Aspect of Smart Grid Technology & its Development in Indian Scenario

[1]Mr. Rajesh Harinkhede, [2]Prof. U. B. Vaidya, [3]Prof. P. D. Kamdi

[1]AMIE Student Scholar, [2]AMIE Supervisor, [3]Assistant Professor
AMIE Kolkata, India

***Abstract*: The economic growth of a nation depends heavily on reliability and eminence of its electric power supply. Global energy demands are expected to grow by 60% over the next 25 years subjected to three significant factors; population growth, rate of gross domestic product (GDP) and energy intensification. This has the potential to cause a significant increase in GHG emissions associated with climate change. Secure, reliable and affordable energy sources are fundamental to economic stability and development. In addition, RES which continued to cultivate strongly in all end-use segments, delivering close to 20% of global electricity supply in 2010, and expected to procure 39% and 77% of the global power supply from all sources by 2030 and 2050 as per recent market policy. It will play an essential role in advancing development by improving the access of millions to energy, whilst helping ensure energy security, and mitigating the existential risk of climatic change by reducing emission. The power market in India is characterized with poor demand side management (DSM) and consequences on technical and non-technical aspects with response to lack of proper infrastructure and awareness. In order to mitigate these preventable challenges, the innovative power system architecture with incorporation of RES can acknowledge reduction in line losses to overcome prevailing power shortages, improve the reliability of supply, power quality improvement and its management, safeguarding revenues, preventing theft etc.**

I. INTRODUCTION

The global energy deficiency has directly foiled the economics, society, development of the nations, and environments through greenhouse gases (GHGs) and by gaining carbon credits. The growing demand of power across the globe is being envisaged and logged to be exponential. Lack of asset with outdated network infrastructure, climate change, rising fuel costs, has resulted inefficient and increasingly unstable electric system. With this, the global concern has raised certain critical points upon which the energy revolution for a green and sustainable future are guaranteed and ensued.

Fossil fuel deadlock: Raising energy demand is knocking pressure on fossil fuel supply and now oil exploration towards "unconventional" oil resources. Switching from fossil fuels to renewable also offers substantial benefits such as independence from world market fossil fuel prices and the creation of millions of new green jobs. It can also provide energy to the two billion people currently without access to energy services. A closer look at the measures required to phase-out oil faster in order to save the Arctic from oil exploration, avoid dangerous deep sea drilling projects and to leave oil shale in the ground are wellthought- out. The changeover from the fossil-driven based energy sources to the renewable energy sources. (RES) is being addressed globally according to significant benchmarks. The dynamic characteristics of the RESs and its developing sparingly sustainable means to produce energy with less environmental challenges, is one of its foremost.

Climatic change threat: It has major implications for the world's social and economic stability, its natural resources and in particular, the way we produce our energy. In order to avoid the most catastrophic impacts of climatic change, the global temperature increase must be kept as far below 2°C as possible. The main greenhouse gas is carbon dioxide (CO2) produced by using fossil fuels for energy and transport. Keeping the global temperature until 2°C is often referred to as a 'safe level' of warming; beyond which unacceptable risks to the world's key natural and human systems might occur. Even with a 1.5°C warming, increase in drought, heat waves and floods, along with other adverse impacts such as increased water stress for up to 1.7 billion people, wildfire frequency and flood risks, are projected in many regions. Partial de-glaciations of the Greenland ice sheet, and possibly the West Antarctic ice sheet, could even occur from additional warming within a range of 0.8 – 3.8°C above current levels.

Energy efficiency: The most cost competitive way to reform the energy sector. There is enormous potential for reducing our consumption of energy, while providing the same level of energy services. New business models to implement energy efficiency must be developed and must get more political support. The challenge ahead will require an innovative power system architecture involving both new technologies and new ways of managing the network to ensure a balance between fluctuations in energy demand and supply. The key elements of this new power system architecture are micro grids, smart grids and an efficient large scale super grid, which could play a dynamic role in remodeling the global energy scenario with factors like policies, regulation, and efficiency of market with costs, benefits and services which also normalizes the power and energy market with the reduction of carbon footprints and foot-dragging the GHG emissions.

