



Smart Grids and Renewable Energy: Powering Rural Sanitation

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Access to water and sanitation is essential for the health and well-being of individuals and communities. The integration of Smart Grids and Renewable Energy offers an opportunity to ensure reliable power supply for rural sanitation initiatives, such as water pumping and waste management. The *PM-Surya Ghar Yojana* is set to be a game changer by empowering rural households with affordable solar energy. Solar PV systems, particularly through microgrids, can help *Gram Panchayats* reduce electricity costs and provide reliable power for sanitation efforts, aiding India's goal of carbon neutrality by 2070.

Providing a consistent power supply in rural areas remains a challenge. A stable power supply is vital for the availability of clean water and its access is intrinsically linked to sanitation. Climate

change is expected to worsen water scarcity and a lack of basic hygiene practices will heighten the risk of disease transmission. The Smart Grid and Renewable Energy integration creates an opportunity for efficient rural sanitation.

DID YOU KNOW?

PM KUSUM initiative empowers barren and fallow land to generate solar energy and supports farmers with additional income from their unused land.



Smart Grid

It is an electric grid enabled with automation, communication and IT systems that monitors power flows from point of generation to point of consumption, controls the power flows and curtails the load to match generation in real time. Smart grid solutions contribute to integrating consumer and renewable power sources, reduce transmission and distribution losses, peak load management, increase reliability and offer additional features. Smart grid facilitates faster restoration of services on outages, as it has an automated outage management system. Real-time monitoring and recording of power measurement at the consumer end makes it possible to implement dynamic pricing mechanisms based on 'Time of the Day' (TOD) consumption patterns, which helps in the reduction of peak load demand. Peak hours' tariff being highest discourages consumption. Off peak hours incentivise consumers for a reduced tariff during night/off peak time. It has features of sharing information through web portals or mobile apps, giving consumers the opportunity to track their consumption and reduce it.

Smart Grid also facilitates widely spread generation by allowing movement and measurement bi-directionally and net metering, which helps prosumers (producer and consumer) to connect with the grid. Smart grid integrates generation sources and consumers in a safe manner.

Smart grid utilities have better information and control over the distribution network and better asset management. With Smart Grid deployment, utilities have improved their financial health.

Microgrid

A microgrid is an integrated energy and communication system consisting of interconnected loads and distributed energy sources. It can operate in stand-alone or parallel mode with the grid (macro grid) in case of emergency. Microgrid generation sources include solar, wind, microturbines or other small energy sources. Its ability to isolate from larger networks along with dispersed generation sources makes microgrids a highly reliable source of electric power for its customers.

Drinking Water

In the *Jal Jeevan Mission*, the Government of India has envisaged making available safe and adequate drinking water to all households in rural India through individual household tap connections by 2024. As its mandatory elements, sustainability measures are to be implemented, such as rainwater harvesting, recharge of groundwater, graywater management and water conservation. It is a community-based approach to water where the active participation of people is crucial and includes extensive communication along with information sharing, educating the people and having them as key components of the mission. It necessitates water to be everyone's priority, and citizens are

DID YOU KNOW?

Solar Pumping Water Systems generate more solar electricity. Farmers with USPC not only irrigate fields but also solarize other farm applications like chaff cutters, cold storage, dryers, etc.



connected with the initiative as 'Jan Andolan' (people's movement).

Rural Sanitation

Under the *Swachh Bharat Mission* (SBM) launched by the Prime Minister on 2 October 2014, all village Gram Panchayats, Districts, States and UTs have declared themselves 'Open Defecation Free' (ODF) by 2 October 2019, the 150th birth anniversary of Mahatma Gandhi. This great feat was achieved by constructing more than 100 million toilets in rural India. To attain sustainability in the use of these toilets, a consistent water supply is essential, despite the fact that water scarcity exists in many rural communities. Along with supplying drinking water, ensuring water availability for toilets has become a top issue. In most cases, people use the same water for flushing toilets as they do for drinking, but using graywater or recycled water for flushing can reduce the demand for clean and safe water.

Sanitation coverage in the country has improved from 39 per cent in 2014 to 100 per cent in 2019 under the *Swachh Bharat Mission* launched in 2014. Encouraged by the achievements of the *Swachh Bharat Mission*, Phase-2 has been launched by the government, and under it the focus is being directed to ensure that the open defecation behaviours are eliminated and waste management facilities are made accessible in villages. However, it poses a great challenge for creating the requisite

infrastructure and its operational mechanism for waste management. The work is enormous and widespread. It requires not only the creation of physical infrastructure facilities but also making available the required power supply to run these facilities. Proper operation is dependent on the availability of a consistent and quality power supply, which is typically difficult to get in remote locations.

