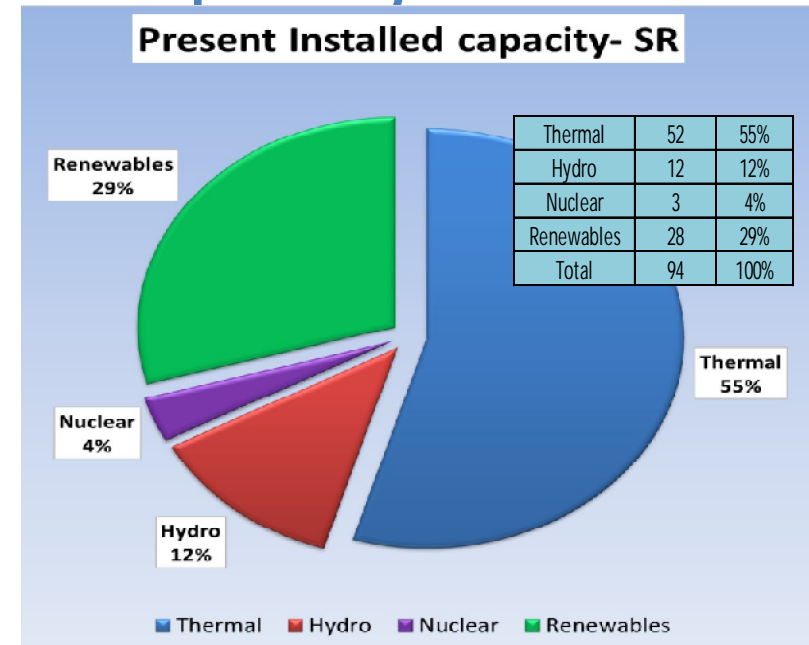
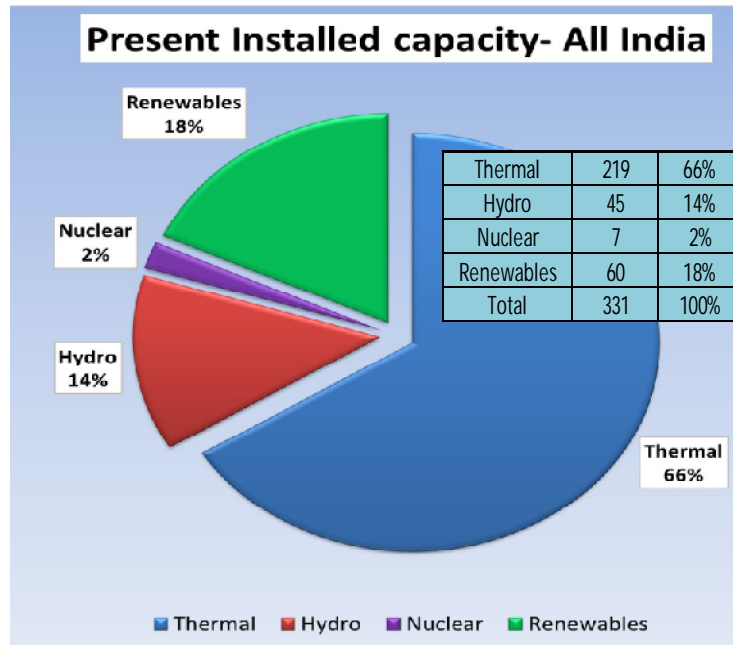




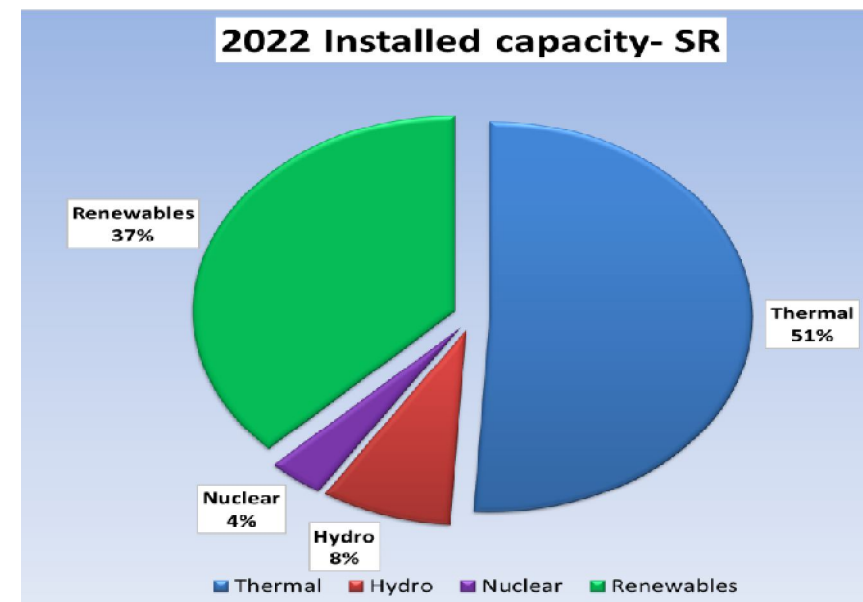
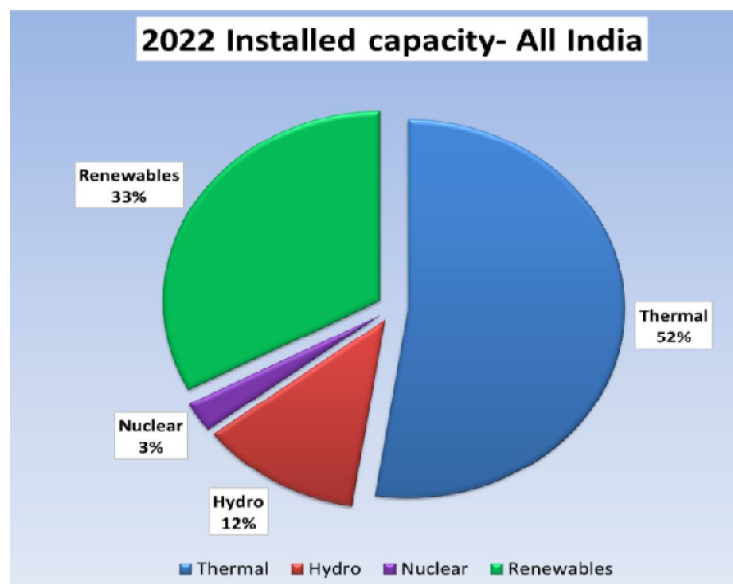
Flexible generation for
RE penetration in SR
Abraham Varghese, SRLDC, POSOCO, Bengaluru



