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EFFICIENCY IMPROVEMENT IN POWER SYSTEM

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Abstract— The improvement of efficiency in the power system of Ashok Leyland Ltd, Plant 1, Hosur is necessary since the plant consumes thousands of units of electricity each day. The power fed in is not utilized completely and is wasted during non working hours. The power from the solar power unit is not utilized completely due to reverse power relay tripping. The efficiency of the solar panels are low and that has to be improved. We observed that 100% utilization is not possible due to reverse power relay position. During analysis of solar power generation, we found that shop 1 solar inverter power production is marginally low when compared to shop. We have analyzed the load pattern and found that the consumption during non-working hours can be optimized. We have checked machine-wise and found idle running cutoff incorporated and working. The losses are due to hidden or eaten away losses of loads like control transformers, indication lamps, etc. To avoid the losses a solution has been derived and `handed over to the Ashok Leyland team. That is grouping of loads in one transformer. The remaining transformers can be switched off during non-working hours. Further, on discussion with the Ashok Leyland team we have arrived modified ducting arrangement for exhaust fan to avoid dust accumulation on the solar panels. And with the help of the Ashok Leyland team we provided a solution to utilize the maximum level during holidays. The position of reverse power relay has been changed. So, the 100 % utilization of solar power is possible.

Keywords: reverse power relay, idle time power loss, grouping of load, hidden loss.

1. INTRODUCTION

Ashok Leyland receives power from Thally road TNEB substation with a supply voltage of 33 kV at main receiving station which is stepped down to 11 kV and distributed to various shops through two manned substations namely up land (shop 2) and down land shop 5.All major shops having substation with 11 kV input which is again stepped down to 415 v for various application. As back up source during TNEB failure the supply is fed through Diesel generators from the generator house through these manned substations. Totally 23 transformers are available in the premises

In this system, solar power generated in shop1 and shop 2 and it is distributed among upland (i.e. from substation 2). Since the system uses on-grid inverter there is a chance of reverse power flow towards TNEB. To prevent that, they have provided reverse power relay at the incoming of sub-station 2. The reverse power relay in sub-station 2 often trips so the solar output is not utilized fully.

When we analyze shop wise we found that the generation of solar power in sub-station 1 is less compared to sub-station 2

During our analysis we found that the hidden loss or idle time loss is more which affects the effective use of electric power

The following topics to be discussed are [2] Existing system in Ashok Leyland. [3] Various solutions for those issues. [4] Proposed system. [5] Conclusion.

2. PROBLEMS WITH EXISTING SYSTEM IN ASHOK LEYLAND

1. Feeders continued with load.

In all the shops the loads are supplied with separate feeders. Those feeders are supplied with individual transformers which are always ON even in no load condition which is known as hidden loss. This will happen in every break hours and shift changing hours which will be approximately three hours per day. So, huge amount of loss will occur as idle time loss. we observed that the wastage of power during idle time is controlled by low cost idle running cut off system. Switching off the load will not reduce the idle power to the extent of 90%
.only remaining 10% is due to eaten away losses or no load losses like transformer losses. During lunch breaks and other breaks 1.5 hrs per day savings can be achieved if we avoid eaten away loss or hidden losses.

Ashok Leyland has installed solar plant with 840 KW capacities. The shop 1 and shop 2 each has 1680 roof top solar panel of total capacity of 420 KW. This solar plant has a single panel capacity of 320w. Twenty solar panels are connected in series to form one single string. In this way, we can have two

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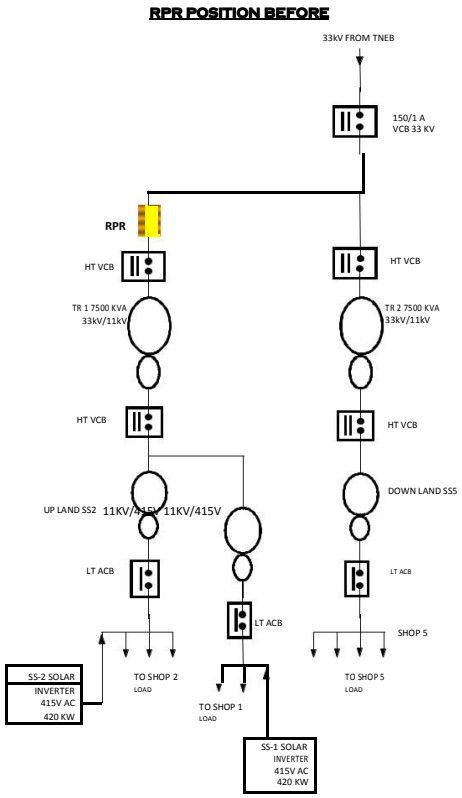
strings in a row. Each shop has seven inverters. Each inverter will receive supply from 12 string of panel arrangement. So, totally 240 panels per inverter.

During non-working days, more reverse power flow will occur. To prevent this we are adding the reverse power relay. This will trip off the breaker when reverse power flow beyond substation 2. Here the trip circuit gets activated many times and the power from the solar is unable to utilize as much as possible. Some passive techniques are provided like several of them are more sophisticated passive techniques depend on the generator swing equation [3].



2. Position of RPR initially

Both shop 1 and shop 2 has same capacity of solar generation. But, substation 1 has less output power then shop 2. The solar efficiency decreased in shop 2 but the problem is not with the inverter and efficiency may be decreased due to some other reasons.

