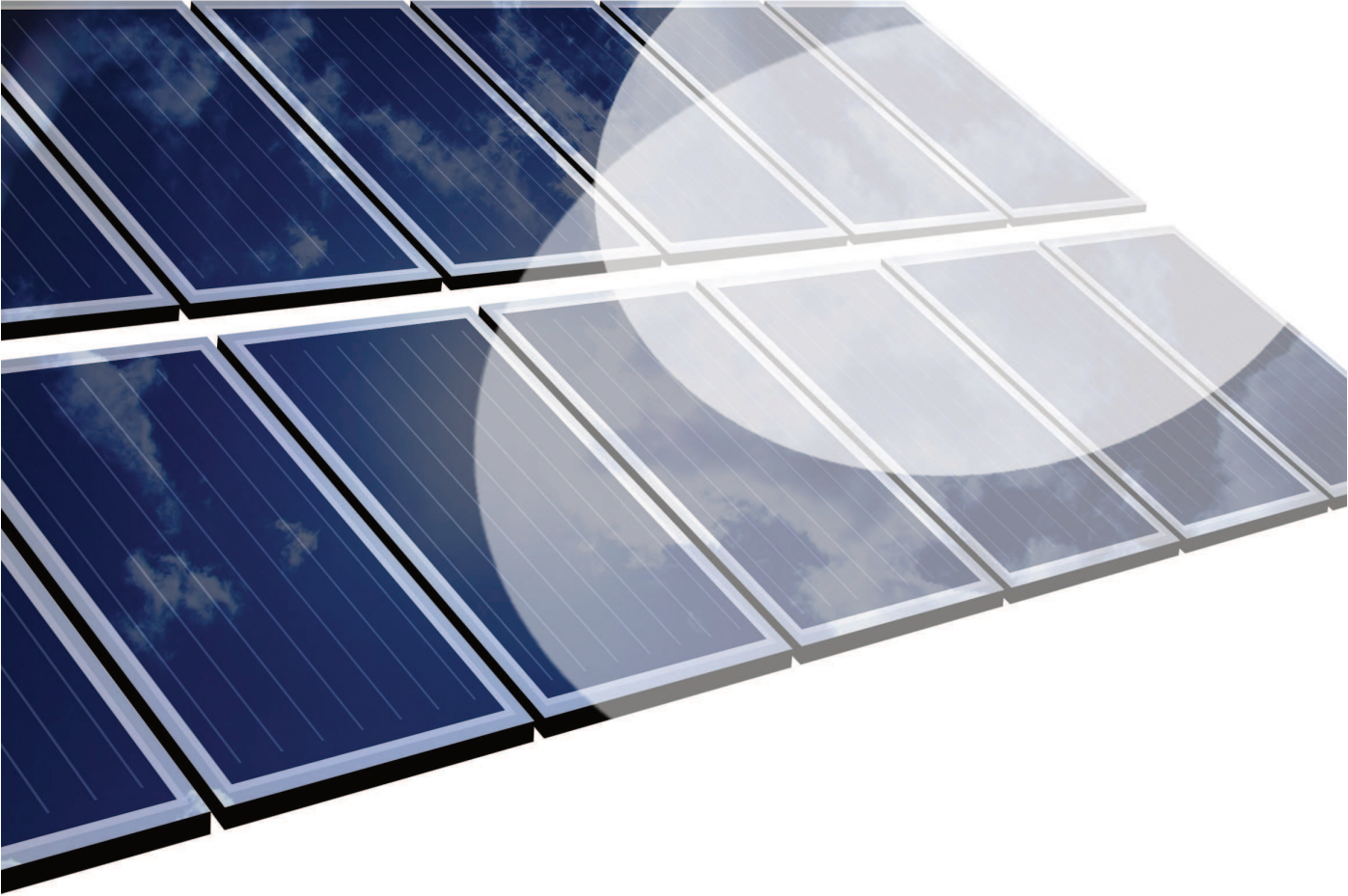
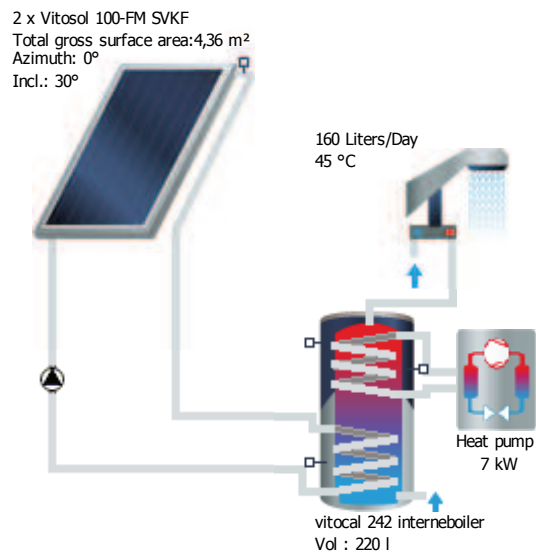