Present Installed capacity



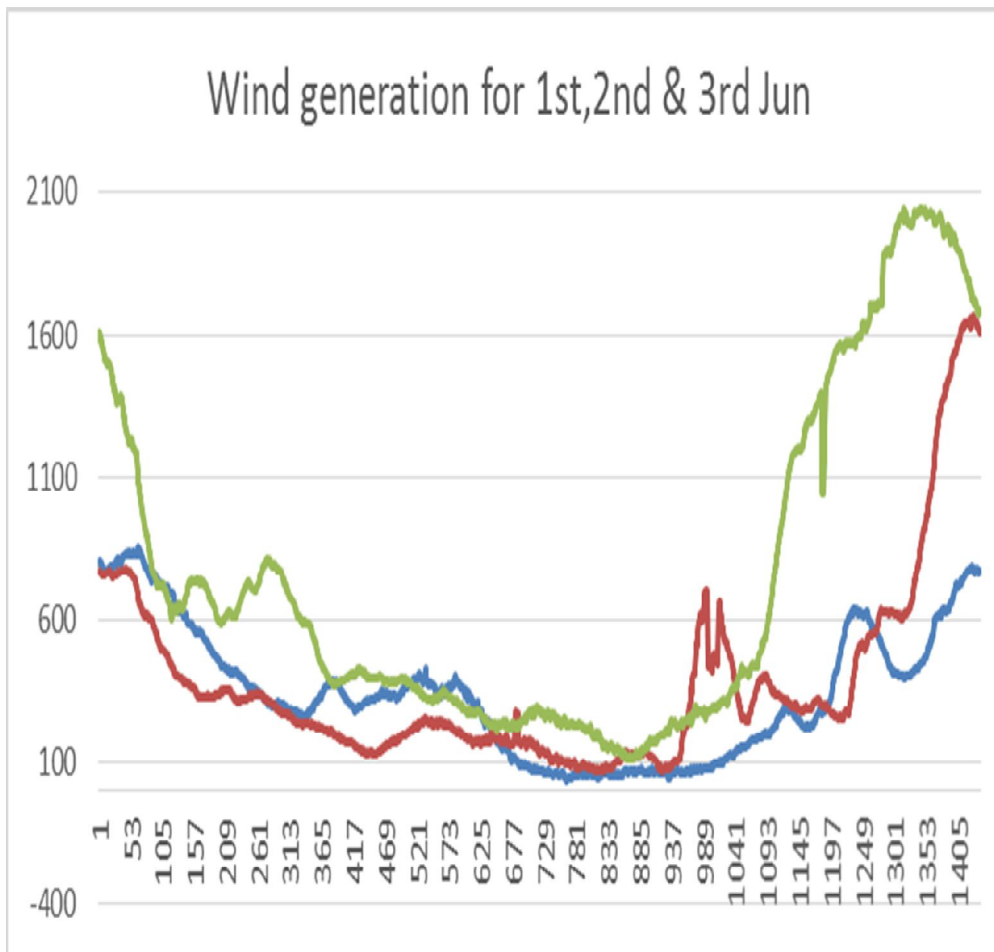
Projected Installed capacity in 2022



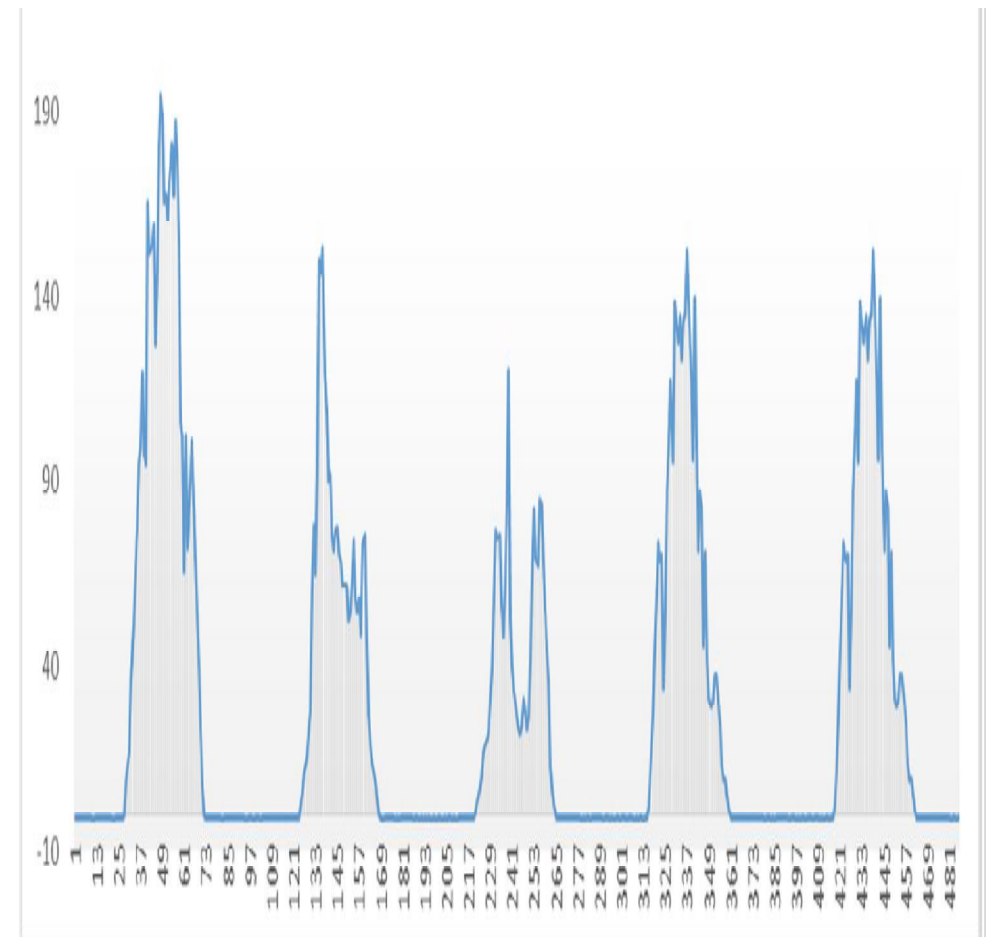
RE integration-System Operator's preview

- *Variability of loads & unforeseen generator outage*
- Variability from RE generators
- Forecastable RE generation can be scheduled and others including 'not visible' RE cannot be scheduled
- System operator is continuously balancing the **generation including the forecasted RE** with the **load**, keeping a flexibility for the unscheduled RE & for any variation in the scheduled RE
- SO's main challenges are
 - i) sharp ramp up/down of 'net load'
 - ii) integrating high RE during low demand time
 - iii) frequent changes or shorter despatch for conventional generators
 - iv) System reliability concern

