Secure and reliable energy access through renewable energy in India

Assessing the co-benefits of decarbonizing the power sector

Synopsis

The mini-grid sector has not witnessed an organic expansion pursuant to the kind of demand that still exists in rural India for adequate and reliable electricity. The absence of a replicable and sustainable model is generally attributed to the market risks mini-grid developers face from the fast expanding grid infrastructure, especially post-Saubhagya, which may render them irrelevant or redundant, and the government's tariff subsidies that directly contest mini-grid tariffs and undercut profit margins. To remain relevant and to meaningfully deliver co-benefits to poorly electrified communities as well as contribute to positive environmental impacts, mini-grids need to scale up and provide a higher level of service that goes beyond basic lighting and mobile charging services. Taking a case-study approach, this study examined the current nature of co-benefits that consumers of a typical mini-grid derive in comparison to grid consumers, in order to establish the need for scaled up mini-grid capacities and more inclusive village level services. The study was conducted in two villages in Hardoi district of Uttar Pradesh, where mini grids were operational and connected households, enterprises and anchor loads. A neighbouring grid connected village was also surveyed to make a comparison in terms of the level of services provided by the electricity systems to the consumers. On the supply-side, the study sought to examine the business case for scaling-up minigrids in India, through a cost-of-supply and tariff analysis of mini-grids in relation to the grid and to understand at what scale mini-grids became cost competitive.

The study finds that mini-grid consumers pay significantly higher per unit charges, around Rs. 40.75/kWh for very basic electricity services in comparison to what grid consumers pay, which is around Rs. 3.6/kWh. This narrows the scope for increasing service levels and

capacities, as low income levels and affordability factors kick-in. As a result, mini-grid consumers remain at the lowest access level (Tier 1) and in the absence of grid connectivity or poor connectivity, do not have any alternative but to carry on using limited lighting services. Correspondingly, our LCOE (Levelised Cost Of Electricity) analysis shows that theoretically it is possible to make mini-grids cost competitive and viable while increasing the capacity of mini-grids to medium scale (500kW) and above, indicating economies of scale. While this can translate to lower tariffs for mini-grid consumers, due to a lack of cross-subsidy mechanisms in the mini-grid sector, the gap between the tariff charged to mini-grid consumers in comparison to what grid consumers pay will still remain. Further, instead of viewing mini-grids as an alternative to grid supply, by scaling up mini-grids and the corresponding services they can then offer, mini-grids have the potential to become natural extensions of the centralised grid network – which is a significant co-benefit as well, as it will reduce the pressure on discoms, who are grappling with demand management and network maintenance issues, and will in turn bring in more reliability in supply.

A key limitation of the study has been the limited data availability on actual mini-grid input costs, which forms the basis of our cost-tariff analysis, as private developers were generally unwilling to reveal financial details which are proprietary to their business and business model. This gap was addressed though multiple consultations with sector experts and developers, review of regulatory benchmarks and through real time market rates of system components.

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