

Interdisciplinary Analysis of Renewable Energy-Based Mini-Grids in Namibian Remote Areas – An Overview on the PROCEED Project

Carina Fromm

Mathias Ehrenwirth, Christoph Trinkl, Wilfried Zörner
Institute of new Energy Systems, Technische Hochschule Ingolstadt (THI)
Esplanade 10, 85049, Ingolstadt, Germany

Phone: +49 841-9348-6411 Email: carina.fromm@thi.de

Website: www.thi.de/go/energy; www.bmbf-client.de/en/projects/proceed

Keywords: mini-grid, remote village power supply 2.0, decentralised electricity transition, interdisciplinary approach, payment business model, validated algorithm / living-lab

Background

In Namibia, about 28 % (2016) of the rural population has no access to electricity [1, 2]. Due to its low population density and a distributed settlement structure, the country faces particular challenges in the electrification of remote areas. Despite the abundant availability of solar and wind resources, the share of renewable energies (RE) in Namibia's energy consumption is less than 20 % (2018) [3]. Against this background, the German-Namibian joint project PROCEED (Pathway to Renewable Off-Grid Community Energy for Development) aims at the interdisciplinary analysis of options for an efficient, sustainable and renewable energy-based power supply in Namibian remote areas using mini-grids (MG). Using the example of different regions in Namibia, the project consortium conducts case studies at existing remote MG (cf. Figure 1), investigating social and community structures, societal perceptions, legal, regulatory and economic conditions as well as the energy technologies applied.



Figure 1: PROCEED's reference objects in Tsumkwe (left) and Gam (right) in the Otjozondjupa region in northeast Namibia are currently the country's largest mini-grid systems (images: Fabian Junker, THI)

The Project in Brief – Innovation through Interdisciplinarity

Aiming at effective implementation of the project, the PROCEED project is organised in four work packages focusing on *society*, *economics*, *technology* and *sustainability*. Researchers from University of Bayreuth will

conduct interviews and data surveys in order to analyse geographic and sociocultural conditions (*mini-grid communities*) for increased power generation by means of off-grid hybrid energy systems. Regarding the topic of *mini-grid economics*, University of Applied Sciences Neu-Ulm is investigating options for a cost-covering tariff and payment system for locally organised hybrid energy systems and develops suitable business models for the commercial use of the generated electricity. The determination of consumption profiles and building loads as well as the optimal design of hybrid systems based on RE are the focus of research in *mini-grid technology*, which is performed by the Institute of new Energy Systems at THI and IBC Solar AG. By formulating practice-oriented recommendations for action and developing training program concepts based on the outcomes of the three main research areas, the fourth focus, *mini-grid sustainability*, will enable the sustainable utilisation of project results at national and supraregional levels.

In addition to the PROCEED's interdisciplinary approach, the consortium attaches particular importance to the close cooperation with local partners in Namibia. The long-term experience of PROCEED's Namibian partners (e.g. Namibian Energy Institute, Alensy Energy Solutions (Pty) Ltd and the Renewable Energy Industry Association of Namibia) with the technical and social conditions in the local environment is thereby the basis for effective solutions for MG systems. At the same time, ongoing exchange with partner institutions at the national (Ministry of Mines and Energy) and regional (SADC Center for Renewable Energy and Energy Efficiency) level ensures that the outcomes are tailored to Namibia's energy policy agenda. As a result, the findings obtained from the PROCEED project constitute a valuable basis for the long-term promotion of RE systems, for instance by the Hanns Seidel Foundation Namibia based in Windhoek.

The project is funded by the *Federal Ministry of Education and Research* within the funding scheme *Client II* (International Partnerships for Sustainable Innovations); Funding Code: 03SF0570A-D

References

- [1] The World Bank (2016), "Access to electricity, rural (% of rural population)", available at: <https://data.worldbank.org/indicator/EG.ELC.ACCS.RU.ZS> (accessed 24th September 2019).
- [2] World Development Indicators (WDI) (2016), "Energy Production & Changing Energy Sources. Rural-urban divide: developing rural infrastructure", available at: <https://ourworldindata.org/energy-production-and-changing-energy-sources#energy-consumption-poverty-and-economic-growth> (accessed 24th September 2019).
- [3] Federal Ministry for Economic Affairs and Energy (2019), "Factsheet Namibia – Allgemeine Energiemarktinformationen", available at: <https://www.german-energy-solutions.de/GES/Navigation/DE/Marktinformationen/Publikationen/publikationen.html> (accessed 24th September 2019).