NAMIBIA UNIVERSITY OF SCIENCE AND TECHNOLOGY

NEI NAMIBIA ENERGY INSTITUTE

SOLTRAIN Conference Report

Windhoek, 23-24 February, 2017

SOLTRAIN

AUSTRIAN DEVELOPMENT AGENCY

OFID THE OPEC FUND FOR INTERNATIONAL DEVELOPMENT

AEE INTEC

2017

TABLE OF CONTENTS

INTRODUCTION

The Namibia Energy Institute (NEI) successully hosted the Southern African Solar Thermal Training and Demonstration Initiative (SOLTRIAN) Conference in Windhoek from 23-24 February 2017. The last day of the SOLTRAIN Conference (24 February) comprised of a Technical Tour to Solar Thermal Demonstration Systems in Windhoek (NHE houses in Otjomuise suburb and Joe's Beerhouse Restaurant).

The Conference was preceded by a two-day training course for Solar Water Heating (SWH) Quality Inspectors and a meeting of the SOLTRAIN Steering Committee.

The SOLTRAIN Project, which is currently in its third phase, is a regional programme initially covering Mozambique, Namibia, South Africa and Zimbabwe, and has since expanded to cover Lesotho and Botswana in Phase III. Phase III will run until July 2019. The project, which commenced in 2009, is funded by the Austrian Development Agency (ADA) and OPEC Fund for International Development (OFID). It is implemented by the Institute for Sustainable Technologies (AEE – INTEC) from Austria, together with educational institutions, renewable energy institutions and companies in the participating countries. NEI, which is based at the Namibia University of Science and Technology (NUST), is the SOLTRAIN implementing institute in Namibia.

SOLTRAIN III activities focussed on Policy Support and Roadmap Implementation, Monitoring, Quality, Performance, Data Acquisition, Awareness Campaign, Training and Research, Development and Provision of Technical assistance and training to companies in order to meet quality standards and sustainability of the installed solar thermal demonstration systems.

The SOLTRAIN Conference brought together representatives from all the participating countries, as well as the Austrian implementing agency. Also in attendance were senior officials from the host country's Ministry of Mines and Energy, the Austrian Embassy, SADC, other stakeholders in the renewable energy industry and the media.

SOLTRAIN Project partners from AEE-INTEC, together with the Director of Energy, in the Namibian Ministry of Mines and Energy, Mr John Titus (fourth from right) visited some of the monitored demonstration systems in Windhoek.

OPENING SESSION

Dr Tjama Tjivikua, NUST Vice Chancellor

Dr Zivayi Chiguvare, NEI Director

The Opening Session was chaired by the Director of the host institute, NEI, Dr Zivayi Chiguvare who introduced Dr. Tjama Tjivikua, Vice Chancellor of NUST, to welcome the participants and invited guests to the Conference. Dr Tjivikua said he was impressed by the huge turnout and expressed gratitude to everyone present, adding that the issue of renewable energy was very important to Namibia and the world.

The Vice Chancellor said he was delighted to note that the overall objective of the SOLTRAIN Project was to promote the exploitation of the abundant solar energy resource available to the participating countries, and help them become more efficient in the way they use electricity that is either imported, or generated and transmitted at high costs.
"This Conference, therefore, precisely attempts to bring together the main stakeholders on solar thermal energy including the manufacturers, suppliers, facilitators such as the government, the academic, and the research community, so that we think together and craft discuss and learn from the experiences gained by each of the project partners while developing implementation plans for their national solar thermal technology road maps,"said the Vice Chancellor.

Dr Tjivikua also revealed that NUST was working at introducing a Master's Degree in Sustainable Energy Systems as from 2018.

Mr John Titus, Director of Energy, MME

Namibia's Ministry of Mines and Energy Permanent Secretary, Mr Simeon Negumbo, in an address delivered on his behalf by the Director of Energy, Mr John Titus, expressed gratitude for the assistance provided by the Austrian government towards the SOLTRAIN Project. He emphasized that Namibia was committed to improving the energy sector and Cabinet issued a directive in 2007 to ensure that all new government buildings in the country are fitted with Solar Water Heaters.

The government official said he witnessed the setting up of the Namibia - Solar Thermal Technology Platform (Nam-STTP), which aims to effectively pursue the ultimate mission of defining the targets, setting up the Strategic Research Agenda; and establishing and implementing a Roadmap for the large scale development and deployment of solar thermal technologies in the country.
The Nam-STTP was established at the founding meeting in May 2013 and has defined its mission: to achieve a fully functional 0.5 m² (approximately 0.35 kW thermal equivalent) of flat plate solar thermal collector installed capacity per inhabitant in Namibia by 2030. By achieving the said penetration of solar thermal technologies, some 1.5 million m² of collector area with a thermal output equivalence of approximately 525 MW would be available by 2030.
The Roadmap document for Namibia has been adopted by the government into the Renewable Energy Policy developed by the Ministry of Mines and Energy in 2016 to facilitate implementation of the proposed plans. Mr Negumbo encouraged the strengthening of collaboration with the AEE – INTEC, Institute for Sustainable Energy Technologies and the Austrian Development Agency, and other project partners, through concrete projects and programmes. Namibia is also fully supportive of the newly-established SADC Centre for Renewable Energy and Energy Efficiency (SACREEE), which is based in the country.

The Permanent Secretary said opportunities existed in Namibia for close co-operation between the SOLTRAIN III Project and already existing initiatives, programmes and projects, such as the Renewable Energy Policy, Demand Side Management, National Energy Policy, the curriculum development for Universities and Vocational Training Centres.

Namibia takes seriously the need to inform the public about renewable energy thus the major role played by NEI through workshops for decision makers and financial institutions. The Ministry of Mines and Energy, the Environmental Investment Fund of Namibia (EIF), and the SME Bank, have contributed towards co-financing the SOLTRAIN initiatives, especially for the procurement and installation of solar water heating systems at Vocational Training Centers (VTCs) throughout the country, for research purposes, and to contribute to curriculum development at tertiary institutions (both university and VTCs).

