

Distributed Solar: The Future of Energy Resilience in Urban India

The urban population in India—the world’s most populous country—is expected to reach 675 million by 2035 as per the World Cities Report 2022 by UN-Habitat. As most commercial and industrial activities occur in urban areas and electricity is a major factor for development, this population increase will fuel a surge in electricity demand, leading to acute pressure on traditional energy grids and frequent blackouts. At the same time, Indian cities, similar to their global counterparts, are facing increasing climate disasters, highlighting the need for more resilient and decentralised energy solutions.

Building urban energy resilience by embracing distributed solar

The widespread adoption of distributed solar technologies such as rooftop solar (RTS) systems, building integrated photovoltaics (BIPVs), and urban PVs could be a promising solution. With a decentralised and clean approach for electricity generation, these systems offer some key advantages.

Power during outages

Solar-powered off-grid establishments and mini/microgrids with battery storage offer significant benefits during power outages. By providing independent power for buildings during crises, they can also serve as a backup for essential services such as hospitals.

Resilience during disasters

Electricity grids are vulnerable to infrastructure damage during extreme weather events, leading to widespread outages. For instance, after Cyclone Fani in 2019, several power lines were damaged in Odisha, leading to power outage for weeks. However, some households with RTS systems were able to generate electricity by removing and reinstalling the systems following the cyclone.

Peak load reduction

In sprawling urban areas, electricity demand often peaks during the day, particularly in summers due to the increased need for cooling. As per the State Load Dispatch Center, Delhi, the city’s peak load touched 8,656 MW in the financial year (FY) 2024-25, 16% higher than the previous FY’s peak. With abundant solar energy during daytime, distributed solar technologies could effectively address this peak demand by generating clean energy during these critical hours.



Distributed solar and vehicle-to-grid (V2G)

RTS systems allow homeowners to generate renewable energy, which can be used to charge electric vehicles (EVs) directly, reducing reliance on grid electricity. During peak hours, if EVs are fully charged and stationary, power can be fed back into the grid through a V2G system. This combination of solar power and V2G makes the energy system more flexible and resilient, particularly in urban areas with limited space for large-scale storage.

However, distributed solar systems need to have robust designs to tolerate extreme climate events. For instance, in extreme heat, PV systems suffer significant dips in performance along with shortening of module lifespans. Innovative designs such as rooftop agrivoltaics with circulating water systems can reduce ambient temperatures.

In conclusion, distributed solar represents the future of India’s urban energy landscape, empowering consumers with greater energy independence and resilience against climate disasters.

The author works as an Analyst in the Renewable Energy and Energy Efficiency group at the Center for Study of Science, Technology and Policy (CSTEP), a research-based think tank.



**Sheikh
Madiha Syed**

Analyst
CSTEP

