ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 6, Issue 10, October 2017

A Review Paper on Smart Grid System using Power flow control System

Akanksha Athwani [1], Ritesh Diwan[2]

[1]Deparment of Electronics and Telecommunication
RITEE , Raipur

[1]Deparment of Electronics and Telecommunication
RIT , Raipur

Abstract: Before we can begin to modernize today's grid, we first need a clear vision of the power system required for the future. Understanding that vision, we can create the alignment necessary to inspire passion, investment, and progress toward the Smart Grid for the 21st century. The Smart Grid is a necessary enabler for a prosperous society in the future. Energy supply has become one of the most challenging issues facing the world in the 21st Century. Growing populations, more homes and businesses and a myriad of new appliances have caused energy demand to skyrocket in every part of the country. Utilities across the globe are trying to figure out how to bring their networks into the 21st century and the digital age. This effort to make the power grid more intelligent is generally referred to as creating a "smart grid". The industry sees this transformation to a smart grid improving the methods of delivery as well as consumption. In This Paper 'State of the Art' of Smart Grid along with the vision, application and control are introduced. This Paper also identifies the advantage, Growth and the problem for Smart Grid. The Paper also presents a case study of Implementation of Smart grid Technologies discussed on the basis of recent references and technical reports issued from government and research and academic authorities. In this paper we present the a study on power loss and power flow system for smart grid.

Keywords- Smart Grid, Power, Power Flow, Power Loss.

1. Introduction

1.1 SMART GRID

Smart Grid encourages proficient and dependable end-to-end savvy two-way conveyance framework from source to sink through coordination of sustainable power sources, brilliant transmission and dispersion. Along these lines Smart Grid innovation might get effectiveness and manageability taking care of the developing power demand with unwavering quality and best of the quality. Brilliant Grid likewise empowers constant checking and control of energy framework and also helps in decrease of AT&C misfortunes, request reaction and request side administration, influence quality administration, blackout administration, Smart home vitality framework and so forth. Smart Grid will go about as a spine foundation to empower new plans of action like brilliant city, electric vehicles, savvy groups separated from stronger and productive vitality framework and levy structures.

POWERGRID has made spearheading strides in conveying Smart Grid innovation to all features of energy supply esteem chain and created brilliant network pilot extend at Pondicherry through open joint effort covering all qualities of keen matrix in distribution. Indian goliath control framework is confronting the different issues. Because of these issues, the development of power advertise is moderate.

The present network framework in this nation is unfit to deal with these disparities. To deal with these errors and other run of the mill catches in control framework, there is a need to finish robotization. Survey these issue keen Grid advancements is to be present/implanted in control arrangement of our nation. In nowadays Smart Grid is the panacea of the greater part of the issues in the power framework. The keen framework will check and kill the different bottlenecks and disparities in the present power lattice system. The

Indian power matrices are not secure, solid and up to the stamp. To diminish these lacks, the innovation of "Savvy Grid" is required. The Smart Grid can be made by propel innovation, instruments and Smart administration framework .Smart Grid is a vital reaction to the ecological, social, and political requests, set on vitality supply.

The Smart power matrix turns out to be significantly more intricate than a customary power lattice as time-fluctuating wellsprings of vitality and new unique burdens are coordinated into it.

The brilliant lattice's many-sided quality will advance after some time and require new innovations for productive, solid and secure operation and control as the interest for power increments. The motivation behind Smart Grid is to distinguish and revise supply request lopsidedness quickly and recognize blames through a self-recuperating" process that enhances administrations quality, effectiveness, improves unwavering quality and decreases costs .

With the advanced technologies, the smart electric power grid will be secure, reliable and bi-directional.
The Smart Grid will be providing green energy, high quality supply of power and integration of renewable energy resources.

The Smart Grid mainly consists two parts
(a) Intelligent components and
(b) Intelligent supervisory systems.

