Smart Grid-The Upcoming Era

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Abstract— **Smart Grid is all about information and control. The objective behind the smart grid was to reduce the complexity of the grid system Solution for increased energy demand. We discussed about the smart grid features, functionalities and characteristics. At last, it gives brief information about how these technologies shaped our modern electricity grid. It increases the weight for better alignment of energy demand and supply.**

Index Terms— **Smart grid, Co_2 Emission, Smart Home**

I. INTRODUCTION

This paper briefly explains about the evolution of Smart Grid, the need for its invention. Today the world is running behind new technologies and everyone wants to be comfort and to be more secure towards their life. Our electric system has not changed from years but today we need to enter into a new phase of development. So there is a need to move into a new era of electrical system. The grid was built when energy was reasonably low cost. While minor upgrading has been made to meet rising demand, the grid still operates the way it did almost 100 years ago energy flows from central power plants to consumers, and reliability is ensured by preserving excess capacity (www.theiet.org).

The present revolution in communication systems, particularly moved by the Internet, offers the possibility of much greater monitoring and control throughout the power system and hence more effective, flexible, and lower-cost operation. The Smart Grid is an opportunity to use new information and communication technologies (ICTs) to modernize the electrical power system. However, due to the vast size of the power system has been made in it over the years, even any significant change will be expensive and requires careful justification (www.theiet.org). Today no one can imagine their daily life without electricity. People are habituated to use gadgets in their daily life. Today life of man becomes complicated without the use of electronic and electrical appliances.

Grid system is one of the most complex systems in the electrical department. Today grid system satisfying the people needs and desires but present grid fails at critical situations. So the people who first used the word smart in conjunction with the word grid, came with the development Smart Grid were convinced that the present grid would be fail to provide services of energy demand to the future society, so there must be a scope to change our present grid system (www.theiet.org). The future grid has to meet the demands of consumers efficiently and reliably. It should decrease the waste and decrease the environmental effect. Future grid would have to be responsive, Paper also explains about where the Smart grid is put into practise today. When electricity was introduced over 100 years ago, in companies the supply of electricity used to be independent i.e., the local bodies generate their independent electricity generation.

In 1930's the system has undergone a drastic change, all these independent electric systems are combined as they all are connected to a common grid called as transmission system or national grid. The reasons behind this were to provide better supply security and to reduce cost. The system allowed larger and more efficient power stations to be built far away from the consumers place (www.theiet.org). Next to this a prior development in electrical system is Smart Grid. Among the improvements to the present grid, the grid should situationally aware and should respond locally to meet the needs regionally, globally, to maintain stability and efficiency.

Smart Grid has to work "smarter" than what we have today. Nearly 40% of CO2 are emitted from electricity generation sector through the combustion of fossil fuels like coal, oil, and natural gas to generate the heat needed to power steam-driven turbines. Burning fuels results in greenhouse gases which are responsible for global warming (M. Liserre et al. 2010). Climate scientists are clear that man-made greenhouse gases like in generation of electricity power, are leading to dangerous climate change. Hence generating electricity without the production of CO2 must be found. Scientists, researchers, industrialists, and academics are all working hand in hand to make a smarter and stronger electricity grid to achieve efficiency and a more environmentally sound approach to meet our energy demands. Smart meters are an important development of the Smart Grid as they provide information about the loads and hence the power flows throughout the network. Because of all its advantages the Smart Grid is being proposed to call by many names like "electricity with a brain", "the energy internet" (S. Khoussi et al. 2017).

II. Evolution of Smart Grid

The existing electricity grid is a result of rapid urbanization and infrastructure developments in various parts of the world. The growth of the electrical power system has been influenced by economic, political, and geographic factors. Despite such differences the existing electrical power system has remained unchanged. Since its beginning, the power industry has operated with clear differentiations between its generation, transmission, and distribution subsystems and thus has shaped different levels of automation, evolution, and transformation. The existing electricity grid is hierarchical system in which power plants power delivery to customers loads.