VIESSMANN



Variant 1



Results of annual simulation

Installed collector power:		3,05 kW
Installed solar surface area (gross):		4,36 m ²
Irradiation on collector surface (active):	4.636,04 kWh	1.153,24 kWh/m ²
Energy delivered by collectors:	1.777,89 kWh	442,26 kWh/m ²
Energy delivered by collector loop:	1.514,45 kWh	376,73 kWh/m ²
DHW heating energy supply:		2.295,57 kWh
Solar energy contribution to DHW:		1.376,91 kWh
Energy from auxiliary heating:		1.146,3 kWh
Electricity savings:		550,8 kWh
CO2 emissions avoided:		366,81 kg
DHW solar fraction:		54,6 %
Relative savings of supplementary energy (DIN EN 12977):		58,4 %
System efficiency:		29,7 %

Variant 1

Site Data

Climate data

Location:	BRUSSELS NATIONAL
Climate data record:	BRUSSELS NATIONAL
Total annual global irradiation:	1014,311 kWh/m ²
Latitude:	50,9 °
Longitude:	-4,53 °

Domestic hot water

Average daily consumption:	0,16 m ³
Desired temperature:	45 °C
Consumption profile:	Detached house (evening max)
Cold water temperature:	February: 9 °C August: 13 °C
Circulation:	no

Variant 1

System

Collector loop

Manufacturer:	Viessmann Werke GmbH & Co
Type:	Vitosol 100-FM SVKF
Number:	2,00
Total gross surface area:	4,36 m ²
Total active solar surface area:	4,02 m ²
Inclination (Tilt Angle):	30 °
Orientation:	180 °
Azimuth:	0 °

