



Final Report

SOLTRAIN – Phase IV

Southern African Solar Thermal Training
and Demonstration Initiative

Project: OEZA-Vertrag 2608-00/2019

AEE - Institute for Sustainable Technologies (AEE INTEC)
8200 Gleisdorf, Feldgasse 19 AUSTRIA

Final Report

SOLTRAIN – Phase IV

March 2023

Funded by



Implemented by:



Project Partners

University of Botswana

Clean Energy Research Centre (CERC)
Block 248, Room 182
Gaborone, Botswana



Solar Industries Association Botswana (SIAB)

PO Box 20076, Gaborone, Botswana



Bethel Business and Community Development Centre (BBCDC)

PO Box 53, Mt. Moorosi 750
Lesotho



Empresa Nacional de Parques de Ciência e Tecnologia E.P. (ENPCT)

Av. Mocambique km 60
Maputo, Mozambique



Namibia Energy Institute (NEI)

Namibian University of Science and Technology
Private Bag 13388
Windhoek, Namibia



Centre for Renewable and Sustainable Energy Studies (CRSES)

Stellenbosch University
South Africa



South African National Energy Development Institute (SANEDI)

152 Ann Crescent, Upper Grayston Office Park, Block C
Strathavon, Sandton 2146



National University of Science and Technology (NUST)

Corner Gwanda Road and Cecil Avenue
Bulawayo, Zimbabwe



SADC Centre for Renewable Energy and Energy Efficiency (SACREEE), 11 Dr Agostinho Neta Road, Windhoek, Namibia



Table of Content

1	Summary.....	5
1.1	Aims and goals of the project.....	5
1.2	Interim results and highlights of 2021.....	6
1.2.1	Highlights 2021.....	7
2	Background and Project Structure.....	9
2.1	Strategic Approach and Methodology.....	11
2.2	Activities and Methodology of Implementation.....	13
2.3	Structure of the overall project.....	14
2.4	Duration of the project.....	15
3	Work carried out.....	15
3.1	Work Package 1 - Solar Thermal Roadmap Implementation.....	15
3.1.1	Support for the implementation of the solar thermal roadmaps.....	15
3.1.2	Solar thermal campaigns and public relations.....	29
3.1.3	Private and public-sector information and support.....	36
3.1.4	Monitoring of the implementation.....	41
3.2	Work Package 2 - Training.....	43
3.2.1	Train the Trainer courses.....	43
3.2.2	Dual training program for artisans.....	46
3.2.3	Training in co-operation with Vocational Training Centers.....	48
3.2.4	Training for artisans from the private and public sector.....	51
3.2.5	Design workshops and support for industry.....	53
3.2.6	Specialized courses for professionals.....	58
3.2.7	Dissemination courses.....	60
3.2.8	Training videos.....	65
3.2.9	Solar Trailer for NUL in Lesotho.....	66

3.3	Work Package 3 - Demonstration Projects	69
3.3.1	Technical tours for decision makers	79
3.4	Work Package 4 - Quality Control, Maintenance, and Monitoring.....	81
3.4.1	Quality control	81
3.4.2	Maintenance	81
3.4.3	Monitoring.....	81
3.4.4	Analyses of the monitoring data and monitoring reports.....	83
3.5	Work Package 5 - Awareness Raising and Dissemination of Results	83
3.5.1	SOLTRAIN e-mail Newsletter	83
3.5.2	SOLTRAIN Website	86
3.5.3	General awareness activities.....	89
3.5.4	Social media activities	91
3.5.5	Dissemination of SOLTRAIN activities via the websites of the project partners	91
3.5.6	Annual SOLTRAIN conference	95
3.5.7	Support of student projects	98
3.5.8	Support – Participation at national and international conferences	102
3.6	Work package 6 - Project Management, Review, and Evaluation.....	105
3.6.1	Project Coordination	105
3.6.2	Kick-Off Meeting and launching of the project	105
3.6.3	Steering Committee Meetings	105
3.6.4	Annual progress and financial reports	106
3.6.5	Mid-term Review	107
3.6.6	Gantt Diagram	110
4	Gender aspects.....	111
5	Social Standards.....	112
6	Annexes	113
6.1	Annex 1 – Installed Solar Thermal Demonstration Systems	113

