

Planning Renewable Grid Integration in India

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Abstract: Deployable potential of renewable energy sources in India is massive (~1000 GW) even if 10% of which is deployed properly will fulfill demand of the largest load centers of India even by 2035. Grid Integration of such systems is not easy due to fluctuations in weather conditions but can be estimated on basis of past trends. Planning of transmission lines properly with good regulations will really be a great help to ever increasing demand of the country.

Keywords: India, Power Grid, Planning, Renewable Energy, Solar Energy, Transmission Network, Wind Energy.

I. INTRODUCTION

The paper contains the results of an original research inspired by the events and observations made in the real world. The major problems faced by renewable developers is not only the renewable energy regulatory framework or finances but also availability of transmission infrastructure for their evacuation. The problem of regulatory framework and financial viability are being looked into but the green energy evacuation corridors projects are somewhat sluggish. The paper deals with pro-active planning of renewable power evacuation based on potential renewable sites and potent load centers in the country.

II. RENEWABLE POWER POTENTIAL OF INDIA

India is a tropical country and has great potential to generate electricity from hydro, solar and wind energy. But these resources are scattered throughout the geographies in India. If the north and north-east are rich in hydro energy potential, then the west is rich in wind and solar energy potential and the south as well. India has a huge wind potential of 300 GW at about 100 m above ground level distributed among southern and western states and about 750 GW of solar potential in the western and southern India. India also has a vast network of perineal rivers which make it rich in hydro potential as well (~150 GW). The following figure gives an idea about the power potential of the country.

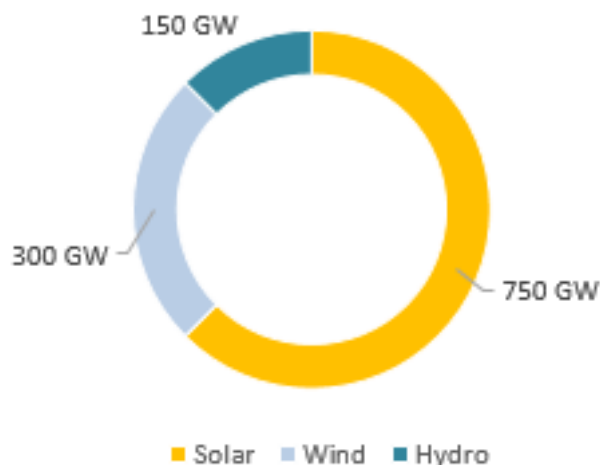


Fig. 1: Renewable Energy Potential of India

III. HEAVY LOAD CENTRES IN INDIA

India has only a few heavy load centres having energy requirements of more than 60000 MUs per annum. These load centres are not located very far away from the potent renewable power sites. This makes the work and planning easier. Major states with heavy load centres are Uttar Pradesh, Maharashtra, Tamil Nadu, Gujarat, Rajasthan and Madhya Pradesh.

IV. VARIATION IN SPEEDS OF WIND AND SOLAR HOUR AVAILABILITY

The following graph shows that fortunately when the speeds of wind go down they can almost be compensated by solar power and when the later dips it can be substituted by the former. Any excess power can be deployed for the sake of pumped storage hydro plants. The hydro plants in the south can serve for ramp up, whenever needed. The gas plants being revived at the Krishna Godavari basin can be deployed to adjust for the unpredicted variations of the renewable power plants in the west.