Dual coil indirect hot water tank

Manufacturer:	Viessmann
Type:	vitocal 242 interneboiler
Volume:	0,22 m ³

Auxiliary heating

Manufacturer:	Standard
Type:	Heat pump
Nominal output:	7 kW

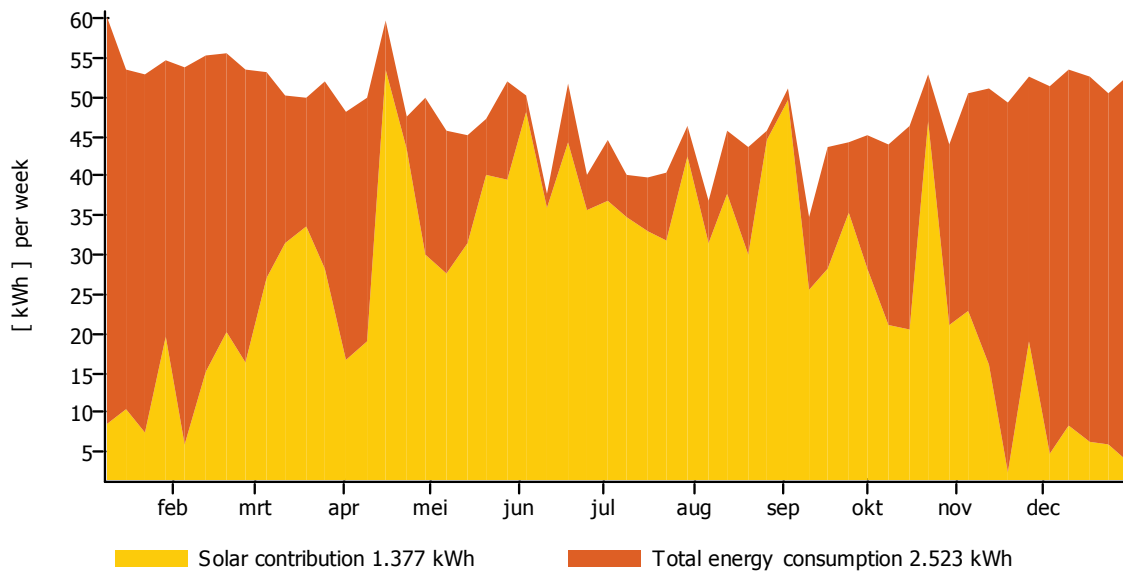
Legend

With test report
Solar Keymark

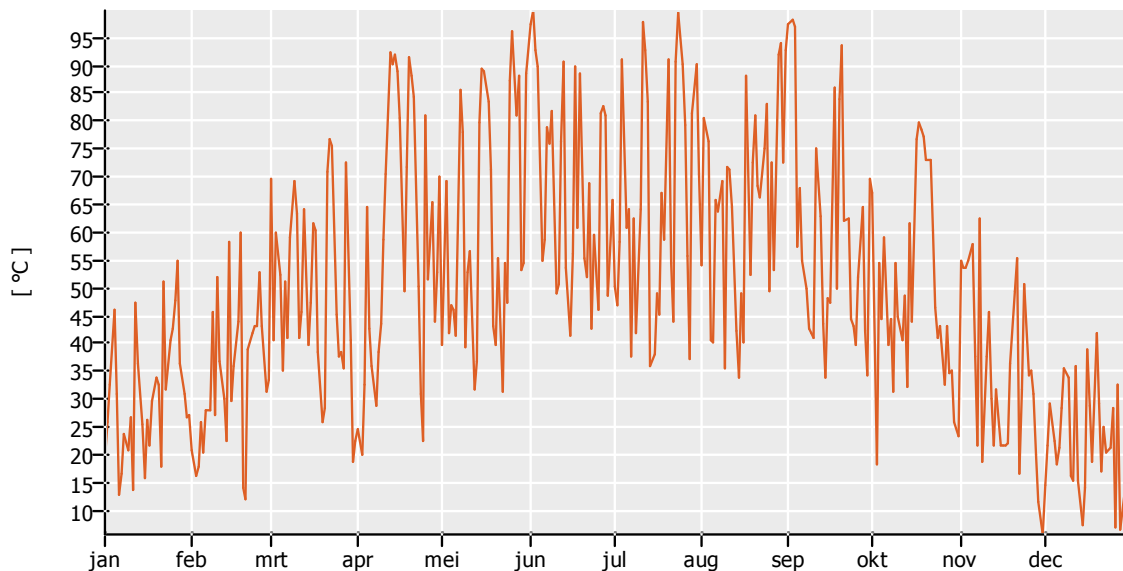


Variant 1

Solar energy consumption as percentage of total consumption

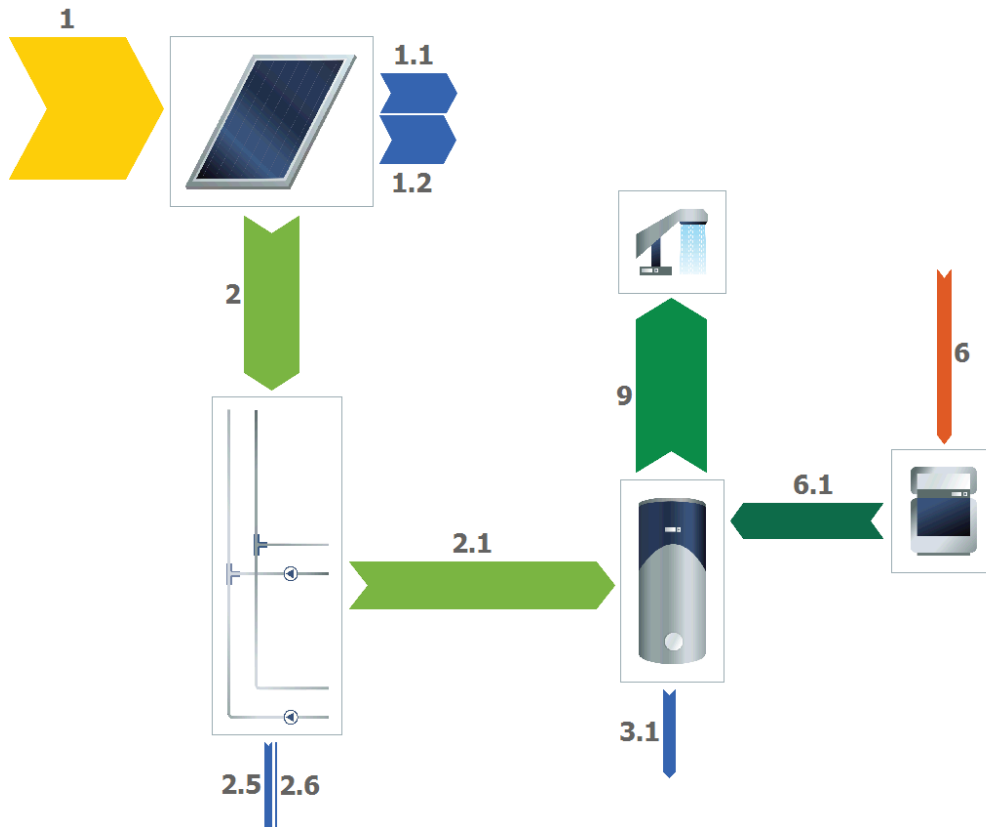


Daily maximum collector temperature



These calculations were carried out by T*SOL 2016 (R4) - the simulation program for solar thermal heating systems. The results are determined by a mathematical model calculation with variable time steps of up to 6 minutes. Actual yields can deviate from these values due to fluctuations in climate, consumption and other factors. The system schematic diagram above does not represent and cannot replace a full technical drawing of the solar system.

Energy balance schematic



Legend

1	Irradiation on collector surface (active)	4.636 kWh
1.1	Optical collector losses	1.289 kWh
1.2	Thermal collector losses	1.570 kWh
2	Energy from collector array	1.778 kWh
2.1	Solar energy to storage tank	1.514 kWh
2.5	Internal piping losses	221 kWh
2.6	External piping losses	43 kWh
3.1	Tank losses	366 kWh
6	Final energy	459 kWh
6.1	Supplementary energy to tank	1.146 kWh
9	DHW energy from tank	2.296 kWh

Glossary

- 1 Irradiation on collector surface (active)
Solar energy irradiated onto tilted collector area (active surface area)
- 1.1 Optical collector losses
Reflection and other losses
- 1.2 Thermal collector losses
Heat conduction and other losses
- 2 Energy from collector array
Energy output at collector array outlet (i.e. before piping)
- 2.1 Solar energy to storage tank
Energy from collector loop to storage tank (minus piping losses)
- 2.5 Internal piping losses
Internal piping losses
- 2.6 External piping losses
External piping losses
- 3.1 Tank losses
Heat losses via surface area
- 6 Final energy
Final energy supply to system. This can be supplied from natural gas, oil or electricity (not including solar energy) and takes efficiency into account.
- 6.1 Supplementary energy to tank
Supplementary energy (e.g. boiler) to tank
- 9 DHW energy from tank
Heat from tank (excluding circulation) for DHW consumption

