



Case Studies in Low Carbon Urban Development in India

#3.

Tapping Renewable Energy Sources for Urban Management: A Case of Surat

Introduction

Surat is the second largest city of Gujarat and a rapidly growing metropolis with an estimated mid-year population of 6.9 million persons in 2021 (Surat Municipal Corporation), which is projected to double by 2035. It is an important industrial city of western India connected with the National Capital Delhi and the Financial Capital Mumbai through National Highway 8. It has a unique geographic location being sited along the river Tapi which forms an estuary with the Arabian Sea. Historically, Surat flourished as a trade centre due to its port located at a short distance from the city. The Magdalla Port in the vicinity of Pandesara and Udhana industrial areas of the city is operational for international trade. Surat is well known for manufacturing of textiles, chemicals, and is a world leader in cutting and polishing of diamonds.

In view of its rapid urbanisation and industrial development, Surat has been facing increased demand for basic services – water supply, sewage disposal and street lighting, all of which have accounted for over 90% of electricity bill of Surat Municipal Corporation (SMC). With an aim to reduce dependence on conventional energy sources for electricity, SMC embarked on a mission for achieving energy efficiency by establishing an Energy Efficiency Cell in October 2001 to monitor and manage its energy consumption. As part of this, the Energy Bill Monitoring System was established in June 2003 to monitor energy consumption by all departments of SMC and maintaining records of monthly energy bills. It regularly conducts energy audit SMC facilities such as sewage treatment plants, water treatment plants, water pumping stations, drainage pumping stations, hospitals, schools, and other premises.

Solar Power Plants

A 5 MW capacity Solar Power Plant was first established at Surat Science Centre. Subsequently 37 Solar Power Plants generating a total of 1390 KWp electricity have been set up by SMC on its properties across the city. The solar power generated is being used to operate various water treatment plants and drainage/sewage treatment systems. In fact, Surat is the first city in India where water distribution is being carried out through solar power. Out of the 6 MW solar power plants, 4MW is dedicated for Sarthana waterworks, Katargam waterworks, Rander waterworks, Varachha waterworks, Udhana water distribution station, Magob water distribution station and Simada water distribution station. About 53 lakhs units per annum of water supply is being carried out using solar power plants.

Wind Power Plant

SMC installed its first Wind Power Plant at Adodar of Porbandar district of Gujarat in November 2010. It has an installed capacity of 3 MW. Another 3 Wind Power Plants with a total of 30.3MW have been set up by SMC at various locations of Porbandar, Jamnagar and Kutch districts of Gujarat to run various



treatment plants of waterworks and drainage/sewage system. It has further proposed to install additional 2.1MW Wind Power Plants.

Biogas

With a vision to treat the organic waste generated from Agricultural Produce Market Committee (APMC) market in a decentralised manner, SMC established a biogas manufacturing plant in association with Akshar Bioscience Technology. SMC is the first Municipal Corporation in India which is maintaining its Anjana Sewerage Treatment Plant (STP) with bio-gas energy. It has been running total six STPs to treat the municipal liquid waste. These are run on the anaerobic treatment process to produce the biogas. In addition to the positive impact on the environment by reduction in the greenhouse gases emissions, there is estimated energy recovery of 4.75 MW electricity from these STPs. Thus, not only will this produce green energy, but it will also enable replacement of high-cost LPG with bio CNG, thereby reducing transportation cost and generate revenue through sale of biogas.

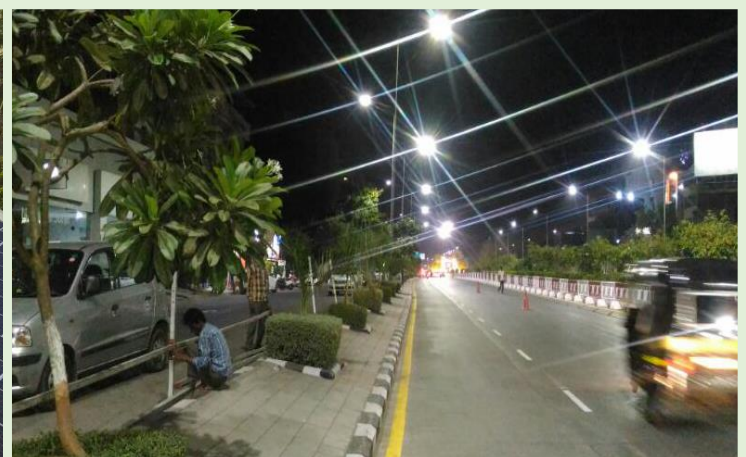
Street Lighting

SMC undertook a decision to replace all conventional light fittings by LED light fittings known as Smart light. A smart monitoring system was implemented to monitor the functioning of the smart streetlights to ensure optimum Lux level which would ensure saving of electrical energy. Of the total 1,20,725 conventional streetlights 90,000 were replaced by LED where EESL, a Government of India company undertook the replacements.

As part of the ongoing Smart City Mission, it is mandated that Surat would achieve 10% of its total electricity consumption through renewable energy resources in the locations earmarked for Area Based Development. Accordingly, it has proposed an enhancement in the existing capacity of its renewable energy resources by 1 MW solar roof top, 2.1 MW of wind energy, biogas plant for organic waste (in association with APMC) and LED street lighting with automatic operation of streetlights through auto sensors and Smart monitoring system.