Type of Wind & Solar generation variations

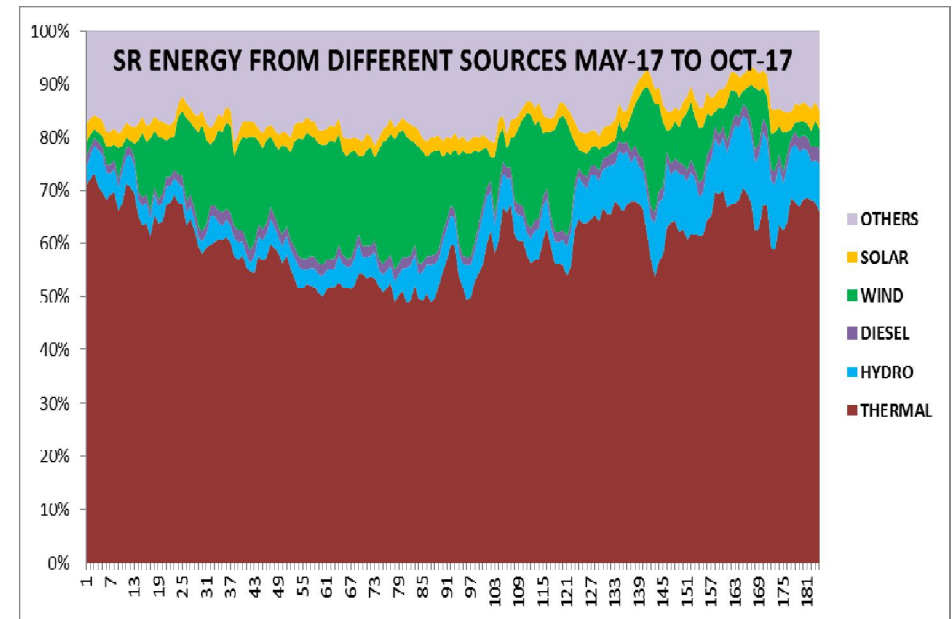
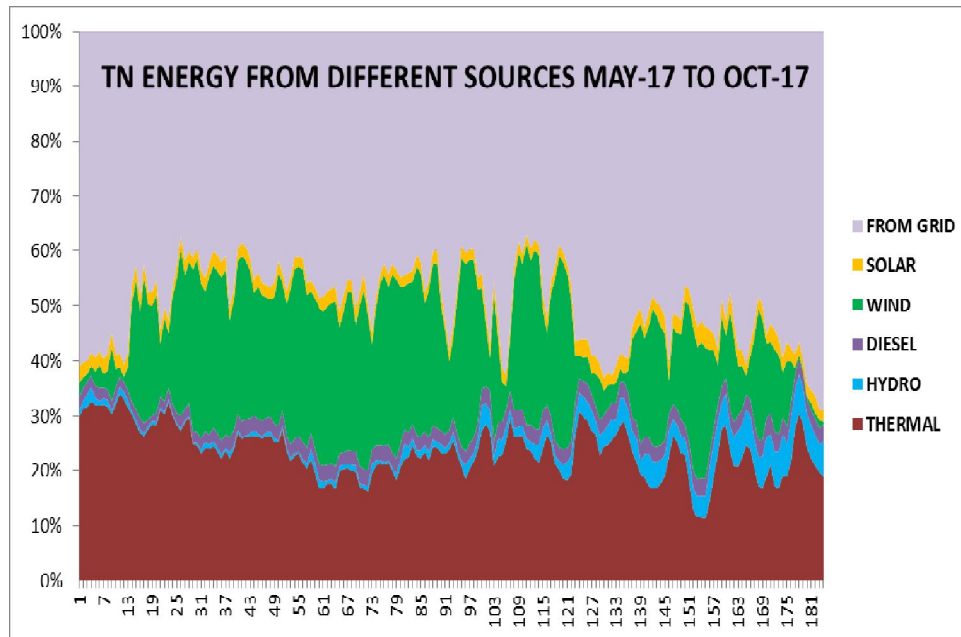
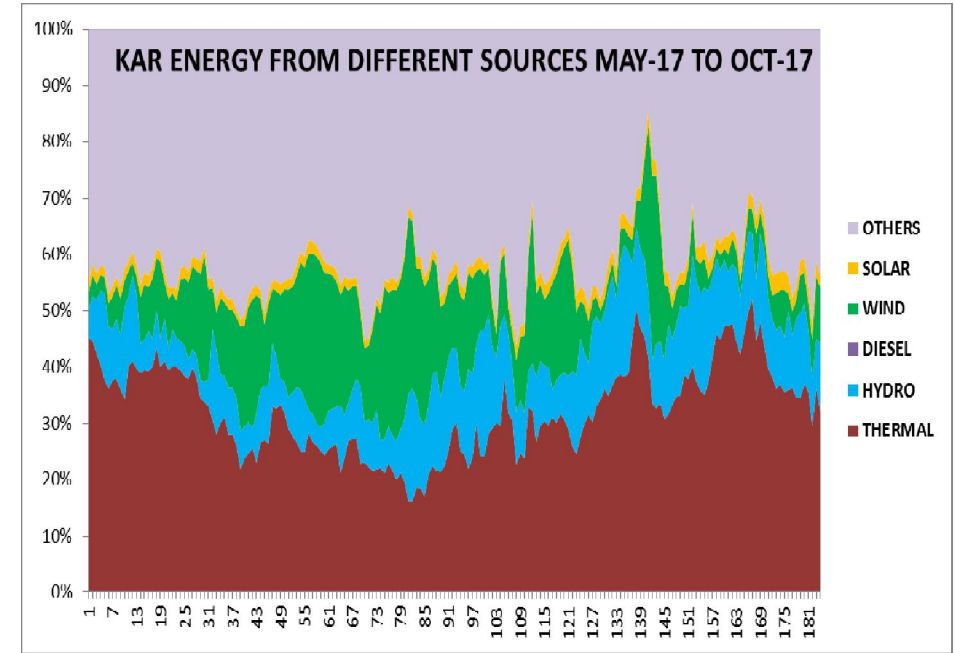
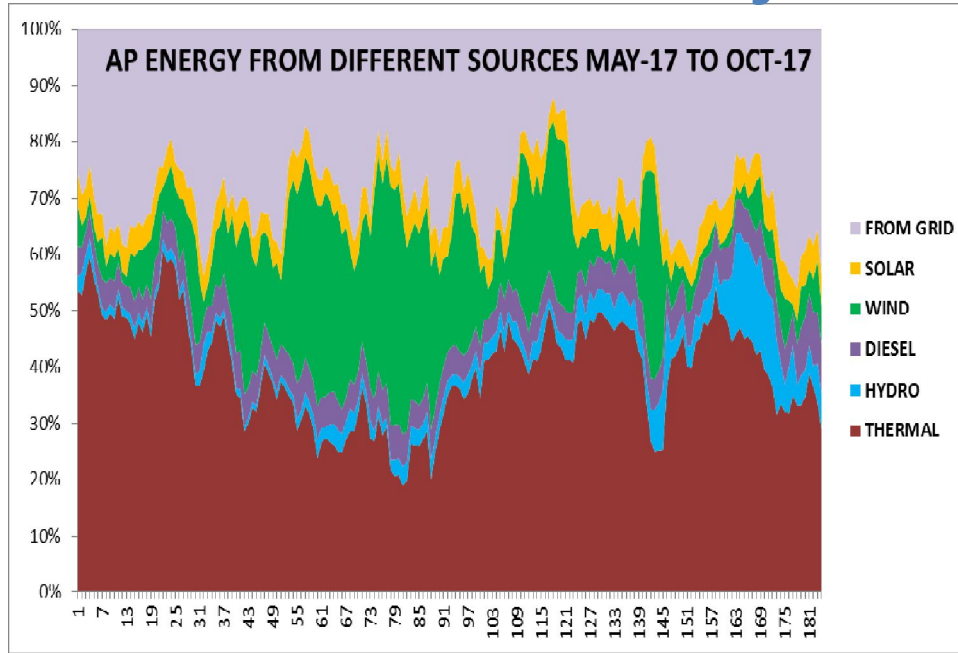


Wind generation variations-AP State



Solar generation variations-250 MW park

State-wise analysis on flexible generation for RE penetration from May17 to Oct17



