



THE NEW WAY OF ELECTRICITY IN INDIA (SMART GRID)

Bhoomika Sharma
M.Tech Student
Bhagwant University
Ajmer (Raj.)

Mr. Satya Narayan Joshi
Assistant Professor
Department of Electrical Engineering
Govt Women Engineering College, Ajmer

Mr. Prashant Singh
Assistant Professor
Department of Electrical Engineering
Bhagwant University, Ajmer

Abstract: Energy sector is the most essential segment of India while considering infrastructural and economical impact. India is fifth largest electricity producer and sixth in terms of consumption. India itself consumed 3.4 % of global energy. The demand of electricity in India is increasing at the rate of 3.6% per year over the last 30 years. The electricity grid faces new challenges and tensions a day that put at risk its ability to supply energy reliably to the consumer. Thus resolved all the previous problem that we need to introduce a new form of electricity is the intelligent network. The document presents information on Smart Grid. Using data and recent knowledge on Smart Grid, this paper mainly presents the meaning of Smart Grid, the importance and objectives, the challenges of Smart Grid, the history of the development of Smart Grid. The application of the intelligent network, the smart meter and the intelligent network component are also discussed.

Keywords: Smart Grid, Electrical Power Grid, Smart Meter, Application, Challenges, Reliability.

1. INTRODUCTION

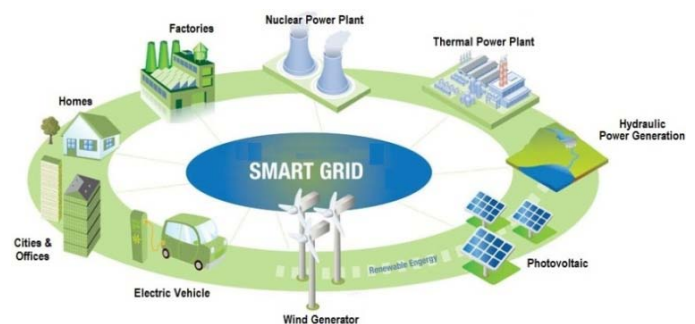
The intelligent network is a new way of representing a current electricity network. Smart Grid is a technique which interconnects digital technology to electrical power grid. It provides many future technologies, some of them are currently being used in untied states which. The main components of Smart Grid is

- electrical power grid generation,
- automated digital control device
- intelligent monitoring, transmission
- Smart distribution system.

All these flows the electricity from generating station to distribution substation and distribution substation to customers. By This process we can control and monitor energy flow, cut the power loss, improve the quality and developed the more reliable and controllable smart network of electricity. [1] An intelligent network is an electricity network that includes a range of operational and energy measures that include smart meters, smart devices, renewable energy resources and energy efficient resources. [2] Electronic energy conditioning and control of electricity production and distribution are important aspects of the smart grid. The intelligent network is a combination of electrical and electronic technology. Electricity is generated and this energy is controlled, electronically distributed. The intelligent network is a digital towing technology. The intelligent network is a smart view of the Indian network. The digital technology that enables bi-directional communication between the utility and its customers and detection along transmission lines is what makes the network intelligent. Most suitable example to describe smart grid is

internet .as we can see in internet smart grids also have automated control devices, monitoring meter (smart meter) etc. [3] smart grid is basically used to improve the power efficiency, minimize the consumption of energy, transparency, cost and accuracy and reliability of the power . The purpose of smart grid is

- remove weakness of conventional power grid
- Actively production of electricity.
- A different way to increase the use of apparatus and technology in smart network system [4]



2. SMART GRID DEVELOPMENT ERA

Nikola Tesla was a Serbian American and electrical engineer. he was introduced The electricity grid in 1896, but just, over the last 50 years, conventional electricity system have not deal with new challenges, like that accuracy, high demand for energy quality, relativity etc. Therefore, the thought of Smart Grid has emerged and since

2005 the word intelligent network (smart grid) has been used.

