

Project: Calculation Example 2 Date: 2014-01-04
Description: Apartment building
Performed by: User name Sign: Signature
Project file: C:\Projekt\VIPENERGY.NET\Beräkningsexempel\Example 2 Residential block\Example 2 Apartment building.VIP Company: **Company name**

COMMENTARIES

At the start of VIP-Energy text strings about Signature, User and Comment is loaded from the file Title_Eng.vpd. Text strings can be updated under Catalog Data -> Update Catalogs. The check box "User Data" should be checked.

Projekt name and Description is loaded från the input file (VIP-file) an is updated when the file is saved.

INDATA

Generic

Calculation period - Day	1 - 365
Solar reflection from ground	20.00 %
Wind velocity % of climate data	S:70 SW:70 W:70 NW:70 N:70 NE:70 EO:70 SE:70 °
Air pressure	1013 hPa
Horizontal angle to ground	S:20 SW:20 W:20 NW:20 N:20 NE:20 EO:20 SE:20 ° °
Form factor for wind pressure	0:0.70 45:0.50 90:-0.60 135:-0.50 180:-0.50 ROOF:-0.00
'South facade' angle to south"	0 °
Activity	No Resident
NO of apartm	0
Ventilation volume	0.0 [m³]
Heated floor area	2335.4 [m²]
Ground properties Heat conductance:	2.3 [W/m²K]
Silt, Undrained sand and gravel, moraine.	

Climate data

STOCKHOLM 1996-2005	Latitude	59.4	degrees	
	Highest value	Average value	Lowest value	
Outside temperature	30.2	7.5	-18.2	°C
Wind velocity	13.5	3.3	0.0	m/s
Solar radiation	905.0	111.8	0.0	W/m²
Relative humidity	100.0	74.3	0.0	%

Building part types 1-dimensional - Catalog

Build part name	Material From outside to inside	Layer thickness m	Heat conduct. W/m,K	Density kg/m³	Heat capacity J/kgK	U-value W/m²K	Delta U-value W/m²K	Permeability q50 l/sm²	Solar absorp-tion %
Roof type 1	Wood Pine	0.020	0.140	500	2300	0.100	0.010	0.80	70.00
	Blower wool	0.400	0.042	40	800				
	Concrete Normal RH	0.250	1.700	2300	800				
Floor type 1	Exp. Plastics 36	0.200	0.036	25	1400	0.169	0.010	0.10	0.00
	Concrete Normal RH	0.100	1.700	2300	800				
	Wood Pine	0.020	0.140	500	2300				
Light inner	Gypsum board	0.013	0.220	900	1100	0.396	0.010	0.80	50.00
	Bars s600	0.100	0.045	87	961				
	Gypsum board	0.013	0.220	900	1100				
Wall type 1	Concrete Normal RH	0.080	1.700	2300	800	0.199	0.040	0.50	50.00
	Exp. Plastics 36	0.170	0.036	25	1400				
	Concrete Normal RH	0.150	1.700	2300	800				
Heavy inner	Concrete Normal RH	0.200	1.700	2300	800	3.476	0.000	0.10	0.00
Inner flooring_u	Wood Pine	0.020	0.140	500	2300	2.174	0.000	0.10	0.00
	Concrete Normal RH	0.250	1.700	2300	800				
Inner flooring_o	Concrete Normal RH	0.250	1.700	2300	800	2.174	0.000	0.10	0.00
	Wood Pine	0.020	0.140	500	2300				

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Building part types 2- dimensional - Catalog

Build part name	Psi-value W/m	Width m	Permeability q50 l/sm ²	Solar absorption %	Build part name	Psi-value W/m	Width m	Permeability q50 l/sm ²	Solar absorption %
Wall-Roof	0.129	0.300	0.50	50.00	Outer corner	0.126	0.200	0.50	50.00
Window splay	0.112	0.200	0.50	50.00					

Bygghelstyper 3-dimensionella - Katalog

Build part name	U-value W/m ² °C	Area m ²	Permeability q50 l/sm ²	Solar absorption %
Balcony	0.459	0.20	0.80	80.00

