U-vērtība ēkas norobežojošām konstrukcijām

Energy balance calculation with PHPP Version 9.6a

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 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. 01ud | Building assembly description: ārsiena | Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall | interior R_{si}: 0.13
Adjacent to: 3-Ventilated | exterior R_{se}: 0.13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Apdare	0.250					25
siltumizolācija	0.036	koks	0.130			50
tvaika izolācija-						
siltumizolācija	0.036	koks	0.130			200
siltumizolācija	0.033					30

Percentage of sec. 1: 88% | Percentage of sec. 2: 12.0% | Percentage of sec. 3: | Total: 30.5 cm

U-value supplement: W/(m²K)

U-value: 0.149 W/(m²K)

Assembly no. 02ud | Building assembly description: Pārsegums | Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 1-Roof | interior R_{si}: 0.10
Adjacent to: 3-Ventilated | exterior R_{se}: 0.10

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Apdare	0.250					25
tvaika izolācija-						
siltumizolācija	0.036	koks	0.130			250

Percentage of sec. 1: 88% | Percentage of sec. 2: 12.0% | Percentage of sec. 3: | Total: 27.5 cm

U-value supplement: W/(m²K)

U-value: 0.177 W/(m²K)

Assembly no. 04ud | Building assembly description: Grīda | 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]
	0.200					20
Estrich betons B20	2.500					150
Polietilēna plēve 200 MK						
Siltumizolācija	0.033					200

Percentage of sec. 1: 100% | Percentage of sec. 2: | Percentage of sec. 3: | Total: 37.0 cm

U-value supplement: W/(m²K)

U-value: 0.156 W/(m²K)

Energy balance calculation with PHPP Version 9.6a

Norobežojošo konstrukciju Laukumu noteikšana

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 kWh/(m²a)

Summary

Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment		Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/a]	Radiation-load cooling period [kWh/a]
	Treated floor area	1	**28.00**	m²	*Treated floor area according to PHPP manual*				10 Months	7 Months
A	**Ziemeļu logi**	2	**1.80**	m²			**Ziemeļu logi**	**0.779**	**54**	**97**
A	**Austrumu logi**	3	**0.00**	m²	Results come from the 'Windows' worksheet.		**Austrumu logi**			
A	**Dienvidu logi**	4	**3.60**	m²	Window areas are subtracted from individual opaque areas.		**Dienvidu logi**	**0.779**	**230**	**425**
A	**Rietumu logi**	5	**0.00**	m²	which is displayed in the 'Windows' worksheet.		**Rietumu logi**			
A	**Horizontal windows**	6	**0.00**	m²			**Horizontal windows**			
A	**Exterior door**	7	**2.52**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**	**1.000**		
A	**External wall - Ambient**	8	**79.88**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0.149**	**65**	**110**
B	**External wall - Ground**	9	**0.00**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**			
A	**Roof/Ceiling - Ambient**	10	**40.02**	m²			**Roof/Ceiling - Ambient**	**0.177**	**1**	**1**
B	**Floor slab / Basement ceiling**	11	**40.02**	m²			**Floor slab / Basement ceiling**	**0.156**		
		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"*	Factor for X				
X	**Cortain wall**	14	**0.00**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	**30%**	**Cortain wall**			
							Thermal bridges - Overview	**Ψ [W/(mK)]**		
A	**Thermal bridges Ambient**	15	**39.80**	m	*Units in m*		**Thermal bridges Ambient**	**-0.050**		
P	**Perimeter thermal bridges**	16	**0.00**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**			
B	**Thermal bridges FS/BC**	17	**26.60**	m	*Units in m*		**Thermal bridges FS/BC**	**0.100**		
I	**Building element towards neighbo**	18	**0.00**	m²	*No heat losses, only considered for the heating load calculation*		**Building element towards neighbour**			
Total thermal envelope			**167.84**	**m²**			**Average therm. envelope**	**0.194**	0.182693137	100%

Garažas neapkurināmo telpu redukcija | Nobīde no Z Grādi: 0

Go to building components list

Area input

2-Sorting: BY ID

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 Ziemeļi	Angle of inclination from the horizontal	Orientation	Reduction factor shading	Exterior absorptivity	Exterior emissivity
	Projected building footprint	**0**	Projected building footprint	**1**	x (		x		+	**40.02**	-		)		=	40.0									
	Treated floor area	**1**	Treated floor area	**1**	x (		x		+	**28.00**	-		)		=	28.0									
	Apkalpes lūkas	**7**	Exterior door		x (		x		+		-		) -		=		Exterior door								
	Ārdurvis	**7**	Exterior door	**1**	x (	**1.20**	x	**2.10**	+		-		) -		=	2.5	Exterior door	**1.00**							
	Garāžas vārti	**7**	Exterior door		x (		x		+		-		) -		=		Exterior door								
1	**Z**	**8**	External wall - Ambient	**1**	x (	**8.70**	x	**3.30**	+		-	**2.50**	) -	**1.8**	=	24.4	**01ud- ārsiena**	**0.149**	**0**	**90**	**Ziemeļi**	**0.80**	**0.70**	**0.90**
2	**D**	**8**	External wall - Ambient	**1**	x (	**8.70**	x	**3.30**	+		-		) -	**3.6**	=	25.1	**01ud- ārsiena**	**0.149**	**180**	**90**	**Dienvidi**	**0.80**	**0.70**	**0.90**
3	**R**	**8**	External wall - Ambient	**1**	x (	**4.60**	x	**3.30**	+		-		) -	**0.0**	=	15.2	**01ud- ārsiena**	**0.149**	**270**	**90**	**Rietumi**	**0.80**	**0.70**	**0.90**
4	**A**	**8**	External wall - Ambient	**1**	x (	**4.60**	x	**3.30**	+		-		) -	**0.0**	=	15.2	**01ud- ārsiena**	**0.149**	**90**	**90**	**Austrumi**	**0.80**	**0.70**	**0.90**
5	**Grida 1**	**11**	Floor slab / Basement ceiling	**1**	x (		x		+	**40.02**	-		) -	**0.0**	=	40.0	**04ud-Grida**	**0.156**	**0**	**0**	**Hor**	**0.00**	**0.00**	**0.00**
6					x (		x		+		-		) -	**0.0**	=				**0**	**0**	**Hor**	**0.00**	**0.00**	**0.00**
7	**Pārseg**	**10**	Roof/Ceiling - Ambient	**1**	x (		x		+	**40.02**	-		) -	**0.0**	=	40.0	**02ud-Pārsegums**	**0.177**	**0**	**0**	**Hor**	**0.00**	**0.70**	**0.90**

Norobežojošo konstrukciju Laukumu noteikšana

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 kWh/(m²a)

Summary

Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment		Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/a]
	Treated floor area	1	**28.00**	m²	*Treated floor area according to PHPP manual*				10 Months
A	**Ziemeļu logi**	2	**1.80**	m²			**Ziemeļu logi**	**0.779**	**54**
A	**Austrumu logi**	3	**0.00**	m²	Results come from the 'Windows' worksheet.		**Austrumu logi**		
A	**Dienvidu logi**	4	**3.60**	m²	Window areas are subtracted from individual opaque areas.		**Dienvidu logi**	**0.779**	**230**
A	**Rietumu logi**	5	**0.00**	m²	which is displayed in the 'Windows' worksheet.		**Rietumu logi**		
A	**Horizontal windows**	6	**0.00**	m²			**Horizontal windows**		
A	**Exterior door**	7	**2.52**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**	**1.000**	
A	**External wall - Ambient**	8	**79.88**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0.149**	**65**
B	**External wall - Ground**	9	**0.00**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**		
A	**Roof/Ceiling - Ambient**	10	**40.02**	m²			**Roof/Ceiling - Ambient**	**0.177**	**1**
B	**Floor slab / Basement ceiling**	11	**40.02**	m²			**Floor slab / Basement ceiling**	**0.156**	
		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"*	Factor for X			
X	**Cortain wall**	14	**0.00**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	**30%**	**Cortain wall**		
							Thermal bridges - Overview	**Ψ [W/(mK)]**	
A	**Thermal bridges Ambient**	15	**39.80**	m	*Units in m*		**Thermal bridges Ambient**	**-0.050**	
P	**Perimeter thermal bridges**	16	**0.00**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**		
B	**Thermal bridges FS/BC**	17	**26.60**	m	*Units in m*		**Thermal bridges FS/BC**	**0.100**	
I	**Building element towards neighbo**	18	**0.00**	m²	*No heat losses, only considered for the heating load calculation*		**Building element towards neighbour**		
Total thermal envelope			**167.84**	**m²**			**Average therm. envelope**	**0.194**	0.182693137

