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A SIMPLIFIED ANALYTICAL METHOD FOR SIZE OPTIMIZATION OF A STANDALONE PV SYSTEM

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Abstract:

The worth of standalone photovoltaic (SAPV) systems is associated to the precise prediction of system cost and required power reliability. This paper presents a simplified analytical method for size optimization of a SAPV system with least possible cost and predetermined power reliability to satisfy load. The cost is optimized by accounting the two most expensive components of SAPV systems, namely PV array area and battery storage capacity. The power reliability is quantified by the loss of load probability index. The isoreliability power curves were drawn based on latitude and clearness index of the area. The analytical expressions for optimum PV array capacity ($C_{a,opt}$), optimum battery storage capacity ($C_{b,opt}$) and the shifting parameter (k) were formulated. The curves obtained from the proposed method were compared with the two existing analytical and numerical methods. A case study was carried out for a load demand of 7200 Wh/day (19.117×10^6 ft.lb/day) at Kuching for optimal sizing of SAPV system parameters. The required PV array area and useful battery storage capacity were found to be 14.631 m^2 (157.5 ft^2) and 56417Wh (150×10^6 ft-lb) respectively. It was revealed from the analysis that the proposed analytical method is more practical in terms of accuracy and is simple to implement for the design and size optimization of SAPV system components.

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