Solar Panels at Katagram Water Works



LED Street Lighting on Major Roads



Low-Carbon Impact

The Solar Power Plants are transmitting electricity to SMC utilities like several waterworks and Anjana Sewage Treatment plant (capacity augmentation from 82.5MLD to 122MLD). This has not just reduced the overall energy demand received at Grid but has been financially beneficial to the SMC in reducing its total energy bills. 1 MW plant can generate 14 lakhs units per annum, resulting in savings of around Rs. 85 lakhs / annum in electricity bill and an expected reduction in CO₂ emissions of 6500 tonnes CO₂ / annum. Likewise, the 2.1 MW Wind Power Plant is expected to generate 54,00,000 KWh/annum, resulting in saving of around Rs. 3.2 crore annually in electricity bill and a reduction in carbon emission of 38,000 tonnes /annum.

LED streetlights have several benefits over conventional streetlights such as higher longevity. Along with smart monitoring system there would be more effective street lighting system with automatic operation of the streetlights thereby, reducing wastage and misuse of electricity. Replacement of conventional streetlights with LED lights would save 1.5 crore units / annum, resulting in financial saving of around Rs. 9 crore / annum in electricity bills to the SMC.

Table: Energy Savings from Renewable Energy Sources (From Apr-2003 to Feb-2021)

Energy Sources	Total Installed Capacity till Feb-2021 in Mega Watt (MW)	Gross Energy Saving/Benefits (Including GBI applicable)		Reduction in Greenhouse Gas Emissions (Tonnes)
		GWH	INR in Crores (Million USD)	
Net Wind Power Generation	32.40	479	278.00 (34.4)	358,100
Bio-Gas Power Generation	4.60	30	21.60 (2.64)	25,200
Solar Power Generation	6.00	79	43.40 (5.31)	451,800
Total Generation	43.00	588	343.00 (42.35)	835,100

Institutional Enablers

All the projects have been established by Surat Municipal Corporation and Surat Smart City Development Limited (SSCDL). Although it is important to note that SMC's futuristic vision regarding the city services has been one of the most important enablers in the process of renewable energy adoption. In October 2001, SMC established an "Energy Efficiency Cell" to manage and monitor energy use in municipal utilities. SMC realised that 92% of its electricity bill constitutes services like water supply, sewage disposal and street lighting. It was also worried by the fact that their electricity bill increased by 245% within 5 years from 1996 till 2001. As per the smart city guidelines, issued by the Government of India under the Smart Cities Mission, it is envisaged that at least 10% of the smart city's energy requirement should be met by solar power. SSSDL proposed all its energy initiatives in line with the following target and tried to propose projects which were able to target energy use in key sectors like water supply, sewage treatment and streetlighting.



Financial Enablers

All the four renewable energy projects had different funding mechanisms. The wind power project costed INR 19 Crores (USD 2.32 million) and all of it was paid by the state government of Gujarat through its Swarnim Jayanti Mukhya Mantri Shaheri Vikas Yojana (SJMMSVY). The solar power project has been envisaged by the smart city project and 15% of the total cost of INR 5.13 Crores (USD 628 thousand) was funded by the Ministry of New and Renewable Energy (MNRE) of the Government of India and the rest under SJMMSVY by the Government of Gujarat.

The smart street lighting project had an innovative financing mechanism where SMC engaged in a contract with the Government of India company Energy Efficiency Services Limited (EESL) following Energy Performance Contract Guaranteed Savings (EPCGS) model under which an Energy Service Company (ESCO) guarantees a certain saving on client's electricity bill by a technological intervention. In case of SMC, 90 thousand bulbs were replaced into LED lights by EESL at its own cost. SMC did not incur any capital cost. The saving incurred will be shared by both SMC and EESL in a pre-defined ratio.

In case of the biogas plant the funding of INR 6.6 Crores (USD 809 thousand) has come from the Surat's Agricultural Produce Market Committee (APMC) which is now selling the gas to Gujarat Gas company. This waste was initially collected by SMC which required a huge cost of almost INR 5 lakh per month (USD 6.1 thousand) to be incurred by the APMC. As per the most recent news reports APMC is currently earning about INR 15 lakh (USD 18 thousand) per month from the sale of gas by processing approximately 35 tonnes of fruit and vegetable waste.

In all the cases above the Government of Gujarat has been the largest financial enabler for all the renewable energy initiatives in Surat through its various schemes for urban development like SJMMSVY.



A Tank at the Bio-Gas Plant at APMC Surat (Images from under construction phase)



Learnings for Cities

Surat is marching ahead in adopting green and clean energy for meeting its energy demands in running urban utilities like water supply, sewage treatment, solid waste management and streetlighting. Surat's case provides two key lessons for Indian cities looking towards low-carbon energy solutions.

1. **Monitoring and Managing Energy Use Effectively:** Surat's case shows that SMC's initiatives of monitoring and managing energy use through setting an energy cell within the urban local body and a greater understanding of its financial implications in the future. All the cities could set up such cells to monitor electricity usage to prioritise areas of intervention but fully utilising the potential of existing state and central government programmes.
2. **Engage in Innovative Financing Mechanisms:** SMC's understanding of innovative financing mechanisms specifically in the case of street lighting project through EPCGS model is extraordinary. Through this model SMC was not only able to save the cost of electricity for street lighting but was also able to change about 90 thousand bulbs into electricity efficient LED lighting without spending a single rupee. Indian cities can benefit from such opportunities by engaging with the private sector ESCOs.

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