

Scales of rural photovoltaics – considerations assisting deployment

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Abstract

Photovoltaics (PV) is often claimed not to provide the necessary power output required for rural village electrification when the electricity provision concerns not only households but also businesses, so-called productive use. It is, however, the hypotheses of this study that a closer inspection of demand load curves of the various village demands will show that the cost-effectiveness of PV could be greatly improved by addressing system optimisation over temporal and spatial scales.

For small, isolated systems supply-demand interactions grow in importance due to limitations in redundancy. Since PV has its major comparative advantages in off-grid power supply and often is deployed in small, decentralized applications the supply-demand interactions are of large importance for successful PV deployment. Thus, knowledge of the electricity demand is a key to PV deployment success.

The study is based on a comparison of load curves and interview-based data on demand development in already electrified villages in rural Tanzania. Two types of temporal scales are addressed, the short-term variations of the demand during the day, and the long-term development of demand with time after electrification. The spatial scales involve the step-wise process of connection of the various loads until a partial or full minigrid is evolving.

The results show that there are large differences in terms of load curve characteristics between the different demand categories and, thus, that there are considerable possible benefits from a partial or full connection of the various demands. This, in turn, is linked to important possible cost-efficiency improvements, and results in the possibility of productive use electrification by PV. It also has implications for the PV-battery design balancing.

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