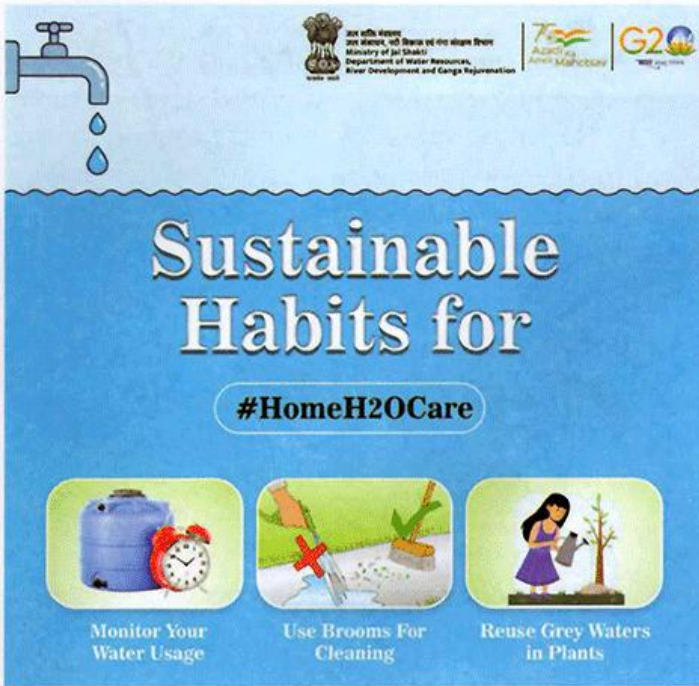
Sustainable Development Goals

India's achievements of SBM are consistent with the SDG target 6.2, which essentially eliminate 'open defecation' nation-wide.

PM-Surya Ghar: Muft Bijli Yojana

To increase the share of solar rooftop capacity and empower residential households to generate their own electricity, the Government of India has launched the *PM-Surya Ghar Yojana* on 29 February 2024. Local bodies' capabilities have been leveraged to reach the consumers and ensure the convergence of stakeholders at the ground level. For each installation in the residential segment under *PM-Surya Ghar: Muft Bijli Yojana*, Central Financial Assistance shall be transferred to the concerned consumer through the National Portal under the scheme guidelines.

The scheme includes an incentive of Rs 1000 crores for local bodies, aiming to incentivise urban and local bodies as well as *Panchayati Raj* Institutions at Gram Panchayat level to promote



residential rooftop solar (RTS) installation within their respective jurisdictions and undertake local mobilisation efforts to maximise the number of installations under this scheme.

The governing bodies are also expected to bring together the major stakeholders, viz. consumers, residential welfare associations, DISCOMs, banking institutions, local contractors and community members, to effectively promote and manage rooftop solar projects. They are expected to provide training opportunities on technical, financial and regulatory aspects, inter alia, to advance local expertise and knowledge in RTS adoption in the country.

Urban Local Bodies and *Panchayati Raj* Institutions are tasked with undertaking scheme promotion activities within their respective areas through awareness campaigns and door-to-door mobilisation through their field units and convergence of stakeholders by hosting local melas and bringing together DISCOMs, vendors and banking institutions in the area for quick process of applications and implementation. It is well realised that local bodies can play an active role in generating demand, facilitation with financial institutions, awareness creation, community mobilisation and coordination with DISCOMs.

Access to water and sanitation is essential for the health and well-being of individuals and communities. India is blessed with ample sunshine throughout the year, which can be extensively

used to generate electricity by the installation of solar PV (solar photovoltaic) systems. The scheme 'PM-Surya Ghar Yojana' is going to be a game changer for ensuring availability of reliable and affordable power supply to rural households, which is an important factor for efficient sanitation in rural areas.

Sanitation and Renewable Energy

The key elements of efficient rural sanitation are maintenance of toilets in hygienic condition and in functional mode at all times, isolation of human waste from human contact, proper management of solid and liquid waste and following hygienic practices. Renewable energy can play an important role in ensuring regular water supply in rural areas. Renewable energy, in particular solar, comes very handy in providing the required reliable power through a smart microgrid for operating water pumping systems. Gram Panchayats generally have limited funds and struggle to meet expenditure on developmental activities and regular operational expenses. Solar PV systems may also save their expenditure on electricity charges. The rate of solar electricity is lower in comparison to DISCOMs (Distribution Companies). Gram Panchayat Institutions may get their solar plants installed in RESCO (Renewable Energy Service Company) mode, under which the cost of installation of the solar plant is borne by the developer and the consumer purchases electricity, by entering into a power purchase agreement for the purchase of the entire electricity generated by the solar plant at a rate fixed for 25 years. At present, that rate is about Rs 4.5 to 5.0 per unit. In this mode, electricity is available at almost half of the DISCOMs rate (their rate is about Rs 8 to 9 per unit plus other charges and taxes). Alternatively, Gram Panchayat Institutions may get their solar plant installed in CAPEX (capital expenditure) mode by investing their funds for installation of the plant, wherein payback period is 4 to 5 years. They may therefore utilise any of the RESCO/CAPEX modes and get the grid connected solar plant installed under a net metering system, to meet their electricity requirements for the operation of the pumping system. Most of the States and UTs support a net-metering system, wherein a bi-directional energy meter is installed by DISCOM. Based on the net consumption, the electricity bill is generated by DISCOM each month and any surplus is carried forward to the next, and the final account is settled yearly.

