Smart Grid on Distribution Energy System: A Review

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***Abstract*— Smart grid is the modern form of power grid it considered as next generation power grid, which provides bidirectional flow of electricity and information in a suitable manner from generation to transmission and to distribution. It provides security to the system with improving the power grid reliability and efficiency of electrical system. The smart grid is modified version of power grid infrastructure. It has high power converters sensing and metering technologies, automated control for enhancing efficiency and reliability. Smart grid is more effective channel for communication cause of his modern techniques and infrastructure. The latest energy management techniques based on the optimization of demand, availability of network and depends on energy requirements. For improving the reliability of smart grid we explore various failure protection mechanism to make protection better and to get smart protection system. Failure protection mechanism explores the privacy issues in the smart grid.**

Keywords- Energy, smart grid, infrastucture, Relibility

I. INTRODUCTION

The modern electricity system having good sensors, quality of monitoring, completely automatic, having good communication to improve efficiency and safety of the electricity system is known as smart grid. It has ability to delivering power in a reliable manner with more effective ways by using latest technology and responding all events which occurs anywhere in grid such as power generation, transmission, distribution and consumption also. A smart grid provides flexibility, security and reliability to the system. Sometimes any event occurs cause of failure of medium voltage transformer in the distribution grid, automatically smart grid change the power flow and recover the power delivery service. Set of seven chief domains makes complex infrastructure of a smart grid 1. Bulk generation 2. Energy distribution 3. Power transmission 4. Operation and control 5. Market 6. Service providers 6. Customers. Each domain comprises same type elements that include organization, buildings, individuals system, system resources and other entities. The internal are crucial for connecting the different entities involved such as customers and utility systems through an advanced metering infrastructure. An advanced metering infrastructure interacting with smart meters and provide bidirectional communication. Smart meter measures energy consumption more than any conventional meter. It simplify the monitoring the system demand.

The benefits of smart grid are following:

1. It is improve the system stability and reliability.
2. Optimizing facility utilization and averting construction of back-up (peak load) power plants
3. Enhancing capacity and efficiency of existing electric power networks
4. Enabling predictive maintenance and self-healing responses to system disturbances
5. Facilitating expanded deployment of renewable energy sources
6. Accommodating distributed power sources;
7. Automating maintenance and operation;
8. Reducing greenhouse gas emissions by enabling electric vehicles and new power sources;
9. Reducing oil consumption by reducing the need for
10. inefficient generation during peak usage periods
11. Presenting opportunities to improve grid security;
12. Enabling transition to plug-in electric vehicles and new energy storage options;
13. Increasing consumer choice
14. Enabling new products, services, and markets.

II. REVIEW ON SMART GRID ON DISTRIBUTION ENERGY SYSTEM

A . An interesting research work was done by Takuno *et al.*[2]. Takuno *et al.* proposed two in-home power distribution systems, in which the information is added to the electric power itself and electricity is distributed according to this information. The first one is a circuit switching system based on alternating current (AC) power distribution, and the other is a direct current (DC) power dispatching system via power packets. Note that the packetization of energy is an interesting but challenging task since it requires high power switching devices. Researchers have shown that silicon carbide junction gate field-effect transistors are able to shape electric energy packets [234]. Hence, the system proposed in [235] has the potential as an intelligent power router. More specifically, supplied electricity from energy sources is divided into several units of payload. A header and a footer are attached to the unit to form an electric energy packet. When the router receives. packets, they are sorted according to the addresses in the headers and then sent to the corresponding loads. Using energy packet, providing power is easily regulated by controlling the number of sent packets. In addition, many in-home electric devices are driven by DC power and have built-in power conversion circuits to commutate AC input voltage. Thus, DC based power distribution is feasible. These systems will make in-home power distribution systems more efficient and easier to control energy flow. [1]

B. Reliability can be substantially improved by detecting, locating, and repairing incipient failures before catastrophic failure, often before an outage occurs. Requirements for data and computation are substantially greater than for devices like digital relays and power-quality meters, but feasible with modern electronics .Moslehi et al. An architectural approach is essential to the transformation of the grid to a "smarter grid" as the iPhone architectural paradigm was in the transformation of the phone. It was not because of a few specific applications that iPhone revolutionized the "phone" but for its architecture that led to an explosion of functionality.[3]

