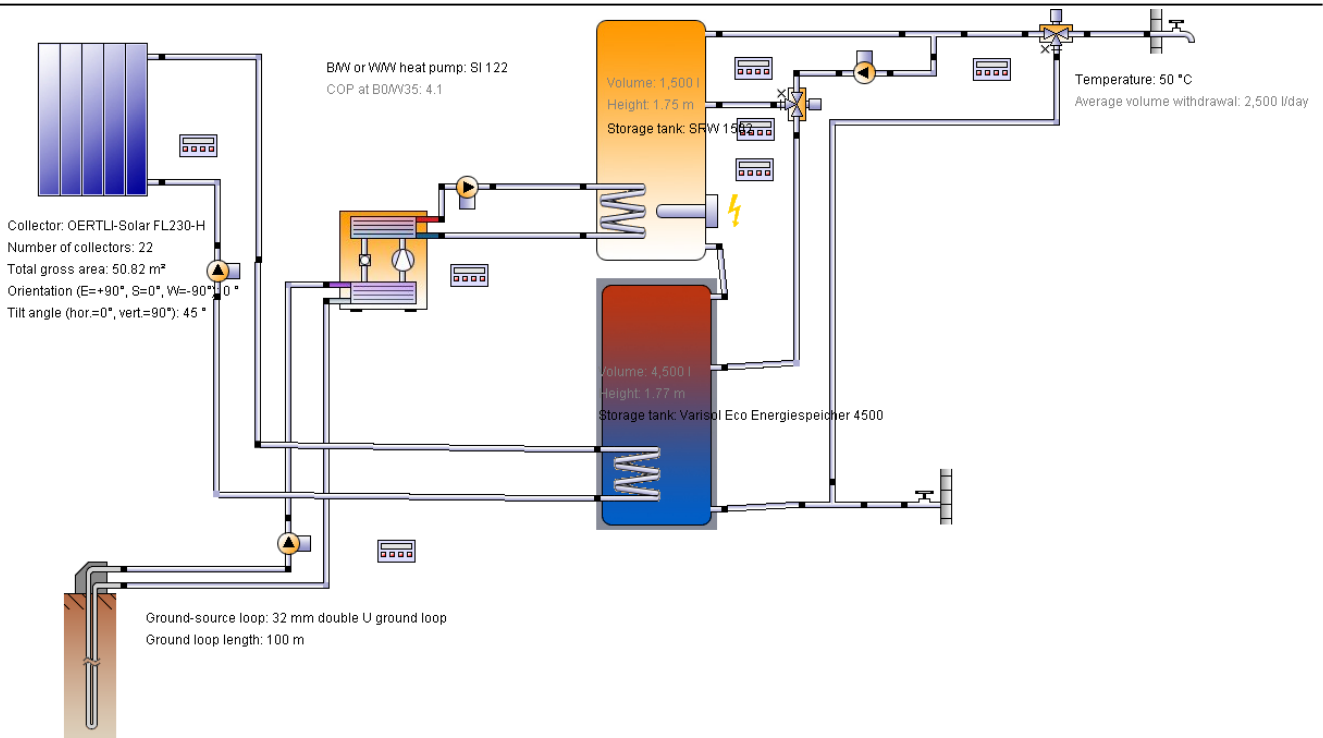


# Professional Report

2

## Preheating: 2 solar water heaters with 1 coil - Standard, brine-to-water heat pump



### 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 [E <sub>tot</sub> ]	5,992.1 kWh
Total energy consumption [Q <sub>use</sub> ]	44,314.3 kWh
System performance (Q <sub>use</sub> / E <sub>tot</sub> )	7.4
Comfort demand	Energy demand covered

# Professional Report

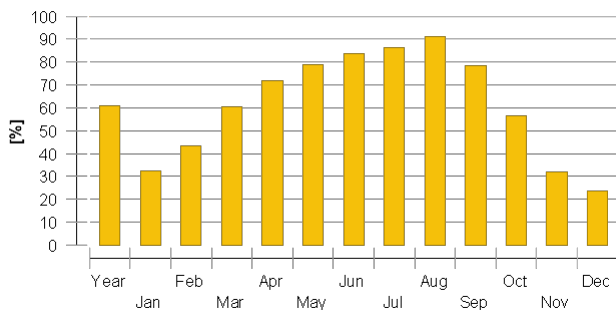
## Overview solar thermal energy (annual values)

Collector area	50.8 m <sup>2</sup>
Solar fraction total	61%
Total annual field yield	28,412 kWh
Collector field yield relating to gross area	559.1 kWh/m <sup>2</sup> /Year
Collector field yield relating to aperture area	645.7 kWh/m <sup>2</sup> /Year
Max. fuel savings	9,261.8 kWh: [Electricity]
Max. energy savings	9,261.8 kWh
Max. reduction in CO2 emissions	4,968 kg

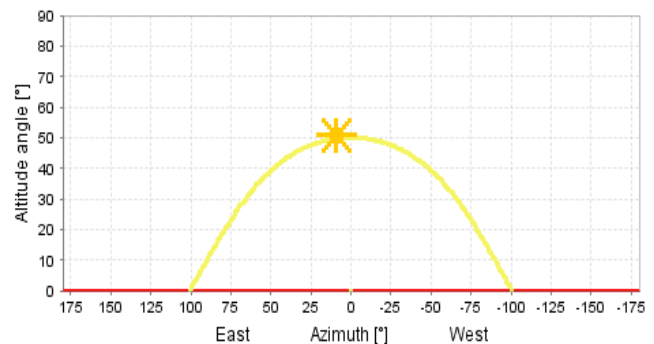
## Overview heat pump (annual values)

Seasonal performance factor (without pump energy)	3.1
Total electrical energy consumption when heating [Eaux]	5,926.9 kWh
Ground loop length (Total)	400 m
Energy withdrawal of the ground-source loop	12,214.7 kWh
Total energy savings	12,254.8 kWh
Total reduction in CO2 emissions	6,573.5 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>B/W or W/W heat pump</b>		<b>SI 122</b>
Seasonal performance factor (without pump energy)		3.07
Energy from/to the system [Qaux]	kWh	18,181.8
CO2 emissions	kg	3,179.2
Fuel and electrical energy consumption [Eaux]	kWh	5,926.9
Energy savings solar thermal	kWh	9,261.8
CO2 savings solar thermal	kg	4,968
Energy savings heat pump	kWh	12,254.8
CO2 savings heat pump	kg	6,573.5
<b>Collector</b>		<b>OERTLI-Solar FL230-H</b>
Data Source		TÜV
Number of collectors		22
Number of arrays		2
Total gross area	m <sup>2</sup>	50.82
Total aperture area	m <sup>2</sup>	44
Total absorber area	m <sup>2</sup>	44
Tilt angle (hor.=0°, vert.=90°)	°	45
Orientation (E=+90°, S=0°, W=-90°)	°	0
Collector field yield [Qsol]	kWh	28,412
Irradiation onto collector area [Esol]	kWh	54,391.3
Collector efficiency [Qsol / Esol]	%	52.2
Direct irradiation after IAM	kWh	27,364.8
<b>Ground-source loop</b>		<b>32 mm double U ground loop</b>
Ground loop length	m	100
Number of ground-source loops		4
Distance between ground loops	m	5
Earth layer 1	m	10 / Limestone
Inflow temperature during operation	°C	5.9
Outflow temperature during operation	°C	7.5
Energy withdrawal of the ground-source loop	kWh	12,214.7
<b>Hot water demand</b>		<b>Constant</b>
Volume withdrawal/daily consumption	l/d	2,501.5
Temperature setting	°C	50
Energy demand [Qdem]	kWh	42,348.4
<b>Pump Solar loop</b>		<b>Eco, small</b>
Circuit pressure drop	bar	0.308
Flow rate	l/h	1,320
Fuel and electrical energy consumption [Epar]	kWh	14.1

# Professional Report

<b>Pump Circulation</b>	<b>Eco, small</b>	
Circuit pressure drop	bar	0.143
Flow rate	l/h	3,600
Fuel and electrical energy consumption [Epar]	kWh	4.6

<b>Pump Heat generator pump</b>	<b>Eco, small</b>	
Circuit pressure drop	bar	0.083
Flow rate	l/h	2,700
Fuel and electrical energy consumption [Epar]	kWh	4.9

<b>Pump Ground-source loop</b>	<b>Eco, large</b>	
Circuit pressure drop	bar	1.053
Flow rate	l/h	8,100
Fuel and electrical energy consumption [Epar]	kWh	41.6

<b>Storage tank Pre-heating</b>	<b>Varisol Eco Energiespeicher 4500</b>	
Volume	l	4,500
Height	m	1.77
Material		Steel
Insulation		Mineral wool
Thickness of insulation	mm	160
Heat loss	kWh	393.5
Connection losses	kWh	102.8

<b>Storage tank Potable water tank</b>	<b>SRW 1502</b>	
Volume	l	1,500
Height	m	1.75
Material		S235 JR G2
Insulation		Flexible polyurethane foam
Thickness of insulation	mm	100
Heat loss	kWh	677.8
Connection losses	kWh	445.7

## Loop

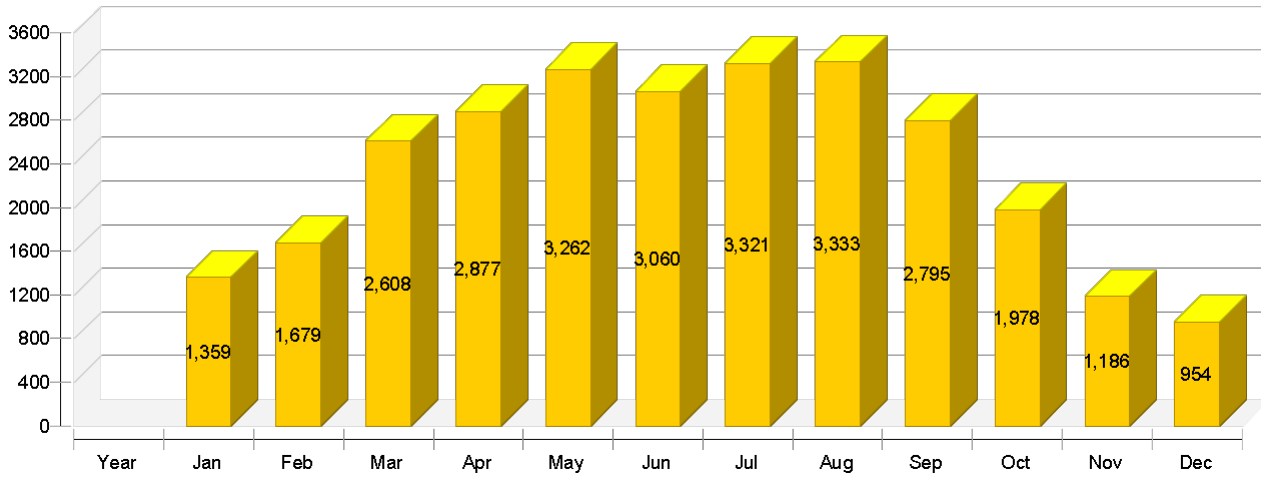
<b>Solar loop</b>		
Fluid mixture		Propylene mixture
Fluid concentration	%	33.3
Fluid domains volume	l	90.9
Pressure on top of the circuit	bar	4

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Demo Version

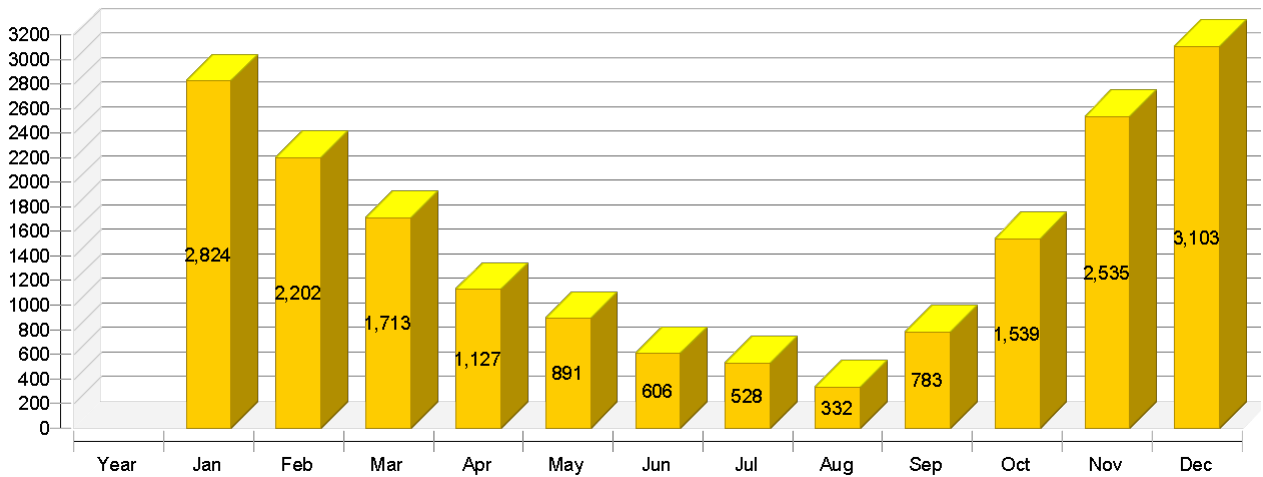
Solar thermal energy to the system [Qsol]

kWh



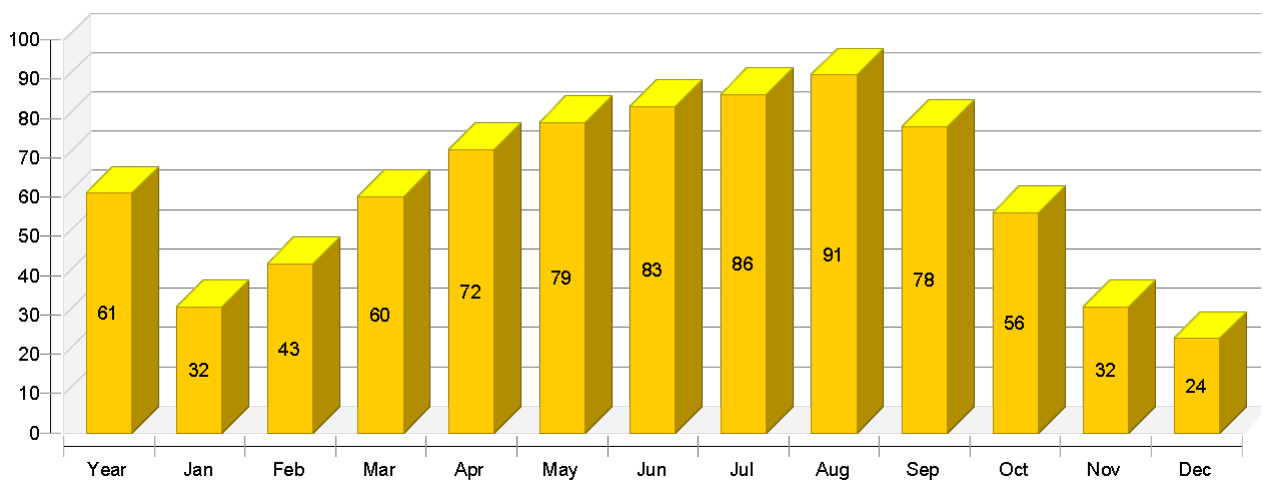
Heat generator energy to the system (solar thermal energy not included) [Qaux]

kWh



Solar fraction: fraction of solar energy to system [SFn]

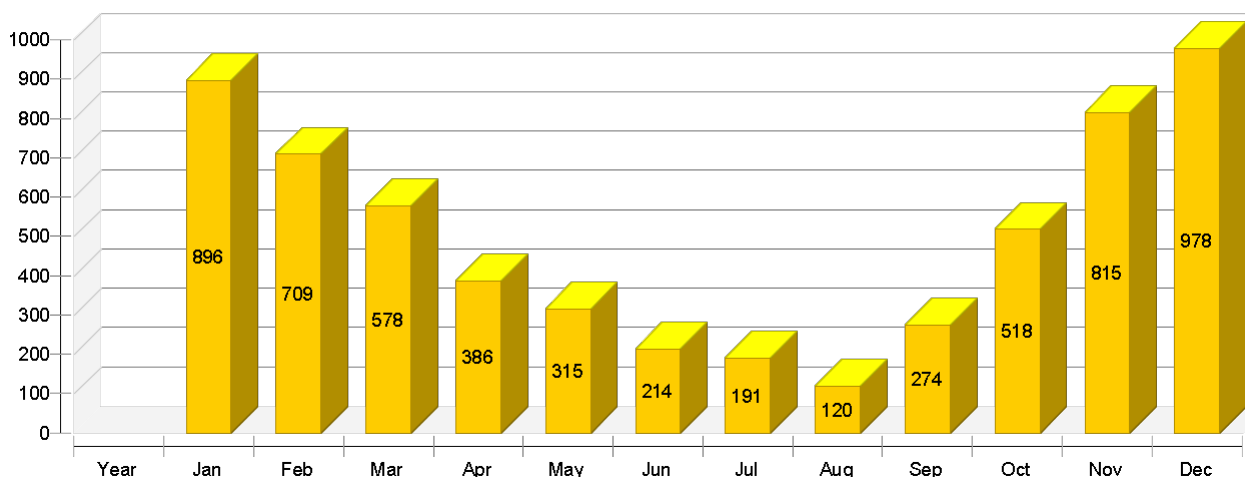
%



# Professional Report

Total fuel and/or electrical energy consumption of the system [Etot]

kWh



Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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## Solar thermal energy to the system [Qsol]

kWh	28412	1359	1679	2608	2877	3262	3060	3321	3333	2795	1978	1186	954
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## Heat generator energy to the system (solar thermal energy not included) [Qaux]

kWh	18182	2824	2202	1713	1127	891	606	528	332	783	1539	2535	3103
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## Heat generator fuel and electrical energy consumption [Eaux]

kWh	5927	888	702	572	381	310	211	187	117	271	512	807	969
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## Solar fraction: fraction of solar energy to system [SFn]

%	61	32.5	43.3	60.4	71.9	78.5	83.5	86.3	91	78.1	56.2	31.9	23.5
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## Total fuel and/or electrical energy consumption of the system [Etot]

kWh	5992	896	709	578	386	315	214	191	120	274	518	815	978
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## Irradiation onto collector area [Esol]

kWh	54391	2507	3172	4884	5564	6163	6005	6593	6419	5242	3752	2265	1827
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## Electrical energy consumption of pumps [Epar]

kWh	65	8	7	6	5	4	4	3	3	4	5	7	9
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## Total energy consumption [Quse]

kWh	44314	4016	3692	4079	3864	3826	3545	3517	3444	3338	3545	3578	3870
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## Heat loss to indoor room (including heat generator losses) [Qint]

kWh	2188	132	131	173	189	210	221	239	245	204	185	137	123
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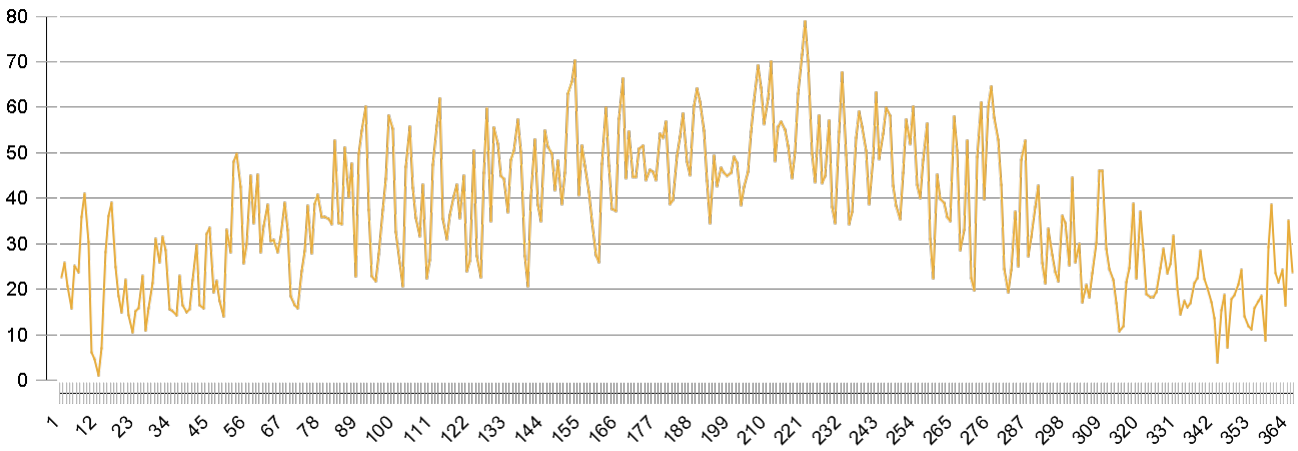
## Heat loss to surroundings (without collector losses) [Qext]

kWh	31	2	2	3	3	3	3	4	4	3	2	1	1
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# Professional Report

## Collector

Daily maximum temperature [ °C]



## Energy flow diagram (annual balance)

