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3G POWER GRID SYSTEM

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ABSTRACT

3G Power grid system is dual side stream of electricity and automated construct information and distributed advanced energy delivery network. In this 3G Power grid system avoided the thermal and hydro sources of energy. By using the solar power and wind power energy will generate electricity according with the condition of nature. 3G Power grid system provides the facility of generating as well as marketing of electricity not only for the producers but also for consumers. By using megabytes of data to move megabytes of electricity consummately and affordably. Under the extensive control of highly intelligent management and control systems it being a sloppy adjustment of complementary components, subsystems, functions and services. Integrated communication, sensing and measurement, improved interfaces and decision support advanced components, advanced control methods are the distinct technologies of 3G Power grid. 3G power meter, 3G substations, 3G distribution systems, 3G appliances universal access are the some exponential components of the 3G Power grid system. By facing the three main challenges in the design and operation the utility industry , committed to providing quality and simplicity for the customers.

KEYWORDS: grid, power

INTRODUCTION

As the revolution in the generation day by day being rapidly augmentation in the techniques and using of this demand of electricity is also enhance. Nikola Tesla's assumptions of unidirectional transmission of electricity was remarkable. But Tesla's assumption was valid for chronic era and unidirectional transmission are now considered as outmoded. 3G Power grid system is dual side stream of electricity and automated construct information and distributed advanced energy delivery network. A 3G Power grid also called as smart grid, smart electrical/Power grid, intelligent grid, future grid, inter-grid, or intra-grid is an augmentation of 21st century Power grid. In early 1882, Edison opened the world's first steam-powered electricity generating station at Holborn Viaduct in London, where he had entered into an agreement with the city corporation for a period of three months to provide street lighting. In time he had supplied a number of local consumers with electric light. The method of supply was direct current (DC). The mid to late 1880's saw the introduction of Alternating currents (AC) systems in Europe and the U.S. From modest beginnings, a grid has grown to cover the entire continent, providing almost everyone with a reliable source of electricity. Electricity, considered by most to be energy, is actually an energy currency. Power collected from a variety of sources, such as falling water, burning fuel, wind and solar is used to create electricity for delivery to customers. Electricity has proven to be a convenient and efficient means of delivering energy. Electricity is delivered at the speed of light and is consumed the instant it is created. There is no means to store electricity without converting it to another form of energy. As a result, the demand for power, driven by users, must match the supply of power from the available sources (e.g. generators and energy storage devices) at all times.

The utility industry, committed to providing quality and simplicity for customers, is currently facing three main challenges in the design and operation of the Power grid of tomorrow.

1) Meeting the Demand

Utilities have taken responsibility to meet the demand of customers with little or no advance notice.

2) Reliability

The grid is designed for reliability. Even at the annual peak load, a contingency loss of generation or a single transmission element will not cause serious losses for customers.

3) Quality

Power system frequency and voltages are maintained within acceptable limits, regardless of the loads applied.
These standards have become a part of the daily life for users, most of whom have little idea of the challenges they create.
Two recent trends have started what may become a paradigm shift in the way that power systems are designed and operated:
1. The addition and rapid growth in renewable energy systems as sources of supply.
2. The computerization of industrial equipment and the increase in the use of office/home computers, server farms, data banks, electronics and other non-linear loads.
These trends are increasing the need for a 3G Power grid that relies on communication between Independent System Operators (ISOs)/Regional Transmission Organizations (RTOs) and consumers so that renewable energy can be used more efficiently, the electric power system can run more reliably and greenhouse gases can be reduced.
Table I gives a brief comparison between the present grid and the 3G Power grid.

TABLE I: A brief comparison between the present grid and the 3G Power grid

Present Grid	**3G Power grid**
Renewable as well as non-renewable sources of energy	Only renewable sources of energy
Unidirectional communication	Bidirectional communication
Electromechanical	Digital
Centralized generation	Distributed generation
Some Sensors are used	Throughout sensors
Manually monitoring	Self-monitoring
Manually restoration	Self-healing
Blackouts and Failure	Islanding and adaptive
Limited control	Pervasive control
Few customer choices	Many customer choices
Losses and less efficiency	Loss less and high efficiency
Less accuracy	High accuracy

