Net Load Ramping Requirements of Southern Region by 2022

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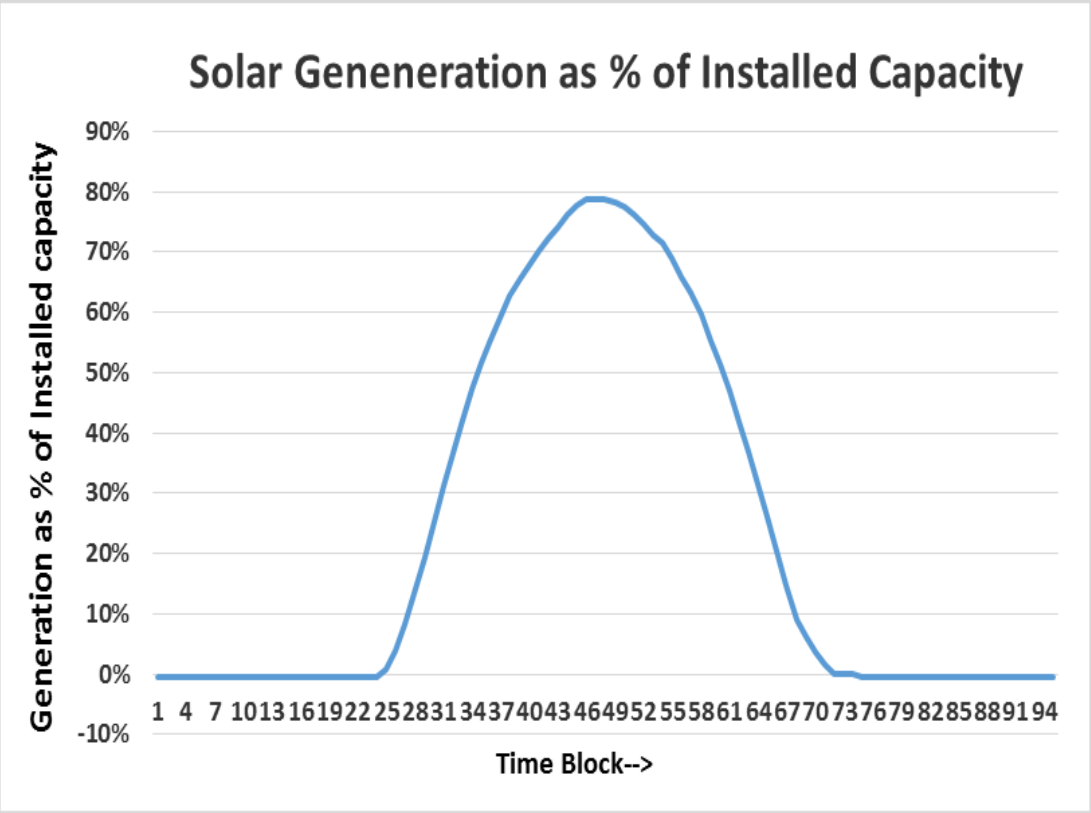
Contents:

I. Introduction

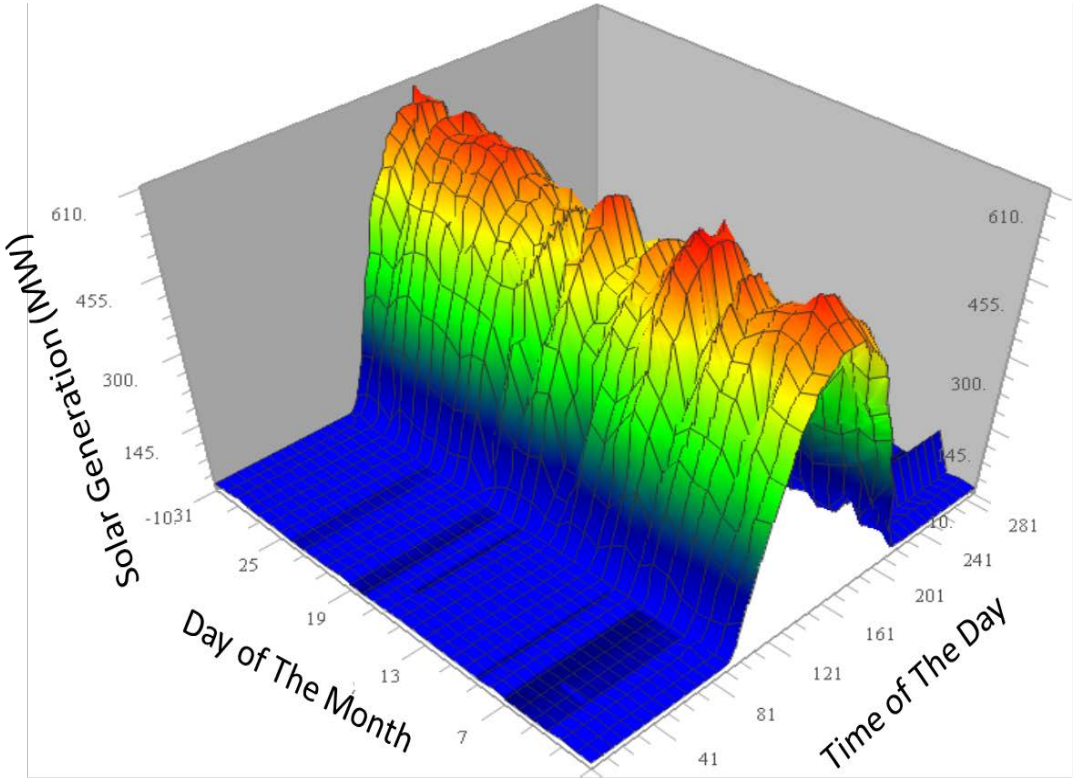
- 175 GW of Renewable energy targets & Infirm and intermittent nature of the renewables.
- SR present capacity is 22 GW expected to reach 55GW by 2022 (Wind+Solar)
- Maintaining Load-Generation balance at every instant is essential requirement for stable operation of grid.
- **Net Load:** Difference between actual connected load and generation from Wind & Solar.
- Based on the derived net load, system operator has to flex the generation of conventional power stations in order to achieve load-generation balance, on real time basis.
- Estimating Net load is important for managing the high penetration of renewables.
- Expected net load of SR for the year 2022 presented here

