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Innovative aerial survey project maps rooftop solar energy potential for Bengaluru

by Sapna Gopal on 18 April 2018

- *Bengaluru recently conducted a series of aerial surveys to gauge the potential of rooftops for solar energy generation.*
- *The surveys were conducted using the light detection and ranging (LiDAR) technology, which has high accuracy and works quicker for data collection as compared with other tools of aerial mapping.*
- *Rooftop solar energy is expected to contribute 40 GW to India's goal of 100 GW solar power by 2021-22.*

A recent series of aerial surveys of Bengaluru, using the Light Detection and Ranging (LiDAR) technology, could possibly be a pioneer project to assess the potential for rooftop solar photovoltaic energy in urban centres in India. Using the LiDAR technology, which is otherwise used to assess biomass in forests, experts could quickly gauge the real potential for implementing solar energy in Bengaluru.

The aerial survey in Karnataka's capital city intends to identify the most suitable rooftops and eventually achieve the capacity to generate a targeted 1 GW of solar energy in Bengaluru alone by 2021-22.

With financial support pouring in for rooftop solar projects in India, there is an increased focus on tapping the abundant potential of rooftops as a renewable energy source in India. The World Bank has sanctioned a $625 million (Rs. 42.7 billion) loan to support India's solar rooftop program, while the Green Climate Fund (GCF), this February, approved a $100 million (Rs. 6.5 billion) loan, giving a further boost to the industry. GCF, a global fund under the United Nations Frame Convention on Climate Change (UNFCCC), was established to assist developing countries counter climate change, has approved a proposal from India's National Bank for Agriculture and Rural Development (NABARD) for a line of credit to develop commercial, industrial and residential rooftop solar projects.

Urban buildings have great potential for harnessing solar energy. Solar panels at the HUDA City Centre, Gurgaon. Photo by R. Srikanth / Wikimedia Commons.

According to Saptak Ghosh, a research scientist at the Bengaluru-based think tank Centre for Study of Science, Technology and Policy (CSTEP), which is executing the project, the data from the survey will be processed to digitise each rooftop in the city and account for shading aspects which hamper solar energy generation. The solar rooftop potential will be then calculated based on shadow-free area and the associated economics will be estimated by linking the Bangalore Electricity Supply Company Limited (BESCOM) consumer ID linked with a specific rooftop.

The tool will be accessible to all consumers, free of charge, in the coming months. This will help building owners, institutions and individuals to understand how much solar energy they could potentially harvest from their rooftops.

The process of gathering the aerial data, carried out by Geokno India Private Limited, began on February 19, 2018 and the last flight took off on March 6, 2018. Using LiDAR, high resolution 3D maps of the city have been developed, including building heights and neighbouring obstacles such as trees, other buildings, poles, billboards and others.

India's Goal of 40 GW through rooftop solar by 2021-22

India has a rooftop photovoltaic (RTPV) target of 40 GW by 2021-22. At the time of inception of the project, the RTPV capacity in the country was only 0.1 GW, Ghosh told Mongabay-India about the conceptualisation of the project. "The low RTPV capacity meant that something wasn't working in spite of attractive policies, especially the net-metering regime in Karnataka

which allowed RTPV consumers to export surplus power to the grid at Rs 9.56 per kilowatt hour (kWh)."

A deeper dive into the problem revealed that most consumers did not know much about RTPV and its technical, financial and regulatory aspects. Moreover, systems that had been installed were not generating enough power because of bad design that did not account for the impact of shadows cast by neighbouring obstacles. Also, distribution companies were reluctant to promote RTPV fearing that they would lose high paying consumers and would not have the finances to pay the higher net-metering rates to other consumer categories.

However, the current project has taken into consideration these issues and plans to digitise rooftops, calculate the shadow-free area and link to customer identities for estimating economics. The national Ministry of New and Renewable Energy (MNRE), the Karnataka Renewable Energy Development Limited (KREDL), CSTEP and BESCOM have recognised the need for rooftop photovoltaic to be a champion of decentralised clean energy generation.