Building part - Walls, slabs

Description	Build part name	Ori-entation	Amount Area m ² Length m	Lowest level m	Highest level m	Adjacent tempera- ture °C	Share of effect demand %	U-value with ground and D-U W/m ² °K
	Wall type 1	EAST	193.5m ²	0.0	2.5		0	0.239 W/m ² K
	Wall type 1	WEST	226.1m ²	0.0	2.5		0	0.239 W/m ² K
	Wall type 1	NORTH	223.8m ²	0.0	2.5		0	0.239 W/m ² K
	Wall type 1	SOUTH	216.6m ²	0.0	2.5		0	0.239 W/m ² K
	Floor type 1	SOG 0-1 m	64.4m ²	0.0	0.0		0	0.161 W/m ² K
	Floor type 1	SOG 1-6 m	227.5m ²	0.0	0.0		0	0.133 W/m ² K
	Roof type 1	ROOF	281.7m ²	2.5	2.5		0	0.110 W/m ² K
	Heavy inner	INNER	1716.0m ²				0	
	Light inner	INNER	5060.0m ²				0	
	Inner flooring_o	INNER	2043.4m ²				0	
	Inner flooring_u	INNER	2043.4m ²				0	
	Window splay	SOUTH	291.0m	0.0	0.0		0	0.112 W/mK
	Window splay	WEST	228.8m	0.0	0.0		0	0.112 W/mK
	Window splay	EAST	278.4m	0.0	0.0		0	0.112 W/mK
	Window splay	NORTH	289.6m	0.0	0.0		0	0.112 W/mK
	Outer corner	NORTH	22.0m	0.0	0.0		0	0.126 W/mK
	Outer corner	SOUTH	22.0m	0.0	0.0		0	0.126 W/mK
	Outer corner	WEST	22.0m	0.0	0.0		0	0.126 W/mK
	Outer corner	EAST	22.0m	0.0	0.0		0	0.126 W/mK
	Wall-Roof	SOUTH	8.9m	0.0	0.0		0	0.129 W/mK
	Wall-Roof	NORTH	8.9m	0.0	0.0		0	0.129 W/mK
	Wall-Roof	WEST	8.2m	0.0	0.0		0	0.129 W/mK
	Wall-Roof	EAST	8.2m	0.0	0.0		0	0.129 W/mK
	Wall-Roof	ROOF	34.2m	0.0	0.0		0	0.129 W/mK
	Balcony	SOUTH	29.4st	0.0	0.0		0	0.459 W/K
	Balcony	WEST	29.4st	0.0	0.0		0	0.459 W/K
	Balcony	EAST	58.8st	0.0	0.0		0	0.459 W/K

Solar shading types

Name	Funktion	Values	Activated at out temperature over:	Activated at room temperature over:	Activated at solar effect over:	Inactivated at wind speed over:
Balcony W	Upper fin	77.0 // 45.0		0.0		
Balcony WD	Upper fin	77.0 // 36.0		0.0		

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Building part - Window, door, valves

Description	Build part name	Orientation	Area m²	Glass share %	Solar transm. Total %	Solar transm. Direct %	U-value W/m²K	Lowest level m	Highest level m	Permeability q50 l/sm²	Solar protection name
	Window type 1	SOUTH	66.4	80	50	40	1.00	0.0	2.5	0.50	
	Window type 2	SOUTH	21.3	80	50	40	1.00	0.0	2.5	0.50	Balcony W
	WD type 2	SOUTH	16.8	80	50	40	1.00	0.0	2.5	0.50	Balcony WD
	Entrance	SOUTH	2.9	80	50	40	2.00	0.0	2.5	0.50	
	Window type 1	WEST	47.0	80	50	40	1.00	0.0	2.5	0.50	
	Window type 2	WEST	15.7	80	50	40	1.00	0.0	2.5	0.50	Balcony W
	WD type 2	WEST	16.8	80	50	40	1.00	0.0	2.5	0.50	Balcony WD
	Window type 1	EAST	33.3	80	50	40	1.00	0.0	2.5	0.50	
	Window type 2	EAST	29.4	80	50	40	1.00	0.0	2.5	0.50	Balcony W
	WD type 2	EAST	33.6	80	50	40	1.00	0.0	2.5	0.50	Balcony WD
	Window type 1	NORTH	89.6	80	50	40	1.00	0.0	2.5	0.50	
	WD type 1	NORTH	16.8	80	50	40	1.00	0.0	2.5	0.50	

