CHAPTER 7

DISCUSSION, CONCLUSION AND RECOMMENDATION

7.1 Discussion

The concept of feeding reactive power is a well-known solution to eliminate the low voltage issues occurred along the feeder. Installing capacitor banks are the most common method and that's a separate cost added activity. The installation of capacitors can be done in both ways by the customer or by the utility. I have gone through many of the research papers and various proposals of analyzing the results of installing capacitor banks in either customer or utility sides.

With the rapid popularity of renewable energy concept in the world, Sri Lankan Government also has started to motivate to add more renewables to power system. Under that concept Government has invited the customers to install more solar power generation modules and feed active power to the utility. Considering electricity generation by solar power many of the researches have made with several proposals to increase the efficiency of the generation or methods of store generated energy. Due to the absence of solar power at night, the generating module is not 100% utilized for full day.

According to the load curve of the Sri Lanka the peak of the demand is occurred at night time where the solar power generation is totally equal to zero. Therefore the installed PV inverters can be used to feed reactive power by changing the power factor in which the efficiency of the solar generation module can be fully utilized. Several researches have been carried out regarding this concept but this is totally new to Sri Lanka.

Since the Sri Lanka has a small grid system mainly controlled under one utility and even the concept is benefited, it is needed to be controlled to avoid several adverse circumstances. This research thesis theoretically identifies the concept and to avoid the practical issues such as over voltages, proposes a theoretical algorithm which calculates "Optimum Operating power factor" for each PV inverter installation.

"Sensitivity Factor" was introduced to identify the critical locations where it is necessary to attend first, under the limitations of "over voltage". The operating power factor for each PV inverter (which the customers who accepts to feed reactive power at night peak) needs to be decided by the utility according to the behavior of the particular power system.

"Rewarding Method" is also proposed to encourage the customers and to utilize their inverters at night.

This research thesis discussed the whole concept with the modification which is suitable for the Sri Lankan Power System.

7.2 Conclusion

According to the case study when selecting the optimal operating power factor for the existing installed PV inverters, conclusions can be finalized as follows.

1. Even with the small capacities of distributed PV inverters can be used to eliminate the low voltage for some extent. According to the case study it fixed the voltage around 80m of the feeder.
2. Since the concept is introduced for the night peak solar generation module is mostly utilized and the efficiency of the installation increased.
3. Due to the reduction of reactive power feeding from the transformer it has reduced the total line current and caused to reduce the power loss of the total system. According to the case study the reduction of power loss is 9.26%.
4. Even after the rewarding back to the customers the net saving due to the feeding reactive power using the installed PV inverters to the utility is positive and according to the case study it is nearly 185000 LKR per year.

7.3 Recommendations

As per the research, when promoting feeding reactive power with existing installed PV inverters following recommendations can be made.

1. The behavior of the feeder parameter values at the night peak needs to be analyzed such as voltage, power loss along the feeder before computing the

power factors. By analyzing the whole feeder under the limitations the operating power factor for each inverter has to be decided by the utility and to be informed to the customer.

2. Solar inverter manufactures have to manufacture their products with the provision of changing the power factor setting by the user and with the ability to program the setting on hourly basis.
3. General Public, including the customers who wish to connect solar power generation module, are need to be educated on selection of proper PV inverters which are capable of operating in reactive mode as well.
4. The rewarding method for reactive feeding by PV inverters needs to be introduced to customers in order to encourage them maintaining the stability of the system voltage.

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