Surplus Biomass and Wastes

India has a target of 50 per cent cumulative electric power installed capacity from non-fossil fuel-based energy sources and achieving net zero by 2070. Surplus biomass and other wastes available in the rural areas may be utilised to produce electricity. Apart from renewable energy and reduction in waste management costs, it also provides several social and environmental benefits, e.g., reducing air, water and land pollution.

Electricity Demand

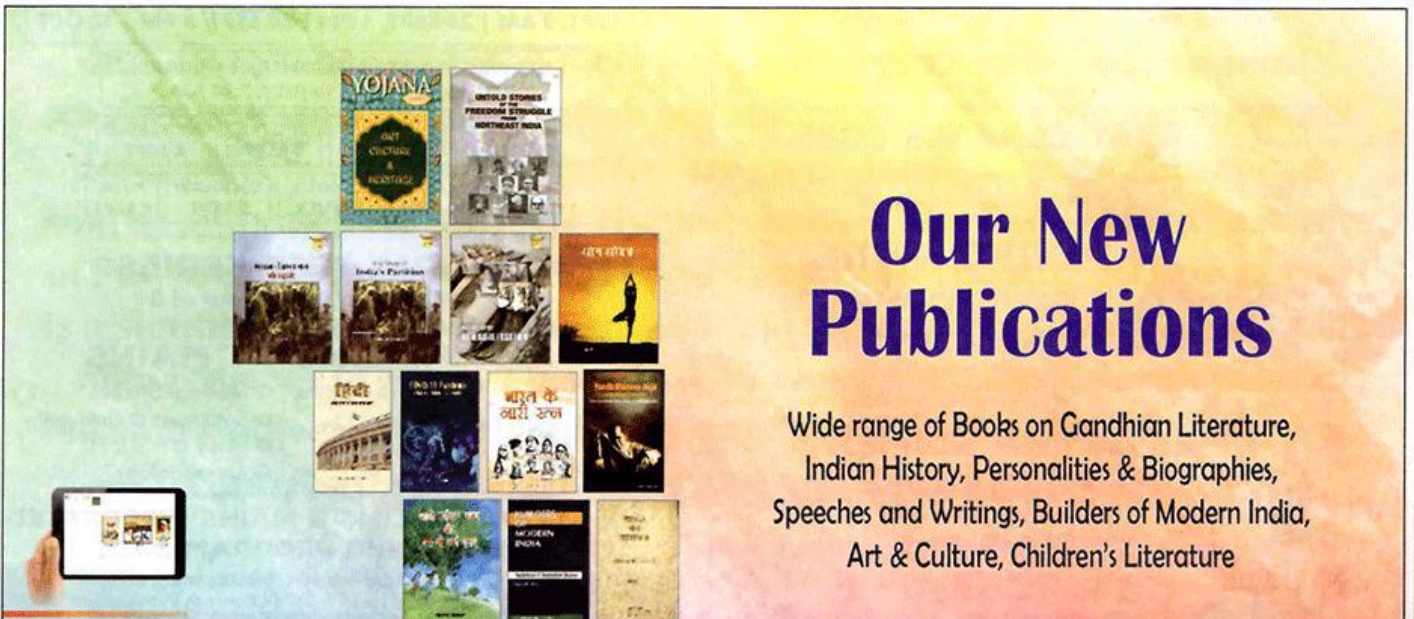
The electricity demand in rural areas is not only quantitatively small but also sparsely placed, necessitating the establishment of capital-intensive power distribution networks. Installing the solar PV systems and meeting the electricity requirements locally may lessen the distribution network demand. In this regard, microgrids with solar PV systems of smaller capacities may assist rural communities.

The integration of Smart Grid with widespread renewable energy sources provides a significant

opportunity to meet the power requirements for sanitation initiatives in rural areas, including water pumping systems, mechanical cleaning of toilets and public spaces, and waste management. Adopting renewable energy is essential for the future; its extensive use will help satisfy the energy demands of rural areas and support the country's goal of achieving carbon neutrality by 2070. □

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