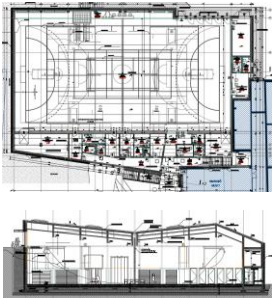


PHPP-Energy balance calculation



Building: ŠPORTNI CENTER LUČE

Street: p.št. 26/4, 25/3, 25/1, 30/21, 30/9, 30/14, 30/16

Postcode/City: 3334 Luče, k.o. Luče

Province/Country: Slovenija SI-Slovenia

Building type: telovadnica

Climate data set: Iud-01-Ljubljana

Climate zone: 3: Cool-temperate Altitude of location: 309 m

Home owner / Client: Občina Luče

Street: Luče 106

Postcode/City: 3334 Luče

Province/Country: Slovenija SI-Slovenia

Mechanical engineer: REM PROJEKT D.O.O.

Street: Podvin 102

Postcode/City: 3310 Žalec

Province/Country: Slovenija SI-Slovenia

Certification:

Street:

Postcode/City:

Province/Country:

Architecture: STUDIO LIST D.O.O.

Street: Oblakova 30

Postcode/City: 3000 Celje

Province/Country: Slovenija SI-Slovenia

Energy consultancy: dr. Miha Praznik, Gradbeni inštitut ZRMK d.o.o.

Street: Dimičeva 12

Postcode/City: 1000 Ljubljana

Province/Country: Slovenija SI-Slovenia

Year of construction: 2018

No. of dwelling units: 1

No. of occupants: 130,0

Interior temperature winter [°C]: 20,0

Interior temp. summer [°C]: 25,0

Internal heat gains (IHG) heating case [W/m²]: 2,8

IHG cooling case [W/m²]: 2,8

Specific capacity [Wh/K per m² TFA]: 204

Mechanical cooling: x

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fulfilled? ²
Space heating	Treated floor area m ²	1445,2				
	Heating demand kWh/(m ² a)	33,0	≤	-	-	no
	kWh/(m ³ a)	4,1	≤	6,0	-	
Heating load W/m ²	21	≤	-	-		
Space cooling	Cooling & dehum. demand kWh/(m ² a)	3	≤	-	-	-
	Cooling load W/m ²	7	≤	-	-	-
	Frequency of overheating (> 25 °C) %	-	≤	-	-	-
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	-	-	-
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	≤	-	-	-
Non-renewable Primary Energy (PE)	PE demand kWh/(m ² a)	204	≤	-	-	-
Primary Energy Renewable (PER)	PER demand kWh/(m ² a)	118	≤	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	≥	-	-	

² Empty field: Data missing; '!': No requirement

Task: _____ First name: **Miha** Surname: **Praznik** Signature: _____

Issued on: **29.06.18** City: **Ljubljana**

IZRAČUN NOVOGRADNJE GLEDE NA STANJE REŠITEV V FAZI PZI TER PREDVIDENE IZBOLJŠAVE ZA sNES, PO ROBNIH POGOJIH EKO SKLADA J.S.

U-value of building assemblies

Energy balance calculation with PHPP Version 9.6a

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?		
	1a - streha telovadnice					
Heat transmission resistance [m ² K/W]						
Orientation of building element	1-Roof	interior R _{si}	0,10			
Adjacent to	1-Outdoor air	exterior R _{se}	0,04			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
vezana plošča, perfor.	0,200	strešni nosilci	0,130			16
akustični filc	0,190	strešni nosilci	0,130			0
kamena volna, akust.	0,040	strešni nosilci	0,130	lesena podkonstrukcija	0,130	40
mirujoči zrak	6,860	strešni nosilci	0,130			1120
OSB plošča	0,130					18
parna zapora	0,190					0
toplotna izolacija 039	0,039			lesena konstr. 8/28/72	0,130	280
OSB plošča	0,130					22
strešna folija	0,190					2
Percentage of sec. 1		Percentage of sec. 2		Percentage of sec. 3		Total
85%		4,1%		11,1%		149,8 cm
U-value supplement			U-value: 0,136 W/(m ² K)			

Assembly no.	Building assembly description			Interior insulation?		
	1b - streha telovadnice					
Heat transmission resistance [m ² K/W]						
Orientation of building element	1-Roof	interior R _{si}	0,10			
Adjacent to	1-Outdoor air	exterior R _{se}	0,04			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
MK plošče	0,210					25
mirujoči zrak	2,760					450
OSB	0,130					18
kamena volna 035	0,035	lesena konstr. 12/14/90	0,130			140
kamena volna 035	0,035			lesena konstr. 6/14/65	0,130	140
deske	0,130					20
sekundarna kritina	0,190					0
letvanje, strešniki						
Percentage of sec. 1		Percentage of sec. 2		Percentage of sec. 3		Total
77%		13,3%		9,2%		79,3 cm
U-value supplement			U-value: 0,136 W/(m ² K)			

Assembly no.	Building assembly description			Interior insulation?		
	2a - tla na terenu, keramika					
Heat transmission resistance [m ² K/W]						
Orientation of building element	3-Floor	interior R _{si}	0,17			
Adjacent to	2-Ground	exterior R _{se}	0,00			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
keramika	1,800					10
ma cementni estrih	1,600					70
penjena folija	0,190					1
XPS 035	0,035	(npr. sva sloja FIBRANxps300L 0,035 W/mK)				220
hidroizolacija	0,190					10
podložni beton	2,000					100
komprimirano nasutje						400
Percentage of sec. 1		Percentage of sec. 2		Percentage of sec. 3		Total
100%						81,1 cm
U-value supplement			U-value: 0,151 W/(m ² K)			

Assembly no. **2b - tla na terenu, organska obloga** Interior insulation?

Heat transmission resistance [m²K/W]
 Orientation of building element: **3-Floor** interior R_{si}: 0,17
 Adjacent to: **2-Ground** exterior R_{se}: 0,00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
organska talna obloga	0,200			SKLOP OKI		3
ma cementni estrih	1,600					77
penjena folija	0,190					1
XPS 035	0,035	(npr. sva sloja FIBRANxps300L 0,035 W/mK)				220
hidroizolacija	0,190					10
podložni beton	2,000					100
komprimirano nasutje						400
Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total
						81,1 cm

U-value supplement W/(m²K) U-value: **0,151** W/(m²K)

Assembly no. **2c - tla nad ogrevanim prostorom** Interior insulation?

