Smart Grid – for Smart Cities

Shubham Bhatnagar[1] Gurusha Nahar[2] Vijendra K Maurya[3] Rajeev Mathur[4]
[1,2]B.Tech Student [3]PhD scholar [4]Assistant Professor
[4]Department of Electronics Engineering
[1,2]RTU [3]CPU Kota RAJ [4]GITS, Dabok, Udaipur, RAJ

Abstract— To meet the requirements of a smart city in supporting a sustainable high-quality lifestyle for people, there is a need of a lot of smart technologies & a smart city needs a smart grid. Smart grid is an integration of electrical and digital technologies, information and communication. It delivers electrical power to the customers using two-way digital technologies and also monitors the supply to the customers and measurements. Existing grid has he limited delivery system and a high cost of a power outage and power quality interruption and the communications of the grid are too slow.

Key words: Smart grid, Features, capabilities of the smart grid, Smart home, Renewable energy, Consumer engagement, Distribution intelligence

I. INTRODUCTION

The smart cities of today will require a network which can enhance the system reliability by adapting new technologies. It is also provide end to end efficient power management. This includes high level utility strategic planning functions. The existing power network is outdated and needs better systems to achieve improved, reliable and economical power delivery information flow and secure integrated communication.[1] The Smart Grid with digital communications help to keep an eye on the network whether it is working properly or not, if in case any fault is detected in the network it is capable of sorting it and removing it and again restoring it to maintain the continuity of the system. This action is called as the self healing action. [2,3]

II. SMART GRID

A Smart Grid is a electrical network that in integration of digital and other technologies to monitor the transfer of electricity from various generating stations to fulfill the demand for the users.

It uses smart appliances like smart meters for monitoring, smart energy storing devices, regulating devices for power quality monitoring etc.

The smart grid has advantages for all the consumers whether domestic, industrial or commercial. It simply provides two way channel for energy transfer as it can communicate with both the conventional grid and non conventional grids.

A. Capabilities of Grid Smart:

1) It can repair itself
2) Encourages consumer participation in grid operation
3) Ensures a consistent and superior quality power supply that resists power leakage.
4) Efficient

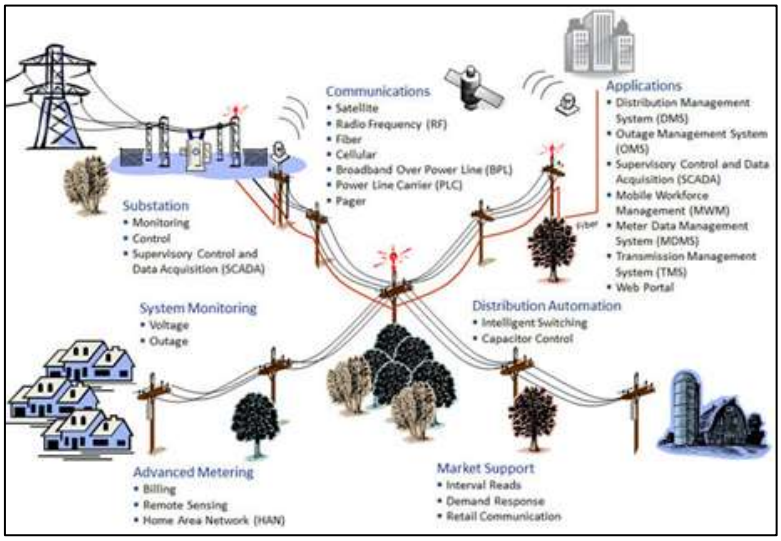

Fig. 1: Commercial & Domestic integration of Smart Grid[2]

III. NEED OF SMART GRID

A. Demand Response and Consumer Energy Efficiency:

When power accuracy is at risk the leftover energy is used by civil and residential customers by mechanism and enticement for utilities. Exact response is quiet necessary for optimizing the stability of power supply and demand. The increased access to the vast energy utilization information, clients can also save energy with efficiency performance and investments that can be achieved by measurable results.[5]

B. Wide Area Situational Awareness:

Monitoring of the power system components display and performance across the internal connections and over large geographic areas in near real time. The aim of situational awareness is to be understood and eventually optimize the managing of energy network components.

C. Energystorage:

The energy must be stored, directly or indirectly. The most common mass energy storage technology used is hydroelectric storage energy. Latest storage capabilities would benefit the entire grid, from production to end use, especially for distributed storage.

D. Advance Metering Infrastructure:

It is the current focus for utilities. It provides synchronized monitoring of energy usage. The metering networks are of many diverse designs and might also be used for the implementation of customer required response which includes the effective pricing. AMI basically consists of the interactions of the hardware and software, and the corresponding method and data managing software that consummately generate the two-way network between progressive and utility systems that allows the distribution and assortment of information and network to consumers and additional parties.

IV. FEATURES

A. Reliability:

This technology uses includes the state estimation which improves the error detection and also allow self-recovery of the arrangement and system without the intervention of technicians. This will make certain more sound supply of electrical energy and hence will reduce susceptibility to natural calamities or attack.

However multiple routes are lauded as a characteristic of the smart grid system, the old technology also featured with several routes. Initial power lines in the grid were built by means of a branched model, later on the connectivity was guaranteed through several routes (network structure). However, this has formed a new problem: if the flow of current in the arrangement or related effects across the arrangement exceeds the certain limits of the specific system constituent, it might fall short, and the current would be shunted to further network essentials, which ultimately might fails causing domino effect.[8]

B. Flexibility in system topology:

The transmission infrastructure in the succeeding generation will be enhanced capable to feel likely bidirectional energy flows, that will be allowing intended for dispersed generation for instance commencing PV panels on structured roofs, and also the utilization of fuel cells, charging to or from the batteries of electric vehicles, wind turbines, and other sources.

