

Managing Peak Demand Days to Reduce Mini-Grid Generation Costs

Mini-grid developers face a fundamental challenge in managing generation costs. Systems often must be oversized to handle rare peak consumption days, which leads to expensive equipment sitting underutilized most of the time. Our study identified these peak-day to average-day demand ratios as the main cause of high costs in rural solar-battery mini-grids. This insight points to an opportunity: if we can manage those rare peaks, we might significantly reduce costs.

To address this challenge, we found that limiting the electricity supply during peak demand days significantly reduces system costs. Implementing load shedding of just 5% of annual consumption halves generation costs. Figure 1 illustrates this dramatic drop in cost. This load-shedding percentage is measured in terms of energy, rather than the length of time of the outages. This approach only curtails the most extreme usage spikes and still meets the vast majority of the community's needs reliably. For communities concerned about reliability, adding a diesel generator to cover these peak periods still results in significant overall savings compared to a solar-battery system designed to meet all demand at all times.

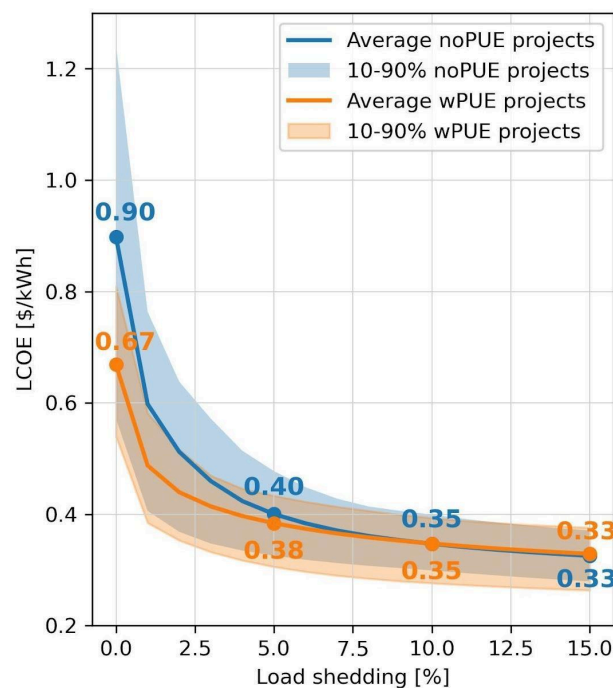


Figure 1 – Modeled generation system Levelized cost of electricity (LCOE) changes with load shedding on a percentage of annual electricity energy consumption.

Figure 1 also compares mini-grids with productive use of energy (PUE) against household-only systems. The shaded ribbons display the 10-90 percentile range across various projects analyzed in a more detailed study, illustrating natural variation in outcomes. Most importantly, the data demonstrates that load shedding effectively reduces generation costs in both scenarios.