The system is essentially a one-way pipeline where the source has no real-time information from the service benefiters. A typical example is the widely organized system known as supervisory control and data acquisition (SCADA) given the fact that nearly 90 % of all power blackouts and disturbances have the main reasons in the distribution network; the move toward the Smart Grid has to start at the foot of the chain, in the distribution system. Moreover, the drastic increase in the cost of fossil fuels with the inability of utility companies to expand their generation capacity in line with the rising demand for electricity has accelerated the need to modernize the distribution network by introducing technologies that can help with demand-side management and revenue protection (M Rahat Hossain et al.2013).

III. Smart Grid

Power generation is likely to move towards more renewable sources in generation side. Some non-conventional sources like wind farms are large-scale and interface with transmission networks, but many renewables are small-scale, and hence appropriate for interconnecting at the distribution level. This change in the design of the grid needs special interfaces. It incorporates distributed (or local) generation such as PV, biogas and wind, which will be supported by battery storage and fast-starting generation sources (M. Liserre et al. 2010). Non-conventional energy sources like hydropower, solar, and wind energy are environment friendly sources. However, they are not available everywhere. Hydropower energy is restricted to dams, and solar energy requires sufficient intensities.

Wind energy requires a constant unidirectional wind speed, which could not be possible at every time. But in most cases, solar and wind energies are coupled with a traditional diesel or gas generator to supply power when these sources are insufficient. Hydropower dams convert water kinetic energy when falling from high potential to a lower potential into electricity. The construction of hydropower dams has many impacts on natural river systems. It can flood lands and destroy land habitats; it destroys the life of river populations (C. Harris et al. 2010). There are two different methodologies to generate electricity from the sun: photovoltaic (PV) and solar-thermal technologies. Photovoltaic cells were initially advanced for the outer space program over 30 years ago. When sunlight strikes the PV cell, physical reactions leads to release of electrons, thus by generating electric current.

The small current from individual PV cells, which are fitted in modules, can power individual homes. Solar-thermal technologies are a thermal electricity generating technology. They use the sun to heat water and create steam to run an electric generator. Parabolic systems use reflectors to focus sunlight to heat water which in turn creates steam to drive a standard turbine (L Abdallah et al. 2013). Wind power plants use large spinning blades to arrest the kinetic energy in moving wind, which is then transferred to rotate rotors to produce electricity. Regions where wind speeds exceed 20 km/hour are the best wind power plant sites. A wind farm consists of large numbers of turbines each mounted atop tall towers in rural areas, requiring a large portion of land with almost no populations. Two worries always arise when designing a wind farm: noise pollution and the effect on bird populations (L Abdallah et al. 2013).Introducing Smart Grid to the power grid infrastructure will:

- ✓ Ensuring the reliability of the grid.
- ✓ Allow for the advancements and efficiencies.
- ✓ Exerting downward pressure on electricity prices.
- ✓ Maintain the affordability for energy consumers.
- ✓ Provide consumers with greater information.
- ✓ Lodge renewable and traditional energy resources.
- ✓ Enable higher penetration of alternating power generation sources.
- ✓ Revolutionizing not only the utility sector but also the transportation sector through the integration of electrical vehicles as generation and storage devices.

The Smart Grid will promote environmental friendly quality by allowing customers to purchase lower-carbon-emitting generation, and allow access to more environmentally friendly central station generation. Furthermore, the Smart Grid will allow for more efficient consumer response to prices, which will reduce the need for additional fossil fuel-fired generation capacity, thereby reducing the emission of CO_2 and other pollutants (M Rahat Hossain et al.2013).