Operating data

Operating case name	Activity energy W/m²	Activity energy W/lgh	Activity energy external W/m²	Building - energy to room W/m²	Building - energy external W/m²	Person energy W/m²	Hot tap water W/m²	Hot tap water W/lgh	Moist added mg/s,m²	Highest room temp °C	Lowest room temp °C	Room-temp passive forc °C
Residential block 22	2.74	0.00	0.70	1.00	0.40	1.00	2.85	0.00	0.80	27.00	22.00	0.00

Operating hours

Operating case name	Week-days	Week number	Time	Operating case name	Week-days	Week number	Time
Residential block 22	Mondays	Remaining time	- - - -		Fridays	==	Mondays
	Tuesdays	==	Mondays		Saturdays	==	Mondays
	Wednesdays	==	Mondays		Sundays	==	Mondays
	Thursdays	==	Mondays				

Ventilation unit

Unit name	Inlet air Fan pressure Pa	Inlet air effc. %	Exhaust air Fan pressure Pa	Exhaust air effc. %	Control case
EF1	0.00	0.00	500.00	70.00	EF
Airing	0.00	0.00	0.00	0.00	Airing

Control case

Control case	Control type	Outside temperature L	Control value L	Outside temperature H	Control value H
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Ventilation unit - Operating hour and flow

Unit name	Week-days	Supply air l/s,m²	Exhaust air l/s,m²	Week number	Starttime-Endtime
EF1					
	Mondays	0.000	0.350	1 - 53	0 - 24
	Tuesdays	==	Mondays		
	Wednesdays	==	Mondays		

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Ventilation unit - Operating hour and flow

Unit name	Week-days	Supply air l/s,m²	Exhaust air l/s,m²	Week number	Starttime-Endtime
	Thursdays	==	Mondays		
	Fridays	==	Mondays		
	Saturdays	==	Mondays		
	Sundays	==	Mondays		
Airing					
	Mondays	0.025	0.025	1 - 53	0 - 24
	Tuesdays	==	Mondays		
	Wednesdays	==	Mondays		
	Thursdays	==	Mondays		
	Fridays	==	Mondays		
	Saturdays	==	Mondays		
	Sundays	==	Mondays		

Heating and cooling

Heat pump: NIBE F1330 A	Share of effect	25.0	%
Heat pump: NIBE F1330 A	Share of effect	25.0	%
Heat pump: NIBE F1330 A	Share of effect	25.0	%
Heat pump: NIBE F1330 B	Share of effect	25.0	%
NIBE F1330 A			
Refrigerant type	R407C		
Heat pump type	Geothermal, Rock		
Lowest temperature cold side	-10.0	°C	
Highest temperature warm side	65.0	°C	
Heat to hot tap water			
Heat to heating system			
Output effect	10900.0	W	
COP	3.4		
Temperature warm side	45.0	°C	
Temperature cold side	0.0	°C	
Testing standard	EN 14511	Inclusive circulation pumps and fans	
Power to brine pump	2.0	%	
Power circulation pump room heating	1.0	%	
Priority to hot tap water			
NIBE F1330 B			
Refrigerant type	R407C		
Heat pump type	Geothermal, Rock		
Lowest temperature cold side	-10.0	°C	
Highest temperature warm side	65.0	°C	
Heat to hot tap water			
Output effect	10900.0	W	
COP	3.4		
Temperature warm side	45.0	°C	
Temperature cold side	0.0	°C	
Testing standard	EN 14511	Inclusive circulation pumps and fans	
Power to brine pump	2.0	%	
Power circulation pump room heating	1.0	%	
Priority to hot tap water			

Example 2 Apartment building

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Heating system	Op. point 1	Op. point 2
Outside temperature	-20.0	20.0
Supply pipe temperature	55.0	20.0
Drain pipe temperature	45.0	20.0
HOT TAP WATER SYSTEM		
Cold water temperature	8.0	[°C]
Hot tap water temperature	65.0	[°C]
Heat loss from hot tap water system to building	5.0	[W/K]

