November 2018

SOLTRAIN Newsletter #10

Uniting against Poverty

WITH FUNDING FROM
AUSTRIAN DEVELOPMENT AGENCY

SOLTRAIN Bursary Programme - Applications about to close

The SOLTRAIN Bursary Programme aims to support the work of the SOLTRAIN project in SOLTRAIN partner countries, and to motivate students at universities to do their masters thesis in the field of solar energy.

The bursary supports travel costs to visit another institution in Southern Africa for further study or experimental work, equipment costs to conduct experiments to support research, and the running cost of experimental work or further studies.

You can read more on last year's successful applicants (pictured below) at this link.




This year's application form can be downloaded by clicking the button below. Please distribute it to your local networks and note that the closing date for applications is the **16 November 2018**.

Download Application

Investigating the cost of large-scale solar thermal systems in SADC Countries

Mr Angelo Buckley

A study entitled "*Investigation into the Costs of Large-Scale Solar Thermal Systems in SADC Countries*", authored by Mr Angelo Buckley and co-authored by Ms Karin Kritzinger and Prof Sampson Mamphweli from the Centre for Renewable and Sustainable Energy Studies (CRSES), Stellenbosch University, was submitted and presented at the Southern African Solar Energy Conference (SASEC) 2018 which was held in Durban, South Africa in late June.

The goal of the study was to investigate the variation of the specific costs in EURO/m^2 installed of both thermosyphon and pumped type solar thermal systems in the partnering SADC countries of the Southern African Solar Thermal Training and Demonstration Initiative (SOLTRAIN). These countries include South Africa, Lesotho, Botswana, Namibia, Zimbabwe and Mozambique.

The cost data of SOLTRAIN co-funding applications from 2010 to mid-2017 was made available by AEE-Intec to conduct the study. This included co-funding applications from SOLTRAIN phase 1, phase 2 and midway through phase 3. This data accounted for 92 solar thermal projects, which amounts to a total of 294 solar thermal systems which applied for co-funding from the six SADC partnering countries.

The study highlighted the following:

- The average specific cost of pumped solar thermal systems ranged from approximately 470 to 1 000 EURO/m^2 across five of the six countries, with Lesotho exhibiting the highest costs.
- The average specific cost of thermosyphon systems ranged from approximately 500 to 700 EURO/m^2 across four of the six countries, with South Africa presenting the highest costs.

- The average specific cost of pumped and thermosyphon systems was 745 EURO/m^2 and 613 EURO/m^2, respectively, over the period from 2010 to mid-2017.

The study shows that there is a large variation in specific cost of both pumped and thermosyphon installations in the SADC countries in relation to the gross collector area installed and that this variation is noticeably larger for pumped systems in relation to that of thermosyphon systems. The results of this study were limited to the availability of application data, which, it is hoped, will be built upon with the progression of the SOLTRAIN project.

The findings of this study aim at providing clearer approximation of the average specific costs for particular solar thermal technologies attributed to each of the SADC countries, and also to investigate the behaviour of cost trends through the growth of the technology's deployment within the SADC region.

SANEDI assists the SA National Defence Force with going green

Dr Karen Surridge

From 2014 to 2016, SANEDI, as a government partner, was invited to speak about renewable energy and energy efficiency at national level at the Department of Defence (DoD) Annual Environmental Seminar.

Through this relationship, SANEDI was subsequently invited to speak at a provincial environmental forum to contribute towards improving energy usage and assist in advising towards compliance with the DODs environmental and energy strategy at military installations in Limpopo region.

SANEDI representatives have to date attended several exploratory trips to military installations at different scales throughout Limpopo Province in order to assess energy needs and to be able to provide preliminary informed advice on plausible, sustainable renewable energy and energy efficiency interventions. SANEDI now has a formal agreement to act as an implementing arm for DoD on identified collaborative projects that will address energy needs.

An initial project will entail the construction and operationalization of two 1 500 litre Solar Water Heating (SWH) systems at a pre-selected military base in Limpopo province. Since DoD is already constantly undertaking installation, maintenance and repair of water heating infrastructure at its units, this project aims to support and build capacity in this space for the DoD and its members. This can be achieved by implementing an energy efficient, renewable energy hardware system that supports human capacity development (HCD) as well as contributing towards reduced energy costs and reliable water heating energy security.

SOLTRAIN visits Regional Works Unit (RWU) Limpopo in connection with potential collaboration and training/ skills development support.

