

Comparison of Power Conversion Techniques for Rural Electrification

Seppälä A.K., Technical University of Munich, Lichtenbergstr. 4a, 85748 Garching, Germany

Abstract

Over a billion people worldwide have no access to electricity, which effectively hinders their economic and social development. The problem is most apparent in rural and developing regions where extending the national power grid is neither easy nor economically feasible.

The majority of these areas are situated in sub-Saharan Africa and Southeast Asia.

Providing access to reliable, affordable and sustainable energy would help lift communities out of poverty, and mitigate environmental impacts of future economic development. Small off-grid systems have the potential to do so by supplying communities with flexible energy solutions, but due to the variability of renewable energy sources, efficient power conversion systems are a necessity. However, cost reductions are still needed in such systems to make them feasible in low-income scenarios, and to ensure the systems will easily be extended in the future.

This study focuses on comparing existing power conversion techniques in small off-grid systems in rural and developing areas, and will exhaustively discuss the advantages and drawbacks of traditional methods, such as transformers, and more modern technologies that utilise power electronics components. In the latter case, a distinction is made between high-tech and possibly self-made, low-cost solutions. Moreover, various system architectures and DC/AC power distribution shall be considered. The main emphasis is given to finding an optimal method in terms of cost and efficiency.

The aim of the study is to show the potential of low-cost conversion technologies in low-power off-grids for the promotion of rural electrification in low-income regions. This objective is reached by means of a literature review and cost analysis of the most prevalent power conversion strategies.

Keywords: Rural electrification, Power conversion, Off-grid, Sustainable development,

Power electronics

Seppälä Anna-Kaarina
anna.seppaelae@tum.de
+49 (0)89 289 52735