Heat transmission resistance [m²K/W]
 Orientation of building element: **1-Roof** interior R_{si}: 0,10
 Adjacent to: **1-Outdoor air** exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
omet	0,800					20
AB plošča	2,200					200
parna zapora	0,190					1
XPS 035	0,035	(npr. sva sloja FIBRANxps400L 0,035 W/mK)		v naklonu, povprečno 22cm		220
hidroizolacija	0,190					10
hidroizolacija	0,190					10
brušeni AB	2,200					150
Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total
						61,1 cm

U-value supplement W/(m²K) U-value: **0,149** W/(m²K)

Assembly no. **2e - tla v dvorani** Interior insulation?

Heat transmission resistance [m²K/W]
 Orientation of building element: **3-Floor** interior R_{si}: 0,17
 Adjacent to: **2-Ground** exterior R_{se}: 0,00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
parket	0,150					21
slepi pod	0,130	zrak	0,100			18
zrak	0,190	(3,5+1,0cm)				45
kamena volna 037	0,037	(npr. KI TPS)		blažilci, podloga	0,200	150
gradbena folija	0,190					2
AB plošča	2,200					180
XPS 035	0,035	(npr. FIBRANxps400L 0,035 W/mK)				100
hidroizolacija	0,190					10
podložni beton	2,000					100
komprimirano nasutje						400
Percentage of sec. 1	46%	Percentage of sec. 2	50,0%	Percentage of sec. 3	4,0%	Total
						102,6 cm

U-value supplement W/(m²K) U-value: **0,135** W/(m²K)

DELEŽ TOPLOTNO IZOLACIJSKIH MATERIALOV V TOPLOTNEM OVOJU STAVBE

	A [m ²]	debelina toplotnih izolacij			prostornina toplotnih izolacij		
		polistiren	biološko	mineralno	polistiren	biološko	mineralno
01ud-1a - streha telovadnice	1170,3			0,320	0,0	0,0	374,5
02ud-1b - streha telovadnice	45,8			0,280	0,0	0,0	12,8
03ud-2a - tla na terenu, keramika	180,1	0,220			39,6	0,0	0,0
04ud-2b - tla na terenu, organska obloga	74,2	0,220			16,3	0,0	0,0
05ud-2c - tla nad ogrevanim prostorom	61,5	0,220			13,5	0,0	0,0
06ud-2e - tla v dvorani	899,7	0,100		0,150	90,0	0,0	135,0
07ud-2h - strop nad zunanjim vhodom	11,7			0,330	0,0	0,0	3,9
08ud-3a - vkopana AB30 stena	88,0	0,240			21,1	0,0	0,0
09ud-3b - vkopana AB40 stena	165,1	0,240			39,6	0,0	0,0
10ud-3c - lesena prezračevana fasada AB40 stene	55,6			0,280	0,0	0,0	15,6
11ud-3d - lesena prezračevana fasada AB30 stene	491,6			0,280	0,0	0,0	137,7
3E - kontaktna fasada na AB steni 30	235,2			0,240	0,0	0,0	56,4
3F - kontaktna fasada na AB steni 40	36,5			0,240	0,0	0,0	8,8
					0,0	0,0	0,0
					220,2	0,0	744,5
					22,8%	0,0%	77,2%

POVRŠINA IN PROSTORNINA KONDICIONIRANIH PROSTOROV ZNOTRAJ OVOJA

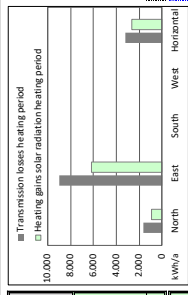
01 POPIS KVADRATURE					V TOPLOTNEM OVOJU	
ime etaže	št.	ime prostora	kv adraturo	prostornina	kv adraturo	prostornina
PRILIČJE						
	1	VADBENI PROSTOR	854,13	8699,25	854,13	8699,25
	2	SODNIŠKA NIŠA	43,34	440,9	43,34	440,9
	3	SHRAMBA_01	36,82	109,35	36,82	109,35
	4	GARDEROBA_01	10,83	32,17	10,83	32,17
	5	UMIVALNICA_01	7,54	22,27	7,54	22,27
	6	TUŠ_01	3,74	11,12	3,74	11,12
	7	WC_01	3,09	9,19	3,09	9,19
	8	GARDEROBA_02	10,42	30,96	10,42	30,96
	9	GARDEROBA_03	10,28	30,52	10,28	30,52
	10	UMIVALNICA_02	6,9	20,48	6,9	20,48
	11	TUŠ_02	2,75	8,17	2,75	8,17
	12	WC_02	1,67	4,95	1,67	4,95
	13	GARDEROBA_04	10,82	32	10,82	32
	14	HODNIK_01	24,64	73,01	24,64	73,01
	15	DOSTOPNA NIŠA	14,92	44,31	14,92	44,31
	16	POŽARNO STOPNIŠČE	24,51	108,72	24,51	108,72
	17	STROJNICA_02	8,88	30,02	8,88	30,02
	18	SHRAMBA_02	22,56	65,84	22,56	65,84
	19	ČISTILA	3,77	11,2	3,77	11,2
	20	WC_INVALIDI	4,24	12,6	4,24	12,6
	21	KABINET RAZREDNI POUK	6,93	20,58	6,93	20,58
	22	KABINET ŠPORTNI UČITELJ	14,12	41,93	14,12	41,93
	23	SANITARIJE ŠPORTNI	4,7	13,97	4,7	13,97
	24	ZUNANJE SANITARIJE	4	11,72	4	11,72
	25	STROJNICA_01	23,28	69,14	23,28	69,14
	26	LOPA (SOL, PESEK)	5,23	10,57		
	27	STRANSKI VHOD	6,24	0		
			1.170,35	9.964,94	1158,88	9954,37
NADSTROPJE						
	1	GALERIJA	67,13	461,62	67,13	461,62
	2	GALERIJA VHOD	43,48	286,62	43,48	286,62
	3	SHRAMBA_03	7,83	57,93	7,83	57,93
	4	GALERIJA VADBA	75,7	459,62	75,7	459,62
	5	HODNIK	5,49	26,93	5,49	26,93
	6	STROJNICA_03	10,36	35,29	10,36	35,29
	7	ČISTILA	4,61	15,86	4,61	15,86
	8	WC_ŽENSKI	6,95	24,01	6,95	24,01
	9	PREDPROSTOR	4,13	14,32	4,13	14,32
	10	WC_MOŠKI	8,52	25,33	8,52	25,33
	11	STRELIŠČE	48,84	236,21	48,84	236,21
	12	INŠTALACIJSKI JAŠEK	3,31	16,95	3,31	16,95
			286,35	1660,69	286,35	1660,69
			1.456,70	11.625,63	1445,23	11615,06