A curriculum for solar thermal systems will be implemented at the VTCs by the Namibia Training Authority (NTA), pending final aproval from the Namibia Qualification Authority (NQA).

Mr Matthias Radosztics, Minister Counsellor, Austrian Embassy, Windhoek

Installation of solar water heaters at houses in Otjomuise, Windhoek, built under the government mass housing initiative

The Minister Counsellor at the Austrian Embassy in Windhoek, Mr. Matthias Radosztics, said the high turnout at the SOLTRAIN Conference was a good indication that more countries were now getting an understanding of the importance of solar energy and renewable energy in general.
Mr Radosztics said the Conference was an ideal platform to provide a glance into what was happening in all the six countries participating in the SOLTRAIN Project. He said it was important to have as many citizen participations as possible in the implementation of projects to ensure that they have a sense of ownership to the products that are donated to them.

The Austrian government supports the installation of Solar Thermal Heaters by providing 50% of the cost, training of trainers who install the water heaters and provide monitoring systems for the installed systems. The Austrian Minister Counsellor was happy that the Namibia University of Science and Technology was addressing the need to have qualified engineers to provide solutions to harness renewable energy by introducing a Master's Degree programme

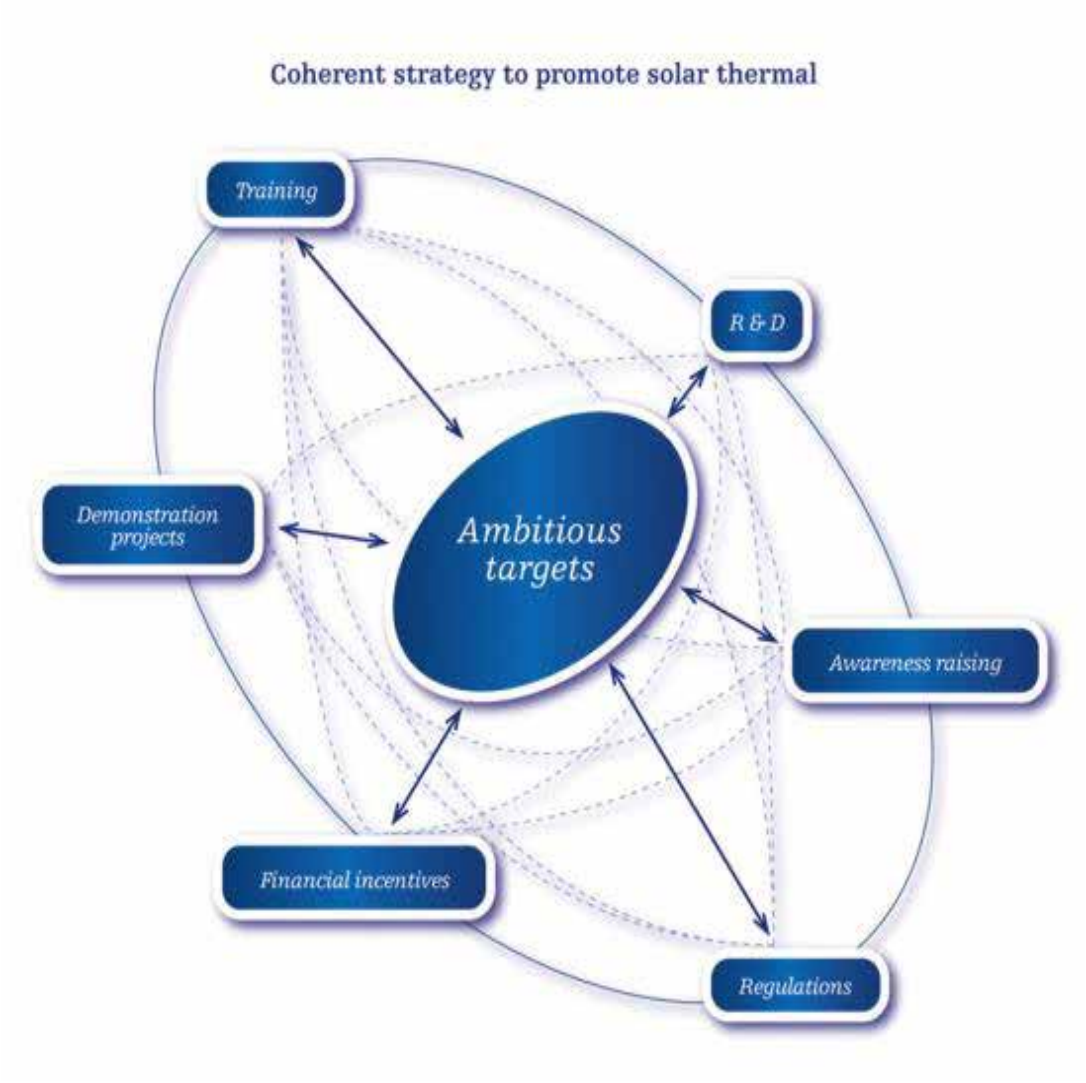
SOLTRAIN TARGETS AND INTERIM RESULTS FOR PHASE 3

