International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 05| May 2021 www.irjet.net p-ISSN: 2395-0072

Incorporation of Renewable Energy in Smart Grid

Anjali M. Kotwal[1], Mehul M. Kotwal[2], Nikhil S. Khapare[3]

[1]Graduate Mechanical Engineer from SNJB KBJ College of Engineering, Chandwad, Maharashtra, India.
[2]Student, Shri HHJB Polytechnic, Chandwad, Maharashtra, India.
[3]Graduate Mechanical Engineer from SNJB KBJ College of Engineering, Chandwad, Maharashtra, India.

Abstract - *Due to environmental issues and fossil fuels elevated cost the renewable energy sources have increased remarkably. Grouping of renewable energy sources to utility grid rest on the scale of power generation. Large scale power generations are attached to transmission systems however small scale distributed power generation is attached to distribution systems. There are several hassles in the integration of both types of systems altogether. Because of this, wind energy has achieved a lot of investments from all over the world. Yet, due to wind speed's unidentified behavior it is tough to obtain good quality power, while wind speed fluctuations reflect on the voltage and active power output of the electric machine linked to the wind turbine. Solar gap also varies the voltage profile and frequency response of the system and adapts the transmission and distribution systems of utility grid.*

Key Words: *Renewable Energy, wind speed, Grid Integration, Smart Grid, Renewable energy sources*

1. INTRODUCTION

Renewable energy technologies like solar and wind have enormous potential to lessen both negative environmental impacts from electricity generation and greenhouse gas emissions, incorporating these technologies into the electric power grid poses ongoing technological and institutional challenges. Large-scale improvement of renewable power needs upgrading of the electric power grid: both the high voltage transmission desired to integrate and transport electricity generated from significant and variable renewable energy projects and schemes and the low-voltage distribution linkage needed to integrate small-scale, decentralized renewable energy. The term "smart grid" exemplifies these advances and contains a broad array of individual technologies including advanced meters, energy storage, sensors and others that are essential for the integration of more renewable and low carbon electricity into the electric power link. Smart grid also incorporates the development of new standards, systems to increase reliability, management practices, ensure affordability and manage temporal and spatial variability of renewable electricity generation. Smart grid has the ability to deliver numerous social advantages containing an extra reliable and protected energy sector, a more powerful economy, a tidier environment, and an empowered population involved in energy system management. In different contexts and among different key actors, the potential benefits (and risks) of smart grid are ranked differently. Although the critical links between a "smarter" grid and renewable energy are among the most prominent explanations for smart grid, the several promises of smart grid effect in a complex policy discourse that spreads beyond connections between smart grid and renewable. Building a smarter grid involves the evolution of intertwined technical and social systems connecting public and private stakeholders at regional, federal and state levels.

1.1 ROLE OF SMART GRIDS

Maximum part of the world depend on electricity system built around fifty years ago. These are unproductive and cannot offer an appropriate response to today's urgent global arguments. This poses an imminent need and opportunity to shift towards a low carbon, efficient, safe and clean energy system. Smart Grids will be an essential enabler in this conversion. Smart grid is a growing network of transmission lines, equipment, controls, devices and new technologies working together to react immediately to our 21st Century demand for electricity. It makes possible efficient and reliable end-to-end intelligent two-way delivery system from source to sink. In this way the system brings efficacy and sustainability in meeting the rising demands of power with reliability and finest of the quality. Smart Grids also enables real time monitoring, examining and control of power system. The fundamental objectives of Smart Grids is to commence active participation of customers, accommodate renewable energy generation and storage options, enable new products and services which would provide a better economy, optimize strength utilization an[d operate efficiently, address disturbances through automated prevention, containment and restoration and operate resiliently in contradiction of all hazards.

Present-day grids were designed to deliver electricity to the consumers and bill them on time in a month. The energy requirements have been increasing and it has become

difficult for the existing grids to cope up with it. Smart Grids presents a two-way transmission where electricity and information can be transacted between the customers and utilities. Smart Grids integrates advanced new technologies, Smart meters and there is a facility for data monitoring and control. It also incorporates renewable energy such as the wind and solar energy to the grids. In addition, the consumers can manage their electricity usage by measuring the electricity consumption through the Smart meters set up at their homes. Smart instruments can be created which would regulate their run schedules to lower electricity demand on the grid at critical times and lower the energy bills. Electricity is more expensive during peak times because additional and often less efficient power plants must be run to meet the elevated demand. Smart grids will enable utilities to manage and moderate electricity usage with the assistance of their customers. Operators can fare the electricity consumption in real-time. The current distribution system is inefficient and any break in this system due to ruinous weather or storms or sudden changes in electricity demand can lead to power outages. Smart Grids division intelligence counters these energy variations and outages by automatically recognizing problems and re-routing and rebuilding power delivery.