Why LiDAR?

Aerial imagery is the best way to construct 3D maps of urban centres with discrete digitised rooftops, elaborated Ghosh. The choice of LiDAR technology, he said, was because it provided the most accurate images (resolution of nearly 5-10 cm) by capturing even the smallest of objects, which can cast shadows on RTPV panels. CSTEP also proposes to develop a web-based tool for consumers to accurately assess the RTPV potential considering shadows and understand the business case better.

Even as there are other options to digitise rooftops and create 3D maps of urban centres, such as high-resolution satellite imagery (ISRO, Google, etc.) and aerial photogrammetry, these datasets are difficult to obtain for civil society due to security reasons. Also, they take more time compared to LiDAR.

Aerial LiDAR, according to Ghosh, takes less than 15 days to complete the data collection exercise for 1,200 square km and another three months to process the raw data and provide 3D maps with discrete digitized rooftops.

"Although the costs for this pilot project are quite high, scaling it up to most urban centres and towns will drive down costs and make it more feasible if MNRE wants to take a more structured and scientific approach to planning and commissioning of RTPV to reach the 40 GW target by 2021-22," Ghosh said.

By capturing the entirety of urban Bengaluru along with the industrial pockets, it will be possible to identify the most suitable rooftops in the city that can lead to 1 GW capacity addition in the next three to four years.

CSTEP will use the tool to select these suitable rooftops and then run a multi-criteria analysis (considering RTPV potential, business case for consumers, financial outlay for BESCOM and impact on its distribution network) to rank the rooftops. It is expected that BESCOM will then call for large-scale tenders for these rooftops which will drive down the capital cost of RTPV

and thereby the net metering rates. A robust roadmap for 1 GW RTPV in the BESCOM area will help planners, policy makers and consumers to make informed decisions regarding RTPV in the near future.

The Bengaluru skyline. Most of the buildings can harness solar energy. Photo by Prateek Karandikar / Wikimedia Commons.

A step in the right direction

The project has been welcomed by industry experts and they feel it will help steer the solar sector further ahead.

P. Ravi Kumar, additional chief secretary (Energy), Government of Karnataka, was quoted as saying that the project is an innovative way to map solar rooftop potential in densely populated cities. The results of this exercise will lay the foundation for replicating such efforts in other cities in Karnataka and the rest of the country. The time taken to finish this exercise using other means or technology would be far greater considering the levels of accuracy expected from the usage of aerial LiDAR.

"The raw data collected can also be processed to help in other city planning applications such as tree cover densities, surface water drainage systems, road networks, etc. The government of Karnataka will explore these options to maximise the utility of this project," he added.

Damian Miller, CEO of Orb Energy, said that this is a great initiative and has the power to trigger a solar revolution in India – one in which people become increasingly aware of just how much money they can save with a rooftop solar system, as well as how much of a positive

impact they can have on the environment. All of this helps to create a bigger market for solar, and accelerate adoption.

"One of the challenges for companies like Orb to reach the right consumers is data on shadow-free roof space, suitability of rooftops for solar and this digitisation drive will empower both consumers and service providers alike by addressing these issues", Miller told Mongabay-India.

More than 50,000 solar technicians are already working in the country, and this will increase in the coming years. Photo from Renewable Energy of Kolkata.

When it comes to policy development and a broad assessment of this potential, this is the best possible way to go about, a senior MNRE official said. However, all this is macro analysis and it always needs validation through ground work. When rooftop potential is done through an aerial survey, then the roofs are looked at. Yet, beyond the roofs and the rooftop, there are many other things which need to be considered as well.

This is a first step to look at the potential of rooftop and Bengaluru has done it, made a beginning. Certainly, it can be used as a reference point, but it needs to be validated and vindicated by a ground survey when it goes for installation, the official explained.