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Review on Design and Modeling of Hybrid Power Generation System using Renewable Energy Resources

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Abstract –

Renewable energy is an alternative solution for power generation in the day today life. Power generation from conventional energy is having a drastic effect to the environment and the ecological life of humans. The energy from renewable sources is abundantly available over the universe. Energy from renewable sources is clean, eco friendly, efficient and reliable. Solar and wind are gaining much importance in the present world. In this project, recent trends in power electronics for the integration of wind and solar power generators are presented. Discussion about common and future trends in solar and wind energy systems based on reliability and maturity of each technology are presented. Power Electronics interface not only plays a very important role in efficient integration of Wind and Solar energy system but also to its effects on the power-generation system operation especially where the renewable energy source take and special place of the total system capacity. However there are various issues related to grid integration of RES keeping in the view of predicated trends it becomes necessary to investigate the possible solutions for these issues.

Key Words: Renewable Energy System, MSEB Power, Power Load, Change over Switch, Controlling Unit.

1. INTRODUCTION

Renewable energy resources are going to become alternative for future energy needs. India is a country of different size and this is helpful in balancing the variable output of renewable energy sources located in some states by integrating them into all India grids. Government of India targeting to achieve 20000 MW grid interactive powers through solar and 38500 MW from wind by 2022. Wind energy and Solar energy, are considered to be the main attributes of renewable energy for electricity generation, and are growing at faster rate for the last twothree decades. Renewable generation from wind and solar has increased substantially during last few years and forms a significance proportion of the total generation in the grid. Three main factors are impacting the future electric systems of the world; government policies, efficiency need of the consumer, and the introduction of new intelligent computer and hardware technologies. Environmental concern have created the governmental policies around the world, including at the federal and state levels, which on flow the entire energy system to efficiency, conservation, and renewable sources of electricity . These factors are the main drivers that are expanding the use of all sorts of new renewable energy and storage technologies on one hand and new energy efficiency and conservation techniques on the other hand.

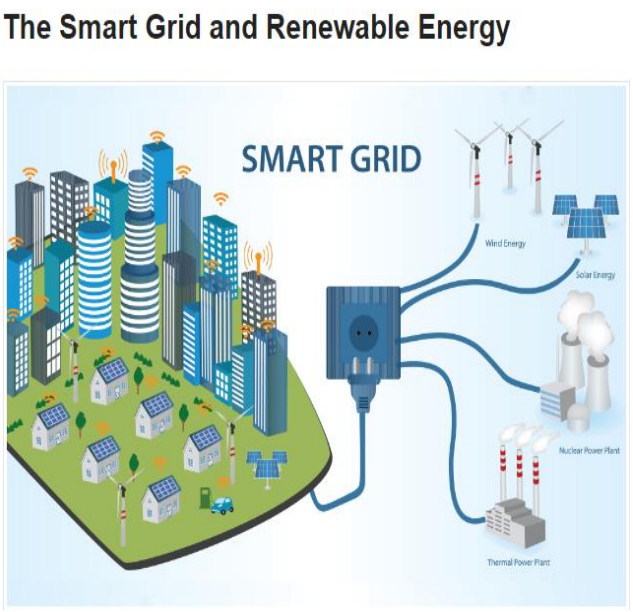

Figure-1 the Smart Grid and Renewable Energy

Consumers are becoming more proactive and are being empowered to engage in the energy consumption decisions affecting their day-to-day lives. At the same time, they are expanding their energy needs. Example are consumer participation will ultimately include extensive use of electric vehicles (both cars and trucks), remote control of in-home appliances to promote energy conservation, ownership of distributed generation from ever more renewable energy sources, and management of electricity storage to locally match supply to that demand.

The availability of new technologies such as more aware about SCADA sensors, secure 2-way communications, integrated data management, and intelligent, autonomous controllers has open up opportunities that did not exist even a decade.

2. Literature Review

H. Gharavi and R. Ghafurian[1] says that "A smart grid (SG), also called next generation power grid, is generally defined as the aggregation of emerging technologies, hardware, software and practice that make the existing infrastructure of power

grid more reliable, accommodating, secure, resilient and ultimately more beneficial for consumers".

A. Thomas[2] says that "In conventional power grid a large number of customers are generally fed from a few central generators while in the smart grid bi-directional transfer of power and information occurs that makes the delivery network distributed and automated. The recent development in the power system allows the seamless integration of alternate form of energy production sources into the existing power grid".

X.P. Zhang [3] said that "However, the alternating and discrete characteristics of these sources is the major barrier in integration to the smart grids that can be handled by the deployment and effective use of

control modes. This not only cause the improvement in performance but also the operational hours of these sources will be increased".

The most exploited renewable energy sources are hydel energy, wind and photovoltaic source. The share of the renewable energy production to global electricity demand is increasing continuously and it was about 20% at the end of 2011. However, these sources vary in requirements for their abstract in main streamline. Issues such as the efficiency, reliability and security in power

System forces the operators to exploit widely distributed renewable energy sources and deploy them rapidly into grid. These sources are helpful to environment and also to human health due to less pollution generated. Risk associated with others plants such as disruptions in fuel supply due to international conflicts, problems in transportation and unavailability of unit can also be overcome by the onsite small scale renewable generations. Renewable energy resources can be used for

Power generation as isolated system but their benefits are significantly enhanced when they are integrated into electric utility system. With greater use of smart grid enabling technologies, higher degrees and rates of penetration can be accommodated. Integration of variable natural renewable energy resources require a huge modification in existing network operation which may in due time lead to increase in electricity cost. In ref. U. Helman said that [4] "problems are mentioned related to intermittent nature of RER" and "these problems are clearly demonstrated in ref. [5] said by S. Kiliccote". Cameron W. Potter [6] also describes "the variation aspect of RERs in the integrated power system that is named as daily, monthly and yearly variability. For the ability and stability of modern grid, the understanding of this variability is vital".

