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Smart Grid-A Review Paper

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Abstract: *Right a vertically integrated utility is one that has been managed by a centralized body since the commencement of the production of electrical energy. In order to address the needs of electricity consumers in the twenty-first century, a new technology known as "Smart Grid" has been devised. Decentralization of industries has been expanding day by day. In this essay, we will examine the meaning of the term "smart grid," its advantages, as well as the various technologies used in it. The traditional electrical power system has been replaced by the smart grid thanks to its different technologies. In the past, when smart grid technology wasn't available, we had to deal with a lot of power outage issues, such as substation or generating unit failure. In order to achieve energy efficiency, the smart grid employs smart pricing strategies and renewable energy sources. Today's globe has seen the effective emergence of smart grid as a means of delivering electricity at the lowest cost and highest quality. We'll talk more about the specifics of smart grid technologies later.*

Keywords: Smart Grid; SCADA; AMR; load forecasting

I. INTRODUCTION

A type of electrical network that makes use of digital technologies is called Smart Grid. It establishes connections between distributors, suppliers, and customers. It uses two digital communications to operate appliances in consumers' homes to distribute electricity from suppliers to consumers, which will actually save energy while lowering cost and improving dependability. Automation technology, which enables the utility to alter and regulate each individual unit or millions of devices from a central place, is a major component of the smart grid. In a typical smart grid, central management oversees every device linked to it, ensuring that they are all running as efficiently as possible. The central management not only evaluates for better energy management inside the building but also aids in lowering the use of electricity during peak hours. Significant energy is saved as a result. A smart grid also facilitates the transition from fossil fuel to renewable energy. If a facility has a source of renewable energy, the grid makes it simple to incorporate that source into thegrid. Greater use of highly erratic renewable energy sources, such wind and solar energy, is made possible by smart grid. The term "smart grid" also describes a group of technologies being used to modernise the way that power is delivered, including automation and compute-based remote control. These systems are made possible by computer processing that has been used for decades in other industries and two-way digital communications technology. They are starting to be used on the networks that carry electricity, from the generators and wind farms to the people who use it in their homes and places of business. They provide numerous advantages to utilities and consumers, most notably significant increases in energy reliability and efficiency in homes and workplaces as well as on the power grid.

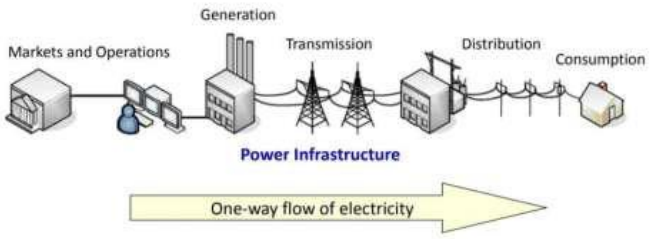

Figure 1- Power infrastructure

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II. CURRENT SMART GRID PROJECTS

A smart grid is far more dependable than a conventional grid and can reduce greenhouse gas emissions by up to 211 million metric tonnes. This is what motivates investors to invest in this cutting-edge technology.

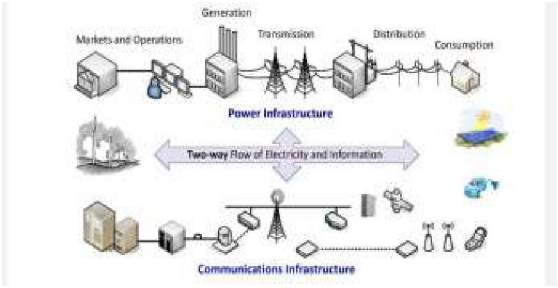

Figure 2- Two way flow of Electricity and Information

Around 150 smart grid technology businesses are thought to exist worldwide, with the US accounting for 77.4% of them. The top 25 smart grid providers collective market capitalisation is currently around $2.03 trillion. The global market for smart grid technology is anticipated to reach $400 billion by 2020 with a compound annual growth rate of 8%. The market is anticipated to continue expanding by double digits in the United States alone, reaching $26.7 billion by 2017. General Electric, Honeywell, Itron, and Trilliant Networks have all received money to date ranging from $60 to $300 million.

The market for smart grid technologies is increasing in the US. The federal government, which has supported R&D initiatives to the tune of billions of dollars, provides incentives that drive the market. $2.5 billion was spent on smart grid technologies in 2014. Spending is anticipated to reach $3.3 billion by 2017. In 2016, it is anticipated that 13.3 million smart metres will be shipped across the country. By 2020, the penetration of non-residential smart metres is anticipated to reach around 71.7% in North America.

III. FUTURE SMART GRID

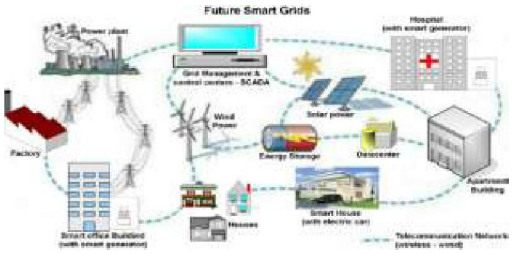

Figure 3- Future Smart Grid

To encourage innovation in the smart grid technology sector, the Department of Energy proposed spending $3.5 billion between 2016 and 2026. Machine learning, plug-and-play technologies, a self-healing grid, and complete grid automation will be the main areas of research.

The system will compel consumers to cut their energy consumption by 5% to 10% by giving them real-time information on their usage. According to research, customers are more likely to take the necessary steps to reduce their energy use when they are fully aware of how much energy they are using. The entire amount of energy saved as a result of smart grid technology is projected to reach $42 billion after one year. The annual savings will rise to $48 billion in five years. The savings will rise to $65 billion in 15 years and $102 billion in 30 years. With the energy saved, Las Vegas could be powered 207 times over, a refrigerator could run for 199 million years, or 378 million houses could be cooled.

