

DESIGN OF THE ACHIEVEMENT OF SMARTGRID

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Introduction

The modern trend of the world in the development of electrical energy is the construction of intelligent networks. Their installation makes it possible to appreciably increase the reliability of the power supply for the consumers, to reduce waste and to reduce the consumption of the energy resources [1].

Many new electronics equipment of electronics power, the means of communication and computerization, technologies of management are put in work during last years.

The modern equipment makes it possible to build intelligent networks like a common system automated in real time to manage the modes of operation in the processes of transformation, transport, distribution and electric energy consumption. Smart grid obtains information thanks to a system of sensors in “online” mode. Smart grid reacts automatically to the entire regime changes by adopting optimal solutions for the power supply with a maximum reliability and an economic efficiency. The creation of an intelligent network is based on the digitalization of energy. The article has the need, the objectives, the principal tasks and the expected results of the realization of the intelligent network.

Need for the achievement of Smart grid

The design and the achievement of Smart grid correspond to two principal directions for the development of the European energy system:

- The development and reinforcement of the energy system of Europe ENSTO-E;
- The development of the intelligent network, built on the digitalization of the energy system.

A set of automated systems and of manageable elements for a digitalization of electrical communications are characterized by:

- an effective use of the various producers decentralized on the basis of renewable energy source;
- technologies of the numerical information and automated systems;
- systems of application for a flexible management FACTS in the networks high and very high voltage;
- a diagnosis of the state of the devices in normal mode ;
- a coordinated operation of the users, storage systems and energy producers electric.

The actual position of the installation of the electrical communications is characterized by a high degree of physical strain and reduced energy efficiency. The number of emergency disconnection is important, indicating the importance of the necessary measures to increase reliability during the operating time [2]. The need for the reconstruction and the modernization of the equipment must respect the stages of the achievement of Smart grid. Because of the great complexity in the energy system of the management of the technological processes in the various hierarchical levels, it is necessary to create and conceive digitized electrical communications.

The first stage of the realization of Smart grid is possible by an implementation of the principles of observability and automation. That means that the first stage should be the implementation of the information technology (automatic, telemetry and digital protection, etc). The following stages will treat behavior of the equipment of the digital stations and flexible systems FACTS.

The expected results of the digitalization of the electrical communications are:

- a more effective use of the energy sources electric;
- the reduction of the losses of electricity;
- to reduce the time of emergency disconnection;
- improvements of the effectiveness of the load of electrical equipment;
- to reduce the production cost of electrical energy;
- to ensure a bilateral food of the consumers.

Digitalization of the intelligent networks of transport

Systems FACTS are modern means of management of the modes of the transport networks to solve the following tasks:

- regulation of tension in the nodes;
- increase in the capacity of transit of the electric lines;
- increase in the stability (of the angle and the tension) of the energy system;
- damping of the low frequency fluctuations of the energy system;
- adjustment of each phase in the asymmetrical loading case;
- limitation of overpressures of commutation and the lightnings;
- compensation of reactive power.

Systems FACTS will solve the problems of quality of the tension, the reduction in the fluctuations, the distribution of the powers of transfer and the stability of the energy system in conditions of digitalization. Systems FACTS implement complex algorithms of control, which carry out multiple functions. The principal tasks to solve are:

- optimization of the localization of the FACTS;
- realization of the protection of system FACTS;
- to develop strategies for management and the reservation;
- evaluation of the interaction enters close FACTS;
- evaluation of the interaction enters FACTS and PSS (Power System Stabilizer).

Digitalization of the intelligent networks of distribution

The need for rebuilding and for modernizing the distribution network is the presence of a large number of decentralized sources of electricity connected. The trends for the construction of Smartgrid focus on the resolution of essential problems such as:

- A reorganization of the distribution network in intelligent network with minimal losses of electrical energy or a minimal quantity of electrical energy which is not ensured the consumers in the case of damages.
- A bilateral supply for the consumers by changes of diagrams or the introduction of reservation by decentralized energy producers;
- A realization of self-management, self-diagnosis and of auto--repair of network;

- Coordination of the adjustment of the “réenclencheurs” with the operation of all the means of relay of protection and automatic in the distribution networks [2.3].
- Introduction of digital protections adaptive.
- Introduction of systems FACTS into the distribution network for an adjustment of the tension and to overcome the risk of variability of renewable energy.

