

Optimal Applications of Solar Energy Systems: Comparative Analysis of Ground-Mounted and Rooftop Solar PV Installations in Drought-Prone and Residential Areas of the Indian Subcontinent

Authors : Rajkumar Ghosh, Bhabani Prasad Mukhopadhyay

Abstract : The increasing demand for environmentally friendly energy solutions highlights the need to optimize solar energy systems. This study compares two types of solar energy systems: ground-mounted solar panels for drought-prone locations and rooftop solar PV installations measuring 300 sq. ft. (approx. 28 sq. m.). The electricity output of 4730 kWh/year saves ₹ 14191/year. As a clean and sustainable energy source, solar power is pivotal in reducing greenhouse gas CO₂ emissions reduction by 85 tonnes in 25 years and combating climate change. This effort, "PM Suryadaya Ghar-Muft Bijli Yojana," seeks to empower Indian homes by giving free access to solar energy. The initiative is part of the Indian government's larger attempt to encourage clean and renewable energy sources while reducing reliance on traditional fossil fuels. This report reviews various installations and government reports to analyse the performance and impact of both ground-mounted and rooftop solar systems. Besides, effectiveness of government subsidy programs for residential on-grid solar systems, including the ₹78,000 incentive for systems above 3 kW. The study also looks into the subsidy schemes available for domestic agricultural grid use. Systems up to 3 kW receive ₹43,764, while systems over 10 kW receive a fixed subsidy of ₹94,822. Households can save a substantial amount of energy and minimize their reliance on grid electricity by installing the proper solar plant capacity. In terms of monthly consumption at home, the acceptable Rooftop Solar Plant capacity for households is 0-150 units (1-2 kW), 150-300 units (2-3 kW), and >300 units (above 3 kW). Ground-mounted panels, particularly in arid regions, offer benefits such as scalability and optimal orientation but face challenges like land use conflicts and environmental impact, particularly in drought-prone regions. By evaluating the distinct advantages and challenges of each system, this study aims to provide insights into their optimal applications, guiding stakeholders in making informed decisions to enhance solar energy efficiency and sustainability within regulatory constraints. This research also explores the implications of regulations, such as Italy's ban on ground-mounted solar panels on productive agricultural land, on solar energy strategies.

Keywords : sustainability, solar energy, subsidy, rooftop solar energy, renewable energy

Conference Title : ICRSE 2024 : International Conference on Renewable and Sustainable Energy

Conference Location : Kathmandu, Nepal

Conference Dates : October 17-18, 2024