Left to right: Cpt. (now Maj.) Shivhishi ; Mr Werner Weiss (Director AEE ITEC); Col. Benedict Manzini (Officer Commanding RWU Limpopo); Lt. Col. Hennie Davel (Chief Environmental Officer RWU Limpopo); Dr. Karen Surridge (RECORD Centre Manager, SANEDI)

These developments have a great deal of overlap with the Austrian-funded bi-lateral project called the Solar Thermal Training & Demonstration Initiative (SOLTRAIN) which aims to tackle similar needs and create opportunities through addressing the SWH sector across six partner countries in the Southern African Development Community (SADC), namely, Botswana, Lesotho, Mozambique, Namibia,

South Africa, and Zimbabwe. All these partner countries are pursuing policies that enhance security of supply, energy conservation and increase energy access. Furthermore, in all partner countries there are national plans and policies on the support to increase the use of solar thermal systems in place.
Starting in 2009, SOLTRAIN aims to support the national solar thermal plans and is currently in its third 3-year-long phase, through the initiative, parties are able to apply (through the appointed contractor) to the SOLTRAIN programme for financial support towards SWH systems and artisan training (elaborated in a subsequent project agreement). SANEDI, supported by the Centre for Renewable and Sustainable Energy Studies (CRSES) at University of Stellenbosch, is the national implementing partner for the SOLTRAIN programme in South Africa.

In this regard, RECORD (Renewable Energy Centre Of Research and Development) at SANEDI, has been hard at work procuring a SWH system for the DoD, the first of several collaborative projects taking place between SANEDI and the DoD after the signing of a 5-year Memorandum of Agreement on 16 July 2018. The project is expected to be partially supported through SOLTRAIN funding and will be implemented by SANEDI, thus cementing the interaction of SANEDI, the DoD and SOLTRAIN in the upcoming fourth phase commencing in July 2019.

This SWH installation will provide hot water to two accommodation bungalows that are used to accommodate military members, approximately half of which are female, performing medical tasks. Furthermore, four DoD members will be trained to maintain this system and will shadow the contractor during installation and maintenance.

In a similar vein, RECORD has delivered a number of training sessions on renewable energy, energy efficiency and SWH system understanding and awareness at several military units, in order to prepare members for the upcoming projects.

Furthermore, SANEDI and RECORD, under the banner of SOLTRAIN, are conducting half-day awareness sessions including the basics of renewable energy and energy efficiency with a focus on how SWH works, and how it can make a difference at varying scales.

Dr Karen Surridge addressing a monthly briefing meeting for the military base (26 September 2018)

This includes an experiment conducted from a worksheet designed originally for School Science clubs known as the Science Spazas. In the experiment, members of the South African National Defence Force get to test the hypothesis behind why heating water with the sun really works. In fact, at the most recent session, after only three and a half hours in the sun, the test water had reached a whopping 660 Celsius! There is nothing like a touch and feel exercise to prove science.

Monitoring of domestic solar water heating systems in Namibia

Fenni Shidhika and Helvi Ileka

A Namibian cabinet directive of 2007 on Solar Water Heaters (SWH) requires SWH to be installed in all government financed and subsidised buildings such as those of the National Housing Enterprise (NHE). The NHE authorised the Southern African Solar Thermal Training and Demonstration Initiative (SOLTRAIN) II project to contract Trinity Business Solutions to install 62 SWHs in newly constructed houses under the NHE in Namibia starting from December 2015 until March 2016, and the Namibia Energy Institute (NEI) through the SOLTRAIN project, Ministry of Mines and

Energy and NHE, financed the installation of 62 SWHs at low-cost houses in Otjomuise, Windhoek.

NEI, together with the AEE-Institute for Sustainable Technologies, installed monitoring equipment at four of the houses with domestic solar water heaters (DSWH) with electrical back up elements, and two monitoring systems on houses with normal domestic electric water heating (DEWH) systems.

The measuring, monitoring and data acquisition equipment functioned to collect and store data about system performance in order to verify and demonstrate the efficiency and cost savings of SWH compared to conventional electric geysers. Parameters analysed included the proportion of thermal energy generated by solar (the solar fraction), the energy from the electrical back-up element, the energy required to heat the water, the total mains electricity consumption, the volume of hot water per person per day and thermal heat losses.

A long-term comparison of benefits and disadvantages between DSWH and DEWH systems is useful in informing policy makers and to guide the NHE in the implementation of the cabinet directive.

From the graph below, a number of observations warrant attention:

- The electricity consumed in the two houses with DEWH is much higher compared to the houses with DSWH.
- The average solar yield per month is between 58 - 63 kWh/m^2.
- House 2's SWH system is under-designed, resulting in the need for an additional 86 kWh to heat up the water with an electrical backup element, representing 37 % of total energy consumption.
- The hot water demand is between 26 - 40 litres per person per day.
- The heat losses in DSWH are much higher when compared with those in the DEWH systems. This is due to the water in the storage tanks reaching higher temperatures during sunlight hours when compared with DEWH, resulting in a higher temperature difference compared to the ambient temperature of the tank's surrounds. These losses could easily be reduced in future systems by better insulation of the tanks.

It was also observed that for some months, house 1 and 4 used 100 % solar to heat their water and the back-up element was only switched on in winter when solar energy was limited. Furthermore, the demand for hot water varies with seasons, and the behaviour of the occupants affects the operation of the SWH with the yearly solar fraction ranging between 60 - 96%, while the yearly solar yield ranges from 700 - 760 kWh/m^2.