Go to building components list

Thermal bridge inputs

Sortierung ändern

No.	Thermal bridge - denomination	Group No.	Assigned to group	Quantity	x (	Length [m]	-	Subtraction length [m]	)=	Length ℓ [m]	User determined psi value [W/(mK)]	User determined $f_{Rsi=0.25}$ (optional)	or	Selection building system	Ψ-Value [W/(mK)]	f_{Rsi}-Requirement met?
1	**Ārsienas stūris**	**15**	Thermal bridges Ambient	**4**	x (	**3.30**	-		) =	13.20	**-0.050**		or		**-0.050**	
2	**Dzega**	**15**	Thermal bridges Ambient	**1**	x (	**26.60**	-		) =	26.60	**-0.050**		or		**-0.050**	
3	**Ārsiena/ grīda**	**17**	Thermal bridges FS/BC	**1**	x (	**26.60**	-		) =	26.60	**0.100**		or		**0.100**	

Siltuma zudumi caur grunti redukcijas faktora noteikšana

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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_i	20.0	°C
Avg indoor temp. summer	T_i	24.0	°C
Avg ground surface temperature	$T_{g,ave}$	8.6	°C
Amplitude of $T_{g,ave}$	$T_{g,\wedge}$	10.6	°C
Phase shifting of $T_{e,m}$	τ	1.1	Months
Length of the heating period	n	7.3	Months
Heating degree hours - exterior	G_t	95.4	kKh/a

Building data

Area of ground floor slab / basement ce	A	40.0	m²	U-value floor slab/basement ceiling	U_f	0.156	W/(m²K)
Perimeter length	P	26.6	m	TBs floor slab / basement ceiling	Ψ_B*l	0.10	W/K
Charact. dimension of floor slab	B'	3.01	m	U-value floor slab / basement ceiling in	U_f'	0.159	W/(m²K)
				Equivalent thickness floor	d_t	12.58	m

Floor slab type (select only one)

x **Slab on grade**

Perimeter insulation width/depth	D	1.65	m	Orientation of perimeter insulation	horizontal	x
Perimeter insulation thickness	d_n	0.05	m	(check only one field)	vertical	
Conductivity perimeter insulation	λ_n	0.036	W/(mK)			

Heated basement or floor slab completely / partially below ground level

Basement wall height below ground lev	z		m	U-Value wall below ground	U_{wB}	W/(m²K)

Unheated basement

Height aboveground wall	h		m	U-Value wall above ground	U_W	W/(m²K)
Basement wall height below ground lev	z		m	U-Value wall below ground	U_{WB}	W/(m²K)
Air change unheated basement	n		h^{-1}	U-Value basement floor slab	U_{fB}	W/(m²K)
Air volume basement	V		m³			

Suspended floor above a ventilated crawl space (at max. 0.5 m below ground)

U-Value crawl space	U_{Crawl}		W/(m²K)	Area of ventilation openings	εP	m²
Height of crawl space wall	h		m	Wind velocity at 10 m height	v	4.0 m/s
U-Value crawl space wall	U_W		W/(m²K)	Wind shield factor	f_W	0.05 -

Additional thermal bridge heat losses at perimeter

				Steady-state fraction	$\Psi_{P,stat}$*l	0.000 W/K
Phase shift	β		Months	Harmonic fraction	$\Psi_{P,harm}$*l	W/K

Groundwater correction

Depth of the groundwater table	z_w		m	Groundwater correction factor	G_w	-
Groundwater flow rate	q_w		m/d			

Interim results

Phase shift	β	1.41	Months	Steady-state heat flow	Φ_{stat}	62.3 W
Steady-state transmittance	L_S	5.46	W/K	Periodic heat flow	Φ_{harm}	15.8 W
Exterior periodic transmittance	L_{pe}	4.13	W/K	Heat losses during heating period	Q_{tot}	418 kWh
Transmittance building	L_0	6.36	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	5.4	3.6	3.6	5.3	8.4	11.9	15.0	16.8	16.8	15.1	12.1	8.5	10.2
Summer	6.0	4.2	4.1	5.9	8.9	12.5	15.6	17.4	17.4	15.7	12.6	9.1	10.8

Design ground temperature for 'Heating load' worksheet 3.6 — **For 'Cooling load' worksheet** 17.4

Reduction factor for 'Annual heating' worksheet 0.69

Total result (all building parts)

Phase shift	β	1.41	Months	Steady-state heat flow	Φ_{stat}	62.3 W
Steady-state transmittance	L_S	5.46	W/K	Periodic heat flow	Φ_{harm}	15.8 W
Exterior periodic transmittance	L_{pe}	4.13	W/K	Heat losses during heating period	Q_{tot}	418 kWh
Transmittance building	L_0	6.36	W/K	Charact. dimension of floor slab	B'	3.01 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	5.4	3.6	3.6	5.3	8.4	11.9	15.0	16.8	16.8	15.1	12.1	8.5	10.2
Summer	6.0	4.2	4.1	5.9	8.9	12.5	15.6	17.4	17.4	15.7	12.6	9.1	10.8

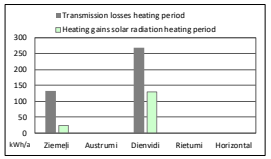
Design ground temperature for 'Heating load' worksheet 3.6 — **For 'Cooling load' worksheet** 17.4

0.1077787 **Reduction factor for 'Annual heating' worksheet** **0.69**

Logi

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 kWh/(m²a)

Window area orientation	Global radiation (main orientations)	Shading	Dirt	Non-vertical radiation incidence	Glazing fraction	g-Value	Solar irradiation reduction factor	Window area	Window U-Value	Glazing area	Average global radiation		Transmission losses heating period	Heating gains solar radiation heating period
Standard values →	kWh/(m²a)	0.75	0.95	0.85				m²	W/(m²K)	m²	kWh/(m²a)		kWh/a	kWh/a
Ziemeļi	94	0.61	0.95	0.85	0.58	0.50	0.29	1.80	0.78	1.04	94	Ziemeļi	134	24
Austrumi	217	1.00	0.95	0.85	0.00	0.00	0.00	0.00	0.00	0.00	217	Austrumi	0	0
Dienvidi	367	0.43	0.95	0.85	0.58	0.50	0.20	3.60	0.78	2.08	367	Dienvidi	268	131
Rietumi	222	1.00	0.95	0.85	0.00	0.00	0.00	0.00	0.00	0.00	222	Rietumi	0	0
Horizontal	318	1.00	0.95	0.85	0.00	0.00	0.00	0.00	0.00	0.00	318	Horizontal	0	0
Total or average value for all windows.						0.50	0.23	5.40	0.78	3.12			401	155



Design temperature [°C] (user determined)
-10 °C
-10.0 [°C] User defined

Recommendation for $U_{W,installed}$ [W/(m²K)]
0.65 0.70 0.80 0.55

Heating degree hours [kKh/a]: 95.4

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Quantity	Description	Deviation from Ziemeļi	Angle of inclination from the horizontal	Orientation	Window rough openings: Width	Window rough openings: Height	Installed in: Selection from 'Areas' worksheet	Glazing: Selection from 'Components' worksheet	Frame: Selection from 'Components' worksheet	EnerPHit: Exception	g-Value: Perpendicular radiation	U-Value: Glazing	U-Value: Frames (avg.)	Ψ Glazing edge: $\Psi_{Glazing\ edge}$ (Avg.)	Installation situation: left	right	bottom	top	$\Psi_{Installation}$ (Avg.)	Results: Window Area	Glazing area	U_w installed	Glazed fraction per window	Window surface temperature indicator: Comfort	Energy balance
		°	°		m	m		1-Sorting: LIKE LIST	1-Sorting: LIKE LIST	Mark with an 'x'	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%	Exemption	kWh/a
2		0	90	Ziemeļi	0.600	1.500	1-Z	01ud-3 kāršais stiklojums	01ud-aluplast GmbH - energeto 8000 I passiv - SWISSPACER Ultimate		0.50	0.53	0.82	0.021	1	1	1	1	0.010	1.8	1.04	0.78	58%		-109
4		180	90	Dienvidi	0.600	1.500	2-D	01ud-3 kāršais stiklojums	01ud-aluplast GmbH - energeto 8000 I passiv - SWISSPACER Ultimate		0.50	0.53	0.82	0.021	1	1	1	1	0.010	3.6	2.08	0.78	58%		-137
1															1	1	1	1							
1															1	1	1	1							
1															1	1	1	1							
1															1	1	1	1							
2															1	0	1	1							
2															1	1	1	1							
1															1	1	1	1							