Dr Werner Weiss

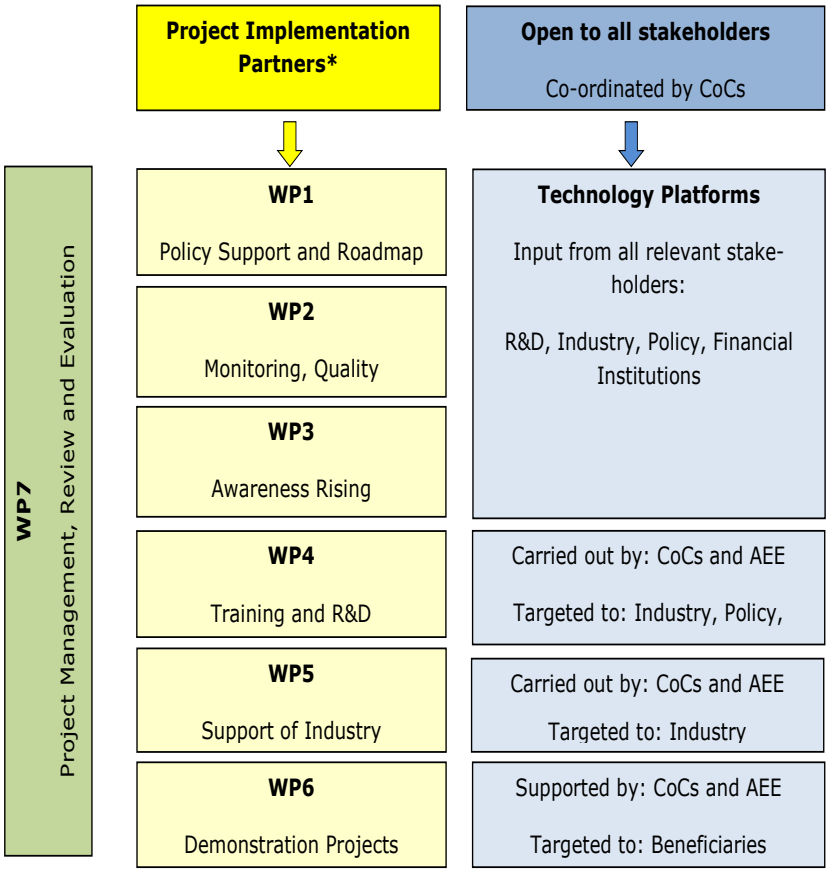
Dr Werner Weiss from AEE INTEC explained that SOLTRAIN is a regional initiative that offers training and demonstrates how solar thermal systems work. The project has trained a sizable number of installers in the SADC region.

AEE INTEC offers training for the SOLTRAIN intitiative to the six participating countries. In Botwana they work through the University of Botwsana's Clean Energy Research Centre (CERC), in Lesotho with Bethel Business and Community Development Centre (BBCDC), in Mozambique the Empresa Nacional de Perques de Ceincia e Tecnologia E.P. (ENPCT) is the partner, in South Africa at the Stellenbosh University they work with the Centre for Renewable and Sustainable Energy Studies (CRSES) as well as the South African National Energy Development Institute (SANEDI) and in Zimbabwe the Domestic Solar heating Pvt. Ltd. (DSH) is the implementation partner.

Dr Weiss said the shortage of power threatens Africa's long term economic growth and competitiveness. The cost of load-shedding to the economy is equivalent to 2.1% of the GDP on average. This is a problem that requires an immediate solution. The solution to the energy crisis, he said, requires a well researched and thought out solution, hence the SOLTRAIN Project's ambitious targets. These ambitious targets include research and development, awareness raising, regulations, financial incentives, demonstration projects and training.



Graphic above illustrates the concept of the SOLTRAIN Project



SOLTRAIN III Project Management , Review and Evaluation

Phase III of the SOLTRAIN initiative is the implementation phase of solutions that come out of the efforts in Phase I and II. The results show that the member countries are really working hard and smart with the Solar Thermal Roadmap Implementation Plans for Namibia, Mozambique and South Africa taking shape.

Nine workshops for political decision makers, the renewable energy industry and administration took place in order to work on the Solar Thermal Roadmap Implementation Plans. A total of 317 experts participated.

In addition, Zimbabwe, Lesotho and Botswana have put together their Solar Thermal Vision and Technology Roadmap documents and seven stakeholder workshops with a total of 161 participants were carried out, three each in Botswana and Zimbabwe and one in Lesotho.

The Roadmaps that were presented at the SOLTRAIN Conference are working documents which will be finalised by June 2017. Each of the six SADC member countries who are part of SOLTRAIN will present their Vision for 2030, which will be encorporated into a final document by June 2017.

Phase III Beneficiaries

Mr Weiss said target groups for Solar Thermal Demonstration Systems in Phase III include small and medium enterprises, home owners, patients of hospitals, occupants of homes for elderly people, students of student hostels, guests of the accommodation sector (hotels, lodges), visitors of restaurants, and industrial processes.

In the upcoming call for applications for demonstration systems a special focus is going to be on institutions which support women (such as girls' schools, maternity clinics, shelters for battered women) and other marginalised groups. It is estimated that about 7,000 persons will directly benefit from these demonstration systems by reducing their energy bills and by improving the hygienic standard.

Mr Kudakwashe Ndhlukula

SACREEE: STATUS OF ESTABLISHMENT & POSSIBILITIES OF COOPERATION

Mr Kudakwashe Ndhlukula, the Executive Director of the SADC Centre for Renewable Energy and Energy Efficiency (SACREEE), introduced the organisation as the newest entity in the regional organisaton. SACREEE was established in 2016 by the SADC Energy Ministers and endorsed by 35th SADC Council of Ministers Meeting - Decision 61. SACREEE's mandate is to promote increased access to modern energy services, improved energy security across the SADC Region.

SACREEE is also mandated to implement the Regional Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP), through the promotion of market based adoption of renewable energy and energy efficient technologies and energy services.

Mr Ndhlukula explained that SACREEE was established on a sustainable basis through support from Member States contributions, donor funding, cost recovery from services offered to projects. The Secretariat is based in Windhoek, Namibia.

SACREEE develops and executes regional programmes and projects in order to support SADC Member States. The programmes include increasing access to sustainable energy services to improve the availability of quality energy data and information for sound decision making on policy and investment.

The 14 SADC countries create a market of over 350 million inhabitants whose growth rate is more than 1.5 per cent annually. This is a sizable market for any business person to be attracted to invest.

