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Review on Smart Grid

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ABSTRACT: In order to provide the computational intelligence required to create the Smart Grid, this paper discusses the future of the electric energy system, covering every aspect from power generation to substations, distribution, and customer feedback loops. The transparent, seamless, and immediate two-way communication of energy information is known as the "smart grid," and it gives consumers greater control over their energy choices while also helping the electrical industry manage energy delivery and transmission. Essentially, the goal of the smart grid is to enable user participation in the operation of the electrical system and to greatly improve visibility to lower voltage networks, mostly through the use of smart meters and smart homes. While the roles and forms of smart grid applications and technology vary, they often share common potentials including distributed renewable generation, intelligent energy curtailment, effective demand response integration, and energy storage.

KEYWORDS: Smart grid, Monitoring and Control Network, Smart Power Meter, lifetime, Controller, Cable.

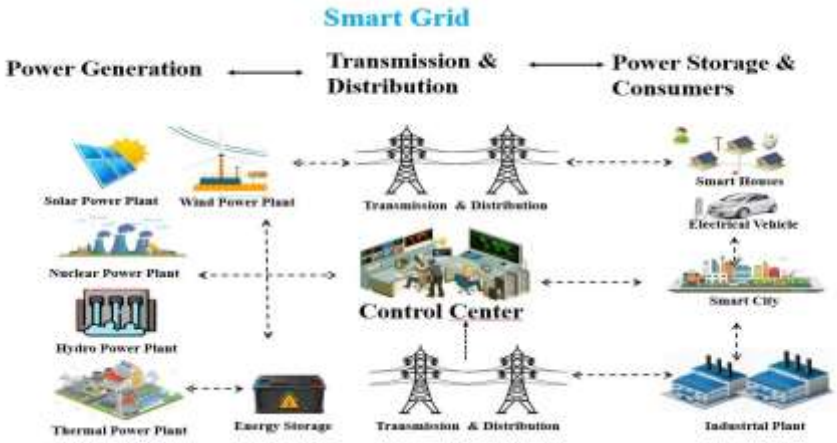
I.INTRODUCTION:

Urbanization, rising living standards, and technological advancements have increased energy demand. This caused an increase in electricity use that, if ignored, would become unmanageable. After a long day, the conventional, centrally-controlled method of distributing electricity is still in use. This is referred to as the power grid. Even with the development of technology, electric grids around the world share the same structure, dynamics, and set of guiding principles since the invention of electricity. Better electric power generation, as well as efficient transmission and distribution, can be achieved with the help of smart grid technologies. The allocation of this power. Compared to conventional methods, it is more space-efficient and easier to install due to its adaptability charts.

Grid observability is the goal of the smart grid design concept. Increase security, performance, and asset controllability particularly the operational economics of the power grid, upkeep and scheduling. A stable and reasonably priced electricity supply is essential for maintaining economic expansion and enabling people to live up to their full potential. The methods used to generate, transmit, and consume energy have changed dramatically during the last few decades. But in the developed world, fossil fuels still make up the majority of primary energy sources. Some of those developed nations had sustained economic expansion, which over time revealed how unsustainable their heavily reliant energy policy was on imported fossil fuels. On the other hand, as seen by the numerous failures in recent years, managing the power grid, which faces new challenges brought on by rising demands and expanding digital and nonlinear loads, has placed additional worries over reliability.

The electric energy system of the future must use cutting-edge technologies to build a smarter, more sustainable grid in order to solve all of these demands and issues. The Smart Grid has been the subject of several papers and conferences in recent years, but there is still considerable misunderstanding about what the word actually means among all parties involved. Despite the fact that the term "smart grid" has been defined in a variety of ways, users have often selected meanings that are specially targeted to their unique applications and regional requirements. We provide the largest definition of the Smart Grid globally below.

The proliferation of renewable energy technology makes the switch to the smart grid imperative in order to improve the stability of our power grid. Technology advancements and the need to reduce pollution have led to a greater reliance on distributed energy resources for the generation of renewable energy. While these resources have a lower carbon footprint and are therefore very environmentally friendly, they can have unfavourable effects on the current grid. Additionally, it can lower losses and increase grid efficiency, which lowers consumer energy costs.



II. Smart Grid Concept:-

A multitude of technologies, consumer solutions, and policy and regulatory forces are all addressed by the notion of the "smart grid." The term "smart grid" lacks a clear definition. There isn't a single description for the smart grid

(SG) that can accurately characterize the phenomenon. On the other hand, an automated intelligent network with the capacity to store, communicate, and make decisions can be summed up as the smart grid.

Realizing a fully functional smart grid will require several decades, as it will be a slow and evolving process. It is neither required nor practical to integrate every function at once in order for a system to be considered smart; instead, each new feature can be added separately. Cost justification and a reasonable return on investment are required for each.

The following features of the smart grid will be unavailable in the traditional electric energy system:

- It optimises and efficiently operates assets by intelligent operation of the delivery system (rerouting power, working autonomously) and pursuing efficient asset management. This includes utilising assets depending on what is needed and when it is needed.
- Two-way secure communications that cover the entire system
- Every major component—cables, junctions, terminations, transformers, consumer consumption, power quality, etc.—is felt, and deviations are identified. Real-time monitoring is carried out.
- Smart Grid gives customers more information and supply options while enabling them to participate in optimizing the system's performance.
- Flexible: the ability to quickly and safely integrate dispersed energy generation and storage at any time or place within the system.
- Reliability: The grid system's capacity to meet consumer needs determines its reliability. This refers to a system that is error-free and flawless and has a constant supply of electricity.
- Automatically repairing or removing possibly defective equipment from service before it breaks down, as well as system reconfiguration to redirect energy sources to keep all customers' electricity on.

III. Components: -

1) Monitoring and Control Technology Component:-Smart upgrades for the power system's generation level will include technology that increases the generation's stability and dependability as well as intelligent controls and a generation mix that mostly uses renewable energy sources.

2) Energy The addition of a sizable energy storage capacity will be a crucial component of the Smart Grid. PV, solar thermal, and wind energy are examples of intermittent power sources that need a place to store electricity in order

to meet demand during cloudy and/or windless periods. The Electricity Storage Organization keeps tabs on the expenses associated with large and small energy storage systems, ranging from fly wheels and supercapacitors to several largescale battery storage devices, and from Lithium-Ion, Nickel-Cadmium, and Lead-Acid batteries.

3) Transmission Subsystem Component:- The core of an integrated power system is the transmission network that links each major substation and load centre. Transmission lines must withstand dynamic load and emergency changes without experiencing service disruptions.

4) Intelligent Grid Distribution Subsystem The last phase of power transmission to end customers is the distributions system. Intelligent assistance systems at the distribution level will include energy management components, communication links between consumers and utility control, and monitoring capabilities for automation utilizing smart meters.

5) Smart Power Meters: It is the most crucial piece of equipment for any customer since it allows for two-way communication between the customer and the DISCOM. It collects end-user data to provide services like automated bill creation and faster repair and rectification of issues by identifying device faults.

IV. Challenges:

1) The general public has low demand and little knowledge.
2) Exorbitant setup costs at first.
3) Data sharing-related security issues.
4) Concern over state abuse of electrical energy regulation.
5) Absence of a legal structure and rectification of issues by identifying device faults.

V. Conclusion

The smart grid, despite its extremely high initial setup costs, is predicted to reduce energy waste to the tune of billions of dollars and enhance the quality of power provided to homes. The smart grid is self-sufficient due to the usage of smart appliances and two-way communication between the consumer and the electrical distribution company. This improves dependability while increasing efficiency and lowering labour expenses associated with the manual meter reading.

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