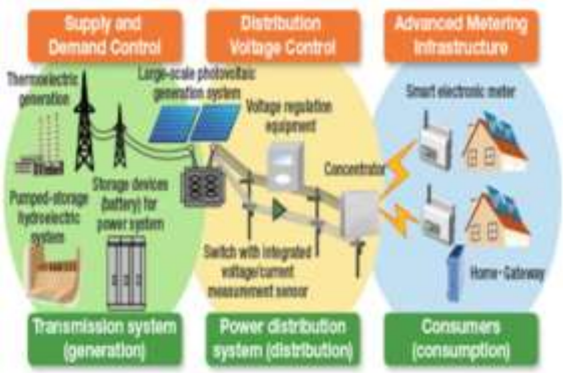

Fig.1 Power Generation and Distribution (M R Hossain et al. 2013)

Fig.1 illustrates about how the power is being generated, distributed to the consumers. We can observe that the electricity being generated with renewable sources like solar and hydro power and also how the transmission lines are equipped with sensors. Now-a-days, we mostly heard about Smart Grid through media, but no one had clarity about what a Smart Grid is. Don't think that as the "Smart Grid" has "Smart" word in it, it is no way related to our phones but the concept slightly matches to it. As we know the Grid, is a group of transmission lines, transformers, distribution system along with accessories supplying electricity (M Rahat Hossain et al.2013).

The grid refers to electric grid which delivers electricity throughout the day to satisfy user's daily demand. Smart grid is an user safety by continuously reliably distributing electricity grid by adding smart meters and monitoring systems to the power grid in order to ensure electronic communication between suppliers and consumers. The mode of communication between the producer and consumer. Smart Grid is a powerful plant with fully constructed with computer programming, digitalization which performs a two way communication (M Rahat Hossain et al.2013). When Smart Grid gets fully functional around 2040, "it ensures sustainable power system with low losses, high levels quality and security of supply. "Smart Grid gives an opportunity to learn about new information; technology and it reforms the electrical system".

The government is concerned about the environment as the release of harmful gases into the atmosphere is being increased day by day. Merely the release of 40% of CO2 into the environment is due to electricity production in India. As the government is concerned about the issue, the need of usage of fossil fuels in the production system has to be decreased which can be attained by using Smart Grids rather than power grids. If power grids be replaced with Smart Grid, the emission of greenhouse gases into the environment can be decreased (M. Liserre et al. 2010).

3.1 Need to go for Smart Grid

It is important to knowthat the conventional grid is a unidirectional network i.e., electricity flows unidirectional from generators to substations, over transmissions lines, and eventually to consumers. It should be noted that most of the equipment and lines of the conventional grid were installed many years ego. They are large investments. As a result, these grid elements are out dated and need to be maintained frequently in order to keep the power flowing. Also, fossil fuels are constantly being depleted. By considering all points there is a need to go for Smart Grid is which has more advantages than the traditional grid. Challenges in a conventional grid are installed grid elements were designed to meet historical energy demands rather than the present-day demand. Increased demand for power during peak demand a challenge to the existing grid infrastructure. If demand exceeds supply, then grid collapse or if supply exceeds demand, then the result is unused energy or waste. Have to monitor the electric flow manually. The Smart Grid offers solutions to most of the points discussed above (S Khoussi et al. 2017).

3.2 Characteristics of Smart Grid

In short, a Smart Grid services innovative products and services together with intelligent monitoring, control, communication, and self-healing technologies. The following suggests the following characteristics of the Smart Grid: Smart Grid permits consumers to play a part in optimizing the operation of the system and provides consumers with greater information. Smart meters, smart appliances and consumer loads, micro-generation, and electrical vehicles enables demand response and demand-side management through the integration of information related to energy use and prices. It is expected that customers will be provided with information and to modify their consumption pattern to overcome some of the constraints in the power system.

