

Abstract

Solar power plants are expected to play a significant role in India's power sector. The country plans to achieve an installed capacity of 100 GW by 2022. However, in a stand-alone mode, solar power plants are not able to deliver a consistent power supply, as per the demand requirement, to Electricity Supply Companies (ESCOMs). This is mainly because of the nature of intermittency associated with solar energy. Hybridization of renewable energy (RE) resources would significantly contribute toward solving this issue by providing a stable and sustainable supply.

Biomass is a potential renewable resource for hybridization. Considering the technology maturity and economics, this study addresses solar photovoltaics and biomass hybrid systems for power generation and is restricted to decentralized applications. A detailed techno-economic case study has been presented for a 5-MW solar photovoltaic and biomass hybrid system in the present paper. At a capital cost of the hybrid plant at INR 10 crores/MW, the levelized cost of electricity (LCOE) and capacity utilization factor (CUF) for only solar (1-shift) are respectively INR 4.5/kWh and 10.7%. With sunshine hours in 1-shift mode in hybrid (both solar and biomass), the LCOE is INR 8.5/kWh and CUF is 24%, because the biomass system requires a higher capital investment (compared to solar) and less utilization (restricted to sunshine hours) for energy generation. If biomass system along with solar is utilized for 24 × 7 operation, the cost of generation reduces to INR 5.4/kWh (CUF 75%). However, PV-based hybrid plants with biomass system offer advantage only during the day time. The present results show that PV-biomass is a viable system and, more importantly, provides stable power to the grid during daytime without any battery support. Further, the biomass plant can be used to operate the plant beyond solar hours depending on the power demand and biomass availability.