A. Smart Grid Initiatives

ENEL S.P.A is an electricity department authority located in Italy .it is introduced Teleogestore project in 2005. this project was very dissimilar from that of other systems. Its general construction integrates are electronic meters, measurement functions, PLC and SCADA communication functions.. The Teleogest project is considered to be the first commercial use of Smart Grid. It provides an annual savings of € 500 million for € 2.1 billion[5]European technology works on the smart grid project since 2005.recently European union set a mission to provide smart meter more than 80% consumer till 2020 .Europe countries implement the following project like development of RES , smart metering with smart appliances etc.aim of united kingdom is developing the smart grid which is provide the flexibility to the electricity network.

B. Work Flow in United States

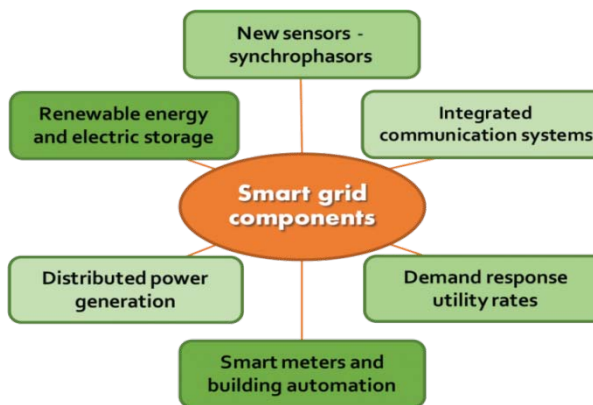
In United States currently many institutions are involved in developing of smart grids. Major universities like – Texas University, California State University some other universities are also already actively create the new ways to increases the efficiency of machinery and technology to build a smarter network.

Some Major Institutes involved are -:

1. University of Hawaii.
2. Institute of Technology.
3. Beach Cities
4. Fort Collins [6].

3. MECHANISM OF SMART GRID

- New Sensors and Controls
- Integrated Communications System
- Demand Response
- Smart Meters
- Distributed Power Generation And Renewable Energy
- Energy storage



A. New Sensors And Synchrophasors

The sensors in our high-voltage network normally provide measurements for network operation and control in one direction every two to four seconds. A few seconds is all that an interruption in the distribution must cause blackouts. Instead, the phaser units (PMU) or the synchropors are

distributed in greater numbers to control the voltage, current, frequency, phase angle and various environmental conditions at a rate of 30 times per second. Furthermore, these measurements are synchronized by the GPS to provide accurate knowledge of the network status over a large area at any time. [7]

B. Included Communications Systems

The intelligent network depends to a large extent on data collection and communication and control systems. To achieve this, a more sophisticated information infrastructure must be integrated into the existing energy infrastructure. Wireless telecommunications systems in wavelengths and dedicated radio frequencies are the main option to become the standard for data transmission from new sensors and communication with various electronic devices. [8]

C. Demand Response

Reducing the demand for maximum power is an important part of an intelligent network. DR offers consumers the opportunity to play an important role in the operation of the electricity grid by reducing or modifying their electricity consumption during peak periods in response to time-based tariffs or other forms of financial incentives. A smart network will allow them to better combine supply and demand and possibly reduce these losses by half [9].

D. Advanced Metering Infrastructure (AMI) or Smart Meters

Smart Devices are electronic devices that reduce power consumption within an hour or less and communicate with at least every day with the users to monitor and bill. Smart meters allow for double bonds between metric and central systems. Intelligent meter is a new type of gas and electricity that can deliver metric data readings to your energy provider for more precise energy bills. [10] Smart meter is different from the basic home energy meter .the feature of smart meters is collect data for generated automatic reports. Reading of advanced measurement infrastructure (AMI) is different from the traditional energy meter reading (AMR) as it provides two way communications from Electricity Company to consumer and vice versa. Communications between meters to the network can be done through to fixed or wireless connections. Cable communication options include support for power line (PLC) [11]

An intelligent meter continuously monitors the use of electricity in the service company's home. In the opposite direction, the smart meter provides consumers with price information for dynamic usage time. Smart meters are a state-of-the-art measuring device for both gas and electricity. They replace standard meters, which use technology created decades ago and require families to follow their own readings and send them to suppliers if they want precise invoices [12]



advances in storage technology reduce costs, increase reliability and increase energy and power density [15]