MATERIALS AND METHODS

2. Hypothetic Pattern

In order to realize this new grid pattern, NIST provided a hypothetical pattern (as shown in Fig.2.1), which can be used as a reference for the various parts of the electric system where 3G Power grid standardization work is taking place. This hypothetical pattern divides the 3G Power grid into seven regions. Each region encompasses one or more 3G Power grid performers, including devices, systems, or programs that make decisions and exchange information necessary for performing applications.
The hypothetic pattern is represented in this paper supports planning and organization of the diverse, expanding collection of interconnected networks that will compose the 3G Power grid. For this purpose, NIST adopted the approach of dividing the 3G Power grid into seven regions, as mentioned graphically in Figure. Each region and its sub-regions encompass 3G Power grid performer and applications. Performers include devices, systems or programs that make decisions and exchange information necessary for performing applications: smart meters, solar generators, and control systems represent examples of devices and systems. Applications on the other hand, tasks performed by one or more performer within a region.
Region performers in the region is explained as below;

1. Bulk Generation- Generation of electricity in bulk quantities, may also store energy for later distribution.
2. Transmission- Huge amount of electricity is carried over a long distances, may also store and generate electricity.
3. Distribution- The distributors of electricity to and from customers, may also store and generate electricity.
4. Markets- Markets for the operators and the customers, may sale or purchase electricity.

5. Operation- The officers for the movement of electricity, which manage the electricity.
6. Service Providers- The organizations providing services to electrical customers and utilities.
7. Customers- Customers are the end users of electricity, may also generate, store and manage the use of energy. Traditionally, three customer types are discussed, each with its own regions i.e. residential, commercial and industrial.

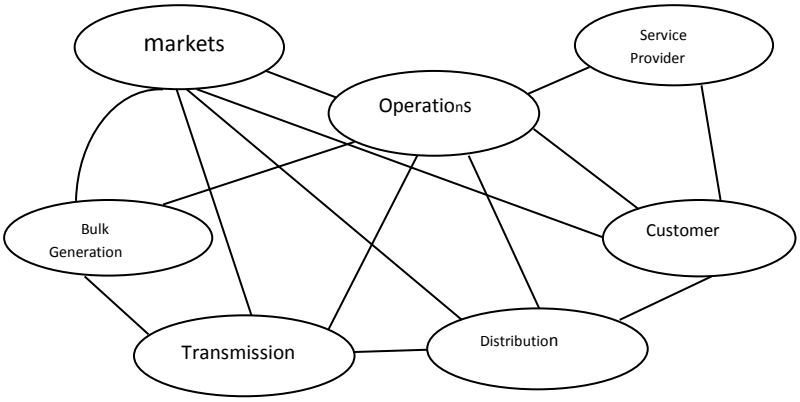

Fig.2 NIST Hypothetical Pattern for 3G Power grid System

Need of 3G Power grid

The way it's utilized today, the electric power system is created to manage peak demands that happen once every several years. Because the system is created to handle critical peak loads, the system is being substantially underutilized much of the time. The 3G Power grid would drastically improve the flexibility of the electric power system, making it easier for electricity system operators to balance the supply and demand. This would help flatten the consumption profile, make generation run more efficiently and delay or replace transmission projects or new generation. By flattening out consumption, the system could potentially run at 80% capacity instead of 50%. This is a more efficient and cheaper option because load distribution will reduce the requirement to increase transmission and generation when demand spikes.

3. System of 3G Power grid

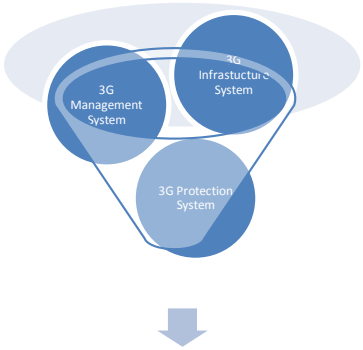

Fig.3. Systems of 3G Power grid

The 3G infrastructure system is the energy, information, and communication infrastructure base of 3G Power grid. It supports bidirectional flow of electricity and information. Note that it is straightforward to know the concept of "Bidirectional flow of communication". "Bidirectional flow of electricity" denote that the electric energy delivery is not unidirectional anymore. For example, in the recent Power grid, the electricity is generated by the generation plant, then moved by the transmission grid to the distribution grid, and finally delivered to users. In 3G Power grid system, electricity can also be put back into the grid by customers. For example, users may be able to generate

electricity using solar panels at homes and put it back into the grid, or electric vehicles may provide power to help balance loads by "peak shaving" (sending power back to the grid when demand is high). This backward flow is important. For example, it can be extremely helpful in a micro-grid that has been 'islanded' due to power failures. The micro-grid can function, even though at a reduced level, with the help of the energy fed back by the customers. This 3G Power grid infrastructure split up into three subsystems: the 3G energy subsystem, the 3G information subsystem, and the 3G communication subsystem.

