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Analysis of Recent Technologies Introduced in the Electric Power System

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Abstract

This paper examines the impact of technologies recently introduced in the electric power system. The penetration of distributed generation, smart grid and micro grid in the power system in recent years leads to number of technical, economic and environmental benefits. The overall improvement in the electric power system due to these technologies was need of the hour. A lot of work has been carried out regarding proper placement of distributed generator in the network. However, it is found that distributed generator operated by non-conventional energy sources always found beneficial in many ways. Addition of smart grid and micro grid further enhances power system efficiency, economy and reliability.

Key words: Distributed generator (DG); Smart Grid; Micro Grid; Power System

I. INTRODUCTION

During last few decades the whole world was busy in carrying out reforms in their electric power industry. This was required because of the fact that economic, social, academic developments are impossible without electricity. The per capita consumption of electricity indicates the prosperity of the country or rather to say decides whether the country is developed or not.[1] There were number of objectives behind the reform, such as creating competition among utilities to have lower energy prices with increased reliability, price transparency as demanded by the consumers, regulation of cross subsidies among different users, increase efficiency of the utilities, unexpected growth in energy demand particularly in developing countries, pressure on government to raise fund for economic as well as overall reforms and to raise funds for social services etc.[3]

The above objectives could have been achieved by using advance technologies in the power system, by reducing technical as well as commercial losses which is a big challenge for all electric utilities all over the world by reducing subsidies given to different class of consumers etc. As far as use of advance technology is concerned, penetration of distributed generators based on non-conventional sources of energy at different position in the distributed network improves the efficiency, economy, technical quality of the distributed network.

Smart grid is advance version of current grid system. In current grid system power plant supply electricity to consumers and there is no communication from consumer to utility. Smart grid system is a two way communication. A micro grid is semiautonomous grouping of generating sources and consumers.

II. Case Study

The electric power generated by conventional sources such as coal, gas, nuclear power etc. cannot be generated at any place. Such power plants can be constructed at suitable locations only. Hence such power plants are centralized and to transmit electric power to load centers, a large network of transmission and distribution system is required. The large network of transmission and distribution system requires large capital investment as well as power loss during operation. However, electric power generated by non conventional energy sources such as wind energy, solar power etc.[6] can be generated in small quantity at almost any location. Hence such types of generating stations are



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decentralized and need no large transmission and distribution network. Such generating stations are called distributed generators and are located at or near the premises of end consumers which provide incremental capacity to power system. In the deregulated power market, concerns about the enviournmental as well as economic issues have led increased interest in distributed generation [7].

The alternative to conventional energy sources like electric energy converted by sun energy, wind energy, geothermal energy etc. are found to be very promising in near future. Their input cost is zero and can be generated near to end consumers thereby avoiding huge capital investment in developing transmission and distribution network. The present condition of electric market is demanding tremendous transformations in order to control instability in the prices, ageing infrastructure, enviournmental challenges, unexpected growing demand of electricity, and social as well as political pressure on electric utilities. Distributed generators are expected to play a key role in the future electric market because of their economic viability and unending power. As per study conducted by electric power research institute (EPRI), that the 30% of power generation will be shared by distributed generation in near future. Apart from economy other factors which led to increasing interest in distributed generation placement in our power system are saving in conventional sources reserves, increasing conciseness of enviournmental protection etc.[2]

Distributed generation unlike centralized electric generation aim to generate electric energy on small scale as near as possible to load centers. Now days, even small individual consumers are installing distributed generators at their own premises and such consumers are then almost independent of electric utility. [13]

As stated before, smart grid is the advanced version of Current grid. Current grid supply electricity to its consumers and it is a one way communication system. Whereas, smart grid is a two way system, i.e. communication from both sides, from utility to consumer and vice versa using analog or digital information and communication technology.[9]

The smart grid will take electric industry into a new era where reliability, avlaiblity, economy,

efficiency, quality of power supply will be as required. Also it will be enviournmental friendly. [10]

The smart grid will be equipped with all the latest technologies, innovations, devices and equipments. Hence smart grid will have the quality to transmit power more efficiently, restore power system after disturbances more quickly, reduced operational and maintenance losses will be able to reduce peak demand, will be able to penetrate renewable energy sources at large scale in the power system so that carbon-di-oxide emission will be reduced. Smart grid will provide full help and knowledge to its consumers having their own distributed generation to sell surplus power back to utility etc.[5]

Micro grids are local grids which are formed by interconnection of some distributed generators and consumers. The micro grid can be operated independently as well as can be connected with the traditional grid. When connected with the traditional grid, micro grid provides good quality of electricity and helps the electric utility to reduce transmission and distribution losses and number of another economic, technical and enviournmental benefits.[12]

During any kind of disturbances in the traditional grid, micro grid is operated independently and supply electric power to its consumers. [11]

III. CONCLUSION

Due to day by day advancement in technologies related to sun energy, wind energy and other nonconventional form of energies, placement of distributed generators operated by non-conventional energy sources in distribution network is increasing exponentially. Though due to continually changes in weather conditions, the distributed generators operated by solar and wind energy creates continuity and stability problems but even with these problems their benefits cannot be ignored and distributed generator placement in distribution network will always be beneficial due to number of economic and enviournmental factors.



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Through collecting, using and sharing of renewable energy, the distributed generation, micro grid and smart grid solve the energy crisis. The micro grid is in the stage of building demonstration projects, although the smart grid is at the initial stage. Worldwide, it has become a vision of future to developed smart cities.

The future of electric industry depends on all the three technologies described above. In future, conventional energy sources will be no more. The world has to depend upon non-conventional sources only. The smart grid and micro grid will play very important role in managing activities of electric industry so that electric industry will provide its services to consumers as per their requirements. There will be no load shading, no blackouts and no shortage of power. A lot of research work is required to enhance capability and reliability of distributed generation as well as to fulfill the dream of perfect micro and smart grids.

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