***All data presented is as per SCADA/SEM meter data available at SRLDC.*

II. SOLAR GENERATION CHARACTERISTICS



Solar generation during a day

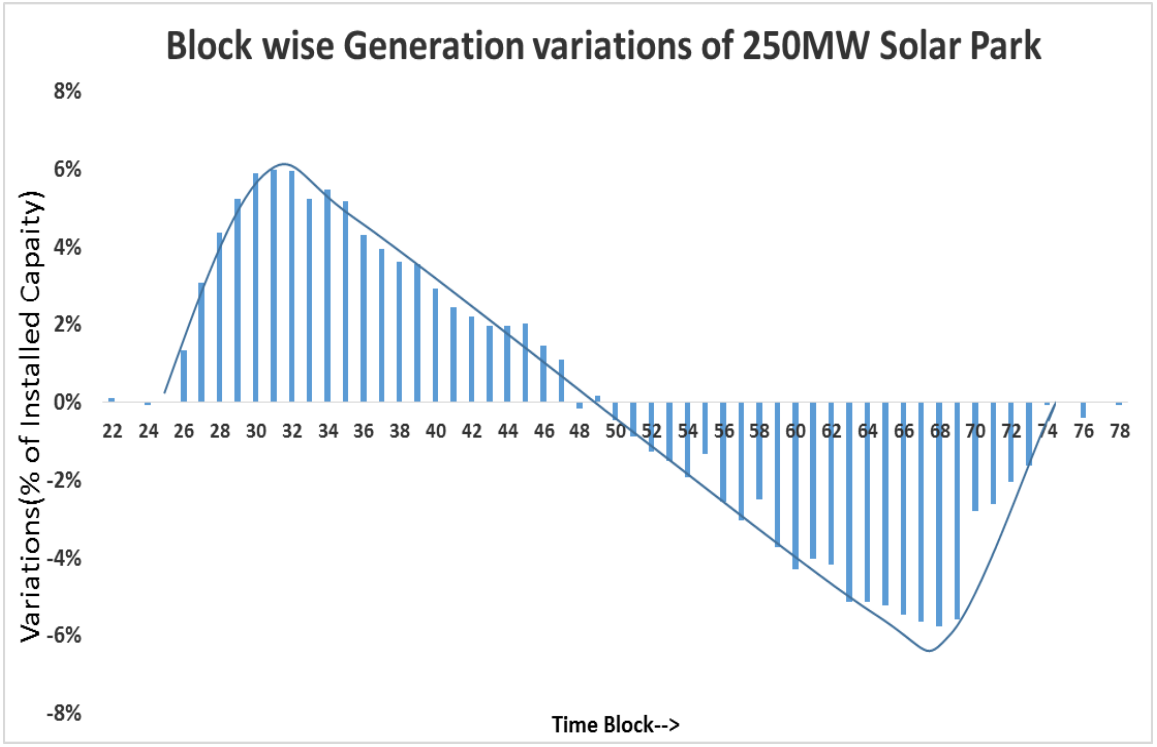


Solar generation for one month

II. SOLAR GENERATION CHARACTERISTICS

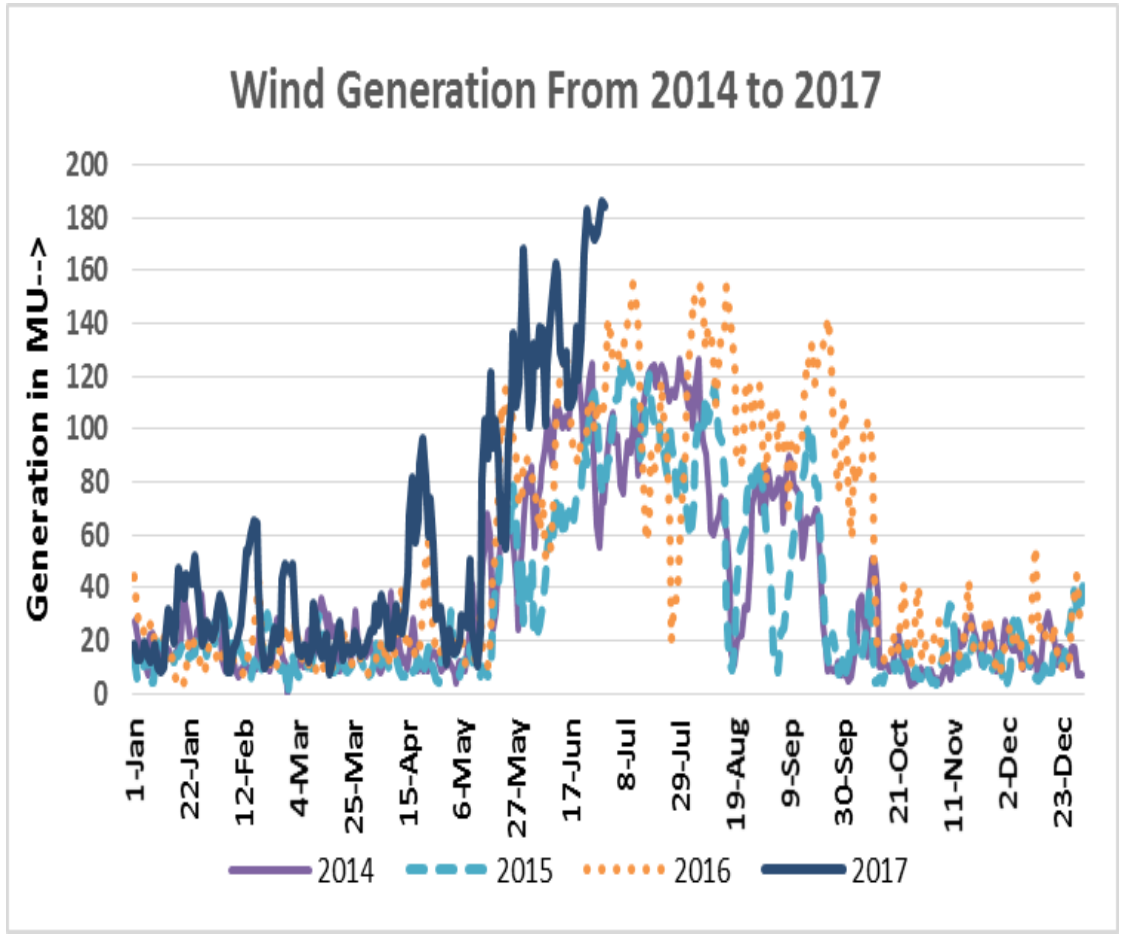
Time Blocks	Time Period	Average Ramp Rate as % of Installed Capacity	Remarks
26-27	06:15 - 06:45	2.20%	Slow Ramp
28-38	06:46 - 09:30	5.00%	Steep Ramp
39-45	09:31 - 11:15	2.40%	Slow Ramp
46-53	11:16 -13:15	(+/-) 1 to 1.5 %	Minimum Ramps
54-58	13:16 - 14:30	-2.20%	Slow Ramp
59-69	14:31 -17:15	-5.00%	Steep Ramp
70-73	17:16 - 18:15	-2.50%	Slow Ramp

