

Case description

The modified IEEE 33-bus distribution [1] is used as test case, as shown in Fig. 1. The base voltage level is 12.66 kV. Non-dispatchable DGs in the form of *PV* panels and wind turbines (*WT*) are considered in the system. Seven 400kW *PV* units are installed on buses #8, #12, #15, #21, #28, #31, #33. Two 1MW *WT* is connected at bus #18 and #33. The load profile in a typical day is shown in Fig. 2, in which the *PV* and *WT* profiles are obtained from [2-3], respectively. The ESS is located at bus #5. The voltage magnitude limits are 0.95~1.05 p.u., while the maximum allowable current for each branch is 1.2 kA. Confidence level of voltage chance constraint is set as 90%. The parameters of ESS units are listed in Table 1.

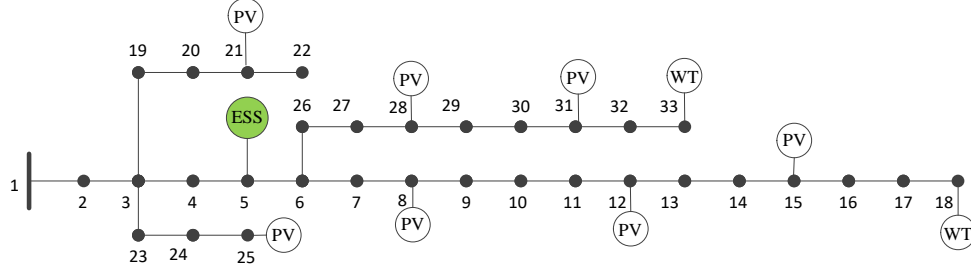


Fig.1 IEEE 33-bus distribution network

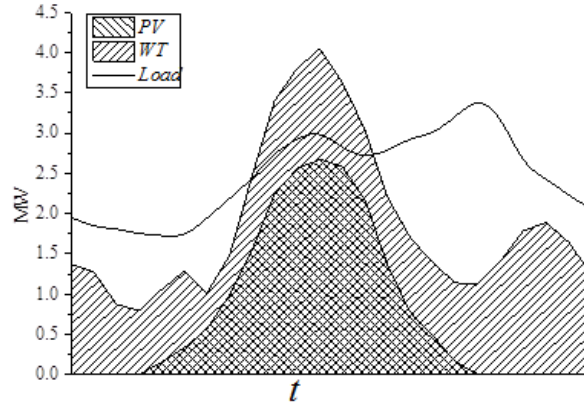


Fig.2 Power from DG and the load in a typical day

TABLE 1
PARAMETERS OF ESS UNITS

Parameter	Quantity
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/>