Windows

Energy balance calculation with PHPP Version 9.6a

ŠPORTNICENTERLUČE / Climate: Ljubljana / TFA: 1445 m² / Heating: 33 kWh/(m²a) / Cooling: 2.8 kWh/(m²a) / PER: 118.4 kWh/(m²a)

Window area orientation	Global radiation (main orientations) kWh/(m²a)	Shading	Dirr	Non-vertical radiation incidence	Glazing fraction	g-Value	Solar radiation reduction factor	Window area	Window U-Value W/(m²K)	Average global radiation kWh/(m²a)	Transmission losses heating period kWh/a	Heating gains solar radiation heating period kWh/a
North	94	0.82	0.95	0.85	0.77	0.50	0.51	25.02	0.92	19.29	1643	913
East	201	0.73	0.95	0.85	0.70	0.50	0.41	131.78	0.96	92.06	8992	6142
South	383	1.00	0.95	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0	0
West	215	1.00	0.95	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Horizontal	322	0.96	0.95	0.85	0.77	0.35	0.60	34.90	1.30	27.04	3242	2676
Total or average value for all windows:											13877	9732



Design temperature [°C] (from location)
-12 °C
[°C] User defined

Recommendation for U_{frame} [W/(m²K)]

0.85 1.00 1.10 0.52

Quality	Description	Deviation from north	Angle of inclination from the horizontal	Window rough openings		Installed in	Glazing	Frame	g-Value	U-Value		Glazing edge (Avg.) W/(m²K)	Installation situation				Results		Window surface temperature indicator		
				Width	Height					Perpendicular radiation	Glazing		Frames (avg.) W/(m²K)	left	right	bottom	top	U _{frame} W/(m²K)		U _g W/(m²K)	Glazing area
1	ZV-03	20	50	1.90	3.00	32-fasada S	Sort: AS LIST	0.50	0.60	1.30	0.040	1	1	1	1	0.040	4.2	3.14	0.93	75%	-129
5	O-01	70	50	1.90	3.00	32-fasada S	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	1	1	1	0.040	20.9	16.15	0.92	77%	-600
1	ZV-02	70	50	0.798	2.150	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	1	1	1	0.040	1.7	1.05	1.07	61%	-67
2		70	50	0.798	2.150	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	3.4	2.10	1.02	61%	-123
1	O-02	70	50	0.798	2.150	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	1.7	1.05	1.07	61%	-67
3	O-02	70	50	2.000	0.700	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	1	0	1	1	0.040	4.2	2.46	1.17	58%	-192
1	ZV-06	70	50	1.165	2.500	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	1	1	1	0.040	2.9	2.06	0.96	71%	-56
2		70	50	1.165	2.500	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	5.8	4.13	0.92	71%	-98
1	ZV-07	70	50	1.053	2.500	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	2.6	1.81	0.98	68%	-62
2		70	50	1.053	2.500	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	5.3	3.62	0.94	68%	-110
1	O-04	70	50	1.653	2.500	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	1	0	1	1	0.040	2.6	1.81	0.98	69%	-62
1	O-05	70	50	0.920	2.650	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	1	1	1	0.040	2.4	1.59	0.99	69%	-62
2		70	50	0.955	2.820	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	1	1	1	0.040	2.4	1.64	0.96	68%	-60
1	O-06	70	50	0.955	2.820	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	4.8	3.28	0.96	68%	-120
1	O-07	70	50	0.940	2.985	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	2.4	1.64	1.01	68%	-68
3		70	50	0.940	2.985	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	2.8	1.98	0.98	70%	-64
1	O-07	70	50	0.940	3.195	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	3.0	2.13	0.98	70%	-66
3		70	50	0.940	3.195	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	9.0	6.38	0.93	71%	-172
1	O-08	70	50	0.946	3.450	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	3.0	2.13	0.97	71%	-66
3		70	50	0.946	3.450	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	3.3	2.34	0.96	71%	-68
1	O-09	70	50	0.946	3.450	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	9.8	7.01	0.92	71%	-175
2	O-09	70	50	1.011	2.900	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	3.3	2.34	0.96	71%	-68
10		70	50	1.011	2.900	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	5.9	4.21	0.96	72%	-117
2		70	50	1.011	2.900	33-fasada J	02d-svetlo vrata	0.50	0.60	1.30	0.040	0	0	1	1	0.040	29.3	21.05	0.92	72%	-501
9	ST-01	160	10	1.200	3.000	2-fa - stena belovodnice	02d-svetlo kupola	0.35	1.10	1.10	0.050	1	1	1	1	0.040	32.4	25.20	1.30	78%	-508
		160	10	1.000	2.500	3-fa - stena belovodnice	02d-svetlo kupola	0.35	1.10	1.10	0.050	1	1	1	1	0.040	2.5	1.84	1.34	74%	-58

71.4

Heating degree hours [K(h)]:

Go to glazing list

Go to window frames list

Ventilation data

ŠPORTNI CENTER LUČE / Climate: Ljubljana / TFA: 1445 m² / Heating: 33 kWh/(m²a) / Cooling: 2,8 kWh/(m²a) / PER: 118,4 kWh/(m²a)

Treated floor area A _{TFA}	m ²	1445	(Areas' worksheet)
Room height h	m	8,04	8,04
Volume of ventilated space (A _{TFA} ·h) V _V	m ³	11615	(Worksheet 'Annual heating')

