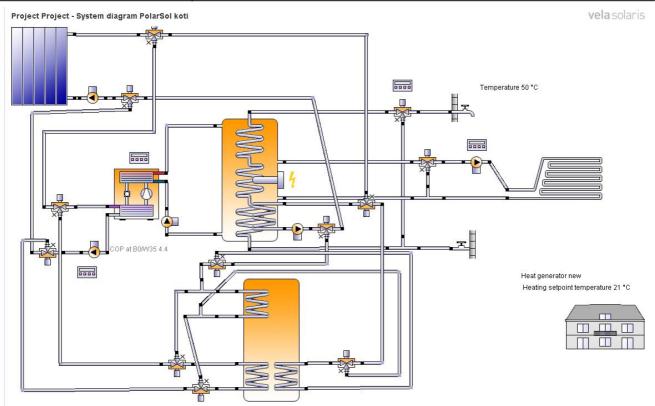




Project PolarSol koti 41\193\-



Location of the system

Map section

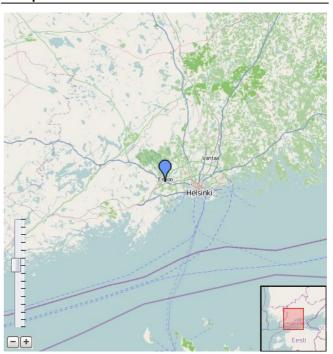
Espoo

Longitude: 24.659° Latitude: 60.213° Elevation: 10 m

### This report has been created by:

Anton Serbin

Dealer: www.profil.fi Annerman Oy





# **Professional Report**



PolarSol Oy Nurmeksentie 80, 80100 Joseph Field +358 4405 58098 +358 4420 22028 www.polarsol.com

### Comments on the project

### Photograph of property

Projekt in Espoo



### System overview (annual values)

Total fuel and/or electrical energy consumption of the system [Etot]	5,624.9 kWh
Total energy consumption [Quse]	18,985 kWh
System performance (Quse / Etot)	3.38
Comfort demand	Energy demand covered

### Overview solar thermal energy (annual values)

Collector area	8.9 m²
Solar fraction total	99.9%
Solar fraction hot water [SFnHw]	99.9 %
Solar fraction building [SFnBd]	99.9 %
Total annual field yield	6,570.5 kWh
Collector field yield relating to gross area	739.2 kWh/m²/Year
Collector field yield relating to aperture area	821.3 kWh/m²/Year
Max. energy savings	1,752.5 kWh
Max. reduction in CO2 emissions	940 kg



## **Professional Report**





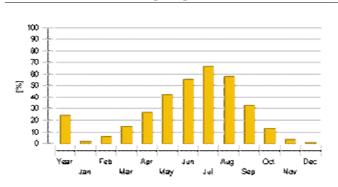


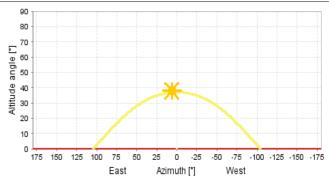
### Overview heat pump (annual values)

Seasonal performance factor (without pump energy)	3.7
Total electrical energy consumption when heating [Eaux]	5,562.9 kWh
Total energy savings	15,294.2 kWh
Total reduction in CO2 emissions	8,203.8 kg

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

### Horizon line





### **Meteorological data-Overview**

Average outdoor temperature	5.8 °C
Global irradiation, annual sum	966.3 kWh/m²
Diffuse irradiation, annual sum	440.3 kWh/m²

#### Component overview (annual values)

B/W or W/W heat pump	Thermalia® 5P	Thermalia® 5P					
Seasonal performance factor (without pump energy)		3.75					
Energy from/to the system [Qaux]	kWh	20,857.1					
CO <sub>2</sub> emissions	kg	2,983.9					
Fuel and electrical energy consumption [Eaux]	kWh	5,562.9					
Energy savings solar thermal	kWh	1,752.5					
CO <sub>2</sub> savings solar thermal	kg	940					
Energy savings heat pump	kWh	15,294.2					
CO <sub>2</sub> savings heat pump	kg	8,203.8					



Total gross area         m²         8.89           Total aperture area         m²         8           Total absorber area         m²         8           Tilt angle (hor.=0°, vert.=90°)         °         30           Orientation (E=+90°, S=0°, W=-90°)         °         0           Collector field yield [Qsol]         kWh         6,570.5           Irradiation onto collector area [Esol]         kWh         9,434.7           Collector efficiency [Qsol / Esol]         %         69.6           Direct irradiation after IAM         kWh         5,243.1           Diffuse irradiation after IAM         kWh         3,581.4           Building           Heated/air-conditioned living area         m²         150           Heating setpoint temperature         °C         21           Heating energy demand excluding DHW [Qdem]         kWh         15,500           Annual specific heating energy demand         kWh/m²         103.3           Useful heat gain         kWh         31,000           Total energy losses         kWh         46,499.9           Convector         Floor heating 1000W           Number of heating/cooling modules         -         13           Power per heating module under standard con	Collector 2	Flat-plate collecte	or, premium quality				
Number of arrays         1           Total gross area         m²         8.89           Total aperture area         m²         8           Total absorber area         m²         8           Tilt angle (hor.=0°, vert.=90°)         °         30           Orientation (E=+90°, S=0°, W=-90°)         °         0           Collector field yield [Qsol]         kWh         6,570.5           Irradiation onto collector area [Esol]         kWh         9,434.7           Collector efficiency [Qsol / Esol]         %         69.6           Direct irradiation after IAM         kWh         5,243.1           Diffuse irradiation after IAM         kWh         3,581.4           Building         -           Heated/air-conditioned living area         m²         150           Heating setpoint temperature         °C         21           Heating energy demand excluding DHW [Qdem]         kWh         15,500           Annual specific heating energy demand         kWh/m²         103.3           Useful heat gain         kWh         31,000           Total energy losses         kWh         46,499.9           Convector         Floor heating 1000W           Number of heating/cooling modules         -         13	Data Source		SPF				
Total gross area         m²         8.89           Total aperture area         m²         8           Total absorber area         m²         8           Tilt angle (hor.=0°, vert.=90°)         °         30           Orientation (E=+90°, S=0°, W=-90°)         °         0           Collector field yield [Qsol]         kWh         6,570.5           Irradiation onto collector area [Esol]         kWh         9,434.7           Collector efficiency [Qsol / Esol]         %         69.6           Direct irradiation after IAM         kWh         5,243.1           Diffuse irradiation after IAM         kWh         3,581.4           Building           Heated/air-conditioned living area         m²         150           Heating setpoint temperature         °C         21           Heating energy demand excluding DHW [Qdem]         kWh         15,500           Annual specific heating energy demand         kWh/m²         103.3           Useful heat gain         kWh         31,000           Total energy losses         kWh         46,499.9           Convector         Floor heating 1000W           Number of heating/cooling modules         -         13           Power per heating module under standard con	Number of collectors		4.44				
Total aperture area m² 8 Total absorber area m² 8 Tilt angle (hor.=0°, vert.=90°) ° 30 Orientation (E=+90°, S=0°, W=-90°) ° 0 Collector field yield [Qsol] kWh 6,570.5 Irradiation onto collector area [Esol] kWh 9,434.7 Collector efficiency [Qsol / Esol] % 69.6 Direct irradiation after IAM kWh 5,243.1 Diffuse irradiation after IAM kWh 3,581.4  Building	Number of arrays		1				
Total absorber area  Tilt angle (hor.=0°, vert.=90°)  Orientation (E=+90°, S=0°, W=-90°)  Collector field yield [Qsol]  Irradiation onto collector area [Esol]  KWh  9,434.7  Collector efficiency [Qsol / Esol]  MWh  3,581.4   Building	Total gross area	m²	8.89				
Tilt angle (hor.=0°, vert.=90°) Orientation (E=+90°, S=0°, W=-90°) Collector field yield [Qsol] Irradiation onto collector area [Esol] Irradiation onto collector area [Esol] Irradiation onto collector area [Esol] Irradiation after IAM Collector efficiency [Qsol / Esol] Why 9,434.7 Collector efficiency [Qsol / Esol] Why 69.6 Direct irradiation after IAM Why 5,243.1 Diffuse irradiation after IAM Why 3,581.4   Building	Total aperture area	m²	8				
Orientation (E=+90°, S=0°, W=-90°)  Collector field yield [Qsol] kWh 6,570.5  Irradiation onto collector area [Esol] kWh 9,434.7  Collector efficiency [Qsol / Esol] % 69.6  Direct irradiation after IAM kWh 5,243.1  Diffuse irradiation after IAM kWh 3,581.4   Building	Total absorber area	m²	8				
Collector field yield [Qsol] kWh 6,570.5  Irradiation onto collector area [Esol] kWh 9,434.7  Collector efficiency [Qsol / Esol] % 69.6  Direct irradiation after IAM kWh 5,243.1  Diffuse irradiation after IAM kWh 3,581.4   Building	Tilt angle (hor.=0°, vert.=90°)	0	30				
Irradiation onto collector area [Esol] kWh 9,434.7  Collector efficiency [Qsol / Esol] % 69.6  Direct irradiation after IAM kWh 5,243.1  Diffuse irradiation after IAM kWh 3,581.4   Building	Orientation (E=+90°, S=0°, W=-90°)	0	0				
Collector efficiency [Qsol / Esol] % 69.6 Direct irradiation after IAM kWh 5,243.1 Diffuse irradiation after IAM kWh 3,581.4  Building	Collector field yield [Qsol]	kWh	6,570.5				
Direct irradiation after IAM Diffuse irradiation after IAM  Revitable  Building  Heated/air-conditioned living area Heating setpoint temperature  C Heating energy demand excluding DHW [Qdem] Annual specific heating energy demand Revitable Revitab	Irradiation onto collector area [Esol]	kWh	9,434.7				
Diffuse irradiation after IAM kWh 3,581.4    Building	Collector efficiency [Qsol / Esol]	%	69.6				
Building  Heated/air-conditioned living area m² 150  Heating setpoint temperature °C 21  Heating energy demand excluding DHW [Qdem] kWh 15,500  Annual specific heating energy demand kWh/m² 103.3  Useful heat gain kWh 31,000  Total energy losses kWh 46,499.9  Convector Floor heating 1000W  Number of heating/cooling modules - 13  Power per heating module under standard conditions  Nominal inlet temperature °C 45  Nominal return temperature °C 35  Net energy from/to heating/cooling modules  Hot water demand  Constant	Direct irradiation after IAM	kWh	5,243.1				
Heated/air-conditioned living area m² 150  Heating setpoint temperature °C 21  Heating energy demand excluding DHW [Qdem] kWh 15,500  Annual specific heating energy demand kWh/m² 103.3  Useful heat gain kWh 31,000  Total energy losses kWh 46,499.9  Convector Floor heating 1000W  Number of heating/cooling modules - 13  Power per heating module under standard conditions  Nominal inlet temperature °C 45  Nominal return temperature °C 35  Net energy from/to heating/cooling modules kWh 15,384.8  Hot water demand  Constant	Diffuse irradiation after IAM	kWh	3,581.4				
Heated/air-conditioned living area m² 150  Heating setpoint temperature °C 21  Heating energy demand excluding DHW [Qdem] kWh 15,500  Annual specific heating energy demand kWh/m² 103.3  Useful heat gain kWh 31,000  Total energy losses kWh 46,499.9  Convector Floor heating 1000W  Number of heating/cooling modules - 13  Power per heating module under standard conditions  Nominal inlet temperature °C 45  Nominal return temperature °C 35  Net energy from/to heating/cooling modules kWh 15,384.8  Hot water demand  Constant							
Heating setpoint temperature  "C 21  Heating energy demand excluding DHW [Qdem] kWh 15,500  Annual specific heating energy demand kWh/m² 103.3  Useful heat gain kWh 31,000  Total energy losses kWh 46,499.9  Convector Floor heating 1000W  Number of heating/cooling modules - 13  Power per heating module under standard conditions  Nominal inlet temperature "C 45  Nominal return temperature "C 35  Net energy from/to heating/cooling modules  Hot water demand  Constant							
Heating energy demand excluding DHW [Qdem] kWh 15,500  Annual specific heating energy demand kWh/m² 103.3  Useful heat gain kWh 31,000  Total energy losses kWh 46,499.9  Convector Floor heating 1000W  Number of heating/cooling modules - 13  Power per heating module under standard conditions  Nominal inlet temperature °C 45  Nominal return temperature °C 35  Net energy from/to heating/cooling modules  Hot water demand  Constant							
Annual specific heating energy demand kWh/m² 103.3  Useful heat gain kWh 31,000  Total energy losses kWh 46,499.9  Convector Floor heating 1000W  Number of heating/cooling modules - 13  Power per heating module under standard conditions W 1,000  Nominal inlet temperature °C 45  Nominal return temperature °C 35  Net energy from/to heating/cooling modules kWh 15,384.8  Hot water demand Constant	· · · · · · · · · · · · · · · · · · ·						
Useful heat gain  Total energy losses  kWh  46,499.9  Convector  Floor heating 1000W  Number of heating/cooling modules  Power per heating module under standard conditions  Nominal inlet temperature  °C  Nominal return temperature  °C  35  Net energy from/to heating/cooling modules  kWh  15,384.8  Constant	Heating energy demand excluding DHW [Qdem]		15,500				
Total energy losses kWh 46,499.9  Convector Floor heating 1000W  Number of heating/cooling modules - 13  Power per heating module under standard conditions  Nominal inlet temperature °C 45  Nominal return temperature °C 35  Net energy from/to heating/cooling modules kWh 15,384.8  Hot water demand Constant	Annual specific heating energy demand	kWh/m²	103.3				
Convector  Number of heating/cooling modules  Power per heating module under standard conditions  Nominal inlet temperature  Nominal return temperature  C 35  Net energy from/to heating/cooling modules  Floor heating 1000W  1,000  45  C 45  Nominal return temperature  C 35  Net energy from/to heating/cooling modules  Constant  Constant	Useful heat gain	kWh	31,000				
Number of heating/cooling modules  Power per heating module under standard conditions  Nominal inlet temperature  °C  Nominal return temperature  °C  35  Net energy from/to heating/cooling modules  Constant  13  1,000  45  15,384.8	Total energy losses	kWh	46,499.9				
Number of heating/cooling modules  Power per heating module under standard conditions  Nominal inlet temperature  °C  Nominal return temperature  °C  35  Net energy from/to heating/cooling modules  Constant  13  1,000  45  15,384.8	Convector	Floor heating 100	00W				
Conditions  Nominal inlet temperature  °C  V  45  Nominal return temperature  °C  35  Net energy from/to heating/cooling modules  KWh  15,384.8  Constant	Number of heating/cooling modules	_	13				
Nominal return temperature  °C 35  Net energy from/to heating/cooling modules  kWh 15,384.8  Hot water demand  Constant	Power per heating module under standard conditions	W	1,000				
Net energy from/to heating/cooling modules kWh 15,384.8  Hot water demand Constant	Nominal inlet temperature	°C	45				
Hot water demand Constant	Nominal return temperature	°C	35				
	Net energy from/to heating/cooling modules	kWh	15,384.8				
	Hot water demand	Constant					
	Volume withdrawal/daily consumption		202				

Pump 2	Pump Eco, small	
Circuit pressure drop	bar	0.004
Flow rate	I/h	660
Fuel and electrical energy consumption [Epar]	kWh	19.5

50

3,790.7

°C

kWh



Temperature setting

Energy demand [Qdem]

# **Professional Report**



Pump Eco, small	
bar	0.005
l/h	619.1
kWh	14
Pump Eco, small	
bar	0.088
I/h	2,640
kWh	19.5
Pump Eco, small	
bar	97.18
l/h	3,600
l/h kWh	3,600 9.1
	9.1
kWh	9.1
kWh  Combined solar t	9.1 cank HTS 1450
kWh Combined solar t	9.1 cank HTS 1450 1,450
kWh Combined solar t	9.1 <b>Eank HTS 1450</b> 1,450 2.19
kWh Combined solar t	9.1  Fank HTS 1450  1,450  2.19  Steel
kWh  Combined solar t  I  m	9.1  tank HTS 1450  1,450  2.19  Steel Rigid PU foam
kWh  Combined solar to the sola	9.1  Fank HTS 1450  1,450  2.19  Steel Rigid PU foam  80
kWh  Combined solar to the sola	9.1  cank HTS 1450  1,450  2.19  Steel Rigid PU foam  80 784.5
kWh  Combined solar to the sola	9.1  cank HTS 1450  1,450  2.19  Steel Rigid PU foam  80 784.5
kWh  Combined solar to the sola	9.1  ank HTS 1450  1,450  2.19  Steel Rigid PU foam  80  784.5  529.4
kWh  Combined solar form  mm  kWh kWh	9.1  Fank HTS 1450  1,450  2.19  Steel Rigid PU foam  80  784.5  529.4
kWh  Combined solar form  mm  kWh kWh	9.1  Fank HTS 1450  1,450  2.19  Steel Rigid PU foam  80  784.5  529.4
	I/h kWh  Pump Eco, small bar I/h kWh  Pump Eco, small

kWh

kWh

-2,269.6

-50

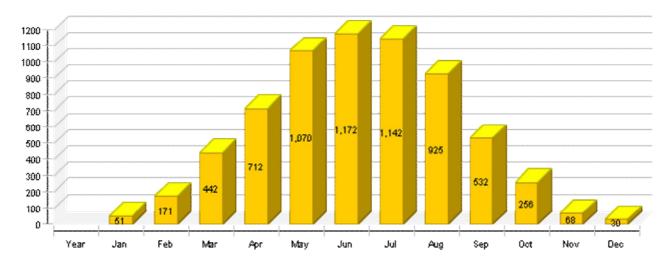


**Heat loss** 

Connection losses

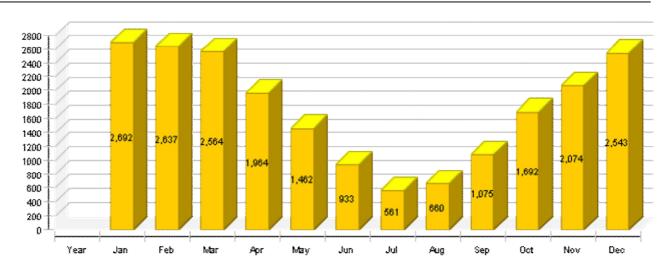
### Solar thermal energy to the system [Qsol]

kWh



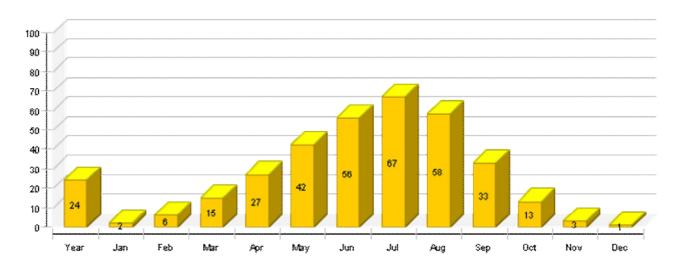
Heat generator energy to the system (solar thermal energy not included) [Qaux]

kWh



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

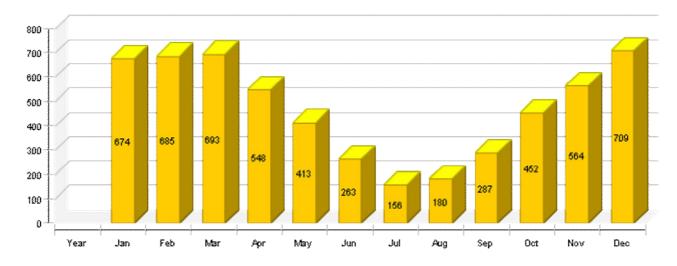
%



polysun

### 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
Solar thermal energy to the system [Qsol]													
kWh	6571	51	171	442	712	1070	1172	1142	925	532	256	68	30
Heat (	Heat generator energy to the system (solar thermal energy not included) [Qaux]												
kWh	20857	2692	2637	2564	1964	1462	933	561	660	1075	1692	2074	2543
Heat	generate	or fuel a	nd elec	trical e	nergy c	onsump	tion [Ea	aux]					
kWh	5563	668	678	686	542	408	259	154	177	284	447	559	702
Solar	fraction	ı: fractio	on of so	lar ene	rgy to s	ystem [	SFn]						
%	24	1.9	6.1	14.7	26.6	42.3	55.7	67	58.4	33.1	13.2	3.2	1.2
Total	fuel and	d/or elec	ctrical e	nergy c	onsum	otion of	the sys	tem [Et	ot]				
kWh	5625	674	685	693	548	413	263	156	180	287	452	564	709
Irradi	ation on	to colle	ctor are	ea [Esol	]								
kWh	9435	149	379	771	1071	1467	1522	1446	1202	764	426	154	82
Electi	rical ene	ergy cor	nsumpti	ion of p	umps [E	Epar]							
kWh	62	7	7	7	6	5	4	3	3	4	5	6	7
Heat I	loss to i	ndoor r	oom (in	cluding	heat g	enerato	r losses	) [Qint]					
kWh	-442	102	16	-51	-85	-102	-88	-54	-14	6	-7	-49	-116
Heat loss to surroundings (without collector losses) [Qext]													
kWh	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	energy	consun	nption [	Quse]									
kWh	18985	2521	2503	2379	1804	1299	783	413	510	927	1535	1906	2406







# Collector 2 Daily maximum temperature [ °C]