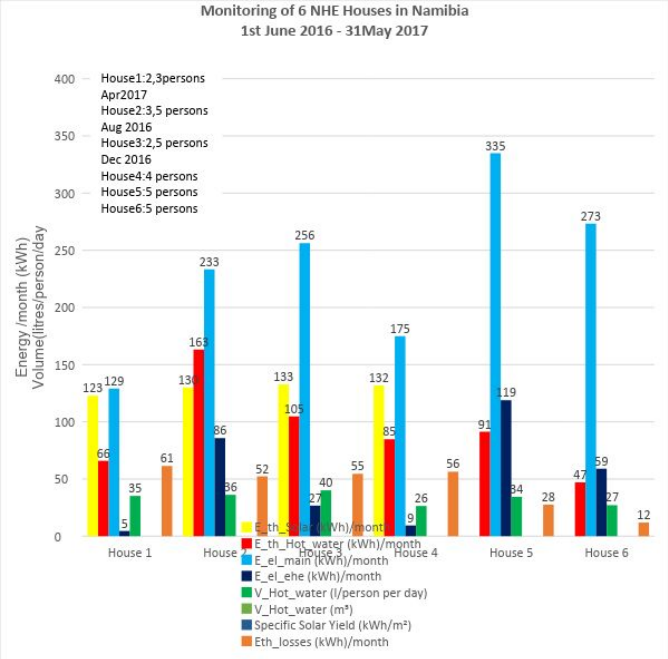


Figure 1: Energy, Losses and hot water consumption characteristics for 6 houses in Otjomuise, Windhoek, averaged over a 12 month period (1st June 2016 – 31 May 2017)

House 3 and House 5 were selected to do a detailed comparison of the two systems due to the fact that these houses both had 5 occupants. The results indicated that a house with a DSWH can save between 50 - 96% of the energy required for heating water on an annual basis, while a house with DEWH uses 37% of their total electricity consumption for heating water.

The savings realised by houses with DSWH equate to between N$1 500 and N$3 000 per year. This results in a payback period of 7 years assuming an initial investment of N$25 000, an

inflation rate of 6% and an annual maintenance cost of 1% of the initial investment.

This could be reduced to 5 years with a subsidy from MME. Assuming that good quality DSWHs have a service lifetime of 15 to 20 years, the results look promising in demonstrating the long term techno-economic benefits of DSWHs when compared with DEWHs.

SOLTRAIN demonstration systems update

Monika Spörk-Dür

One of the major components of the SOLTRAIN project is the installation of demonstration systems to present best practice examples in the SOLTRAIN partner countries, and to showcase the possibilities of solar thermal systems to stakeholders. The systems serve as case studies for technical tours under the banner of SOLTRAIN, and provide valuable data in the instances where they are monitored which is useful for evaluating performance and identifying potential for improvement.

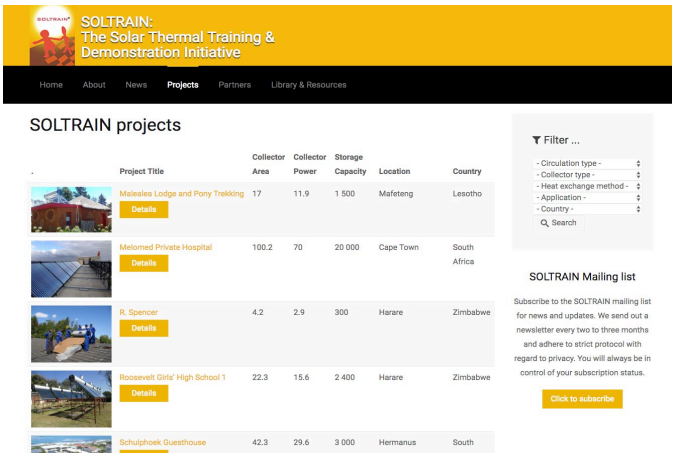
The third phase of SOLTRAIN now boasts a total of 135 systems, all approved by the steering committee, with 8 of the systems having a collector area of larger than 50 m².

The types of applications range from small to medium systems for tourist lodges and social institutions, larger systems for high schools and very large systems for a university campus and the provision of solar process heat for a tannery in South Africa.

The configuration of the systems varies according to the climate, application and scale. Collectors are either of the evacuated tube or flat plate type. Some are pumped, often by photovoltaic power, and others are thermosyphon systems. In most countries, indirect thermosyphon systems are used, and some direct thermosyphon systems have been installed in Zimbabwe. The back-up for the systems is predominantly electrical and some installations use heat pumps or gas as a back-up.

All the systems that have been installed and quality checked so far have been updated on the SOLTRAIN website along with photo galleries of the installation, so do please pay a visit:

https://soltrain.org/demonstration-systems



SOLTRAIN

The Southern African Solar Thermal Training & Demonstration Initiative is a regional initiative on capacity building & demonstration of solar thermal systems in the SADC region. It is funded by the Austrian Development Agency & co-funded by the Opec Fund for International Development.

Visit SOLTRAIN on the web

www.soltrain.org

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