Ventilation type

Please select **1-Balanced PH ventilation with HR**

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

Wind protection coefficient, e		For annual demand: 0,07	For heating load: 0,18	
Wind protection coefficient, f		15	15	
Air change rate at press. test n ₅₀	1/h	0,60	0,60	Net air volume for press. test V _{n50} m ³ : 11615
				Air permeability q ₅₀ m ³ /(hm ²): 1,87
Excess extract air	1/h	0,00	0,00	
Infiltration air change rate n _{V,Rest}	1/h	0,042	0,105	

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
		m ³ /h	1/h	1/h	[-]	[-]	Wh/m ³	[-]
<input type="checkbox"/>	Standard design (Ventilation' worksheet, see below)							
<input checked="" type="checkbox"/>	Multiple ventilation units, non-res (Addl vent' worksheet)	5814	0,50	0,00	82,0%	0,0%	0,20	0,0%
Cooling recovery								Efficiency SHX
								η*SHX: 0%

Average interior humidity during winter operation

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
33%	34%	39%	47%	-	-	-	-	67%	58%	45%	35%

Specific energy for heating (monthly method)

Energy balance calculation with PHPP Version 9.6a

ŠPORTNI CENTER LUČE / Climate: Ljubljana / TFA: 1445 m² / Heating: 33 kWh/(m²a) / Cooling: 2,8 kWh/(m²a) / PER: 118,4 kWh/(m²a)

The sum of the heating periods calculated through the monthly method will be presented on this side.

Interior temperature:	20	°C
Building type:	telovadnica	
Treated floor area A _{TFA} :	1445,2	m ²
Spec. Capacity:	204	Wh/(m ² K)

Building assembly	Temperature zone	Area m ²	U-Value W/(m ² K)	Month. red. fac.	G _i kWh/a	kWh/a	Per m ² of treated floor area	
External wall - Ambient	A	818,9	0,144	1,00	81	9508	6,58	
External wall - Ground	B	253,1	0,142	1,00	35	1249	0,86	
Roof/Ceiling - Ambient	A	1227,7	0,136	1,00	81	13513	9,35	
Floor slab / Basement ceiling	B	1215,5	0,139	1,00	35	5901	4,08	
	A			1,00				
	A			1,00				
	X			0,00				
Windows	A	191,7	1,014	1,00	81	15715	10,87	
Exterior door	A	10,5	0,900	1,00	81	762	0,53	
Exterior TB (length/m)	A	59,0	0,040	1,00	81	191	0,13	
Perimeter TB (length/m)	P	137,0	0,143	1,00	35	681	0,47	
Ground TB (length/m)	B	46,0	0,125	1,00	35	200	0,14	
						Total	47720	33,0

Transmission heat losses Q_T

Effective air volume V _v	A _{TFA} m ²	Clear room height m	m ³				
	1445	8,04	= 11615				
Effective air change rate Ambient n _{V,e}	n _{V,system} 1/h	η*SHX	ηHR	n _{V,Res} 1/h	n _{V,equi,fraction} 1/h		
0,501	0,501	0%	0,82	0,042	0,132		
0,501		0%	0,82		0,000		
V _v m ³	n _{V,equi,fraction} 1/h	C _{Air} Wh/(m ² K)	G _i kWh/a	kWh/a	kWh/(m ² a)		
11615	0,132	0,33	81	40904	28,3		
11615	0,000	0,33	47	0	0,0		
					Total	40904	28,3

Ventilation heat losses Q_V

Total heat losses Q _L	Q _T kWh/a	Q _V kWh/a	Reduction factor night/weekend saving	kWh/a	kWh/(m ² a)
	(47720 + 40904)		1,0	88624	61,3

Total heat losses Q_L

Orientation of the area	Reduction factor see 'Windows' worksheet	g-Value (perp. radiation)	Area m ²	Global radiation kWh/(m ² a)	kWh/a	kWh/(m ² a)	
North	0,51	0,50	25,0	237	1517		
East	0,41	0,50	131,8	364	9859		
South	0,00	0,00	0,0	546	0		
West	0,00	0,00	0,0	337	0		
Horizontal	0,60	0,35	34,9	567	4171		
Sum opaque areas					4609		
					Total	20156	13,9

Available solar heat gains Q_S

Internal heat gains Q _I	Length Heat. Period kh/d	d/a	Spec. Power q _i W/m ²	A _{TFA} m ²	kWh/a	kWh/(m ² a)
	0,024	242	2,8	1445,2	23503	16,3
Free heat Q _F	Q _S + Q _I =				43659	30,2
Ratio free heat to losses	Q _F / Q _L =				0,49	
Utilisation factor heat gains h _G					94%	
Heat gains Q _G	η _G * Q _F =				40951	28,3

Heat gains Q_G

Annual heating demand Q _H	Q _L - Q _G =		47672	33
Limiting value	kWh/(m ² a)	Requirement met?	(Yes/No)	-

