

Location of the system

Switzerland  
Rapperswil (SG)  
Longitude: 8.82°  
Latitude: 47.23°  
Elevation: 417 m

This report has been created by:

Vela Solaris AG

System overview (annual values)

Total fuel and/or electrical energy consumption of the system [Etot]	998.5 kWh
Total energy consumption [Quse]	6,861.1 kWh
System performance (Quse / Etot)	6.87
Comfort demand	Energy demand covered

# Professional Report

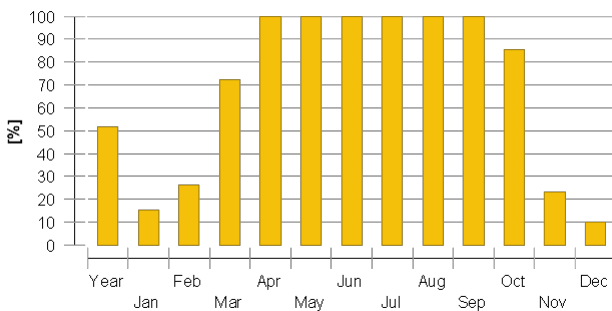
## Overview solar thermal energy (annual values)

Collector area	10 m <sup>2</sup>
Solar fraction total	51.7%
Solar fraction hot water [SF <sub>h</sub> Hw]	72.3 %
Solar fraction building [SF <sub>h</sub> Bd]	14.2 %
Total annual field yield	4,841.3 kWh
Collector field yield relating to gross area	484.1 kWh/m <sup>2</sup> /Year
Collector field yield relating to aperture area	556.8 kWh/m <sup>2</sup> /Year
Max. energy savings	1,011.1 kWh
Max. reduction in CO <sub>2</sub> emissions	542.3 kg

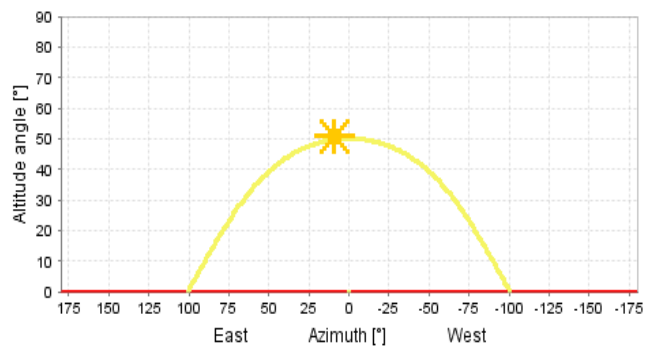
## Overview heat pump (annual values)

Seasonal performance factor (without pump energy)	4.8
Total electrical energy consumption when heating [E <sub>aux</sub> ]	944.4 kWh
Ground loop length (Total)	396 m
Energy withdrawal of the ground-source loop	3,569.4 kWh
Total energy savings	3,577.5 kWh
Total reduction in CO <sub>2</sub> emissions	1,919 kg

## Solar fraction: fraction of solar energy to system [SF<sub>n</sub>]



## Horizon line



## Meteorological data-Overview

Average outdoor temperature	10.1 °C
Global irradiation, annual sum	1,103.5 kWh/m <sup>2</sup>
Diffuse irradiation, annual sum	578 kWh/m <sup>2</sup>

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## Component overview (annual values)

B/W or W/W heat pump		Thermalia®H (15)
Seasonal performance factor (without pump energy)		4.79
Energy from/to the system [Qaux]	kWh	4,521.9
CO2 emissions	kg	506.6
Fuel and electrical energy consumption [Eaux]	kWh	944.4
Energy savings solar thermal	kWh	1,011.1
CO2 savings solar thermal	kg	542.3
Energy savings heat pump	kWh	3,577.5
CO2 savings heat pump	kg	1,919
Collector		CPC 6 OEM
Data Source		ITW
Number of collectors		8.7
Number of arrays		2
Total gross area	m²	10
Total aperture area	m²	8.696
Total absorber area	m²	8.7
Tilt angle (hor.=0°, vert.=90°)	°	45
Orientation (E=+90°, S=0°, W=-90°)	°	0
Collector field yield [Qsol]	kWh	4,841.3
Irradiation onto collector area [Esol]	kWh	10,749.3
Collector efficiency [Qsol / Esol]	%	45
Direct irradiation after IAM	kWh	5,637.7
Ground-source loop 1		32 mm double U ground loop
Ground loop length	m	99
Number of ground-source loops		4
Distance between ground loops	m	5
Earth layer 1	m	400 / Moraine, firmly deposited
Inflow temperature during operation	°C	8.5
Outflow temperature during operation	°C	9.2
Energy withdrawal of the ground-source loop	kWh	3,569.4
Building		Single family house, passive building
Heated/air-conditioned living area	m²	210
Heating setpoint temperature	°C	19.5
Heating energy demand excluding DHW [Qdem]	kWh	3,730.1
Specific heating energy demand excluding DHW [Qdem]	kWh/m²	17.8
Solar gain through windows	kWh	15,042.3
Total energy losses	kWh	28,749