Noēnojuma koeficienta aprēķins

Dzīvojamā ēka / Climate: Riga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 kWh/(m²a)

Latitude: 56

Orientation	Glazing area [m²]	Reduction factor winter r_s	Reduction factor cooling $r_{s,1}$	Reduction factor cooling load $r_{s,2}$	Solar load [kWh/(m²$_{Glazing}$a)]
Ziemeļi	1.04	61%	84%	84%	93
Austrumi	0.00	100%	100%	100%	0
Dienvidi	2.08	43%	71%	71%	204
Rietumi	0.00	100%	100%	100%	0
Horizontal	0.00	100%	100%	100%	0

								Horizon		Lateral reveal		Reveal / Overhang						Reduction factors for shading in winter				Reduction factors for shading in summer				
Quan-tity	Description	Deviation from North	Angle of inclination from the horizontal	Orientation	Glazing width	Glazing height	Glazing area	Height of the shading object	Horizontal distance	Window reveal depth	Distance from glazing edge to reveal	Overhang depth	Distance from upper glazing edge to overhang	Additional reduction factor winter shading	Additional reduction factor summer shading	Reduction factor z for temporary sun protection	Regulated / unregulated	Horizon	Reveal	Overhang	Total for heating case	Horizon	Reveal	Overhang	Total for cooling case	Total for cooling load
		[Degree]	[Degree]		w_G [m]	h_G [m]	A_G [m²]	h_{Hori} [m]	d_{Hori} [m]	o_{Reveal} [m]	d_{Reveal} [m]	o_{Over} [m]	d_{Over} [m]	$r_{other,w}$ [%]	$r_{other,s}$ [%]	z [%]		r_H [%]	r_R [%]	r_O [%]	r_S [%]	r_H [%]	r_R [%]	r_O [%]	$r_{S,1}$ [%]	$r_{S,2}$ [%]
2		0	90	Ziemeļi	0.40	1.30	1.0			0.15	0.050	0.50	1.00	80%					84%	91%	61%		86%	97%	84%	84%
4		180	90	Dienvidi	0.40	1.30	2.1			0.15	0.050	1.00	1.00	50%					89%	95%	43%		86%	83%	71%	71%
1										0.15	0.050			50%												
1										0.15	0.050			50%												
1										0.15	0.050			50%												
1										0.15	0.050			80%												
2										0.15	0.050			80%												
2										0.15	0.050			80%												
1										0.15	0.050			80%												
2										0.15	0.050	5.00	0.00	80%												
2										0.15	0.050			80%												
4										0.15	0.050			80%												
1										0.15	0.050	3.00	0.00	80%												
2										0.15	0.050			80%												
4										0.15	0.050			80%												
1										0.15	0.050			80%												
2										0.15	0.050			80%												

Ventilācijas dati

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 kWh/(m²a)

Treated floor area A_{TFA}	m²	28		*('Areas' worksheet)*
Room height h	m	2.70	2.70	
Volume of ventilated space (A_{TFA}*h) = V_V	m³	76		*(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

			For annual demand:	For heating load:				
Wind protection coefficient, e			0.02	0.05				
Wind protection coefficient, f			15	15	Net air volume for press. test	V_{n50}	Air permeability	q_{50}
Air change rate at press. test	n_{50}	1/h	1.50	1.50	76	m³	0.68	m³/(hm²)

			For annual demand:	For heating load:
Excess extract air		1/h	0.00	0.00
Infiltration air change rate	$n_{V,Rest}$	1/h	0.030	0.075

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 m³/h	Average air change rate 1/h	Extract air excess (extract air system) 1/h	Effective heat recovery efficiency unit [-]	Humidity recovery efficiency [-]	Specific power input Wh/m³	Heat recovery efficiency SHX [-]
x	Standard design	*('Ventilation' worksheet, see below)*	40	0.53	0.00	77.7%	0.0%	0.37	0.0%
	Multiple ventilation units, non-res	*('Addl vent' worksheet)*							

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
61%	59%	62%	69%	80%	93%	-	-	91%	78%	70%	63%

Standard data input for balanced ventilation

Dimensioning of ventilation system with only one ventilation unit

Occupancy	m²/P	9				
Number of occupants	P	3.0				
Supply air per person	m³/(P*h)	30				
Supply air requirement	m³/h	90				
Extract air rooms		Kitchen	Bathroom	Bathroom (shower only)	WC	veļas mazg
Quantity				1		
Extract air requirement per room	m³/h	60	40	100	20	15
Total extract air requirement	m³/h	100				

Design air flow rate (maximum): 100 m³/h — Recommended: 100 m³/h

Average air change rate calculation

Type of operation	Daily operation times h/d	Factors referenced to maximum	Air flow rate m³/h	Air change rate 1/h
maximum		1.00	100	1.32
Standard		0.77	77	1.02
Basic ventilation		0.54	54	0.71
Minimum	24.0	0.40	40	0.53
	Average value	0.40	Average air flow rate (m³/h): 40	Average air change rate (1/h): 0.53

Selection of ventilation unit with heat recovery

Location of ventilation unit: **1-Inside thermal envelope**

	Go to ventilation units list 1-Sorting: LIKE LIST	Heat recovery efficiency	Humidity recovery efficiency	Specific efficiency [Wh/m³]	Application [m³/h]	Frost power input
Ventilation unit selection	**0483vs03-Aerex - Reco-Boxx 170 C, Reco-Boxx 170 CE**	0.86		0.37	57 - 106	yes

Conductivity outdoor air duct	Ψ	W/(mK)	0.308	Implementation of frost protection	1-No
Length of outdoor air duct		m	2	Limit temperature [°C]	-2
Conductivity exhaust air duct	Ψ	W/(mK)	0.402	Useful energy [kWh/a]	0
Length of exhaust air duct		m	2		
Temperature of mechanical services room		°C	0.0	Room temperature (°C)	20
(Enter only if the central unit is outside of the thermal envelope)				Avg. ambient temp. heat. period (°C)	2.7
				Avg. ground temp (°C)	8.6

Effective heat recovery efficiency $\eta_{HR,eff}$: **77.7%**

Effective heat recovery efficiency subsoil heat exchanger

SHX efficiency	η^*_{SHX}	
Heat recovery efficiency SHX	η_{SHX}	0%

Secondary calculation
Ψ-value supply or outdoor air duct

Nominal width:	160	mm
Insulation thick	50	mm
Reflective coating?	x	Yes
		No
Thermal conductivity	0.035	W/(mK)
Nominal air flow rate	40	m³/h
Δϑ	17	K
Exterior duct diameter	0.160	m
Exterior diameter	0.260	m
α-Interior	3.46	W/(m²K)
α-Surface	2.66	W/(m²K)
Ψ-value	**0.308**	**W/(mK)**
Surface temperature difference	2.458	K

Secondary calculation
Ψ-value extract or exhaust air duct

Nominal width:	500	mm
Insulation thickness	50	mm
Reflective coating?	x	yes
		no
Thermal conductivity	0.035	W/(mK)
Nominal air flow rate	40	m³/h
Δϑ	17	K
Exterior duct diameter	0.500	m
Exterior diameter	0.600	m
α-Interior	0.44	W/(m²K)
α-Surface	2.36	W/(m²K)
Ψ-value	**0.402**	**W/(mK)**
Surface temperature difference	1.569	K

Apkures enerģija (pa mēnešiem)

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 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:		
Treated floor area A_{TFA}:	28.0	m²
Spec. Capacity:	84	Wh/(m²K)