Flexible generation on Maximum wind Day 17-JUL-2017

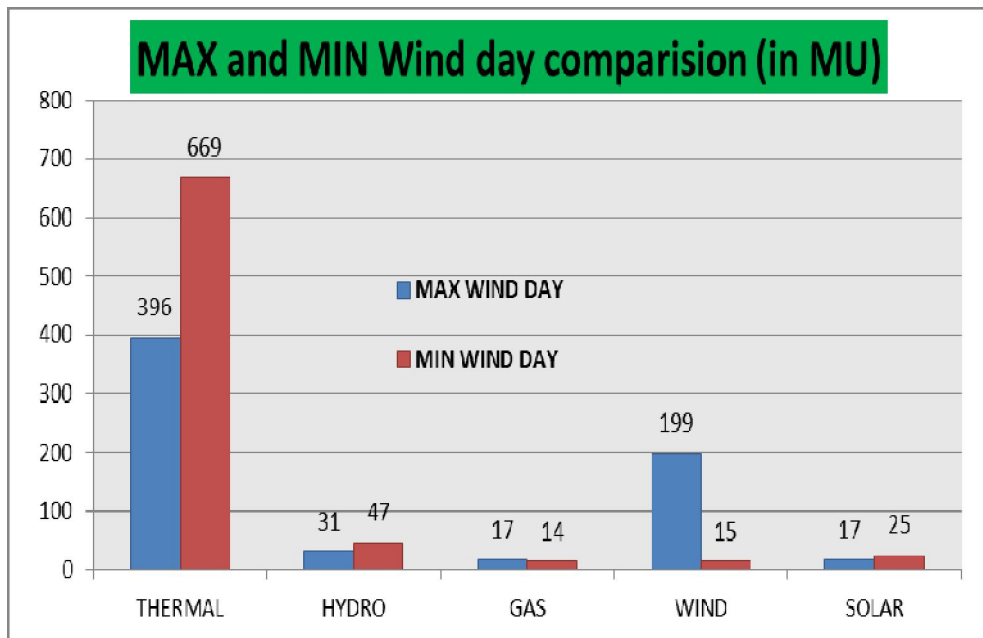
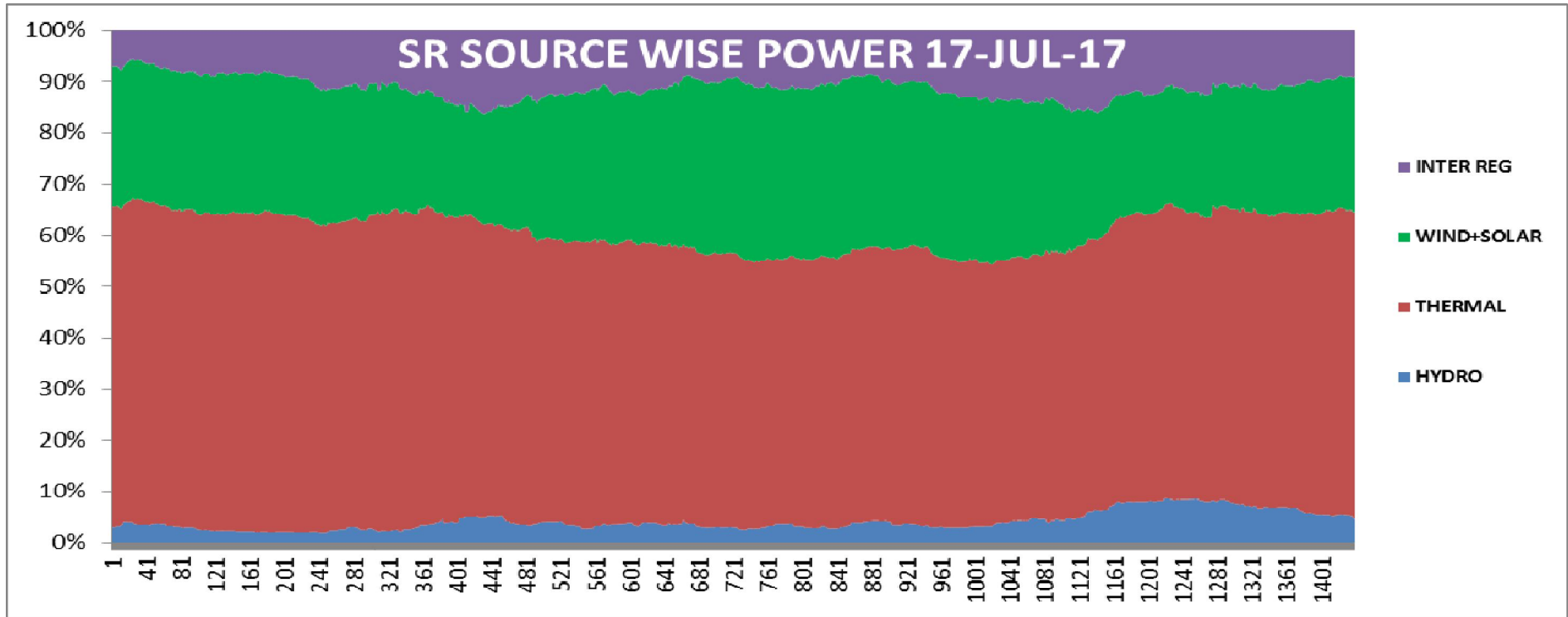
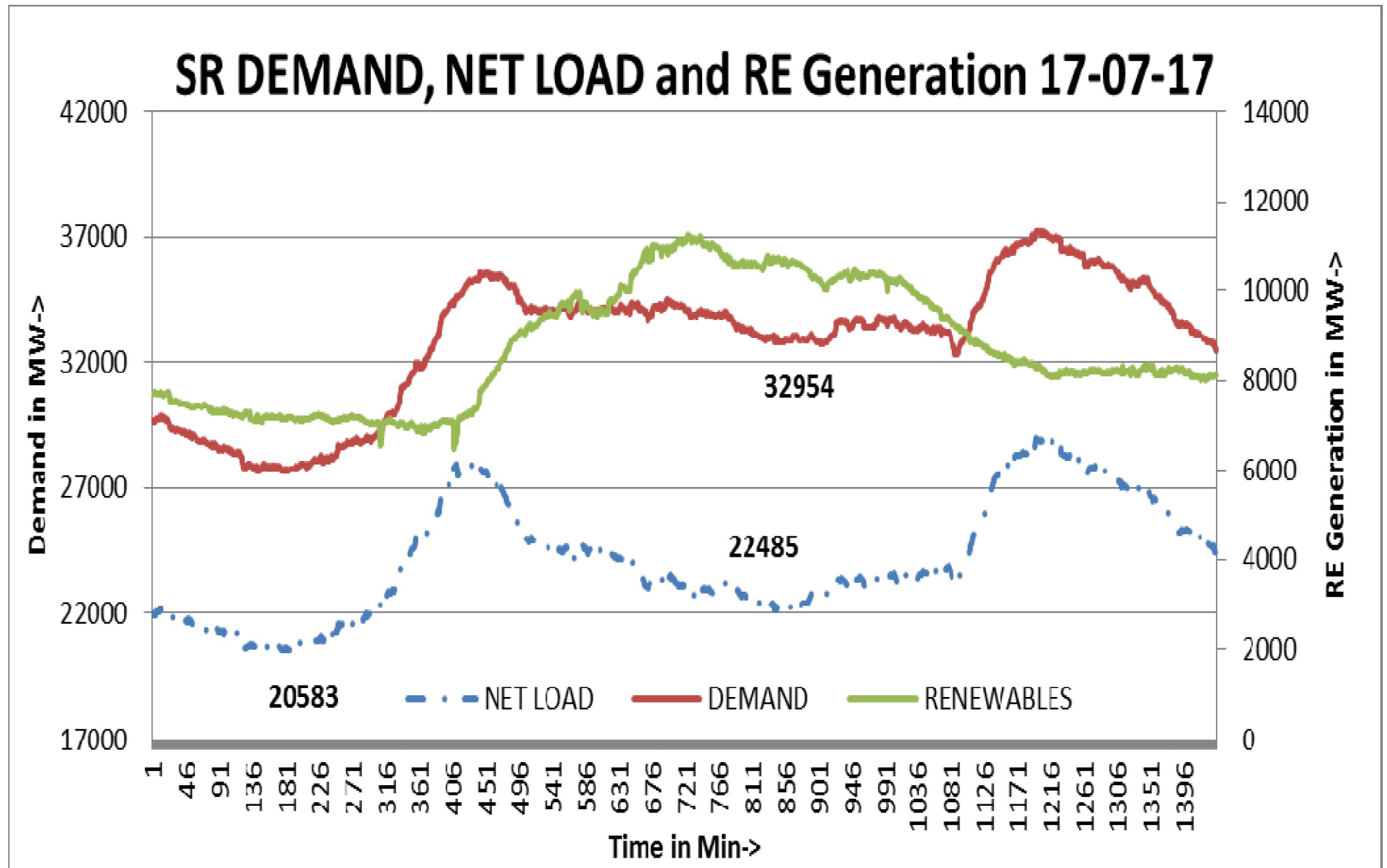