This large SADC market can easily come up with standards and regulations that makes it easy to introduce good quality renewable energy products. SACREEE's role here is to ensure that any sustainable energy efficient product that has succeeded in one country can be duplicated in another country.

The SACREEE Executive Director said the SOLTRAIN Project has done very well in research, development and implementation of Solar Water Heaters and other solar thermal technologies, such that SACREEE can replicate the success stories in other SADC member states that are not part of SOLTRAIN.

Mr Ndhlukula said SACREEE was ready to work with SOLTRAIN, the Austrian government and other investors to ensure that the lessons, experience and technologies developed under the project benefits the entire SADC region. SACREEE will also coordinate the use of raw materials abundant in the SADC region and promote local manufactures, rather than continuing to import finished products. Local production of solar technologies will promote local job creation.

SOLAR THERMAL ROADMAPS AND IMPLEMENTATION PLANS

This session was chaired by Professor Wikus van Niekerk from Stellenbosch University, South Africa.

SOUTH AFRICA

Ms Karin Kritzinger

The country was represented by Ms Karin Kritzinger from the Centre for Renewable and Sustainable Energy Studies (CRSES), at Stellenbosch University. She told the Conference that the South African Solar Thermal Technology Platform (SA-STTP) was introduced on 17 May 2013 as part of the SOLTRAIN II programme. The aim was to bring together all interested parties to work towards sharing and promotion of all aspects of the solar thermal industry in South Africa. The SA-STTP aims to contribute to the switch from fossil fuels to sustainable energy, such as solar heating, cooling and process heat.

The South African Solar Thermal Technology Road Map (SA-STTRM) is a sector specific Roadmap underpinning the Solar Energy Technology Road Maps (SETRM), an initiative of the Department of Energy (DoE) and the Department of Science and Technology (DST) supported by CSIR, SANEDI, the International Energy Agency, Solar Heating and Cooling (IEA SHC) and GIZ, through the SAGEN programme. The SA-STTRM is recommended by SESSA to its members.
Ms Kritzinger pointed out that the original SA government target set in 2003 was for 10 000 GWh electricity to be produced from RE by 2013. DoE estimated that 23% of this target could be supplemented by implementing SWH technologies.

The vision for the South African STTP is ½ m^2 of solar thermal collector area by 2030 for every member of the population. (Circa 30 10^6 m^2).

South African STTRM Implementation Plan involves determining what can feasibly be implemented during SOLTRAIN III by SA partners. The idea is to address market development in the SWH space for the country including the marketing campaign, assess eligibility to get funding through government consider different sectors such as residential, commercial, industrial. The other important tool will be to use the online system specification recommendation tools.

Marketing will make a difference in the third phase of the SOLTRAIN project in South Africa because there has been bad publicity. Out of over 300 000 (three hundred thousand) solar geyser installed in one town there has been about 1% failure, and you can imagine if there are many people going on social media with an exploded water tank. The amount of videos on social media can lead to poor uptake of this renewable energy option hence the need to constantly remind people that this technology is safe. The budget for marketing on television, radio, print media and online campaigns is estimated at between 5 and 10 million rand (ZA 5 million to 10 million) a year.

ZIMBABWE

Dr Anton Schwarzlmueller

Dr Anton Schwarzlmueller of Domestic Solar Heating (DSH) presented the Solar Thermal Roadmap and Implementation Plan (STRIP) for Zimbabwe. The country receives sunshine on average for 300 days each year making the country a good candidate for harnessing the potential of solar energy.

The drafting of the STRIP for Zimbabwe was launched in May 2016, at a meeting attended by representatives from the government of Zimbabwe, through the Ministry of Energy and Power Development and Zimbabwe Enegy Regulatory Authority, the education sector, manufacturers and distributors of solar products, mining, property and other sectors. The first meeting drew 39 participants, but the number declined in the second meeting in August and the subsequent meetings also witnessed a decline in numbers of participants. However, representatives of the Ministry of Energy and Power Development and those from the Zimbabwe Electricity Regulatory Authority attended the meetings consistently to make their contributions to the final document.

The National Energy Policy (NEP, 2012) and the National Solar Water Heating Programme (NSWHP) was launched by the government of Zimbabwe in September 2013. The government is also aligning the implementation of policies to the new constitution therefore a new draft National Renewable Energy Policy, the first draft was published in November 2016.

The group formulating the Roadmap had to look at the possibility of a tertiary education system to train enough qualified solar artisans and solar engineers in the country. It was of importance to persuade research and development institutions to come up with improved component and system designs that meets the requirements of different customers.

Zimbabwe has affirmed that the solar industry will be able to locally manufacture and assemble solar

thermal components as required by the National Solar Water Heating Programme. They had to look at the ability and willingness of finance institutions to provide loans to investors. The document looks at the mastery of the marketing sector to recommend a solar hot water system as a must-have.

It is also assumed that a significant increase in public housing will lead to a remarkable growth of solar thermal installations. Once there are more houses the expectation is that the demand side management in industry and commerce, if carried out professionally, will ultimately lead to electricity and fossil fuel being substituted by solar heat. The target for 2030 Solar Thermal Plan for Zimbabwe is 0.1 m^2 / inhabitant.

The idea is to work with the government's vision as much as possible to provide the much needed energy for industry and domestic consumers both in urban and rural settings.

MOZAMBIQUE

Dr Fabiao Cumbe

Dr Fabiao Cumbe, of ENPCT, E.P. Mozambique presented his country progress on the implementstion of SOLTRAIN. Mozambique's economy is growing significantly and so is the demand for electricity. Statistics show that access to electricity over a period of 9 years from 2004 to 2013 has improved from as low as 10% to over 25% of the population having access to electricity however these figures have since improved but data was not available at the time of compiling this report.

Mozambique faces the same challenge of making available electricity on demand hence the need to come up with alternative ways of generating the needed power sustainably and cost effectively. Public funding will be necessary to kick-off technology roll-out programmes, which will sustain and ensure the feasibility of private manufacturing and commercialisation of SWH in Mozambique.

