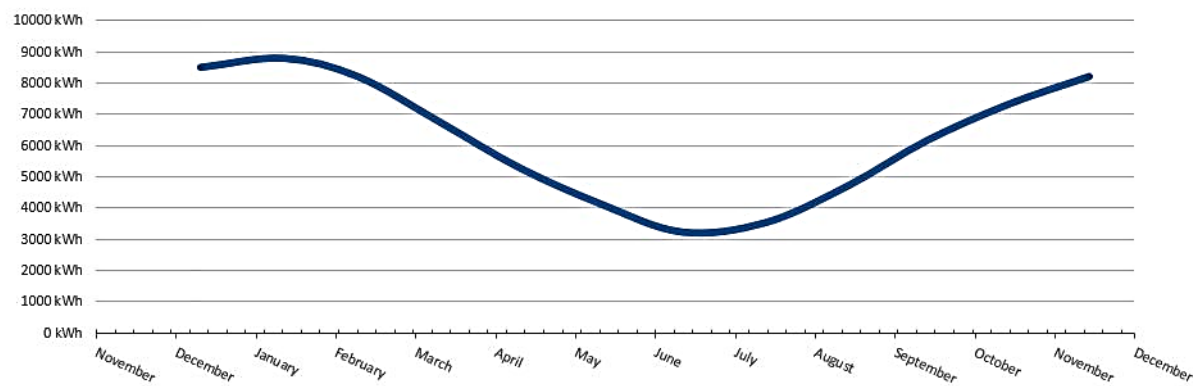


Solar thermal collector production

Energy demand

	January	February	March	April	May	June	July	August	September	October	November	December	Annual	%
Heating	6,718	7,010	6,426	4,965	3,505	2,337	1,460	1,752	2,921	4,381	5,549	6,426	53,449 kWh	72%
Lightning	0	0	0	0	0	0	0	0	0	0	0	0	0 kWh	0%
TV / Stereo	0	0	0	0	0	0	0	0	0	0	0	0	0 kWh	0%
Stove / kitchen	0	0	0	0	0	0	0	0	0	0	0	0	0 kWh	0%
Dishwasher	0	0	0	0	0	0	0	0	0	0	0	0	0 kWh	0%
Dryer	0	0	0	0	0	0	0	0	0	0	0	0	0 kWh	0%
Washing machine	0	0	0	0	0	0	0	0	0	0	0	0	0 kWh	0%
Cooler / fridge	0	0	0	0	0	0	0	0	0	0	0	0	0 kWh	0%
Refrigerator and freezer	0	0	0	0	0	0	0	0	0	0	0	0	0 kWh	0%
Tap water (50 ltr/pers)	1,772	1,772	1,772	1,772	1,772	1,772	1,772	1,772	1,772	1,772	1,772	1,772	21,264 kWh	28%
Cooling demand kWt/mnd - 0-100 %	0%	0	0	0	0	0	0	0	0	0	0	0	0 kWh	0%
Defined cooling kWh	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 kWh	0%
Swimming pool ltr	0	0	0	0	0	0	0	0	0	0	0	0	0 kWh	0%
Swimming pool usage 0-100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0 kWh	0%
Total	8,490	8,782	8,198	6,737	5,277	4,109	3,232	3,524	4,693	6,153	7,321	8,198	74,713 kWh	
fraction available to solar thermal	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Available for solar thermal	8,490	8,782	8,198	6,737	5,277	4,109	3,232	3,524	4,693	6,153	7,321	8,198 ✓	74,713 kWh	



* Source = Hafslund 2009 - http://www.hafslund.no/privat/artikler/les_artikkel.asp?artikkelid=652