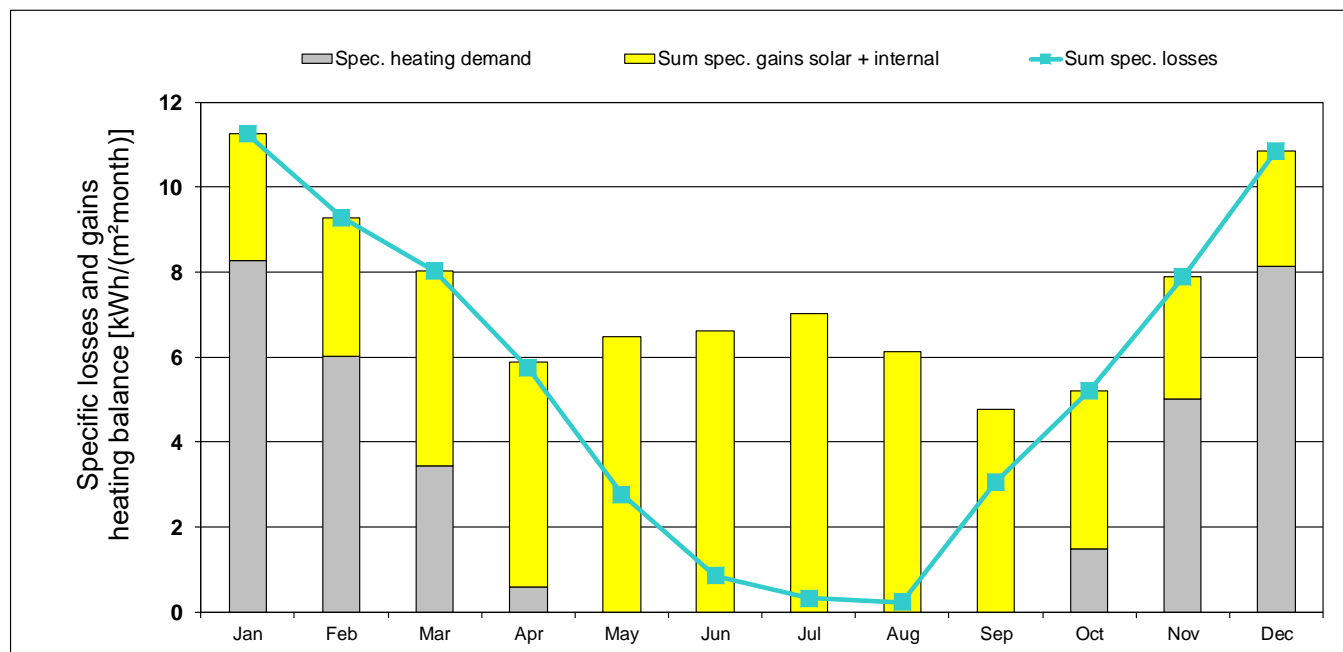
Annual heating demand Q_H

Limiting value

Specific energy for heating (monthly method)

 ŠPORTNI CENTER LUČE / Climate: Ljubljana / TFA: 1445 m² / Heating: 33 kWh/(m²a) / Cooling: 2,8 kWh/(m²a) / PER: 118,4 kWh/(m²a)
Interior temperature: **20** °CBuilding type: **telovadnica**Treated floor area A_{TFA}: **1445** m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - Exterior	15,2	12,4	10,5	7,2	3,2	0,6	-0,1	-0,2	3,6	6,7	10,5	14,7	84	kKh
Heating degree hours - Ground	4,9	4,6	5,0	4,7	3,4	2,9	2,6	2,4	3,4	3,8	4,0	4,5	46	kKh
Losses - Exterior	15134	12366	10442	7219	3227	588	-133	-228	3625	6672	10484	14649	84046	kWh
Losses - Ground	1122	1052	1160	1073	774	659	602	560	791	868	921	1044	10626	kWh
Sum spec. losses	11,2	9,3	8,0	5,7	2,8	0,9	0,3	0,2	3,1	5,2	7,9	10,9	65,5	kWh/m ²
Solar gains - North	83	141	276	400	592	646	669	503	300	172	85	61	3927	kWh
Solar gains - East	603	955	1809	2394	3308	3473	3734	3002	1998	1122	561	417	23376	kWh
Solar gains - South	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - West	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - Horiz.	280	420	734	937	1191	1226	1318	1138	816	512	273	199	9044	kWh
Solar gains - Opaque	325	471	804	1012	1276	1307	1403	1220	886	569	312	230	9814	kWh
Internal heat gains	3011	2719	3011	2914	3011	2914	3011	3011	2914	3011	2914	3011	35449	kWh
Sum spec. gains solar + intern	3,0	3,3	4,6	5,3	6,5	6,6	7,0	6,1	4,8	3,7	2,9	2,7	56,5	kWh/m ²
Utilisation factor	100%	100%	100%	97%	43%	13%	5%	4%	64%	100%	100%	100%	58%	
Annual heating demand	11955	8714	4968	839	0	0	0	0	1	2159	7260	11776	47672	kWh
Spec. heating demand	8,3	6,0	3,4	0,6	0,0	0,0	0,0	0,0	0,0	1,5	5,0	8,1	33,0	kWh/m ²



Annual heating demand: Comparison

Monthly method	(<i>Heating</i>)	47672 kWh/a	33,0 kWh/(m ² a) reference to treated floor area according to PHPP
Annual method	(<i>Annual heat</i>)	49802 kWh/a	34,5 kWh/(m ² a) reference to treated floor area according to PHPP
		- kWh/a	-

Month	1	2	3	4	5	6	7	8	9	10	11	12	Annual total	Heating period method
Days	31	28	31	30	31	30	31	31	30	31	30	31	365	188
Ambient Temp.	0,10	2,10	6,50	10,50	16,20	19,70	20,70	20,80	15,40	11,40	5,80	0,70	10,9	4,1
North Radiation	9,0	15,0	26,0	34,0	46,0	47,0	47,0	38,0	25,0	18,0	10,0	7,0	322	143
East Radiation	23,0	32,0	57,0	69,0	92,0	93,0	103,0	86,0	62,0	35,0	19,0	15,0	686	227
South Radiation	61,0	65,0	86,0	83,0	87,0	80,0	89,0	92,0	88,0	71,0	51,0	41,0	894	383
West Radiation	24,0	34,0	54,0	75,0	88,0	91,0	96,0	90,0	65,0	44,0	24,0	17,0	702	215
Horiz Radiation	32,0	50,0	90,0	119,0	155,0	162,0	173,0	146,0	101,0	62,0	32,0	23,0	1145	364
Tsky	-11,20	-10,40	-6,40	-1,90	4,00	8,20	9,20	9,90	5,40	2,60	-3,30	-9,40	-0,2	
Ground Temp	13,45	13,20	13,23	13,53	15,49	16,03	16,48	16,73	15,23	14,93	14,45	13,91	14,7	13,8

Cooling: energy value for useful cooling energy

SPORTNI CENTER LUČE / Climate: Ljubljana / TFA: 1445 m² / Heating: 33 kWh/(m²a) / Cooling: 2,8 kWh/(m²a) / PER: 118,4 kWh/(m²a)

The sum of the cooling periods calculated through the monthly method will be presented on this side.

