

Comparative Impact Analysis of Factors Affecting Renewable Energy Integrated and Conventional Energy Sources In Smart Grids Using MATPOWER

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Abstract : Integrating renewable energy sources (RES) alongside conventional energy sources (NRES) in the grid has introduced challenges that highlight the need for a detailed analysis of various performance factors. Factors such as active and reactive power losses, voltage deviation, transmission line loading, power factor, fast voltage stability index, and capacity factor require careful evaluation to understand their impact on grid performance. In this study, MATPOWER's optimization tools are used to model both NRES and a combined NRES + RES setup. The analysis compares the performance of each configuration across these factors. Findings indicate that integrating RES with NRES generally enhances performance across most of the analyzed factors compared to using NRES alone. The insights from this study offer valuable guidance for grid operators and policymakers, aiding in the balanced integration of RES with NRES to optimize smart grid performance and resilience.

Keywords : smart grid, impact analysis, renewable energy integration, FVSI, transmission line loading

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