Smart Grid facilitates the connection and operation of generators of all sizes and technologies and accommodates generation and storage options. It provides accommodations and facilitates all renewable energy sources, distributed generation, residential micro-generation thus significantly reducing the environmental impact of the whole electricity supply system. It optimizes and efficiently operates assets by intelligent operation of the delivery system (rerouting power, working autonomously) and pursuing efficient asset management. This includes utilizing assets depending on what is needed and when it is needed. It operates buoyantly in disasters, physical or cyber-attacks and delivers enhanced levels of reliability and security of supplying energy. It assures and improves reliability and the security of supply and responding in a self-healing manner, and strengthening the security of supply through enhanced transfer capabilities. It provides power quality of the electricity supply that enhances with the digital economy. It access to the markets through increased transmission paths, aggregated supply and demand response initiatives. (M Rahat Hossain et al.2013)

IV. ELECTRICITY IMPACT ON ENVIRONMENT

4.1 Causes for Pollution

Environmental scientists say that 40% of carbon di-oxide emissions into the environment are due to electricity generation where continuous burn of fossil fuels is required Fossil fuel power plants release air pollution. But today no one can live without electricity. All variety of fuels used in generation of electricity has some impact on the environment. Fossil fuel power plants release air pollution, require large amounts of cooling water, and releases more amount of CO2 during the mining process. People are habituated to live luxurious life. So electricity became part and parcel of present day lives. At the time of disasters, at the time of blackouts, people suffer a lot because of scarcity of water, need of communication, need for health issues for three days. So the industrialists are not worried about effect on environment. They are worried only about the consumer demands, but the government is worried about environment pollution which is increasing day-by-day. So we need a grid which works smarter than today.

A grid consists of mainly three sectors: generation, transmission, distribution and consumption. Smart generation includes the use of non-conventional sources like wind, solar, hydro power. Smart transmission and distribution relies on developing the existing overhead transmission lines, substations. Smart consumption will depend on the use of energy-saving lighting lamps, developing smart homes (Lamiaa Abdallah et al. 2013).

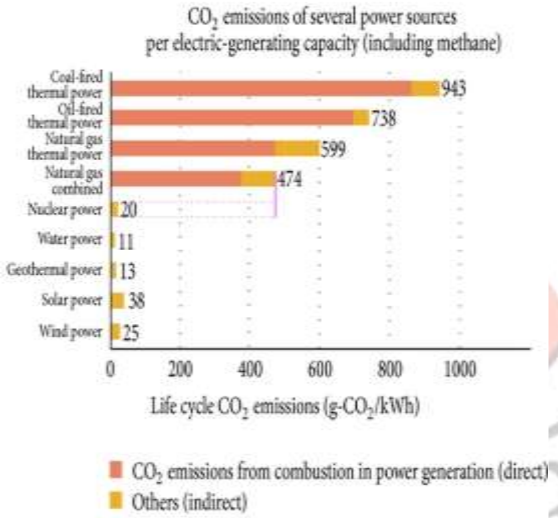

Fig. 2 Effect of Green House (Lamiaa Abdallah et al. 2013)

The figure 2 shows the direct and indirect effect of Green House Gases (GHG) emissions from various energy sources, which tremendously increasing the present day pollution.

4.2 Consequences of Pollution

Over the past two periods, mankind has increased the concentration of CO2 into the atmosphere and it is rising faster every day. As the concentration of CO2 has risen, the average temperature of the planet is also increasing day-by-day. If we continue to emit carbon emissions into the environment then we have to face consequences in near future. Because of increase in percentage of carbon dioxide emissions the temperatures are expected to rise during summer season and many several severe consequences are like sea level rise, droughts, floods, forest fires, water scarcity, acid rains and etc. Because of these our greatest monument, TajMahal losing its appearance because of environmental pollution. Not only monuments of India, wild animals and aquatic lives are also being affected due to environmental pollution. So there is a need to protect our country wealth. As mentioned earlier 40% of CO2emissions are due to electricity generation which uses non-renewable sources which releases greenhouse gases into the environment. So we need a grid which is smarter than today called Smart Grid.

