

# SOLAR WATER HEATING

ANZSES NSW seminar 2006

Graham Morrison

School of Mechanical Engineering

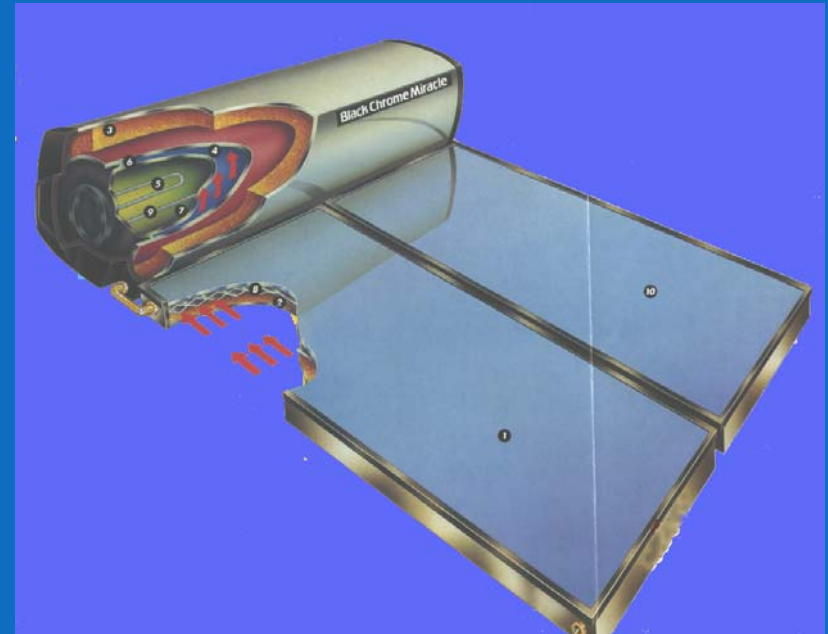
University of New South Wales



Solar Thermal Energy The University of New South Wales

# THERMOSYPHON SOLAR WATER HEATERS

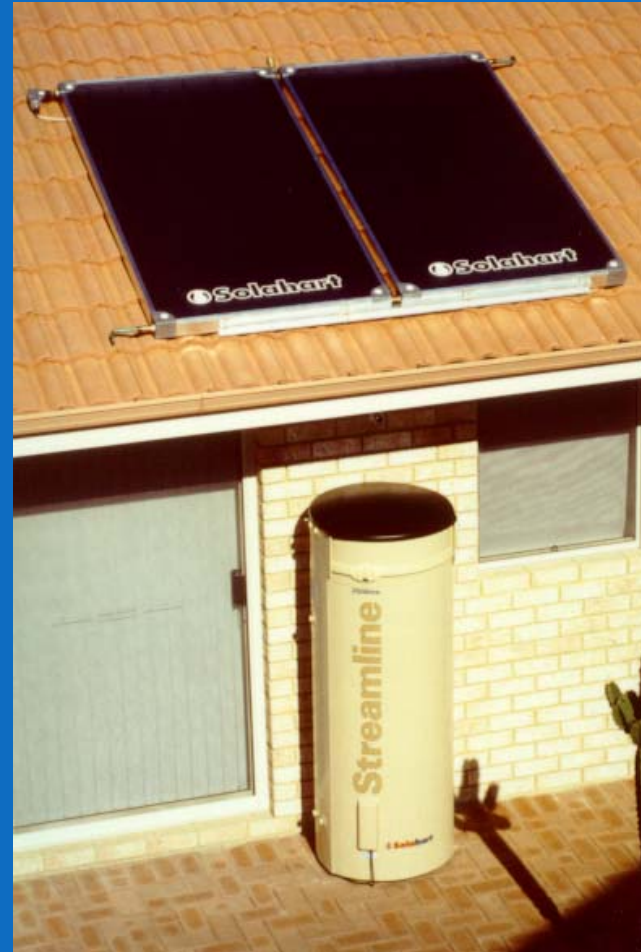
Flat-plate collectors with direct connection to a horizontal tank



