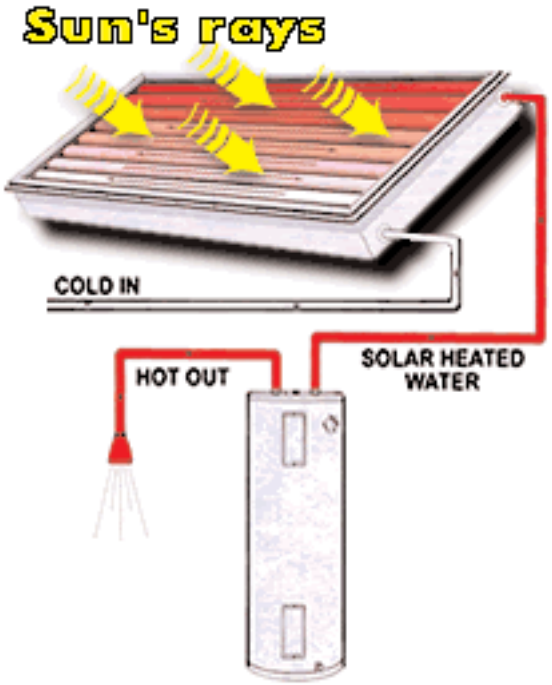
Solar water heating

Solar water heaters use the sun's energy to heat water for the home or for use in business. This is becoming more popular in many African countries, especially for people who have water piped to their homes. Larger systems are now being used in hospitals, schools and hotels. The costs of installing solar water heaters vary, but once you have paid for the system, it is a very cheap way to have hot water – because sunshine is FREE!



A solar water heater. Image, Sharpe Solar)

What is a solar water heater?

A solar water heater is any system that uses the thermal energy of the sun to heat water. They are usually aimed at heating water to a temperature hot enough for washing clothes, washing dishes, and personal hygiene, but not hot enough to cook with straight away. However, as long as it is clean, the hot water can also be used in cooking to save time and fuel.

The benefits of solar water heating

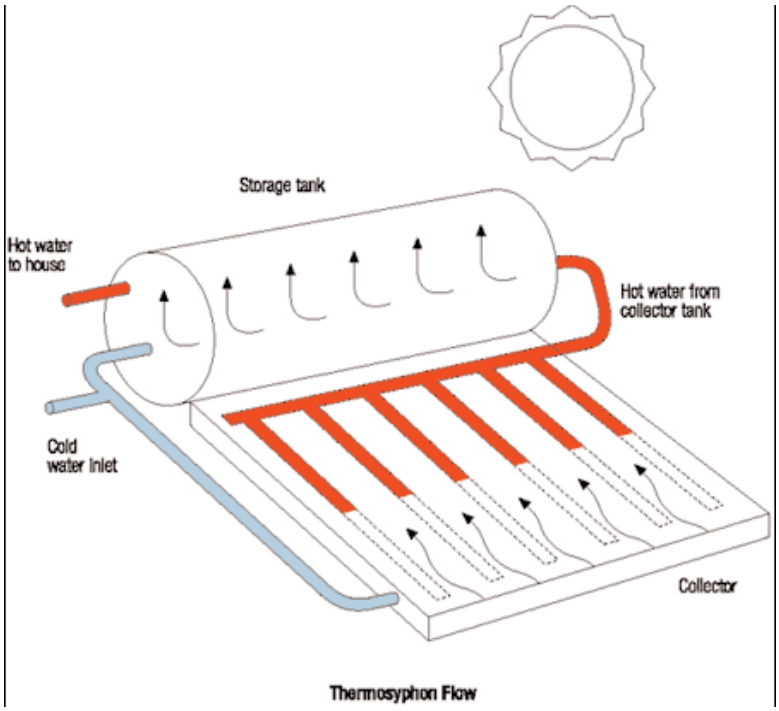
- Heating water with sunshine costs you less. Once you have paid for it, your water heating costs will be zero.
- A solar water heater cannot give you a shock or set fire to your house like electrical or flame-based water heating systems.
- Solar water heaters do not make any smoke, so they don't make your home smell or get dirty.
- If you usually heat water with gas or electricity from fossil fuels, a solar water heater helps reduce the carbon dioxide produced by your household, helping in the fight against global warming.