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Month. red. fac.		G_t kKh/a		kWh/a	Urm W/(m²K)	Per m² of treated floor area
External wall - Ambient	A	79.9	*	0.149	*	1.00	*	109	=	1292	0.23	46.15
External wall - Ground	B		*		*	1.00	*		=		0.23	
Roof/Ceiling - Ambient	A	40.0	*	0.177	*	1.00	*	109	=	772	0.2	27.59
Floor slab / Basement ceiling	B	40.0	*	0.156	*	1.00	*	79	=	494	0.2	17.65
	A		*		*	1.00	*		=			
	A		*		*	1.00	*		=			
Cortain wall	X		*		*	0.30	*		=			
Windows	A	5.4	*	0.779	*	1.00	*	109	=	458	1.1	16.36
Exterior door	A	2.5	*	1.000	*	1.00	*	109	=	274	1.8	9.80
Exterior TB (length/m)	A	39.8	*	-0.050	*	1.00	*	109	=	-217	0.2	-7.74
Perimeter TB (length/m)	P		*		*	1.00	*		=		0.2	0.00
Ground TB (length/m)	B	26.6	*	0.100	*	1.00	*	79	=	210		7.50
Transmission heat losses Q_T									Total	3284		117.3 kWh/(m²a)

	Effective air volume V_V	A_{TFA} m²		Clear room height m		m³		
		28	*	2.70	=	76		

	$n_{V,system}$ 1/h		η*$_{SHX}$		η_{HR}		$n_{V,Res}$ 1/h		$n_{V,equi,fraction}$ 1/h
Effective air change rate Ambient nV,e	0.529	*(1-	0%	)*(1-	0.78	)+	0.030	=	0.148
Effective air change rate Ground nV,g	0.529	*	0%	*(1-	0.78	)		=	0.000

	V_V m³		$n_{V,equi,fraction}$ 1/h		c_{Air} Wh/(m³K)		G_t kKh/a		kWh/a	kWh/(m²a)
Ventilation losses ambient Q_V	76	*	0.148	*	0.33	*	109	=	402	14.4
Ventilation losses ground $Q_{V,e}$	76	*	0.000	*	0.33	*	83	=	0	0.0
Ventilation heat losses Q_V								Total	402	14.4 kWh/(m²a)

	Q_T kWh/a		Q_V kWh/a		Reduction factor night/weekend saving		kWh/a	kWh/(m²a)
Total heat losses Q_L	(3284	+	402	) *	1.0	=	3686	**131.7**

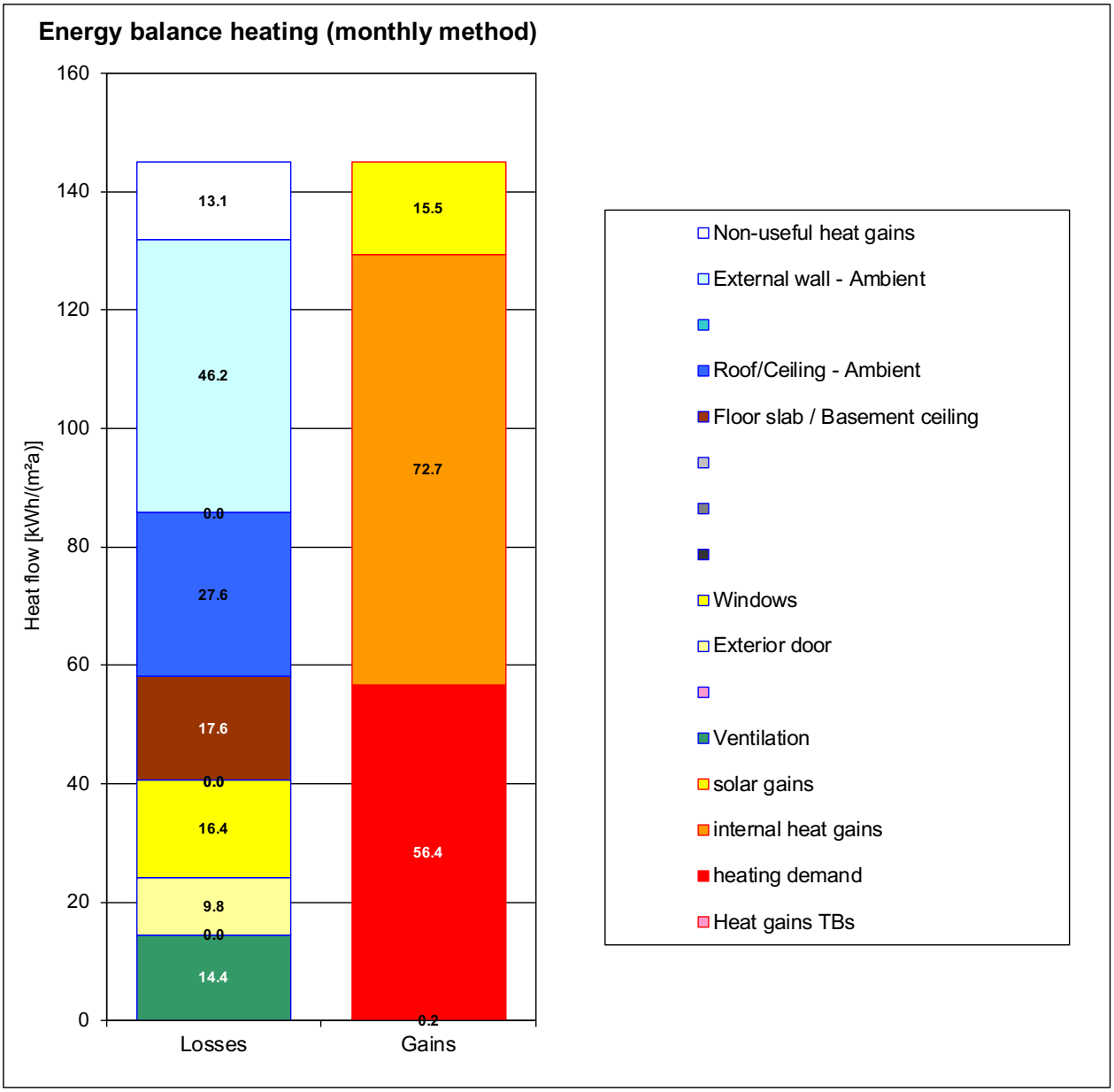
Orientation of the area	Reduction factor see 'Windows' worksheet		g-Value (perp. radiation)		Area m²		Global radiation kWh/(m²a)		kWh/a
North	0.29	*	0.50	*	1.8	*	210	=	54
East	0.00	*	0.00	*	0.0	*	467	=	0
South	0.20	*	0.50	*	3.6	*	644	=	230
West	0.00	*	0.00	*	0.0	*	467	=	0
Horizontal	0.00	*	0.00	*	0.0	*	690	=	0
Sum opaque areas									151
Available solar heat gains Q_S								Total	435 kWh/(m²a) 15.5

			Length Heat. Period d/a		Spec. Power q_I W/m²		A_{TFA} m²		kWh/a	kWh/(m²a)
Internal heat gains Q_I	kh/d 0.024	*	303	*	10.0	*	28.0	=	2036	72.7

			kWh/a	kWh/(m²a)
Free heat Q_F	Q_S + Q_I	=	2471	88.3
Ratio free heat to losses	Q_F / Q_L	=	0.67	
Utilisation factor heat gains h_G		=	85%	
Heat gains Q_G	η_G * Q_F	=	2106	**75.2**

