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Development of a smart monitoring and evaluation framework for hybrid renewable mini-grids

Babak Ravanbach[a], Meike Kühnel[a], Benedikt Hanke[a], Karsten von Maydell[a], E. Ernest van Dyk[b], Monphias Vumbugwa[b], Golden Makaka[c], Mahali Elizabeth Lesalac, Ngwarai Shambirac, Kittessa Roro[d]

[a] DLR Institute of Networked Energy Systems, Carl-von-Ossietzky-Str. 15, 26129, Oldenburg, Germany, Email: Babak.Ravanbach@dlr.de

[b] Nelson Mandela University, PO Box 77000, Port Elizabeth, 6031,

South Africa, Email: Ernest.vanDyk@mandela.ac.za

[c] University of Fort Hare, Ring Road, Alice, 5700, South Africa, Email: Gmakaka@ufh.ac.za

[d] Council for Scientific and Industrial Research (CSIR), PO Box 395, Pretoria, 0001, South Africa Email: KRoro@csir.co.za

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Abstract

Hybrid renewable mini-grids have emerged as a viable solution for providing reliable, environmentally friendly electricity to remote communities. An affordable and grid-quality supply of energy can open new possibilities for socioeconomic progress. As part of a joint project between South Africa's Eastern Cape province and Germany's state of Lower Saxony a Photovoltaic (PV) hybrid mini-grid is developed in the municipality of Upper Blinkwater in Eastern Cape for a rural community of 70 households with 90% living off of social grants and no access to the main national grid. The aim of this work is to develop a smart Monitoring and Evaluation Framework (MEF) for hybrid renewable mini-grids by integrating cutting-edge technologies in a scalable platform of replicable solutions towards connecting the mini-grid with diverse stakeholders with enhanced observability of both generation and consumption profiles. The MEF provides the opportunity to streamline the flow of real-time energy data (generation, consumption, and storage) from the system to generate accurate and high-resolution data-driven load profiles for rural households. Simultaneously, the interrelation between energy access and social development will be studied and analyzed.