

# **Integration of Renewable Energy Technologies for Sustainable Development in South Africa: A Focus on Grid-Connected PV Systems**

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## **Abstract**

Energy is essential for crucial development in Africa. The current electricity shortages and load shedding in South Africa show that the country faces significant challenges in reaching positive economic growth. For industries to operate sustainably, an innovative mechanism must be tailored to solve the negative impacts of industrial energy use, particularly climate change. This study aims to show how renewable energy technologies can provide new economic opportunities, contribute to higher standards of living, and reduce the impacts of society on ecosystems, among other things. This paper presents a feasibility analysis and optimization of new energy technologies by designing and simulating a grid-connected PV system for sustainable development. PV Syst software (PV Syst 6.8.8) was used to simulate and optimize the PV system. The software was employed to design and model the PV systems, calculating energy production, economic performance, and environmental impact. Using simulation data, the researchers compared PV system performance across three scenarios and identified the optimal system. Scenario A was chosen as the best system, with an energy production of 1720 MWh/year. Overall, the findings of this study suggest that grid-connected PV systems are a feasible and sustainable option for meeting South Africa's energy needs. By implementing the results and recommendations, the government, investors, and community can work together to develop and deploy a successful PV system that will benefit all.

**Keywords:** energy; sustainable development; PV Syst; technology