



ACP Science  
and Technology II Programme

# NEED — Network of excellence in renewable energy technologies for development

## SUMMARY OF RESULTS

NEED has interlinked initiatives, research institutions, small and medium-sized enterprises, national and local public decision makers in the area of renewable energy technologies to contribute to a wider acceptance of renewable energy within Southern Africa. Research policies were formulated, a process for the alignment of industry standards in the region was initiated, involving the local industry, the national and Southern African Development Community (SADC) standardisation bodies. Furthermore, higher education and vocational training institutions, and national training authorities were interlinked and an undergraduate dual-study programme in renewable energy technology was developed to serve as a blueprint for the region. Energy concepts and transition roadmaps, i.e. a community-based methodology for the transition from fossil to renewable energies for two model regions (fossil-free wetlands and renewable mini-grid drylands) were developed. Scientists involved in renewable energy technologies have been enabled to ensure increased supply of secure energy in the region.

## BACKGROUND

Supply of and access to sustainable and secure energy is lagging behind in many Southern African countries, in particular in remote areas. Despite existing ambitious plans and policies to prioritise the use of renewable energy resources, the lack of professional know-how and a skilled workforce in the field of renewable energy technologies (RET) still undermines their development and economic use. To date, mainly small-scale research and demonstration projects have been initiated, but a comprehensive, integrated approach and good practices to establish RET on a broad scale for the supply of energy are still lacking. Weak links among research and education institutions and the private sector, as well as slow governmental decision-making processes hinder the widespread deployment of RET in Southern Africa.

The project established a SADC-wide network of public, private and higher education stakeholders to unite and boost local capacities and roll out RET on national and local level that have previously been out of scope. The research results are of use for policy

makers, scientists and technical staff in the area of RET, and feed into the development of future energy and research policies of the relevant national ministries (e.g. of higher education, research and energy) of the SADC region and the EU. The private sector can improve the planning and implementation of RET projects.

Botswana, Namibia and Zambia have a comparable state of the introduction of RET with respect to their policy background and presence of significant renewable energy potential. The majority of their populations depend on firewood and charcoal for cooking and hot water supply, which poses serious threats to the environment, health and economy because local resources are used unsustainably, generating the risk of deterioration of valuable soil necessary for food production. Simultaneously, because of the favourable climatic conditions, the use of solar-based RET in these countries has enormous potential. The availability of sustainable and affordable energy is considered vital for development.



Visit to the Biomass Test Facility at Thomro Biofuels, Lusaka, Zambia (April 2014).

## PROJECT IMPLEMENTATION PERIOD

March 2014 - August 2017

## CONSORTIUM

- Technische Hochschule Ingolstadt (THI), Germany
- Botswana International University of Science and Technology (BIUST), Botswana
- Okavango Research Institute (ORI) - University of Botswana, Botswana
- Namibia University of Science and Technology (NUST), Namibia
- University of Zambia (UNZA), Zambia

## Associated partners:

- Botswana: Ministries of Infrastructure, Science and Technology, Education and Skills Development, Minerals, Energy and Water Resources; Botswana Power Corporation
- Namibia: Ministry of Education, Arts and Culture; Desert Research Foundation of Namibia
- Zambia: Zambia Electricity Supply Corporation; Copperbelt Energy Corporation; Centre for Energy, Environment and Engineering Zambia; Muhanya Solar; National Technology Business Centre
- Germany: Deutsche Gesellschaft für Internationale Zusammenarbeit; Bundesverband Solarwirtschaft; Munich Advisors Group

