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## Feasibility of Hybrid Renewable Energy Systems in Ranchi, Jharkhand

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### ABSTRACT

This review presentation shows about the feasibility of hybrid renewable energy systems (HRES) in Ranchi, Jharkhand, with synthesizing insights from existing secondary sources. The focus is on the integration of photovoltaic (PV) and wind energy systems to meet the region's energy demands. Secondary data from various studies indicate that combining PV and wind energy can provide a stable and reliable energy supply throughout the year. Research highlights that PV panels perform optimally during the summer, capturing abundant solar energy, while wind turbines are particularly effective during the monsoon season, harnessing high wind speeds.



Fig: Hybrid Renewable Energy Systems (HRES)

The initial capital investment for HRES is noted to be high, which can be a barrier to implementation. However, literature suggests that these costs are offset by low operational and maintenance expenses. The payback period for such systems is generally estimated to be around 6 to 7 years, making them economically viable in the long term. Environmental benefits of HRES are consistently reported across studies, with significant reductions in carbon emissions and minimal ecological impacts. The integration of renewable energy sources contributes to sustainable development goals by mitigating climate change effects and reducing dependency on fossil fuels. Socio-economic advantages are also prominent in the literature. Reliable electricity from HRES has been linked to improved quality of life, particularly in rural areas. Enhanced access to energy supports better educational and healthcare services and fosters local economic development through job creation in the renewable energy sector. This presentation shows the importance of tailoring renewable energy solutions to local conditions. Secondary sources advocate for the adoption of hybrid systems that leverage the specific climatic and geographic characteristics of regions like Ranchi. Overall, the feasibility of HRES in Ranchi is well-supported by secondary sources, highlighting the potential for these systems to promote sustainable rural electrification. Future research and policy efforts should focus on addressing initial cost barriers and promoting community engagement to maximize the benefits of hybrid renewable energy systems.

***Keywords: Hybrid Renewable Energy Systems, Ranchi, Jharkhand, Photovoltaic (PV), Wind Energy, Socio-Economic Impact, Energy Security.***