iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** V **Month of publication:** May 2021

DOI: https://doi.org/10.22214/ijraset.2021.34671

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue V May 2021- Available at www.ijraset.com

Impact of Smart Grid on Deregulated Power System

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Abstract: The Smart grid is the power grid of the next generation with multi-directional electricity flows and broadly distributed data. The power system is intelligent via a smart grid by intelligence communication, sensing, monitoring, and application. Ideally, the smart grid technology is more compatible with many features that can be optimized by combining bulk generation with the transmission. Everything in the Smart grid is also kept free from pollution, minimizing, cost-effectiveness, hazards, and dangers of all kinds. We are discussing the Smart grid technology, its standard, and recent challenges in this review. We explore the various Smart grid projects in developed countries and discuss the challenges in their implementation.
Keywords: Challenges, power systems, smart grid, standards, technologies

I. INTRODUCTION

The voltage stability problem has recently deregulated the electricity market and increased energy consumption. The stability of the voltage system means the power system's ability to maintain constant voltages in all the system buses following a disturbance from a particular operating condition. The previous electromechanical grids were based on a vertically integrated power management structure. In recent times these grids have various operational challenges such as schedule reverses increased penetration of renewable systems, and so forth. These challenges have led to unforeseen, awful events because management personnel and other physical and cyber attacks have little awareness. The consumer is always affected by such voltage instabilities, high quality, and improved electricity supply services. To solve the various challenges, electrical grids must be transformed into smart devices, electronics, and computer algorithms. The increasing demand for long-distance power transfers recently stressed the importance of power grid stability. Stability refers to the grid's ability to withstand disturbance and to the nature of interest disturbance. The power industry, national laboratories, and governments have been set up to overcome these challenges and manage problems with future grids like smart grid, grid wise, etc.

Smart grid technologies have been used to distribute electricity and upgrade through two-way communication. A smart grid delivers electricity between consumers and suppliers to save energy, increase efficiency, reliability, and transparency. In this study, we review smart grid technologies in different aspects.

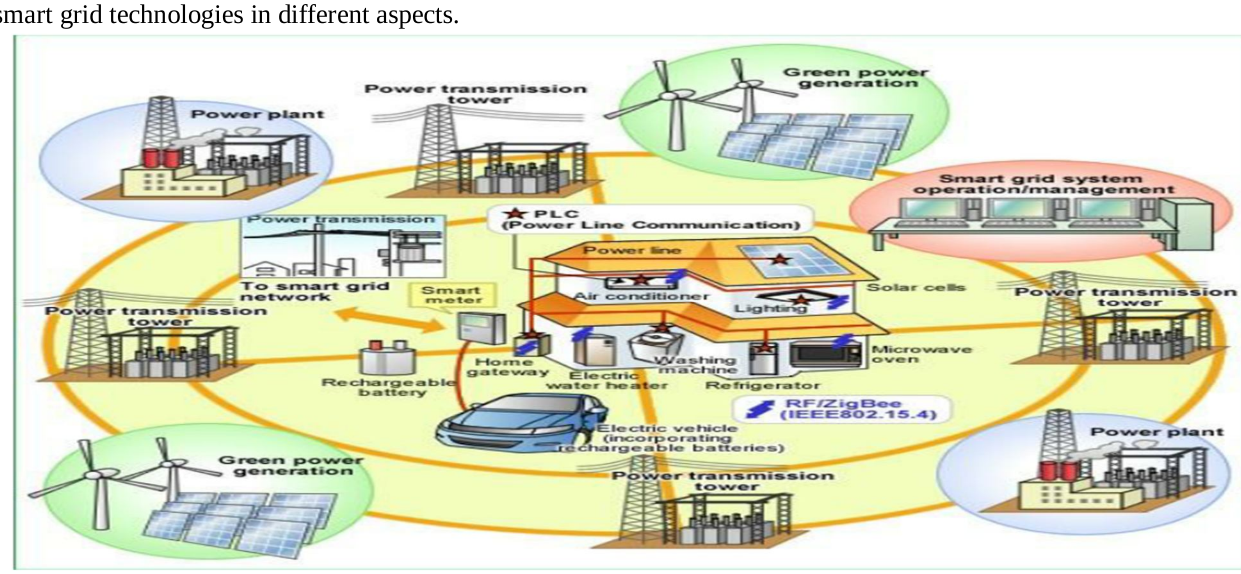

Figure. 1:Conceptual model of smart grid

II. SMART GRIDS

The smart grid is a power grid that allows a two-way flow of electricity and data, often as a first step. Smart grids have become known over a decade ago as a concept and are essential for digital electricity transformation. An introduction to definitions, trends, and key features of smart grids. Big data analytics and IoT technologies are major drivers of smart grids, where analysis is moving to the forefront as it is in advanced computing. Smart grids use more technology, but not just IT or technology.

