

Solar Hot Water performance in Alice Springs

Results from one system

February – August 2005

Purpose of monitoring

Solar hot water (SHW) systems are known to work effectively in Alice Springs. However until recently, detailed analyses of performance have not been undertaken to inform design improvements or town planning decisions. To address this information shortfall, one solar hot water system has been opportunistically monitored from February to August 2005 (with monitoring ongoing).



Technical specifications

The monitored Solahart 302J unit and its installation are very typical for Alice Springs. 60% of houses have solar hot water and most are Solahart 302J systems (DIPE survey 2001).



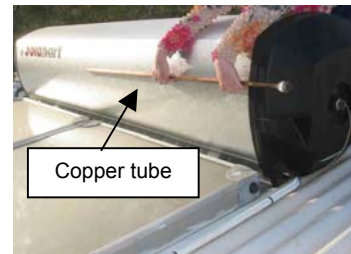
Monitored Solahart 302J unit

Property	Lot 7841 Lillecrapp Rd Alice Springs
House	3 bedroom
SHW unit	Solahart 302J two-panel 300-litre tank
Location	North roof. 20° pitch. No shading.
Booster	2400W electric 'one shot relay' in fusebox (push-button thermostat set to 60°C)
Install date	March 2002
Maintenance	None (to Sep 2005)
Occupants	2 adults, 3 children under 8yo.
Occupancy	Weekdays: 1 adult & 1-2 kids home. Weekends: all home.
Hot water fixtures	Shower (9L/min), bath, handbasin, kitchen sink, laundry tub (hot rarely used), front load washing machine (95% cold washes)
Consumption pattern	Typically 1 x morning shower, 1 x evening shower, 1 x evening bath, dishes washed at night, clothes washed during day.
Tempering valve	Set to 50°C, precedes all hot water fixtures.
Temperature probe	K type thermocouple temp probe inside 1.2m length of 13mm copper tube, screwed into blanking plug at end of SHW tank
Datalogger	DataTaker DT50. 30 min record intervals.

Temperature stratification

Solahart indicates that temperature stratification occurs in the tank, with hotter water nearest the outlet pipes at the top. The temperature probe is in the middle of the tank and recorded temperatures 4 to 8°C lower than the hot water that flows from the pressure relief valve outlet pipe.

Date	Probe temp (C)	Outlet water temp (C)	Diff.
16 Feb 05	80	85	5
10 Mar 05	69	73	4
12 Apr 05	70	75	5
2 Sep 05	50	58	8
Average			5.5



13mm copper tube as screwed into middle of tank

Water temperature

Water temperatures in the SHW tank varied daily with use, sunshine (cloudiness) and night-time thermal losses. In summer (Feb-March) average temperatures ranged from 63 to 82°C and peaked at 88°C (probably 93°C plus in upper parts of the tank). In winter (May-July), temperatures were far lower, averaging 29 to 58°C, with extremes of 15 and 72°C. Night-time thermal losses from the insulated tank averaged 15 to 20°C in winter (6°C min air temp) and 12 to 15°C in summer (18°C min air temp). Hot water was rarely used between 9pm and 7am so the tank was not 'robbed' of heat at night.

Month	Air temperature		Solar hot water temperature	
	Average min (C)	Average max (C)	Average min (C)	Average max (C)
Feb 05	18.3	35.0	62.9	82.0
Mar 05	17.6	35.2	63.7	80.9
Apr 05	15.5	33.1	59.5	75.3
May 05	7.6	26.0	37.8	57.6
Jun 05	6.2	21.0	28.7	51.3
Jul 05	5.2	19.3	32.9	54.4
Aug 05	5.6	22.4	39.0	61.2
Average	10.8	27.4	46.4	66.1

Air temp from BOM data

Monitoring by



Contact CSAT via www.alec.org.au

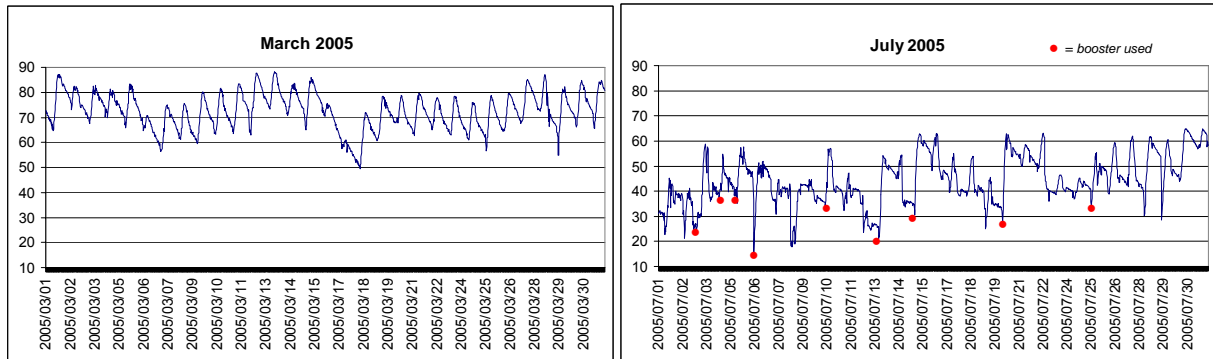
CSAT is a knowledge-based consultancy helping clients to achieve efficient, cost-effective and intelligent resource use in arid land communities.