1 Summary

1.1 Aims and goals of the project

The SADC region faces a huge power deficit due to low investment in the power sector. In South Africa widespread rolling blackouts began already in 2007 and continue to this day as supply falls behind demand. Load shedding is required, which means switching off parts of South Africa's electric grid in a planned and controlled manner due to insufficient capacity or to avoid a countrywide blackout. In South Africa in 2022 maintenance and breakdowns of generation units have resulted in over 2,400 hours, or 100 full days, of load shedding.

80% of the electricity in South Africa is generated from coal¹. In all countries that are part of the Southern African Power Pool (SAPP), the share of thermal coal-fired power plants is 61%².

The recurring interruptions in the power supply throughout the SADC region are a major threat to the economic growth. Since a considerable share (40-50%) of the electricity generated is converted into heat in the industrial, commercial and residential sectors, the use of solar thermal systems could be a major contributor to the reduction of electricity use, with resulting environmental benefits such as reduced CO₂ emissions. SADC member states have excellent solar irradiation with more than 2,000 kWh/m² annual radiation and estimates from the International Energy Agency (IEA) suggest that solar thermal systems could meet about 70 – 80% of the regions low-temperature heating and cooling demand.

For these reasons, SOLTRAIN was designed to support and contribute towards the implementation of energy policies of the target countries that enhance the use of solar thermal systems. Energy poverty negatively affects the circumstances of large numbers of people in general, and particularly in the SADC Member States. There are close links between energy supply and practically all aspects of sustainable development, such as access to water, agricultural and industrial productivity, health care, education, job creation, environmental pollution and climate change.

The focus of SOLTRAIN was to contribute towards reducing energy poverty by improving access to sustainable energy technologies, specifically solar thermal solutions, and thus directly contributing to the realisation of SDG 7 and indirectly to SDG 1, SDG12 and SDG 13³.

SOLTRAIN started in 2009 and has had four phases to date, with the most recent running from 2019 to 2022. Phase IV was carried out in cooperation with partner institutions from Botswana, Lesotho, Mozambique, Namibia, South Africa,

¹ <https://www.usaid.gov/powerafrica/south-africa>

² SAPP Annual Report, 2019

³ <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

Zimbabwe and the SADC Centre for Renewable Energy and Energy Efficiency (SACREEE).

1.2 Results and highlights of Phase IV

This chapter provides a brief summary of the work carried out in Phase IV. A detailed description of all activities is given in chapter 3.

Achieved results

The following table summarizes the results achieved in SOLTRAIN Phase IV, based on the indicators defined in the project document.

As can be seen from the indicators in Table 1, almost all results were achieved despite the Covid-related restrictions in 2020 and 2021. All goals regarding training and demonstration systems were significantly overachieved.

Table 1: Results achieved, based on the indicators defined in the project document

Indicators of expected outputs according to the contract	Accomplished	Deviation from the target
Work Package 1 - Solar Thermal Roadmap Implementation		
24 Policy Workshops carried out	28	+4
Participation at 24 trade fairs	23	-1
50 Solar trailer exhibitions	52	+2
42 information workshops for private and public sector (6 by each partner)	42	-
Work Package 2 - Training		
13 Train the Trainer courses carried out	13	-
15 persons trained in the dual training program	18	+3
10 training courses for VTCs organized	11	+1
7 training courses for artisans from the private and public sector organized	7	-
Three specialized courses for professionals carried out	3	-
38 dissemination courses carried out	41	+3
Set of 4 short training videos on solar thermal	4	-
Solar Trailer for the National University of Lesotho	delivered in March 2021	-
Work Package 3 - Demonstration Projects		
100 Solar thermal demonstration systems approved	338	+238
100 Solar thermal systems installed, in operation and quality checked	337	+237
2,500 MWh of electricity saved	2,115	-385
430 tons of CO ₂ emissions avoided annually	667	+237
32 technical tours carried out	35	+3
Installed demonstration systems documented on the SOLTRAIN Website	337	-
Work Package 4 - Quality Control, Maintenance, and Monitoring		
Quality checks carried out for all installed systems	337	-
Monitoring reports for all monitored systems	8	-
Work Package 5 - Awareness Raising and Dissemination of Results		
14 SOLTRAIN Newsletters published	18	+4
Redesign of the SOLTRAIN website	completed	-
10 articles in newspapers and journals	33	+23
3 SOLTRAIN conferences organized	2	-1

