A desktop study to investigate the global best practice for Solar Water Heating manufacturers

Completed by: PDC, South Africa and Synopsis, France
Author: Marlette Balmer
Commissioned By: REEEP Southern Africa
Date: December 2006

Summary
Internationally, the use of solar water heaters (SWHs) is driven by sustainability issues, security of supply as well as government incentives in a number of formats. Interest in solar water heating within South Africa is fuelled by the target set for renewable energy as well as electricity generation capacity problems and, to a lesser degree, to encourage sustainable energy consumption. The study presented here was commissioned by the Central Energy Fund (CEF) of South Africa to inform the public/private sector of global best practice for available solar water heating technologies, warranty periods, pricing, and standards.

A questionnaire-based survey was addressed to international manufacturers, requesting offers for the export of SWHs into South Africa. Proposed systems were similar in size and type but differed strongly in price. Thus, countries were classified into low price ("Group A") and high-price ("Group B") categories. Imported SWH ex-factory prices were compared with South African prices, which were found to be slightly higher than the imported ones. International experience indicates a mix of demand and supply stimulation is required to develop the solar water heating market.

End-user area		Target Audience		Technical	
	New buildings		Citizens		Energy efficiency
	Refurbishment of buildings		Households	X	Heating
	Transport and mobility		Property owners		Cooling
	Financial instruments		Schools and universities		Appliances
X	Industry	X	Decision makers		Lighting
	Legal initiatives (municipal regulations, directives, etc)		Local and regional authorities		CHP
X	Planning issues		Transport companies		District Heating
	Sustainable communities	X	Utilities	X	Solar energy
	User behaviour		ESCOs		Biomass
	Education		Architects and engineers		Wind
	Other		Financial institutions		Geothermal
			Other		Hydro power
					Other

Introduction
Solar water heaters (SWHs) have been available for more than 40 years; yet have failed to make significant in-roads in the various markets for hot water. Notable exceptions are the Israel; Greek and Turkey markets where SWHs have enjoyed significant market penetration. Solar water heating is generating renewed interest internationally due to energy security issues, as well as locally in South Africa where the potential contribution of SWHs to the reduction in peak electricity demand and achieving renewable energy targets, is prompting some positive developments. Solar water heating is not an alien technology in South Africa and a number of product suppliers and manufacturers are active in the relatively small market. The case study is based on research

commissioned by the Central Energy Fund to investigate the global best practice for available SWH technologies, warranty periods, pricing, and standards.

Objectives
The main outputs of the project were:

- A database containing information on various SWH systems:
- A report, based on sectored nodes (Australia, China, India, Europe-high tech, Europe – low tech, USA, small islands) detailing the current global technology market environment dealing with policy, standards, approaches and the technology best practice recommendations relating to South Africa's current market.

Methodology
The research was conducted through a desktop analysis of technical and market data. Data collection was through a structured questionnaire; e-mailed to a contact database of SWH manufacturers whose contact details were obtained from the web, trade publications, personal contacts and existing reports.
Some difficulties encountered were:

- Incorrect contact details, e-mail non functional, unknown recipients and non-functioning fax numbers;
- Some websites only listed postal addresses for companies;
- A number of websites requires paid membership before company contact details could be accessed; and
- Reluctance of some organizations to provide requested information.

Financial resources and partners
The study was funded by the Central Energy Fund (CEF) and carried out by PDC and Synopsis.

Finding / Outcomes
In terms of available SWH technologies, there was a clear indication that internationally, split systems, either with collector and tank as separately installable elements, or with collector and tank mounted onto a common support ("mono-blocs") are the most popular systems and leading the market, except in China where Vacuum tubes were dominant. The team requested the participating organisations to recommend the optimal system for South African conditions from their product range. Group A manufacturers (low-price) proposed direct (without heat exchanger) and indirect (with heat-exchanger) systems, with gravity flow and pumped storage. Group B (higher price) manufacturers proposed mostly indirect pumped systems. No manufacturer of integrated solar water heaters (where collector and tank are the same element) responded, prompting the team to conclude that integrated systems seem to be disappearing from the market. The average system dimensions proposed were of the same order for Groups A and B: collector surfaces 3.8 m² for the sunnier Group A against 4.1 m² for B, with tanks slightly larger for Group B: 258 against 225 litres. Although the team concluded that integrated systems seem to be disappearing from the market, it should be noted that integrated SWH are much lower in cost and the development of an integrated SWH for the low price market segment should be encouraged and investigated in South Africa.

In terms of warranty periods, typical periods were one year for tanks (6 years for collectors) from Israel, two years for India, three years for China, and between 5 and 6 years (up to 10 years in one case) for other countries.

There are two types of standards for SWHs, the first concerning components, and the second complete systems. A standard for SWH in South Africa has been developed and should be used as a basis for further efforts. Component standards exist mainly for collectors, but also for tanks, heat exchangers, and controls, concerning thermal performance under different, well-defined and controlled environmental conditions (indoors or outdoors) as well as durability parameters. The

corresponding tests require elaborate experimental set-ups, although simplified versions have been designed.

There are three basic options for RSA:

1. develop and use original standards,
2. adapt standards to the local situation, and use these standards,
3. have components tested abroad.