Summary of solar generation ramping during the day

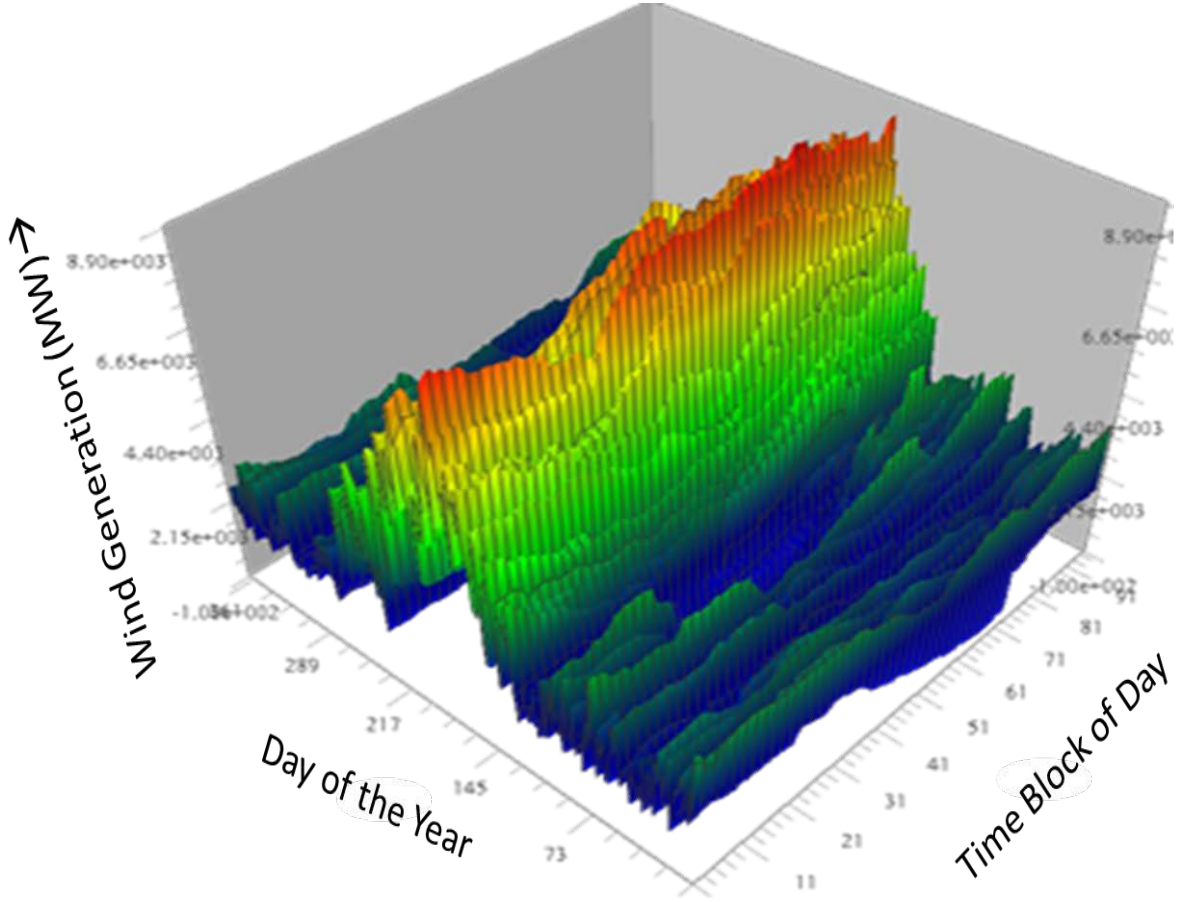


Block wise solar generation ramps during the day

III.WIND POWER VARIATIONS IN SOUTHERN REGION

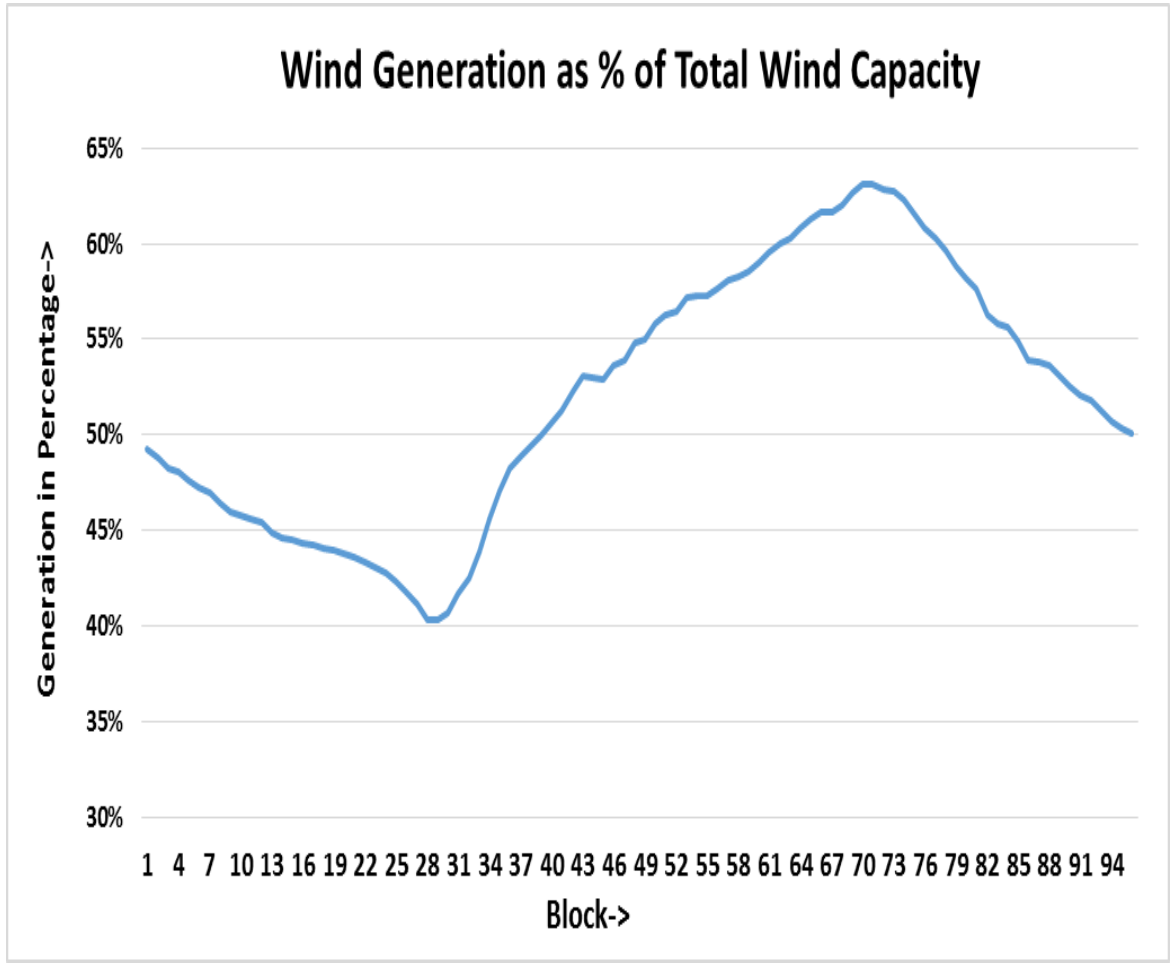


Wind generation in MU for 3 years

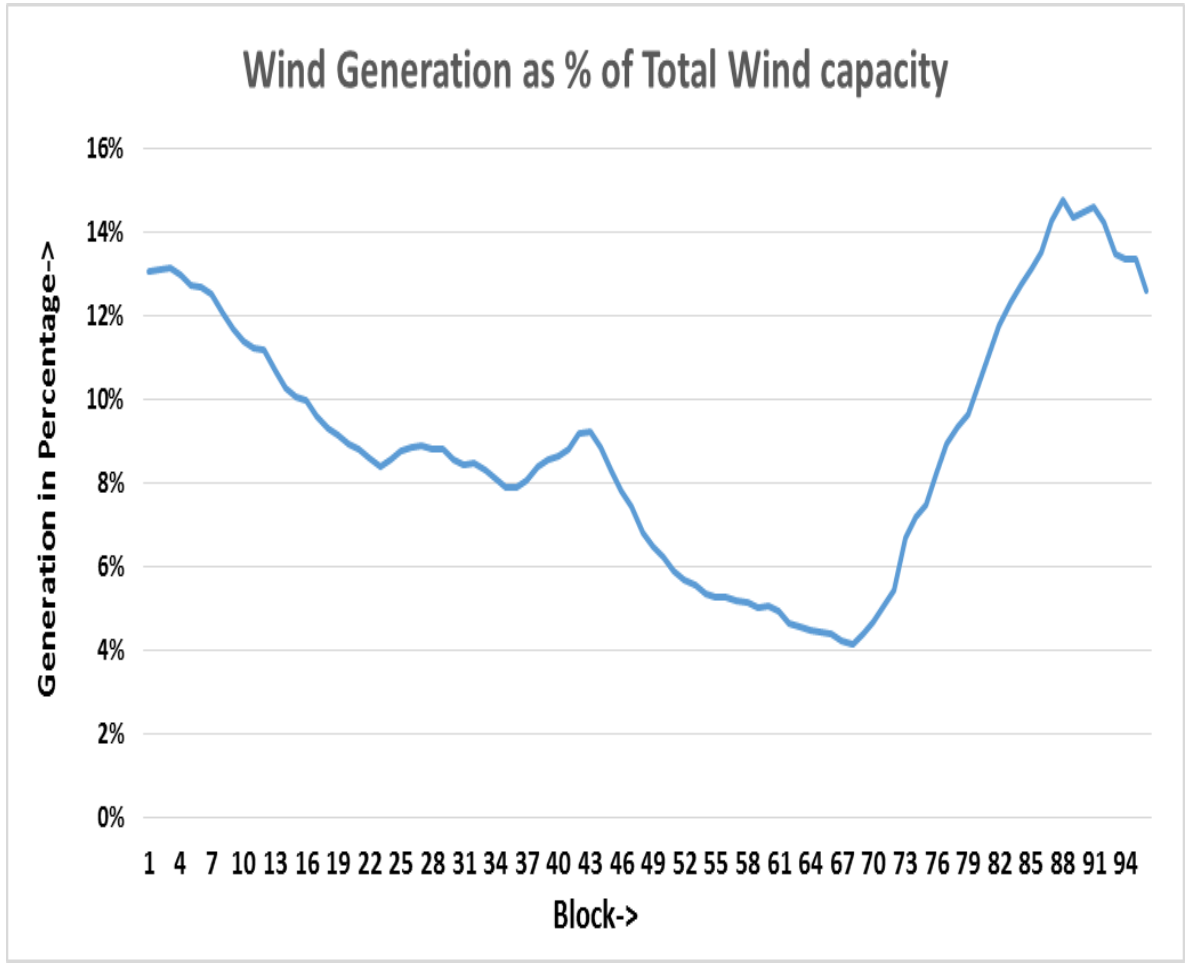