V. SMART UTILIZATION OF ELECTRICITY TO PRESERVE THE ENVIRONMENT

5.1 Smart Homes

A smart home system integrates massively organised sensors and smart meters that can signal appliances, devices. Each home might have such as appliances, Heating Ventilation Air Conditioning (HVAC), solar panels, electric vehicles. All these are to be controlled using a single control unit with a programming feature for switching on and off. The information provided to consumers could consist of various parameters conveyed numerically, graphically, or symbolically as alerts or alarms, including: current and historical energy use, equivalent emissions, instantaneous demand, current prices, and ambient temperature, humidity, and lighting levels. The forms of display devices under development vary, consisting of visual indicators employing data tables, charts, colour codes, and flashing lights as well as audio indicators in which alarms are triggered by pre-set values to inform the consumer of pending price events or energy use thresholds. Managing peak load through demand response instead giving consumer's continuous direct feedback on electricity pricing through the day, especially during the peak interval, will make consumers adjust their usage in response to pricing.

Figure 3 shows an illustration of the smart home, with local generation presented in PV cells atop the roof of the home, with sensors embedded in everywhere in the home which sense people, temperature, lighting, and so forth and send these data to the control unit (a small computer) which takes pre-programmed decisions in response to the sensed data, such as switching off lights when there is no one in the room or decreasing power consumption when there are only few persons (as programmed), operating the washing machine and charging the electric car in off-peak periods (Lamiaa Abdallah et al. 2013). The figure 3 makes us to visualize a Smart Home which is embedded with sensors and controlling unit.

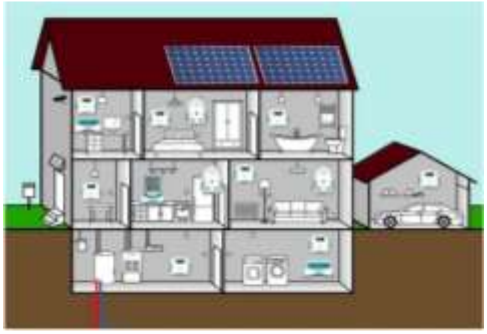

Fig. 3 Smart Home (Lamiaa Abdallah et al. 2013)

5.2 Hybrid Electric Vehicles

Electric Vehicles uses electricity to run. Plug-in hybrid electric vehicles (PHEVs) can run using both electricity and petrol. The batteries of these cars can be charged at home or other places using a usual plug. Only during longer trips, gasoline will be used, as the vehicle batteries are exhausted. The introduction of PHEV might also create the demand needed for companies to invest in electrical resupplying stations.

Fig. 4 Hybrid Electric Vehicle (Lamiaa Abdallah et al. 2013)

The figure 4 is a pictorially representation of a Plugging-in electric or hybrid vehicle and tells how an electric vehicle or hybrid vehicle (running using both electricity and gasoline) is plugged in. A Smart Grid will also enable the market adoption and interconnection of plug-in hybrid electric vehicles (PHEVs) that can be plugged into electrical outlets for recharging. PHEVs will save fuel costs. From a utility perspective, the ability to charge PHEVs overnight provides operational benefits like load factor and utilization of base load resources. From an environmental perspective, the deployment of PHEVs will lead to reductions of greenhouse gases. However, widespread consumer charging of PHEVs during peak periods in the day, for example, increase peak load and increase operational costs. The development of a Smart Grid is therefore vitally important to functions, since it involves the intelligence to send signals to consumers on when to charge their vehicles or provide distinguished rates to encourage off-peak charging. With parallel advances in smart vehicles, the Smart Grid, PHEVs become an integral part of the distribution system itself, providing storage, emergency supply, and grid stability (Lamiaa Abdallah et al. 2013).