## PROJECT CONTACT

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## PROJECT WEBSITE

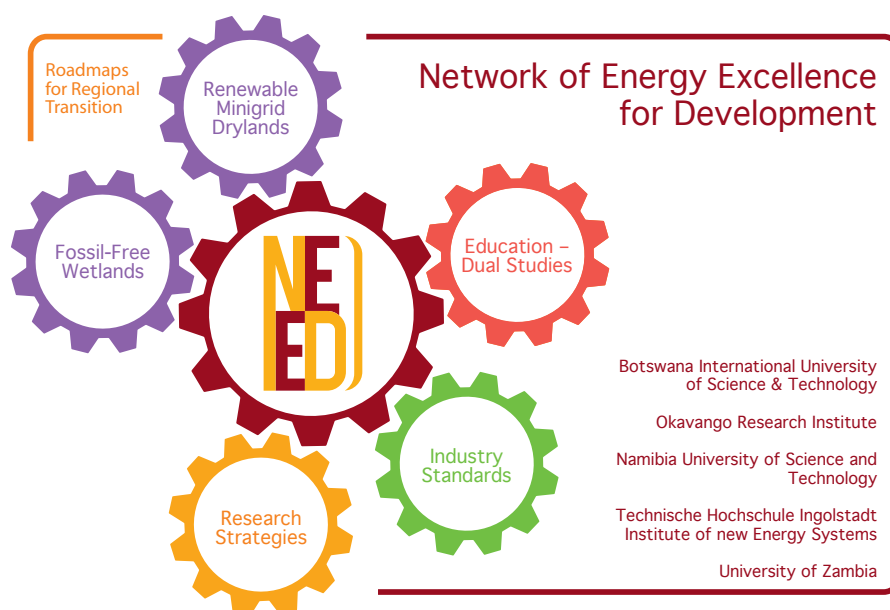
<http://www.need-project.org>



Network of  
Energy Excellence  
for Development



## METHODOLOGY



### Research strategies

In cooperation with relevant stakeholders (research and higher education institutions, NEED's industry partners and respective ministries), research strategies were prepared to accelerate research in RET which are appropriate to endogenous energy resources. In this respect, the status of the technologies in the renewable energy sector was assessed, areas herein that required further investigation were identified, and a methodology for developing research strategies was created. National RET stakeholder mappings were also carried out in order to identify relevant actors for future research activities and to develop national research strategies.

### Dual study programmes

Aimed at enhancing practical training in RET as part of an undergraduate study programme, a curriculum including compulsory vocational training components and industry internship was developed. A web-based survey was conducted to assess the specific training needs of

scientists, engineers and technologists focused on applied RET knowledge. Based upon this survey, a framework for courses at Higher Education Institutions (HEIs) in solar photovoltaic, solar-thermal and wind energies as well as the structure and curriculum of a RET dual study programme was developed. Within this process, two focus group meetings with officials of the National Training Authority (NTA) in Namibia were held in order to capture input related to national needs.

### Industry standards

The requirements for RET standards and technical directives as well as the standardisation processes in the SADC region were assessed with respect to the alignment of RET industry standards. Certain standards exist, but are not compatible across national borders. A survey was conducted to obtain information from RET practitioners, as well as national and SADC standardisation bodies, in Botswana, Namibia and Zambia. An appro-

priate process for the SADC-wide alignment of industry standards was identified and the respective actors involved.

A workshop with RET stakeholders in Botswana resulted *inter alia* in the foundation of the Renewable Energy Association of Botswana (REAB) to support the development of cost-effective, sustainable renewable energy generation and consumption solutions.

### Fossil-free wetlands and Renewable mini-grid drylands

In so-called 'model-regions', technical options of RET for two typical local environments were investigated: a small village in the desert (dryland area) and an accumulation of tourist lodges in a national park (wetland area). The principles that were developed for setting up an energy concept and its incorporation within local structures and policy frameworks created a model for the implementation of sustainable energy concepts in other typical rural regions.

Several case studies have been conducted, e.g. at the Chobe Game Lodge and the Guma Lagoon Lodge in Botswana, for the development of a simulation model of typical wetlands tourist facilities. These included collecting and evaluating local energy production and consumption data. A simulation-based case study with the Topnaar community in the Namibian desert was conducted in order to show the technical and economic options of village electrification based on a solar photovoltaic mini-grid. This included a local community workshop to explain all aspects of the operation of a mini-grid, such as the maintenance and management of the installations.



Non-electrified Topnaar settlement using a solar home system in the Erongo Region in Central Namibia where NEED conducted a survey to assess the sources and use of energy amongst the Topnaar community (March 2015).

