Smart Grid towards Smart distribution of Non Conventional Energy Sources

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***Abstract*— Smart grid technology enables us to enhance the overall performance of the power sector. Many advanced technologies have been identified for Smart grid applications having a potential to significantly improve and enhance the overall efficiency of power grids. In this review paper, we are proposing a smartly operated grid which is capable to lower down the wastage of natural resource. In particular, we recognise three main challenges: information flow, generation and environmental pollution.**

Keywords- Smart Grid, Nano Technology, Pollution.

I. INTRODUCTION

Electricity grid are designed and installed to meet the present demand and requirement of the society. In conventional grid the problem lies with the radial, centralized power generation, and manual restoration. The major drawback is the one way power flow from power plants (grid) to consumers, which leads to the huge wastage of natural resources and dependent sustainability of the generation of the power. Although lots of newly-developed technologies have dramatically affected the other industrial sectors, the electric systems generally remain to operate in the same way for decades.

Most of the electrical energy we consume today comes from Non renewable power stations. Electricity generated from the fossil-fuel power plant has low efficiency and cause pollution to the environment. In other words, there is a tremendous amount of energy left behind in the process of electricity generation [1-2]. In this sense, the power generation presents a substantial waste of limited natural resources and emits lots of carbon dioxide gas (CO_2) into the air. Renewable energy resources, characterized by their carbon-free and environment friendly electricity generation processes, have become more and more popular in a coming generation. However, these resources are mostly intermittent in nature and distributed over electrical grid. Combination of distributed energy storage systems and distributed energy resources is an attractive way to address the environmental problems with existing grid [3]. The distributed storage nodes can be used to supply energy during peak loads and save the surplus energy when demand is low.

Table I makes a comparison between Smart Grid and the existing grid. Smart Grid enables us to lower the transmission and distribution losses and additionally provides the effectiveness in distributing the electric power. It also allow us to make the information flow bidirectional. As we know that the issue with the most of generated electrical energy in the grid cannot be stored, and even if it can, lots of electricity will be lost in energy conversion processes. Therefore, Smart Grid is needed to make generated electricity closely match to the demand. If we focus on the end of grid, customers' non-smart appliances are the main cause for ineffective use of electricity. Smart Grid will help those appliances to use electricity in a more efficient manner by its communications capabilities. Smart appliances in the future should be able to manage power to take advantages of real-time billing function. Lots of current sensor, voltage sensor may help us to enhance the overall efficiency of smart gird network.

TABLE 1. COMPARISON BETWEEN CONVENTIONAL (EXISTING) AND SMART GRID WHICH SHOWS THE ADVANTAGE OF SMART GRID OVER THE CONVENTIONAL GRID TECHNOLOGY.

	Comparison	
	Conventional Grid	***Proposed Smart Grid***
Information flow	Unidirectional	Bidirectional
Electricity generation	Central generation	Distributed generation
Overrall efficiency	Low	High
Enviromental pollution	High	Low
Sensors	Few sensor	Lots of sensor
Monitoring ability	Usually blind	Self-monitoring
Grid topology	radial	network

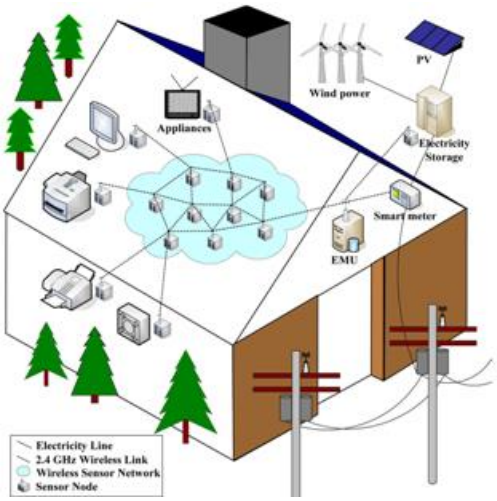

Figure 1. Architecure for the smart grid technology.

II. NANOTECHNOLOGIES ENHANCING THE POWER GRID

Another possible solution to enhance the performance of smart grid is nanotechnology based smart grid. Nanostructures are introduced for the smart power grid. Nanotechnology science is a trend in improvement and changing of material characteristics, behaviour and cost. Enhancement in strength, change in optical properties and change in electrical conductivity are the some beauty of nanostructures. These include silicon nano particles, nano based membranes, carbon nano tubes, Li batteries based on nanotechnology, nano-wires, quantum dots, and diamond nanowires.

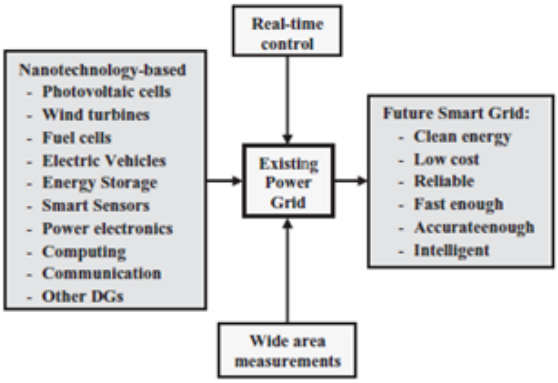

Figure 2.Possible nanotechnnology based technology enhancement for betterment in power grid.

One application of silicon nanoparticles is PV cells. Carbon nanotubes are fullerene-related structures that consist of grapheme hollow cylinders closed at their ends by semifullerene- like structures [4]. Carbon nanotubes are of different kinds: long, short, open, closed, single walled and multi walled. Carbon nanotubes are very small size and have great strength, electrical conductivity, and themal conductivity. The most common nanostructures are carbon nanotubes. Nanoelectronics, semiconductors, super-capacitors, data storage, Li batteries, hydrogen (H_2) storage, and solar storage are the applications (related to the smart grid) of carbon nanotubes. Quantum dots are nano-scaled semiconductor crystals [5]. These semiconductor nanocrystals shine at a specific wavelength depending on their design and excitation. These nanocrystals having the properties of quantum mechanics and semiconductors, makes quantum dots suitable for those applications, including LED , biological tags and optical logic gates. Solar cells and PV cells also use quantum dots. The major trend of nano-based PV cells is oriented toward absorbing more sunlight with low cost. Advancement and further development in nanotech based Photovoltaic cells via nanotubes, quantum dots, and hot carriers may help us in reducing the cost of PV cells and modules for bulk power generation as well as in improving the efficiency of cell conversion.

Increasing the penetrations of renewable and distributed energy resources, such as Photovoltaic arrays, fuel cells , and wind farms, requires the ability to store electrical energy for reuse on various interval . The stored electrical energy can be reused for the public utility and small portable electronic devices.

III. CONCLUSION

In this paper, the key technologies of smart grid have been identified and reviewed. Nanotechnology based solutions and applications in the devices/components of smart grid have been presented. This review paper also discusses about the promising use of nanomaterials in some distributed resources and renewable energy resources.

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