During 2016 there were 3 stakeholders workshops held. However, most of the stakeholders were represented by low rank officials, without decision power. Meetings were also held with specific groups of stakeholders and questionnaires were drafted about stakeholder specific contribution to the roadmap implementation.

Mozambique's solar thermal vision is to install 0.1 square meters (0,07 kWh) of solar collector area per inhabitant by 2030. This relates to an overall installed collector area of 3.4 million square meters by 2030 for a population of 34 million persons countrywide.

Mozambique's solar thermal vision

The Energy Strategy ("Resolução 10/2009", issued on 4 June, 2009 and the Policy for Development of the New and Alternative Renewable Energies ("Resolução 62/2009", issued in October), both identified Solar Thermal Energy as a key area for the national development. The National Strategy for Renewable Energy 2011-2025 (EDENR 2011-25) sets a target of 100, 000 solar thermal systems to be installed by 2025, with full technical assistance and local manufacture capabilities in place.

The national strategy also identifies the need to engage the public electricity operator in the substitution of electric water heating with solar water heating, and to establish credit mechanisms and fiscal incentives, as well as appropriate tariff regimes, promote public and private participation in the solar markets. The strategy also proposes installation of local manufacturer/s of solar water heaters, which supports any programme intending to develop local design and installation capabilities.

BOTSWANA

Dr Edwin Matlotse

The Director of Clean Energy Research Centre, (CERC) at the University of Botswana, Dr Edwin Matlotse, presented the country's STRIP. Botswana is the latest addition to the SOLTRAIN Project having been coopted in 2016, hence is still finding its ground to catch-up with the rest of the participating states.

The census of 2014 shows that Botswana's population was 2.2 million, with a growth rate of 1.98% per annum. By 2020, the country's population is projected to be around 2.45 million and by 2030 the country could have 4 million inhabitants. As the population grows, so does the demand for electricity.

Currently, Botswana's installed capacity generation is 892 MW with operating capacity of 410 MW, peak demand of 610 MW, and with peak demand adding the reserves of 698 MW this leads to a capacity shortfall of 288 MW.

Dr Matlotse told the SOLTRAIN Conference that for Botswana it was necessary to first of all understand the situation on the ground around in the country by way of physically going around to research before embarking on the SOLTRAIN visionary document. So far, Botswana has discovered a disheartening situation with an estimated 90% of the solar water heaters installed around the country not working probably and most of them now connected to electricity. The situation indicates that there was poor workmanship in installation of the systems and the users did not have adequate knowledge concerning Solar Thermal Technology.

There is still work to be done in Botswana because there is no clear policy for thermal energy technology uptake, energy efficiency and productive use of thermal energy technology and there is no assessment of energy efficiency and renewable energy potential and capacities that can be achieved.

There is need for identification and costs/benefits of various thermal energy technologies. As a country there is need to have dedicated financing mechanisms with reduced cost of finance to enable the poor to afford thermal energy technology. The country has a lot of work to do in terms of research and development.

Botswana had a lot of work to do before coming up with the Roadmap for implementation. CERC took the bull by the horns and went all out to produce a workable document in a short period of time. The first Botswana Solar Thermal Technology Platform workshop was held on 12 May 2016, where the BSTTP was launched and the Roadmap idea introduced. The session was mainly a brainstorming one as lots of diverse ideas came forward. Leaders from key stakeholders were identified to take the process forward. A Working Group was also created and themes for the Roadmap were drafted.

The second BSTTP workshop was held on 29 August 2016 where thematic group leaders presented findings and the University of Botswana team formulated a Roadmap Document from presentations and contributions from the discussions. The third workshop held on 25 October 2016 refined the contributions incorporated them into the Roadmap Document.
Botswana's vision is to achieve installation of 1.2 million m2 of solar thermal technology collectors by 2030. The target installation will be equivalent to have 0.3 m2 of net solar thermal collector area for every member of the population by 2030 in Botswana. This relates to an installed capacity of 1886.910 000 MWh, avoiding 1276872 tons of CO_2 every year

The Roadmap for Botswana will also cover the following areas; mining and quarries, such as diamond, copper mines, industrial factories, manufacturing - textiles, meat, airports and fuel service stations, commercial centres and shopping malls.

NAMIBIA

Ms Helvi Ileka

Ms Helvi Ileka, the SOLTRAIN focal person at the Namibia Energy Institute, at the Namibia University of Science and Technology, tabled Namibia's progress report. As the host country of the SOLTRAIN International Conference, Namibia displayed an advanced level of organisation with government support, finance services support and technical support from the AEE-INTEC.

Ms Ileka informed the meeting that the journey to the Roadmap started in May 2013 when the solar thermal technology platforms was formed, defined with a clear mission and vision that took a bottom up approach. Work continued until November 2013 when the first draft vision document was discussed and consolidated.

In December, 2014 the second draft was presented to stakeholders, by May 2015 the third draft was presented to stakeholders for input. The draft which included comments from the previous meeting was made available for review by external members, enabling the committee members to have a final draft in December 2015. In February 2016 the document was presented at regional level. Once the targets were clear it was now time to start on discussions around the implementation of the proposed plans.

The Solar Thermal Roadmap and Implementation Plan for Namibia aims to install 1.5 million m^2 of solar thermal collectors, which will translate to 0.5 m^2 of solar thermal collector area per person living in Namibia by 2030. Ms Ileka said Namibia viewed this vision attainable because there is a steering committee with clear terms of reference. The steering committee is mandated to, among other things, ensure proper running of the Nam-STTP platform, set periodic objectives and develop the monitoring and evaluation framework for the implementation plan and to propose actions needed for the achievement of the vision.

The different groups in the steering committee include those dealing with research and development, policy enactment (RE, DSM); outreach and public awareness, housing (Policy and Codes), industry development and standards, finance and subsidies.

