0,75	0,95										5452	1312
North	90	0,47	0,95	0,85	0,83	0,65	0,31	58,58	1,37	48,60	110		9158	3410
East	191	0,25	0,95	0,85	0,85	0,65	0,17	100,59	1,34	85,98	307		8114	11841
South	369	0,95	0,95	0,85	0,85	0,65	0,65	86,46	1,38	73,86	323		2873	725
West	215	0,46	0,95	0,85	0,80	0,65	0,30	29,50	1,43	23,61	126		0	0
Horizontal	309	1,00	0,95	0,85	0,00	0,00	0,00	0,00	0,00	0,00	309	25597	17288	
Total or average value for all windows.						0,65	0,37	275,13	1,36	232,05				

Heating degree hours [kKh/a]:

68,2

Go to glazing list

Go to window frames list

					Window rough openings		Installed in	Glazing	Frame	g-Value	U-Value		Ψ Glazing edge	Installation situation user determined value for Ψ <sub>installation</sub> or '1': Ψ <sub>installation</sub> from 'Components' worksheet '0': in the case of abutting windows					Results			
Qa n- tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien- tation	Width	Height	Selection from 'Areas' worksheet	Selection from 'Components' worksheet	Selection from 'Components' worksheet	Perpen- dicular radiation	Glazing	Frames (avg.)	Ψ <sub>Glazing edge</sub> (Avg.)	left	right	bottom	top	Ψ <sub>installation</sub> (Avg.)	Window Area	Glazing area	U <sub>w</sub> installed	Glazed fraction per window
		°	°		m	m		1-Sorting: AS LIST	1-Sorting: AS LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%
4	O1	225	90	South	4,050	2,500	15-Fasada Z3 - JZ	01ud-Zasteklitev dvoslojna zasteklitev	02ud-ALU profil	0,65	1,10	2,70	0,041	1	1	1	1	0,040	40,5	36,91	1,34	91%
4	O2	225	90	South	0,700	1,400	15-Fasada Z3 - JZ	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	3,9	2,82	1,54	72%
8	O3	225	90	South	1,200	1,400	15-Fasada Z3 - JZ	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	13,4	10,68	1,42	80%
4	O6	225	90	South	1,000	2,300	15-Fasada Z3 - JZ	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	9,2	7,43	1,40	81%
1	O5	225	90	South	4,000	1,400	15-Fasada Z3 - JZ	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	5,6	4,86	1,30	87%
6	O6	225	90	South	1,000	2,300	6-Fasada Z1 - JZ	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	13,8	11,1	1,4	81%
8	O7	135	90	East	2,200	2,100	14-Fasada Z3 - JV	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	37,0	32,3	1,3	87%
1	O8	135	90	East	2,200	1,600	14-Fasada Z3 - JV	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	3,5	3,0	1,3	85%
1	O9	135	90	East	2,200	1,300	14-Fasada Z3 - JV	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	2,9	2,4	1,4	84%
4	O10	135	90	East	3,100	1,400	14-Fasada Z3 - JV	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	17,4	14,9	1,3	86%
4	O11	135	90	East	2,600	1,400	14-Fasada Z3 - JV	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	14,6	12,4	1,3	85%
1	O12	135	90	East	3,450	2,500	5-Fasada Z1 - JV	01ud-Zasteklitev dvoslojna zasteklitev	02ud-ALU profil	0,65	1,10	2,70	0,041	1	1	1	1	0,040	8,6	7,8	1,4	91%
7	O13	135	90	East	1,000	1,400	5-Fasada Z1 - JV	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	9,8	7,6	1,5	77%
3	V1	135	90	East	1,000	2,300	5-Fasada Z1 - JV	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	6,9	5,6	1,4	81%
12	O14	45	90	North	1,400	1,600	16-Fasada Z3 - SV	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	26,9	22,1	1,4	82%
5	O8	45	90	North	2,200	1,600	16-Fasada Z3 - SV	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	17,6	15,0	1,3	85%
1	O3	45	90	North	1,200	1,400	16-Fasada Z3 - SV	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	1,7	1,3	1,4	80%
4	V1	45	90	North	1,000	2,300	16-Fasada Z3 - SV	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	9,2	7,4	1,4	81%
1	V2	45	90	North	1,400	2,300	16-Fasada Z3 - SV	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	3,2	2,7	1,3	85%
10	O15	315	90	West	1,200	1,600	17-Fasada Z3 - SZ	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	19,2	15,5	1,4	81%
5	O16	315	90	West	1,000	1,600	17-Fasada Z3 - SZ	01ud-Zasteklitev dvoslojna zasteklitev	01ud-PVC profil 5-komorni	0,65	1,10	1,50	0,041	1	1	1	1	0,040	8,0	6,3	1,4	78%
1	V3	315	90	West	1,000	2,300	17-Fasada Z3 - SZ	01ud-Zasteklitev dvoslojna zasteklitev	02ud-ALU profil	0,65	1,10	2,70	0,041	1	1	1	1	0,040	2,3	1,9	1,6	81%