			kWh/a	kWh/(m²a)
Annual heating demand Q_H	Q_L - Q_G	=	1580	**56**

	kWh/(m²*a)		(Yes/No)
Limiting value	-	**Requirement met?**	-

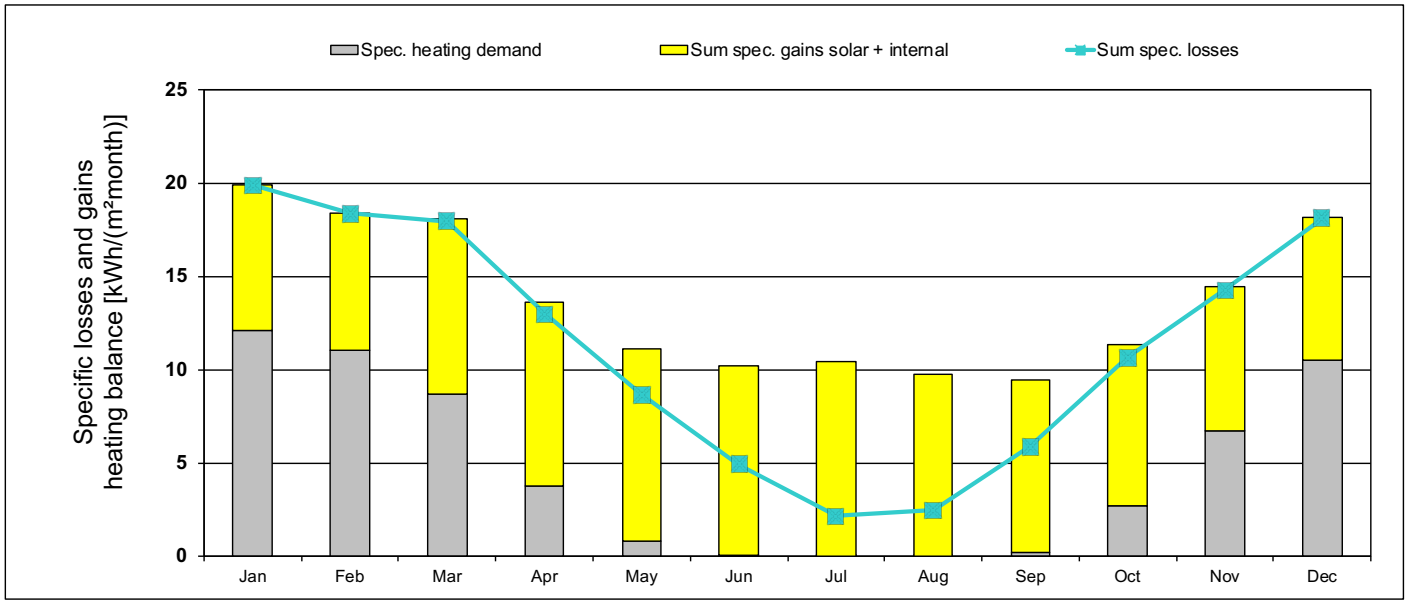

Energy balance heating (monthly method)
Heat flow [kWh/(m²a)]
160
140
120
100
80
60
40
20
0
13.1
46.2
0.0
27.6
17.6
0.0
16.4
9.8
0.0
14.4
15.5
72.7
56.4
0.2
Losses
Gains
Non-useful heat gains
External wall - Ambient
Roof/Ceiling - Ambient
Floor slab / Basement ceiling
Windows
Exterior door
Ventilation
solar gains
internal heat gains
heating demand
Heat gains TBs

Apkures enerģija (pa mēnešiem)

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 kWh/(m²a)

Interior temperature: 20 °C
Building type:
Treated floor area A_{TFA}: 28 m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - External	16.8	15.2	14.4	9.8	6.1	3.3	1.1	1.9	5.3	9.7	12.8	15.7	112	kKh
Heating degree hours - Ground	10.8	11.0	12.2	10.6	8.7	5.4	3.3	2.0	2.3	3.6	5.7	8.5	84	kKh
Losses - Exterior	460	416	393	269	166	89	31	51	144	266	349	431	3065	kWh
Losses - Ground	97	98	109	94	77	48	29	17	20	32	51	76	751	kWh
Sum spec. losses	19.9	18.4	17.9	13.0	8.7	4.9	2.2	2.4	5.9	10.6	14.3	18.1	136.3	kWh/m²
Solar gains - Ziemeļi	1	2	5	8	12	15	13	9	6	3	1	1	77	kWh
Solar gains - Austrumi	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - Dienvidi	7	10	32	41	39	36	39	33	33	21	8	4	302	kWh
Solar gains - Rietumi	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - Opaque	3	6	18	26	30	32	31	23	20	11	4	2	205	kWh
Internal heat gains	208	188	208	202	208	202	208	208	202	208	202	208	2453	kWh
Sum spec. gains solar + internal	7.9	7.4	9.4	9.9	10.3	10.2	10.4	9.8	9.3	8.7	7.7	7.7	108.4	kWh/m²
Utilisation factor	100%	100%	99%	94%	76%	48%	21%	25%	61%	92%	98%	99%	74%	
Annual heating demand	338	309	243	105	22	1	0	0	5	75	189	293	1580	kWh
Spec. heating demand	**12.1**	**11.0**	**8.7**	**3.7**	**0.8**	**0.0**	**0.0**	**0.0**	**0.2**	**2.7**	**6.7**	**10.5**	**56.4**	kWh/m²



Annual heating demand: Comparison

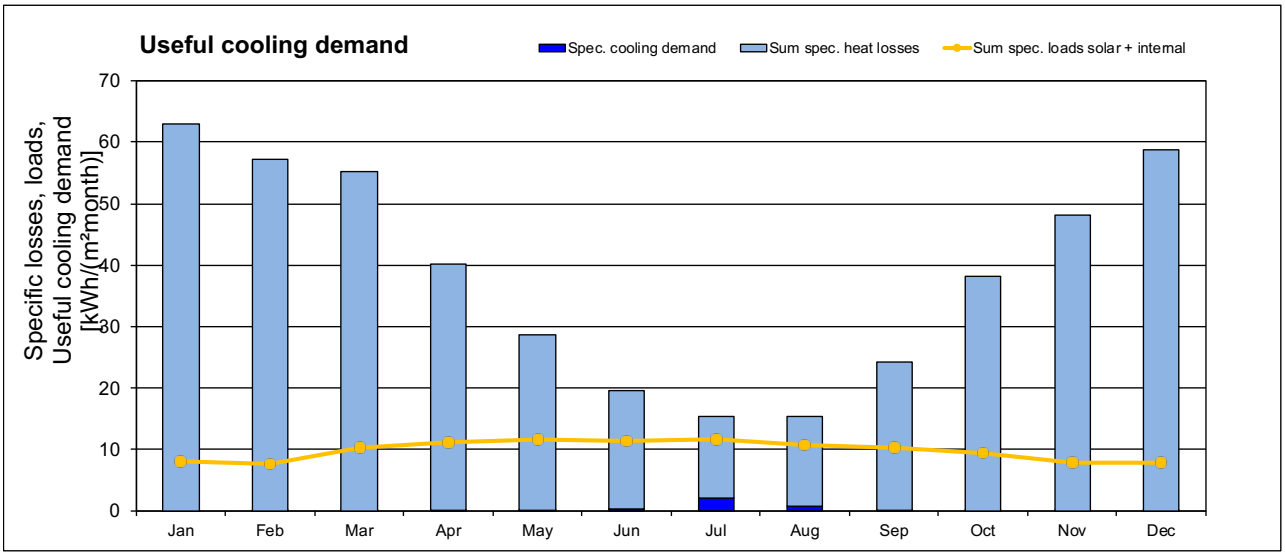
Monthly method	*('Heating')*	1580	kWh/a	56.4	**kWh/(m²a)** reference to treated floor area according to PHPP
Annual method	*('Annual heating')*	1574	kWh/a	56.2	**kWh/(m²a)** reference to treated floor area according to PHPP

Cooling: energy value for useful cooling energy

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 kWh/(m²a)

Interior Temperature: 24 °C
Building type:
Treated Floor Area A_{TFA}: 28 m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - Exterior	19.8	17.9	17.4	12.8	9.1	6.2	4.2	4.9	8.2	12.7	15.7	18.7	147	kKh
Heating degree hours - Ground	13.8	13.7	15.2	13.5	11.6	8.3	6.3	4.9	5.2	6.6	8.6	11.5	119	kKh
Losses - Exterior	630	570	551	404	286	194	130	153	258	404	498	596	4674	kWh
Losses - Ground	123	122	136	120	104	74	56	44	46	59	77	103	1063	kWh
Losses summer ventilation	1008	910	861	603	409	270	185	215	371	607	775	947	7162	kWh
Sum spec. heat losses	62.9	57.2	55.3	40.3	28.5	19.2	13.2	14.7	24.1	38.2	48.2	58.8	460.7	kWh/m²
Solar load North	1	3	7	12	17	22	19	13	9	5	2	1	111	kWh
Solar load East	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load South	13	18	56	72	68	64	68	58	58	37	14	6	533	kWh
Solar load West	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load Opaque	3	6	18	26	30	32	31	23	20	11	4	2	205	kWh
Internal heat gains	208	188	208	202	208	202	208	208	202	208	202	208	2453	kWh
Sum spec. loads solar + internal	8.1	7.7	10.3	11.1	11.6	11.4	11.7	10.8	10.3	9.3	7.9	7.8	117.9	kWh/m²
Utilisation factor losses	13%	13%	19%	28%	40%	57%	72%	68%	42%	24%	16%	13%	25%	
Useful cooling energy demand	0	0	0	0	2	10	58	21	2	0	0	0	95	kWh
Spec. cooling demand	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.4**	**2.1**	**0.7**	**0.1**	**0.0**	**0.0**	**0.0**	**3.4**	kWh/m²
Specif. dehumidification demand	**0.6**	**0.4**	**0.7**	**1.2**	**2.1**	**1.0**	**1.5**	**0.7**	**3.0**	**2.0**	**1.3**	**0.8**	**15.1**	kWh/m²
Sensible fraction	0%	0%	0%	1%	4%	27%	58%	51%	3%	0%	0%	0%	18%	