# PUMPED SOLAR WATER HEATER

Component matching has a significant effect on performance

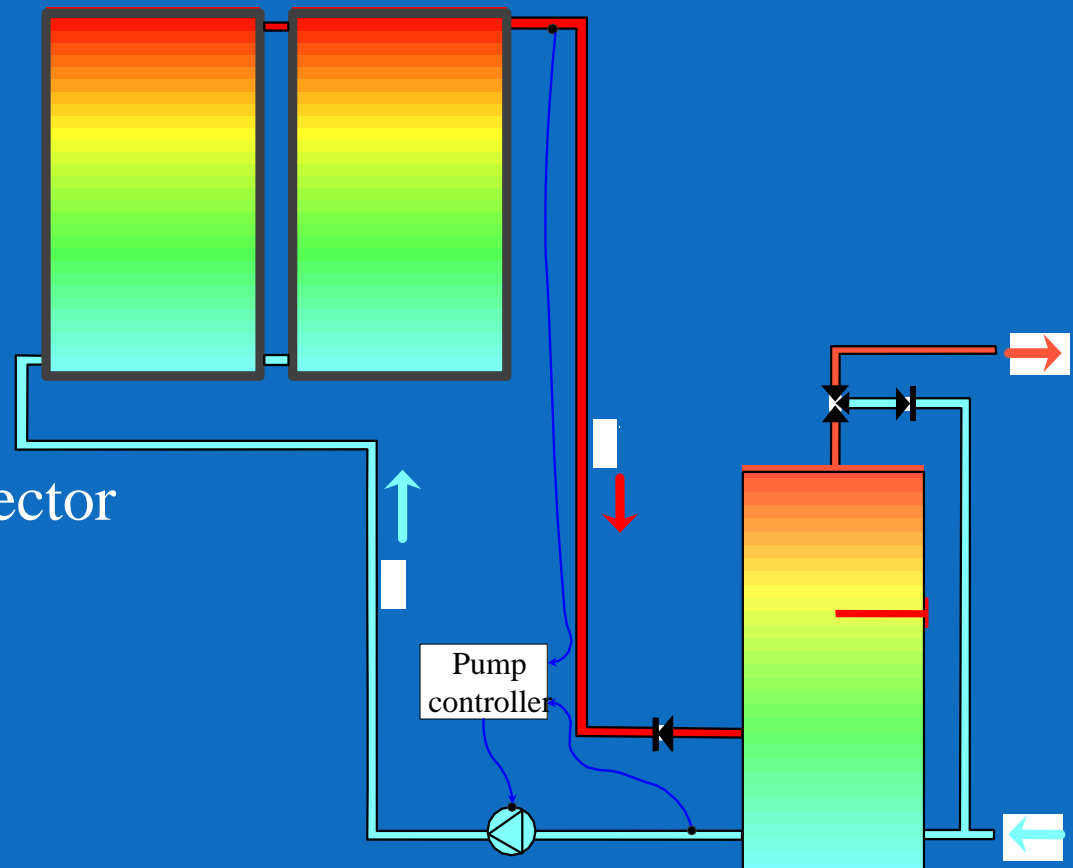
Both pumped and thermosyphon system performance maximised by “Low Flow” design to improving thermal stratification in the storage tank.