Wind generation in MW for 1 year Day wise

III.WIND POWER VARIATIONS IN SOUTHERN REGION



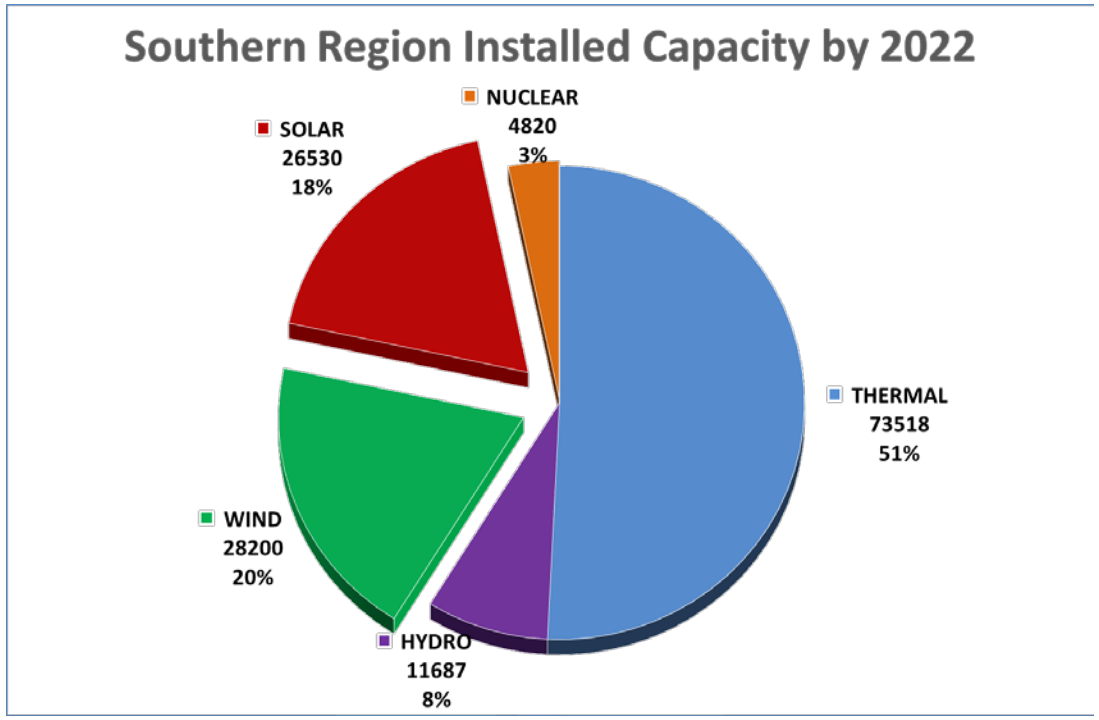
General curve during high wind season:



General curve during lean wind season:

IV. EXPECTED NET LOAD BY 2022

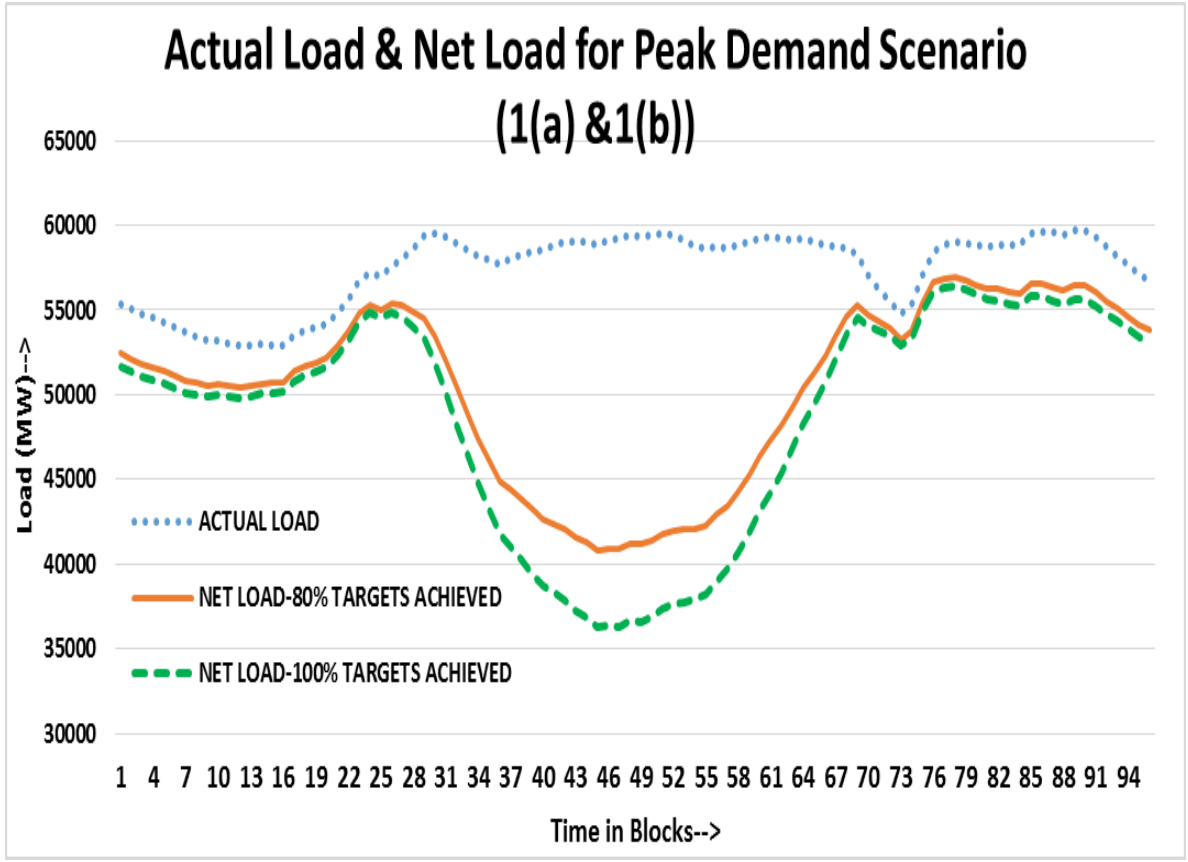
- Wind & Solar forms around 38% of total generating capacity of SR in 2022
- Net load is defined as the difference between actual connected load and generation from Wind & Solar.
- Net Load gives an idea to system operator about the amount of flexibility required from conventional generation to accommodate renewables



