Should I buy a Solar Water Heater or a Heat Pump?

By Riaan Honeyborne, ITS Solar, January 2012

With the price of electricity and the awareness for sustainable living sharply increasing, the popularity of renewable energy technology for heating water has also sharply increased. But, as with many products on the market, one can find considerably contradicting claims with regards to the different technologies used for water heating. Many of these claims and advertisements are nothing more than marketing "blah" and have no facts behind them.

We have therefore decided to cut through the "blah" and try and shed some light on, specifically, the savings that a homeowner will get from a solar water heater versus a domestic hot water heat pump.

A Background to the Technologies

Let's first touch on some basics with regards to **solar water heaters** and **heat pumps.**

Solar water heaters use the radiation from the sun to generate heat. The size of the solar panel will determine how much energy can be collected from the sun. So if we for example have a 3m² solar panel connected to a 150L geyser this might give us 150L of 60°C water at the end of a warm sunny day but during cooler days with less sunshine it might only be able to heat the 150L to 35°C.

In this case we would need an electrical element to heat the water further. If we have a solar panel that is only half the size (1.5m²) we would only get out half the energy and an electrical element will need to do the rest.

Also if we assume we have 150L of 60°C water at the end of a warm sunny day and we use hot water in the evening, the water will more than likely be cold in the morning and so if someone would like to take for example a shower in the morning, an electrical element again will need to heat the water to a useable temperature.

From the above it should be clear that solar water heaters do rely on electrical elements to provide hot water at all times. In our experience a high efficiency properly sized solar system will typically provide up to a 50% saving on the energy required for hot water.

The sad truth however, is that most solar systems in South-Africa are undersized and therefore will provide much less than a 50% saving on the water heating bill. I see so many houses where families of 3 or more are living having just a 2m² solar panel on the roof.

Most likely they were promised big savings by the company that sold it to them but it is simply physically impossible. Please also note that if a high efficiency properly sized solar water heater gives a saving of 50% on your water heating bill this will not result in a 50% saving on your total electrical bill - unless the geyser is the only electrical device in your house.

Domestic hot water heat pumps work slightly differently. The heat pump uses a small amount of electricity to extract a lot of energy from the surrounding air. So a heat pump is also using the energy from the sun but only indirectly and so it can work day and night, winter and summer. The efficiency of a heat pump is called the COP. A COP value of 4 means that the heat pump produces 4 times as much thermal energy as what it uses electrically - in other words a 75% saving on the water heating bill.

Unfortunately the COP of a heat pump is dependent on the ambient temperature and the water temperature and so, in a practical domestic hot water system using a high efficiency heat pump, a more realistic annual COP value is 3. A high efficiency heat pump like the ITS-4.7HDP takes about 1.5 hours to re-heat a 150L geyser (as is used in most households in South-Africa). This enables you to always have hot water at a fraction of the cost no matter when or how much water you use.

Some Practical Examples

My neighbours are a family of 4 (husband, wife and 2 young boys) that use water very conservatively. Measurements we have done on their 200L geyser show an average consumption of 16kWh/day. They would like to save on their electricity bill and the most cost effective way is to install a solar water heater or a heat pump. Let's first look at the solar water heating option. On a 200L geyser most solar installers will put a 3m² solar panel (flat plate or evacuated tube). A top of the range high efficiency 3m² solar panel that is perfectly mounted will provide a maximum thermal output of 7kWh/day (based on the South-African national average solar radiation of 23MJ/ m²/day).

At an Eskom tariff of R1.25/kWh this will equate to a saving of R24,640 over 5 years. A high quality solar system like this will cost them from about R14,000 for a retrofit system (solar panel connecting to the existing geyser) and from about R21,000 for a complete system (solar panel plus new solar ready geyser). Pricing estimation is for a fully installed system and with the Eskom rebate already deducted.

With a high quality domestic hot water heat pump working at average South-African ambient temperatures you will conservatively get a COP of 3. With a COP of 3 they would on average save 10.66kWh/day and therefore R37,500 over 5 years. A heat pump like this would cost them about R13,500 fully installed and with the Eskom rebate already deducted.

The Joneses are also a family of 4 but they are more liberal with their water use. They are using an average of 30kWh per day on their 200L electrical geyser. Since a 200L geyser can only store 200L of hot water, connecting a bigger solar panel on will not necessarily result in a bigger saving. But the Joneses do have people in the house during the daytime and so we can go for a bigger 4m² high efficiency panel. This solar panel will give an average of 9.5kWh/day and therefore a saving of about R33,400 over 5 years.