Standard grids were planned for the direct stream of electricity, but if a limited sub-network generates additional energy than it is using, the counter flow can raise reliability and safety issues. A smart grid system aims to cope with these situations.

C. Effectiveness:

Assistance to overall improvement of the efficiency of power infrastructure are predictable from the exploitation of smart grid system, which includes consumer management, for example turning off air conditioners during temporary spikes in energy price, lines through Voltage, eliminating truck-rolls for meter reading, and reducing truck rolls by enhanced outage management using data from Advanced Metering Infrastructure systems. In general the effect is less redundant in conduction and supply lines, and better utilization of generators, hence lowering the power cost.

D. Load adjustment/balancing:

The overall load associated to the power grid varies considerably over time. Even if the total load is the addition of various individual choices, the total load is not stable; a slow varying increment of the load if a popular TV program starts and millions of televisions will draw current straight away.

E. Market-enabling:

The smart grid allows for efficient communication between suppliers and consumers and permits both the suppliers and the consumers to be more flexible and refined in their outfitted strategies. Only the significant loads will be needed to recompense the energy prices, and also consumers will be able to be further considered in when they use system energy.

V. SMART HOME

Smart home with the integration of smart technologies can prove a very useful system as it can not only improve power consumption but also with use of renewable sources it can improve the consumptions rate with active human participation. This can be achieved by monitoring and controlling power from utility grid and the appliances used at home. The power consumed or produced after an extent can be send back to the utility grid so it is two way communications between grid and consumers. Thus it reduces the overall cost and only one time cost is considered.

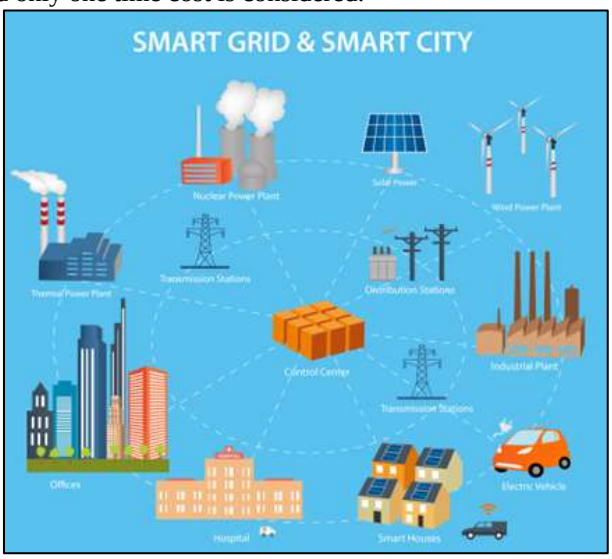

Fig. 2: Smart City & Smart Grid

A. Smart Meters and Home Energy Management Systems:

With the new enhancemenet of technology there is also need of new appliances so comes the need of smart meters. Smart meters provides smart grid interfacing between consumers and service provider. The smart meters take the place of old meters and uses digital technology for automation and for transfer of information between consumers place to the energy provider grid. It reduces the energy costs. Smart meter operates on EMS.

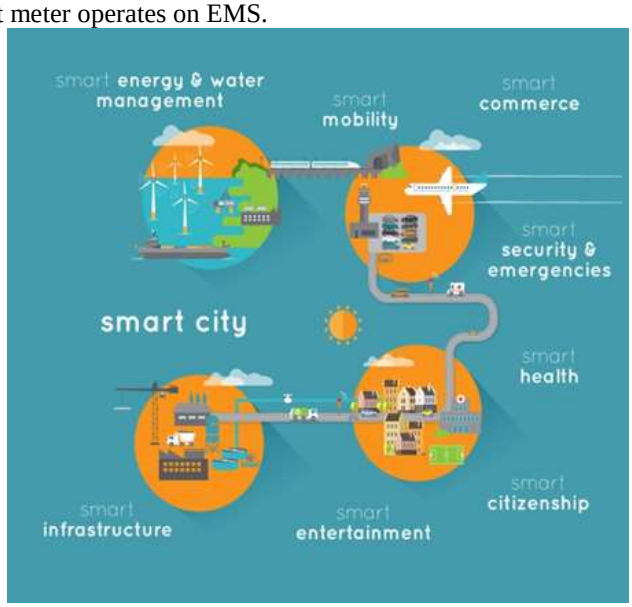

Fig. 3: Smart community

VI. THE "SELF-HEALING" POWER DISTRIBUTION SYSTEM:

A self healing grid makes use of digital technology and components and real time secure communications automated technologies. The self-healing grid removes problems as soon as they are detected so that the continuity in the network is maintained. The whole process of detection of fault, removing it and restoring the network is self healing action of grid.[10]

VII. DISTRIBUTION INTELLIGENCE

Ditribution intelligence refers to the distribution of power with the components such as transformers, feeders, isolators, circuit breakers which help in outage management. In smart grid the real time outage management is priority so to achive real time

monitoring the components carrying power to the consumers home should be smart enough for monitoring the outage management.

VIII. CONCLUSION

The smart grid is an essential component of smart cities as the electrical power is the basic need of the community. So by this paper work we focused to reflect the importance of the smart grid its features and components. For this proper planning and maps should be provided and this can be achieved by using smart appliances for monitoring the technology. For this this project must be considered as a top priority by the Government in their SMART CITIES PROJECT.

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