Fig in MW	HYDRO	THERMAL	WIND & SOLAR	INTER REG	DEMAND
17-Jul-17	992	17367	11236	2924	34051
12:04:00	3%	51%	33%	9%	100%

Fig in MU	HYDRO	THERMAL	WIND & SOLAR	INTER REG	DEMAND
17-Jul-17	31	396	199	118	807
	4%	49%	25%	15%	100%

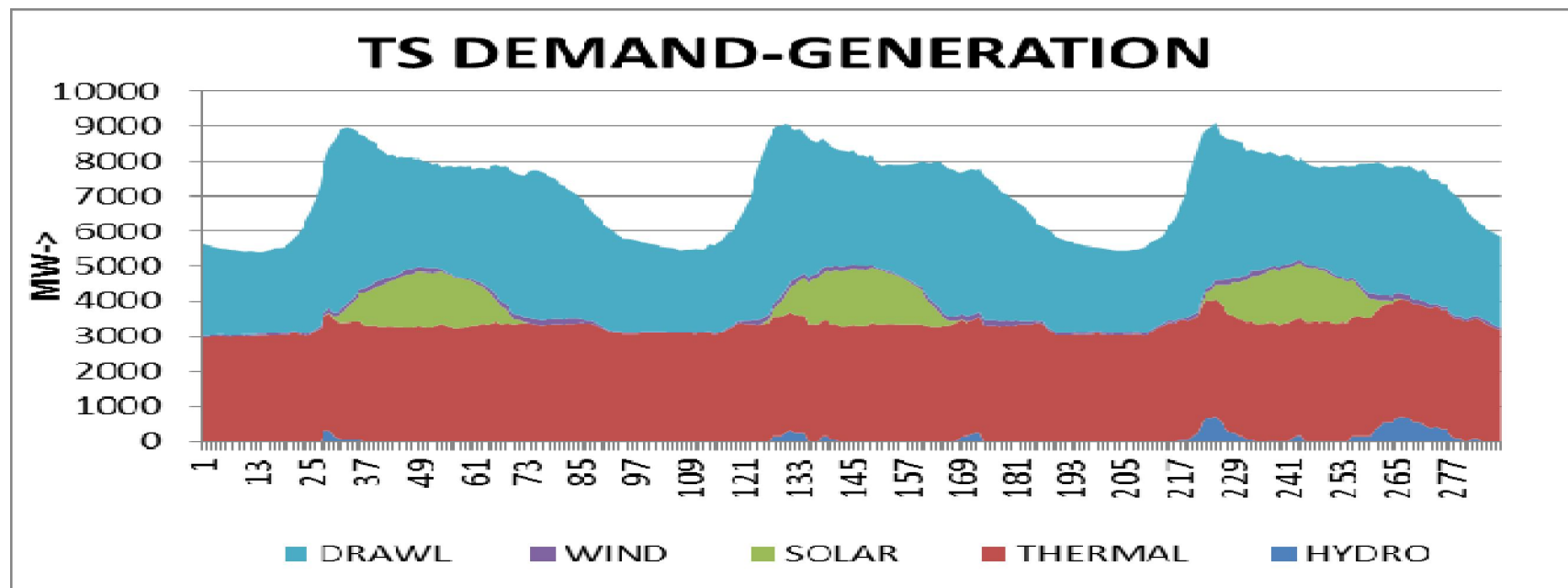
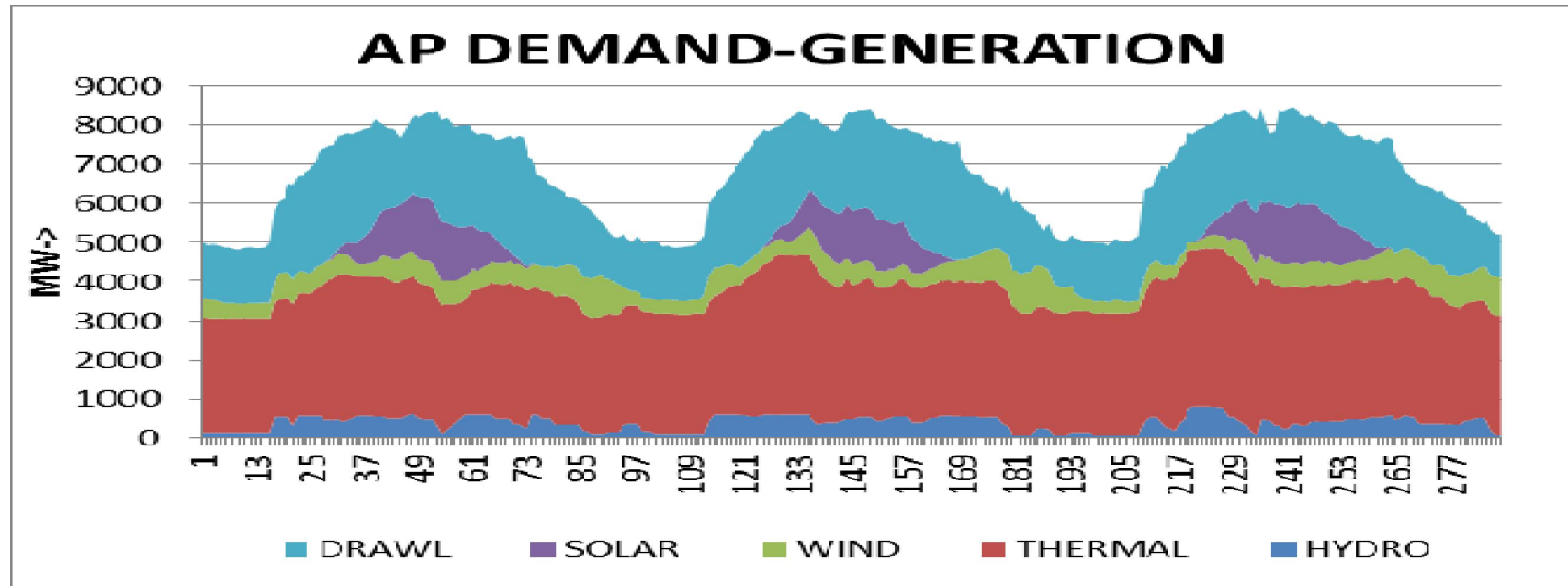
'Net Load' on Maximum wind Day 17-JUL-2017