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Heating element	Floor heating	
Number of heating/cooling modules	-	9
Power per heating element under standard conditions	W	1,000
Nominal inlet temperature	°C	35
Nominal return temperature	°C	25
Net energy from/to heating/cooling modules	kWh	3,720.1
Hot water demand	Constant	
Volume withdrawal/daily consumption	l/d	202.1
Temperature setting	°C	45
Energy demand [Qdem]	kWh	2,994.6
Pump Building loop	Eco, medium	
Circuit pressure drop	bar	0.002
Flow rate	l/h	412.9
Fuel and electrical energy consumption [Epar]	kWh	15
Pump Solar loop	Eco, small	
Circuit pressure drop	bar	0.009
Flow rate	l/h	130.4
Fuel and electrical energy consumption [Epar]	kWh	15.2
Pump Heating loop	Eco, small	
Circuit pressure drop	bar	0.118
Flow rate	l/h	3,600
Fuel and electrical energy consumption [Epar]	kWh	2.4
Pump Ground-source loop pump	Eco, large	
Circuit pressure drop	bar	1.858
Flow rate	l/h	10,800
Fuel and electrical energy consumption [Epar]	kWh	21.6
Storage tank Tank	CombiSol Compact	
Volume	l	1,200
Height	m	1.5
Material		Steel
Insulation		Rigid PU foam
Thickness of insulation	mm	100
Heat loss	kWh	764.6
Connection losses	kWh	1,117.3

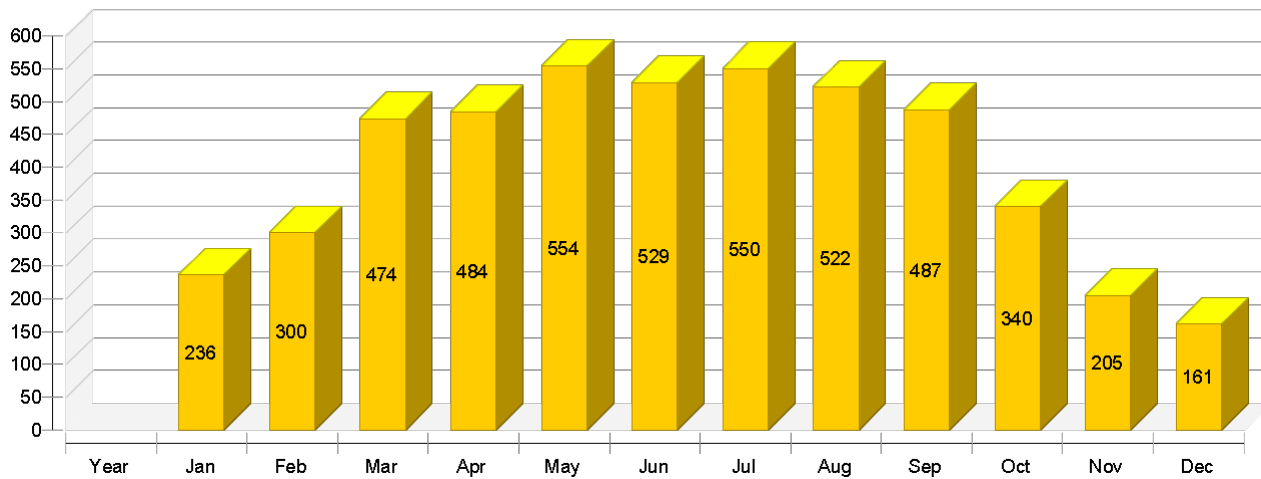
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## Loop

Solar loop		
Fluid mixture		Propylene mixture
Fluid concentration	%	33.3
Fluid domains volume	l	25.8
Pressure on top of the circuit	bar	4