C. Antonio.Grilo et al. The power grid distribution infrastructure mainly consists of a set of substations, MV power lines connecting substations to Medium Voltage/Low Voltage (MV/LV) power transformers residing in the secondary substations and LV power lines from the secondary substations to the customers. Some industrial customers may also get Direct MV power lines. Associated to this infrastructure we consider also the SCADA system, which is a supervisory control and data acquisition system dedicated to the infrastructure. Remote surveillance of the power grid is already done to some extent based on wired sensors. The use of wireless sensors can, however, lead to a more flexible and powerful protection scenario for the substations, power lines and power transformers. The deployment flexibility of Wireless Sensor allows capturing more status parameters than the currently deployed wired sensors and the wireless nature of the communication can contribute to avoid critical points of failure.[5]

D. The tracking of customer power usage, it may also introduce failure. Therefore, a throughout assessment on the new technologies and infrastructure is necessary. Lee-Cheun Hau *et al* current state-of-art of physical protection in terms of system reliability analysis and failures in protection mechanism. Ensuring of system reliability is important in realizing effective and efficient means of smart grid operation. The development of protection mechanism to resist the attacks and failure is also necessary in order to maintain the continuity of supply as well as ensure stability and reliability operation of smart grid. New technology and infrastructure are introduced and deployed for smart grid, the possible risks and challenges must also be assessed. This is to ensure an efficient and effective operation of smart grid with higher security, reliability and stability. For instance, although ensuring system reliability is important, however the increase of system reliability risk may be introduced from the mix of sources in smart grid. Besides that, we also observed that the usage of smart metering itself although enable fast tracking of customer power usage, it may also introduce failure. Therefore, a throughout assessment on the new technologies and infrastructure is necessary. [4]

E. T. M. Overman *et al* As increasing numbers of "smart" sensors and actuators are introduced into the electrical grid, the cyber security factor grows in significance, necessitating the implementation of information assurance controls for devices at all levels within the grid communications network. Determining the appropriate controls for any particular device first requires identifying its place within an established trust model. The term High Assurance Smart Grid (HASG) refers to a Smart Grid with a control system architecture characterized by a distributed architecture that is designed to mitigate against widespread failures when control system components themselves are compromised.[6]

F. The Smart Grid is going to add new functionality to the current electrical power system. However, it will also introduce several new security risks into the system. We rely on the electrical power grid for electricity, and our dependence on electricity makes the electrical power grid a critical asset. Disruption of the electrical power supply will have large societal impacts. The security of the electrical power grid is an important issue. The Smart Grid will introduce several new security risks related to its communication requirements, system automation, new technologies, and data collection. [7]

III. Future Scope

1. A smart grid is affordable, highly efficient and reliable electric power network. It will maintain the whole system through his modern technologies.
2. A smart grid doesn't create any pollution for the environment and provide better safety to the system using highly effective sensors.
3. Monitoring is easily so it develops integrated platforms for inspection of electricity network.
4. Smart grid makes electric power system very reliable it improves the efficiency of system by using modified smart meter.
5. It can create better communication system using communication equipment such as wave trap which is used for transmitting signals from sender to receiver in a specific frequency such as 50Hz in India. Wave trap maintain the frequency of the system.
6. SCADA system, which is a "supervisory control and acquisition" system dedicated to the infrastructure. SCADA system worked as surveillance using wire sensors.

IV Conclusion

A smart grid improves the communication system, it monitors the event occurs in power generation, transmission and distribution. A smart grid is automatic and it enhanced efficiency of electric network. It provides better security and privacy to the power grid. Smart grid is a better way for communication and easier to control energy flow and recover the power delivery service

References

[1] T. Takuno, M. Koyama, and T. Hikihara. In-home power distribution systems by circuit switching and power packet dispatching. IEEE SmartGridComm
[2] T. Takuno, T. Hikihara, T. Tsuno, and S. Hatsukawa. HF gate drive circuit for a normally-on SiC JFET with inherent safety. 13th European Conference on Power Electronics and Applications
[3] K. Moslehi and R. Kumar, "A Reliability Perspective of the Smart Grid", IEEE Transactions on Smart Grid
[4] Lee-Cheun Hau, Jer-Vui Lee, Yea-Dat Chuah and An-Chow Lai " Smart Grid – The Present and Future of Smart Physical Protection" IJEIC
[5] António Grilo1, Helena Sarmento1, Mário Nunes1, José Gonçalves 2, Paulo Pereira1, Augusto Casaca1, Carlos Fortunato3 "A Wireless Sensors Suite for Smart Grid Applications"

[6] T. M. Overman and R. W. Sackman, "High Assurance Smart Grid: Smart Grid Control Systems Communications Architecture", 2010 First IEEE International Conference on Smart Grid Communications (SmartGridComm),
[7] NIST, "Guidelines for Smart Grid Cyber Security: Vol. 1, Smart Grid Cyber Security Strategy, Architecture, and High-Level Requirements, NISTIR 7628," 2010. [Online]. Available