If everyone used solar water heating to the maximum, big savings in fossil fuel consumption could be made. The Kenyan Ministry of Energy estimates that if Kenya used the maximum possible number of solar water heaters, the country could reduce oil imports by 4%, which would save US$30 million annually. It's good for the environment too. In South Africa, a 2m2 solar water heater can save the following resources and emissions: 1,000kg of coal, 2,600 litres water, 1,800kg carbon dioxide; 284kg ash; 16.4kg sulphur dioxide; and 7.2kg nitrous oxide. In Botswana, the government has passed a law that requires all new government buildings to be fitted with solar water heaters.

How does it work?

The basic idea behind the solar water heater is a piece of black piping, filled with water, and laid in the sun for the water to heat up. To heat up more water you increase the number of pipes to make a "collector" and add a tank to store the heated water in. The whole system is insulated to minimize heat-loss. Water is cycled through the collector several times to raise the temperature. Some systems use electric pumps to pump water through the system, but this increases the cost. Alternatively, water can be made to pass through the pipes without a pump using the thermosyphon effect.

Thermosyphons use the fact that hot water rises above cold water. In a passive thermosyphon system, the tank is always above the collector. As the water in the pipes heats up, it rises up into the top of the tank, causing cold water from the bottom of the tank to flow down into the collector. The flow continues until the water in the pipes and the tank is at the same temperature. One-way valves are fitted to stop water flowing back the other way when the temperature drops at night.
Thermosyphon solar water heater (Image: Government of Western Australia website)



How much do household solar water heater systems cost?
The cost will vary widely around Africa, depending on the size of the system and whether the materials used have to be imported. Import taxes and taxes on business sometimes add to the expense. Larger systems with electric back-up will cost more.

What about people without water supply to their houses?

The University of Pretoria, South Africa, developed the Madiba heatbarrow, a stand-alone solar water heater, for people who collect water from a pump or well. The heatbarrow has a wheel attached, helping to transport the water, whilst the solar heat pasteurises the water, making it safe to drink (see Action Sheet 25). Stand-alone water heaters can provide lower income households with more hot water than they would be able to boil on a stove or fire.


The Madiba Heat barrow. Image, University of Pretoria

How can I find out more?

Do some research and find out how popular solar water heaters are in your country. If the price of a solar water heater is beyond your reach, you might find a project offering loans to help spread the costs over time. Companies providing solar water heating equipment should offer a guarantee that the system will work for at least 3 years. Then, if there is a problem, they will be responsible for mending or replacing the system during that time. Stand-alone portable systems should not require technical support after purchase. If you have technical know-how, see Action Sheet 65 or the books listed in the reference section for instructions on building your own system.

Acknowledgements

This Action Sheet was developed by Nancy Gladstone with advice from Horst Reiche at Solar Heat Exchangers, South Africa, and based on information from: ITDG Technical Brief on Solar Water Heating; Ledger, J., Get ready for the solar water heating renaissance, Plumbing Africa Magazine, Volume 11, Number 6; Karekezi, S. and Ranja, T., Renewable Energy Technologies in Africa, AFREPREN/SEI, 1997; de Villiers, M., and Khorommbi Matibe, 2000, Greenhouse gas baseline and mitigation options for the residential sector, EDRC REPORT NO: EDRC/00/R17, Energy And Development Research Centre, University of Cape Town.

More information is available from

ITDG Technical Briefs https://practicalaction.org/knowledge-that-inspires/
Solar Water Heating: A D-I-Y Guide CAT Publications - 1999
Heating Water by the Sun UK-ISES 1981
Solar Domestic Hot Water by Plante R H Wiley and Sons - 1983
Practical Solar Heating McCarthy K/Ford B - - Prism Press - 1978
The Integral Passive Solar Water Heater Book by David Bainbridge from The Passive Solar Institute, Dept. TMEN, P.O. Box 306, Bascom, Ohio 44809). The book contains 99 pages of informative, copiously illustrated guidance in all aspects of IPSWH design and use.
Another good sourcebook, Passive Solar Water Heaters: How to Design and Build a Batch System by Daniel K. Reif, Brick House: 208 pages of valuable passive solar building instruction, available from Mother's Bookshelf, 105 Stoney Mountain Road, Hendersonville, North Carolina, 28791.

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