# Identifying Key Reliability Factors in Micro-Grid Systems Using Principal Component Analysis.

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- **Abstract:** One way to solve the shortage in power supply and the rapid load growth is by operating power systems that could improve power supply reliability. The study aims to carry out a holistic evaluation by identifying the several reliability variables that could influence the micro-grid power system's reliability which is vital in electricity generation. Thirty-three reliability variable factors that are commonly observed to influence power systems reliability were chosen for the micro-grid power systems study and examined using the principal component analysis (PCA). The system reliability key variables were evaluated using the StatistiXL software. A structured questionnaire was crafted considering thirty-three reliability variables, harvested from literature, and administered to respondents in the micro-grid power system industry. The respondent size was determined at a level of confidence of 95% and an error margin of 5% was deployed to corroborate an adequate population size representation which validated the study data. StatistiXL software was deployed to analyze the (mxn) data matrix, collated from the respondents' scores. The matrix was used as the input variable for the model deployed for the factor analysis. Nine factors with eigenvalues ($\lambda$&gt;1) were mined and labeled for the analysis, but all the trivial variables were discarded. The PCA result holistically pinpointed the key reliability variables that influence the micro-grid reliability, revealing that system availability represented by factor 1 (F1) loaded 24% of the total variables studied, with reliability cluster including Mean Time Between Failures (MTBF) = - 0.844, Mean Time to Repair (MTTR) = - 0.737, Demand Response (DR) technique = 0.752, Failure Rate = 0.647 among others. The failure rate and the frequency of outages in F1, were an indication that system availability would be influenced, thereby affecting the micro-grid performance. The study also extracted some weak factor loading, F8 and F9 indicting them as reliability variables whose

influences do not impact negatively on the micro-grid reliability but should not be discarded in the study of the reliability of micro-grid power systems. Hence an attempt to improve the system's reliability, concentrating on the key variables factors, the weak variables should not be neglected.

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