# PUMPED CIRCULATION SOLAR WATER HEATERS

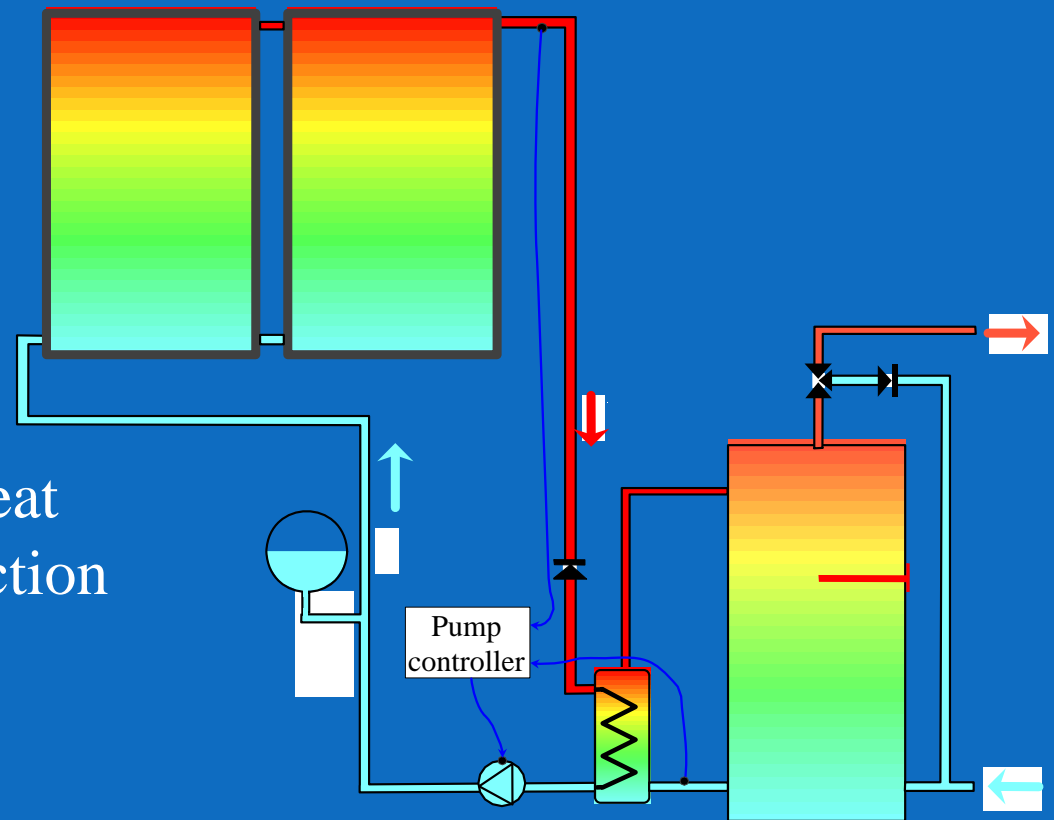
- Pumped circulation

Frees placement of collector and tank



# PUMPED CIRCULATION SOLAR WATER HEATERS

Pumped circulation with heat exchanger for freeze protection design flexibility





# PLASTIC INTEGRAL SOLAR WATER HEATERS



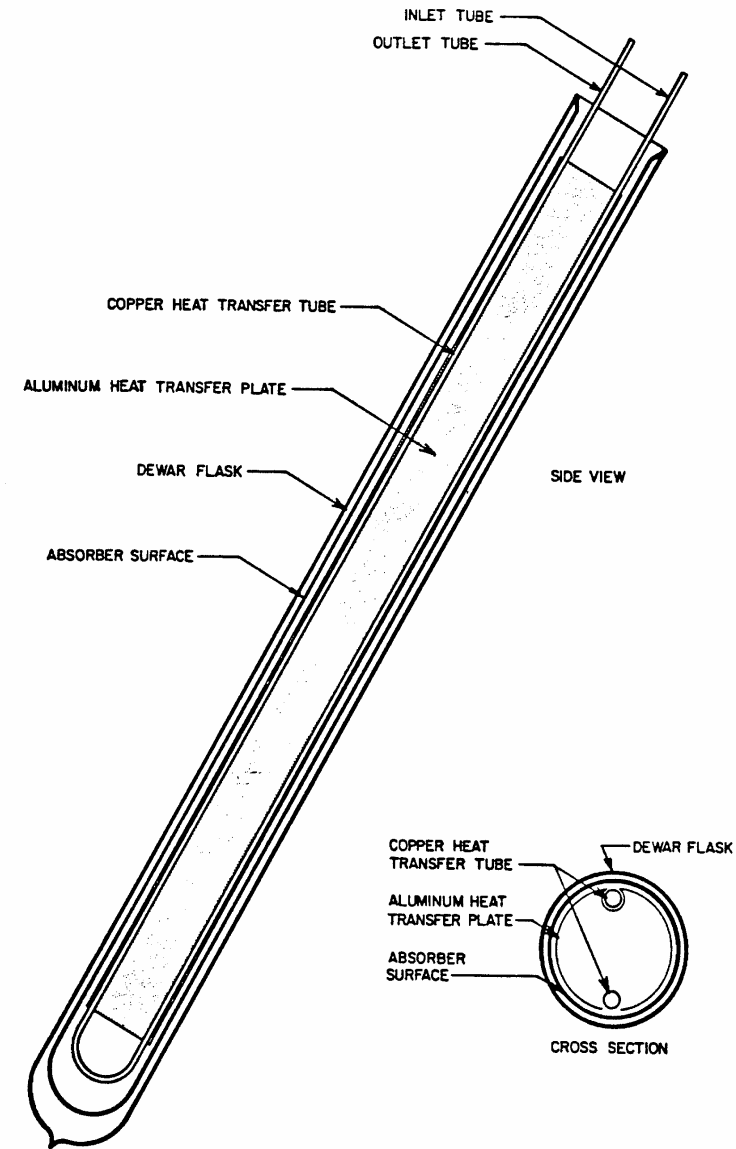
Insulated-tank integral system



Fully integrated collector/ tank

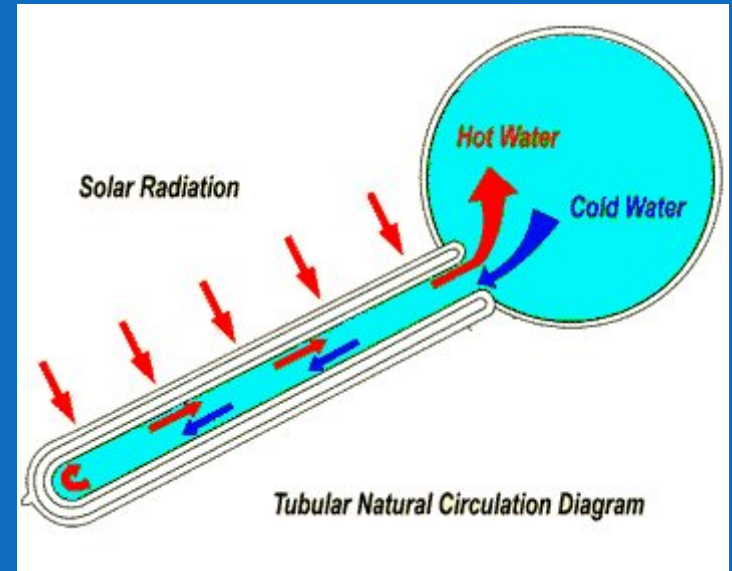