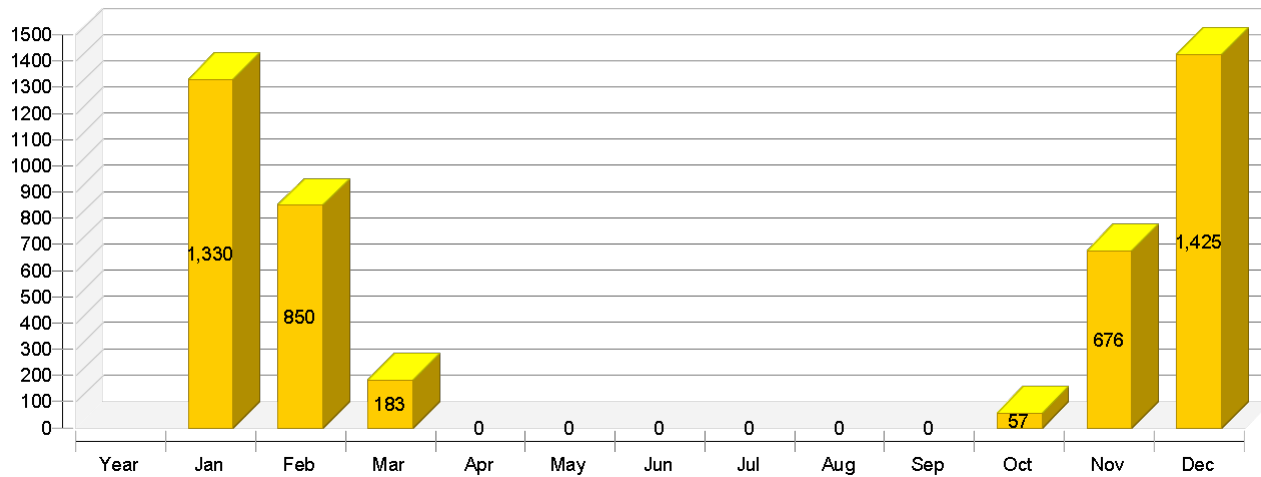
## Solar thermal energy to the system [Qsol]

kWh



## Heat generator energy to the system (solar thermal energy not included) [Qaux]

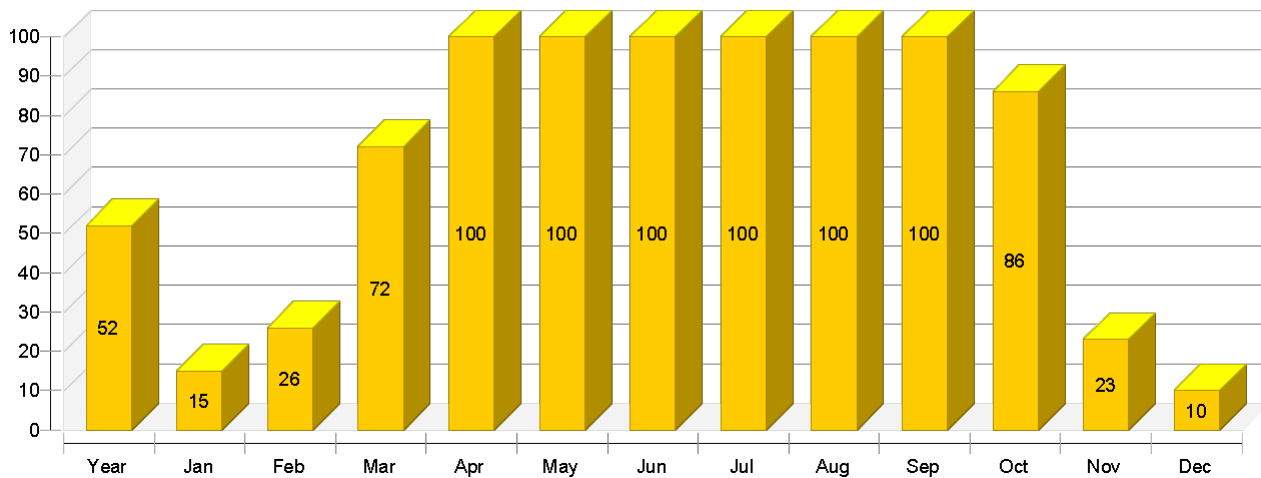
kWh



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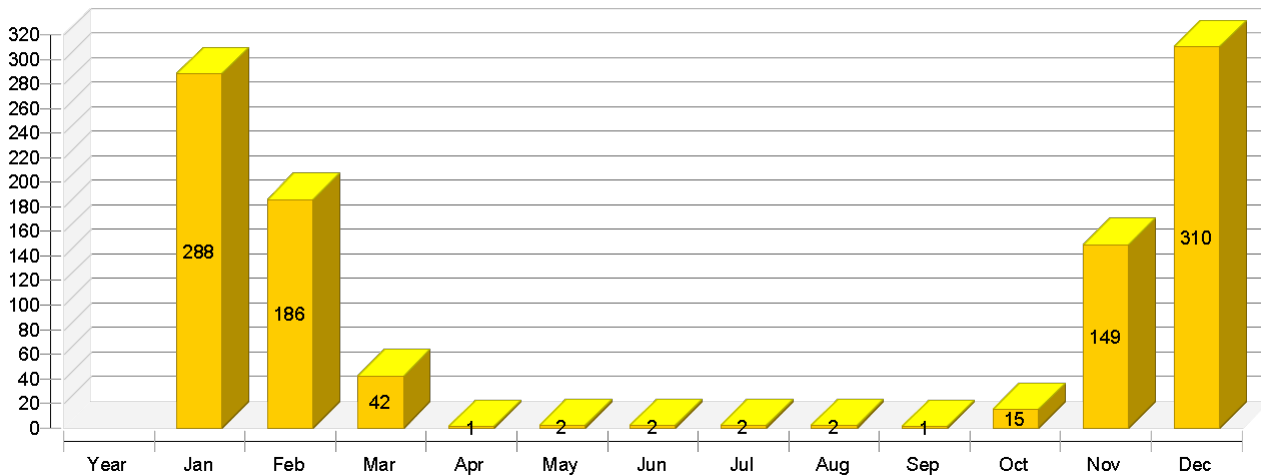
Solar fraction: fraction of solar energy to system [SF<sub>n</sub>]