The reorganization of the distribution network in the intelligent networks in Bulgaria requires a transfer of the open network towards a ringed network, which is carried out by the construction of the lines of connection in mode after damage (fig.1 and 2). The optimal solution must be made with an estimate on preselected criteria.

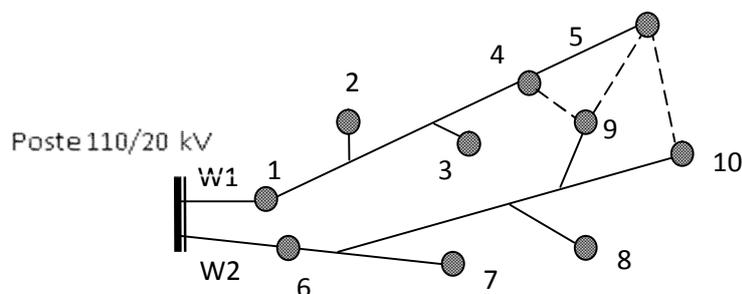


Fig.1. Emergency plugging chart between two branches supplied by a station

In the case of supply of the branches W1 etW2 of a switchyard for the diagram of the fig.1 raises the question to know if one can build a connection between node 4 and 9 or 5 and 9 or 5 and 10. The optimal alternative depends on the size of the electric charges in nodes 5 and 10, and also of the length (impedance) of the electric lines and the type and the section of the conductors. In the case of the construction of connections of help between the nodes at the ends of the branches of the two close switchyards, the choice of the alternative is according to the technical and economic estimate (fig.2).

The possibility of restructuring the distribution network in a structure with an increased reliability is the realization of the loops with a connection or double connection towards the nodes of supply (fig.3 and fig.4).

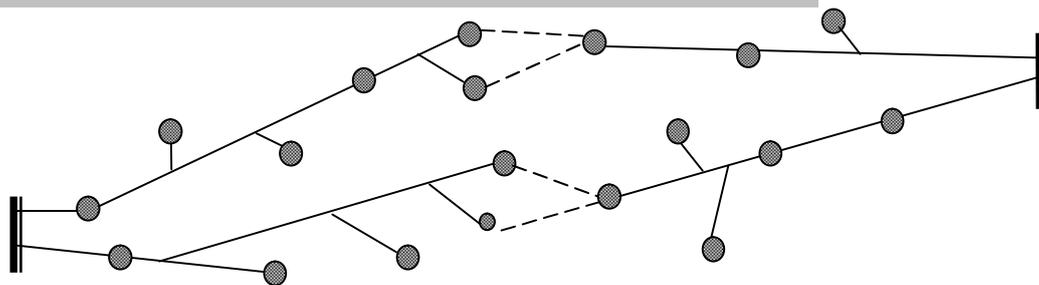


Fig.2. Emergency plugging chart between two branches supplied by two close stations

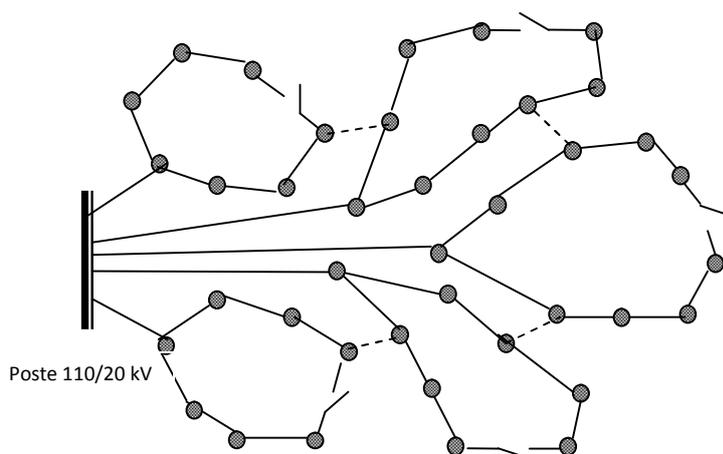


Fig.3. Structure of the networks ringed with a connection towards the node of supply; electric transformation station