OTHER

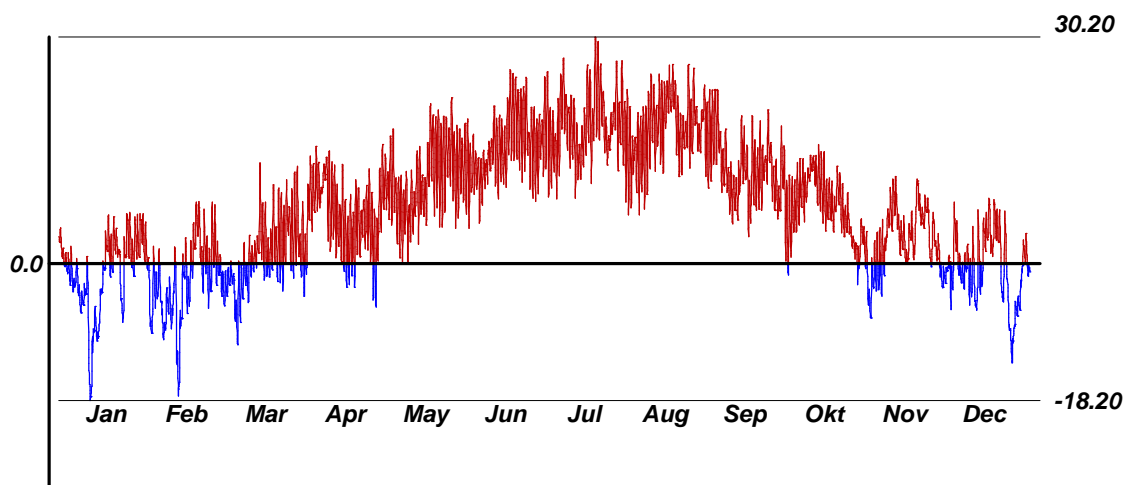
Power circulation pump room heating 2.00 % of energy supply to room and air

Lowest dimensioning outside temperature for heating -17.0 °C

Highest dimensioning temperature for comfort cooling 100.0 °C

Passive cooling

Temperature outdoor



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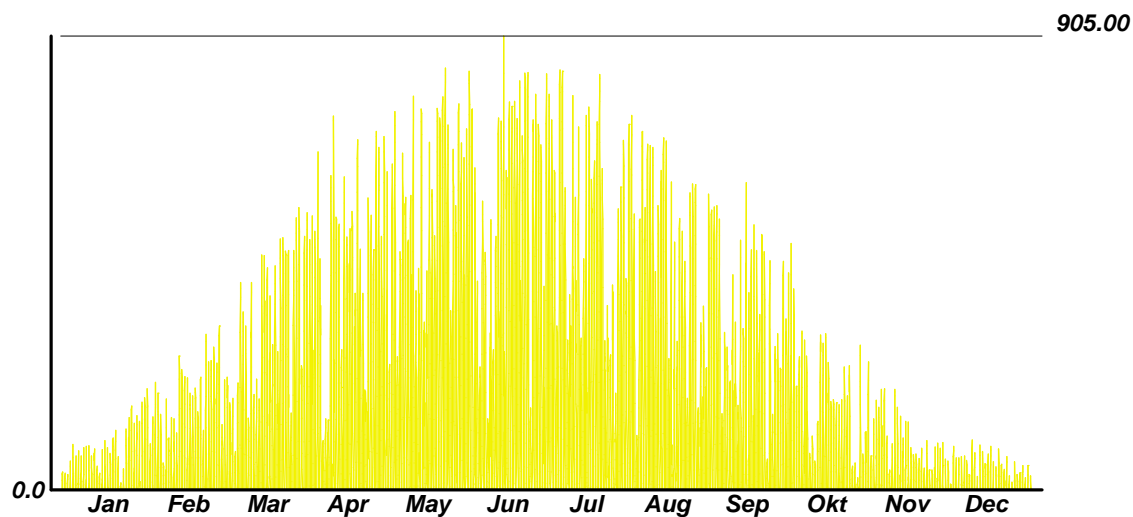
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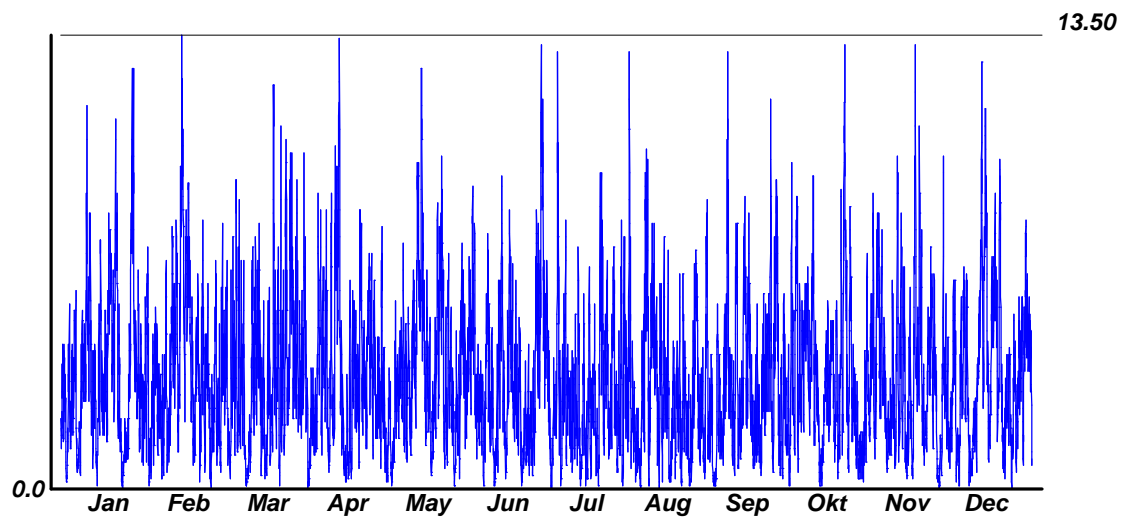
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Solar