1.2 DEFINITIONS OF SMART GRID

While there is no formal definition of the smart grid, but according to the features of it based on literature, “the Smart Grid is a modern grid which consist the advanced technologies of electrical engineering, communication engineering and software engineering with the present power grid”.

To full-fill the objective of electrical power sector, the Smart Grid has the great characteristics.
1. Safe and Reliable: The electricity is still on the power supply capacity for the user, rather than a large area power outagein large electricity failures, malfunctions, natural disasters and extreme weather, orman- madedamagedone to maintain.

2. Efficient and Economical: power grid, will be able to improve the economic benefits through related policy innovation, management and energy efficient, and market competition orderly.

3. Clean and Green: With the large-scale of renewable energy sources, Smart Grid can reduce the potential impact on the environment e.g., carbon emission reduction, more green energy.
4. Optimization: The most appropriate price of the electrical energy provide to the society. Smart grid to optimize resource utilization; reduce investment costs and operation and maintenance costs. Quality of power meets industry standards and consumer needs.

5. Interactive: With the interaction and real-time response to the power market and users, the services are increased. Mature wholesale market operations in place, well integrated nationwide and integrated with reliability coordinators.

6. Self-healing: The new power grid has a features Self-healing. It is a process that improves services quality, enhances reliability and reduces costs. It identify and correct supply demand imbalance instantaneously and detect faults.

7. Flexible and Compatible: The new power grid can support correct, reasonable integration of renewable energy resources and it is suitable for integration of distributed generation and micro power grid. Moreover, it can improve and enhance the function of demand side management to achieve the efficient interaction capability with consumers. It is compatible with the present grid also.

8. Integrated: A unified platform and model are employed on a grid. It can obtain good quality of integration and information sharing of power grid and to achieve standard, normative and refined management that integrates the infrastructure, processes, devices, information and structure of market so that electricity can be generated, distributed, and used more efficiently and cost effectively.

2. Unified Power Flow Controller

A Combination of static synchronous compensator STATCOM and a static series compensator SSSC which are coupled via a common dc link, to allow bidirectional flow of

real power between the series output terminals of the SSSC and the shunt output terminals of the STATCOM , and are controlled to provide concurrent real and reactive series line compensation without an external electric energy source. The UPFC, by means of angularly unconstrained series voltage injection, is able to control, concurrently or selectively, the transmission line voltage, impedance, and angle or, alternatively, the real and reactive power flow in the line.

The UPFC may also provide independently controllable shunt reactive compensation.

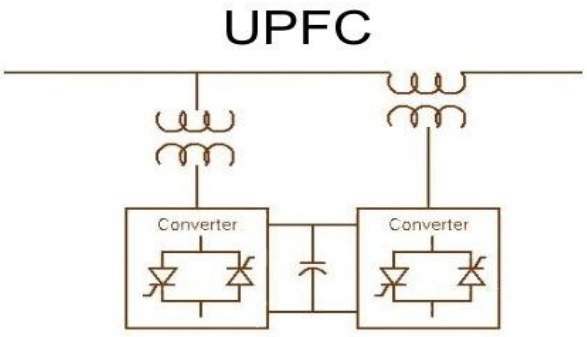

FIG. 1 Block Diagram of UPFC

- MAY CONTROL VOLTAGE, IMPEDANCE, AND ANGLE.
- IMPACTS ACTIVE AND REACTIVE POWER FLOW IN LINE.

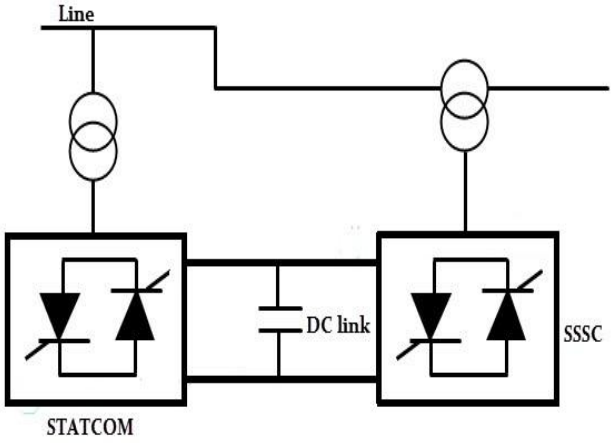

FIG. 2 Schematic Diagram of UPFC

The UPFC was devised for the real- time control and dynamic compensation of ac transmission systems, providing multifunctional flexibility required to solve many of the problems facing the power delivery industry.

