How solar energy tapered power bill at Mahendragarh HVDC terminal?

350 kVAr reactive power supplied to the grid during night hours reduced the monthly electricity bill by more than Rs. 5 lacs

To cater to the auxiliary supply demand at Mahendragarh HVDC terminal, two separate 33 kV auxiliary supplies one from Majhra sub-station and another from Dhanonda substation were used.

During emergency when both sources of power failed, two DG sets of 1500 kVA each were used to cater to the auxiliary requirement.

Presently, the total average load demand of HVDC station through Dhanonda and Majhra feeder plants varies from 600 kW-1500 kW depending upon the load condition & various other factors such as overload condition, weather etc. Generally, the power factor varies in the range of 0.70 to 0.76 depending upon the grid condition and system kVAR requirements. Due to low power factor, higher energy charges are levied by Dakshin Haryana Bijli Vitran Nigam (DHBVNL). While it is planned to compensate the reactive power to maintain the unity power factor through IGBT-based Automatic Power Factor Correction (APFC) System by mid-2019, simultaneously another cost optimisation idea of supplying the reactive power to auxiliary system through solar inverter has been implemented.

Till the installation and commissioning of APFC panel, we initiated cost optimization initiative through the solar inverter to supply the reactive power to the auxiliary system at the Mahendragarh HVDC terminal.

Solution: Reactive power generation through M'garh Solar power plant

Traditionally, PV inverters are designed to feed as much active power [P(kW)] as is available from the solar plant (at unity power factor) into the point of common coupling (PCC). But most of the three phase inverters are also capable to absorb and provide reactive power Q (kVAR) from and to the grid.

During day time, active power is supplied to grid and the inverter absorbs reactive power from grid to compensate the effect from transformer and cabling. During night time the inverter system supplies reactive power to grid to compensate the requirement of auxiliary load and absorb active power from grid to keep the inverter system on.

A total of 350 kVAR reactive power is supplied to the grid during the night hours of 18:30 hrs to 6:10 hrs from the Mahendragarh Solar power plant. Based on the above reactive power injection, monthly electricity bill could be reduced by more than Rs. 5 lacs per month.

Auxiliary power consumption details after reactive power injection through solar inverter during night hours:

SN	Description	Month 1	Month 2	Month 3
1	Active Power (KWH)	3,56,955	3,40,162	3,60,533
2	Apparent Power (KVAH)	4,51,475	4,28,597	4,29,348
3	Power Factor	0.79	0.79	0.84
4	Reactive Power (KVARH)	2,76,429	2,60,740	2,33,143
5	Reactive Power Inject using Solar (KVARH)	1,23,968	1,19,661	1,25,744
6	Total Reactive Power (KVARH)	4,00,396	3,80,400	3,58,887
7	Apparent Power if Reactive Power not injected (KVAH)	5,36,409	5,10,308	5,08,708
8	Power Factor if Reactive Power not injected	0.67	0.67	0.71
9	Diff. in Apparent Power (KVAH)	84,934	81,711	79,360