2. GENERAL FEATURES OF SMART GRID:

Smart grid has various characteristics and can be distinguished as follows:- a) Adaptive and scalable to varying situations b) Interactive with users and markets c) optimized to make the best usage of resources and equipment d) Pro-active instead of reactive to prevent emergencies e) Self-healing grids with advanced automation f)Integrated, merging monitoring, control, protection, g) Maintenance, EMS, DMS, AMI, etc. h) ICT solutions i) Having plug-and-play – features for network equipment j) Safe & reliable k) Cost efficient l) Offers real time data and monitoring Traditional grid includes centralized power generation, and at the distribution level unidirectional power flow and ineffective market integration. Smart grids comprise centralize power generation produced considerably by renewable energy sources. They assimilate spreader and active resources, into energy markets and power systems. Smart grid is the electrical network that smartly brings together producers and consumers to efficiently deliver electricity which is sufficiently capable and coverage area accessible, safe, economic, reliable, efficient, and sustainable. Smart grid development manages to be driven by one of the two principal visions for enriching electric power interactions for both utilities plus end use customers.

3. ISSUES OF RENEWABLE ENERGY SOURCES SYSTEMS – GRID INTEGRATION

Wind Energy System:

Due to convenience of wind renewable energy sources, wind energy production is growing day by day to develop rural electrification, increase job opportunities in technology. But there are some restrictions to the strong wind energy into the grid. Wind speed forecasting has high insecurity, high volatility and low probability reduces the system safety and wind revenue. Problem in maintaining voltage profile. Most of the wind turbines are connected with SCIG, which are not able to aid reactive power within the system. More stress on breaker, transmission line, bus bar at the time of error occurs, due to extreme penetration of wind energy resources due to minor fault ride-through (FRT) capability of wind generator. High pungent of wind energy generates stability problem, and probable blackouts thus wind energy penetration is regulated by ATC (available transfer capability) of the system. Frequency behavior of the system also coins with wind pungent due to lower inertia of distributed wind generators. Finally, wind energy pungent trim down overall efficiency and power quality

Solar Energy System:

The massive amount of solar energy is obtainable on the earth. Humans use almost 15 TW of solar energy. Customers are interested in solar power due to little cost, environment friendly, adaptable installation and no reactive power consumption by solar panel. But constrictions of solar generation are: high installation cost of solar panels, uncertainty of solar irradiance, low generation capacity, and power oscillation due to intermittency behavior of sunlight. Solar pungent also changes the voltage profile and frequency reaction of the system. PV system is drawn with unity power factor and the features of output power are reliant on the inverter. Since photovoltaic system has no inertia, some additional devices are required to maintain frequency oscillation..

CONCLUSION:

In contemporary years in the power production and circulation system displays that penetration level of DG into the Grid has improved considerably. End user appliances are becoming more precise to the power quality condition. This Case grants a technical review of causes of Power quality Problems allied with renewable based distribution generation structure (wind energy, solar energy). Voltage decrease with

wind penetration and increase with solar perforation. To lessen the fluctuations and irregular problems power electronic devices are feasible options. In addition, energy storage and usage of dump load could be used for decreasing the power fluctuations in PV systems. The up-gradation in stability of systems by incorporating the fresh materials and storage elements could reduce the difficulties linked with grid integration.

References:

1. "Smart Grid Technology: Applications and Control" Indrajeet Prasad. International journal of advanced research in Electrical, Electronics and Instrumentation engineering. (IJAREEIE) vol: 3, Issue: 5 May 2014

2. Sheetal Munje. Et al. "Renewable energy integration into smart grid-Energy storage, Technologies and Challenges". International research journal of engineering and technology (IRJET), Vol: 4 Issue: 6

3. Abdulhakim Khalf Alsaif, et al "Challenges and benefits of integrating the renewable energy technologies into AC power system grid American journal of engineering research (AJER) vol: 6, Issue: 4, pp-95-100

4. "Issues, Challenges, Causes, Impacts and Utilization of Renewable Energy Sources-Grid Integration" Er. Mamatha Sandhu, Dr.Tilak Thakur, International journal of engineering research and application (IJERA) vol: 4, Issue: 3, pp-636- 643