Within the framework of traditional power transmission concepts, the upfc is able to control, simultaneously or selectively, all the parameters affecting power flow in the transmission line i.e., voltage, impedance, and phase angle, and this unique capability is signified by the adjective "unified" in its name.

Alternatively, it can independently control both the real and reactive power flow in the line. The control of real power is associated with similar change in reactive power, i.e., increased real power flow also resulted in increased reactive line power.

The flexible AC transmission system (FACTS) controllers such as Unified power flow controller (UPFC) can strongly improve the different parameters in a power system.

3. Literature Review

Here we show the past work which is finished by some exploration in the territory of Smart Grid. M. R. Aghaebrahimi, "Power Consumption Management and Control for Peak Load Reduction in Smart Grids Using UPFC" In this paper, a power utilization administration demonstrate is acquainted with control the pinnacle stack lessening in a Smart Grid utilizing the Unified Power Flow Controller (UPFC). [12]

P.RAMESH, Dr. M .DAMODARA REDDY "Misfortune lessening through ideal arrangement of Unified Power-Flow Controller" The point of this paper is to diminish influence misfortune and enhance the voltage profiles in an electrical framework in ideal way. The adaptable AC transmission framework (FACTS) controllers, for example, Unified power stream controller (UPFC) can emphatically enhance the diverse parameters in a power framework. UPFC can be utilized to enhance voltage profiles, diminish line misfortunes and increment line transmission capacities. The improved assignment of FACTS gadgets is a vital issue, so the Voltage steadiness list (L-record) has been utilized as a part of request to put UPFC in control framework. The benefit of the L-list is to quicken the advancement process.[13]

T.Nireekshana, Dr.G.KesavaRao, Dr.S.Siva Naga Raju "Joining of Unified Power Flow Controller Model for Optimal Placement utilizing Particle Swam Optimization Technique‖, In this work another numerical model of UPFC is produced which can be effortlessly fused in Newton-Raphson stack stream calculation. Ideal area of

UPFC is resolved in view of Voltage Stability Index. Molecule Swarm Optimization (PSO) procedure is utilized to set the parameters UPFC. The target work defined comprises of two terms: cost for vitality misfortune and cost identified with UPFC, which must be expanded for net saving.[2]

M. R. Aghaebrahimi, M. Tourani and M. Amiri, "Power utilization administration and control for top load lessening in Smart Grids utilizing UPFC," This paper proposes an administration demonstrate for enhanced utilization diminishment which diminishes misfortunes, era expenses and over-burden in transmission lines amid the pinnacle time. In spite of the fact that the pinnacle era cost is diminished, the cost of costumer's progressions must be paid as well, consequently these progressions are connected such that the advantages for the two gatherings will be maximal.[12]

This paper portrays the foundation of brilliant data framework and the requirements for savvy network data security. It acquaints the calculated investigation with the technique with the use of hermeneutic circle and data security utilitarian necessity recognizable proof. Data security for the lattice advertise cover matters incorporates computerization and interchanges industry that influences the operation of electric power frameworks and the working of the utilities that oversee them and its attention to this data foundation has turned out to be basic to the unwavering quality of the power framework. Group profits by of cost investment funds, adaptability and sending alongside the foundation of remote correspondences. Be that as it may, concern rotates around the security assurances for effectively available gadgets, for example, the savvy meter and the related correspondences equipment. Then again, the changing focuses between conventional versus brilliant lattice organizing pattern and the data security significance on the correspondence field mirrors the criticality of framework data security utilitarian necessity recognizable proof. The objective of this paper is to distinguish the useful prerequisite and relate its importance delivers to the buyer necessity of a data security of a Smartnetwork. Vulnerabilities may deliver plausibility for an assailant to enter a system, make progress admission to control programming, change it to stack conditions that destabilize the lattice in erratic ways. Concentrating on the framework data security utilitarian prerequisite is venturing ahead in creating customer trust and fulfillment toward savvy network completeness.[14]