Building type:	telovadnica		Treated floor area A _{TFA} :	1445,2	m ²
Interior temperature summer:	25	°C	Building volume:	11615	m ³
Nominal humidity:	12	g/kg	Internal humidity sources:	9,0	g/(m ³ h)
Spec. capacity:	204	Wh/(m ² K)			

Building assembly	Temperature zone	Area m ²	U-Value W/(m ² K)	Mon. red. fac.	G _t kWh/a	kWh/a	per m ² treated floor area	
External wall - Ambient	A	818,9	0,144	1,00	38	4521	3,13	
External wall - Ground	B	253,1	0,142	1,00	41	1480	1,02	
Roof/Ceiling - Ambient	A	1227,7	0,136	1,00	38	6425	4,45	
Floor slab / Basement ceiling	B	1215,5	0,139	1,00	41	6993	4,84	
	A			1,00				
	X			0,00				
Windows	A	191,7	1,014	1,00	38	7472	5,17	
Exterior door	A	10,5	0,900	1,00	38	362	0,25	
Exterior TB (length/m)	A	59,0	0,040	1,00	38	91	0,06	
Perimeter TB (length/m)	P	137,0	0,143	1,00	38	750	0,52	
Ground TB (length/m)	B	46,0	0,125	1,00	41	238	0,16	
							Total	19,6

Transmission losses Q_T (negative: heat loads)

Total

28332

19,6

Summer ventilation from 'SummVent' worksheet

Ventilation conductance, vent. unit

exterior H_{v,e}

345,1 W/K

without HR

1918,6 W/K

ground H_{v,g}

0,0 W/K

without HR

0,0 W/K

Ventilation conductance, others

exterior

161,0 W/K

Ventilation parameter

Temperature amplitude summer

9,9 K

Minimum acceptable indoor temperature

20,0 °C

Heat capacity air

0,33 Wh/(m³K)

Supply air changes

0,50 1/h

Outdoor air changes

0,04 1/h

Window night vent. air change rate, manual @ 1K

0,00 1/h

Air changes rate due to mech., autom. controlled vent.

0,00 1/h

Specific power consumption for

0,25 Wh/m³η_{HR}

82%

η_{ERV}

0%

η*SHX

0%

Summer ventilation regulation

HRV/ERV in summer

None

Controlled by temp.

Controlled by enthalpy

Always

Controlled by temp.

Controlled by humidity

Additional ventilation

Hygienic air change

Effective air change rate Ambient n_{v,e}

$$0,501 \cdot (1 - 0\%) \cdot (1 - 0,00) + 0,042 = 0,540$$

Effective air change rate Ground n_{v,g}

$$0,501 \cdot (1 - 0\%) \cdot (1 - 0,00) = 0,000$$

Ventilation losses ambient Q_V

$$11615 \cdot 0,540 \cdot 0,33 \cdot 34 = 70822 \text{ kWh/a} \quad 49,0 \text{ kWh/(m}^2\text{a)}$$

Ventilation losses ground Q_{V,g}

$$11615 \cdot 0,000 \cdot 0,33 \cdot 0 = 0 \text{ kWh/a} \quad 0,0 \text{ kWh/(m}^2\text{a)}$$

Heat losses summer ventilation

$$11615 \cdot 0,000 \cdot 0,33 \cdot 0 = 0 \text{ kWh/a} \quad 0,0 \text{ kWh/(m}^2\text{a)}$$

Ventilation heat losses Q_V

Total

70822

49,0

Total heat losses Q_LQ_T

kWh/a

28332

+

Q_V

kWh/a

70822

=

kWh/a

99154

kWh/(m²a)

68,6

Orientation of the area	Reduction factor	g-Value (perp. radiation)	Area m ²	Global radiation kWh/(m ² a)	kWh/a	kWh/(m ² a)	
North	0,48	0,50	25,0	486	2937		
East	0,44	0,50	131,8	661	19028		
South	0,40	0,00	0,0	519	0		
West	0,40	0,00	0,0	505	0		
Horizontal	0,65	0,35	34,9	900	7117		
Sum opaque areas					7104		
						Total	25,0

Available solar heat gains Q_S

Total

36186

25,0

Internal heat gains Q_I

kh/d

0,024

Length heat. period
d/a

183

Spec. power q_I
W/m²

2,8

A_{TFA}
m²

1445,2

kWh/a

17773

kWh/(m²a)

12,3

Sum heat loads Q_FQ_S + Q_I

kWh/a

53958

kWh/(m²a)

37,3

Useful heat losses Q_{V,n}

Ratio of losses to free heat gains

Q_L / Q_F

1,84

Utilisation factor heat losses η_G

=

51%

η_G * Q_L

kWh/a

50729

kWh/(m²a)

35,1

Useful cooling demand Q_KQ_F - Q_{V,n}

kWh/a

3229

kWh/(m²a)

2,2

Recommended maximum value

kWh/(m²a)

15

Requirement met?

(Yes/No)

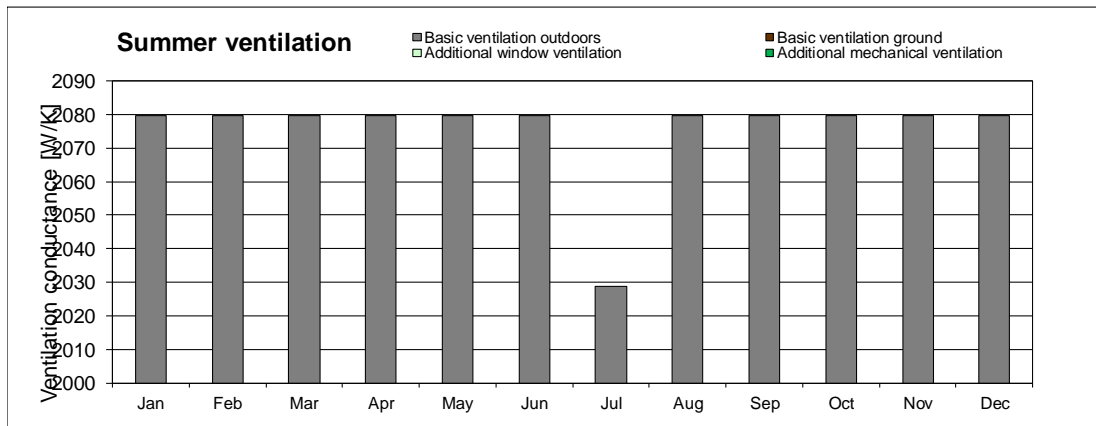
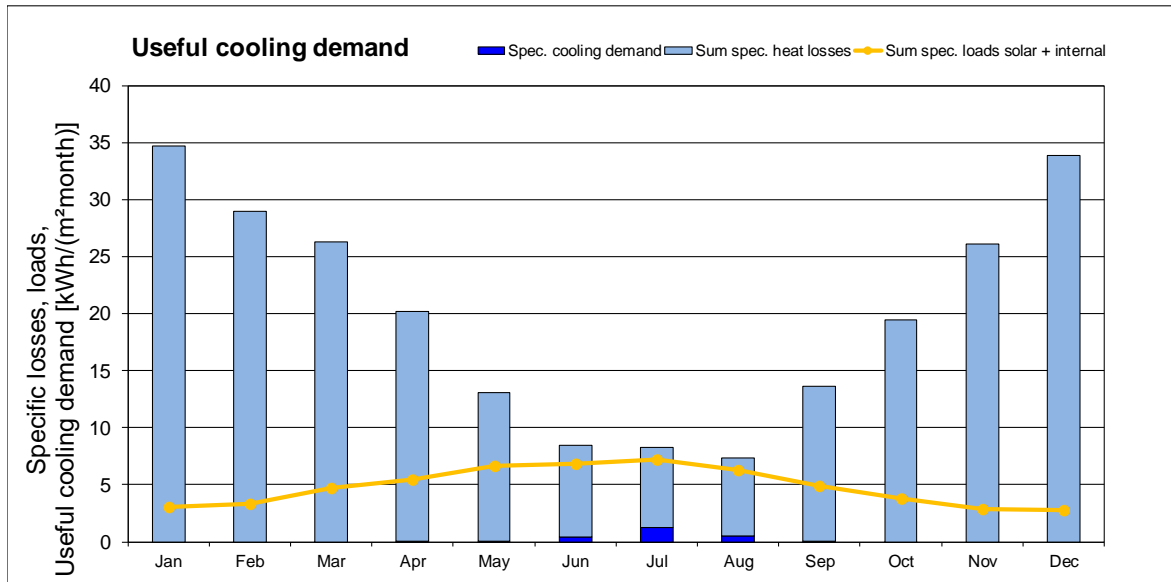
Yes