5.3 Challenges in Smart Grid

For any new invention, there will be a drawback which is going to be fulfilled by its new development. As a coin has two sides ever development leaves some drawbacks which leads to some new development. As same as conventional grid, has its own disadvantages. Some disadvantages lead to a new phase of development in electrical era i.e., Smart Grid. Even though it has advantages over conventional grid, there are some disadvantages that to be discussed about. Smart Grid challenges start from its implementation itself. The challenges being faced during its implementation is going to be discussed briefly.

Consumers don't know how power is being delivered to their homes, locality. So before and implementing Smart Grid concepts, they should be made aware about what Smart Grids are? How Smart Grids can lower carbon economy? What benefits they can experience from Smart Grids? Therefore: Consumers should be made aware about their energy consumption at home, offices. Policy makers must be very clear about the future prospects of Smart Grids. Utilities need to focus more on the capabilities of Smart Grids rather than implementation of smart meters. They need to consider a complete view. There is a need to make the society and the policy makers aware about the capabilities of a Smart Grid. The main step is to form perfect description on the common principles of a smart grid. Beyond agreement on its characterization, the matter also needs to be debated more holistically as a true enabler to the low-carbon economy. The importance of consumer education is not to be misjudged. The formation of user-friendly and services will play a significant role in convincing the society about Smart Grids. Also the utilities are required to analyze the major challenges in implementation of Smart Grid and their impact on their business model and operations (Huang et al. 2013).

Policy and regulation

The current policy and regulatory frameworks were typically designed to satisfy the existing networks and utilities. To some extent the existing model has increased competition in generation and supply of power but is unable to promote clean energy supplies. With the move towards smart grids, the prevailing policy and regulatory frameworks must evolve in order to encourage reasons for investment. The new frameworks will need to match the interests of the consumers with the utilities and suppliers to ensure that the goals are achieved at the lowest cost to the consumers. Generally, governments set policy whereas regulators observe the implementation in order to protect the consumers and seeks to avoid market exploitation.Moving further, the regulatory model will have to adopt the policy which mainly focuses much on long term carbon reduction and security of supply. This may mean creating frameworks that allow risk to be shared between customers and shareholders, so that risks and rewards are balanced providing least cost to the customer (Huang et.al. 2013).

Technology Maturity and Delivery Risk

Technology is one of the essential tools of Smart Grid which include a broad range of hardware, software and communication technologies. In some cases, the technology is well developed; however, in many areas the technologies are still at initial stage of development and are to be developed to a significant level. As the technologies spreads, it will reduce the delivery risk; but till then risk factor have to be included in the business situation.

On the hardware side, speedy evolution of technology is seen from dealers all over the world. Many recent companies have become more unconvinced to the communications solutions and have focused on operating within a peer of hardware and software solutions. Moreover the policy makers look upon well-established hardware providers for Smart Grid implementation. And this trend is expected to continue with increasing competition from Asian industrialists and, as a result for consequences, standards will naturally form and equipment costs will drop as economies of scale arises and competition increases.

On the software side, the major challenge is to overcome the integration of the entire hardware system and to manage high volume of data. In addition, the multiplying of data puts stresses on the data management architecture that are much similar to the telecommunications industry. Many of these issues are currently being addressed in pilots such as Smart Grid task force and, consequently, the delivery risk will reduce as standards will be set up (Huang et al. 2013).

Access to affordable capital

Funds are one of the major walls in implementation of Smart Grid. Policy makers have to make more beneficial rules and regulations in order to attract more private players. Besides the risk associated with Smart Grid is more; but in long run it is expected that risk-return profile will be closer to the current situation. In addition to this, the hardware manufacturers are expected to invest more on mass production so that technology risk can be minimized and access to the capital required for this transition is at affordable cost (Huang et al. 2013).

Skills and knowledge

As the utilities will move towards Smart Grid, there will be a demand for a new skill sets to complete the gap and to have to develop new skills in data management and decision support. To address this issue, pioneers of engineers and managers need to be trained to manage the transition. These transitions require investment of both time and money from both government and private organizations to support education programs that helps in building managers and engineers for tomorrow. To bring such a change, utilities have to think hard about how they can manage the transition in order to avoid over loading of staff with change (Huang et al. 2013).