3.1 BASIC OPERATING PRINCIPLE OF UPFC

In the UPFC arrangement the real power exchanged is provided by one of the end buses e.g., the sending- end bus. These back- to- back converters, labeled “converter 1” and “converter 2” are operated from a common dc link provided by a dc storage capacitor.

This arrangement functions as an ideal ac- to- ac power converter in which the real power can freely flow in either direction between the ac terminals of the two converters, and each converter can independently generate or absorb reactive power at its own ac output terminal.

Converter 2 provides the main function of the UPFC by injecting a voltage V with controllable magnitude V and phase angle p in series with line via an insertion transformer. This injected voltage acts essentially as a synchronous ac voltage source.

The transmission line current flows through this voltage source resulting in reactive and real power exchange between it and the ac system.

The reactive power exchanged at the ac terminal i.e., at the terminal of the series insertion transformer is generated internally by the converter.

The real power exchanged at the ac terminal is converted into dc power which appears at the dc link as a positive or negative real power demand.

The basic function of converter 1 is to supply or absorb the real power demanded by converter 2 at the common dc link to support the real power exchange resulting from the series voltage injection.

This dc link power demand of converter 2 is converted back to ac by converter 1 and coupled to the transmission line bus via a shunt – connected transformer.

In addition to the real power need of converter 2, converter 1 can also generate or absorb controllable reactive power, if it is desired, and thereby provide independent shunt reactive compensation for the line.

It is important note that whereas there is a closed direct path for the real power negotiated by the action of series voltage injection through

converters 1 and 2 back to the line, the corresponding reactive power exchanged is supplied or absorbed locally by converter 2 and therefore does not have to be transmitted by the line.

Thus, converter 1 can be operated at a unity power factor or be controlled to have a reactive power exchange with line independent of the reactive power flow through the UPFC dc link.

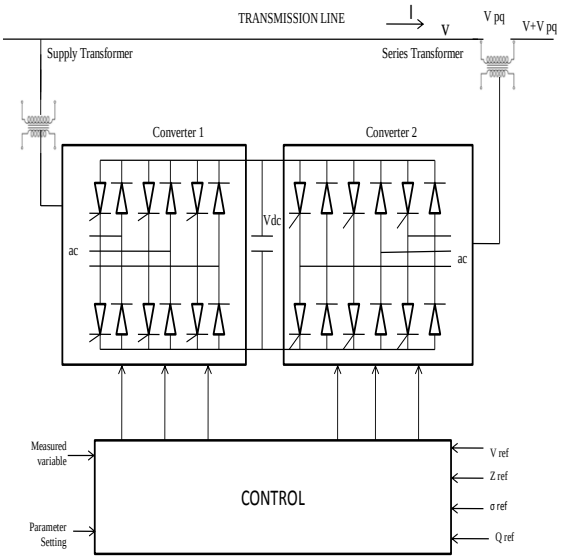

Fig.3. Implementation of the UPFC by two back-to- back voltage – sourced converters

4. Research Gap & Future Objective

As we can all existing approach are tacking about the power loss control but all those previous research are not enough to control it there is need of some more system which can intiragte with UPFC system and will help to reduce the power loss of smart grid system. So in this area there is lots of future objective will be there which further research are resolve and give a novel approach which is able to reduce to reduce the power loss on the smart grid system.

5. Conclusion

The reduction of power consumption at peak hours not only reduces the utility's cost of generation and operation, but also can bring about considerable benefits for the customers who co – operate with the utility towards realizing the smart grid. In this paper we present the complete study about the existing proposed which is try to reduce the power loss.