Cooling: energy value for useful cooling energy

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 kWh/(m²a)

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

Building type:			Treated floor area A_{TFA}:	28.0	m²
Interior temperature summer:	24	°C	Building volume:	76	m³
Nominal humidity:	12	g/kg	Internal humidity sources:	10.7	g/(m²h)
Spec. capacity:	84	Wh/(m²K)			

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Mon. red. fac.		G_t kKh/a		kWh/a	per m² treated floor area
External wall - Ambient	A	79.9	*	0.149	*	1.00	*	58	=	688	24.56
External wall - Ground	B		*		*	1.00	*		=		
Roof/Ceiling - Ambient	A	40.0	*	0.177	*	1.00	*	58	=	411	14.68
Floor slab / Basement ceiling	B	40.0	*	0.156	*	1.00	*	56	=	353	12.60
	A		*		*	1.00	*		=		
	A		*		*	1.00	*		=		
Cortain wall	X		*		*	0.30	*		=		
Windows	A	5.4	*	0.779	*	1.00	*	58	=	244	8.70
Exterior door	A	2.5	*	1.000	*	1.00	*	58	=	146	5.22
Exterior TB (length/m)	A	39.8	*	-0.050	*	1.00	*	58	=	-115	-4.12
Perimeter TB (length/m)	P		*		*	1.00	*		=		0.00
Ground TB (length/m)	B	26.6	*	0.100	*	1.00	*	56	=	150	5.35
										kWh/(m²a)	
Transmission losses Q_T (negative: heat loads)									Total	1876	67.0

Summer ventilation

from 'SummVent' worksheet

Ventilation conductance, vent. unit

exterior $H_{V,e}$	0.0	W/K
without HR	0.0	W/K
ground $H_{V,g}$	0.0	W/K
without HR	0.0	W/K

Ventilation conductance, others

exterior	8.2	W/K

Ventilation parameter

Temperature amplitude summer	8.1	K
Minimum acceptable indoor temperature	20.0	°C
Heat capacity air	0.33	Wh/(m³K)
Supply air changes	0.00	1/h
Outdoor air changes	0.33	1/h
Window night vent. air change rate, manual @ 1K	1.40	1/h
Air changes rate due to mech., autom. controlled vent.	0.00	1/h
Specific power consumption for	0.00	Wh/m³
η_{HR}	78%	
η_{ERV}	0%	
η^*_{SHX}	0%	

Summer ventilation regulation

	HRV/ERV in summer
None	x
Controlled by temp.	
Controlled by enthalpy	
Always	
	Additional ventilation
Controlled by temp.	
Controlled by humidity	x

	$n_{V,system}$ 1/h		η^*_{SHX}		η_{HR} (considers bypass)		$n_{V,Rest}$ 1/h		$n_{V,equi,fraction}$ 1/h
Hygienic air change									
Effective air change rate Ambient $n_{V,e}$	0.000	*(1-	0%	)*(1-	0.00	)+	0.330	=	0.330
Effective air change rate Ground $n_{V,g}$	0.000	*	0%	*(1-	0.00	)		=	0.000

	V_V m³		$n_{V,equi,fraction}$ 1/h		c_{Air} Wh/(m³K)		G_t kKh/a		kWh/a	kWh/(m²a)
Ventilation losses ambient Q_V	76	*	0.330	*	0.33	*	55	=	456	16.3
Ventilation losses ground $Q_{V,e}$	76	*	0.000	*	0.33	*	0	=	0	0.0
Heat losses summer ventilation	76	*	1.502	*	0.33	*	71	=	2662	95.1
Ventilation heat losses Q_V								Total	3117	111.3

	Q_T kWh/a		Q_V kWh/a		kWh/a	kWh/(m²a)
Total heat losses Q_L	1876	+	3117	=	4993	**178.3**

Orientation of the area	Reduction factor		g-Value (perp. radiation)		Area m²		Global radiation kWh/(m²a)		kWh/a
North	0.41	*	0.50	*	1.8	*	259	=	97
East	0.40	*	0.00	*	0.0	*	574	=	0
South	0.35	*	0.50	*	3.6	*	674	=	425
West	0.40	*	0.00	*	0.0	*	565	=	0
Horizontal	0.40	*	0.00	*	0.0	*	860	=	0
Sum opaque areas									173
									kWh/(m²a)
Available solar heat gains Q_S								Total	695	24.8

	kh/d		Length heat. period d/a		Spec. power q_I W/m²		A_{TFA} m²		kWh/a	kWh/(m²a)
Internal heat gains Q_I	0.024	*	214	*	10.0	*	28.0	=	1438	51.4

		kWh/a	kWh/(m²a)
Sum heat loads Q_F	Q_S + Q_I =	2133	**76.2**

Ratio of losses to free heat gains	Q_L / Q_F =	2.34	
Utilisation factor heat losses η_G	=	41%	
Useful heat losses $Q_{V,n}$	η_G * Q_L =	2038 kWh/a	**72.8** kWh/(m²a)
Useful cooling demand Q_K	Q_F - $Q_{V,n}$ =	95 kWh/a	**3** kWh/(m²a)
Recommended maximum value	15 kWh/(m²*a)	**Requirement met?**	Yes (Yes/No)

Heat distribution and domestic hot water (DHW) system

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 kWh/(m²a)

Interior temperature:	20	°C	Interior temperature summer:	24	
Building type:					
Treated floor area A_{TFA}:	28	m²			
Occupancy:	3.0	Pers			
Number of dwelling units:	1				
Annual heating demand $q_{Heating}$	1580	kWh/a	Annual useful cooling dem. q_{Cool}	95	
Length of heating period:	223	d	Length cooling period:	214	
Average heating load P_{ave}:	0.3	kW	Average cooling load $P_{Average}$:	0.0	
Marginal usability of additional heat gains:	91%		Marginal utility of additional heat losses:	2%	

Space heat distribution

			Inside thermal envelope			Total values	
			1	2	3	Absolute	Specific
Length of distribution pipes	L_H	m	100.0				
Nominal width of pipe		mm	20				
Insulation thickness		mm	0				
Insulation reflective coating?		-					
Thermal conductivity of insulation		W/(mK)	0.040				
Heat loss coefficient per m of insulated pipe		W/(mK)	0.529				
Insulation quality of mountings, pipe suspensions, etc.		-	1-None	1-None	1-None		
Thermal bridge supplement		W/K	17.000				
Total heating loss coefficient per m of pipe	Ψ	W/(mK)	**0.699**				
Temp. of the room through which the pipes pass	ϑ_X	°C	20	20	20		
Design forward flow temperature	ϑ_V	°C	30.0	30.0	30.0		
Design system heating load	$P_{heating}$	kW	0.8	0.8	0.8		
Forward flow temperature control ('x' if appropriate)			x	x	x		
Design return flow temperature	ϑ_R	°C	27.1				
Annual heat emission per m of plumbing	q^*_{HL}	kWh/(m·a)	15				
Possible utilisation factor of released heat	η_G	-	91%				
						kWh/a	kWh/(m²a)
Annual heat losses of heating distribution	Q_{HL}	kWh/a	**137**			**137**	**4.9**
Annual heat losses of heating storage		kWh/a				**0**	**0.0**
Annual heat losses of heating		kWh/a				**137**	**4.9**
Performance ratio of heat distribution	$ea_{,HL}$	-				**109%**	