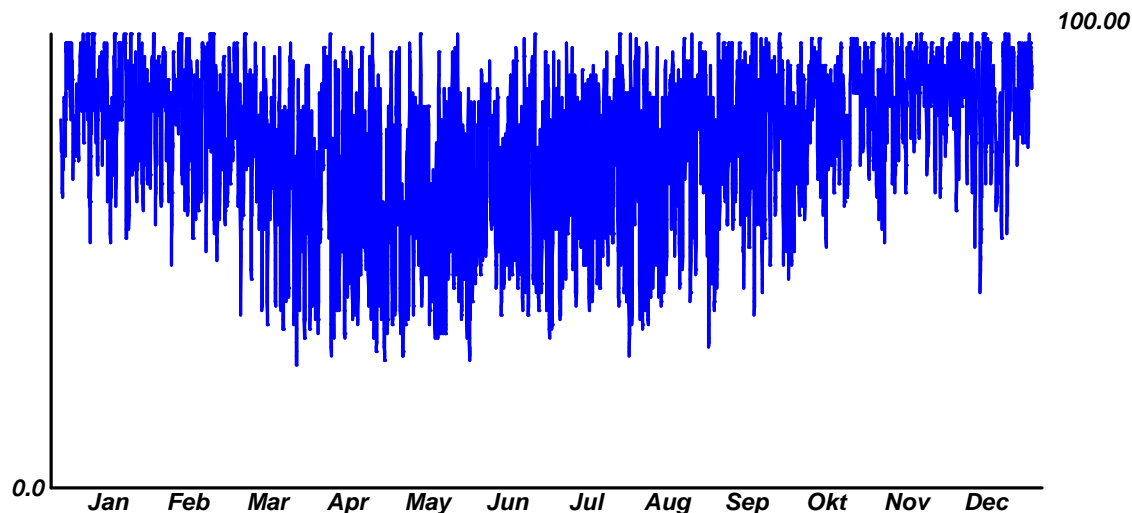


Wind speed



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Relative humidity outdoor



RESULT

Calculation date 2014-01-05 17:38:12

Time detailed energy balance Supplied energy

Period	Supplied energy kWh									
	(27)	(20)	(19)	(29)	(18)	(25)	(45)	(33)	(34)	(52)
	Solar energy window	Recovery vent.	Recovery HP	Recovery sewer	Solar collector	Person heat	Process-energy	Heat supply	El supply	Latent energy
Mon 1	260	0	16554	0	0	1738	6498	5691	7728	3475
Mon 2	790	0	14587	0	0	1569	5869	5530	6916	3139
Mon 3	3955	0	13973	0	0	1738	6498	2056	6662	3475
Mon 4	5860	0	7950	0	0	1681	6289	94	4248	3363
Mon 5	7306	0	4386	0	0	1738	6498	67	2869	3475
Mon 6	7202	0	3074	0	0	1681	6289	-0	2279	3363
Mon 7	7085	0	3175	0	0	1738	6498	-0	2353	3475
Mon 8	6385	0	3175	0	0	1738	6498	-0	2354	3475
Mon 9	4506	0	3370	0	0	1681	6289	57	2418	3363
Mon 10	1453	0	10549	0	0	1738	6498	104	4996	3475
Mon 11	331	0	14747	0	0	1681	6289	1424	6581	3363
Mon 12	165	0	15862	0	0	1681	6289	4553	7321	3363
Period	45302	0	111955	0	0	20458	76512	19698	56978	40916

Time detailed energy balance Emitted energy

Period	Emitted energy kWh				
	(23)	(24)	(21)	(28)	(22)
	Trans-mis-sion	Air-infil-tration	Venti-lation	Waste-water	Passive cooling
Mon 1	14826	0	22156	4952	0
Mon 2	13540	0	20356	4473	0

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Time detailed energy balance Emitted energy

Period	Emitted energy kWh				
	(23)	(24)	(21)	(28)	(22)
	Trans-mis-sion	Air-infil-tration	Venti-lation	Waste-water	Passive cooling
Mon 3	12776	0	20287	4952	0
Mon 4	8853	0	15919	4792	0
Mon 5	6261	0	13463	4952	21
Mon 6	4839	0	11652	4792	2341
