

Executive Summary

The Government of India has ambitious targets of achieving 175 GW of renewable energy by 2022. Karnataka had a renewable capacity share of around 35% out of 20 GW of the installed generation capacity mix, as of March 2017. This is further expected to increase as the state (KREDL) aims to have 6.86 GW of solar and 4.9 GW of wind generation capacity by FY19.

Increasing our renewable generation capacity is necessary, considering various policy targets driven India's Nationally Determined Contributions. However, the intermittent nature of solar and wind raises fundamental technical challenges for the power system. Thus, careful planning of the transmission network is critical for efficiently enabling high level of renewable energy penetration.

This study looks into the impact of planned renewable energy addition, up to FY 2018-19, on the Karnataka grid. Detailed power flow analyses were conducted for each of the financial years 2017-18 and 2018-19. The analyses were conducted for six different scenarios, for these two years, in order to capture the variation in solar and wind generation, and the state's total demand. Solar generation plants are predominantly concentrated in Tumakuru, Chitradurga, Bidar, Ballari, and Raichur districts, while wind generation plants are concentrated in Vijayapura, Gadag, Chitradurga, Davanagere and Belagavi.

The study also looked into the effect that taluk-level limits on RE capacity had on the grid. Such limits for solar (200 MW) are already in place, while they are still being planned for wind (100 MW) and solar-wind hybrids (100 MW). For the purposes of this study, a total of 15 taluks were selected, five each for solar, wind and solar-wind hybrid capacity, to test the effect of these limits.

Key takeaways from this study include:

- The additions projected for FY 2018-19 are likely to overload 18 transmission lines and 3 substations. In order to avoid this, network strengthening is recommended. Setting up of a new transmission line from Bidadi to Vrushabhavati substation, strengthening of NRS – Peenya corridor and upgradation of Dambal substation are some measures that can be taken towards network augmentation.
- It was found that in two out of five selected taluks, increasing solar capacity to 200 MW resulted in network overloading. In contrast, all the selected taluks were able to successfully integrate 100 MW of wind. Increasing solar-wind hybrid plant capacity to

100 MW per taluk also did not cause network overloading in any of the chosen taluks. A detailed analysis is required to arrive at technically feasible limits on renewable capacity addition at the taluk-level.

- An illustrative investment analysis was conducted based on a comprehensive assessment of the different scenario results. The study suggests upgradation of a total of 21 network elements at a cost of around INR 645 crore.
- A Geographical Information System (GIS) enabled, web-based energy planning platform has been developed to visualise power flow scenarios. The visualisation platform allows users to better understand the impact of high renewable energy capacity deployment in Karnataka.
- A thorough network analysis in Bangalore Metropolitan Area Network (BMAN) area should be undertaken in order to plan network strengthening for future load growth.