Strengthened Grids: A Case of Electric Vehicles in Bengaluru

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India pledged to reach net zero emissions by 2070 at the 26th Conference of the Parties (COP26) held at Glasgow recently. The two-week conference saw myriad announcements for an era of net zero emissions. One such announcement revolved around the transport sector, whose surge in greenhouse gas (GHG) emissions is a growing concern globally, given its enormous environmental impact.

According to the Intergovernmental Panel on Climate Change (IPCC), this sector is responsible for approximately one-fourth of global green house gas emissions.

India, the world's third-largest GHGs emitter, has its transport sector contributing 10% of total national GHG emissions, with road transportation contributing about 87% of the sector's total emissions. The adoption of electric vehicles (EVs) is one way to bring down emissions. While the Indian Government has issued various policy measures, successful EV uptake lies in policy implementation at the State level. The Indian EV market varies significantly by State with factors related to demographics, income levels, policy and regulatory landscapes, and urbanisation.

Karnataka raced ahead of all the Indian states in the EV game by becoming the first to introduce the Electric Vehicle and Energy Storage Policy in 2017 to boost EV sales and set up charging infrastructure. The State EV policy aims to convert 50% of its public transport fleet into EVs by 2030. The Government has also given a clear mandate of making Bengaluru the EV capital of India.

Subsequently, Bangalore Electricity Supply Company Limited (BESCOM), the nodal agency to promote EV growth, has set up EV charging stations at 74 locations and has installed 136 EV chargers as of September 2021. However, higher EV penetration may pose destabilisation threats to the grid with its spatial and temporally uncertain nature, by causing significant peaks when coinciding with residential peak demand.

EVs may also impact power quality in the electricity distribution network due to significant harmonics and voltage imbalances. These may lead to additional stress on the distribution transformers (DTs) due to overloading and harmonic injection.

As per an India Smart Grid Forum study for twelve 11kV feeders in Bengaluru, significant upgradation on the DTs (with 100 kVA or above capacity) and cables are required for smooth integration of the EV load, along with filter installation to mitigate the harmonics issues. With BESCOM already facing frequent power cuts, additional load in the form of EVs may worsen the

situation. A flexible and robust distribution infrastructure is, therefore, an imminent step before any planned large-scale EV roll-out.

This should also be complemented by introducing a time-of-day tariff for Bengaluru EV owners by incentivising with lower charging tariff during off-peak and disincentivising with higher charging tariffs during peak demand. Thus, along with a strong charging infrastructure comprising accessibility, profitability, and time-of-use-based tariff, BESCOM will have to make significant investments to upgrade its traditional grid for a smooth transition to e-mobility.

Considering that Bengaluru is also a preferred destination for the installation of solar rooftop photovoltaic (RTPV), EV integration can be motivated with RTPV uptake and vice-versa. BESCOM can encourage solar-based EV charging as decreasing RTPV costs make it an effective alternative to grid electricity. This could be a win-win situation for both distribution companies and consumers.

Leveraging its potential of RTPV uptake along with strong distribution infrastructure investments could help Karnataka achieve its 2030 EV goals. It can be a pioneer in integrating EV with sustainable energy sources and developing a replicable pan-India business model.

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