DHW useful heat

DHW demand for showers, per person and day (with 60°C)		litre/person/d	16.0		
DHW demand others, per person and day (with 60°C)		litre/person/d	9.0		
Performance of shower drain-water heat recovery		-	0%		
Effective DHW demand	V_{DHW}	litre/person/d	25		
Average cold water temperature of the supply	ϑ_{TW}	°C	8.6		
DHW demand for washing machines and dishwashers non-electri		kWh/a	0		
				kWh/a	kWh/(m²a)
Effective useful heat DHW	Q_{DHW}	kWh/a	**1633**	**1633**	**58.3**

Auxiliary calculation - DHW demand calculation (for non-res)
Auxiliary calculation - shower drain-water heat recovery

DHW distribution

			Inside thermal envelope 1	2	3	Total values Absolute	Specific
Temp. of room through which the pipes pass	ϑ_X	°C	20.0	20.0	20.0		
Design forward flow temperature	ϑ_{dist}	°C	55.0	55.0	55.0		
DHW circulation pipes							
Length of circulation pipes (forward + return flow)	L_{HS}	m					
Nominal width of pipe		mm					
Insulation thickness		mm					
Insulation reflective coating?		-					
Thermal conductivity of insulation		W/(mK)	0.040				
Heat loss coefficient per m of insulated pipe		W/(mK)					
Insulation quality of mountings, pipe suspensions, etc.		-	1-None	1-None	1-None		
Thermal bridge supplement		W/K					
Total heating loss coefficient per m of pipe	Ψ	W/(mK)					
Daily circulation period of operation.	td_{Circ}	h/d	24.0				
Design return flow temperature	ϑ_R	°C					
Circulation period of operation per year	t_{Circ}	h/a					
Annual heat released per m of pipe	q^*_Z	kWh/m/a					
Annual heat loss from circulation lines	QZ	kWh/a				kWh/a: 0	kWh/(m²a): 0.0
DHW individual pipes							
Exterior pipe diameter	d_{U_Pipe}	m	0.020				
Accumulated length per single pipes	L_U	m	3.00				
Amount of tapping points in building	$n_{tapping\ poin}$	-	3.00				
Average pipe length per tapping point	$L_{U,\ average}$	m	1.0				
Tap openings per person per day		-	6				
Utilisation days per year		d	365				
Heat loss per tap opening	$q_{Individual}$	/h/tap opening	0.0101				
Amount of tap openings per year and person	n_{Tap}	nings per year	2190				
Annual heat loss of individual pipes	Q_U	kWh/a	66			kWh/a: 66	kWh/(m²a): 2.4
Total heat losses of DHW distribution	Q_{WL}					kWh/a: 66	kWh/(m²a): 2.4
Performance ratio of DHW distribution pipes	$ea_{,HL}$	-				104%	

Storage heat losses

			Storage 1
Selection of storage tank			1-DHW and heating
Storage necessary for HP			x
Solar DHW connection			
Heat loss rate		W/K	3.0
Storage volume		litre	200
Standby fraction		-	
Location of storage tank, inside or outside of thermal envelope			1-Inside
Temperature of mechanical room		°C	20.0
Typical storage tank temperature		°C	55.0
Manual entry of storage temperature		°C	
Average standby heat losses storage tank		W	105
Additional heat losses storage tank, solar operation		W	
Possibly utilisation factor of heat losses			—
Annual heat losses DHW storage tank		kWh/a	920
Annual heat losses buffer storage tank			—

		Absolute	Specific
Annual heat losses DHW storage tank		kWh/a: 920	kWh/(m²a): 32.9

Auxiliary calculation - heat losses through storage tank according to EU efficiency classes

Total energy demand of domestic hot water

		Absolute	Specific
Heat losses of DHW distribution and storage	Q_{WL}	kWh/a: 986	kWh/(m²a): 35.2
Performance ratio DHW-distribution + storage	$e_{a,WL}$	160%	
Total heating demand of DHW system			
Including storage tank	Q_{gDHW}	kWh/a: 2619	kWh/(m²a): 93.5

Internal heat gains for residential buildings (at the moment this worksheet is inactive)

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 kWh/(m²a)

Utilisation: 22-Other

Type of values used: 4-PHPP calculation ('IHG non-res' worksheet)

Go to utilisation pattern selection

IHG heating	12.00	W/m²
IHG cooling	9.71	W/m²

12.00 W/m²

Persons	3.0	P
Living area	28	m²

Heating demand	56	kWh/(m²a)
Heating period	223	d/a

Application	Existing [1/0] or occupancy	Within the thermal envelope [1/0]	Norm consumption		Utilisation factor	Frequency		Useful energy [kWh/a]		Included in electricity balance?		Availability		Utilisation period [h/a]		Internal heat gains [W]
Dishwashing	1	1	1.1	kWh/Use	1.00	65	/(P*a)	215	*			0.30	/	8.76	=	7
Clothes washing	1	1	1.1	kWh/Use	1.00	57	/(P*a)	188	*			0.30	/	8.76	=	6
Clothes drying with:	1	0	3.5	kWh/Use	0.88	57	/(P*a)	0	*			1.00	/	8.76	=	0
1-Clothes line		0	0.0					0				0.80				
Energy consumed by evaporation	1	0	0.0	kWh/Use	0.60	57	/(P*a)	0	* (1-	0	) *	1.00	/	8.76	=	0
Refrigerating	0	1	0.8	kWh/d	1.00	365	d/a	0	*			1.00	/	8.76	=	0
Freezing	0	0	0.9	kWh/d	0.90	365	d/a	0	*			1.00	/	8.76	=	0
or combination	0	1	1.0	kWh/d	1.00	365	d/a	0	*			1.00	/	8.76	=	0
Cooking	1	1	0.5	kWh/Use	1.00	500	/(P*a)	750	*			0.50	/	8.76	=	43
Lighting	1	1	72.0	W	1.00	2.9	kh/(P*a)	626	*			1.00	/	8.76	=	72
Consumer electronics	1	1	80.0	W	1.00	0.55	kh/(P*a)	132	*			1.00	/	8.76	=	15
Household appliances/Other	1	1	50.0	kWh	1.00	1.0	/(P*a)	150	*			1.00	/	8.76	=	17
Auxiliary appliances (cf. aux Electricity sheet)															=	85
Other applications (cf. Electricity sheet)	0	0.0						0	*			1	/	8.76	=	0
Persons	3	1	80.0	W/P	1.00	8.76	kh/a	2102	*			0.55	/	8.76	=	132
Cold water	3	1	-19.3	W/P	1.00	8.76	kh/a								=	-58
DHW - circulation	0	0	0.0	W	1.00	8.76	kh/a	0	*			1.00	/	8.76	=	0
DHW - individual pipes	1	1	7.6	W	1.00	8.76	kh/a	66	*			1.00	/	8.76	=	8
DHW storage tank heating case	1	1	105.0	W	1.00	8.76	kh/a	920	*			1.00	/	8.76	=	105
DHW storage tank cooling case	1	0	0.0	W	1.00	8.76	kh/a	0	*			1.00	/	8.76	=	0
Evaporation	3	1	-25.0	W/P	1.00	8.76	kh/a	-657	*			1.00	/	8.76	=	-75
Total IHG														W		357
Specific IHG														W/m²		12.76
Heat available from internal sources										223	d/a			kWh/(m²a)		68.4

Heat pump

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 kWh/(m²a)