Solar thermal energy production

	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Solar hours / mnt	0.0	12.0	217.0	362.0	444.0	446.0	454.0	407.0	285.0	70.0	0.0	0.0	2,697.0 hours
Avg W / m2 @ 25 °	0	15	54	110	164	197	182	129	69	24	2	0	368 kWh/m2 91%
Avg W /m2 @ 27 °	0	16	54	111	166	200	184	130	70	24	2	0	373 kWh/m2 92%
Avg W /m2 @ 90 °	0	17	60	123	181	215	199	144	78	25	2	0	407 kWh/m2 100%
Energy demand	8,490	8,782	8,198	6,737	5,277	4,109	3,232	3,524	4,693	6,153	7,321	8,198	74,713 kWh
Total kWh @ 25 °	0	7	447	1,523	2,793	3,378	3,165	2,015	757	64	0	0	14,148 kWh 91%
Total kWh @ 27 °	0	7	451	1,540	2,827	3,418	3,203	2,039	764	64	0	0	14,314 kWh 92%
Total kWh @ 90 °	0	8	503	1,712	3,082	3,679	3,463	2,252	851	68	0	0	15,618 kWh 100%
Net kWh @ 25 °	0	7	447	1,523	2,793	3,378	3,165	2,015	757	64	0	0	14,148 kWh 18.9 %
Net kWh @ 27 °	0	7	451	1,540	2,827	3,418	3,203	2,039	764	64	0	0	14,314 kWh 19.2 %
Net kWh @ 90 °	0	8	503	1,712	3,082	3,679	3,232	2,252	851	68	0	0	15,387 kWh 20.6 %

Latitude in decimal degrees (positive in northern hemisphe
logditude in decimal degrees (positive is east of Greenwic

69.3

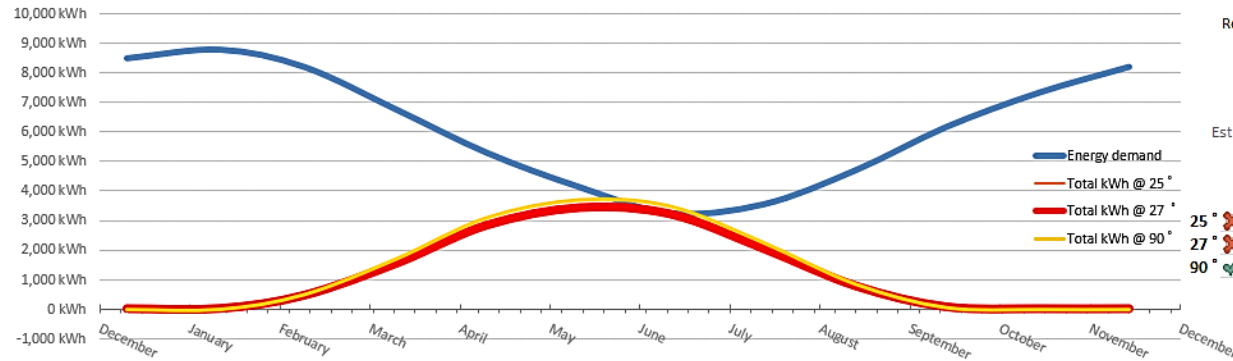
17

Panel-face direction: 0 - 359° (0° is North, 90° is east, 180° is sout
Panel tilt relative to ground (0°: flat on ground ; 90°: vertical pane

270

27

Best tilt 48 ° = year around 46 ° = summer 93 ° = winter



Recommended area **384 m2 ... 61 m2**
Collector area **64.0 m2**
Thermal storage **5,000 liter**