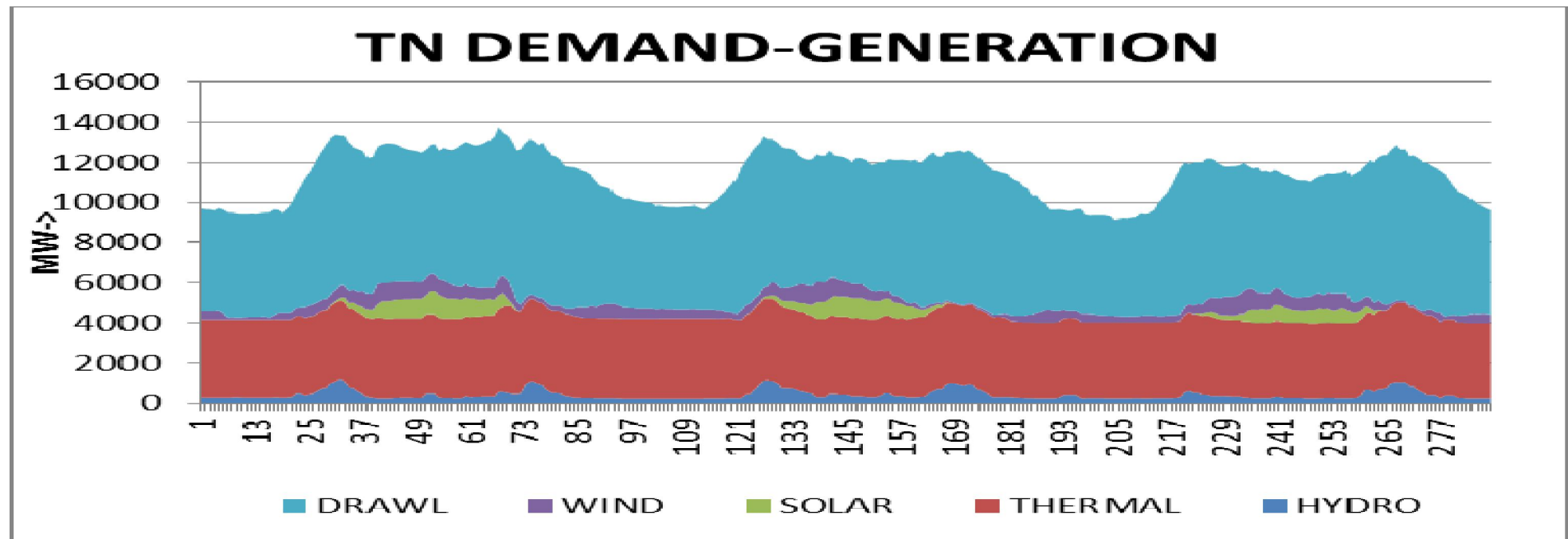
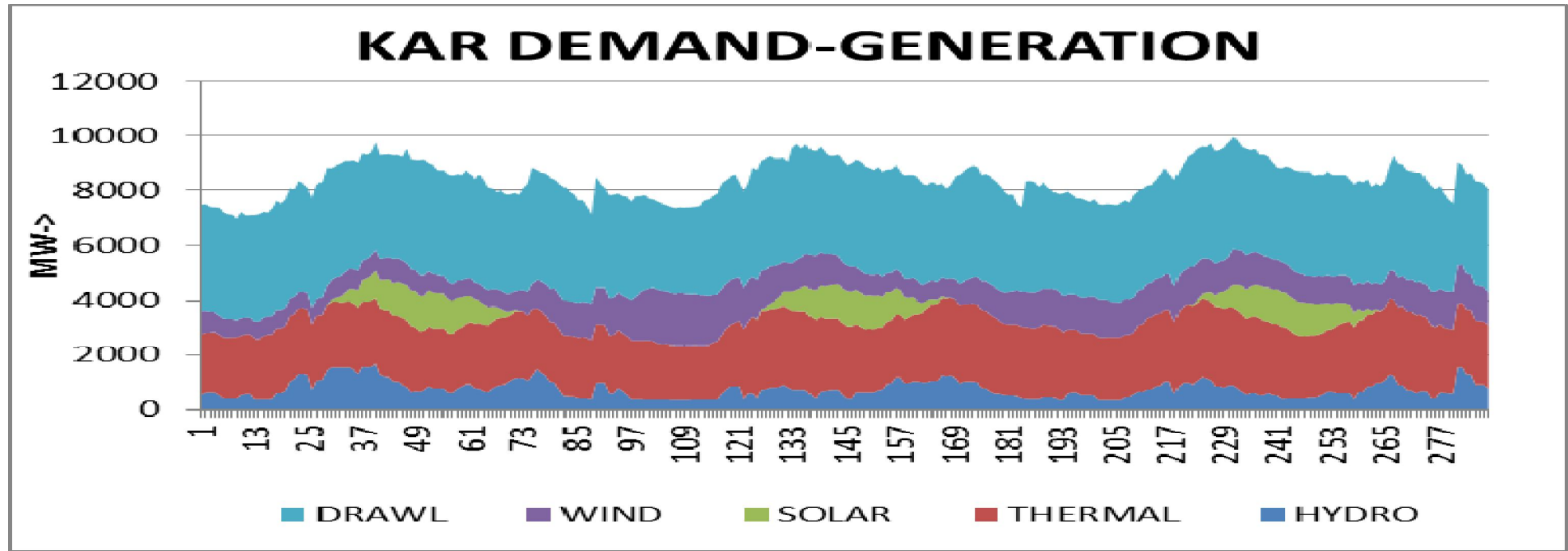
All time maximum penetration of renewables in Southern Region

State	Instantaneous RE Penetration (MW)	RE Generation (MW) / Demand (MW)	Over the day RE penetration (in Million units)	RE Generation (Mu) / consumption (Mu)
AP	69 %	3,809 / 5,509	48 %	64.46 / 133.30
Karnataka	47 %	2,627 / 5,558	29 %	46.53 / 158.63
Tamil Nadu	48 %	4,931 / 10,242	36 %	103.30 / 290.60
Southern Region	39 %	12,995 / 33,387	27 %	216.20 / 807. 50