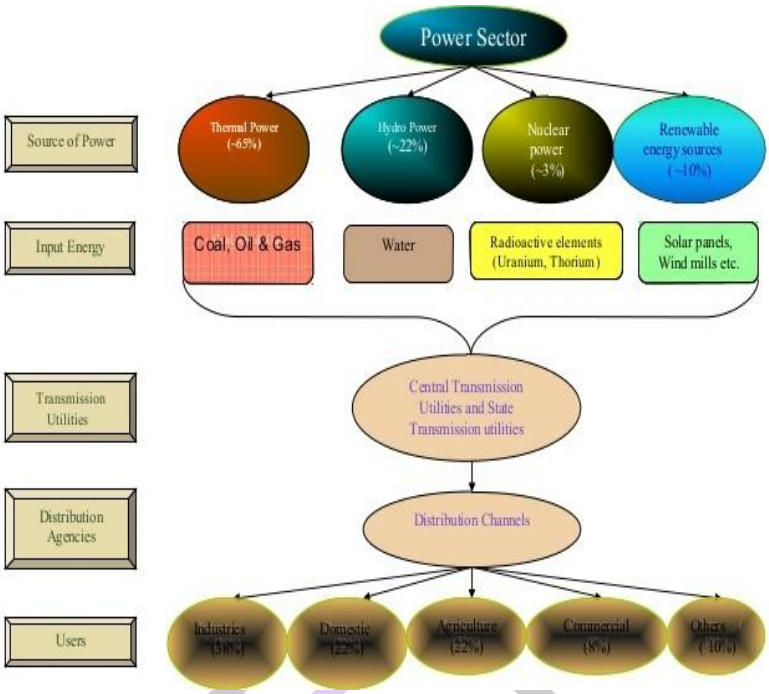

Fig. 1 Indian Energy Scenario

II. RENEWABLE ENERGY DISTRIBUTION IN INDIA

With the study, in India it has been proven under Energy Revolution scenario that, around 67,076 km^2 area is intended to support for the 3,300 PJ of energy production per region and 542 PJ of energy production per capita by wind power, subjected to mean wind speed of 14-17 mph at 80m by 2050 as shown in Fig. II.1. Similarly, around 44,105 km^2 area is projected to support for the 12,254 PJ of energy production per region and 2,011 PJ of energy production per capita by solar power, subjected to horizontal irradiance level of 180-200 Wm^2 by 2050.Upon such geophysical and climatic studies, the section further organizes the renewable energy sources (only wind and PV) and their technologies being used in India for the implementation and incorporation new and renewable energy to achieve a sustainable and promising energy revolution scenario.

III. INDIAN RES STRATERGY

India has over 25.86 GW of installed renewable power generating capacity. Installed wind capacity is the largest share at over 18.55 GW, followed by small hydro at 2.8 GW. The remainder is dominated by bioenergy, with solar contributing only 1.2 GW. JNNSM targets total capacity of 20 GW grid-connected solar power by 2022. Fig. III.1 shows the current and future perspective RES in India. Renewable energy technologies are being deployed at industrial facilities to provide supplemental power from the grid, and over 70% of wind installations are used for this purpose. Biofuels have not yet reached a significant scale in India. India's Ministry of New and Renewable Energy (MNRE) supports the further deployment of renewable technologies through policy actions, capacity building, and oversight of their wind and solar research institutes.

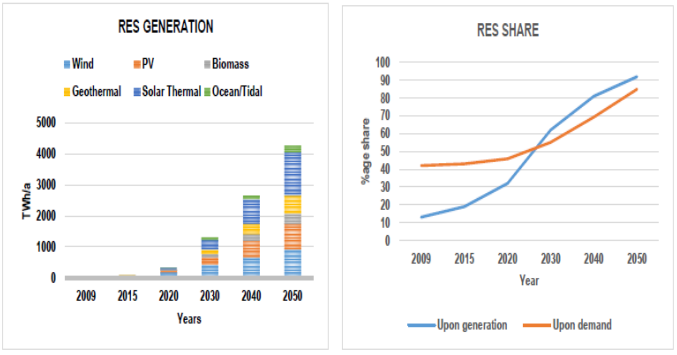

Fig. III.1 (a) Fig. III.1 (b)

Fig.3 Indian RES Strategy

IV. SMART GRID

The Smart Grid is the integration& modernization of Electrical & Digital Technologies, Information and communication which facilitates integration of business processes and systems to yield real measurable value across the power delivery chain. It is an intelligent future electricity system that connects all supply, grid and demand elements through a communication system. Smart grid delivers electricity to consumers using two-way digital technology that enable the efficient management of consumers, efficient use of the grid to identify and correct supply- demand imbalances. Smart Grid solutions enable utilities to increase energy

productivity and power reliability while allowing the customers to manage the usage and costs through real time information exchange. It impacts all the components of the power system like Generation, Transmission and Distribution.

EXISTING GRID	SMART GRID
Electromechanical	Digital
One way communication	Two way communication
Centralized generation	Sensors through
Few sensors	Self monitoring
Manual restoration	Self healing
Failures and blackouts	Adaptive and islanding
Few customer choices	Many customer choices
Limited control	Pervasive control

Table - Comparison of Smart Grid

V. SUMMERY AND CONCLUSION

India's energy generation and consumption are on high growth rate. Climatic change concerns due to emission combined with resource and infrastructure constraints are dampers. With nearly 40 % of its 1.22 billion population deprived of grid electricity, present 186 GW installed power capacity may have to be doubled by the end of this decade to meet energy need of its growing population and expectations of a high GDP growth economy. An overview of Indian Power Market along with brief analysis about the power system units is described. Power market in India is generally characterized by the poor demand side management and response for lack of proper infrastructure and awareness. Smart Grid Technology can intuitively overcome these issues. In addition to that, it can acknowledge reduction in line losses to overcome prevailing power shortages, improve the reliability of supply, power quality improvement and its management, safeguarding revenues, preventing theft etc.. Integration of RES is expected to play significant influence on the operation of the power system for sustainable energy in future. implement Smart grid with RES integration.

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