Under the aegis of the "Smart Grid," distribution grid begin a significant technology and research initiative to address some of the following difficulties in order to fulfil the future power demand of the next generation of electric power:

- Considerable cuts in residential peak demand energy use were made possible by delivering real-time pricing and environmental signals in conjunction with cutting-edge in-home devices.

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- Integration of green energy generation from both private clients and second-tier operators to lessen carbon impact. Thus, this energy source will play a significant part in the development of the Smart Grid.
- Electric vehicles are also regarded as highly significant future components since they have the potential to influence consumption peaks while also serving as energy buffers to make up for any lost energy during these peaks.
- Create an open infrastructure that will make it simple for newcomers to integrate, similar to how the mobile cellular market has been deregulated.
- The provision of scalable and preferential real-time measurement and control technologies for the energy grid.

IV. DISTRIBUTION SYSTEM IN SMART GRID

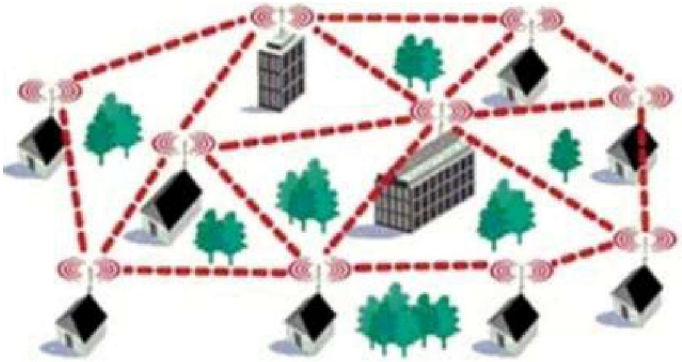

Figure 4- Distribution system

Distribution system is the term used to describe the portion of the Smart Grid that relates to the utility distribution system, specifically the wires, switches, and transformers that link the utility substation to you, the consumer. The power distribution system has wireless mesh networking and fibre optic communication, and one of its components is the power lines that cross people's backyards.

Various Smart Grid Technologies Already Been Used By Indian Power Sector

1. Smart digital metres
2. AMR
3. SCADA
4. Protection
5. Use of IT
6. Load forecasting
7. Web-based data
8. GIS asset mapping
9. Online supply quality monitoring
10. Online system health monitoring
11. Record keeping and document imaging

Benefits of Smart Grid

1. Improving the quality and reliability of power.
2. Better and quicker supply and demand balancing.
3. Reducing the Need for Backup (Peak Load) Power Plant Construction.
4. Increasing Self-Healing Capacity and Resilience to Disruption.
5. Increasing the Use of Distributed and Renewable Energy Sources.
6. Cutting carbon dioxide emissions.

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V. CONCLUSION

A smart grid enhances communication and keeps track of electricity generation, transmission, and distribution events. An autonomous smart grid increases the effectiveness of the electrical network. The electricity grid is given greater security and privacy thanks to it. The grid's adaptability can be improved. Additionally, by integrating Java Embedded Systems, Java Virtual Machines, GPS, and Smart Phones (mobile computing), the current power grid's efficiency, dependability, and safety can be increased. Utility companies as well as end users gain from smart grid. The future of the Indian electrical system is undoubtedly bright after the execution of smart grid pilot projects under the APDRP programme. The smart grid makes it simpler to govern energy flow, improve energy distribution, and improve communication.

REFERENCES

[1]. Artech House, the Advanced Smart Grid: Edge Power Driving Sustainability. June 2011

[2]. The Department of Energy, "The Smart Grid: An Introduction," available at energy.gov/oe/downloads/smart-grid-introduction.

[3]. "A Brief Analysis on Differences in Risk Assesment between Smart Grid and Traditional Knowledge Acquisition and Modeling," by

[4]. J.Z. Hui Hou, Yongchuan Zhang, and Xiongkai Hen (KAM), The United States Agency for International Development, "Smart Grid Vision For India," March 2010.

[5]. Pengpeng Lu, J. Zhao, J. Yao, and S. Yang, "A Decentralized Approach for Frequency Control and Economic Dispatch in Smart Grids," IEEE Journal on Emerging and Selected Topics in Circuits and Systems, 2017, vol. 7, issue 3, pp. 447-458..

[6]. Sunil Luthra, Sanjay Kumar, Ravinder Kharb, Md. Fahim Ansari, and S. L. Shimmi. "Adoption of smart grid technologies: An examination of interactions among barriers," Renewable and Sustainable Energy Reviews, vol. 33, no. 5, may 2014, pp. 554-565. R.

[7]. E. Brown. Smart grid's effects on the architecture of the distribution system. Conversion and Delivery of Electrical Energy in the 21st Century, IEEE Power and Energy Society General Meeting, pages 1-4, 2008.

[8]. P. Siano, A. Piccolo, C. N. Hadjicostis, and V. Calderaro. Petri Net modelling is used for smart grid failure identification. IEEE Transcations on Industrial Electronics, 2011, Vol 58, Issue 10, pp. 4613-4623.

[9]. Miss. Kamble Sunayana Nivrutti, Prof. Gund V. D., et al, “Multimodal Biometrics Authentication System Using Fusion Of Fingerprint And Iris”, International Journal of Trends in Scientific research and Development (IJTSRD), Sep-Oct 2018, Vol 2, Issue 6, pp 1282-1286