Variant 1

Results of annual simulation

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DHW system												
Savings Electricity in												
CO2 emissions avoided in kg												
366,8	13,3	18,0	32,6	41,2	43,5	44,5	41,8	45,7	34,8	29,6	15,1	6,8
DHW solar fraction in %												
54,6	21,2	30,7	55,3	69,8	77,2	88,6	86,6	85,1	72,2	53,4	25,8	10,9
System efficiency in %												
29,7	31,8	32,3	32,0	30,1	27,9	27,7	26,6	30,7	30,1	33,3	32,6	26,2
Solar energy contribution to DHW in kWh												
1.377	50	68	122	155	163	167	157	172	131	111	57	25
E - Solar loop to tank in kWh												
1.514	53	71	130	169	182	188	180	189	146	120	60	27
Energy: Aux. heating in kWh												
1.146	186	153	99	67	48	22	24	30	50	97	163	207
Climate												
Outside temperature in °C												
11,0	4,0	4,7	7,0	10,2	14,1	16,7	18,4	18,2	15,2	11,7	7,8	4,0
Global radiation - horizontal in kWh/m²												
1.014	24	37	74	114	144	153	148	129	91	58	26	16
Position of sun - altitude in °												
12,7	4,0	6,6	11,0	16,4	21,1	23,3	22,3	18,3	12,9	8,0	4,6	3,3
Position of sun - azimuth in °												
-5,6	-6,7	-7,2	-6,8	-5,6	-5,2	-5,7	-6,3	-6,2	-5,1	-3,8	-3,7	-5,1
Wind speed in m/s												
3,9	5,0	4,6	4,3	3,5	3,6	3,2	3,4	3,1	3,2	3,8	4,4	4,3

Variant 1

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Hot water consumption

DHW heating energy supply in kWh

2.296	227	208	209	197	176	168	151	167	164	191	212	226
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DHW heating energy requirement in kWh

2.296	227	208	209	197	176	168	151	167	164	191	212	226
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Circulation losses in kWh

0	0	0	0	0	0	0	0	0	0	0	0	0
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Cold water temperature in °C

11,0	9,2	9,0	9,3	10,1	11,1	12,1	12,8	13,0	12,7	11,9	10,9	9,9
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DHW temperature in °C

44,9	44,9	44,9	44,9	44,9	44,9	45,0	45,0	44,9	44,9	44,9	44,9	44,9
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Preset DHW consumption in m³

58,0	5,5	5,0	5,0	4,9	4,5	4,4	4,0	4,5	4,4	5,0	5,4	5,5
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DHW - consumption in m³

50,9	5,2	4,7	4,7	4,1	3,6	3,4	3,1	3,6	3,7	4,5	5,1	5,2
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Solar loop

Max collector temperature in °C

34,0	18,4	22,1	30,8	39,6	43,8	47,9	47,7	46,7	41,0	33,1	22,4	14,5
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Collector loop

Energy from collector loop (CL 1) in kWh

1.514	53	71	130	169	182	188	180	189	146	120	60	27
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Collector loop efficiency (CL 1) in %

32,7	33,4	33,8	34,1	32,9	31,1	31,2	30,5	33,9	33,6	36,1	34,7	27,9
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Collector loop reference temperature (CL 1) in °C

23,7	13,0	13,9	18,0	24,7	31,4	35,4	38,1	32,4	28,4	20,2	15,2	12,6
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T Coll out (CL 1) in °C

44,1	28,3	31,7	36,8	47,5	48,9	51,9	50,8	49,0	43,6	37,0	35,3	26,4
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Variant 1

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Volume flow (CL 1) in m³

366,9	16,0	19,1	31,5	37,7	42,8	44,0	43,5	41,9	35,7	30,2	14,8	9,6
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Control factor (CL 1) in %

0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
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Collector array**spec. DNI (CL 1) in kWh/m²**

0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
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G opt. loss deduct. (CL 1) in kWh/m²

832,7	28,2	37,4	68,9	92,9	105,1	107,8	105,2	100,7	78,2	59,9	31,3	17,2
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Specific global radiation onto inclined surface area (CL 1) in kWh/m²