			Building type:		
			Treated floor area A_{TFA}:	28	m²
	Covered fraction of space heating demand		('PER' worksheet)	100%	
	Space heating demand + distribution losses		Q_H+Q_{HL}: (DHW+Distribution)	1717	kWh/a
	Solar fraction for space heat		$\eta_{Solar,\ H}$ ('SolarDHW' worksheet)	0%	
	Effective annual heating demand	$Q_{H,Wi}=Q_H*(1-\eta_{Solar,\ H})$		**1717**	kWh/a
	Covered fraction of DHW demand		('PER' worksheet)	100%	
	Total heating demand of DHW system		Q_{gDHW} (DHW+Distribution)	2619	kWh/a
	Solar fraction for DHW		$\eta_{Solar,\ DHW}$ ('SolarDHW' worksheet)	0%	
	Effective DHW demand	$Q_{DHW,Wi}=Q_{DHW}*(1-\eta_{Solar,\ DHW})$		**2619**	kWh/a
	Number of heat pumps in the system			1	
	Functionality			Heating & DHW	
Heating					
	Selection of HP: 1-Standard air/water heat pump		Heat source:	1-Outdoor air	
	Selection of distribution system			1-Underfloor heating	
	Design distribution temperature		θ_{design} (DHW+Distribution)	30.00	°C
	Nominal power of distribution system		P_{nom}	0.82	kW
	Distribution system (to be completed by experienced users only)				
	Nominal power of distribution system		P_{nom}	0.82	kW
	Radiator exponent		n		
	Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)			0-No	
	Specific heat losses storage		U * A $_{Storage}$		W/K
	Storage location in thermal envelope			1-Inside	
	Room temperature (storage location: outside of thermal envelope)		(DHW+Distribution)		°C
	Sink temperature of heat pump for heating		θ_{snk}	56.50	°C
Entries in relation to the domestic hot water system					
	Selection of HP: 1-Standard air/water heat pump		Heat source:	1-Outdoor air	
	DHW temperature		(DHW+Distribution)	55.00	°C
	Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)			1-Inside	
	Specific heat losses storage		U * A $_{Storage}$	3.0	W/K
	Room temperature (storage location: outside of thermal envelope)		(DHW+Distribution)	20.00	°C
	Type of backup heater			1-Elec. Immersion heater	
	Δθ of electric continuous flow water heater				K
Additional options in case of <u>one</u> heat pump for both functions: Heating & DHW					
	Same heat pump's sink temperature for Heating and for DHW			1-Yes	
	Heat pump priority		(Manufacturer, tech. data)	2-Heating priority	
Control strategy					
	Heat pump control strategy			2-Ideal	
Heating					
	Depth ground water / Ground collector / Ground probe		z	2.0	m
	Power of pump for ground heat exchanger		P_{pump}	0.10	kW

-

Heating

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_source °C	θ_sink °C	Heating capacity kW	COP
Test point 1	-7.0	35.0	2.2	2.7
Test point 2	2.0	35.0	2.6	3.1
Test point 3	7.0	35.0	3.1	3.7
Test point 4	15.0	35.0	3.8	4.3
Test point 5	20.0	35.0	4.1	4.9
Test point 6	-7.0	50.0	2.0	2.0
Test point 7	2.0	50.0	2.5	2.3
Test point 8	7.0	50.0	3.0	2.8
Test point 9	15.0	50.0	3.7	3.3
Test point 10	20.0	50.0	3.9	3.5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{Sink}$ 5.0 K

DHW

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_source °C	θ_sink °C	Heating capacity kW	COP
Test point 1	-7.0	35.0	2.2	2.7
Test point 2	2.0	35.0	2.6	3.1
Test point 3	7.0	35.0	3.1	3.7
Test point 4	15.0	35.0	3.8	4.3
Test point 5	20.0	35.0	4.1	4.9
Test point 6	-7.0	50.0	2.0	2.0
Test point 7	2.0	50.0	2.5	2.3
Test point 8	7.0	50.0	3.0	2.8
Test point 9	15.0	50.0	3.7	3.3
Test point 10	20.0	50.0	3.9	3.5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{Sink}$ 5.0 K

Electr. energy consumption pump (grnd. water / ground)	$Q_{El,Pump}$	0	kWh/a
Energy by direct electricity	$Q_{El,dir}$	0	kWh/a
Space heat supplied by HP	$Q_{HP,Heating}$	1307	kWh/a
Winter DHW supplied by HP	$Q_{HP,DHW,Winter}$	1248	kWh/a
Summer DHW supplied by HP	$Q_{HP,DHW,Summer}$	1370	kWh/a
Space heating supplied by HP without storage losses	$Q_{HP,Heating}$	1689	kWh/a
Winter DHW supplied by HP without storage losses	$Q_{HP,DHW,Winter}$	810	kWh/a
Summer DHW supplied by HP without storage losses	$Q_{HP,DHW,Summer}$	889	kWh/a
Electrical consumption of HP	Qel_{HP}	2207	kWh/a

		1. HP: Heating or heating & DHW	2. HP: Domestic hot w
Seasonal performance factor of heat pump	SPF_{H-1}	1.78	
		kWh/a	kWh/(m²a)
Final electrical energy demand heat generation	Q_{final}	2207	78.8
Annual primary energy demand		5517	197.0
		kg/a	kg/(m²a)
Annual CO_2-equivalent emissions		241	8.6

Aux Electricity

Dzivojamā ēka / Climate: Riiga / TFA: 28 m² / Heating: 56.4 kWh/(m²a) / Cooling: 18.5 kWh/(m²a) / PER: 98.4 kWh/(m²a)

Treated floor area	28	m²
Heating period	223	d
Air volume	76	m³
Dwelling units	1	HH

Heat recovery efficiency ventilation unit	0.78	
Operation vent. system Winter	5.36	kh/a
Operation vent. system Summer	3.40	kh/a
Air change rate	0.53	h^{-1}

Annual space heating demand	56	kWh/(m^{2}a)
Boiler rated power	15	kW
DHW system heating demand	2619	kWh/a
Design forward flow temperature	30	°C

Column no.	1	2	3		4		5		6		7		8		9		10		11
Application	Existing [1/0]	Within the thermal envelope [1/0]	Norm demand		Utilisation factor		Period of operation		Reference size		Electricity demand [kWh/a]		Available as interior heat		Utilisation period [h/a]		Internal heat gains winter [W]		Internal heat gains summer [W]
Ventilation system																			
Winter ventilation	1		0.37	Wh/m³ *	0.53	h^{-1} *	5.4	kh/a *	76	m³ =	79		considered in heat recovery efficiency						
Defroster HX	0	1	Data entries in 'Ventilation' worksheet or in 'Addl vent'								0	*	0.2	/	5.36	=	0		
Summer ventilation	0	0.55	0.00	Wh/m³ *	0.00	h^{-1} *	3.4	kh/a *	76	m³ =	0	*	1.0	/	3.40	=			0
																	Internal heat sources ' Additional summer ventilation'		0.0
Additional vent. summer	0		0.00	Wh/m³ *	0.00	h^{-1} *	3.4	kh/a *	76	m³ =	0	*	1.0	/	3.40	=			
Heating system			Controlled / non controlled [1/0]																
Enter the rated power of the pump				W	0														
Circulator pump heating	1	1	85	W *	1.0	*	5.4	kh/a *	1	=	458	*	1.0	/	5.36	=	85		
Boiler electricity consumption at 30% load				W															
Aux. energy - Heat. boiler	0	0	55	W *	1.00	*	0.00	kh/a *	1	=	0	*	1.0	/	5.36	=	0		
Aux. energy - Wood fired/Pellet boiler	0	0	Data entries in 'Boiler' worksheet. Aux. energy demand including possible drinking water production.								0	*	1.0	/	5.36	=	0		
DHW system																			
Enter average power consumption of pump				W															
Circulation pump DHW	0	1	27	W *	1.00	*	3.9	kh/a *	1	=	0	*	1.0	/	8.76	=	0		0
Enter the rated power of the pump				W															
Storage load pump DHW	0	0	46	W *	1.00	*	0.2	kh/a *	1	=	0	*	1.0	/	8.76	=	0		0
Boiler electricity consumption at 100% load				W															
DHW boiler aux. energy	0	0	165	W *	1.00	*	0.0	kh/a *	1	=	0	*	1.0	/	8.76	=	0		0
Enter the rated power of the solar DHW pump				W															
Solar aux. electricity	0		32	W *	1.00	*	1.8	kh/a *	1	=	0	*	1.0	/	8.76	=	0		0
Aux. electricity cooling and dehumidification																			
Aux. electricity cooling				kWh/a *	1.00	*	1.0	*	1	=	0	*	1.0	/	3.40	=			0
Aux. electricity dehum.				kWh/a *	1.00	*	1.0	*	1	=	0	*	1.0	/	3.40	=			0
Misc. aux. electricity																			
Kaloriferu un gaisa aizskaru	0	0	552	kWh/a *	1.00	*	1.0	*	1	=	0	*	1.0	/	8.76	=	0		0
Total											537						85		0
Specific demand	kWh/(m²a) (treated floor area)										**19.2**								