1. The 3G energy subsystem is responsible for advanced electricity generation, delivery, and consumption.
2. The 3G information subsystem is responsible for advanced information metering, monitoring, and management in the context of the 3G Power grid.
3. The 3G communication subsystem is responsible for communication connectivity and information transmission among systems, devices, and applications in the context of the 3G Power grid.

The 3G management system is the subsystem in 3G power grid that provides advanced management and control services and functionalities. The key reason why 3G power grid can revolutionize the grid is the explosion of functionality based on its smart infrastructure. With the development of new management applications and services that can leverage the technology and capability upgrades enabled by this advanced infrastructure, the grid will keep becoming "smarter." The 3G management system takes advantage of the smart infrastructure to pursue various advanced management objectives. Thus far, most of such objectives are related to energy efficiency improvement, supply and demand balance, emission control, operation cost reduction, and utility maximization. Within the framework of 3G power grid, many management goals, which are difficult and possibly infeasible to realize in conventional power grids, become possible and easy. So far, the works for smart management mainly focus on the following three objectives:

1) Energy efficiency and demand profile improvement;
2) Utility and cost optimization, and price stabilization;
3) Emission control.

The 3G protection system is the subsystem in 3G power grid that provides advanced grid reliability analysis, failure protection, and security and privacy protection services. By taking advantage of the smart infrastructure, the 3G power grid must not only realize a smarter management system, but also provide a smarter protection system which can more effectively and efficiently support failure protection mechanisms, address cyber security issues, and preserve privacy. Above figure 3 shows the detailed classification of these three major systems.

Reliability is the ability of a component or system to perform required functions under stated conditions for a stated period of time. System reliability is an important topic in power grid research and design. The future 3G power grid is expected to provide more reliable system operation and smarter failure protection mechanism. It is expected that distributed generation will be widely used in 3G power grid. While using some fluctuant and intermittent renewables may compromise the stability of the grid. To take advantage of new architectures such as micro grid to simplify the impact of distributed generation on the grid. Intuitively, as loads are being served locally within a micro grid, less power flows within the entire grid infrastructure. Thus, the reliability and stability of the 3G power grid can be enhanced.

4. Advantages of 3G Power Grid

1.Create a clean environment

Reduce carbon emissions and improve energy efficiency through reduction in losses and by integrating renewable generation.

2. Decrease demand The Electric Power Research Institute conducted a study that suggested 3G power prid technologies could reduce electricity consumption in the US by 10 to 15% by 2025.

3. Increase efficiency and reliability

By flattening the consumption profile, the system can run much more efficiently and can respond more intelligently, with the potential, as previously mentioned, of running at 80% capacity instead of 50%.

4. Build the economy

Study by the Electric Power Research Institute illustrated that 3G power grid technologies could deliver between $1.3 trillion and $2 trillion in benefits over the next 20 years.

5. Increased consumer participation

The 3G power grid has the ability to change the way consumers use electricity by showing them exactly how much electricity is being used and how much it costs throughout each day. This helps consumers save money and more intelligently control their usage.

CONCLUSION

As the 3G power grid continues to evolve, and demand-side management, which is available today, builds on its growing reputation as a cost-effective way for industrial users to manage energy usage and costs, buy-in from both residential and industrial consumers will become simpler.

There is minimal cost to get involved today. Connecting requires the simple installation of meters to monitor equipment more closely. By monitoring the equipment, smarter decisions regarding usage can be made. The next step, connecting a network of loads to a regional electricity system operator, allows companies to respond to the needs of the grid and start offering grid Balance. This creates a new revenue stream for companies with connected loads. Though the days of full integration are still many years away, the future is now, and companies that embrace innovation today and connect first will stay ahead of the game.

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