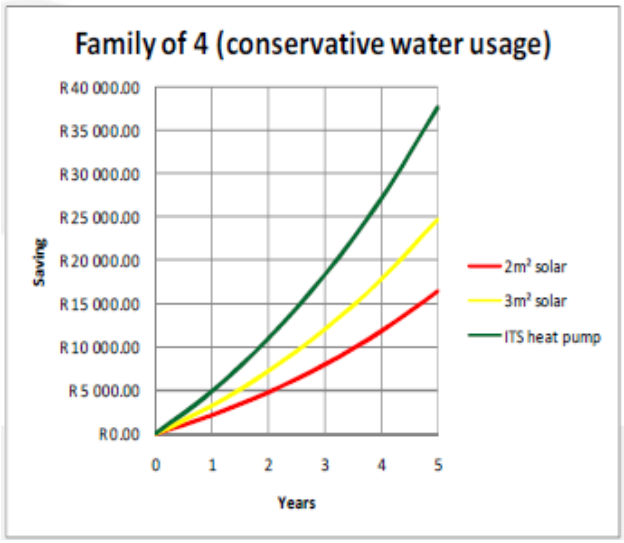
The 4m² solar system will be about R2,500 more than the 3m² system pricing given above. Should the Joneses decide to rather go for a domestic hot water heat pump, we can use exactly the same unit as my neighbours. Again working on a very conservative COP of 3 then the Joneses will save 20kWh/day and therefore R70,400 over 5 years.

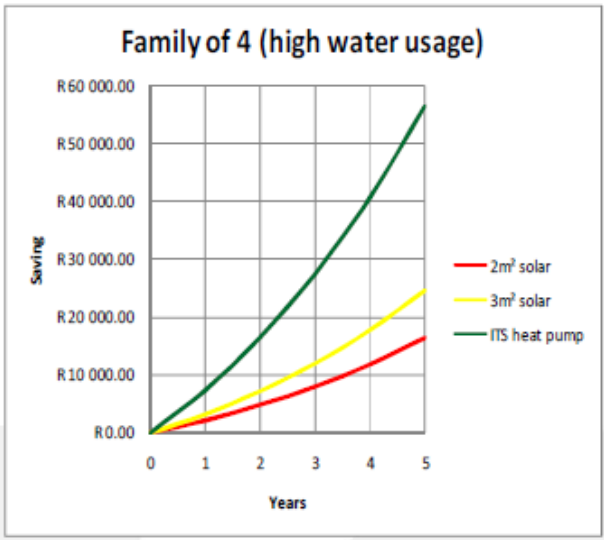
In Conclusion

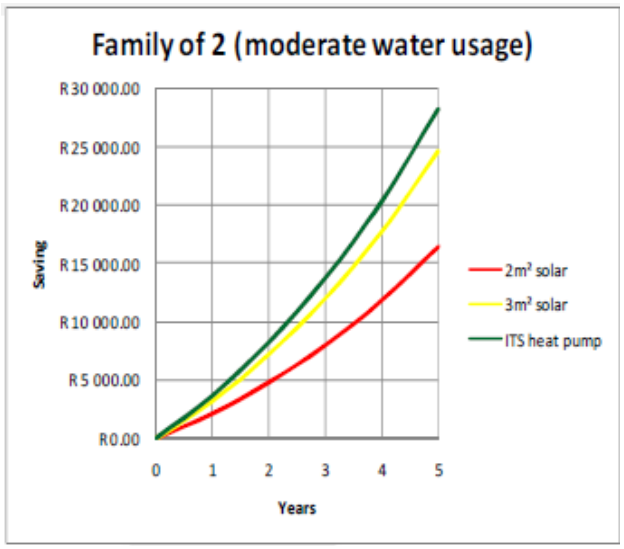
From the examples above it can be seen that even for a family that uses water conservatively, the heat pump will pay for itself in just over 2 years and provide a much bigger long term saving than a solar system. The solar panel savings calculated above also assumes that the solar collector panels are mounted Solar-North with the optimal inclination. Variances in the facing and inclination of the solar collector panels will decrease the systems output.

With the Joneses, the heat pump will pay for itself in about 1 year and 5 months while the solar system will take about 4 years.

The life expectancy of both the solar system and the heat pump is very similar and is estimated at 10 years but in both cases we know of systems that are running for more than 25 years and still going strong.







Please consider also:

- Eskom **rebates** will not always be available;
- Electricity **costs** are forecast to escalate by some 15% per annum, year on year.

Go Green can ensure that you **don't lose out** in the current Eskom rebate climate.

Contact us now for a **FREE** assessment and no obligation quote.

Eugene Bester: 076 519 9473
Technical Manager.

John Tregidga: 082 658 1914
Service Manager.