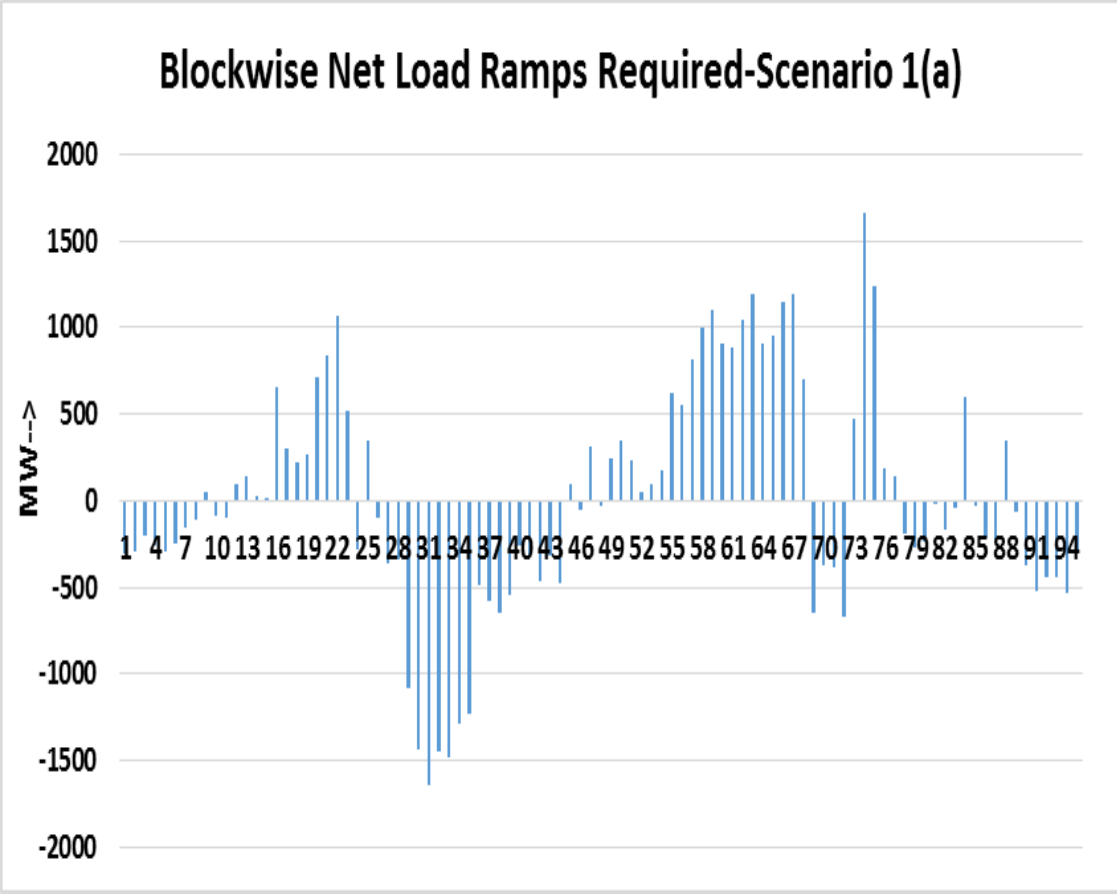
IV. EXPECTED NET LOAD IN PEAK DEMAND SEASON

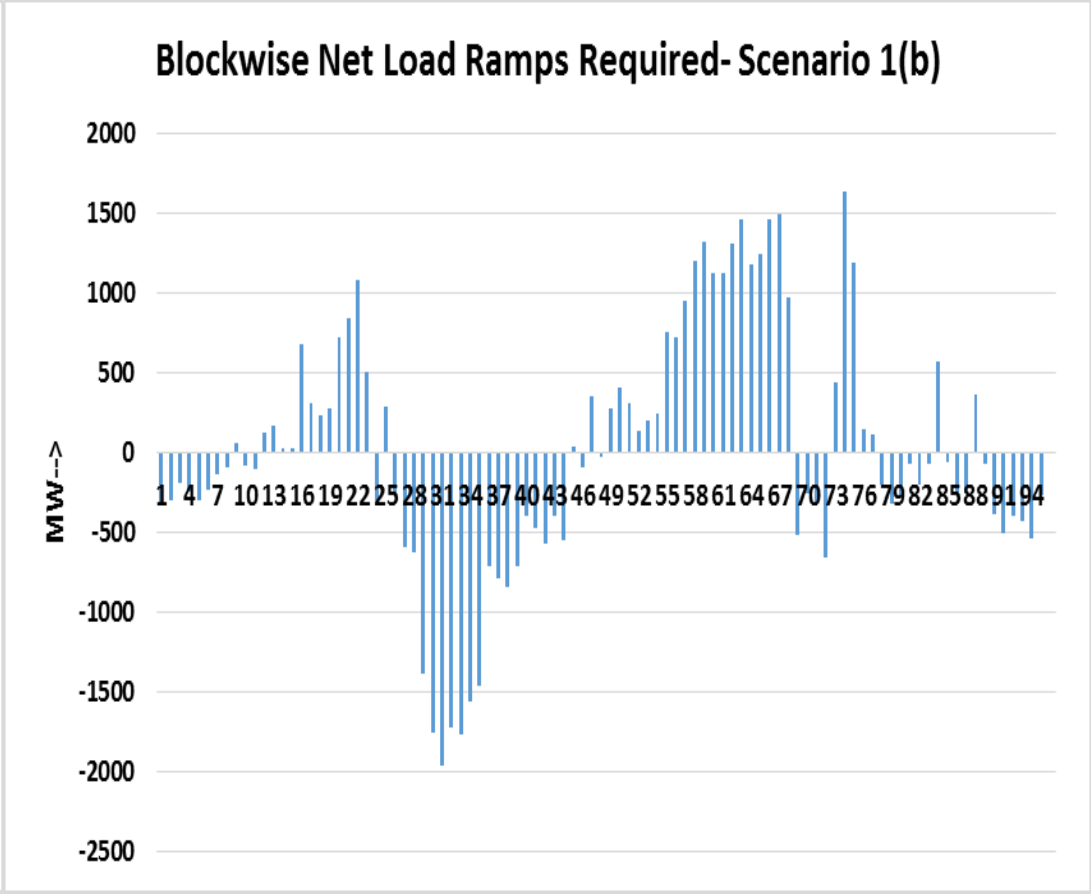
1. Peak demand season
   a) Scenario 1: 80% of RE Target achieved
   b) Scenario 2: 100% of RE Target achieved