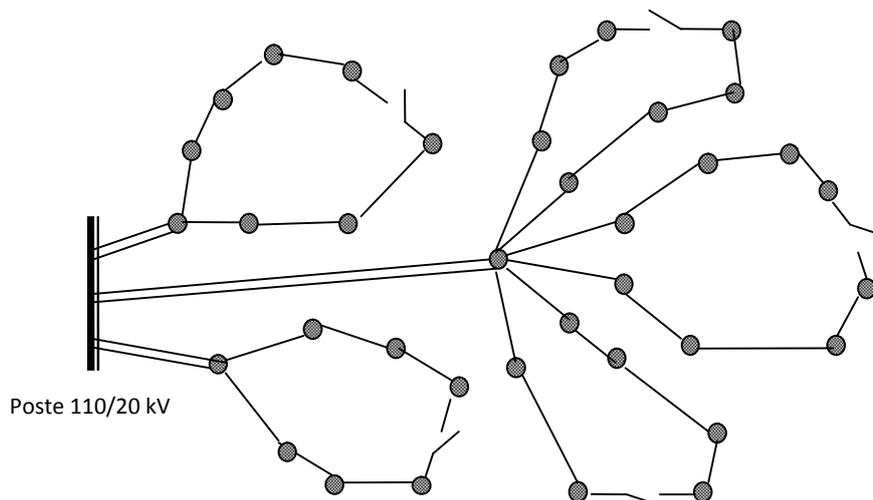


Fig.4. Structure of the networks ringed with a double connection towards the node of supply; electric transformation station

For the diagram of figure 3 all users are connect in the ringed network, which functions in normal circumstances like an open network. Each loop is connected to the network by a radial line. For the diagram of

figure the 4 electric lines of network connection are double. The reliability of the systems is increased by reducing the number of disconnection of damage, but the investments and the costs of exploitation increased. The structures of the diagrams of the fig.1 on figure 4, meet the requirements with Smart grid.

Digitalization of the electric transformation station

The digitalization of the switchyards is based on the introduction of data processing technology, by using a digital processing. All the data of the monitoring system, protection and management produce and treat in digital format by using digital transmitters and systems of digital devices of new generation [4.5].

The modern systems for a digitalization of the stations are the two groups with the same principles of operation and different architecture: systems of telemechanics for the old stations and the automatic systems of control of technological processes for the new or modernized stations.

In the case of the digitalization of the old stations with the systems of telemechanics, existing secondary commutation remains with the maximum capacity. The data are transmitted to the point of control system and the system operator.

The realization of the digitalization of the electric transformation station solves the following tasks:

- unification of the protocols of information;
- to solve the compatibility issues electromagnetic;
- total automation in the stations.

The digitalization of the distribution networks will allow a follow-up of the parameters of the mode in real time.

Conclusion

- The first stage of the digitalization of the electrical communications is a realization of the principles of observability and automation, allowing the transition towards the second phase from digitalization - the management of the processes.

- The introduction of the data processing technology based on the numerical information requires the use of equipment and special digital devices of new generation.

- The design of the digitalization of the electrical communications is compatible with average the techniques for the automation and the

remote control of our energy system with the directives for the development of the European energy systems.

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Abstract. The article has the needs, the objectives and the expected results of digitalization in the electrical communications, formed in accordance with the European energy policy. One formulates principal tasks related to digitalization in the intelligent network of transport and distribution.

Keywords: electric power system, digitalization, Smart grid.