Cyber security and data privacy

With the change from analogous to digital, electricity infrastructure comes the challenge of communication security and data management; as digital networks are more liable to wicked attacks from software hackers, security becomes the key issue to be pointed. In addition to this; concerns on privacy and security of personal consumption data arises. The data collected from the consumption information could provide a significant insight of consumer's behavior and preferences. This valuable information could be mistreated if correct protocols and security measures are not adhered to. If cyber security and data privacy issues are not addressed in a transparent manner, it creates a negative impact on customer's view and will prove to be a barrier for adoption Security (Challenges in the Smart Grid Communication Infrastructure).

Overcoming the Challenges

Inspite of the challenges mentioned above, there are a number of steps that can be taken to the implementation of smart grid technologies. First step that is required to be taken is that policy-makers need to restructure the economic reasons and align risk and reward across the value chain. By building the right economic environment for the private sector investment and focusing more broadly about the way that social value cases are created and presented implementation would become much easier. By analyzing these solutions in bigger environments i.e. in cities, the entire industry will learn to implement smart grids successfully and will result in developing an industry (Challenges in the Smart Grid Communication Infrastructure).

Forming Political and Economic Frameworks

Policy makers have to implement a framework which optimally spread the risk over the whole value chain i.e. to yield the result at lower cost to the customers. They have to form a strong incentive model in order to attract more and more private investment. Rewards and penalty mechanism should be considered in order to monitor the performance of the utilities and to boost them to deliver the outcomes in the most efficient manner.

Technological and delivery risk connected with Smart Grid are significant. And this can be overcome over a period of time as more issues arise and addressed. Risks connected with Smart Grid have to be shared by every member. While making the framework, regulators must consider how much of that risk a utility can pass on to the contractors and consumers. By maintaining the proper balance, there will be an improved orientation of the reasons. And further they have to tackle policy disputes and recommend potential solutions (Challenges in the Smart Grid Communication Infrastructure).

Moving Towards a Societal Value System

The major challenge for the transition from analogous to digital infrastructure will be to move from utility-centric decision to societal-level decisions which determine wider scopes of the Smart Grid. This would help in the adoption of Smart Grid Technology by the society (Huang et al. 2013).

Achieving greater efficiency in energy delivery

Smart Grid Technology should consider building efficiency into the energy system which would result in reduction of losses, peak load demand and thereby decreasing generation as well as consumption of energy. New regulatory framework which utilities for reducing the technical losses would help utilities to perform more efficiently (Huang et al. 2013).

Enabling distributed generation and storage

Smart grids will change when and how energy is produced. Each household and business will be permitted to become a micro-generator. Photovoltaic panels and small-scale wind turbines are the examples; developing resources consist of geothermal, biomass, hydrogen fuel cells, plug-in hybrid electric vehicles and batteries. As the cost of traditional energy sources rise and the cost of distributed generation technologies falls, the economic situation for this evolution will build (Challenges in the Smart Grid Communication Infrastructure).

Creating a Fresh Pool of Skills and Knowledge

Successful implementation of the smart grid requires a large number of skilled engineers and managers mainly who are trained to work on transmission and distribution networks. As a result to on-job training and employees development will be vital across the industry. Simultaneously, there is a requirement for investment in the development of relevant undergraduate, postgraduate to make sure the availability of a suitable work force for the future. The investment in Transmission and Distribution should not be limited neither in research and knowledge development, which would play a key role for the development of this sector (Challenges in the Smart Grid Communication Infrastructure).