Expected net load in the 28th time block of the day is ~55GW and has come down to ~41GW (1a) (~36 GW1(b)) during 49th time block and again increased to ~55GW in 70th time block



Net Load requirement in Peak Demand Scenario

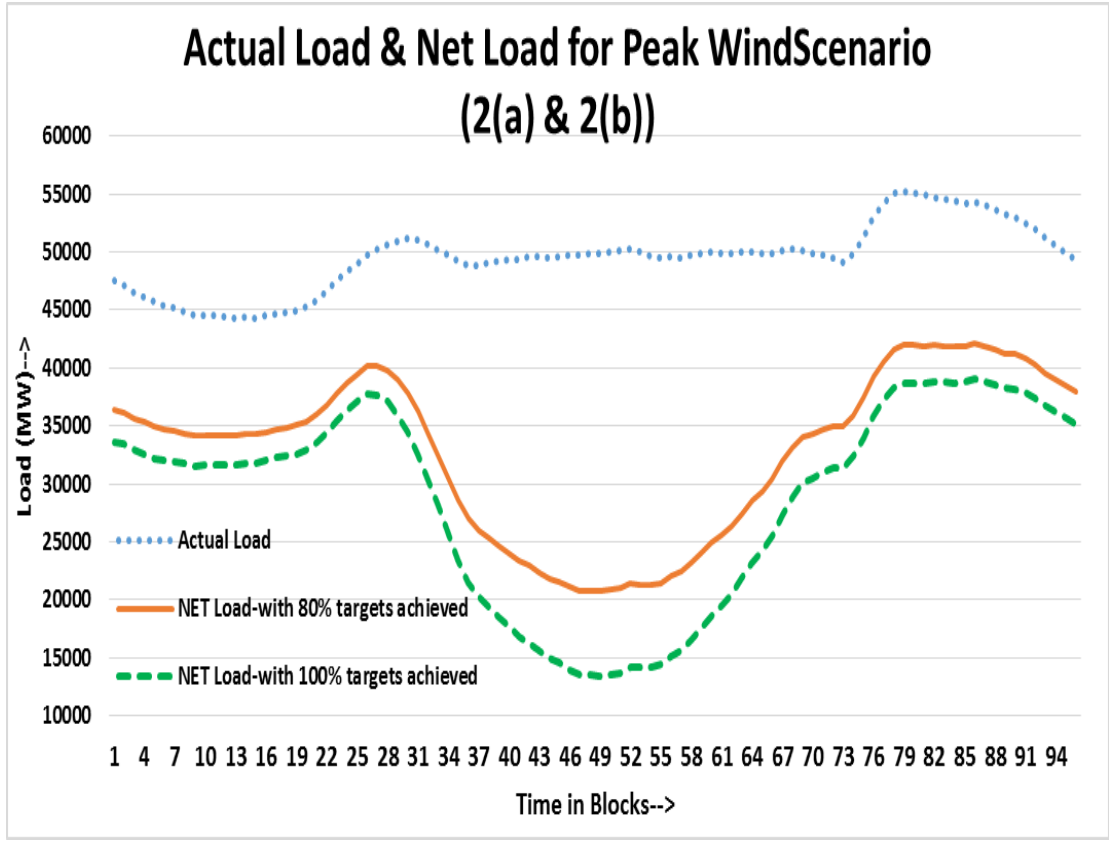




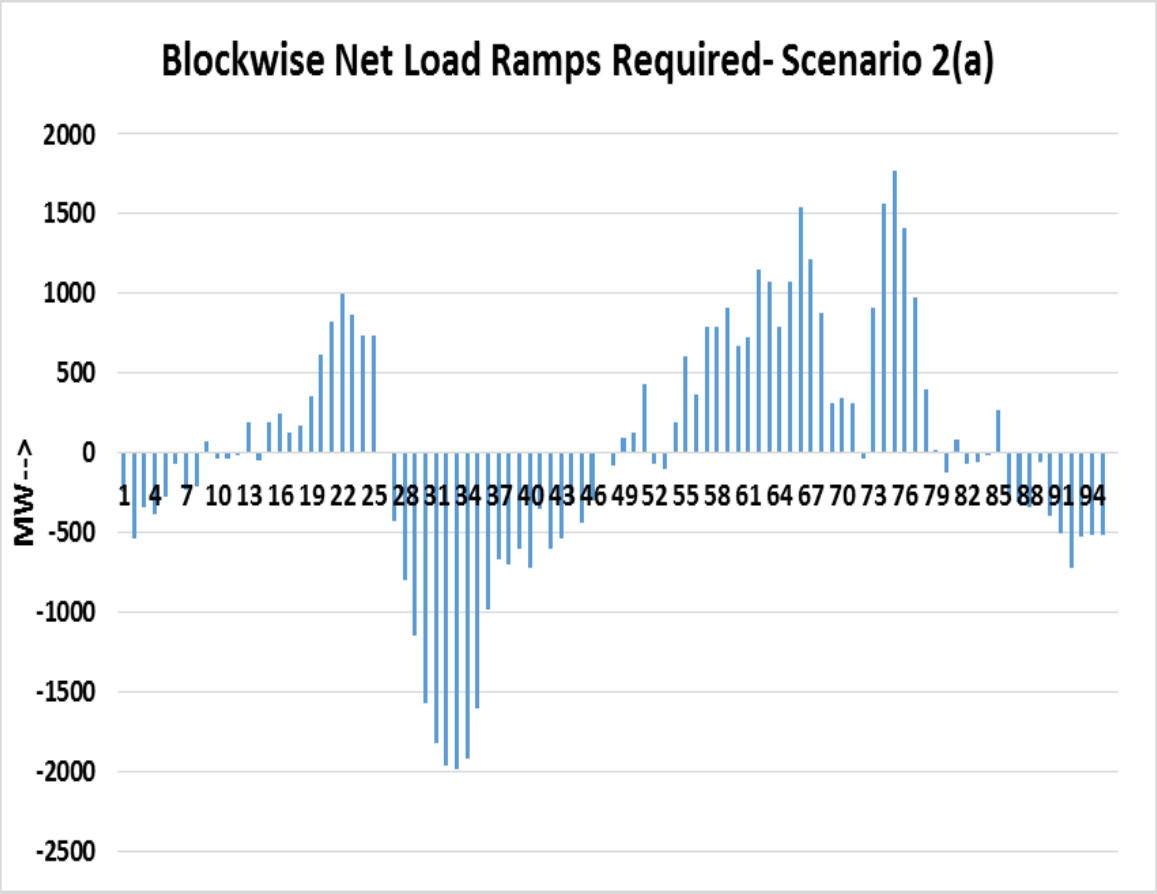
EXPECTED NET LOAD IN PEAK WIND SEASON

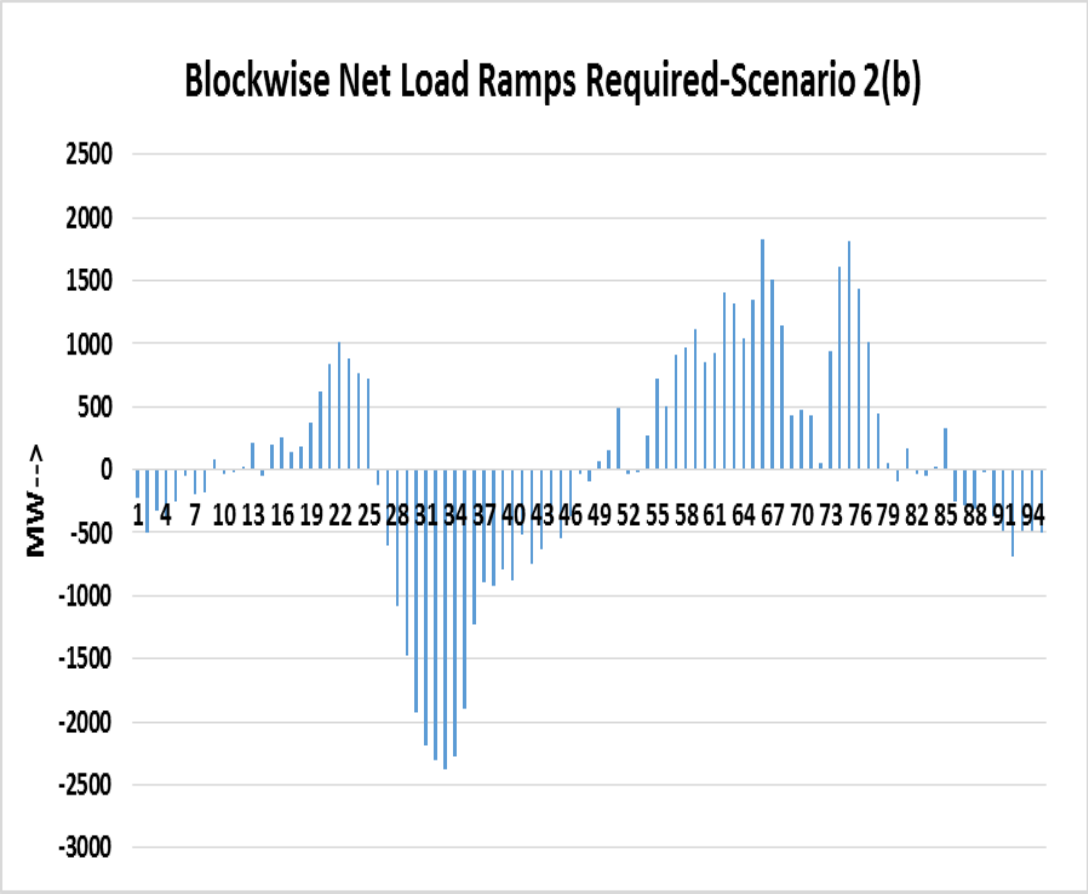
2. Peak Wind season
   a) Scenario 1: 80% of RE Target achieved
   b) Scenario 2: 100% of RE Target achieved

The net load of ~41GW during 28th time block has come down to ~21GW (2(a)) (~15 GW (2(b))) in 49th time block



Net Load requirement in Peak Wind Scenario





V. MANAGING THE LOAD RAMPS – SOLUTIONS

1. **Storage:** Pumped hydro storage and other storage techniques. CEA Draft technical standards proposes maintaining at least 10% of installed capacity as storage facility for the wind & solar plants of 50 MW and above.
2. **Exporting excess power to other regions:** Presently SR is importing power from other grids, in future situation for exporting of power may arise with high RE generation.
3. **Altering the load curve:** Agriculture loads are predominant in SR, presently supply is being given in three time slots on rotational basis & shifting the loads to day hours may help in lowering the ramping requirements.

The net load requirement for region as a whole has been computed while in reality it is different for different states based on their RE status. There must be a flexi trading mechanism among different states within the region for smoothening the net load requirement.