4. CHARACTERISTICS OF THE SMART GRID

A. Load balancing

The total load connected between the power grid and consumers can vary continuously over the clock. The total load is a collection of all individual load used by consumers. Total load is not a stable, perform slow response and consume larger amount of energy. In general, if total load connected with power grid is increases and power consumption due to increases total load also rapidly increase. This change must be faster than the start –up time of a large generator; but resolve this problem some backup generators are put on a standby mode. If there is an intelligent network, it is possible to limit all individual devices, or another larger client, to temporarily reduce the load or continuously (in the case of partial resources). With The help of mathematical prediction algorithms allows us to determine how many backup generators should be used to reach a certain error rate. In the traditional grid, the bankruptcy rate can only be reduced at the expense of multiple reserve generators. In an intelligent network, the reduction of the load even by a small part of the clients can eliminate the problem.

B. . Deduction of The Demand Fraction

electricity grid delivers the power by generator ,transmission line, grid components ,transformer and substation etc to the consumer with the help of control system. Normally, information derives only from users and charges that control utilities. Public utility companies try to meet demand and succeed or fail in varying degrees, such as low voltage, blackouts and uncontrollable disconnections. Demand response support provide generators and loads work together in an computerized way in real time. Due to this fraction of demand load is eliminat and increase the life of equipment and allows comsumers to reduce their energy bills with the help of effective low priority devices.because these devices is cheap .

C. Provides good power quality for distribution of power

Smart grid Distribution substation provides each and every consumer to create owns energy generation small plant like solar plant, wind plant etc. due to this individual loads which is separately used by consumer is manage by own generation plant. This technique makes them independent of the public and private power grid, result is consumers can avoid power outages problems. Current power grid is delivers power in one direction from generator to consumer, and delivers power is limited if a local sub-station generates more energy gather than its capacity so poor power quality problems raise. An intelligent network can handle these situations. [16]

5. WHAT ARE THE CHALLENGES TO IMPLEMENT INTELLIGENT NETWORK IN INDIA?

The implementation of smart grid will not be an easy task since the Indian electricity sector poses a number of

Advantages of Smart Meters

Advantage of installation of Smart Meter for both utility and consumer given below :

- Management of data is batter compare from old grid .
- For metering and billing purpose More reliable and accurate data.
- Reduced cost of electricity.
- Eliminate person efforts for reading and billing
- Beginning of data from renewable energies
- Improved and increased rate options and power quality data
- Reduced connectors and disconnections.
- Early exposure of meter tempering, billing errors and theft
- better efficiency, reliability of services, losses and loading
- Reduction in regulatory complaints
- Improved environmental benefits[13]

E. Distributed Power Generation And Renewable Energy

The electricity grid has been built to transmit energy in one direction, from large centralized power plants to many points of use. With small-scale renewable energy, the system must transmit the power of many manufacturers distributed in the system and route it as needed. Wind and solar energy variability requires rapid response and therefore advanced automation and control techniques to efficiently integrate them into the network [14]

F. Energy Storage

The ability to store energy can provide great flexibility in network operation by providing a degree of decoupling between production and use of energy. This can be particularly useful in the case of renewable energy sources, such as wind and solar, which are inherently intermittent. An intelligent network would allow the renewable energy sources to be fed into the network as needed or temporarily stored for later use. Many options for storing electricity are available or in development and their more general use can occur when

problems, such as the minimization of t & d losses, energy theft, inadequate network infrastructure, poor measurement efficiency and lack of knowledge.

Power Theft: Energy theft has been one of the main problems in India. Distant overhead mechanism is used to cut the energy larceny and LT power cables used for energy allocation could be replaced by insulated chains to decrease power stealing by hooking, another option to minimize power theft is used digital meters which are substitutes of Conventional energy meters and the use of prepaid cards is also reduced the power theft.

Complexity and cost for development smart Grid Infrastructure: India country is a developing country; there is a necessary to build a modern and intelligent network and conventional grid is replaced by smart grid. Due the reliable and economically secure Smart Grid network, India can give a stable and secure atmosphere for investments in electrical road and rail network .smart grid resolve fundamental network problems.