Cooling: energy value for useful cooling energy

SPORTNI CENTER LUČE / Climate: Ljubljana / TFA: 1445 m² / Heating: 33 kWh/(m²a) / Cooling: 2,8 kWh/(m²a) / PER: 118,4 kWh/(m²a)

Interior Temperature: **25** °C
 Building type: **telovadnica**
 Treated Floor Area A_{TFA}: **1445** m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - Exterior	19,2	16,1	14,6	11,2	7,3	4,5	4,0	3,8	7,5	10,7	14,4	18,7	132	kKh
Heating degree hours - Ground	8,6	7,9	8,8	8,3	7,1	6,5	6,3	6,2	7,0	7,5	7,6	8,3	90	kKh
Losses - Exterior	48353	40230	36076	27438	17364	10255	8704	8458	18224	26498	36094	47157	324853	kWh
Losses - Ground	1812	1671	1846	1741	1492	1362	1336	1297	1483	1579	1602	1740	18959	kWh
Losses summer ventilation	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Sum spec. heat losses	34,7	29,0	26,2	20,2	13,0	8,0	6,9	6,7	13,6	19,4	26,1	33,8	237,9	kWh/m ²
Solar load North	78	133	261	378	559	610	632	475	283	162	80	58	3709	kWh
Solar load East	641	1014	1922	2544	3514	3690	3967	3189	2123	1192	596	443	24836	kWh
Solar load South	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load West	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load Horiz.	301	451	789	1006	1279	1317	1416	1222	877	550	293	214	9714	kWh
Solar load Opaque	325	471	804	1012	1276	1307	1403	1220	886	569	312	230	9814	kWh
Internal heat gains	3011	2719	3011	2914	3011	2914	3011	3011	2914	3011	2914	3011	35449	kWh
Sum spec. loads solar + internal	3,0	3,3	4,7	5,4	6,7	6,8	7,2	6,3	4,9	3,8	2,9	2,7	57,8	kWh/m ²
Utilisation factor losses	9%	11%	18%	27%	51%	80%	85%	85%	36%	20%	11%	8%	23%	
Useful cooling energy demand	0	0	0	0	27	551	1850	800	2	0	0	0	3229	kWh
Spec. cooling demand	0,0	0,0	0,0	0,0	0,0	0,4	1,3	0,6	0,0	0,0	0,0	0,0	2,2	kWh/m ²
Specif. dehumidification demand	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,3	0,0	0,0	0,0	0,0	0,5	kWh/m ²
Sensible fraction	100%	100%	100%	100%	100%	100%	86%	63%	100%	100%	100%	100%	81%	



Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
Days	31	28	31	30	31	30	31	31	30	31	30	31	365
Ambient Temp.	0,10	2,10	6,50	10,50	16,20	19,70	20,70	20,80	15,40	11,40	5,80	0,70	10,87
North Radiation	9,0	15,0	26,0	34,0	46,0	47,0	47,0	38,0	25,0	18,0	10,0	7,0	322,0
East Radiation	23,0	32,0	57,0	69,0	92,0	93,0	103,0	86,0	62,0	35,0	19,0	15,0	686,0
South Radiation	61,0	65,0	86,0	83,0	87,0	80,0	89,0	92,0	88,0	71,0	51,0	41,0	894,0
West Radiation	24,0	34,0	54,0	75,0	88,0	91,0	96,0	90,0	65,0	44,0	24,0	17,0	702,0
Hori. Radiation	32,0	50,0	90,0	119,0	155,0	162,0	173,0	146,0	101,0	62,0	32,0	23,0	1145,0
Dew Point	-2,8	-2,5	0,6	4,3	9,4	12,5	13,8	14,6	10,8	8,1	3,1	-1,7	5,9
Tsky	-11,20	-10,40	-6,40	-1,90	4,00	8,20	9,20	9,90	5,40	2,60	-3,30	-9,40	-0,22
Ground Temp	13,45	13,20	13,23	13,53	15,49	16,03	16,48	16,73	15,23	14,93	14,45	13,91	14,73

Primary Energy Renewable PER

Energy balance calculation with PHPP Version 9.6a

ŠPORTNI CENTER LUČE / Climate: Ljubljana / TFA: 1445 m² / Heating: 33 kWh/(m²a) / Cooling: 2,8 kWh/(m²a) / PER: 118,4 kWh/(m²a)

