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Smart Grid

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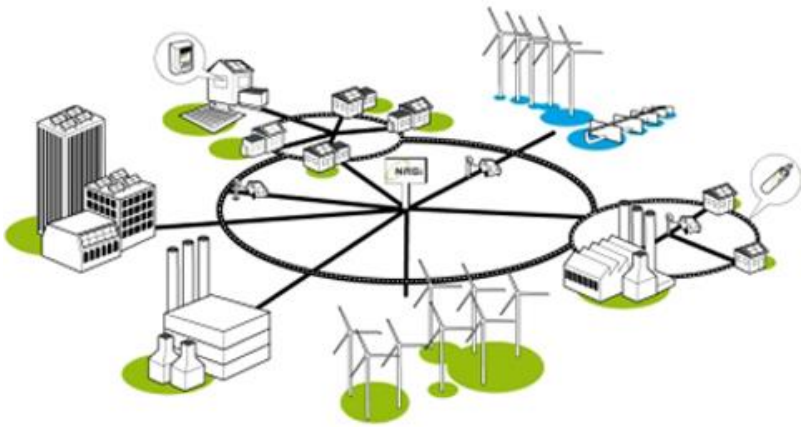
Introduction.

Today, theenergy companieshavea lot of problems: wornand unreliablepower grid, an oldsystem ofone-waytransfer of energy, the nature of supply and demand, moreover, need tofind new andbetter ways tomeet the growing demand for electricity. At the same time consumers are demanding lower tariffs, increasing the reliabilityof services.A smart grid is designed to solve these problems.



A smart grid is a modernized electrical grid that uses information and communications technology to gather and act on information, such as information about the behaviors of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity [1].

Smart grid policy is organized in Europe as Smart Grid European Technology Platform [2]. Roll-out of smart grid technology also implies a fundamental re-engineering of the electricity services industry, although typical usage of the term is focused on the technical infrastructure.

The objectives of the smart grid

Reliability

Today's grids extend over thousands of kilometers. To transport the maximum possible energy, power flow must be carefully controlled along the length of the system. Automation infrastructure now available at the transmission level must be more widely used in distribution systems to provide seamless connections between power generators and individual consumers [1].

The smart grid will make use of technologies that improve fault detection and allow self-healing of the network without the intervention of technicians. This will ensure more reliable supply of electricity, and reduced vulnerability to natural disasters or attack.

To ensure the maximum flow of electricity through transmission lines, flexible alternating current transmission systems (FACTS) must be active. High voltage direct current (HVDC) connections will be required to stabilize large grids or to connect grids running at different frequencies.

Until now transmission systems have been the focus of technical improvements. Distribution systems are still waiting for extended automation technologies that will upgrade their performance and enhance their reliability.

To minimize problems with reliability and the economic disadvantages they bring, the future electrical system must deliver top performance at every point in the chain from power generation to the individual consumer.

Efficiency

The efficient handling of electrical energy offers a huge saving potential. Today, almost 80 percent of primary energy is lost in transmission to the electricity consumer. Realizing this potential requires optimal power plant processes, efficient transmission and distribution systems and technologies to improve the efficiency of the energy use itself [3].

Numerous contributions to overall improvement of the efficiency of energy infrastructure are anticipated from the deployment of smart grid technology, in particular including demand-side management, for example turning off air conditioners during short-term spikes in electricity price. The overall effect is less redundancy in transmission and distribution lines, and greater utilization of generators, leading to lower power prices.

Sustainability

The International Energy Agency predicts that hydro power will remain the major source of renewable energy for the next two decades, followed by wind and solar. The challenges of integrating these renewable energy sources into the electrical system are different for each technology but the system of the future must accommodate them all [1].

The improved flexibility of the smart grid permits greater penetration of highly variable renewable energy sources such as solar power and wind power, even without the addition of energy storage. Current network infrastructure is not built to allow for many distributed feed-in points, and typically even if some feed-in is allowed at the local (distribution) level; the transmission-level infrastructure cannot accommodate it. Rapid fluctuations in distributed generation, such as due to cloudy or gusty weather, present significant challenges to power engineers who need to ensure stable power levels through varying the output of the more controllable generators such as gas turbines and hydroelectric generators. Smart grid technology is a necessary condition for very large amounts of renewable electricity on the grid for this reason.

Capacity

Meeting the rise in global demand for electricity will mean adding a 1 GW power plant and all related infrastructure every week for the next 20 years. This must be achieved in the most economic way with the most environmentally friendly technologies available. The reduction of carbon emissions is an overriding aim in all these efforts.

The International Energy Agency estimates that between now and 2030, global investments in electrical grid infrastructure of around $6 trillion will be needed to satisfy the world's increasing demand for power [3]. Most of the growth is expected in Asia with the construction of new transmission and distribution systems, but new investments will also be needed in the United States and Europe where aging systems must be replaced. To ensure that a grid's capacity is used as effectively as possible, reserve capacity, which is needed to balance fluctuations in demand and supply, will be minimized and larger cross-country grids with high-capacity connections will be required. Small-scale power generation to serve local needs will be more widely established to support central power generation plants.

Conclusion

Smart grids will provide more electricity to meet rising demand, increase reliability and quality of power supplies, increase energy efficiency, be able to integrate low carbon energy sources into power networks.

Smart grids possess demand response capacity to help balance electrical consumption with supply, as well as the potential to integrate new technologies to enable energy storage devices and the large-scale use of electric vehicles.

Electrical systems will undergo a major evolution, improving reliability and reducing electrical losses, capital expenditures and maintenance costs. A smarter grid will provide

greater control over energy costs and a more reliable energy supply for consumers. Environmental benefits of a smarter grid include reduced peak demand, integration of more renewable power sources, and reduced CO_2 emissions and other pollutants.

Smart grid is the future for electrical systems, as it is designed to meet the four major electricity requirements of our global society: capacity, reliability, efficiency and sustainability.

References:

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Chistikhin, A., Balastov, A.V.

Extensive transmission of power

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Introduction.

In this article I will tell you about main concepts of power transmission theory, transmissions on the direct and alternating current, I will tell you about advantages of power transmission on the super high voltage and about interrelation between voltage and efficiency in power transmissions.

Transmission of power as creator of power systems

Super high voltage transmissions have a great part in contemporary energetic because they improve reliability of power systems and make them economically beneficial. Humanity has been trying to increase the voltage in power transmission since it was discovered because the increasing of the voltage increases the efficiency of transmission. Moreover the process of developing of energetic in the whole world is characterized with merger of power system in bigger and bigger unions. Of course, it wouldn't happen without strong connection between these power systems. That is why the main goal of power transmission isn't just transportation of electrical power from point «a» to point «b» or spreading around the power from big electric station but creating of large power systems that are considered to be one of the most important parts in contemporary energetics. So power transmissions unite power systems to increase their reliability and provide the most efficiency method of functioning for them.

Constructive properties of transmission lines

Phase splitting of wire is the most important feature of high voltage lines. Every phase is made as special construction from several wires that are located in angles of polygon on the equal distance from each other. There are 2-10 wires in each phase, this amount depend on the voltage of the lines. For example, there are 2 wires in one phase with the voltage of 330 kV and 10 wires in case of 1150 kV. There are several reasons for splitting of phases: 1) increasing of transmission efficiency 2) decreasing intensity for decreasing interferences of electric transmission.

Types of power system

Power system is the connection of power stations by transmission lines for stronger transportation of electricity for consumers. Power systems have some differences from each other in terms of power of stations and types of their functions. Thereby there are 5 types of power stations: