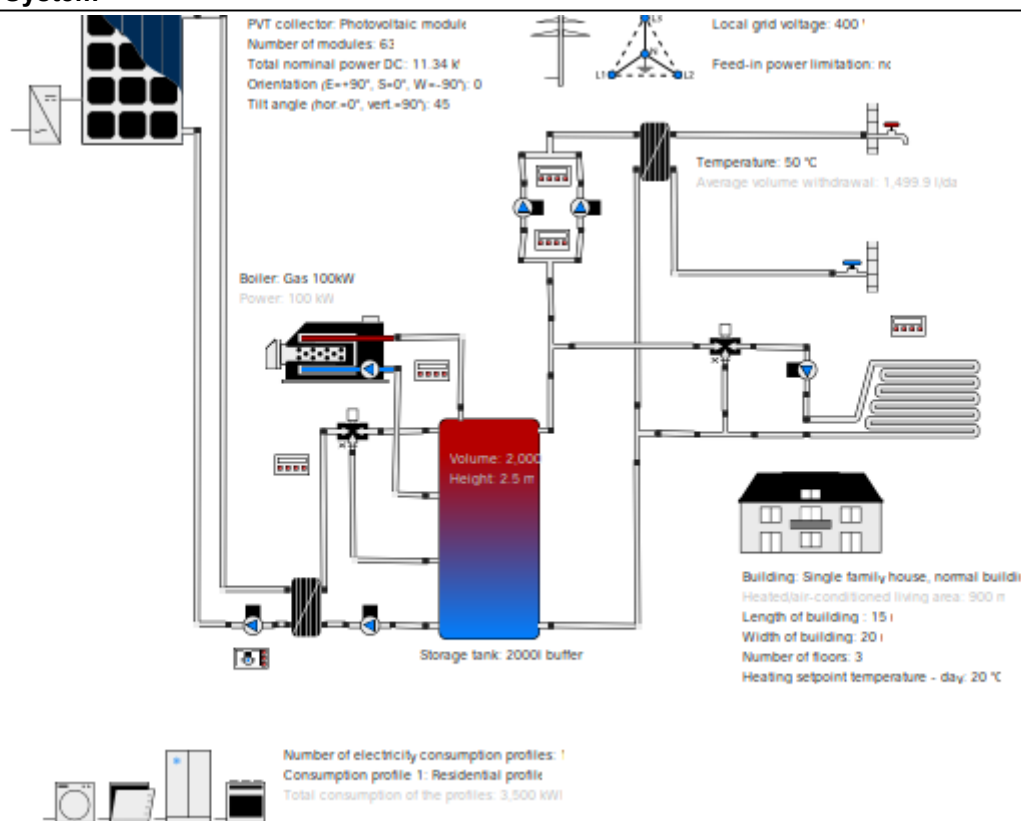


Etems Photovoltaic Thermal (PVT) System

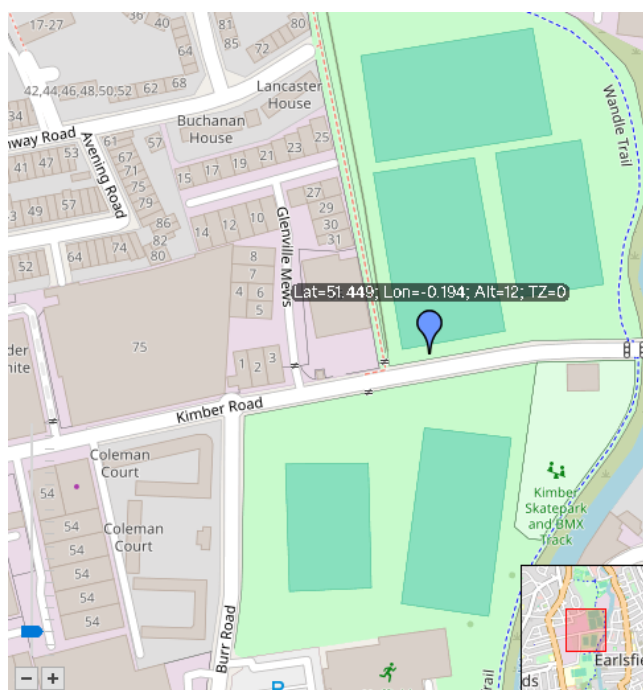
59d: Domestic hot water and space heating, preheating by PVT



Location of the system

Wandsworth Town
Longitude: -0.194°
Latitude: 51.449°
Elevation: 12 m

Map section



This report has been created by:

Etems K2354862

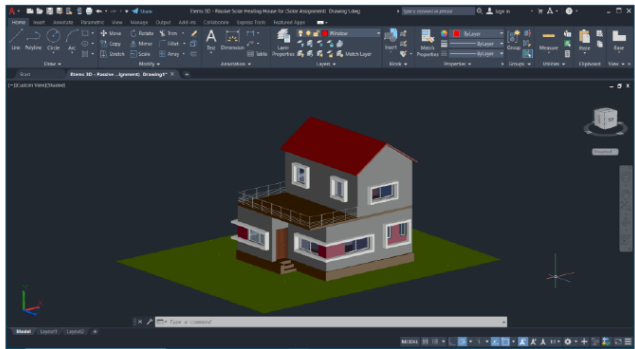
Kingston University
Kingston

Professional Report

Comments on the project

Family house design on AutoCAD 3D for the Photovoltaic Thermal (PVT) Collector system

Photograph of property



System overview (annual values)

Total fuel and/or electricity consumption of the system [Etot]	79,967 kWh
Total electricity consumption [Ecs]	3,629 kWh
Total gas consumption [Egas]	86,696 kWh
Total energy consumption [Quse]	76,418 kWh
System performance $[(Quse+Einv) / (Eaux+Epar)]$	0.88
Primary energy factor	1.25
Comfort demand	Energy demand covered

Overview solar thermal energy (annual values)

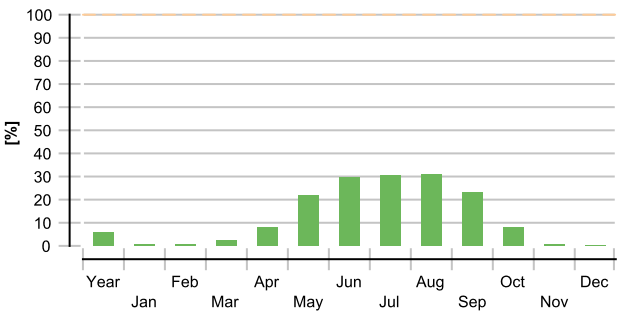
Collector area	80.6 m²
Solar fraction total	5.9%
Solar fraction hot water [SFnHw]	18.2 %
Solar fraction building [SFnBd]	3.3 %
Total annual field yield	4,722.3 kWh
Collector field yield relating to gross area	58.6 kWh/m²/Year
Collector field yield relating to aperture area	58.6 kWh/m²/Year
Max. fuel savings	499.7 m³(gas): [Natural gas H]
Max. energy savings	15,604 kWh
Max. reduction in CO2 emissions	1,215 kg

Overview electricity (annual values)

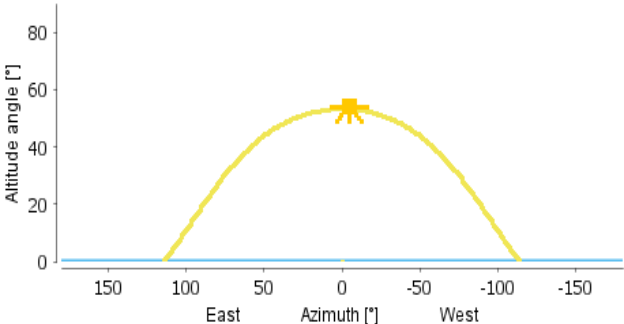
Annual consumption	3,629 kWh
Self-consumption	1,555 kWh
Self-consumption fraction	15 %
Degree of self-sufficiency	42.9 %

Professional Report

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



Horizon line



Meteorological data-Overview

Average outdoor temperature	11.9 °C
Global irradiation, annual sum	998 kWh/m²
Diffuse irradiation, annual sum	548 kWh/m²

Component overview (annual values)

Boiler 2		Gas 100kW	
Power	kW		100
Total efficiency	%		87.4
Energy from/to the system [Qaux]	kWh		75,792
Fuel and electricity consumption [Eaux]	kWh		86,696
Fuel consumption of the back-up boiler [Baux]	m³(gas)		8,257
Energy savings solar thermal	kWh		5,247
CO2 savings solar thermal	kg		1,215
Fuel savings solar thermal	m³(gas)		500
Exhaust fumes losses [Qex]	kWh		8,670
Electric consumers		Standard	
Electricity consumption [Ecs]	kWh		3,629
Electricity consumption of the profiles [Epcs]	kWh		3,500
Electricity consumption of the thermal components [Ethcs]	kWh		129
Self-consumption [Eocs]	kWh		1,555
Self-consumption fraction [Rocs]	%		15
Degree of self-sufficiency [Raut]	%		42.9

Professional Report

PVT collector		Photovoltaic module	
Data Source		Enecolo	
Number of modules		63	
Collector aperture area	m ²	80.6	
Tilt angle (hor.=0°, vert.=90°)	°	45	
Orientation (E=+90°, S=0°, W=-90°)	°	0	
Global irradiation after IAM	kWh	89,378	
Diffuse irradiation after IAM	kWh	42,895	
Collector field yield [Qsol]	kWh	4,722	
Total nominal power DC	kW	11.34	
Performance ratio [PerfR]	%	78.9	
Inverter 1: Name		Inverter	
Inverter 1: Manufacturer		Anonymous	
Layout 1: Number of inverters		9	
Layout 1: A number of strings		1	
Layout 1: A modules per string		7	
Energy production DC [Qpvf]	kWh	12,059	
Energy production AC [Qinv]	kWh	10,357	
Specific annual yield	kWh/kWp	913	
Building		Single family house, normal building	
Heated/air-conditioned living area	m ²	900	
Setpoint room temperature	°C	19.5	
Heating energy demand excluding DHW [Qdem]	kWh	49,486	
Specific heating energy demand excluding DHW [Qdem]	kWh/m ²	55	
Solar gain through windows	kWh	56,182	
Total energy losses	kWh	128,275	
Heating/Cooling element		Floor heating	
Power per heating/cooling element under standard conditions	W	1,000	
Nominal inlet temperature	°C	35	
Nominal return temperature	°C	28	
Net energy from/to heating/cooling modules	kWh	49,383	
Hot water demand		Daily peaks	
Volume withdrawal/daily consumption	l/d	1,500	
Temperature setting	°C	50	
Energy demand [Qdem]	kWh	24,241	
External heat exchanger Solar loop		medium	
Transfer capacity	W/K	10,000	
External heat exchanger Potable water		large	
Transfer capacity	W/K	17,000	

Professional Report

Pump Transfer circuit		Eco, medium	
Circuit pressure drop	bar		0.125
Flow rate	l/h		357
Fuel and electricity consumption [Epar]	kWh		19.4
Pump Solar loop		Eco, large	
Circuit pressure drop	bar		3.297
Flow rate	l/h		62
Fuel and electricity consumption [Epar]	kWh		48.5
Pump Heating loop		Eco, medium	
Circuit pressure drop	bar		0.375
Flow rate	l/h		592
Fuel and electricity consumption [Epar]	kWh		32
Pump Potable water		Eco, large	
Circuit pressure drop	bar		0.012
Flow rate	l/h		47.9
Fuel and electricity consumption [Epar]	kWh		27.5
Pump Potable water		Eco, large	
Circuit pressure drop	bar		0.02
Flow rate	l/h		2.7
Fuel and electricity consumption [Epar]	kWh		1.2
Storage tank Buffer tank		2000l buffer	
Volume	l		2,000
Height	m		2.5
Material			Steel
Insulation			Rigid PU foam
Thickness of insulation	mm		100
Heat loss [Qhl]	kWh		692
Connection losses	kWh		297

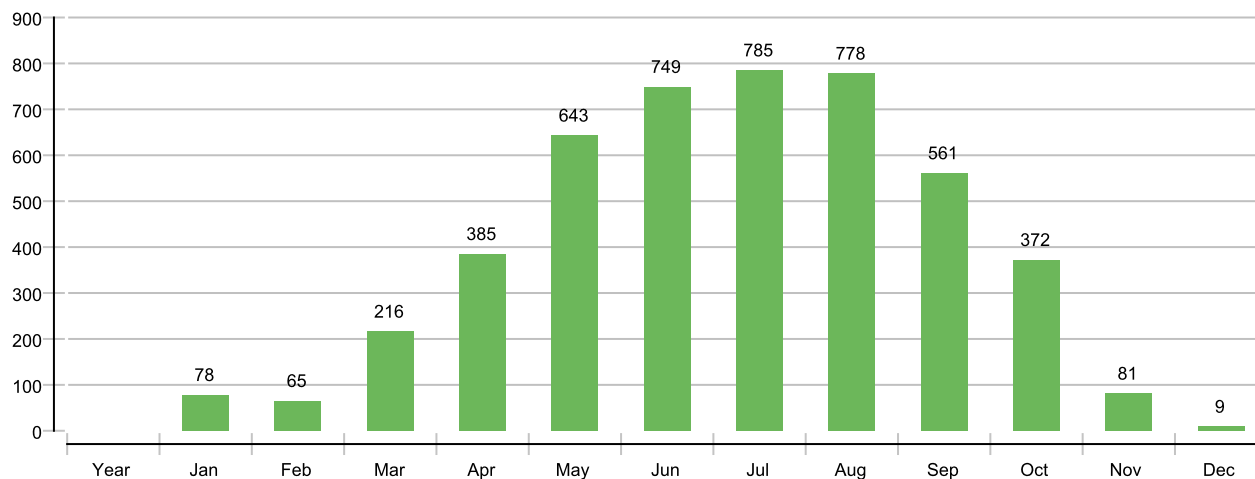
Loop

Solar loop			
Fluid mixture			Propylene mixture
Fluid concentration	%		33.3
Fluid domains volume	l		286
Pressure on top of the circuit	bar		4

Professional Report

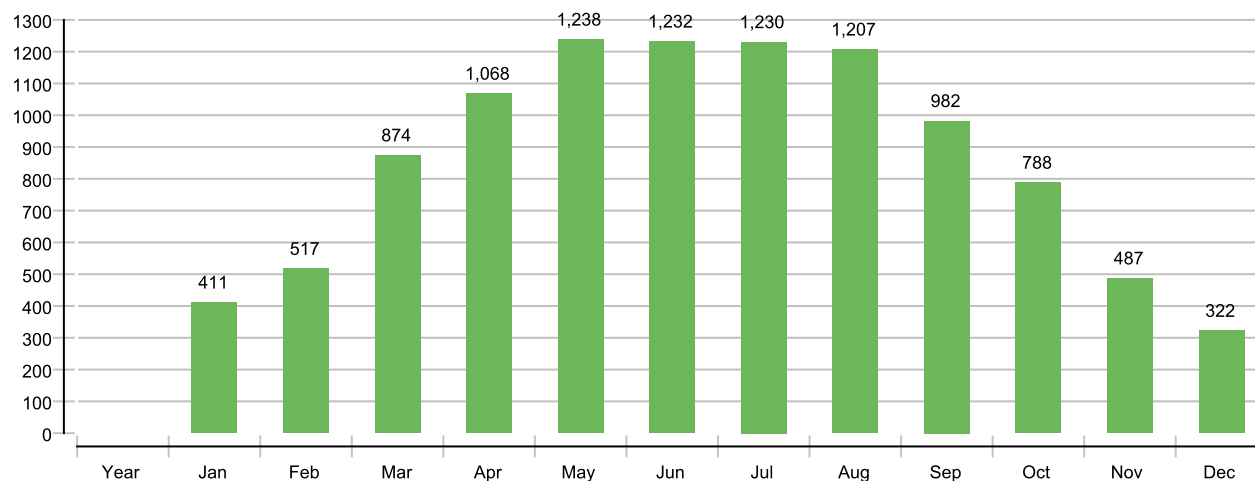
Solar thermal energy to the system [Qsol]

kWh



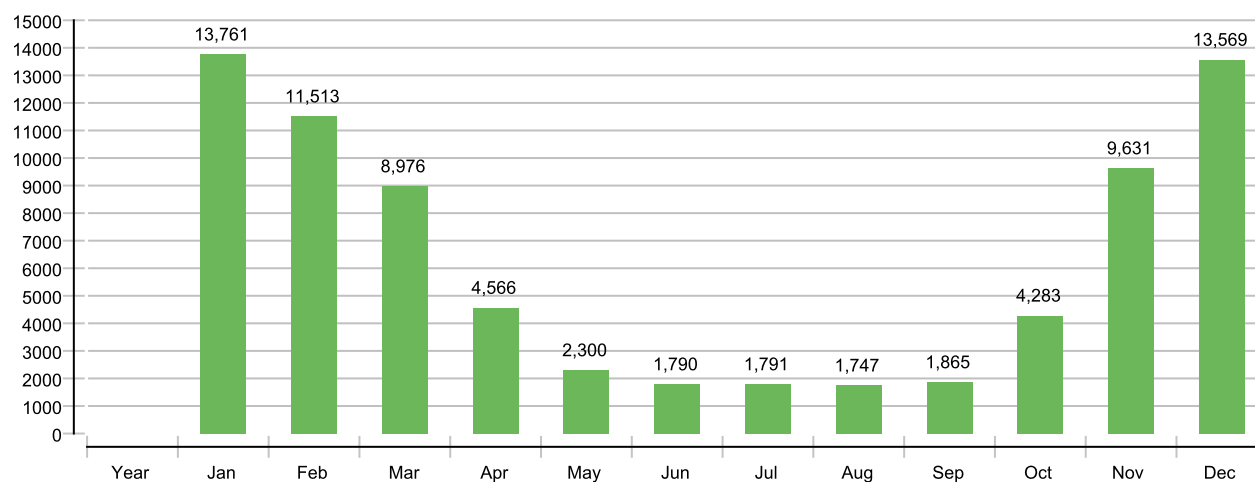
Yield Photovoltaics AC [Qinv]

kWh



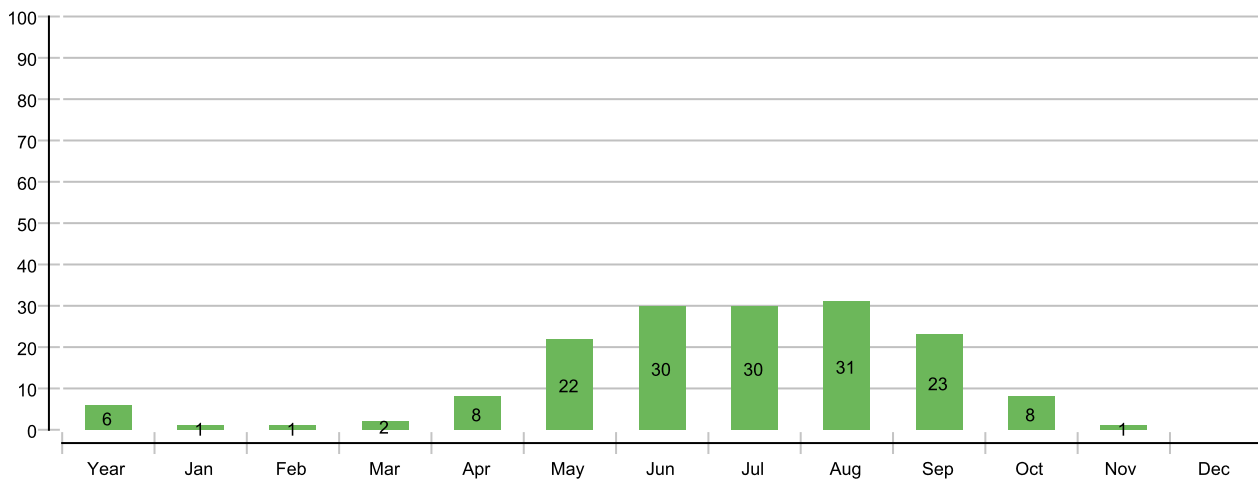
Heat generator energy to the system (solar thermal energy not included) [Qaux]

kWh

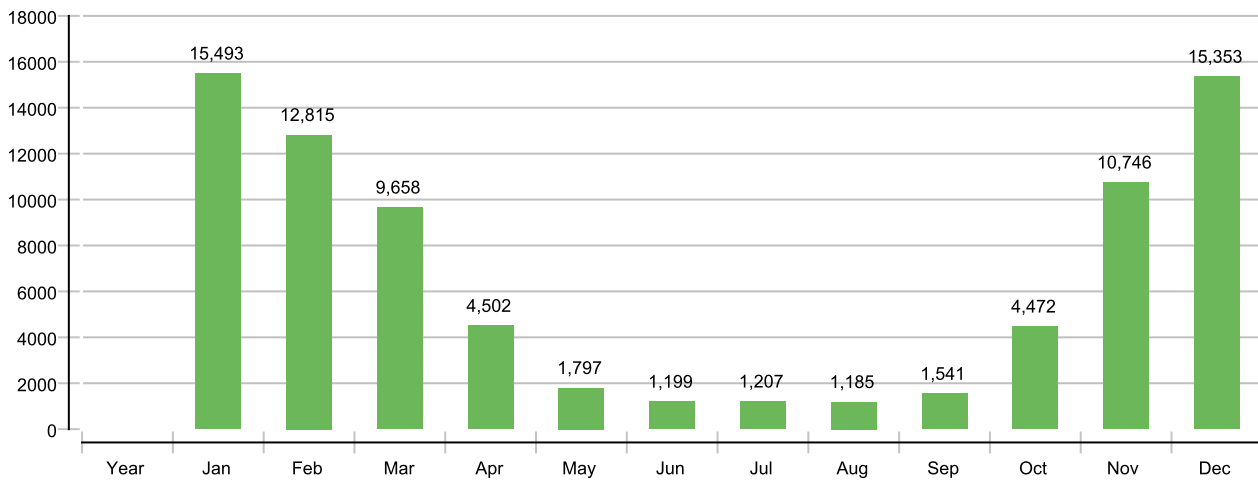


Professional Report

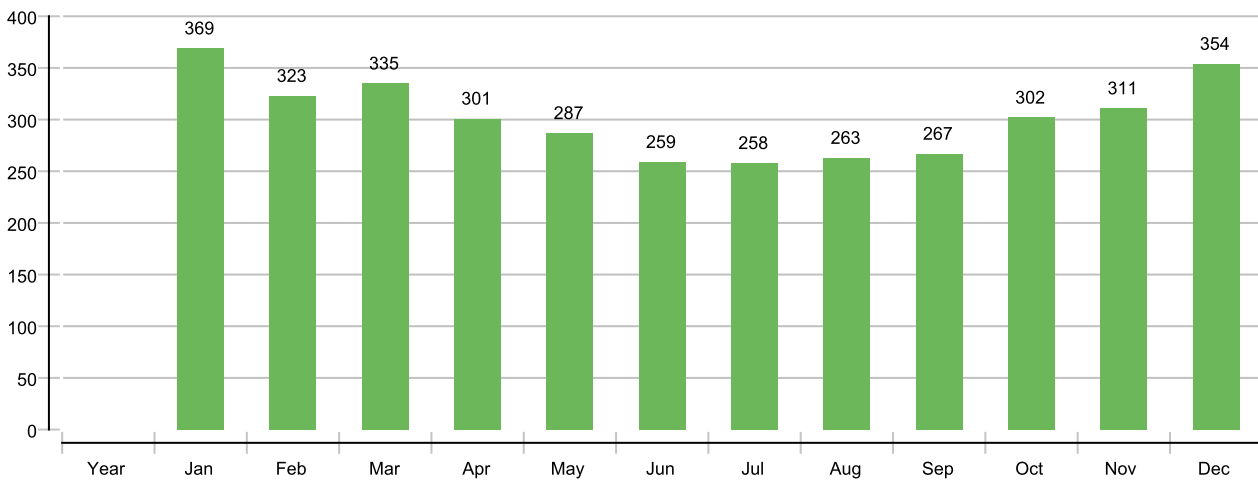
Solar fraction: fraction of solar energy to system [SF_n] %



Total fuel and/or electricity consumption of the system [E_{tot}] kWh



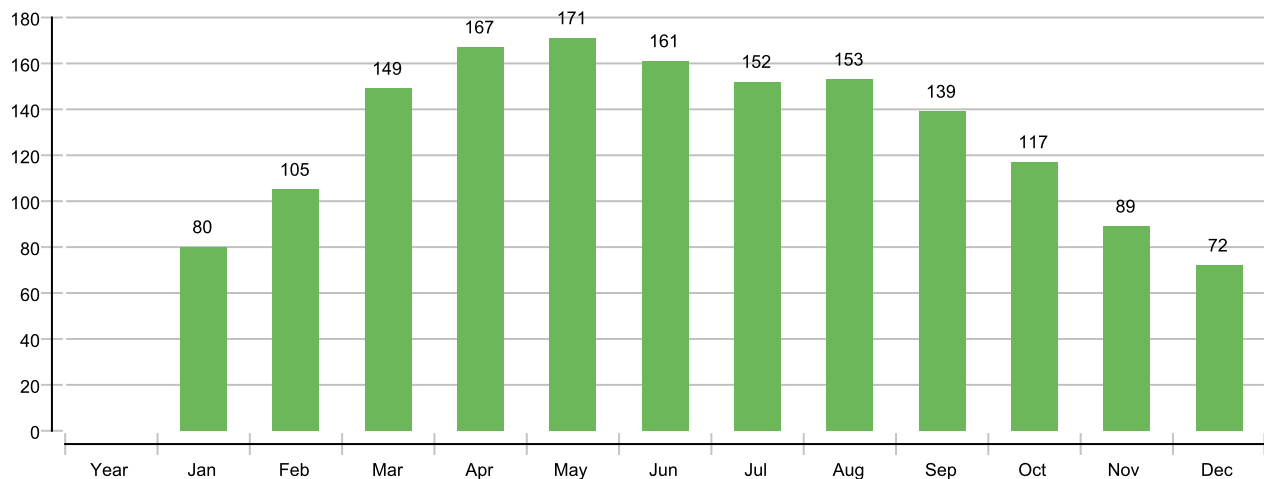
Total electricity consumption [E_{cs}] kWh



Professional Report

Self-consumption [Eocs]

kWh



Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Solar thermal energy to the system [Qsol]

kWh	4722	78	65	216	385	643	749	785	778	561	372	81	9
-----	------	----	----	-----	-----	-----	-----	-----	-----	-----	-----	----	---

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

kWh	75792	13761	11513	8976	4566	2300	1790	1791	1747	1865	4283	9631	13569
-----	-------	-------	-------	------	------	------	------	------	------	------	------	------	-------

Heat generator fuel and electricity consumption [Eaux]

kWh	86696	15535	13009	10197	5269	2748	2172	2179	2130	2256	4959	10922	15320
-----	-------	-------	-------	-------	------	------	------	------	------	------	------	-------	-------

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

%	5.9	0.6	0.6	2.4	7.8	21.8	29.5	30.5	30.8	23.1	8	0.8	0
---	-----	-----	-----	-----	-----	------	------	------	------	------	---	-----	---

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

kWh	79967	15493	12815	9658	4502	1797	1199	1207	1185	1541	4472	10746	15353
-----	-------	-------	-------	------	------	------	------	------	------	------	------	-------	-------