VI. ADDRESSING THE INTRA-DAY/SUDDEN VARIATIONS IN RENEWABLES

- **Primary Response or Governor Response:** Presently only 20 to 30% of mandated response is observed, further improvement required.

- **Automatic generation control:** For controlling the tie line flows (Variations in renewable generation leads to deviation of power flows from schedule)

- **Ancillary services:** Presently Indian specific ancillary services launched covering central generating stations. Further bringing state generating stations & implementation through market mechanisms.

VII. REFERENCES

- [1] Tentative State-wise break-up of Renewable Power target to be achieved by the year 2022 So that cumulative achievement is 1,75,000 MW
- http://mnre.gov.in/file-manager/UserFiles/Tentative-State-wise-break-up-of-Renewable-Power-by-2022.pdf
- [2] Advance National Transmission Plan for 2021-22 http://www.cea.nic.in/reports/others/ps/pspa2/ptp.pdf
- [3] 19TH Electrical Power Survey of India
- [4] 5th Amendment of Indian Electricity Grid Code
- [5] http://cea.nic.in/reports/others/planning/resd/mom_pump_storage_plants.pdf
- [6] http://www.cea.nic.in/reports/regulation/draft_technical_std_grid_regulations.pdf.
- [7] GREENING THE GRID: Pathways to Integrate 175 Gigawatts of Renewable Energy into India's Electric Grid, Vol. I—National Study
- [8] Power for all – A Joint Initiative of Government of India and Government of Andhra Pradesh
- [9] Power for all – A Joint Initiative of Government of India and Government of Telangana

THANK YOU.....

DO YOU HAVE ANY QUESTIONS ?