20 student projects funded	20	-
20 papers or posters for national and international conferences	22	+2
Work Package 6 - Management		
Kick-off meeting organized and carried out	completed	-
3 Annual progress and financial reports	3	-
6 Steering committee meetings	27 ⁴	+21
Mid-term review	11/2021	-
Final project evaluation	10-11/2022	-
Final project report and final financial report	03/2023	-

1.2.1 Highlights

Training

A total of **2,447 people took part in the 134 trainings, courses and workshops** carried out.

If this is compared with the goals set, which was to carry out 90 training courses with 1,200 participants, then the goal has been significantly overachieved in terms of the trainings carried out and the number of participants.

Table 2: Summary of the trainings and workshops that were conducted

Nb.	Trainings, courses, workshops	No. of participants		
		male	female	Total
	Policy workshops	528	242	770
41	Sector specific information workshop	588	197	785
13	Train the Trainer courses	230	58	288
18	Dual training	13	5	18
11	Training courses in co-operation with VTC's	173	37	210
7	Training carried out for artisans from the private and public sector	160	21	181
3	Specialized Courses	131	27	158
41	Dissemination courses	608	199	807
134		1903	544	2,447

⁴ Since physical meetings of all project partners were not possible due to the Covid pandemic in 2020, it was decided to hold more frequent steering committee meetings to maintain momentum in the project. This means that the frequency of Steering Committee meetings has been significantly increased compared to planning.

Installed Solar Thermal Demonstration Systems

In total 60 applications have been received representing 433 demonstration systems. 344 of these systems were approved for funding by the steering committee.

A total of 337 demonstration systems with a collector area of 2.298 m² corresponding to 1.6 MW_{th} are actually installed, commissioned and their quality checked by the end of the project.

Seven of the approved systems could unfortunately not be completed by the end of the project. The advance payments already paid out were transferred back to AEE INTEC by the companies.

On average, the contribution of SOLTRAIN project funds was 33% of the overall system cost, including installation, while the beneficiaries paid 67% of the plant costs. This is significantly higher than the 50% targeted at the beginning of the project.

Environmental Impact

As shown above, a total of 337 solar thermal systems were installed. These systems save 2,115 MWh of electricity per year and thus avoid 667 tons of CO₂.

Thus, the project contributes decisively to the reduction of electricity demand and to the avoidance of local CO₂ emissions.

Gender and support for women

From the total installed solar thermal demonstration systems, 141 of these are used in institutions that support women and marginalized groups, which corresponds to 42% of all installed systems.

The share of women in training courses and workshops was on average 22%.

International Awards and Recognition

SOLTRAIN Phase IV has received the following international awards for its training program, construction of the solar plants and the support for policy makers: the "Energy Globe Award 2019" and the "IEA SHC Solar Award 2022".

SOLTRAIN Phase IV was also recognised as an impactful project in Botswana by the United Nations. The SOLTRAIN country coordinator was invited to the consultative workshop for UN Global Sustainable Development Report 2023 held in Malawi. He shared the success story of SOLTRAIN as a model for impactful community intervention under SDG 7.

Gleisdorf, Gaborone, Harare, Johannesburg, Stellenbosch, Maputo, Windhoek,
Mt. Moorosi

March 2023