# EVACUATED TUBE COLLECTOR



# FLOODED EVACUATED TUBE SOLAR WATER HEATER

Most common system in China





# LARGE SCALE USE OF SOLAR WATER HEATING IN CHINA



Large arrays of evacuated tubes for commercial heat systems



Full utilization of high rise building roof for solar water heaters



# SOLAR BOOSTED HEAT PUMPS

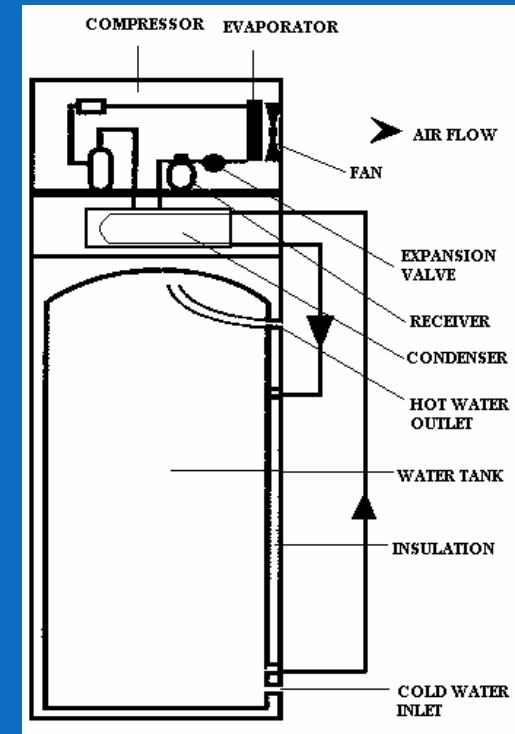
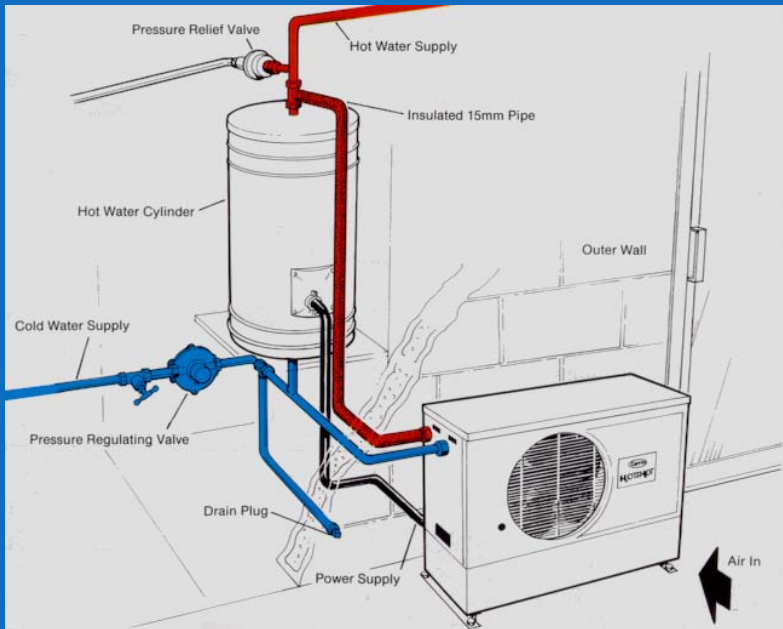
Small refrigerant compressor used to move heat from low temperature solar collector (heat pump evaporator) to high temperature water tank.