Mon 7	3659	0	10146	4952	5511
Mon 8	4344	0	10616	4952	3928
Mon 9	5949	0	11925	4792	695
Mon 10	8925	0	15299	4952	0
Mon 11	11535	0	18149	4792	0
Mon 12	13696	0	20731	4792	0
Period	109663	0	191399	58305	12497

Key values

Inner heat capacity	157.13	[Wh/m ² °C]
Outer heat capacity	48.37	[Wh/m ² °C]
Avg temperature	22.00	[°C]
Avg ventilation	0.38	l/s,m ²
Process energy avg	4.84	[W/m ²]
Person energy avg	1.00	[W/m ²]
Shell area	2102.32	[m ²]
Inside pressure avg	-33.7	[Pa]
Specific fan power	0.7	[kW/(m ³ /s)]
Shell/Floor area	0.90	
Area windows+doors/Floor area	0.17	

Comparison to demands according to BBR

			Value allowed	
Jämförelse mot BBR19				
U-value		0.412	0.400	W/(m ² K)
Energy usage	Totalt	45	55	kWh/(m ² år)
Energy usage	Värmeförsörjning	8		kWh/(m ² år)
Energy usage	El till fläktar och pumpar	3		kWh/(m ² år)
Energy usage	El till värmepump	21		kWh/(m ² år)
Energy usage	Fastighetsel	12		kWh/(m ² år)
Installerad El-effekt		50.7	59.6	kW
Transmission:		31.1		kW
Luftläckage:		2.3		kW
Ventilation:		39.0		kW
Värmepump:		-21.7		kW
Dimensionerande temperaturer	Inne	Ute	Mark	
	20.0	-17.0	6.0	
Atemp: 2335.4 m ²				
Klimatzon BBR19	III			
Activity: / No Resident				
Elvärme				
Verkningsgrad värmeförsörjning: 100.00 %				

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Comparison to demands according to BBR

			Value allowed	
Miljöbyggnad Silver				
U-value		0.412	0.400	W/(m²K)
Energy usage	Totalt	45	55	kWh/(m²år)
Energy usage	Värmeförsörjning	8		kWh/(m²år)
Energy usage	El till fläktar och pumpar	3		kWh/(m²år)
Energy usage	El till värmepump	21		kWh/(m²år)
Energy usage	Fastighetsel	12		kWh/(m²år)
Atemp: 2335.4 m²				