Estimated system cost 224,833 NOK
Est. cost / m2 3,513 NOK

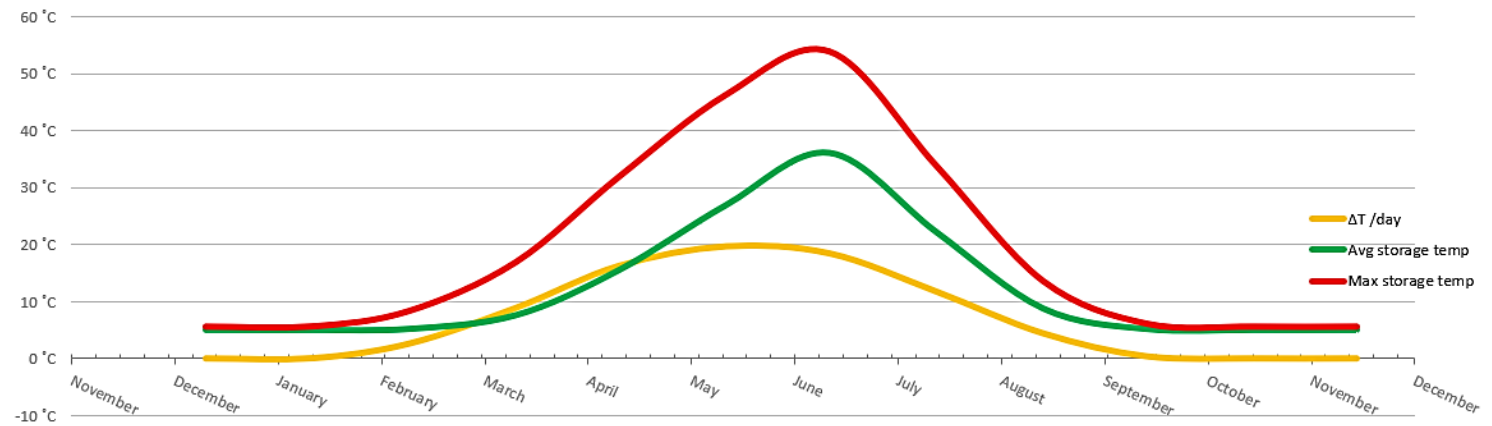
	NOK / kWh	Total energy cost	Annual savings	
25 °	1.10	76,155	14,148 NOK	19%
27 °	1.09	75,989	14,314 NOK	19%
90 °	1.00	74,685	15,387 NOK	21%

Version 12 / 2018

Solar energy system heat

Production at: 64 m2 and 5000 liter heat storage

			January	February	March	April	May	June	July	August	September	October	November	December	
Max temp	95.0 °C	kWh/mnt - solar	●	0 ●	7 ●	451 ●	1,540 ○	2,827 ○	3,418 ○	3,203 ●	2,039 ●	764 ●	64 ●	0 ●	0
Inlet temperature	5.0 °C	ΔT /day		0.00	0.04	2.59	8.85	16.24	19.65	18.41	11.72	4.39	0.37	0.00	0.00
Liter / m2	78	Avg storage temp		5	5	5	8	16	27	36	22	9	5	5	5
Total storage in liter	5,000	Max storage temp		6	6	8	17	32	46	54	34	14	6	6	6
Heatloss in store	1.0 W/m2 K	Storage heatloss		-121	-121	-120	-100	-36	56	130	18	-91	-120	-121	-121
Lenght of pipes	10.0	Pipes heatloss		-2	-2	-2	-1	3	8	13	6	-1	-2	-2	-2
Heatloss in pipe	1.0 W/m2 K	Sum heatloss		-124	-124	-122	-101	-33	65	143	24	-91	-122	-124	-124
Pipe diam i mm	22	Temp imp. Of loss		-1	-1	-1	0	0	0	1	0	0	-1	-1	-1
		kWh demand/day		283	293	273	225	176	137	108	117	156	205	244	273
Outlet temperature	50.0 °C	demand liter/day		4,879	5,047	4,711	3,872	3,033	2,361	1,858	2,026	2,697	3,536	4,208	4,711



Investment analysis

Years	Interest rate 2.00%		Energy cost 1.00 NOK													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Solar thermal energy system	224,833	4,497	4,587	4,678	4,772	4,867	4,965	5,064	5,165	5,269	5,374	5,481	5,591	5,703	5,817	5,933
Conventional energy	14,314	14,887	15,482	16,101	16,745	17,415	18,112	18,836	19,590	20,373	21,188	22,036	22,917	23,834	24,787	25,779
Net gain	-210,519	10,390	10,895	11,423	11,973	12,548	13,147	13,772	14,424	15,105	15,814	16,554	17,326	18,131	18,970	19,845
Accumulated gain	-210,519	-200,129	-189,234	-177,811	-165,838	-153,290	-140,143	-126,371	-111,946	-96,841	-81,027	-64,473	-47,147	-29,016	-10,046	9,800
Internal rate		-89.01%	-42.08%	-26.36%	-18.44%	-13.64%	-10.39%	-8.03%	-6.22%	-4.79%	-3.60%	-2.61%	-1.75%	-0.99%	-0.32%	0.29%
Relative energy cost	✗ 14.71	✓ -0.73	✓ -0.76	✓ -0.80	✓ -0.84	✓ -0.88	✓ -0.92	✓ -0.96	✓ -1.01	✓ -1.06	✓ -1.10	✓ -1.16	✓ -1.21	✓ -1.27	✓ -1.33	✓ -1.39