The team recommend option 2, since the RSA has the potential to conduct tests adapted to local conditions at lower cost, in a shorter timeframe without shipping delays and in closer interaction with manufacturers. In a first step, basic collector performance standards (e.g. based on OG100 or NF EN 12975-2 Installations solaires thermiques et leurs composants - Capteurs solaires - Partie 2 : méthodes d'essai) should be adapted.

Standards for complete SWH systems such as OG300 are essential for the RSA where up-market products could find a market as well as very basic concepts, each being proposed for a well-defined user situation. System standards have to reflect a variety of system types. Their results should allow the client to make an informed choice between different models available.

In terms of pricing, per m² of collector surface, Group A solar water heaters only cost 38% of the Group B models, per unit tank volume 43%. For indirect models, per unit tank volume, the Group A models cost half of the Group B models. For indirect pumped systems, Group A models cost two third of Group B models. It was observed that for the more elaborate designs, the price difference decreases.

For the scope of this study, it was important to compare ex-factory prices. The distributions of per-unit ex-factory prices for an order of 100 units, as well as for an order of 1000 units are shown below.

Figure 1: Ex-factory price per unit (100)
Figure 2: Ex-factory price per unit (1000)

Since larger systems tend to be more expensive than smaller ones, it was useful to calculate "specific" prices (i.e. prices per unit of tank volume or per collector aperture unit). The most frequently offered prices were €3.50 per litre (e.g. €700 for a SWH with a 200 litre tank) and €200 per m² (e.g. € 800 for a SWH with 4 m² collector aperture surface).
The average per m² retail price, including installation, distribution and VAT, for South African SWHs has been found to be ZAR3736 by Holm (2005)[1]. Using figures for installation and distribution published in the same study, this corresponds to an ex-factory price (excluding VAT) of ZAR2340, or €277 (at the exchange rate of 24/05/2006).

Figure 3 below, shows a comparison of the South African price with the 100 unit ex-factory prices proposed by the manufacturers. The entry marked in red corresponds to the average South African price (Holm, 2005) which was 20% higher than the average prices observed in the present study.

Figure 3: Ex-factory price m2 collector area (100)

It should be noted that this comparison must be read with caution, not only due to the variations in the ZAR exchange rate, but also because:

- the transport of the import models is not taken into account
- all but one of the respondent manufacturers don't have a South African legal presence which makes eventual warrantee conflicts more difficult for the client.
- the SWH models compared have different quality standards.

[1] Holm, D. 2005. Market survey of solar water heaters in South Africa. Final report prepared for EDC, CEF and UNDP. Central Energy Fund: Johannesburg.

However, the comparison indicates that there is a price reduction potential for SWH produced in South Africa.

Lessons learned and repeatability

In summary, the following observations were made during the course of the study:

- Internationally, solar water heating application focus shifts between domestic (Australia) and industrial/commercial (India) while the most successful countries (Austria, Spain) have almost a 50/50 split between domestic and commercial applications;
- Most countries have renewable energy policies setting targets, but the more successful countries articulated very detailed targets for SWH (either in number of people to be serviced or m^2 of collectors to be installed);
- A mix of instruments was used in different countries to stimulate the SWH market. These include capital subsidies (mostly to installers or manufacturers), interest rate subsidies, financial incentives to manufacturers, as well as financing/credit schemes for end-users;
- Successful countries (China, Austria, India and Australia) invested in large-scale public awareness programmes together with other incentive schemes;
- Successful countries have on-going research and development (R&D programmes). In countries were the subsidy is calculated based on energy actually produced, there is an active interest for all involved to increase solar energy output, which in turn boosts R&D focussed on the most efficient solution, for example in Germany and China.
- Factors that boosted the market for SWH and may also boost it in South Africa are uncertainty in electricity supply and electricity price increases.

The following recommendations were put forward:

1. Investigate the potential for price reduction in the South African market
2. Support research and development in the field of low-cost SWHs, for example integrated SWHs;
3. In cases where foreign competitors have the means to deliver key technologies cheaper than domestic companies (e.g. vacuum tube collectors from China), enter in a joint venture for the adaptation, production and marketing of these products;
4. Invest in specific standards and assist the industry to obtain labels. However, standards and labels should be used as means for market development and not as market barriers;
5. Tie subsidies to the electricity price - the logic being the "virtual" electricity production by SWH (see above), and that all electricity users should share the cost of transition to renewable electricity
6. Tie subsidies to energy actually produced and not to installed capacity. Subsidies are set and guaranteed at the outset of the programme.
7. Support on-going research and development to ensure a position of market leadership;
8. Access the market in sub-Saharan Africa and neighbouring islands based on these key technologies;
9. Both local as well as regional demand should be targeted by the South African SWH industry. South Africa should focus on becoming the regional centre of SWH expertise.

Contact for more information:
Project Web Site: N/A
Organisation / Agency: PDC
Main contact: Marlett Balmer
Address: PO Box 11906, Queenswood, 0121
Tel: (012) 349-2269
Fax: (011) 501-3388
E-mail: marlett@pdc1.co.za
Web Site: www.pdc1.co.za

Printed reports or other literature available: The Final Report should be requested from CEF via PDC.