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ABSTRACT

India is considering renewable energy sources (RES) like solar and wind as an alternative for future energy needs. As on April 30, 2016 the grid interactive power generation from RES is 43089 MW i.e. around 14.15 % of the total installed energy capacity. Further Ministry of New and Renewable Energy (MNRE), Government of India is targeting to achieve 100 GW grid interactive powers through solar and 60 GW from wind by 2022. However there are various issues related to grid integration of RES keeping in the view of aforesaid trends it becomes necessary to investigate the possible solutions for these issues. Integration of renewable energy sources to utility grid depends on the scale of power generation. Large scale power generations are connected to transmission systems, whereas small scale distributed power generation are connected to distribution systems. There are certain challenges in the integration of both types of systems directly into grid. This thesis presents some of the issues and challenges encountered during grid integration by Solar photovoltaic (SPV) with possible solutions.

The proposed study analyzes the reduction of power loss and fluctuation in the main grid by the integration of distributed solar power through several small micro grids connected to the main grid. These fluctuations are mainly due to seasonal condition and cloud passing over the solar plant. In this thesis, a novel method is proposed where the power generated

from SPV using several small micro grids which are geographically distributed in a 100 km radius are integrated. All the five stations which are generating a certain amount of power say x MW are connected to the main grid at a common point. The collective fluctuation is monitored and compared for each of the sites against a system generating total equal amount of five stations at a single location. It is found that the geographically distributed generation produces less fluctuation in the grid.

The optimal sizing and determination of optimal location for SPV based distributed generation is almost a prerequisite for proposing a complete analysis. An analytical approach is used for optimal size and location of SPV based multiple location distributed generator (MLDG) in primary distribution system. The main objective of this research includes power loss reduction and voltage profile improvement along with economic benefits. Economic analysis is also carried out for a life time of 25 years of SPV, and it has been found that the proposed system is highly cost effective.

Managing the grid is always a dynamic and challenging task due to the fact that during the peak hours, the power demand is too high compared to the base load. One way to provide effective grid management is to shift some type of load to off peak hours or supply such loads through alternate sources of power and disconnecting them from the grid. Here, A case study of Faculty of Engineering and Technology, Jamia Millia Islamia, New Delhi, India is carried out for effective grid management.

In this proposed work power fluctuation reduction from SPV, optimal placement of distributed generation, techno economic feasibility analysis of solar energy followed by grid management has been presented.