POWER QUALITY IMPROVEMENT OF USING STATCOM

Mr. Shubham G. Tamse[1], Dr. S. B. Mohod[2]

Student, Prof. Ram Meghe College of Engineering and Management, Badnera

Professor, Prof. Ram Meghe College of Engineering and Management, Badnera

ABSTRACT:

The integration of small decentralised renewable generation units (DG) and the conversion of existing energy is motivated by increased energy demand due to rapid industrialization, environmental concerns with fossil fuel-based generation, diminishing fossil energy resources, transmission grid overloading, and deteriorating technical performance. Optimizing the technical advantages of a DG placement is a well-known challenge for Distribution System Operators (DNOs) for DGs based on fossil and renewable energy resources, but renewable DG systems face additional challenges in network quality, as electricity loads are more sensitive to PQ disturbances, and renewable energy penetration is increasing. Due to the ongoing transformation of traditional distribution networks through the incorporation of renewable sources, technologies are becoming unavoidables. This article provides a comprehensive analysis of the network quality challenges in the network integration of renewable DG systems, as well as the current state of research on corresponding mitigation techniques, theoretically emphasises all of the critical network quality challenges associated with renewable energy network integration, and, secondly, creates a matlab model of distribution li We may conclude the benefit of STATCOM by observing various faults and putting rectifier load on line with and without STATCOM. This paper is intended to help academics and industry professionals better grasp current PQ difficulties, PQI approaches, and future renewable energy research standards.

Keyword: Solar photovoltaic, Wind energy, Hybrid PV-Wind system, STATCOM, Voltage stability.

Introduction:

The interest in renewable energy sources (RES) has increased significantly in recent years due to the increasing energy demand and awareness of environmental protection.It goes without saying that RES is a means of pollutant-free, harmless, tame and sustainable energy generation and its penetration spreads by itself worldwide by leaps and bounds. 1,2 The increasing spread of renewable energies can be demonstrated and understood in Figure 1A, which shows the relative increase in the consumption of renewable energies between 2004 and 2016 in the member states of the European Union (EU). Member States, Iceland and Sweden.3 Figure 1A clearly shows that 11 Member States achieved their targets for 2020 in 2016 only through exceptional performance in the field of renewable energies in the 12-year period under consideration. and France are further away from their planned targets with 72.6% of their energy from renewable energy sources, Iceland had the most in 2016, followed by Norway and Sweden from the EU group. Solar thermal, photovoltaic. takes into account water, wind, geothermal and biomass energy. However, the above-mentioned advantages of using energy from renewable energies go hand in hand with a certain power quality.The power quality is an aspect that is decisive for the reliability in intelligent distribution networks and therefore takes into account must be that is inevitable. The use of energy from renewable energy sources requires that the generating units are integrated into the networks of the distribution network.

The stable operation of grid-integrated renewable DG systems is a difficult task due to the associated PQ challenges due to environmental fluctuations and differences in the generation technology of DG systems based on fossil fuels, which are a constant source of energy. 48 Only smooth integration and the stable operation of such integrated DG systems can make the idea of future intelligent networks a reality. In recent years, the widespread integration of power electronic inverters, employees, integrating DG units into the network, has created considerable attempts and difficulties for power distribution networks, especially harmonics. Distortions and complications to achieve frequency stability due to the decrease in general inertia. 911 Generation technologies based on power electronics (PE) instead of traditional synchronous generators and the intermittent nature of RES are the main culprits of PQ problems in renewable DG systems PQs are main concerns Voltage fluctuations at nd frequency, which are caused by the uncontrollable inconsistency of renewable energies Model for evaluating voltage fluctuations in sunny and cloudy weather situations with a photovoltaic (PV) DG system The study showed that the solar radiation inte The noise caused by the movement of the clouds Fluctuations in voltage, frequency and power. Four areas were examined: the effect of cloud transient slowing down on PQ performance; the effect of rapid transients; Effect of harmonics on the DG system; and the overall performance of the distribution network with the intention of evaluating the overall performance of the system under conditions of high photovoltaic The report concluded that the penetration rate of up to 37% does not pose any significant problems. Automation in industrial plants is generally prone to voltage drops, as some control devices in your systems do not need to be used in the event of voltage drops. 1820 voltage drop score limits of 4% are recommended as the threshold value for each bus in the European standard EN 50160.21. It has been shown that power distribution systems are more susceptible to power fluctuations in the medium frequency range than ranges from 0.01 to 0.1 Hz, at which most wind power fluctuations exist.22 The limit values for the frequency regulation ratio (FRR) of 1% are set in of the IEC61000 standard is used as the threshold for each bus.23 The second major concern of PQ is harmonics. Harmonics associated with DG systems can be divided into two categories and taken together they can cause excessive degradation of the PQ at the common point of coupling (PCC). Harmonics of the first category are generated by the power electronic inverter interface, which is used to integrate RES and feed real power into the grid) in the network together with the expected active power share of the current. 2628 Harmonics of the second category are caused by locally connected non-linear loads on the PCC. Harmonic distortion causes various problems such as resonances, overheating of lines, cables and transformers and faulty protection trips.