REFERANCES

[1] N. G. Hingorani and L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", New York: IEEE Press, (2000).

[2]T.Nireekshana, Dr.G.KesavaRao, Dr.S.Siva Naga Raju "Incorporation of Unified Power Flow Controller Model for Optimal Placement using Particle Swam Optimization Technique‖, 978-1-4244-8679-3/11 IEEE, 2011.

[3] C.R.Fuerte-Esquivel, E.Acha, "Unified power flow controller: a critical comparison of Newton-Raphson UPFC algorithms in power flow studies"‖, IEE Proceedings on Generation, Transmission, Distribution, Vol. 144, No. 5, pp. 437–443, Sept 1997.

[4] 1k. Venkateswarlu, 2ch. Saibabu," A New Evolutionary Algorithms Used For Optimal Location Of Upfc On Power System ",Jatit&Lls. All Rights Reserved,2005 – 2010.

[5] Jigar S.Sarda1, Manish J. Chauhan2, Viren B. Pandya3, Dhaval G. Patel4, "Optimal Location Of Multi-Types Of Facts Devices Using Genetic Algorithm", International Journal Of Research In Computer Science Eissn 2249-8265 Volume 2 Issue 3,Pp. 11-15,2012.

[6] Sreekanth Reddy Donapati and M.K.Verma ,"An Approach for Optimal Placement of UPFC to Enhance Voltage Stability Margin under Contingencies‖, Fifteenth National Power Systems Conference (NPSC), IIT Bombay, December 2008.

[7] Kiran Kumar Kuthadi and 2 M. Suresh Babu ,"A Modified Particle Swarm Optimization Technique Forsolving Improvement Of Voltage Stability And Reduce Power Losses Using Upfc", Issn: 2248-9622, Vol. 2, Issue 3, Pp. 1516-1521 May-Jun 2012.

[8] M.BehshadA.Lashkarara A. H. Rahmani "Optimal Location of UPFC Device Considering System Laudability, Total Fuel cost, Power losses and Cost of Installation", 2nd International Conference on Power Electronics and Intelligent Transportation System, 2009.

[9] R.JahaniH.A.ShayanfarN.M.Tabatabaei J. Olamaei, "Optimal placement of UPFC power system by a New advanced Heuristic method", International Journal on ―Technical and Physical Problems of Engineering, ISSN 2077-3528, December 2010.

[10] Bindeshwar Singh, N. K. Sharma and A. N. Tiwari, and S.P.Singh "Incorporation of FACTS Controllers in Newton Raphson Load Flow for Power Flow Operation" Bindeshwar Singh et. al. / (IJCSE) International Journal on Computer Science and Engineering Vol. 02, No. 06, 2117-2124, 2010.

[11] Xin-She Yang," Firefly Algorithms for Multimodal Optimization", Xiv: 1003.1466v1 [math.OC] 7 Mar 2010. [13] K..Sudhakara Reddy, Dr. M. DamodarReddy,"Economic Load Dispatch Using Firefly Algorithm", International Journal of Engineering Research and Applications ISSN: 2248-9622 Vol. 2, Issue4, pp.2325-2330, , July-August 2012.

[12] M. R. Aghaebrahimi, M. Tourani and M. Amiri, "Power consumption management and control for peak load reduction in Smart Grids using UPFC," *2011 IEEE Electrical Power and Energy Conference*, Winnipeg, MB, 2011, pp. 327-333.

[13]. Ramesh, P., and M. Damodara Reddy. "Loss reduction through optimal placement of unified power-flow controller using firefly algorithm." International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering 2.10 (2013): 4657-4667.

[14]. Ling, Amy Poh Ai, and Mukaidono Masao. "Grid Information Security Functional Requirement-Fulfilling Information Security of a Smart Grid System." *arXiv preprint arXiv:1108.0267* (2011).