Ventilation data

Vila blok / Climate: Ljubljana T1996-2005/J1981-2000 / TFA: 1392 m² / Heating: 43 kWh/(m²a) / Cooling: 2,8 kWh/(m²a) / PER: 109,8 kWh/(m²a)

Treated floor area $A_{TFA}$	m²	1392		( <i>'Areas' worksheet</i> )
Room height h	m	2,72	2,72	
Volume of ventilated space ( $A_{TFA} \cdot h$ ) : $V_V$	m³	3787		( <i>Worksheet 'Annual heating'</i> )

Ventilation type

Please select 3-Only window ventilation

Infiltration air change rate

Wind protection coefficients e and f				
Coefficient e for wind protection class		Several side exposed	One side exposed	
No protection		0,10	0,03	
Moderate protection		0,07	0,02	
High protection		0,04	0,01	
Coefficient f		15	20	
		For annual demand:	For heating load:	
Wind protection coefficient, e		0,07	0,18	
Wind protection coefficient, f		15	15	
Air change rate at press. test	$n_{50}$	1/h	1,50	Net air volume for press. test $V_{n50}$ m³
				Air permeability $q_{50}$ m³/(hm²)
				3,33
		For annual demand:	For heating load:	
Excess extract air		1/h	0,00	
Infiltration air change rate	$n_{V,Rest}$	1/h	0,105	0,263

Selection of ventilation input - Results

PHPP offers two methods for dimensioning air quantities and choosing the ventilation unit. With "Standard data input for balanced ventilation", supply or extract air quantities for residential buildings and parameters for ventilation systems with a maximum of 1 ventilation unit can be planned. Projects with up to 10 different ventilation units and air quantities determined according to rooms or zones can be entered in the 'Addl vent' worksheet. Please select your design method here:

Ventilation unit / Heat recovery efficiency design		Average air flow rate	Average air change rate	Extract air excess (extract air system)	Effective heat recovery efficiency unit	Humidity recovery efficiency	Specific power input	Heat recovery efficiency SHX
<input checked="" type="checkbox"/>	Standard design	( <i>'Ventilation' worksheet, see below</i> )						
<input type="checkbox"/>	Multiple ventilation units, non-res	( <i>'Addl vent' worksheet</i> )						
		m³/h	1/h	1/h	[-]	[-]	Wh/m³	[-]
		1894	0,50	0,00	0,0%	0,0%	0,00	0,0%
					Cooling recovery	Efficiency SHX		
						$\eta_{*SHX}$	0%	

Average interior humidity during winter operation

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
35%	36%	42%	51%	65%	-	-	-	69%	61%	48%	38%

Specific energy for heating (annual method)

Energy balance calculation with PHPP Version 9.6a

Vila blok / Climate: Ljubljana T1996-2005/J1981-2000 / TFA: 1392 m² / Heating: 43 kWh/(m²a) / Cooling: 2,8 kWh/(m²a) / PER: 109,8 kWh/(m²a)

Interior temperature:20,0°C

Building type:11220 Tri ali večstanovanjski objekti

Treated floor area A<sub>TFA</sub>:1392,0m²

Building assembly	Temperature zone	Area m²	U-Value W/(m²K)	Temp. factor f <sub>t</sub>	G <sub>t</sub> kKh/a	kWh/a	Per m² of treated floor area
External wall - Ambient	A	825,6	0,218	1,00	68,2	12254	8,80
External wall - Ground	B			0,46			
Roof/Ceiling - Ambient	A	363,3	0,234	1,00	68,2	5803	4,17
Floor slab / Basement ceiling	B	240,9	0,546	0,46	68,2	4095	2,94
	A			1,00			
	A			1,00			
	X			0,00			
Windows	A	275,1	1,365	1,00	68,2	25597	18,39
Exterior door	A			1,00			
Exterior TB (length/m)	A			1,00			0,00
Perimeter TB (length/m)	P	641,9	0,200	0,46	68,2	3994	2,87
Ground TB (length/m)	B			0,46			0,00
Total of all building envelope areas		1704,9					kWh/(m²a)

Transmission heat losses Q<sub>T</sub>

Total5174437,2

Ventilation system:

Effective heat recovery efficiency

Efficiency of subsoil heat exchanger

Heat recovery efficiency of SHX

Effective air volume, V<sub>V</sub>

η<sub>eff</sub>0%

η<sub>SHX</sub>0%

n<sub>V,system</sub>1/h

η<sub>HR</sub>

n<sub>V,Res</sub>1/h

Energetically effective air changes n<sub>V</sub>

0,500

1 - 0,00

0,105

0,605

V<sub>V</sub>m³

3787,2

n<sub>V</sub>1/h

0,605

c<sub>Air</sub>W/(m³K)

0,33

G<sub>t</sub>kKh/a

68,2

kWh/a

51544

kWh/(m²a)

37,0

Ventilation heat losses Q<sub>V</sub>

3787,20,6050,3368,25154437,0

Total heat losses Q<sub>L</sub>

(51744 + 51544)1,010328874,2

Orientation of the area	Reduction factor See 'Windows' sheet	g-Value (perp. radiation)	Area m²	Radiation HP kWh/(m²a)	kWh/a
North	0,31	0,65	58,58	110	1312
East	0,17	0,65	100,59	307	3410
South	0,65	0,65	86,46	323	11841
West	0,30	0,65	29,50	126	725
Horizontal	0,00	0,00	0,00	309	0
Total					17288

Available solar heat gains Q<sub>S</sub>

1728812,4

Internal heat gains Q<sub>I</sub>

0,0241844,001392,02452717,6

Free heat Q<sub>F</sub>

Q<sub>S</sub> + Q<sub>I</sub>4181530,0

Ratio of free heat to losses

Q<sub>F</sub> / Q<sub>V</sub>0,40

Utilisation factor heat gains h<sub>G</sub>

(1 - (Q<sub>F</sub> / Q<sub>L</sub>)<sup>5</sup>) / (1 - (Q<sub>F</sub> / Q<sub>L</sub>)<sup>6</sup>)99%

Heat gains Q<sub>G</sub>

η<sub>G</sub> \* Q<sub>F</sub>4154329,8

Annual heating demand Q<sub>H</sub>

Q<sub>L</sub> - Q<sub>G</sub>6174444

Limiting value

kWh/(m²a)

-

Requirement met?

(Yes/No)

-

PHPP, Annual heating

0662 200817 PHPP Pokopališka 46-novo stanje\_25.2.2021



Specific energy for heating (monthly method)

Energy balance calculation with PHPP Version 9.6a

Vila blok / Climate: Ljubljana T1996-2005/J1981-2000 / TFA: 1392 m² / Heating: 43 kWh/(m²a) / Cooling: 2,8 kWh/(m²a) / PER: 109,8 kWh/(m²a)

Interior temperature: 20 °C

Building type: 11220 Tri ali večstanovanjski objekt

Treated floor area A<sub>TFA</sub>: 1392 m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - External	14,9	11,9	10,1	6,4	2,8	0,2	-0,9	-0,5	3,3	6,3	9,7	13,8	78	kKh
Heating degree hours - Ground	6,1	6,0	6,5	5,3	4,1	1,3	0,2	-0,4	1,1	2,1	3,3	4,9	41	kKh
Losses - Exterior	20754	16612	14039	8973	3858	215	-1232	-635	4603	8776	13522	19272	108758	kWh
Losses - Ground	1590	1567	1679	1391	1074	347	52	-93	282	533	868	1283	10573	kWh
Sum spec. losses	16,1	13,1	11,3	7,4	3,5	0,4	-0,8	-0,5	3,5	6,7	10,3	14,8	85,7	kWh/m²
Solar gains - North	134	187	382	597	827	853	927	675	493	258	142	87	5562	kWh
Solar gains - East	479	574	859	1042	1106	1068	1207	1059	969	665	423	325	9775	kWh
Solar gains - South	1604	2049	2934	3487	3516	3545	3721	3596	3219	2398	1471	1200	32741	kWh
Solar gains - West	69	114	200	295	377	414	405	341	241	157	80	62	2755	kWh
Solar gains - Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - Opaque	131	189	327	467	566	593	628	512	391	241	133	97	4274	kWh
Internal heat gains	4143	3742	4143	4009	4143	4009	4143	4143	4009	4143	4009	4143	48776	kWh
Sum spec. gains solar + internal	4,7	4,9	6,4	7,1	7,6	7,5	7,9	7,4	6,7	5,6	4,5	4,2	74,6	kWh/m²
Utilisation factor	100%	100%	100%	92%	47%	5%	100%	100%	52%	96%	100%	100%	57%	
Annual heating demand	15785	11325	6899	1290	3	0	0	0	8	1794	8133	14643	59881	kWh
Spec. heating demand	11,3	8,1	5,0	0,9	0,0	0,0	0,0	0,0	0,0	1,3	5,8	10,5	43,0	kWh/m²