III. OBJECTIVES OF SMART GRID

Energy efficiency Efficient and reliable electricity transmission and distribution is an essential prerequisite for the availability of essential energy resources for companies and economics. The companies are currently in a period of change and upheaval in industrialized countries. On the one hand, the planned end-of-life period of large parts of the grid infrastructure, as much of equipment was installed in the 1960s.On the other hand, the pursuit of greater competition, lower energy prices and increased, and use of renewable, such as solar, wind, and biomass, is strongly regulatory**.**

A. Objectives

1) Secured operation: The smart grid enhance communication networks and information security of the electricity grid;
2) Integrated system: To achieve standardized and refined management, the intelligence grid highly integrates and shares information and data on an electricity grid.
3) Robustness: To provide a continuous and stable flow, the Smart Grid shall increase its resilience to disruptions, preventing large-scale accidents. It will ensure the safe and normal running of the grid even in emergency circumstances like natural disasters, extreme weather, and the man-made breakdown and will provide self-healing abilities;
4) Economical energy usage: The Smart grid has a capacity for more effective electricity markets optimized resource configurations, increased grid efficiency, and reduced grid waste;
5) Green energy: The problems of energy security, energy-saving, carbon dioxide emission, etc are can solve by the Smart grid.
6) Optimization: The Smart grid shall optimize assets, reduce costs and operate efficiently.

Developed countries are using effective and advanced power system techniques including
North America, China, etc.

Based on data from Zpryme Research, Austin, Texas, Research and consultancy firm, which draws on stated federal expenditure figures, China is the leading global investor in 2010. The second US$7.09 billion, the third Japanese US$849 million, respectively South Korea, Spain which reached the fifth place at $807 million, was the first European country.

IV. SMART GRID TECHNOLOGIES

Smart grid technologies are already used in some other applications those are manufacturing and telecommunications.

A. Applications

1) Integrated communications: Substation automation, demand response, delivery automation, supervisory control, and data acquisition(SCADA), energy management systems, wireless mesh networks and other technologies, power-line carrier communications, and fiber-optics are all areas where improvements are required**.**
2) Smart meters
3) Phasor measurements units

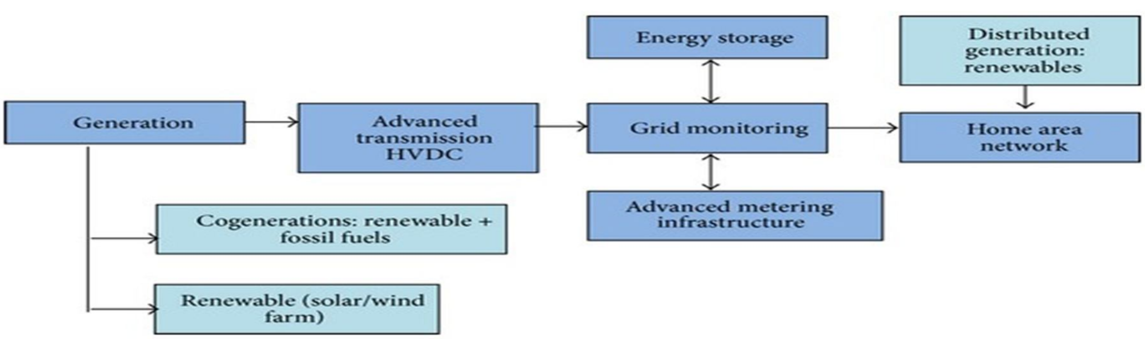

Figure 2.Block diagram representation of working of Smart grid

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
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V. ENABLEING TECHNOLOGIES