Energy balance

Emitted energy		
(23)Transmission	109663	46.96
(24)Infiltration	0	0.00
(21)Ventilation	191399	81.96
(28)Sewer	58305	24.97
(22)Passive cooling	12497	5.35
Supplied energy		
(27)Solar energy trough window	45302	19.40
(20)Heat recovery ventilation	0	0.00
(29)Heat recovery to hot tap water	0	0.00
(19)Heat recovery Heat pump	111955	47.94
(18)Heat recovery Solar collector	0	0.00
(45)Process energy	76512	32.76
(25)Person heat	20458	8.76
(34)El supply	56978	24.40
(33)Heat supply	19698	8.43
(52)Latent energy	40916	17.52

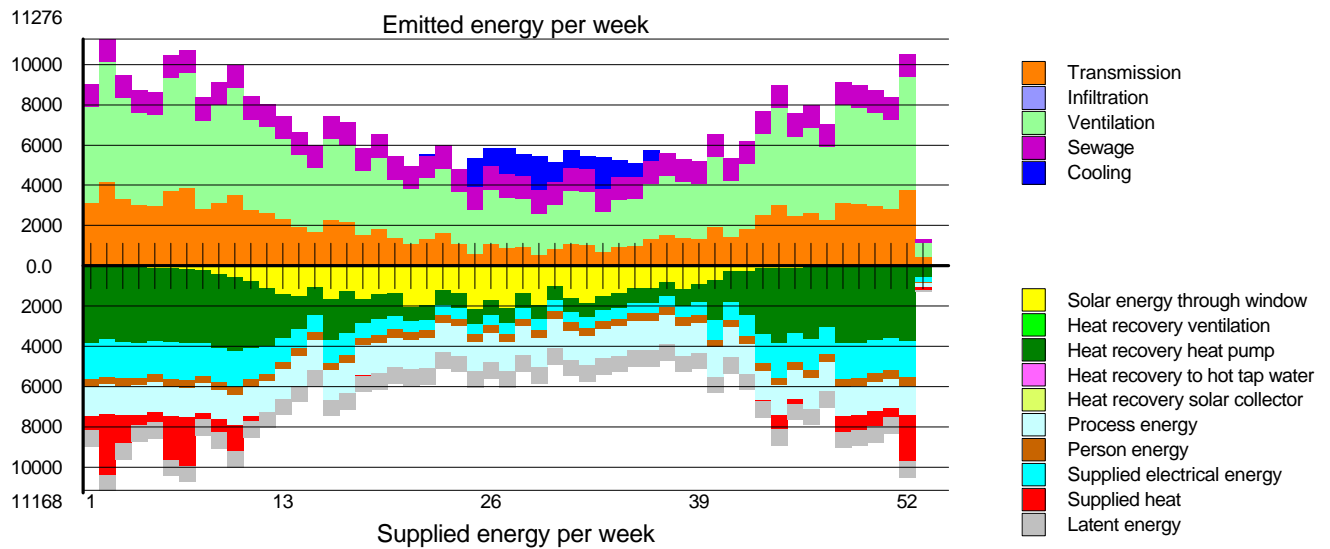
Specification of energy flows

(33)HEAT SUPPLY	19698	8.43	(37)CONDENSER HEAT	161351	69.09
(2)Heating system	19698	8.43	(5)Heating system	101225	43.34
(3)Hot tap water	-0	-0.00	(6)Hot tap water	60126	25.75
(47+48)BUILDING COOLING	12497	5.35			
(48)Cooling in room air	12497	5.35	(26)PROCESSENERGY	99016	42.40
(48S)Sensibel cooling in room air	12492	5.35	(40)Activity energy internal	56054	24.00
(48L)Latent cooling in room air	4	0.00	(41)Activity energy external	14320	6.13
			(39)Operation energy internal	20458	8.76
(34)EL SUPPLY	56978	24.40	(46)Operation energy external	8183	3.50
(35)Heat pump	49396	21.15			
(13)Exhaust fans	5114	2.19	(43)HEATING SYSTEM	123391	52.84
(15)Cirk.pump heating	2468	1.06	(44)HOT TAP WATER SYSTEM	58305	24.97

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Energy balance - diagram



Temperatures

