The number of telecom towers in India has quadrupled from 100,000 in 2006 to nearly 420,000 in 2016. The growth in the number of towers has, in turn, fuelled the growth of telecom services and facilitated the provision of quality services to more than one billion subscribers. However, given the poor grid conditions in most parts of the country, ensuring uninterrupted grid power supply to these towers without any backup sources is next to impossible as most states continue to face long and sporadic power cuts. To address these issues and ensure power supply for towers, energy storage solutions are gaining traction in the industry.

According to the India Energy Storage Overview Report by the India Energy Storage Alliance, out of a total estimated market potential of 16,445 MW for energy storage till the year 2020, telecom towers account for 460 MW. This is equivalent to 3 per cent of the total estimated market potential for energy storage in the country.

Energy storage solutions can be used both for towers that face long-duration power cuts as well as those that have grid power available for most of the day. While in the former case, these solutions can reduce the use of diesel generators (DGs) for long hours, in the latter, they present a possible option for using advanced energy storage systems for completely eliminating DG usage. To this end, tower companies and operators have experimented with a host of solutions and strategies comprising many energy storage techniques and products.

**Energy storage solutions in India**

In the Indian telecom tower industry, batteries have been used as a backup source to ensure uninterrupted power supply at the tower sites. Traditionally, heavier and bigger valve-regulated lead acid (VRLA) batteries were used to provide backup to base transceiver stations (BTSs), but they have limitations like short discharge times, long charging times, a short life, cell pilferage issues and the need for air conditioning at high temperatures. Moreover, most of the older models need manual intervention for maintenance. Over the past few years, battery manufacturers have paid heed to the aforementioned shortcomings and come up with new battery models that charge fast, require less space per kW, and have a higher round-trip efficiency. As a result, tower operators are now integrating storage systems with intelligent energy systems, especially at remote sites, to overcome the dependence on the unreliable grid and DG sets. All the major tower companies have been running trials and experiments on various technologies, including rechargeable batteries like lithium-ion (li-ion) and lead acid, flow batteries, thermal energy storage and protection circuit module batteries to meet the growing demand for air conditioning during peak hours, fuel cells and compressed air storage. Li-ion batteries have thus emerged as the ideal technology solution for most tower companies.

As far as the specific tower companies in India are concerned, companies having medium and good grid sites but higher loads like Indus Towers extensively use VRLA battery hybrids while those having poor grid and medium grid sites but low to medium loads like Bharti Infratel have adopted technologies such as solar, li-ion and VRLA hybrid. Moreover, Indus Towers has deployed a large number of advanced VRLA+ batteries and li-ion batteries, which has resulted in a significant reduction in diesel consumption. VRLA, li-ion batteries and hydrogen fuel cells are some of the other solutions used by tower companies in the country. In the towers deployed in urban areas, li-ion technology is catching on as the most suitable technology for small and micro cells due to its advantages of space, weight, efficiency and charge discharge times.

**A key driver for renewable energy**

Tower companies in India have also been adopting renewable energy like solar, wind and biofuel for their towers, following the Telecom Regulatory Authority of India's (TRAI) suggestion to telecom operators to aim at carbon emission reduction targets of 12 per cent by 2016-17 and 17 per cent by 2018-19. However, energy from renewable sources are not available at all times. Considering this, integration of energy storage solutions with telecom towers operated by renewable energy is a better proposition. Such integration can provide significant savings in fuel costs. Different energy storage technologies like advanced lead acid and li-ion can be used for this purpose. This increases the reliability of energy supply to the tower. Therefore, deployment of suitable energy storage solutions is essential to use renewable energy to power telecom towers. Moreover, TRAI has proposed that 75 per cent of towers in rural areas and 33 per cent in urban areas should be powered by hybrid power consisting of renewable energy technologies (RETs) and grid power by 2020. In order to achieve this target and ensure power supply to rural as well as urban towers, suitable energy storage technologies would need to be deployed.

**Global scenario**

According to the China Energy Storage Alliance, the energy storage solutions deployed in China consist of 74 per cent li-ion batteries, 17 per cent lead acid batteries and 9 per cent flow batteries. The Global Energy Storage Forecast by Bloomberg New Energy Finance for the years 2016 to 2024 predicts that the Asia-Pacific region will account for 53 per cent of the world's total capacity in megawatts. Further, as per the forecast, three Asian countries - Japan, India and China - will be among the world's top five markets for energy storage. Australia and South Korea will reportedly lag behind China and India in terms of the growth in energy storage.

## Issues and challenges

In order to tap the huge potential for energy storage in the Indian telecom tower market, there are several issues that remain to be resolved. Each telecom tower site is different in terms of configuration, number of BTSs, load requirement, grid power availability and prevailing weather conditions. Therefore, companies need to try different permutations and combinations before arriving at the best storage solution for a particular site. Further, the available storage technologies, which provide high efficiency, require a high capex and hence the return on investment becomes a key issue. Storage solutions can be a win-win strategy only if the costs and benefits are shared between telecom operators and their tower companies. Another challenge is that li-ion batteries have a high replacement cost. Unless they are priced in the same range as lead acid batteries, it will be difficult to adopt new solutions, particularly given that tower operators are yet to establish the performance of new systems in the long run.

Li-ion systems have three aspects comprising cells and their bundling, sensors for each cell, and the battery management system. Each of these elements needs regular maintenance but none of them is standardised. Hence, every supplier has a different design, which makes the support system questionable. Moreover, there are issues related to the suitability and compatibility of new technologies with the existing tower site infrastructures, as well as limited field support.

## The way forward

As the deployment of micro base stations increases, li-ion batteries will serve as the best power solution as their light weight would allow them to be easily lifted to the micro base station's vertical deployment. Doing away with DGs from all tower sites will take many years; meanwhile, the need of the hour is to optimise DG usage by deploying these systems in hybrid form with other technologies. In future, a hybrid technology that addresses the cost-effectiveness and challenges of all of these technologies needs to be developed as a viable option for the telecom tower industry. Energy storage solutions will play a key role, especially with industry players showing a commitment to the deployment of green energy technologies.

By 2020, telecom companies will have to convert 75 per cent of rural towers and 33 per cent of urban towers to run on hybrid power. The Ministry of New and Renewable Energy's recent

mandate to immediately convert a minimum of 50,000 towers to solar PV technology is another step towards ensuring compliance with the clean energy norms. The key to success lies with the implementation of energy storage solutions to save opex, among other things.

In addition, the telecom industry is at the forefront of implementing the government's Digital India and the Smart Cities projects. Achieving the goals underlying these programmes would require the setting up of telecom infrastructure including towers, micro sites and fiberised backhaul networks for communications. Along with setting up these towers, innovative energy storage solutions would need to be deployed to ensure power backup for towers in smart cities for smooth communication.

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