## → Outputs

### Stakeholders

- Parastatal and public institutions, public limited companies, state-owned enterprises, government agencies: Botswana (18), Namibia (14), Zambia (8).
- Universities and national research institutes: Botswana (2), Namibia (4), Zambia (6).
- HEIs, vocational and secondary schools, training institutes, national qualification authorities, curriculum development centres: Botswana (4), Namibia (9), Zambia (10).
- International and regional organisations, civil society and non-governmental organisations, major energy consumers: Botswana (40), Namibia (8), Zambia (4).
- Topnaar region (Namibia) and the Okavango Delta (Botswana): 102 lodges, 615 individuals.

### Capacity building

- 2 workshops on the use of RET with tourist service operators in Botswana.
- 3 short courses in solar and wind energy for students at NUST to serve as a blueprint for other HEIs in the region.
- Demonstration of the use of RET kits in photovoltaics (PV), solar thermal and wind energies at the National Commission on Research Science and Technology (NCRST) Science Festival in Ongwediva and the Topnaar community focus group meetings near Gobabeb in Namibia.

### Networks

- 1 local government-university-industry forum in Zambia.
- Renewable Energy Association Botswana (REAB).
- The registration of the 'Network of Energy Excellence for Development (NEED Ltd.)' as a non-profit organisation in Zambia.

### Toolkits

- 1 methodology for developing RET research roadmaps.
- 3 national and 1 regional RET research roadmaps.
- Recommendations on teaching methodology in RET.
- RET kits in PV, solar-thermal and wind energies for use in schools.
- 1 report on sourcing of funds for summer camps.
- 1 funding strategy to promote a culture of science.

### Documents

- 1 report on the development of RET standards within the region and their harmonisation process through the SADC Cooperation in Standards (SADCSTAN).
- 1 comparative table on the RET standards in Botswana, Namibia and Zambia.
- 1 comprehensive report on energy production and consumption.
- 1 regional energy concept for the Okavango Delta in Botswana.
- 1 roadmap for regional transition in sustainable energy production and consumption with the vision of 'Fossil-free wetlands' in the Okavango Delta.
- Recommendations on capacity building in RET.

### Visibility

- Project website.
- 2 scientific fairs; 12 presentations at international conferences; 1 final project conference; 1 half-day summit on RET as part of the International Conference on Development and Investment in Infrastructure Strategies for Africa (DII-2016) in Livingstone, Zambia.
- 5 newsletters (2,500 copies each).
- 3 policy briefs.
- 1 RET-related science quiz competition, 1 RET-related science fair.
- 1 broadcast on Namibian TV, 3 journal articles, 1 press release.
- 1 flyer (10,000 copies), 1 conference flyer, 1 brochure (60 pg; 1,000 copies).
- 150 bags, 1 banner, 160 caps, 100 folders, 60 mugs, 250 notepads, 1,350 pens, 200 USB keys.

### Publications

- Zulu A. *et al.*, 2016. Capacity building in renewable energy technologies in Namibia, Zambia and Botswana. *Journal of Renewable Energy and Energy Efficiency of Southern Africa (JREEESA)*, Vol. 1, No. 1, October 2016, pp. 25-29.
- Third international conference on infrastructure development and investment strategies in Africa, Livingstone, Zambia, 31.08-02.09.2016 (ISBN 978-0-620-70336-9):
  - Zulu A. *et al.*, 2016. Research requirements in renewable energy technologies for Southern Africa.
  - Kelebopile L. *et al.*, 2016. Development and harmonization of renewable energy technology (RET) standards in the SADC sub-region.