Several technologies have to mature to make smart grid reality

A. *Examples of the Reality of Smart Grid*

1) Distributed generation: On the distribution side of the electric grid, distributed generation(DG) refers to small-scale power sources that are normally decentralized and located near end-user locations. This could involve both traditional and renewable energy sources. Interconnection of DG/DER to the grid offers several benefits including on-demand power quality of supply improved efficiency, deferred transmission investment.
2) Energy storage: Electricity in large quantities is difficult to store and must be converted into mechanical energy. These processes are enabled by storage technologies, which are the heart of smart grids.
3) Power Electronics: Since a deeper penetration of renewable and alternative energy sources necessitates sophisticated power converter systems, power electronics are critical in the development of smart grids. A power converter is a device that connects the smart grid to local power sources Solar (SV) and wind power play an increasingly important role as key sources for smart grids.
4) Control Automation and Monitoring: By its very nature, the smart grid is a highly complex, nonlinear dynamic network that poses numerous theoretical and practical challenges. To make it more intelligent and equip it with self-healing, self-organizing, key issues such as monitoring and control must be tackled.
5) Communication: Communication is essential. Sensor measurements and analog/digital signals can be used by local or centralized controllers to allow smart-healing of the system in the event of a disruption. Although these measurements and signals come from various proprietary networks.

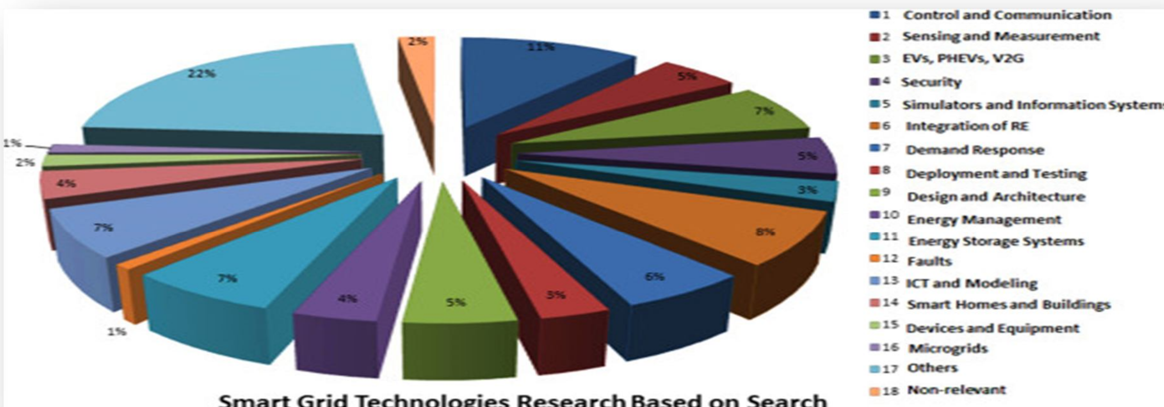

Figure 3. Schematic pie chart of Smart grid technologies

VI. IMPLEMENTATION CHALLENGES

The power industry requires a complete transition to next-generation technology and management through automation. Regardless of global financial concerns, power utilities must start with simple automation systems before processing to advanced automated systems such as DCS and SCADA. The only way forward for the domestic power industry is to analyze rising power demand business competence and energy conservation goals.

A. *Provocations*

1) *Power Theft:* Power theft is one of the most serious problems. The use of insulated overhead lines and the replacement of LT lines used for power delivery with insulated cables are two ways to help avoid power theft by hooking.
2) *Inadequate Grid Infrastructure:* Every country needs a new, smart grid to continue on its ambitious economic growth course.
3) Low metering efficiency: Low metering performance, burglary, and pilferage account for the majority of commercial losses. Improved metering reliability, proper energy accounting, and auditing, and improved billing and collection efficiency will also help to eliminate this.