1.153,2	39,1	52,0	95,0	127,7	145,4	149,7	146,5	139,1	108,2	83,0	43,3	24,1
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Spec. global radiation onto inclined, shaded surface (CL 1) in kWh/m²

1.153,2	39,1	52,0	95,0	127,7	145,4	149,7	146,5	139,1	108,2	83,0	43,3	24,1
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Irradiation on gross surface area -unshaded- (CL 1) in kWh

5.028	171	227	414	557	634	653	639	607	472	362	189	105
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Irradiation on gross surface area (CL 1) in kWh

5.028	171	227	414	557	634	653	639	607	472	362	189	105
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Irradiation on active solar surface area -unshaded- (CL 1) in kWh

4.636	157	209	382	513	585	602	589	559	435	334	174	97
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Irradiation on active surface area (CL 1) in kWh

4.636	157	209	382	513	585	602	589	559	435	334	174	97
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Optical losses (CL 1) in kWh

1.289	44	59	105	140	162	168	166	154	121	93	48	28
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Losses - external piping (CL 1) in kWh

43	2	2	4	5	6	6	5	5	4	3	2	1
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Losses - internal piping (CL 1) in kWh

221	2	5	12	23	31	35	37	33	23	13	5	1
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Thermal collector losses (CL 1) in kWh

1.570	57	73	130	177	204	205	201	178	142	104	59	40
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Variant 1

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Collector outlet temperature (CL 1) in °C												
21,6	8,7	11,3	17,3	24,4	30,0	33,2	34,1	32,3	26,8	20,1	12,8	7,3
Collector temperature (CL 1) in °C												
21,1	8,5	11,0	16,8	23,7	29,3	32,5	33,4	31,6	26,2	19,7	12,5	7,2
Max collector temperature (CL 1) in °C												
31,8	17,1	20,3	28,0	36,7	41,6	44,7	45,1	43,8	38,3	30,9	20,8	13,9
Pump energy (CL 1) in kWh												
92	4	5	8	9	11	11	11	10	9	8	4	2
Dual coil indirect hot water tank												
Tank losses in kWh												
366	11	12	24	37	45	49	52	46	39	28	14	9
Change in internal energy in kWh												
0	0	3	-4	2	9	-8	1	7	-7	-1	-3	0
Average temperature in °C												
35,7	25,6	26,9	32,2	39,3	42,7	45,7	46,5	43,1	40,1	33,6	27,2	24,6
Sensor: collector loop reference temperature in °C												
23,6	12,9	13,9	18,0	24,6	31,3	35,4	38,0	32,4	28,4	20,2	15,2	12,6
Sensor: collector loop switch-off temperature in °C												
50,7	46,9	46,9	47,7	52,9	54,3	55,9	56,3	53,2	52,2	48,3	46,9	47,0
Auxiliary heating sensor on in °C												
50,2	46,1	46,3	47,4	52,5	53,9	55,3	55,8	52,9	51,6	48,0	46,2	46,1
Sensor: auxiliary heating off in °C												
50,2	46,1	46,3	47,4	52,5	53,9	55,3	55,8	52,9	51,6	48,0	46,2	46,1
E-Electric heater rod in kWh												
0	0	0	0	0	0	0	0	0	0	0	0	0
Consumption Natural gas (H) in m³												
0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Desired temperature auxiliary heating in °C												
45,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0

Variant 1

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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solar tank losses in kWh

138	3	3	8	14	18	21	23	18	15	9	4	2
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Heat pump

Energy from boiler in kWh

1.146	186	153	99	67	48	22	24	30	50	97	163	207
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Primary energy equivalent in kWh

459	74	61	40	27	19	9	10	12	20	39	65	83
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Consumption Electricity in kWh

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Return temperature in °C

51,4	50,9	51,2	51,6	51,7	52,5	52,9	52,8	52,6	52,5	51,9	51,0	50,7
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Supply temperature in °C

58,0	58,0	58,0	58,0	58,0	58,0	58,0	58,0	58,0	58,0	58,0	58,0	58,0
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