Poor Metering accuracy: due to the poor power measurement, power theft etc increase the commercial losses .billing problem these entire problem can be remove by improving measurement efficiency, reliability, accounting and accurate power energy auditing and accurate billing. Determining the liability of the staff / feeder managers can greatly help decrease the loss of AT & C.

Lack of knowledge: Consumers' understanding of how energy is delivered to their homes is really minimal. Before implementing Smart Grid concepts, they should be learned about Smart Grids, application, goals, benefits of Smart Grid and the precipitin of Smart Grid to generate good power quality. Consumers should be familiar with their appliances of energy consumption at home, in the office, etc. Power Companies should be focusing on the development of smart grids and give advices to consumer to use of smart meter. Related to future prospects of smart grid Policy makers and regulators must be very clear. [17]

Technical Challenges

The electrical network is made up of a large number of highly distributed nodes that are tightly connected and work in real time security is the main challenges of smart grid because of its digital nature, sometimes it's is affected by the spams, worms; virus etc. and this is concern to national security of the system. However some mechanism developed by engineers but this very complex to implement and understand. Primary all the electrical system is an uncontrollably operation. At the same time, it is continuously rising. The emergent of Smart Grid has previously started and it is to be implemented as an "development" of following projects for more than a few decades. [18]

6. STATUS OF SMART GRIDS ACTIVITIES IN INDIA

There is most unused latent in the electricity sector in India. The significance of Smart Grid and Micro-grid for the nation was underlined by government officials and council from the power sector, developing a promising production chance. India's main objective is the electrification of all

families, providing adequate energy for the agricultural sector and the availability of 24x7 energy for all citizens by 2019.

Vision of India Smart Grids is "transforming the Indian energy sector into a safe, adaptable, sustainable ecosystem and providing digital quality and reliable power for all enabled with the active participation of stakeholders"

In 2015, the Indian Ministry of Energy put up the National Intelligent Grid Mission (NSGM) to plan and observe the completion of policies and programs connected to the actions of smart grids in India. The role of ISGTF has been fused into NSGM, NSGM is also coordinating the progress of smart grids in smart cities inside the Smart Cities assignment. NSGM promotes the consumption of Smart Grid technologies such as Advanced Metering Infrastructure (AMI), the renewal and transformation of substation distribution substations Insulators gas (GIS), where efficiently sustainable and circulation generation in the form of solar photovoltaic roof top, monitoring and control real-time supply transformers, the creation of electric vehicles (EV) charging transportation to support the explosion of electric vehicles, the development of medium-sized microrets and the provision of measures to pick up the quality of power supply dimension. The Indian government is promoting the expansion of smart grid projects within the NSGM through 30% financial support in capital expenses. [19]

7. CONCLUSION

In this article we examine the state of the traditional electricity grid and the realization of a new era Smart Power Grid with new communication technologies for Smart Grid and Smart Meter This document represents the investigation on the intelligent network in India and illustrates the challenges, features and the introduction on the intelligent network. This document also presents a general description of the intelligent network. If the smart grid is fully established in India, then many electricity problems are overcome, but it will take time. this paper also present overview on smart grid .if smart grid is completely established in India so there is many problem is overcome related to electivity, but it will take time.

8. REFERENCES

[1] <http://earth2tech.com/2009/06/05/>
 [2] Wikipedia, the free encyclopedia
 [3] www.smartgrid.gov
 [4] www.techopedia.com/
 [5] <http://www.narucmeetings.org/>
 [6] <http://events.energetics.com/rdsi2008/>

- [7] <http://www.myfloridahomeenergy.com/>
- [8] From Wikipedia
- [9] www.uswitch.com/
- [10] www.uswitch.com/
- [11] Rohit Sharswat. Smart Meter and AMI: the future measuring system in Smart Grid.
- [12] <http://www.myfloridahomeenergy.com/>
- [13] <http://www.energyfuturecoalition.org/>
- [14] <http://smartgrid-for-india.blogspot.in/>
- [15] <http://dst.gov.in/sites/default/files/India%20Country%20Report%20on%20Smart%20Grids.pdf>
- [16] <http://www.iec.ch/smartgrid/challenges/>