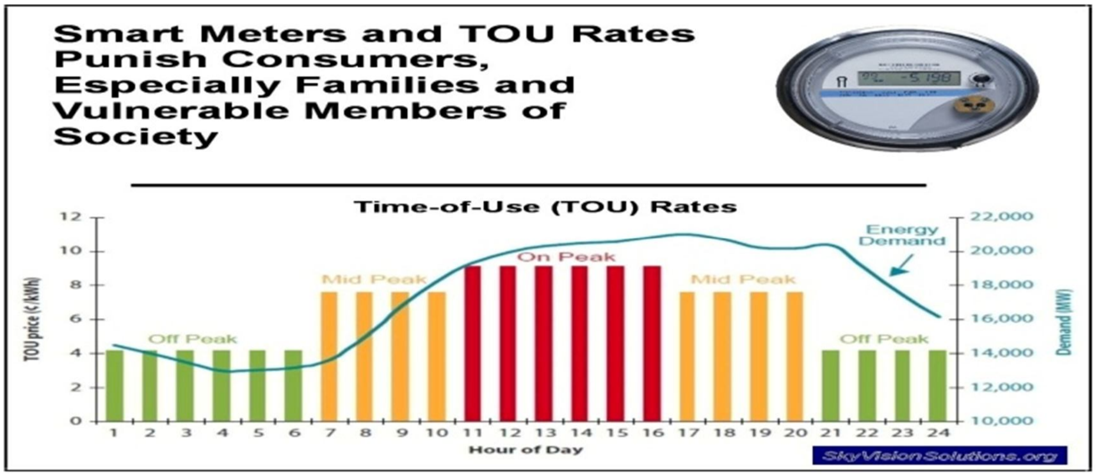

Figure 4.Usage of power a day

4) *Lack of Awareness:* Consumers have a limited understanding of how electricity is distributed to their homes. They should be informed about smart grids, their advantages, and their contribution to a low-carbon economy before introducing smart grid concepts. Smart grid prospects must be clearly understood by policymakers and regulators.
5) *Integration of Decentralized Renewable Power Generation:* There is no policy for integrating decentralized renewable energy generation. People are completely unaware that interacting with the system is only advantageous to them. In addition, there is no proper subsidy formula for this.

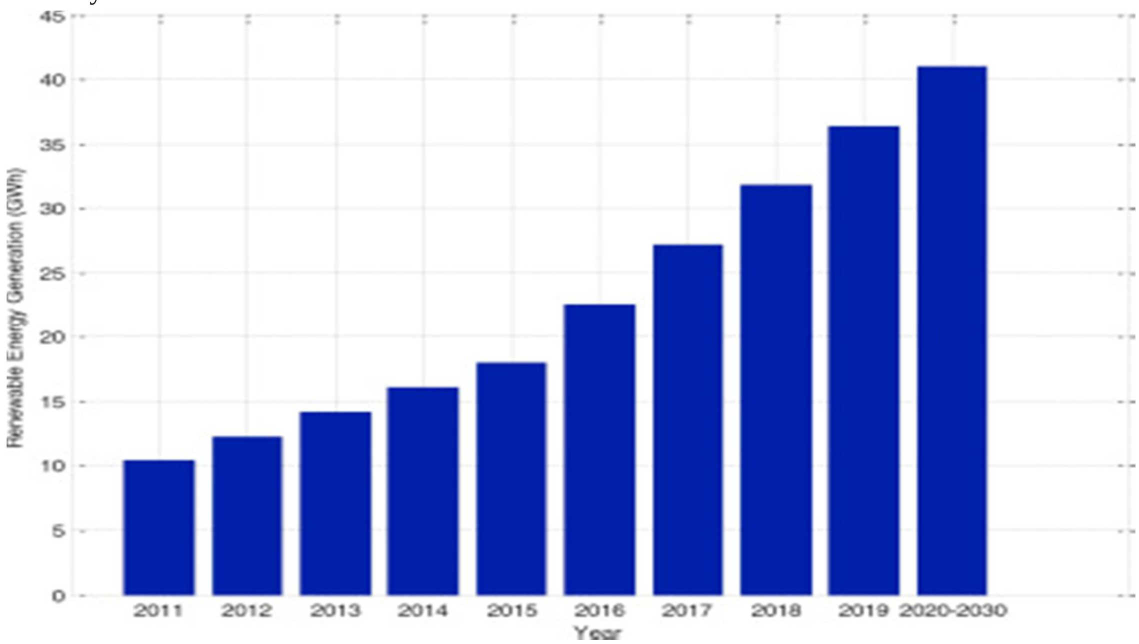

Figure 5. Bar graph of raise of Smart grid technology using Renewable Energy

VII. CONCLUSION

Since the technology's inception, smart grid systems have been implemented. The developing countries have already begun to alter their traditional practices.