3. ANALYISING VARIOUS SOLLUTIONS FOR THE PROBLEMS

To avoid the hidden loss we can provide breaker to each feeder that will not allow the system to take unwanted load. But this will cost more and the result will not be effective during non working hours the supply which flows in the bus bars are cut off. This will be a cost efficient one but the result will not be effective.

The next analysis for often tripping of the reverse power relay we can increase the plug setting of the reverse power relay which is already provided in substation 2. But, this will create series problem to power system in abnormal condition.

To improve the efficiency of solar power generation in shop 1 we need to check the inverter operation and whether it is working properly or not. The problem may be in solar panel also.

4. PROPOSED SYSTEM

During the idle time the machines and light and other appliances should be switched off manually to cut off hidden losses automation will not be cost effective. We came up with an idea to solve this problem. Every machine that can be switched off individually. But, the time taken and cost implementation. Then we searched for another solution and proposed the plan. loss of grid is not a problem provided that the source of generation maintains the systems voltage and frequency within specified limits[1].

Essential Loads are grouped into single transformer. Now, whenever the supply is needed for essential load then we can turn on only that specific transformer's breaker. The most direct method for loss of grid protection is to monitor the auxiliary contacts on all circuit breakers on the utility system between its main source of generation and the dispersed storage and generation unit [2]. Other transformers will be remains OFF. Now the loss will be minimized as much as possible. The below table shows the condition of the transformers in each sub-stations.

SUB-STATION	TRANSFORMER ON CONDITION	
	BEFORE	AFTER
SS-1	5	2
SS-2	2	1
SS-3	1	0
SS-4	3	1
SS-5	5	1
TOTAL	16	5

Table 1. Condition of Transformer

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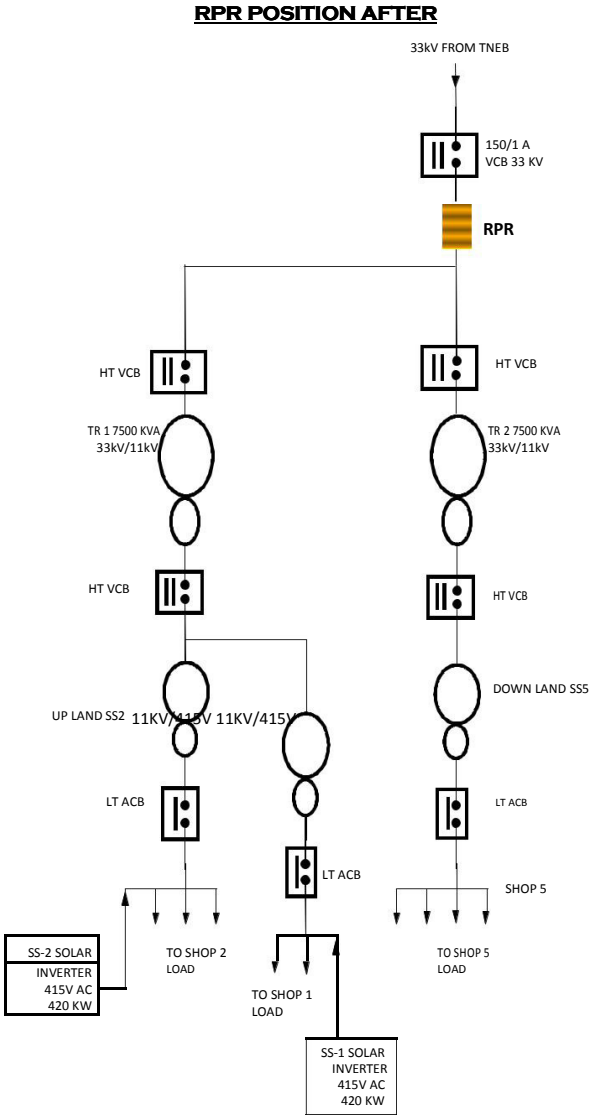
Therefore, hidden power wastage is eliminated with low cost and in lesser time without affecting the essential load. Hence, the switching of essential load is done by transformer in the substation itself by using Air Circuit Breaker. So, there is no need of separate breaker for this. The switching can be done easily without much effort.

3. Air Circuit breaker for Protection.

The EB supply for all the shops is fed from the MRS (Main Receiving Station) and from there it splits into two 11kv supply to substation 2 and substation 5. They have already deployed the reverse power relay at the incoming of substation 2. Now, the reverse power relay will get tripped off before the supply reaches substation 5. And during power shut down solar power will only supply shops and substations under substation 2.

To fix the problem, the reverse power relay is deployed at 33kv incoming side of the Main Receiving Station. Now, the solar power can supply both the substations (substation 2 and substation 5). Now the solar power can be supplied to both substation 5's load and substation 2's load. When the reverse current flow flows in the circuit, reverse power relay in the MRS will get tripped off. So, the number of tripping action of RPR is reduced as much as possible and the solar power utilization is increased.



4 . Position of RPR finally.

Solar power emerges as a concrete alternative for a sustainable and environment-friendly growth of the world energy supply [4]To improve the solar power generation in shop 1 we inspected the roof top solar panel. Then we found that the deposition of cast iron shavings and dust on the solar panel layer from the exhaust fan of that particular shop for this we proposed a solution. The solution is to provide exhaust fan duct. Then we recommended them to change the maintenance schedule. Initially the maintenance of solar panels were done only once in a week (Sunday)

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Roof top Solar panel

4. CONCLUSION

After our proposal idle time power loss is reduced as minimum. This is done after grouping the transformers. Now,upto 100 units of power can be saved.

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Various changes were done in the solar power generation in shop 1 by providing the duct and changing the maintenance schedule from once in a week to twice in a week.

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