- Mbaiwa J.E. *et al.*, 2016. Perceptions of tourism operators towards renewable energy use in accommodation facilities in the Okavango Delta.
- Chisale P. *et al.*, 2016. Sustainable renewable energy mini-grids for energy access: economic and social benefits of mini-grid systems.
- Chisale P. *et al.*, 2016. Dual Studies - An alternative pedagogy for renewable energy training in Southern Africa.
- Junker F. *et al.*, 2016. The NEED project: Strengthen the implementation of renewable energy resources in the Southern African Region. International conference on solar technologies hybrid mini grids to improve energy access, Bad Hersfeld, Germany, 21-23.09.2016.
- Katende J. *et al.*, 2016. The NEED project: Enhancing the widespread use of renewable energy resources in Southern African Region. International conference on domestic use of energy (DUE), Cape Town, South Africa, 30-31.03.2016 (ISBN 978-0-9946759-0-3).
- Mbaiwa J.E. *et al.*, 2017. Tourism and energy use in lodges and camps in the Okavango Delta, Botswana. *International Journal of Tourism Policy*.
- Mbaiwa J.E., 2016. Waste disposal, water resources and the tourism industry in the Okavango Delta, Botswana. The 17<sup>th</sup> WaterNet/WARFSA/GWP-SA Symposium, 26-28 October 2015, theme 'integrated water resources management: Water security, sustainability and development in Eastern and Southern Africa', GICC, Gaborone, Botswana.
- Motsholapheko M.R. *et al.*, 2017. Access to grid electricity in Botswana: Implications for energy transition in the Okavango Delta.
- Oladiran T., 2016. Inching towards RET industry standards for promotion of renewable energy in Botswana. International Renewable Energy Conference (IREC), Gaborone, Botswana, 26-28.10.2016.



## RESULTS

### Outcomes

- Knowledge and skills of project partners strengthened in collaborating with national and international stakeholders in the area of RET research leading to two subsequent research projects and numerous joint project proposals.
- Linkages between academia, RET industry and policy makers strengthened and frequent exchange fostered in the SADC region.
- Awareness raised on curriculum of dual study programme at undergraduate level, and local and higher education institutes and authorities encouraged to introduce practice-oriented higher education in RET in the SADC region.
- Methodology for developing national strategies for research in RET enabling local stakeholders to implement and execute research activities in RET in the SADC region.
- Process and actors at national and international level identified for the harmonisation of RET industry standards enabling the acceleration of industry standard development and alignment in the SADC region.
- Energy concepts for the two model regions used to involve relevant stakeholders, such as the Okavango Wilderness Safaris (OWS) in Botswana and the Topnaar community in Namibia, and to raise awareness about using RET.

### Impacts

#### Usage

- The developed framework and curriculum for dual study programmes serves as basis for the introduction of practice-oriented undergraduate RET study programmes at respective universities in the region.
- Industry actors active in the area of RET benefit from the established network and initiate close cooperation with NEED universities at technical level.
- Government institutions benefit from the established international network and involve NEED universities in decision making related to the use of RET.
- Research institutions benefit from greater government institution awareness of RET and consequently growing public support for the renewable energy sector and innovations.
- The research roadmap and industry standards for RETs can serve as best practice examples which can be adapted to other countries' needs (multiplier effects).
- The regulatory and institutional frameworks for the implementation of renewable energies may be improved through appropriate RET research policies and aligned industry standards.

#### Policy implications

- The results from the investigation on industry standards, and the needs assessment in the area of dual study programmes serve as a sound basis for the development

#### Sustainability

- The non-profit network 'NEED Ltd' will ensure the continuation of technology and

knowledge transfer between its members (academia, industry, civil society and government institutions).

- NEED contributed to ensuring the security of energy supply in the SADC region by the promotion of endogenous sources of energy.
- The reduction of fossil fuel consumption, especially in the model regions (in both the short and medium term, through institutionalised transition processes) can promote the wider use of sustainable energy technologies and contribute to a reduction of climate change impacts.
- The methodology on the development of research strategies will support the development of RET research strategies on national and regional level in Southern Africa.

## TESTIMONIALS



**Kudakwashe Ndhlukula, Executive Director, SADC Centre for Renewable Energy and Energy Efficiency (SACREEE), Windhoek, Namibia**

“NEED addresses the demand for localised information in the RET sector in Southern Africa. As SACREEE, we depend on and work with the academia and industry to provide our stakeholders with relevant information on the local context and suitable solutions. Capacity is still a big issue in Africa's renewable energy sector. We need to build this capacity at both individual and institutional level.”



**Dr. Ackim Zulu, Senior Lecturer, Department of Electrical and Electronic Engineering, University of Zambia, Zambia**

“When we started this project, there were only loose or poor relationships among renewable energy stakeholders on national and regional level. Through the NEED project, we established strong links between stakeholders and target groups in the Southern African region. In addition, the interest in RET from national governments has increased. Governments now participate in RET sector discussions and are interested in the newest developments and innovations. Moreover, the local industry is coming on board to work more closely with higher education and research institutions.”