Power systems are being converted into smart grids, but there are still big issues with policies, standards, and protection. Less developed countries continue to fall behind in every economic and technological region. These countries, on the other hand, are taking significant steps to grow their workforce and invest more money in smart grid projects. Smart grid technology is advantageous for power reliability, customer loyalty, load distribution, and various grid operation. Smart grid systems are becoming more prevalent.

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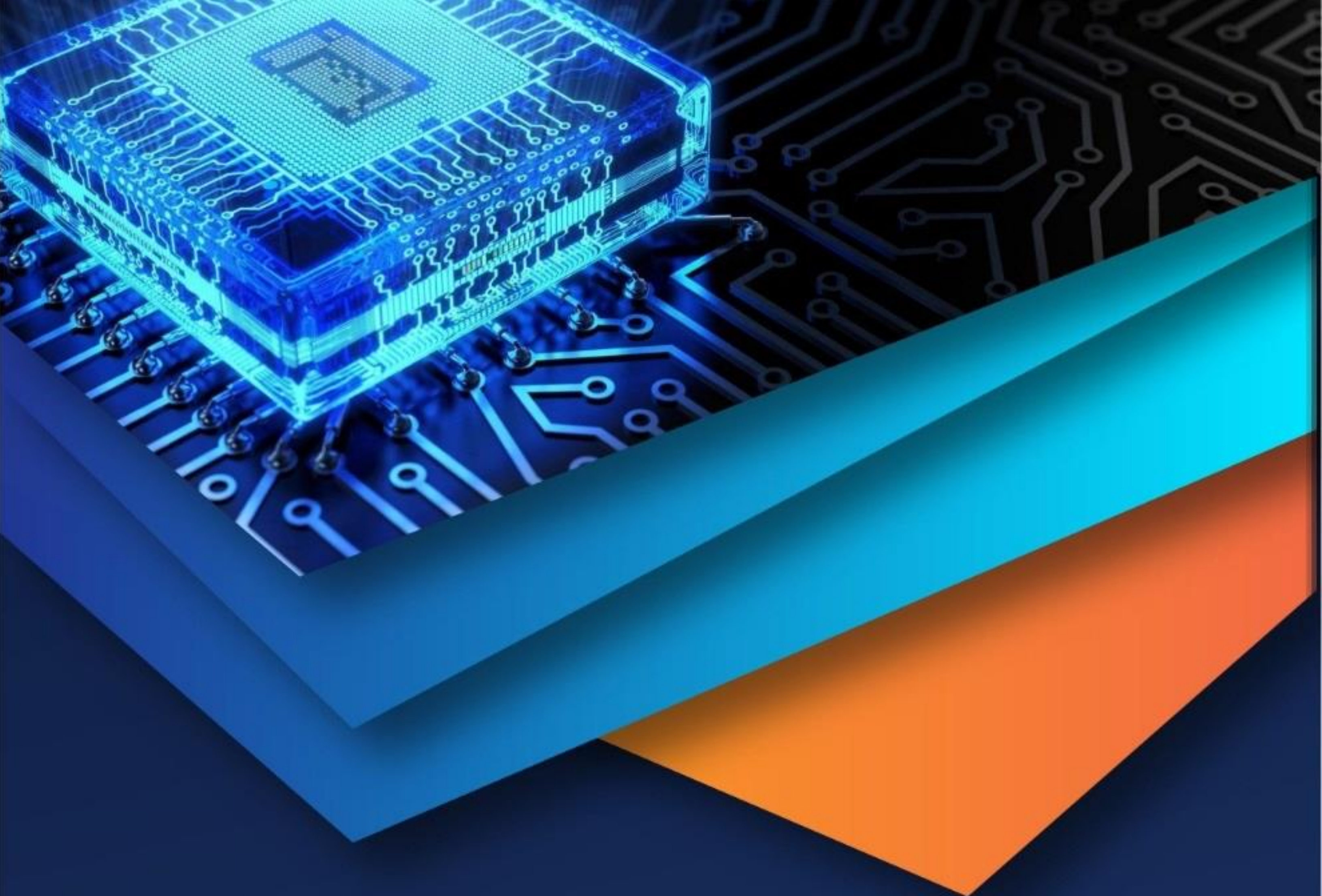

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