2. Body of Paper

Energy is an important factor for the human development and a reason influencing the global prosperity. This system supports the economic growth, human living and the quality of growth of a nation. The energy from limited conventional source which are available has major drawbacks to the present and future ecological balance and safety both locally and globally respectively. We all known fact that the world's existing main energy resources will be depleted in a few years' time throughout the globe. Therefore, in todays more energy demanding world, available renewable energy sources which is clean, non-polluting and eco friendly is a better option which is free for everyone. Renewable energy is a continuous and unlimited form of energy available in plenty from the natural sources such as sunlight, wind, rain, waves, geothermal heat and tides etc. Power generated from the natural sources are carbon free with less pollution and capable enough to compensate the energy generated from coal and other fossil fuels thus preserving these resources for the future generation of human beings and other living things.

To meet the energy crisis demands, India so much depends on conventional and non-conventional sources of energy generation. It is the duty of the country to meets the growing needs at a reasonable and reliable ways to generate and supply the requirements. India has a wide access to all means of energy sources both renewable and non-renewable capabilities. The main source of power generation in India is from thermal energy which is around 67percent of the total installed capacity by 2017 till now and goes on. Renewable energy stands in second position in contributing power to the total capacity of generation and hydro stands in the third position

The hybrid energy systems aim to combine solar and wind energy connected to grid with controlling techniques for maximum power generation. The benefit of hybrid power generation unit coupled to grid is that, at times of any shutdown occur in the production from renewable sources like, the solar or wind energy the grid can act like a source or a backup system to the loads. The excess energy generation from the renewable resources is stored in the grid system and is supplied to meet the load demand at the time of requirements. The hybrid power generation is a best solution in coming future because the seasonal variations for the sun and wind can be solved on combining the energy and output performance is improved to meet the demands.

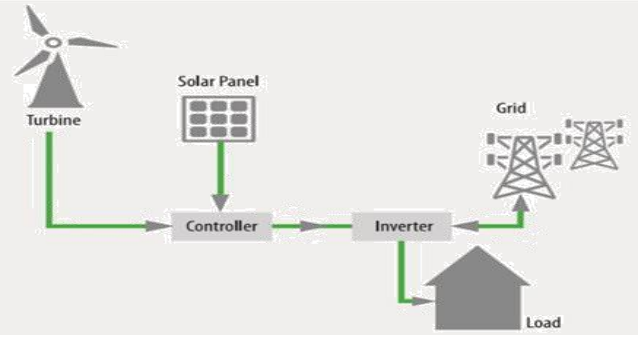

Fig 2 Schematic Dig of Hybrid Solar-Wind Energy

The figure 2 represents the schematic diagram for a hybrid power generation using solar and the wind energy system. In the proposed system two energy resources are combined

through controlling techniques before powering the grid or the load. The solar energy from the sun with the help of MPPT technique is fed to converter to produce a regulated DC output and this output is fed to inverter to form AC output. The mechanical energy produced by the wind turbine is converted to electrical energy using generator and is fed to inverter of the system. Both the output are combined and supplied to the AC grid generator. Due to available seasonal variations of sun and wind, and for continuous power generation, a hybrid system plays a significant role by combining solar and wind energy.

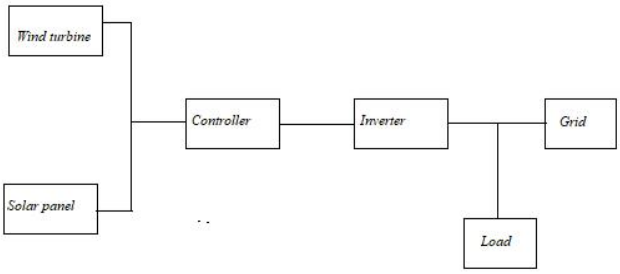

Fig 3: Block Diagram of Hybrid Energy System

The above figure 3 is the block diagram for a hybrid energy generation system using the solar and wind power resources. The figure gives an overall idea of the hybrid system energy generation. The energy from sun is captured and transformed for generating power for that tracking technique is used to utilize the maximum available power from energy resource through the proposed system. The tracking Method used is Perturb and Observe (P&O) scenario. The utilized power is sent through a boost converter to step up the solar DC output power to supply to the inverter to process the energy produce. Inverter converts the DC power to AC power energy. A three-phase inverter is used to transform the input to AC to supply to the grid to meet the energy needs to the applications. Likewise, the energy from wind is transformed to useful form with a wind turbine capturing the rotating wind speed and converting to mechanical energy. The energy from wind is transformed to electrical energy with generator. The generator used is permanent magnet synchronous generator. The generated power is sent to the grid to meet the needs.

3. CONCLUSIONS

Smart grid technology is an extended form of analog technology that has also been introduced for controlling the use of appliances by employing two-way communication. However, the prevalence of Internet access in most homes has made the smart grid more practically reliable to implement. Smart grid devices transmit information in such a way that enables ordinary users, operators and automated devices to quickly respond to changes in smart grid condition systems

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