Monitoring equipment supplied by



Solar Hot Water performance in Alice Springs (cont)

Typical monthly temperature profiles



Sunshine hours

The sun generally raised SHW temperatures from 8.30am to 5.30pm (9 hrs) in summer and 9.30am to 5pm (7.5 hrs) in winter. Alice Springs is amongst the sunniest places in Australia due to long days and relatively cloud-free skies. From February to August 2005, Alice Springs averaged 9.5 hours of sunshine per day. Only 22 of the 210 days from February to August had less than 6 hours of sunshine. In comparison, Melbourne, Brisbane and Perth average 6, 7.5 and 8 hours of sunshine per day annually.

Month	Sunshine
	Average hrs/day
Feb 05	10.0
Mar 05	10.1
Apr 05	10.3
May 05	9.6
Jun 05	8.3
Jul 05	8.4
Aug 05	10.1
Average	9.5

BOM data

Temperatures below 60°C

There is a theoretical risk that SHW systems may allow the growth of Legionella bacteria if water is stored below 60°C¹. For the monitored SHW system, water temperatures were below 60°C for almost the whole of May to August (an average of 22 hours per day). In summer (Feb-Mar) water was above 60°C for all but 1.1 hours per day (on average). ¹ 'Public Health Aspects of Rainwater Tanks In Urban Australia' Occasional Paper 10, CRC for Water Quality and Treatment.

Month	SHW temp	
	No. days <60C	Average hours/day <60C
Feb 05	4	1.1
Mar 05	6	1.1
Apr 05	15	3.1
May 05	31	21.4
Jun 05	30	24.0
Jul 05	31	22.5
Aug 05	31	19.7
Average	21.1	13.3
Total	148	

Month	Booster use	
	Total no. boosts	Total hours boosted
Feb 05	0	0
Mar 05	0	0
Apr 05	0	0
May 05	0	0
Jun 05	4	19
Jul 05	9	43
Aug 05	1	4
Average	2.0	9.4
Total	14	66
Cost		\$22.21

Booster use

The booster is a 2,400W 'one shot relay' push-button booster manually pushed by occupants when hot water feels luke warm. It stays on until water in the tank reaches 60°C then turns itself off.

The booster was used only 14 times over the 2005 winter. The average water temperature was 26°C when activated and 58°C when the booster finished. The booster stayed on for an average of 4.7 hours each time.

Electricity costs averaged \$1.59 per boost or \$22 for the winter (14.02



c/kWh). An alternative booster is a push-button timer

that stays on for 1.5 hours before turning itself off, no matter what the water temperature.

This would have used only \$7 of electricity for 14 boosts (saving \$225 over 15 years) but with high water demand may have been activated more often.

Electricity use by manual on-off booster switches has not been measured in Alice Springs despite their prevalence. Many households turn their boosters on in May and leave them on until September. It is expected this uses around \$200 of electricity per year (based on electric hot water systems using around \$330 per year, proportionally more in winter than summer).

Water use

A cold-water tempering valve is fitted to the solar hot water outlet to prevent scalding hot water exiting taps in summer. It is set at 50°C. In summer (Feb-March), almost half of water exiting hot taps was mixed cold water (57 L of 124 L/day) whilst in winter (May-July) only 20% of water was mixed cold water (36 L of 178 L/day). Winter hot water use was higher than summer due to longer/fuller showers/baths. Hot water use is typical for Alice Springs (ASP averages around 150 L/house/day).



Tempering valve & 1 of 2 water meters for SHW tank

Month	Hot water use		
	Total (L/day)	Hot from SHW (L/day)	Cold from tempering valve (L/day)
Feb 05	122	69	53
Mar 05	126	65	61
Apr 05	128	67	61
May 05	181	142	39
Jun 05	159	125	34
Jul 05	195	160	35
Aug 05	169	127	42
Average	154	108	47

Further data

Detailed data sets from this monitoring are available from CSAT.
csat@ozemail.com.au ph 08 8952 6066.

Additional monitoring

CSAT monitors many household appliances incl. electric hot water systems, refrigerative and evaporative air conditioners, building thermal performance, water consumption. Contact CSAT for details.