# AIR SOURCE HEAT PUMPS

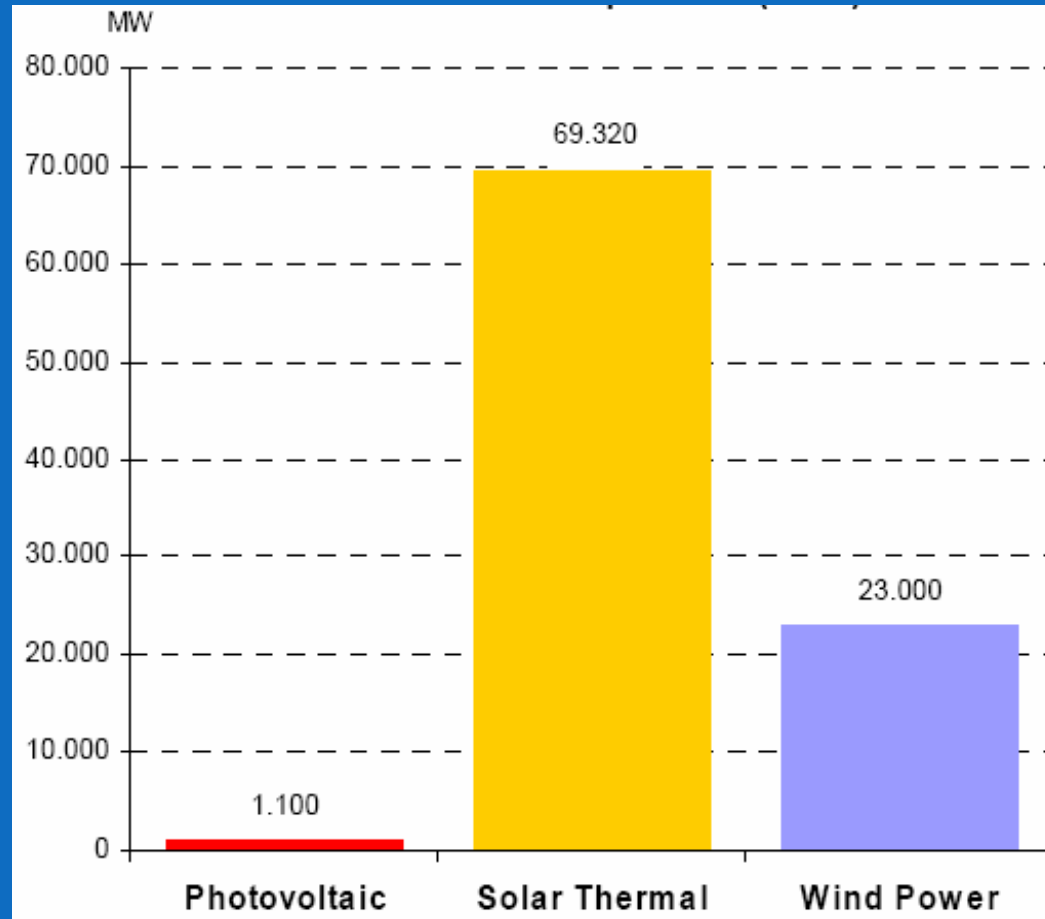


# AIR SOURCE HEAT PUMP WATER HEATERS

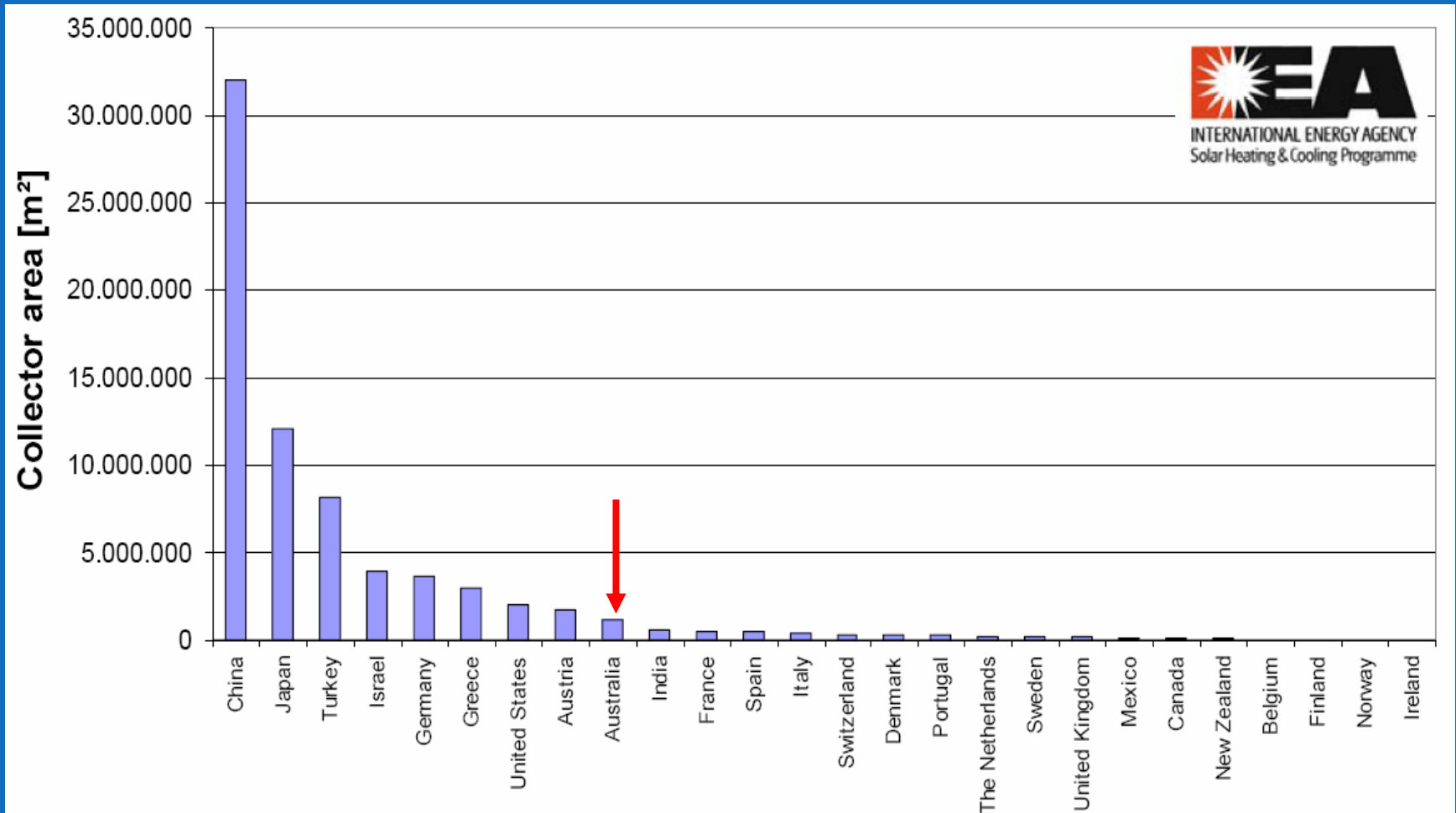




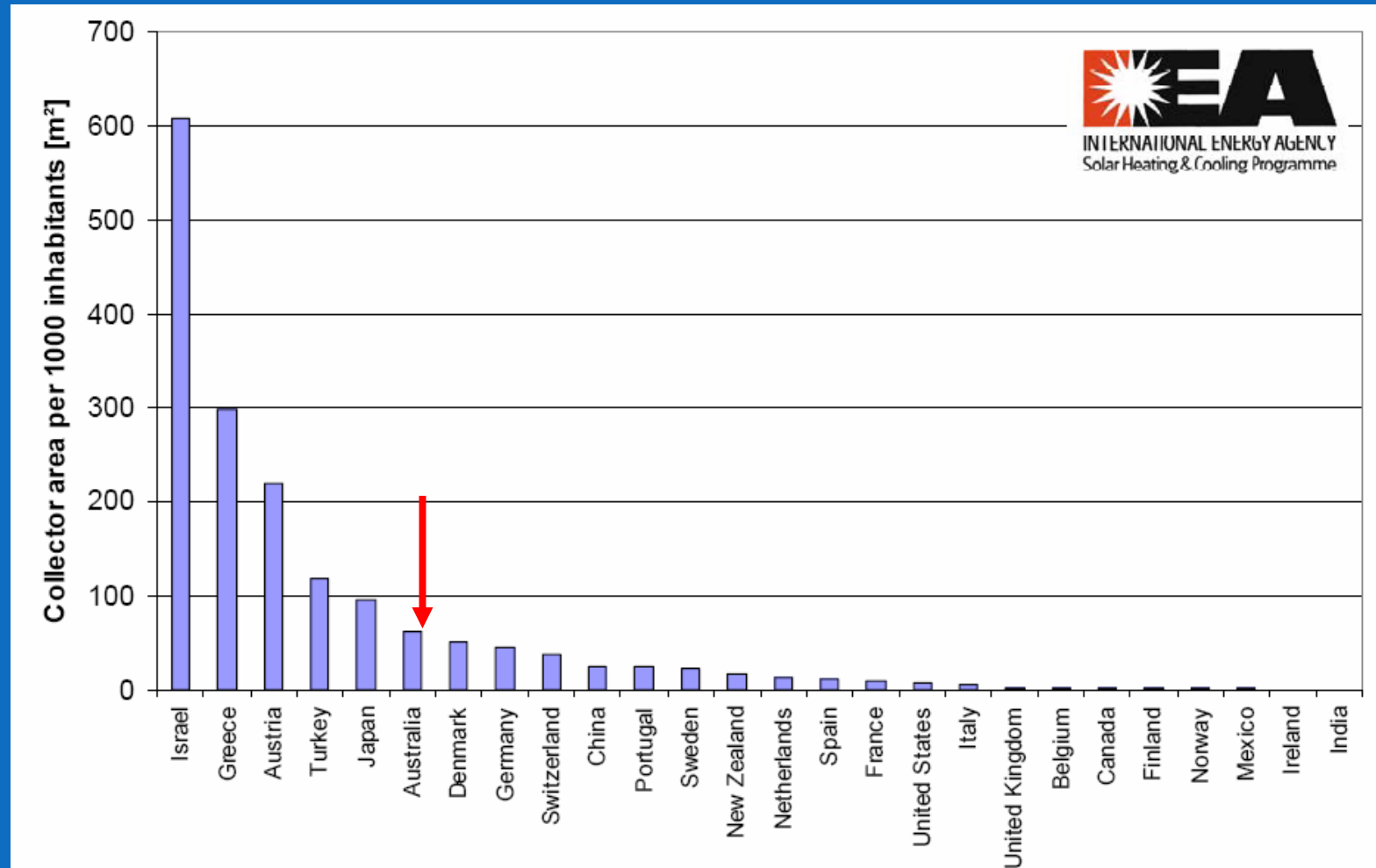
# GLOBAL INSTALLED CAPACITY OF RENEWABLE ENERGY SYSTEMS IN 2001



# SOLAR WATER HEATING COLLECTOR AREA IN USE 2001



# SOLAR WATER HEATING COLLECTOR AREA IN USE PER 1000 INHABITANTS



# INSTALLED CAPACITY OF SOLAR THERMAL COLLECTORS IN 2001 MW output under clear sky conditions

Country	Water Collectors			TOTAL
	unglazed	glazed	evacuated tube	
Australia	1.400	839		2.239
Austria	407	1.217	20	1.644
Belgium	16	17	1	34
Canada	361	51	0	413
China		7.840	14.560	22.400
Denmark	15	189	0	205
Finland		8	0	8
France	69	356		425
Germany	466	2.204	379	3.049
Greece		2.093		2.093
India		420		420
Ireland		2	0	2
Israel		2.744		2.744
Italy	16	238	17	271
Japan		8.229	218	8.447
Mexico	224	77		301
The Netherlands	108	145	2	254
New Zealand	1	47	0	48
Norway	0	5	0	6
Portugal	1	171	0	172
Spain	4	316	4	323
Sweden	23	138	2	163
Switzerland	141	174	16	332
Turkey		5.691		5.691
United Kingdom	62	110	6	179
United States	16.061	1.012	386	17.459
<b>TOTAL</b>	<b>19.375</b>	<b>34.332</b>	<b>15.613</b>	<b>69.320</b>