Proposed methodology:

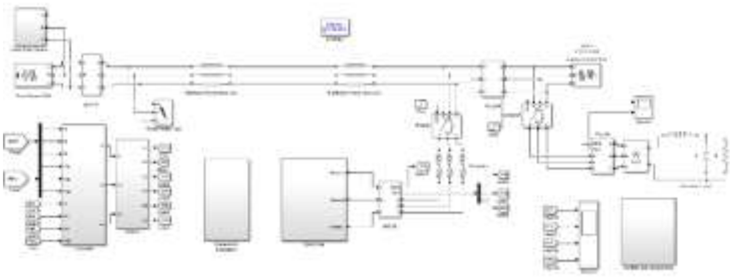

Figure 1 Distributed line with STATCOM

The final model in this work is built using two scenarios: in the first, a distributed line is formed using STATCOM, and in the second, a distributed line is created using STATCOM. The AC load is connected to the receiving side in this model, and a rectifier load is added to add harmonics. It lasts a reasonable amount of time, as do the disturbances caused by three-phase faults, which cause the system to slow down from 0. 8 to 1.2 seconds .

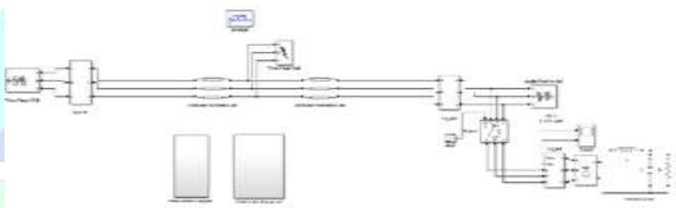

Figure 2 above describes the Statcom model

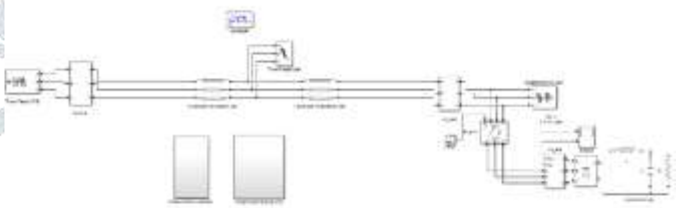

Figure 3 Distribution line without STATCOM

Figure 3 depicts a distribution line without STATCOM; in this model, just the AC load on the receiving side is connected, and the rectifier load is connected to generate harmonics in the line. Case 1 is B, where the load is applied online to generate harmonics for more than 0.5 seconds, and case 2 is B, where many errors are applied online for a period of 0.8 seconds to 1.2 seconds .

RESULT

A) Result for with STATCOM model

Case 1: only rectifier load for harmonics generation

In case 1 model is run with AC Load containing harmonics above 1.2 sec, this harmonic is negligible by using statcom. also, at after 0.8 sec fault is occur on line the effect of fault on line is less as compare to without STATCOM model.