In her concluding remarks Ms Ileka stated that the Draft Implementation Plan was now available. The Nam-STTP is right on track with short term and long term plans and the Roadmap is recognised in policies documents recently developed, such as the Namibia Energy Policy and the Renewable Energy Policy.

The only challenge the process is facing is that of financing, but is hopeful that funds from the Solar Revolving Fund (SRF), SME Bank and Carbon Fund will be available for implementation of some of the projects highlighted in the plan.

LESOTHO

Mr Anadola Tsiu

The Chief Laboratory Technician at the Department of Physics and Electronics at the National University of Lesotho Mr Anadola Tsiu informed the Conference that there is a huge potential for solar thermal technologies in Lesotho. Systems have already been installed in government clinics, educational institutions, lodges, and other places.

However, the lack of readily available baseline data regarding the systems number, size and types was proving to be a challenge.

The government of Lesotho is taking deliberate steps towards a green environment by putting in place documents to create an enabling environment for solar thermal technologies. The documents include the National Vision 2020, National Strategic Development Plan, 12/13-2016/17, which promotes the use of clean energy (RE), increase in production capacity to attain self-sufficiency, export and greening of the economy. Other supportive documents are the Energy Policy Framework of 2015 and the draft Lesotho Renewable Energy Policy, 2012, compiled with help from the UNDP.

The aim is to facilitate phasing out of electric geysers in all existing public buildings and introducing solar water heating systems and heat pump systems, and compel all new public buildings which require hot water to install solar water heaters. The uptake of the Solar Thermal Energy Technologies has facilitated the establishment of Lesotho Solar Energy Society (LESES) and the Energy Sector Coordination Forum.

The Solar Thermal Roadmap for Lesotho is still in its development stage with the draft document having been presented to stakeholders for comments and input. Lesotho's solar thermal vision is to install between 0.3 to 0.5 m^2 of solar collector area per inhabitant this translates into an overall collector area of 1.1 million m^2 by 2030.

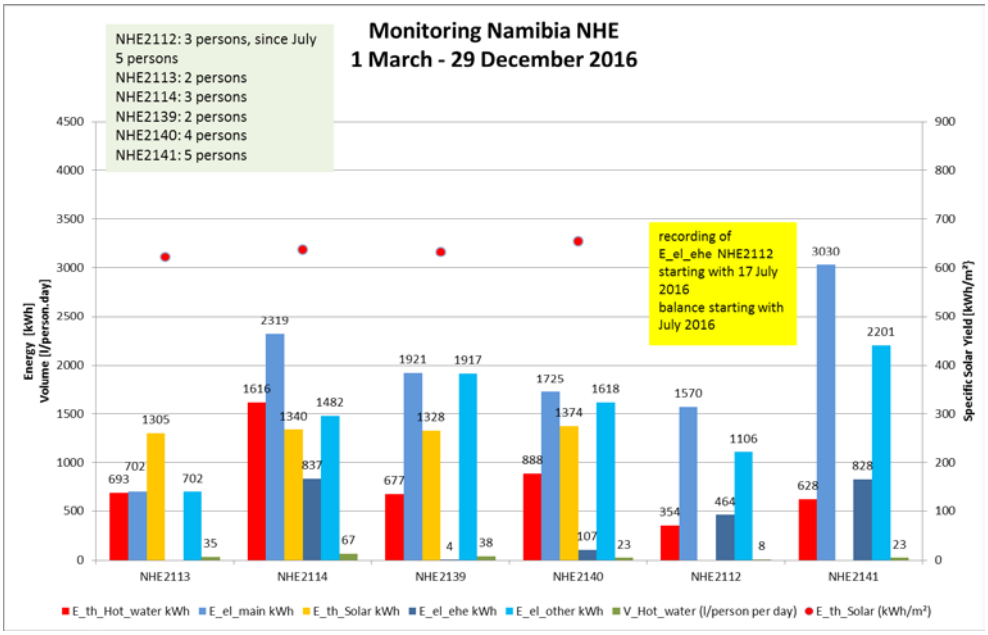
MONITORING SOLTRAIN DEMONSTRATION SYSTEMS RESULTS

Mr Rudi Moschik

Mr Rudi Moschik of AEE-INTEC, Austria, gave regional case studies of the performance of solar thermal systems so far installed as part of the SOLTRAIN initiative and which now have data monitoring systems installed. In Windhoek's Otjomuise suburb, a total of 15 monitoring systems were installed on different properties out of the 62 family houses built.

The systems collect vital information, such as on how much energy is collected and how much hot water is demanded at different times in a day. The systems, said Mr Moschik, will go a long way to help design solar water heating technologies that will best work for the consumer. In the event that there is more energy produced than needed for heating water then a decision can be made on how to use the excess power. In the event that there is a deficit then the data will inform the design team to improve and ensure that there is enough energy generated for the consumer. In the event that the system detect that the water is too hot then a team will be dispatched to look at the problem unit.
Each system collects data and sends the data via satellite which enables Mr Moschik and his team to monitor developments on each unit from one computer. The monitoring will be carried out over 12 months to enable researchers to analyse every month and season of the year.

The summary of data collected at the NHE houses in Windhoek shows that solar yields between 130 – 150 kWh/month were recorded, with a solar fraction of between 80 – 100 %. This means that if a right sized solar system is installed no electrical back up is needed to heat the water. The data



The graph shows the average values for the hot water consumption, total consumption of the main electricity meter, energy generated from the solar collector to heat up the water, energy from the electric element backup to heat up the water, volume of hot water consumption per person per day, global solar radiation per square meter and other kwh represent the difference between the total consumption of the main electricity meter and the energy contributed by the electric element backup to heat up the water from March to December 2016.
For example House NHE 2113 only use solar 100% to heat up the water and did not switch on electric element backup, while House NHE 2114 used 837 kwh to heat up the water with electric element backup representing 36% of total energy consumption.

also showed that the average hot water demand per person id between 23 and 67 liters per day.