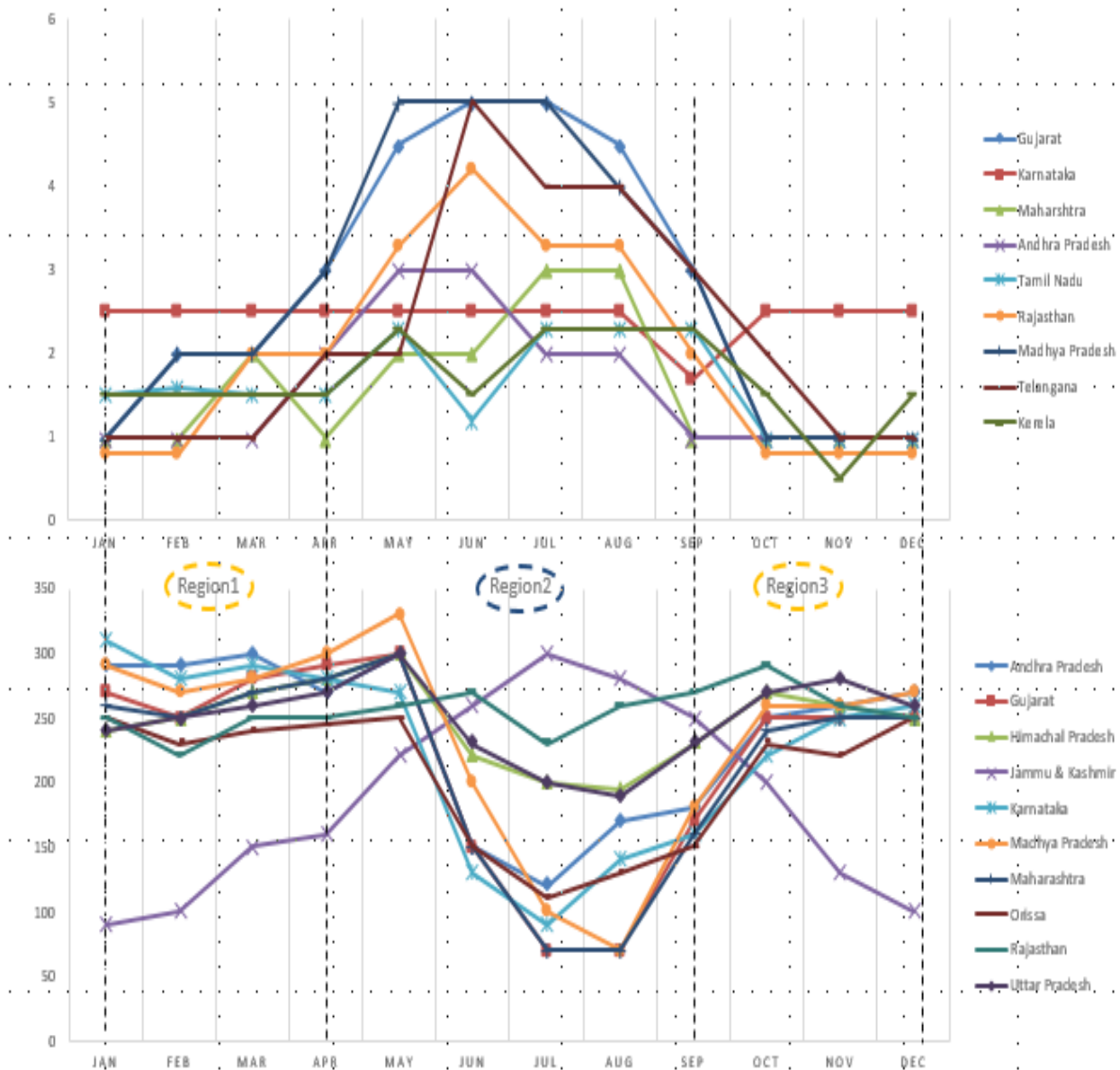


Fig. 2: Average annual variations in wind speed (in m/s in the upper half) and solar hours (in h in the lower half).

V. ANALYSIS OF AVAILABLE POTENTIAL AND ITS ABILITY TO MEET THE ENERGY REQUIREMENTS

The load in the country increases with a CAGR of 3.3%. Majority of this load lies in a few states only. Even the 10% of deployable renewable potential is enough to fulfil energy requirements for major part of the country. The results have shown excess power after the requirements are fulfilled which can cover up for transmission losses. The data is available in the main report. The following figure represents the same.

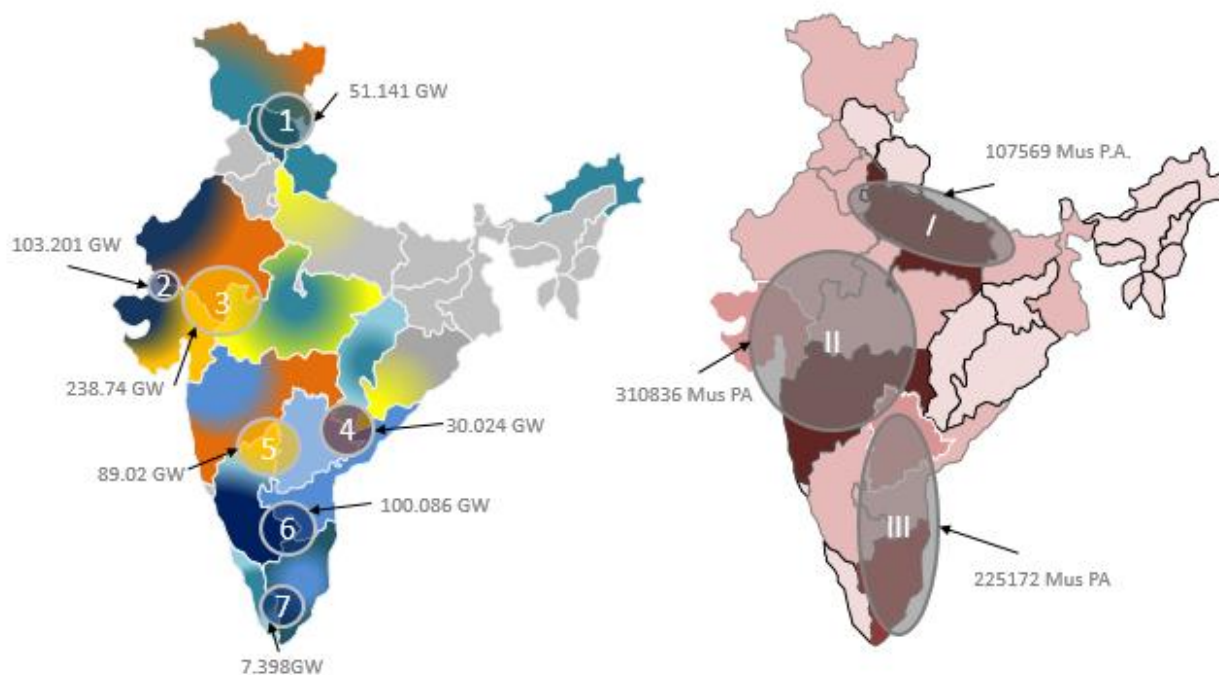


Fig. 3: Renewable Potential (on the left) and Load Centres with heavy energy requirements (on the right)

VI. CONCLUSION

Indian government has emphasized a lot on development of renewable power plants in concordance with COP21, environmental summit. The renewable sources face not just the problems of regulatory framework but also of power evacuation. A transmission network is required to be planned accordingly to integrate enough renewables into the grid so that we can get rid of pollution caused by emissions from conventional plants. This research can explain the probable way out for building a transmission infrastructure before the development of major renewable projects so that their evacuation can be possible in no time after development and doesn't affect the project viability.

REFERENCES

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