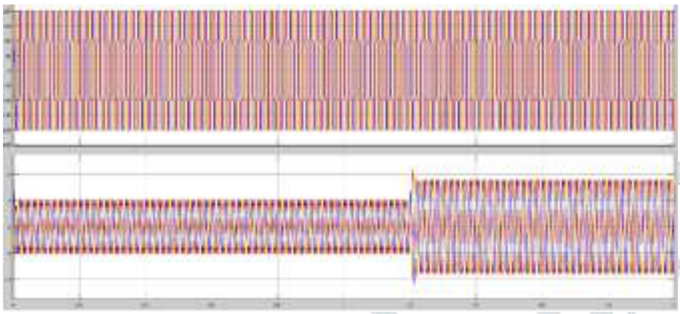

fig: 4 model with harmonics at source

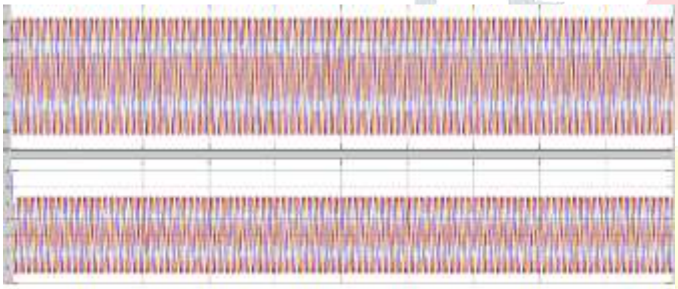

fig:5 model with harmonics at load

case 2 : fault at load side with STATCOM

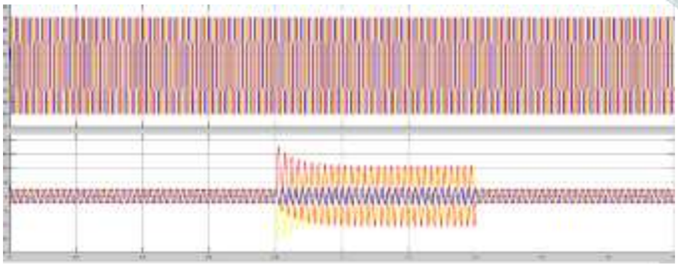

Fig.6 LLG fault on load side

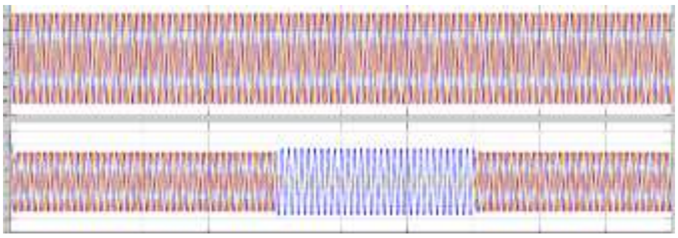

fig.7 LG fault on load side

B) Result for with STATCOM model

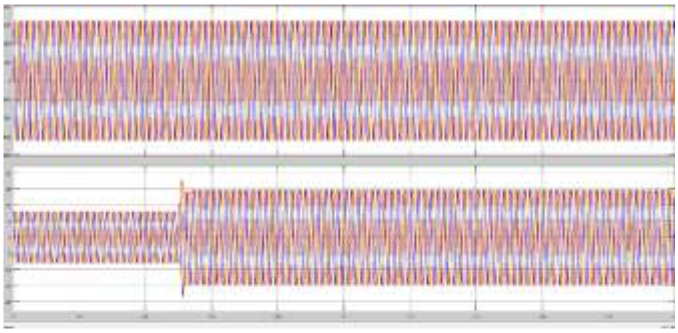

Fig 8 model with harmonics at source

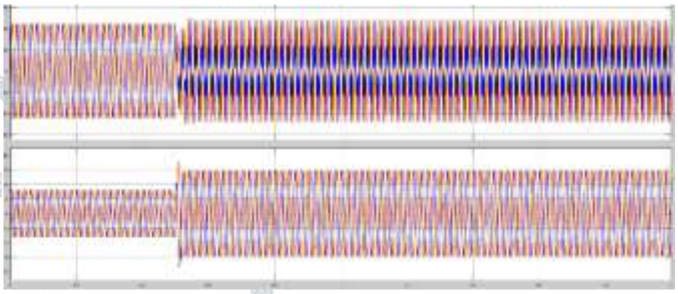

fig:9 model with harmonics at load

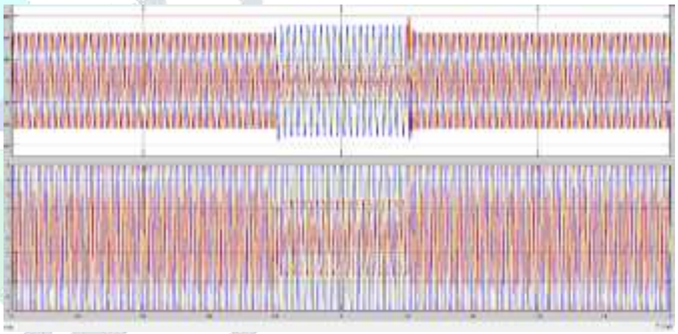

Fig.10 model with LG fault on source

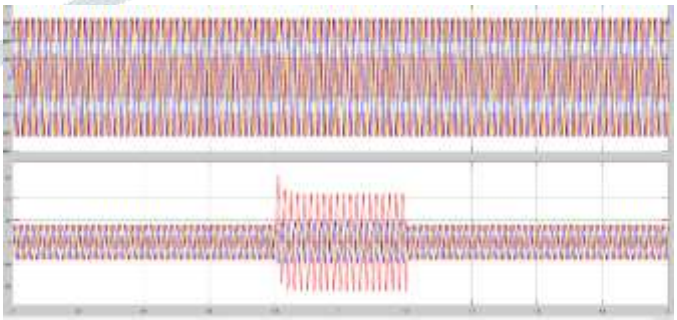

fig.11 model with LG fault on load

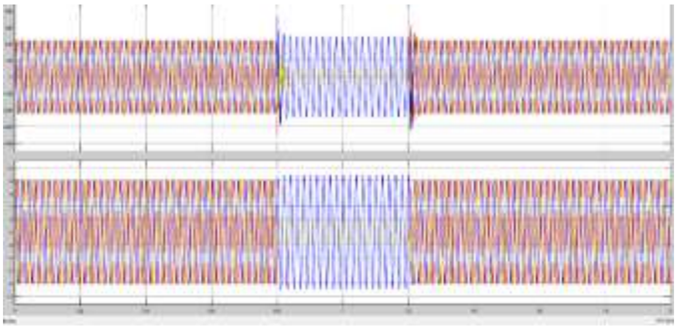

Fig.12 model with LLG fault on source

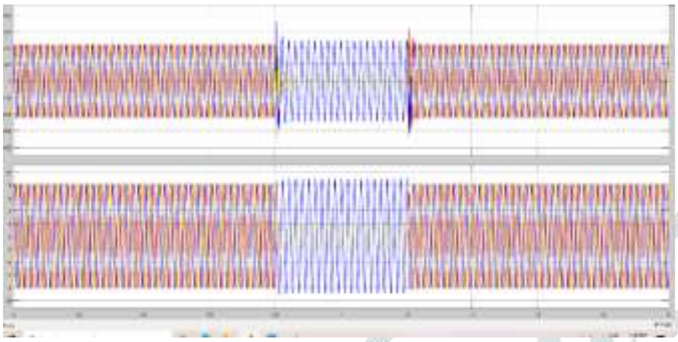

fig.13 model with LLG fault on load

By considering and studying above fault and harmonics, in this by using STATCOM the effect of fault and harmonics on load can be neglected or reduced.

CONCLUSION

This article examined the potential impact of STATCOM in associated environments of grid-connected photovoltaic stellar hybrid systems under different load conditions. 3 completely different ways were developed to evaluate the effectiveness of STATCOM in enhancing voltage regulation. The results obtained showed that the stress profile is successfully maintained in the presence of STATCOM, which effectively counteracts a stronger flow of reactive energy in the track and suppresses its undesirable effects. Generally taken from the result of the simulation, it was found that the STATCOM has the ability to stabilize the voltage in the connection bus by compensating for the reactive power and to give the utilities a shocking reaction before the power and responsibility are responsible for it - work in one purely linear RS cluster, either strictly resistive or inductive for easy simulation. However, these groups are rarely found in electricity systems. Common sense mainly includes loads from inductive and nonlinear motors, all of which add disturbances to the system in terms of current imbalance and harmonic coupling, and in the future this work could even be expanded by implementing these stacks. Smartphones in networked hybrid RES environments to review their effects on system dynamics and to examine the diverse potential of different FACTS controllers to perform different functions.

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