Main electricity demand for houses without solar systems is significantly higher than that of houses with solar hot water system. The electricity demand for electric geysers is 50 – 120 kWh/month.

A monioring system has also been installed at Joe's Beerhouse, one of Windhoek's most popular restaurants. Joe's Beerhouse has 2, 538 liter pumped system with an internal heat exchanger.

DESIGN & OPERATION EXPERIENCE: LARGE-SCALE SOLAR THERMAL SYSTEMS FOR INDUSTRY APPLICATION

SOUTH AFRICA

Mr Angelo Ian Buckley

Mr Angelo Ian Buckley from the Centre for Renewable and Sustainable Energy Studies (CRSES), at Stellenbosch University, gave an overview on the design and operation experiences in South Africa at an industrial scale.

The SA Department of Science and Technology has been funding the Renewable and Sustainable Energy (RSE) Hub at Stellenbosch University, whose aim is to develop human capital, deepen knowledge, and stimulate innovation and enterprise in the field of RSE. The specialisation centre is sponsored by Eskom to focus on concentrated solar power (CSP) and wind energy. The Sasol Technology group sponsored the new facilities for CRSES as well as the work and facilities of the Solar Thermal Energy Research Group.

The South African industries require a total of 1 117 petajoules (PJ) of energy for heating using coal, wood, electricity, gas, oil and oil products. The industrial sector accounts for 67% of the total heat demand in SA. Coal contributes 57% of the heating energy needed for heating boilers.

According to CRSES statistics on large-scale solar water heating systems in SA per province (with gross collector area > 10 m2), Gauteng province accounted for the lion's share of 52.3% of total installations, followed by the Western Cape (17.8%) and Mpumalanga with 13.2%.

Mr Buckley said they had noted a significant drop in the average cost of heating systems (ZAR/m2), with a large amount of new installations in health care industry. There were also financially attractive results observed in the prefeasibility stage of projects.

A database is in the process of being updated to ±150 identified in South Africa (2016).

CRSES has also published a journal article by Joubert E.C. and Hess S. entitled *"Large-Scale Water Heating in South Africa: Status, Barriers and Recommendations"*. The journal provides well researched data collected from all the 10 provinces of South Africa.

MOZAMBIQUE

Dr. Fabiao Cumbe, of Empresa Nacional de Parqe Ciencia Tecnologia, briefed the Conference on Mozambique's approach on solar thermal systems for hotels and hostitals.

He said to meet Mozambique's energy needs in a sustainable manner, the following challenges needed to be considered:

- How to meet increasing electricity demand;
- How to provide universal access to electricity;
- How to provide reliable and efficient electricity supply.

Since a considerable share of electricity is used for converting electricity into low temperature heat, like domestic hot water or low temperature heat in the food and beverage industry, STT is one of the best suited technologies to reduce the electricity demand and the running costs for households, social institutions, small tourism facilities.

Dr Cumbe acknowledged the growing trend in the demand for electricity and the urgent need to reduce electricity consumption and peak demand because of the supply deficit which increases over time.

The approach for large scale uptake of solar thermal technology in Mozambique will target hospitals, hotels, student residences and similar institutions, contracted to EDM on the tariff category "Large Consumers of Low Voltage – GCBT or ("Medium Voltage Consumers") . Significant power savings can be realised once alternatives provided by the SOLTRAIN Project can help mitigate the current energy crisis as a short term response to meeting rising demand.

Mozambique is a vast country and making electricity available to every institution can present challenges, therefor STT can help address the limits of the transmission network. However, there is need for public funding to kick-off technology roll-out programmes, which will sustain and ensure the feasibility of private manufacturing and commercialisation of SWHs in Mozambique.

LESOTHO

Mr Ivan Yaholnitsky

Mr Ivan Yaholnitsky of the Bethel Business and Community Development Centre (BBCDC) presented a case study done at the Malealea Lodge, highlighting Solar Thermal Systems potential in the country's Tourism Sector. The lodge has 55 rooms with bar, dining room, recreational hall and thriving tourism business with approximately 5 000 visitors/year. They employ 28 permanent staff, 12 temporary; 15 pony trekking guides, 30 horse owners, and 15 hiking guides.

All hot water is provided by LPG gas heaters 48kg cylinders, power available for 5 hours daily from 16h00 – 21h00 from a 35KVA diesel generator which required 35 litres/day per set. In this kind of business water is need for washing, cooking, cleaning and drinking and the availability of water was not up to standard.

The Malealea Lodge project was a massive project embarked on with 17 partners on board. The partners included the owners of the Lodge and Pony Trekking, SOLTRAIN III Lesotho, Telecom Techniques, BBCDC/Solarsoft. Individuals who contributed to make this project a success include Glen and Mick Jones, Werner Weiss, Andre Friend, Ivan Yaholnitsky, Stephen Lelimo, BBCDC graduates. The institutions and people made the operation an enjoyable experience, according to Mr Yaholnitsky.

The group worked and installed 5 x 150 litre low pressure SWHs; 1 x 100 litre low pressure SWH and 5 more 150 litre low pressure SWHs were ordered. They had to rebuild the area surrounding the well which provide water to the hotel, installing a new pump to supply the SWHs, improving the quality of water. A 8.4kW solar array was installed along with 16KVA inverters and 40kWh battery bank power is now available 24/7.

BOTSWANA

Professor Andrew Obok Opok

Professor Andrew Obok Opok of the University of Botswana reviewed the challenges and opportunities in large scale Solar Thermal Systems for hotels and industries in that country.

Solar Water Heating contributes to the largest use of solar energy in Botswana. The residential sector (with over 140 000 SWHs) accounts for over 70% of the heaters in use and 30% going to other sectors, such as government institutions and hotels/lodges. Both direct and indirect heat transfers type of collectors are common and most of the systems are imported. Only two companies manufacture SWHs within the country.