%



Total fuel and/or electrical energy consumption of the system [E<sub>tot</sub>]

kWh



Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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## Solar thermal energy to the system [Q<sub>sol</sub>]

kWh	4841	236	300	474	484	554	529	550	522	487	340	205	161
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## Heat generator energy to the system (solar thermal energy not included) [Q<sub>aux</sub>]

kWh	4522	1330	850	183	0	0	0	0	0	0	57	676	1425
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## Heat generator fuel and electrical energy consumption [E<sub>aux</sub>]

kWh	944	275	177	39	0	0	0	0	0	0	14	142	297
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## Solar fraction: fraction of solar energy to system [SF<sub>n</sub>]

%	51.7	15.1	26.1	72.2	100	100	100	100	100	100	85.5	23.2	10.1
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## Total fuel and/or electrical energy consumption of the system [E<sub>tot</sub>]

kWh	999	288	186	42	1	2	2	2	2	1	15	149	310
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## Irradiation onto collector area [E<sub>sol</sub>]

kWh	10749	495	627	965	1100	1218	1187	1303	1269	1036	741	448	361
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Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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## Electrical energy consumption of pumps [Epar]

kWh	54	12	8	3	1	2	2	2	2	1	1	6	13
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## Total energy consumption [Quse]

kWh	6861	1435	987	450	277	274	252	249	243	235	248	748	1463
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## Heat loss to indoor room (including heat generator losses) [Qint]

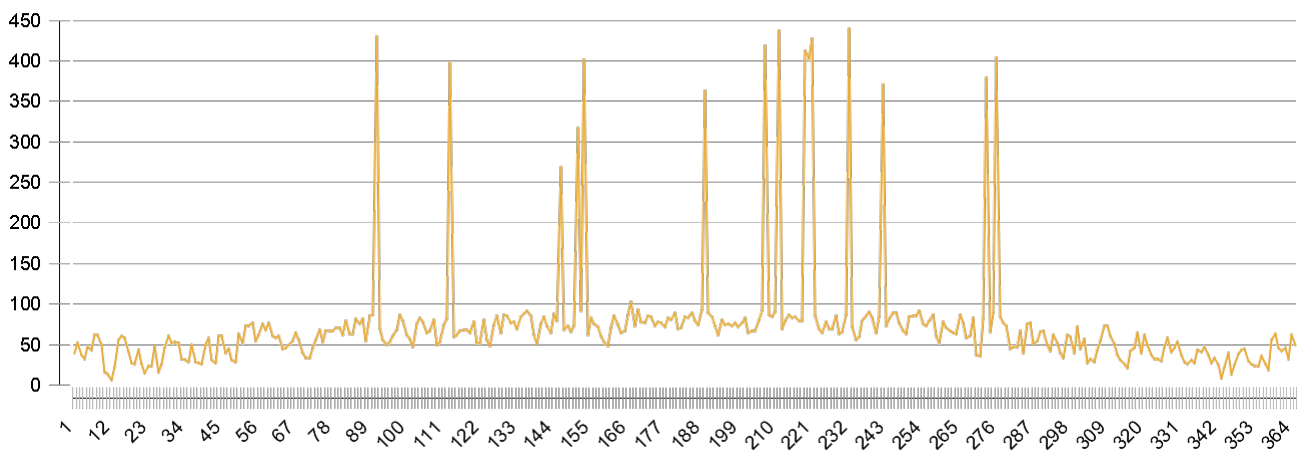
kWh	2126	115	119	154	184	223	229	253	240	219	160	117	112
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## Heat loss to surroundings (without collector losses) [Qext]

kWh	420	19	25	37	43	48	49	52	46	41	27	18	15
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## Collector

### Daily maximum temperature [ °C]



Energy flow diagram (annual balance)