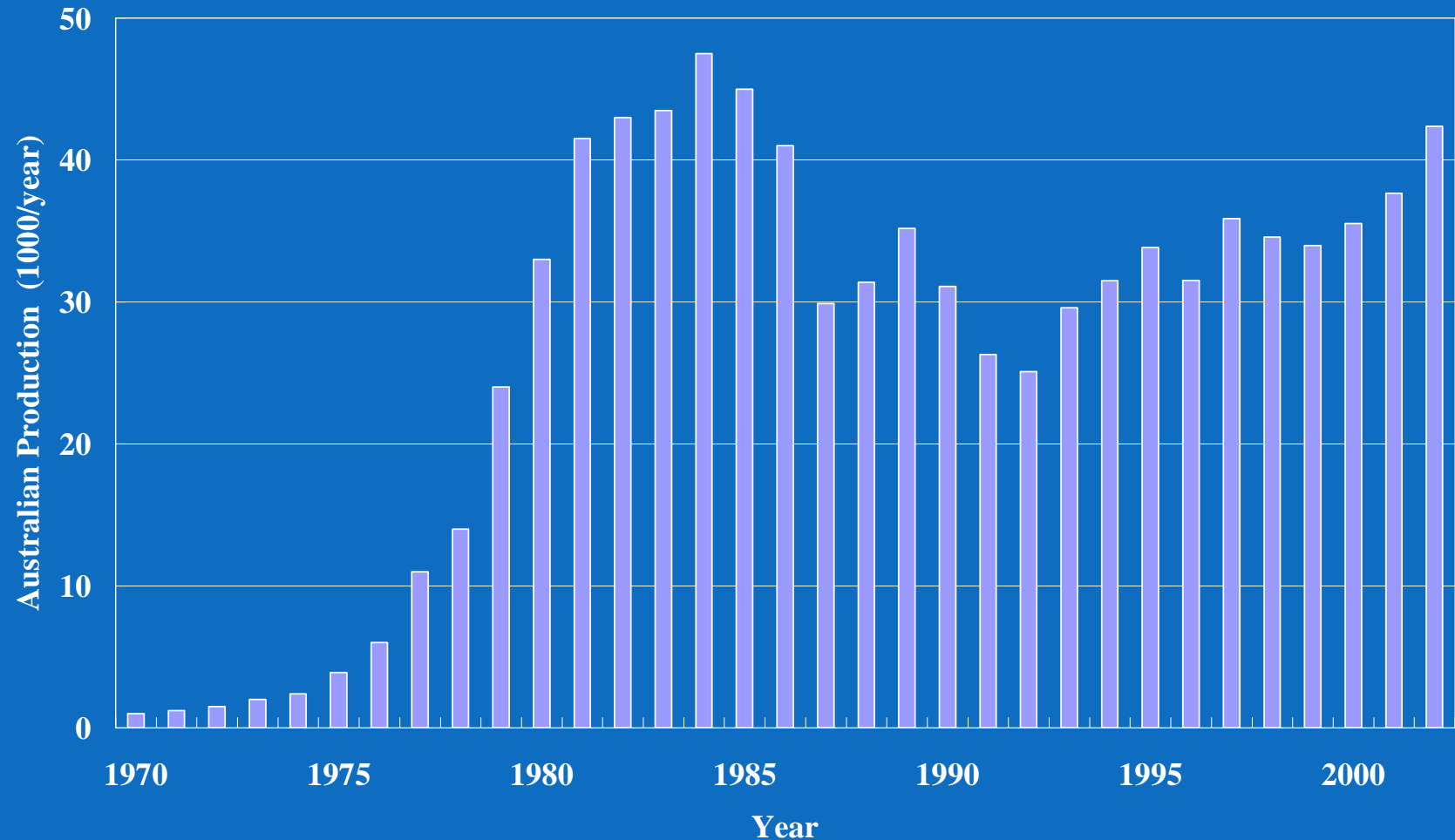


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# SOLAR WATER HEATER PRODUCTION IN AUSTRALIA



# SOLAR WATER HEATER DESIGN INNOVATIONS

- High efficiency flat plate solar collectors
- Evacuated tubular collectors
- Low flow rate system design
- Computer control of solar loop and electric boosting
- Solar preheating with gas boosting
- Low cost integral plastic solar water heaters
- Heat pump water heaters



