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Adaptable Path to Net Zero Carbon: Feasibility Study of Grid-Connected Rooftop Solar PV Systems with Rooftop Rainwater Harvesting to Decrease Urban Flooding in India

Authors : Rajkumar Ghosh, Ananya Mukhopadhyay

Abstract : India has seen enormous urbanization in recent years, resulting in increased energy consumption and water demand in its metropolitan regions. Adoption of grid-connected solar rooftop systems and rainwater collection has gained significant popularity in urban areas to address these challenges while also boosting sustainability and environmental consciousness. Grid-connected solar rooftop systems offer a long-term solution to India's growing energy needs. Solar panels are erected on the rooftops of residential and commercial buildings to generate power by utilizing the abundant solar energy available across the country. Solar rooftop systems generate clean, renewable electricity, reducing reliance on fossil fuels and lowering greenhouse gas emissions. This is compatible with India's goal of reducing its carbon footprint. Urban residents and companies can save money on electricity by generating their own and possibly selling excess power back to the grid through net metering arrangements. India gives several financial incentives (subsidies 40% for system capacity 1 kW to 3 kW) to stimulate the building of solar rooftop systems, making them an economically viable option for city dwellers. India provides subsidies up to 70% to special states such as Uttarakhand, Sikkim, Himachal Pradesh, Jammu & Kashmir, and Lakshadweep. Incorporating solar rooftops into urban infrastructure contributes to sustainable urban expansion by alleviating pressure on traditional energy sources and improving air quality. Incorporating solar rooftops into urban infrastructure contributes to sustainable urban expansion by alleviating demand on existing energy sources and improving power supply reliability. Rainwater harvesting is another key component of India's sustainable urban development. It comprises collecting and storing rainwater for use in non-potable water applications such as irrigation, toilet flushing, and groundwater recharge. Rainwater gathering 2 helps to conserve water resources by lowering the demand for freshwater sources. This technology is crucial in water-stressed areas to ensure a sustainable water supply. Excessive rainwater runoff in metropolitan areas can lead to Urban flooding. Solar PV system with Rooftop Rainwater harvesting systems absorb and channel excess rainwater, which helps to reduce flooding and waterlogging in Smart cities. Rainwater harvesting systems are inexpensive and quick to set up, making them a tempting option for city dwellers and businesses looking to save money on water. Rainwater harvesting systems are now compulsory in several Indian states for specified types of buildings (bye law, Rooftop space ≥ 300 sq. m.), ensuring widespread adoption. Finally, grid-connected solar rooftop systems and rainwater collection are important to India's long-term urban development. They not only reduce the environmental impact of urbanization, but also empower individuals and businesses to control their energy and water requirements. The G20 summit will focus on green financing, fossil fuel phaseout, and renewable energy transition. The G20 Summit in New Delhi reaffirmed India's commitment to battle climate change by doubling renewable energy capacity. To address climate change and mitigate global warming, India intends to attain 280 GW of solar renewable energy by 2030 and Net Zero carbon emissions by 2070. With continued government support and increased awareness, these strategies will help India develop a more resilient and sustainable urban future.

Keywords : grid-connected solar PV system, rooftop rainwater harvesting, urban flood, groundwater, urban flooding, net zero carbon emission
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