

Smart Grids

Nowadays, one can often hear the term “smart grids”. This is the topic of many conferences and seminars in different countries. Smart grid technologies, including power generation, distribution, and consumption, the focus of smart grid development, are also widely discussed.

Although the term “smart grid” has been officially used since 2003, there is no single interpretation of the concept yet. In world practice, to define a smart grid its attributes are used.

Smart grids are commonly understood as modernized power networks that use technologies to collect information about energy production and consumption. This can automatically improve efficiency, reliability, economic benefits, and the sustainability of electricity generation and distribution.

In other words, a smart grid is an electrical network that meets the requirements of the efficient and economical functioning of the energy system through control of the electrical network elements, power plants, and electricity consumers with the help of modern communications.

Smart energy is currently a vector of energy policy in many countries. The creation of smart energy systems is the modernization of the entire complex of generation and delivery of electricity based on improved control, protection, optimization of technical elements of the electric power system in their interconnection. Smart grids deliver greater performance and improve the reliability and efficiency of the entire system by regulating consumption, monitoring, and dynamically managing bi-directional power flows in real-time.

"Smart" meters, as the main elements of such systems, are an economical means for obtaining reliable information, enabling power systems and price-setting authorities to widely introduce differentiated tariffs for consumption depending on the time of day and time of the year. They allow monitoring and managing energy consumption through incentive tariff setting, ensuring the rational use of energy resources.

Smart grids are also a major trend influencing the development of information technologies in the energy sector. We call them “smart” because they do not only transfer electricity but also information that will make up an active part of the electricity supply system. The implementation of smart grids also enables efficient management and requires more attention to the integration of renewable energies.

In general, smart grids combine elements of the traditional electric power industry and the latest electric power technologies.

Informational security plays a crucial role in smart grid systems implementation. They must withstand negative influences without total outages or high costs of restoration work. However, there is a grounded concern about the information reliability of such systems. To put it simply, every system that uses the Internet can be hacked with serious implications.

A smart grid can successfully defend itself and self-recover from major failures, natural disasters, and external threats. In the context of the overall economy, the smart grid fosters the emergence of new markets and services.

Thanks to modern technologies, such systems can be used on both a large industrial scale and in common household electrical devices. However, a unified technological standard system should be implemented for the coordination of diverse industries and technical areas. It is also a critical aspect

for the orderly development of smart grids because they encompass numerous industries and technical fields.

In Ukraine, smart systems for the exchange and management of energy consumption are gaining widespread use. Under the Agreement between the Government of Ukraine and the European Commission, works are carried out to implement automatic energy monitoring and metering systems.

World experience in the implementation of smart grids is promising and economically justified. Even so, the stable progress in renewable energy technologies and the cost-effectiveness of solar and wind power demand a smarter approach to power-grid management.

That is why smart-grid technologies should accommodate larger shares of renewable energy in the electricity sector. Further regulations need to be developed for smart grids and renewable energy sources as soon as possible.

We can conclude that smart grids still have a long way to go until they are fully realized. Government policies, investments, as well as technical maturity, economic efficiency, and grid infrastructure, will all have a significant impact on their development. The probable solution is to divide the process into multiple stages with different emphases to keep the smart grid implementation moving smoothly.

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