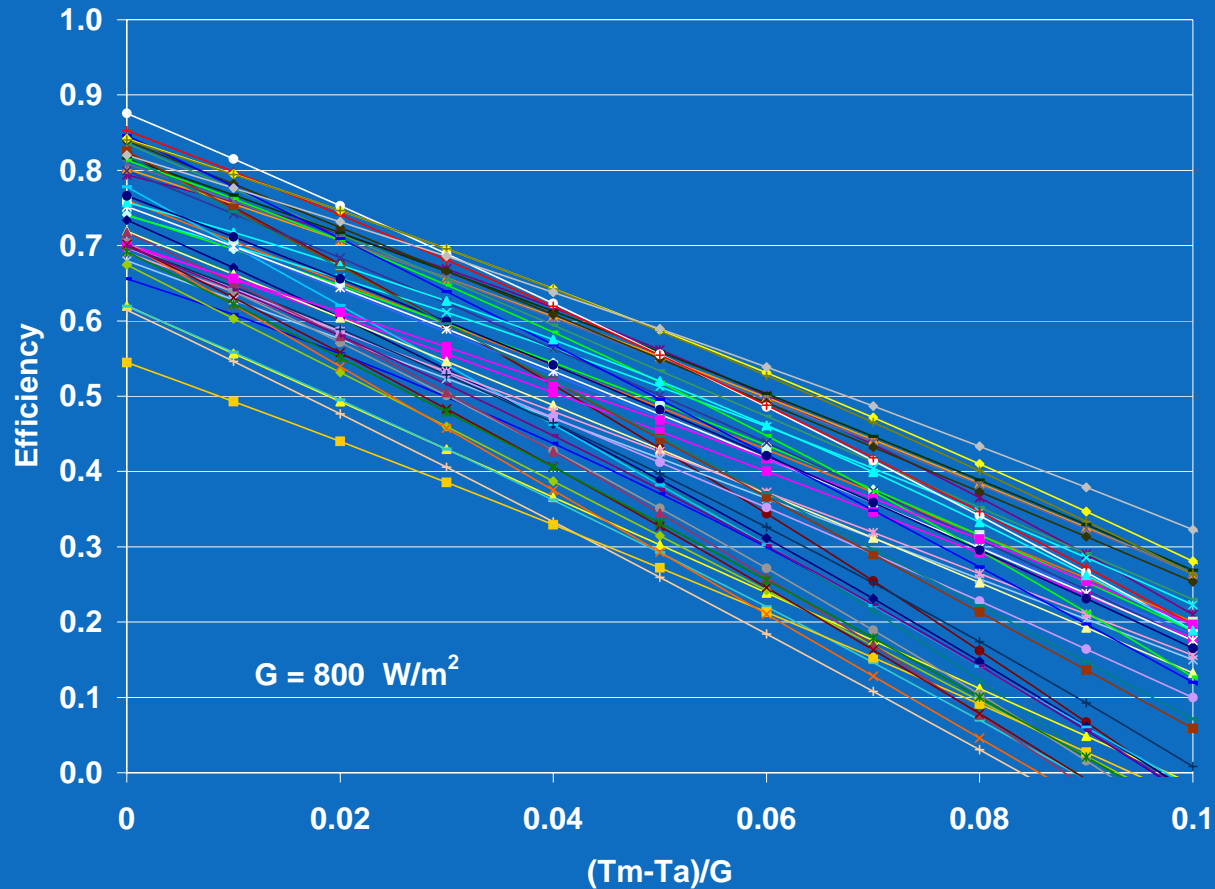
# SOLAR COLLECTOR EFFICIENCY IMPROVEMENTS

- Improved selective surfaces (sputtering of wide absorber sheets)
- Laser welding of absorber and risers
- Anti-reflection coatings on glass cover
- Optimisation of flat plate cover spacing, insulation and casing design
- Evacuated tube absorbers





# SOLAR COLLECTOR EFFICIENCY



# PERFORMANCE INFORMATION

The energy savings achieved by solar water heaters are published by The Office of the Renewable Energy Regulator and the Sustainable Energy Authority of Victoria.

Public information on product performance has promoted competition between manufacturers that has resulted in significant product innovation.

The requirement that products in the Renewable Energy Credit program meet Australian product quality standard AS2712 has had a significant impact on the quality of solar water heaters.



# CROSS SUBSIDY FOR RENEWABLE ENERGY

(really a carbon tax but don't tell John)



## Renewable Energy (Electricity) Regulations 2001

Statutory Rules 2001 No. 2 as amended

made under the

*Renewable Energy (Electricity) Act 2000*

This compilation was prepared on 7 June 2006  
taking into account amendments up to SLI 2006 No. 120



# WHERE TO GO FOR INFORMATION ON RECs

[www.orer.gov.au](http://www.orer.gov.au) (not really useful for home owners)

## Schedule 7

## Certificates for solar water heaters

### Part 2A

Number of certificates — systems up to and including 700 litres capacity

Item	Brand	Model	Eligible from:	Eligible to:	Number of certificates for an installation in Zone:			
					1	2	3	4
25	AquaMax	SC16-165-P1N	20 Aug 2004	31 Dec 2020	24	0	24	19
26	AquaMax	SC16-165-P1ND	25 Mar 2005	31 Dec 2020	23	23	23	20
27	AquaMax	SC16-165-P1P	30 Sep 2005	31 Dec 2020	30	0	30	26
28	AquaMax	SC16-165-P1PD	30 Sep 2005	31 Dec 2020	30	0	30	26
29	AquaMax	SC16-165-P1S	25 Mar 2005	31 Dec 2020	26	0	26	22
30	AquaMax	SC16-165-P1SD	25 Mar 2005	31 Dec 2020	25	0	25	22
31	AquaMax	SC16-165-P1T	20 Aug 2004	31 Dec 2020	27	0	27	24
32	AquaMax	SC16-165-P1TD	25 Mar 2005	31 Dec 2020	27	26	27	23
33	AquaMax	SC16-165-P2A	20 Aug 2004	31 Dec 2020	32	31	32	28
34	AquaMax	SC16-165-P2B	20 Aug 2004	31 Dec 2020	31	0	31	28
35	AquaMax	SC16-165-P2C	20 Aug 2004	31 Dec 2020	34	0	34	30
36	AquaMax	SC16-165-P2L	25 Mar 2005	31 Dec 2020	33	31	33	29
37	AquaMax	SC16-165-P2N	20 Aug 2004	31 Dec 2020	31	0	31	27
38	AquaMax	SC16-165-P2P	30 Sep 2005	31 Dec 2020	36	0	36	33





# WHERE TO GO FOR LOCAL INFORMATION ON SOLAR WATER HEATING

[greenhouse.gov.au/yourhome](http://greenhouse.gov.au/yourhome)

[seav.sustainability.vic.gov.au](http://seav.sustainability.vic.gov.au)