Prof. Opok said the number of SWH installed in Botswana is not easy to determine accurately since the Gaborone City Council and other town councils do not have up to date statistics on SWH installations. But the overwhelming estimate is that there remains a large untapped market for SWH, if nstallation barriers can be overcome.

The University of Botswana student hostels have 200 x 300l solar water heating systems in 9 student hostel blocks. Gaborone Hotel with 44 room has 11 SWHs installed with a total storage capacity of 3300 liters. The estimated energy savings for Gaborone Hotel from the SWHs is 154kwh/day, while the stimated co2 emissions saved can reach 65 tonnes per year. Shakawe Primary Hospital staff houses have 65 stand alone units with a total storage of 12 300l and 60 units are 180l while 5 are 300l.

Prof. Opok explained that in most places visited by the research team, it was confirmed that most

of the SWHs have never worked on solar from the first day of installation but rather were connected to electricity and are running on electricity. On further inspection theycrealised that the reason was mainly poor workmanship, poor maintenance and a consumer without relevant information about how the systems work.

The key gaps and barriers in thermal energy technology application in Botswana include lack of a proper database on statistics, quantities, types, sizes and capacities, technology and subsidisation of imported products, lack of set standards, poor quality installations and lack of maintenance obligations by the suppliers.
Prof. Opok said that the lack of clear policy and strategy for thermal energy technology uptake, energy efficiency and productive use of Thermal Energy Technology was a major setback which is being addressed through the Roadmap. He said Botswana also needs to indentify the costs and benefits of various Thermal Energy Technologies and intitute appropriate regulatory frameworks, such as for technology standards, incentives to reduce costs to consumers. There was also a need to raise awareness of end users on Thermal Energy Technologies and their costs and benefits.

He emphasised the need to monitor and evaluate the set targets for energy access, energy efficiency and renewable energy, while at the same time increasing the capacity of technology developers, designers, installers and maintenance of Thermal Energy Technology. The availability of local financing from commercial banks and financial intermediaries, which can play a decisive role in the development of local markets, is also key. To overcome financial barriers, intelligent investment mechanisms are needed for a quick and broad market penetration, which necessitates the involvement of the banking sector. Training is also needed to fill the gaps in exisiting artisan technician and engineer capacity building.

Botswana has a very high Solar Energy Resource potential although the large scale SWH in the country is still at infancy level. Addressing the challenges highlightd above, such as policy and regulatory framework, standards for SWHs, training and capacity development, would help unlock this huge potential for Solar Thermal Technologies.

THE WAY FORWARD - INTENSIFYING COOPERATION

(from left) Mr Kudakwashe Ndhlukula, Mr John Titus and Dr Werner Weiss
The SOLTRAIN Project is now in its last stages with only two years left on the project.
Dr Werner Weiss pointed out, during a panel discussion on on intsensifying cooperation, that although the project may be coming to the final stages structures and skills passed on will continue to be in use for a long time to come.

AEE-INTEC believes that it is now time to hand over the project to the SADC regional body, SACREEE, and is confident that the transition will be smooth. "We have worked with the governments of our partner states in drafting Roadmaps. We believe that it is now up to the governments of those partner countries to implement the Roadmaps," said Dr Weiss. He emphasised the need to intesify the cooperation in the remaining two years, with governments and institutions such as SACREEE, but

said the duplication of roles should be avoided.

"We must now take this project to a higher level," said Dr Weiss.

SACREEE Execvutive Director Mr Kudakwashe Ndhlukula said his organisation was ready to upscale activities started under SOLTRAIN so that no country in the region is left behind. He highlighted three possible areas of collaboration namely, the implementation of Roadmaps and harmonisation of SWH rollouts, Training and Development, as well as Research and Innovation.

Mr Ndhlukula said SACREEE will work with development partners, government and business people who are willing to offer services and that the valuable expertise that SOLTRAIN has developed can be built upon and duplicated to other SADC Member States.

On the rollout of the Roadmaps and other Solar Thermal Projects, the SACREEE Executive Director said proper planning, technology specifications and standards needed to be put in place by the Member States to avoid rolling out products that are of inferior quality and end up burdenning citizens. He pointed out the need to have a clear policy that can guide the SADC region and ensure the uptake of these efficient green products.

"The whole issue also speaks to quality of the product, quality of installation, the use and maintenance of the product. The whole idea here is to improve the industrial competitiveness of the region through the use of the raw materials that are plentiful," he said.
He also told the Conference that SADC was in the process of developing a regional Industry Energy Efficiency programme and thet SOLTRAIN activities could be part of this programme.

The Director of Energy in the Ministry of Mines and Energy Mr John Titus emphasised the need to have a more coordinated approach in the implementation of energy solutions, of which solar thermal was one of them. He said the Namibian government fully supports the use of renewable energy and hence the decision to lobby to host the SACREEE head office in the country.

The Director said the need to develop a collaborated approach towards solving the energy crisis in the region is a good call to action. The government of Namibia is busy drafting and approving new regulatory reforms which create an enabling environment for the alternative and efficient energy technologies.

Conference delegates also discussed the issue of whether a regional approach to the application of solar technologies was possible and the overall view was that harmonised standards must be put in place to ensure quality products.

A suggestion was made that the design and specifications of the solar thermal products must be done by local people for locals, "For Us By Us" (FUBU) – borrowing from the American clothing and hip hop apparel company with the same name. This would encourage home-grown technologies which speak to the needs of the local people.

The conference was unanimous on the need for research and development to collect information and use the data to inform decisions. Use of the Media and other Information platforms was advocated to educate the consumers and end-users of the technology so that they are given adequate information to ensure correct use of the devices.

The 3rd SOLTRAIN Conference will be held in Gaborone, Botswana, on the 1st and 2nd of February 2018.

SOLTRAIN Conference

Namibia Energy Institute
Namibia University of Science and Technology
Private Bag 13399
Windhoek
Namibia

T: +264 61 207 2154
F: +264 61 207 9154
E: nei@nust.na
W.www.nei.nust.na