Irradiation onto collector area [Esol]

kWh	93293	3643	4521	7654	9465	11116	11259	11412	11084	8934	7041	4296	2870
-----	-------	------	------	------	------	-------	-------	-------	-------	------	------	------	------

Yield Photovoltaics DC [Qpvf]

kWh	12059	487	610	1019	1240	1435	1431	1425	1397	1140	914	575	387
-----	-------	-----	-----	------	------	------	------	------	------	------	-----	-----	-----

Radiation onto module area [Esol PV]

kWh	93293	3643	4521	7654	9465	11116	11259	11412	11084	8934	7041	4296	2870
-----	-------	------	------	------	------	-------	-------	-------	-------	------	------	------	------

Yield Photovoltaics AC [Qinv]

kWh	10357	411	517	874	1068	1238	1232	1230	1207	982	788	487	322
-----	-------	-----	-----	-----	------	------	------	------	------	-----	-----	-----	-----

Electricity consumption of pumps [Epar]

kWh	128.5	10.7	9.2	9.9	9.5	11.7	12.8	13.7	13.2	10.5	9.2	8.5	9.6
-----	-------	------	-----	-----	-----	------	------	------	------	------	-----	-----	-----

Total energy consumption [Quse]

kWh	76418	13506	11269	8855	4617	2592	2202	2201	2163	2082	4317	9367	13247
-----	-------	-------	-------	------	------	------	------	------	------	------	------	------	-------

Heat loss to indoor room (including heat generator losses) [Qint]

kWh	6413	568	505	542	504	520	518	545	549	520	537	539	566
-----	------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Heat loss to surroundings (without collector losses) [Qext]

kWh	257	7	9	19	24	32	35	35	37	29	22	7	1
-----	-----	---	---	----	----	----	----	----	----	----	----	---	---

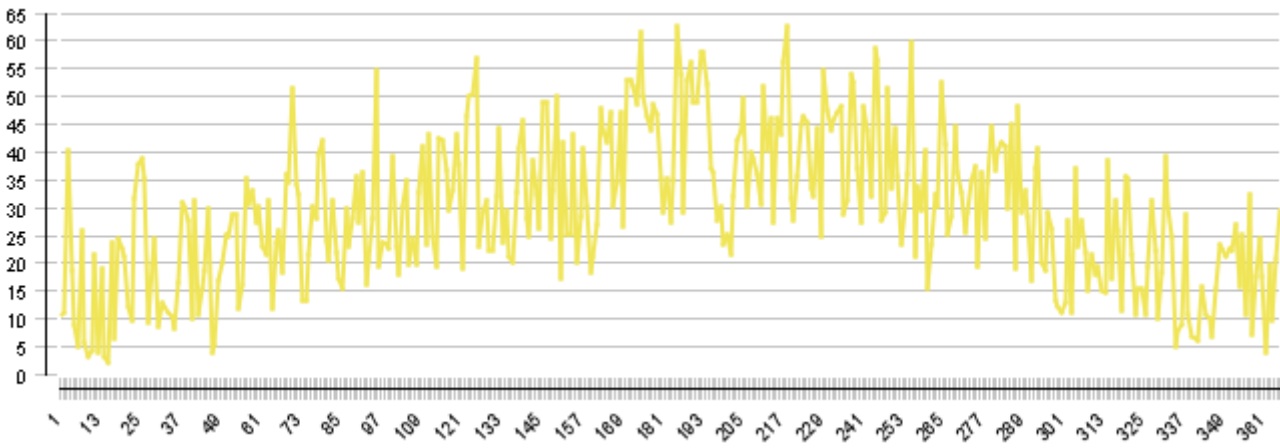
Total electricity consumption [Ecs]

kWh	3629	369	323	335	301	287	259	258	263	267	302	311	354
-----	------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Professional Report

	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Self-consumption [Eocs]													
kWh	1555	80	105	149	167	171	161	152	153	139	117	89	72

PVT collector
Daily maximum temperature [°C]



Professional Report

Energy flow diagram (annual balance)