Addressing Cyber security Risks and Data Privacy Issues

Smart Grid success depends on the handling of two major IT issues:

- ✓ Security
- ✓ Integration and data handling

With increase in computers and communication networks the threat rate has increased. The Government should look into this matter because consumer's consumption data can be misused by the utilities and the third party. Utilities have to assure the consumers that their information is handled by authorized party in ethical manner. The government has to implement high standard level in order to withstand cyber-attacks. Even though this would be an upright system for India, there are several challenges involved in the implementation of this system. The main challenge that policy makers face is high operating costs. Since there is a necessity for a large communications network, it increases the capital and hardware cost to a countless extent. Additionally while calculating the benefits of the system, organizations are usually conservative when it comes to calculation of the cash benefits to the shareholders. But in due course of time uneven policy and regulatory reasons might make the investment less attractive.

The successful operation of the Smart Grid requires continuous connectivity of technology. In India, communication technology is maintaining equality with many developed nations in the world. But in many areas related to communication the point of which is required for a Smart Grid, the technology is at the initial stages of development. This will reduce the positive impact to the service holders. Even if the technological developments are aligned there is the issue of combination of the entire hardware system to manage high volumes of data. It requires intricate data models to manage the various data formats that are to be into the system. As of present there is no such system in India and it needs to be developed. Lack of awareness among the customers is another issue. Since the system needs to be adopted by customers, they need to be made aware of what a smart grid they have to feel secure in adopting for Smart Grid. Indian consumers are not aware of energy consumption patterns. Awareness needs to be created among the customers about the Smart Grid. Policy makers must be knowledgeable about the future visions of the Smart Grid. Most importantly the lack of funds is also a major reason for the implementation of the Smart Grid (Huang et al. 2013).

VI. Conclusion

The smart grid is the recent development for the electric power system. Although the term “smart grid” does not have a exact definition, uniformly accepted definition is the upgrade in digitalisation of the existing power system. It promotes clean energy, controls energy consumption pattern and enhances security to the grid. The future grid should enhance the security and consistency of the electric power system. The implementation of smart grid is a huge process because it involves technological, financial investment and skilled labour. It also involves international effort. The government of India should need to develop a policy for implementing smart grid and should do campaigns in increasing the awareness among people about this new technology. As it has many advantages compared with present grid, definitely consumers will be more benefitted which is the main aim in implementing power grids.

References

[1] www.theiet.org
[2] S. Khoussi, A. Mattas, 2017, “Handbook of System Safety and Security”, Chapter 11: “Introduction to Smart Grid Safety and Security”, pp. 225-226.
[3] M. Liserre, T. Sauter, and J. Y. Hung, “Future energy systems: integrating renewable energy sources into the smart power grid through industrial electronics”, IEEE Industrial Electronics Magazine, vol.4, no.1, pp.18–37, 2010.
[4] C. Harris and J.P. Meyers, “Working smarter, not harder: an introduction to the ‘smart Grid’,” Electrochemical Society Interface, vol.19, no.3, pp.45–48, 2010.
[5] Lamiaa Abdallah and Tarek, “Reducing Carbon Dioxide Emissions from Electricity Sector Using Smart Electric Grid Applications”, HindawiPublishingCorporation, Journalof Engineering, 2013.
[6] M. R. Hossain and B. M. S. Ali, “Smart Grids”, Green Energy and Technology, Springer-Verlag London 2013.
[7] Mitsubishi Electric (2013), Environmental technology R&D achievements. Available via Online. http://www.mitsubishielectric.com/company/environment/report/products/randd/ smart grid/.
[8]http://smartgrid-for-india.blogspot.com/
[9] Huang and Meng, 2013, “Smart Grid Communication: Challenges and opportunities”, IEEE Transaction, Smart Grid.
[10] B. M. Buchholz and Z. Styczynski, Smart Grids – Fundamentals and Technologies in Electricity Networks. Heidelburg, Springer-Verlag, 2014, p. 19.
[11] Naveen Gupta and Apurav Jain, “Smart Grids in India”, RE feature, volume 5, issue 1, 2011.