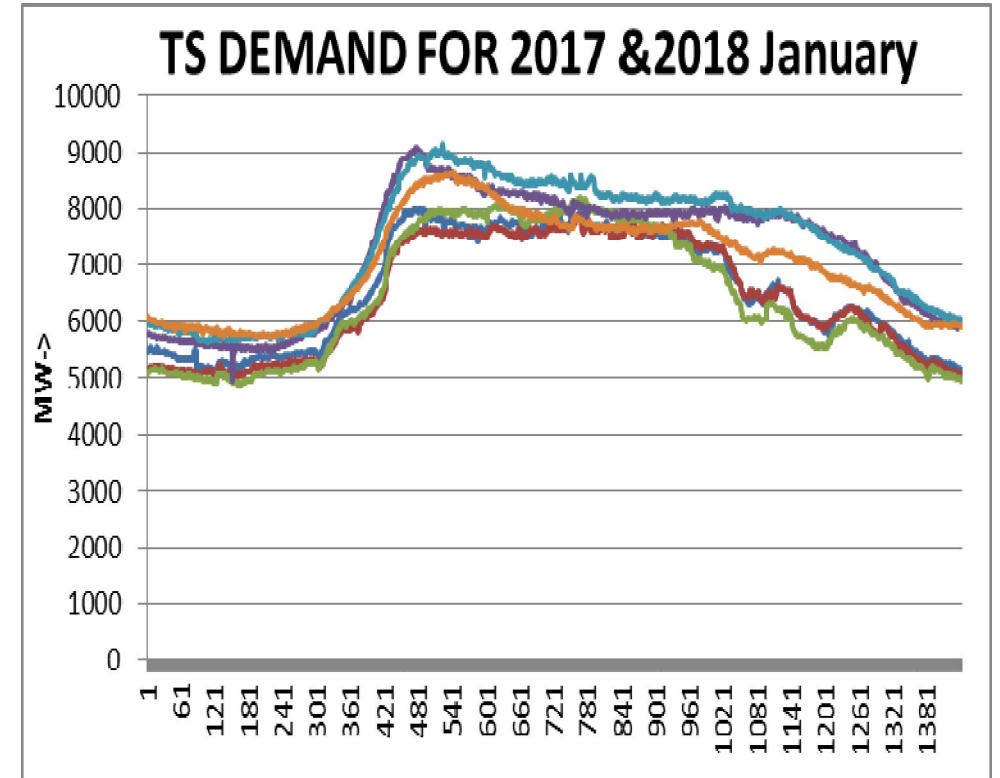
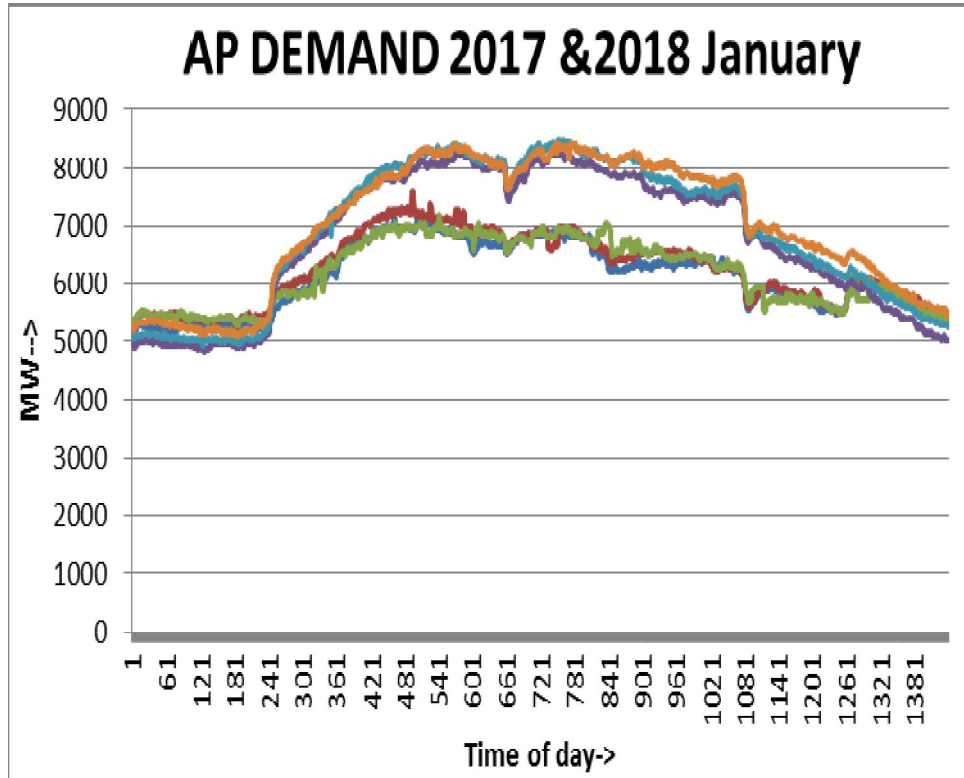
State-wise analysis on flexible generation for Solar penetration