Building type: telovadnica	
Treated floor area A _{TFA} :	1445 m ²
Projected building footprint A _{Projected} :	1227 m ²
Primary heat generation type	33 kWh/(m ² a)
2-Heat pump(s)	3 kWh/(m ² a)
Secondary heat generation type (optional & different)	39 kWh/(m ² a)

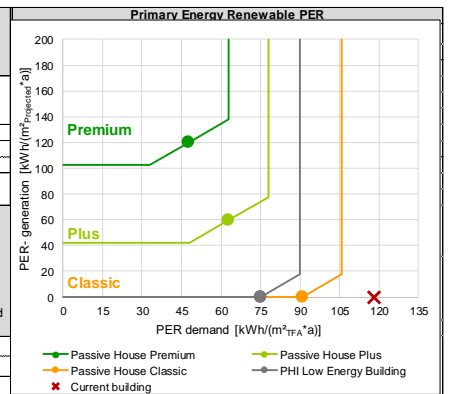
Energy demand	Efficiency		Final energy		PER			PE		CO ₂	
	Calculation	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -ed)	CO ₂ eq emissions
Reference: Treated floor area	-	-	-	kWh/(m ² a)	kWh/kWh	kWh/kWh	kWh/(m ² a)	kWh/kWh	kWh/(m ² a)	kg/kWh	kg/(m ² a)
							118,4	8-PE factors user determined		2-CO2 factors user determined	
									203,5		43,2
Heating											
Electricity (HP compact unit)			100%		1,85	1,69	57,0	2,50	84,4	0,530	17,9
Electricity (heat pump)	1,12		100%	29,6	1,85	1,67	49,4	2,50	74,1	0,530	15,7
District heating: 1-None					0,85	1,43	1,01			0,000	
Wood and other biomass					1,10						
Natural gas / RE gas					1,75			1,10		0,200	
Heating oil / RE methanol					2,30			1,10		0,280	
Solar thermal system											
Electricity (direct)					1,85			2,50		0,530	
Other		1,30			1,75			1,10		0,200	
Aux. electricity (heating, wintertime ventilation)				4,1	1,85	1,85	7,6	2,50	10,3	0,530	2,2
Cooling and dehumidification											
Electricity cooling (heat pump)	3,50			0,7	1,15		5,2	2,50	11,2	0,530	2,4
Auxiliary electricity cooling, ventilation summer				3,5	1,15			2,50	8,6	0,530	1,8
Electricity dehumidification (heat pump)	1,54			0,3	1,40			2,50	0,7	0,530	0,2
Auxiliary electricity (dehumidification)					1,40			2,50		0,530	
DHW generation											
Electricity (HP compact unit)			100%		1,30	1,30	40,1	2,50	77,1	0,530	16,3
Electricity (heat pump)	1,30		100%	30,4	1,30	1,30	39,5	2,50	76,0	0,530	16,1
District heating: 1-None					0,85	1,43	1,01			0,000	
Wood and other biomass					1,10						
Natural gas / RE gas					1,75			1,10		0,200	
Heating oil / Methanol					2,30			1,10		0,280	
Solar thermal system											
Electricity (direct)					1,30			2,50		0,530	
Other					1,75			1,10		0,200	
Aux. electricity (DHW + solar DHW)				0,4	1,30	1,30	0,5	2,50	1,0	0,530	0,2
Household electricity											
Electricity (household or non-residential lighting, etc.)				12,3	1,30	1,30	16,0	2,50	30,9	0,530	6,5
Auxiliary electricity (other)					1,30	1,30		2,50		0,530	
Gas / RE gas dry/cook											
				0,0	1,75		0,0	2,50	0,0	0,215	0,0

Energy generation	Final energy		PER			PE		CO ₂	
	Final energy generation	Final energy generation	PER factor	PER	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ eq emissions
Reference: Projected building footprint area	kWh/a	kWh/(m ² a) _{Projected}	kWh/kWh	kWh/(m ² a)	kWh/(m ² a) _{Projected}	kWh/kWh	kWh/(m ² a)	kg/kWh	kg/a
PV electricity	0	0,0	1,00		0,0	-	0,0	-	0,0
Solar thermal system	0	0,0	-		0,0	1,20	0,0		0,0
Onshore wind power		0,0	1,00		0,0	0,00	0,0	0,000	0,0

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m ² a)]	-	Current building reaches following class	204	Requirement met?	-
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy, performance				Airtightness
	Annual heat dem. Treated floor area	Heating load Treated floor area	Useful cool. energy Treated floor area	Cooling load Treated floor area	
	kWh/(m ² a)	W/m ²	kWh/(m ² a)	W/m ²	n ₅₀ 1/h
Requirement Passive House Premium					0,60
Requirement Passive House Plus	15	10	15	11	
Requirement Passive House Classic					1,00
Requirement PHI Low Energy Building	30	21	30	7	0,6
Current building reaches following class for asg	33		3		Premium
	Unachieved		Premium		Premium

Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
	MWh/a	MWh/a	8-PE factors user determined MWh/a	2-CO ₂ factors user determined kg/a	2-CO ₂ factors user determined kg/a
Demand	117,7	171,0	294,17	62364	62364
Generation	0,0	0,0	0,00	0	0
Demand, cumulative generation (annual balance)	117,67	171,04	294,17	62364	62364
Demand w/o household electricity	99,8	147,8	249,57	52908	52908
Demand w/o household electricity, cum. generation	99,83	147,85	249,57	52908	52908



DELEŽ OBNOVLJIVIH VIROV ENERGIJE V SKUPNI DOVEDENI ENERGIJI ZA OBRATOVANJE

	POTREBNA ENERGIJA			DOVEDENA ENERGIJA			
	topl.ener. MWh/a	pretvorba %, COP	elektrika MWh/a	elektrika MWh/a	fosilno MWh/a	zrak MWh/a	biomasa MWh/a
ogrevanje prostorov, TČ	0,0	3,5		0,0		0,0	
ogrevanje prostorov, KNLB	48,2	100%					48,2
pohlajevanje, TČ	4,2	3,5		1,2		3,0	
topla voda, TČ	20,0	3,5		5,7		14,3	
topla voda, KNLB	37,1	100%					37,1
tehnika			11,5	11,5			
razsvetljava, ostalo			17,9	17,9			
				36,3	0,0	17,3	85,3
				26,1%	0,0%	12,4%	61,4%
						73,9%	