

Case description

The modified IEEE 33-bus distribution [1] is used as the test case. The base voltage level is 12.66 kV. Non-dispatchable DGs are considered to be in the form of *PV* panels and wind turbines (*WT*). Seven 400kW *PV* units are installed on buses #4, #7, #11, #14, #17, #27, and #32, respectively. Two 1MW *WT*s are connected at bus #19 and #24, respectively. The load profile in a typical day is shown in Fig. 1, and the *PV* and *WT* profiles are obtained from [2]-[3], respectively. The ESS is located at bus #8. The voltage magnitude limits are 0.95~1.05 p.u. while the maximum current for each branch is 1.2 kA. Confidence level of voltage chance constraint is set as 90%. The parameters of ESS are listed in Table 1.

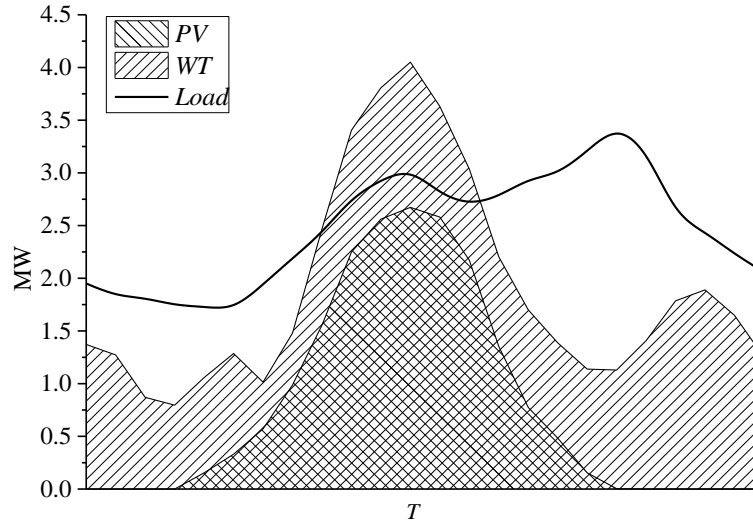


Fig. 1 Power from DG and the load in a typical day

TABLE 1
PARAMETERS OF ESS UNITS \

Parameter	Value
Upper/lower limit of SOC	1/0.2
Charging/discharging efficiency	90%
Life cycle times	3000
Unit capacity cost(\$/(kWh))	285

[1] M. E. Baran, F. F. Wu, "Network reconfiguration in distribution systems for loss reduction and load balancing," IEEE Transactions on Power Delivery, vol. 4, no. 2, pp. 1401-1407, 1989.

[2] Solar Irradiation Data (SODA) [Online]. Available: <http://homerenergy.com/>

[3] Homer Energy [Online]. Available: <http://homerenergy.com/>