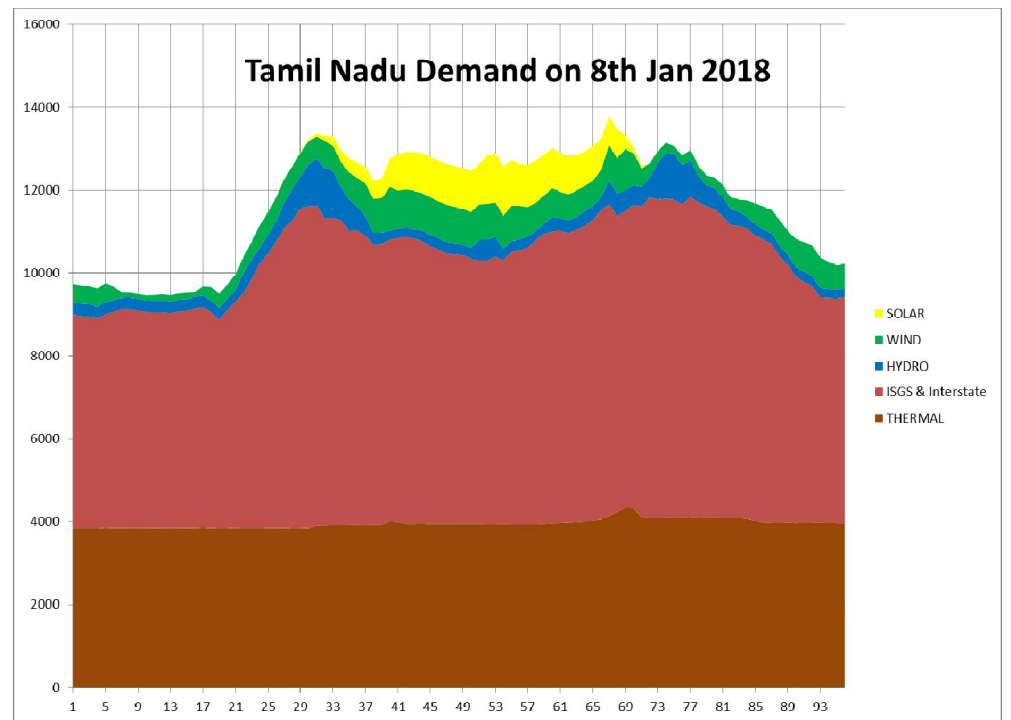
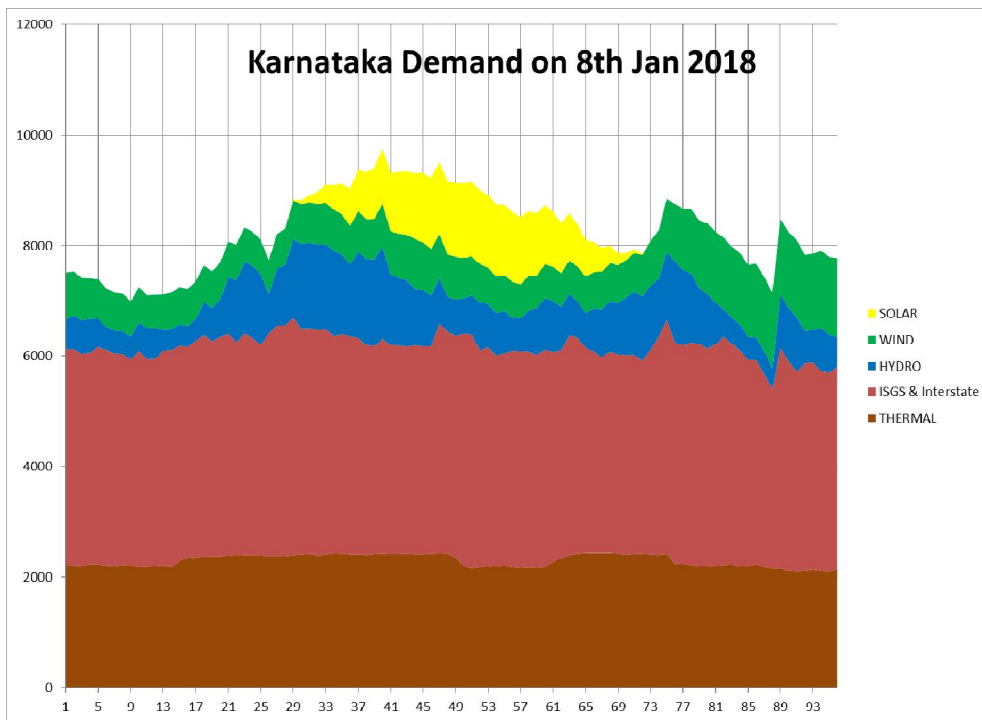
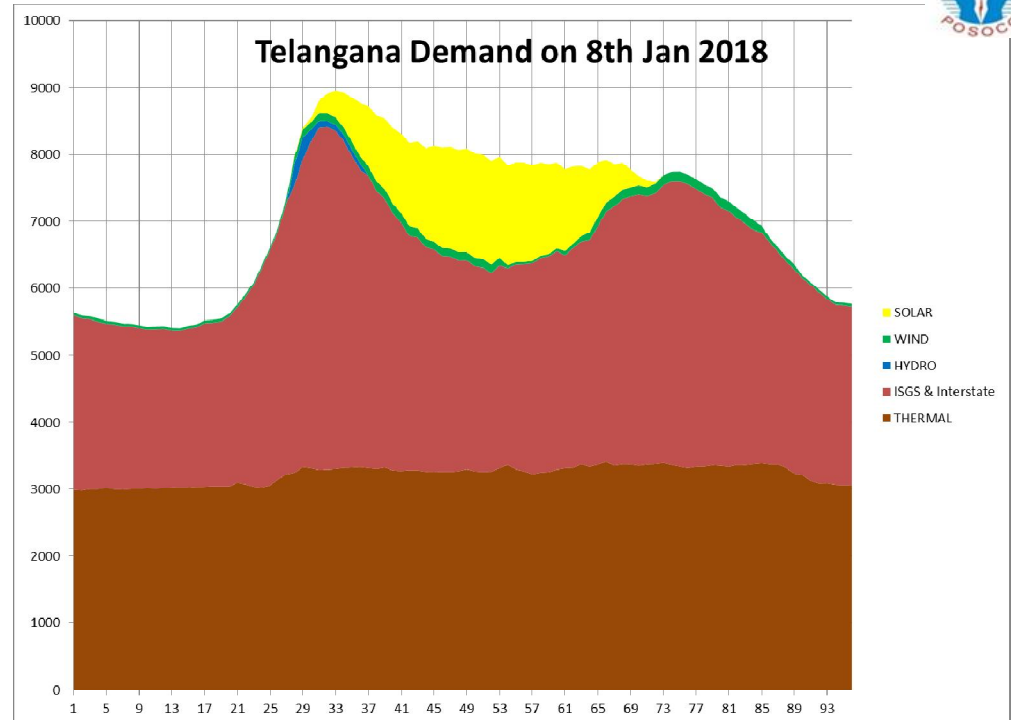
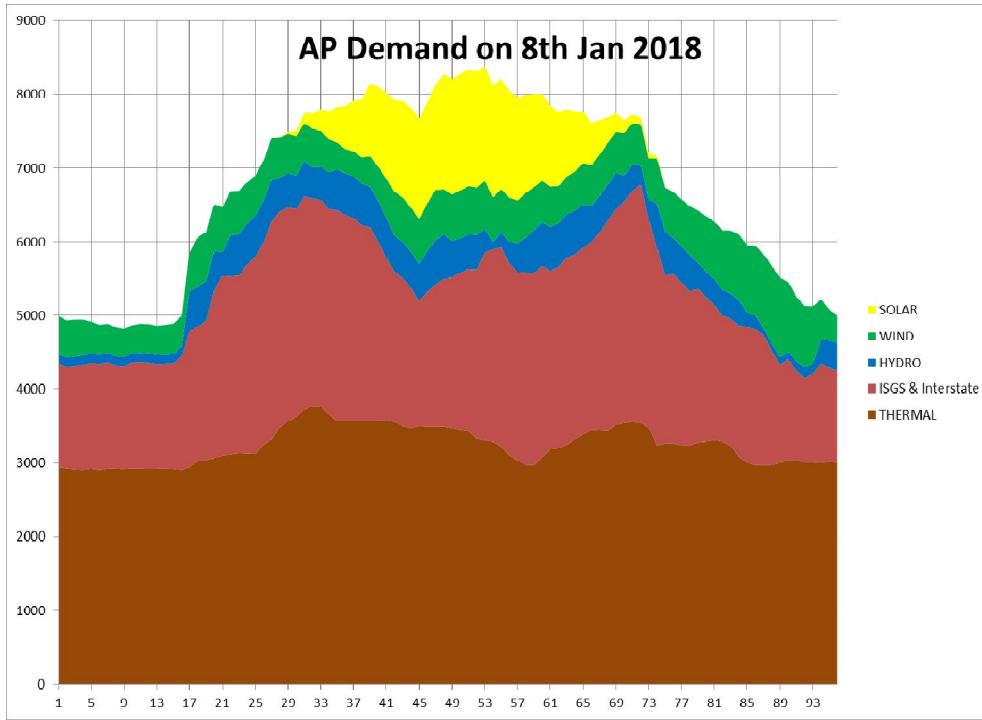


State-wise analysis on flexible generation for Solar penetration



Flexibility through meeting higher Demand





NET Load for the RE rich states of Southern Region

