operational and maintenance cost, ensure the reliability of power supply, and provides tolerant of attacks against physical and cyber security. Hence, without a secure SCADA system, it is impossible to deploy the smart grid system [4].

The cyber security basically can be attacked in three steps as follows:

(1)the attacker has control over the SCADA system,.

(2)the attacker identifies the system to launch an intelligent attack,.

(3)attacker initiates the attack [5].

Attackers at the top level include online hackers, terrorists, workers, opponents, or client, and so on. In order to obtain cyber security it is necessary to build an effective, layered defense system to function broadly across the entire grid infrastructure.

To secure data in the smart grid and SCADA system an encryption is used. Proper key management involves restricting personal access to key storage locations, random key updates and encoded key storage servers. Therefore, key algorithms must be validated in a cryptographic system and kept in locations where they need to be [2].

In addition, a robust hardware designed to withstand cyber threats is needed. One example is managed switches which perform multi-functions like access control, traffic prioritization, managing data flow, and so forth. Another addition to existing systems would be the use of firewalls. They block unauthorized access to any network and work according to the user defined rules [5].

The systems are used to mission critical industrial processes where reliability and performance are paramount. The benefits one can expect from adopting a SCADA system are a rich functionality and extensive development facilities. Modern SCADA systems are increasing in complexity, due to the integration of different components produced in many cases by different manufacturers. Thus, it is necessary to address the security level of each device, as well as on the overall environment and integration tests.

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The Structure of the Modern Power System.

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Abstract

The paper describes the modern power system. This article consists of four main parts. In the first part one can find information about the function of generation subsystem, also learn about generators and transformers? their function and work. The next part deals with trans-

mission subsystem. High voltage transmission lines are terminated in substations, which are called high-voltage substations, receiving substations, or primary substations. The third part provides information about distribution subsystem, which is divided into primery and secondary distribution network. And the final part focuses on load subsystem and kind of consumers.

Introduction

The modern society can't imagine it's life without electricity. A lot of electrical devices are used daily. Your laptop, your telephone or kettle and so on won't work without electricity. And you know it, but who knows how we receive electricity, where and how it appears. Everybody should know it. Because all people, every day, every moment deal with.

The Structure of the Modern Power System.

An interconnected power system is a complex enterprise that may be subdivided into the following major subsystems:

- Generation Subsystem.
- Transmission Subsystem.
- Distribution Subsystem.
- Utilization Subsystem.

Generation Subsystem. This includes generators and transformers.

Generators – An essential component of power systems is the three-phase ac generator known as synchronous generator or alternator. Synchronous generators have two synchronously rotating fields: One field is produced by the rotor driven at synchronous speed and excited by dc current. The other field is produced in the stator windings by the three-phase armature currents. The dc current for the rotor windings is provided by excitation systems. In the older units, the exciters are dc generators mounted on the same shaft, providing excitation through slip rings. Current systems use ac generators with rotating rectifiers, known as brushless excitation systems. The excitation system maintains generator voltage and controls the reactive power flow. Because they lack the commutator, ac generators can generate high power at high voltage,typically 30 kV.

The source of the mechanical power, commonly known as the prime mover, may be hydraulic turbines, steam turbines whose energy comes from the burning of coal, gas and nuclear fuel, gas turbines, or occasionally internal combustion engines burning oil.

Steam turbines operate at relatively high speeds of 3600 or 1800 rpm. The generators to which they are coupled are cylindrical rotor, two-pole for 3600 rpm, or four-pole for 1800 rpm operation. Hydraulic turbines, particularly those operating with a low pressure, operate at low speed. Their generators are usually a salient type rotor with many poles. In a power station, several generators are operated in parallel in the power grid to provide the total power needed. They are connected at a common point called a bus.

With concerns for the environment and conservation of fossil fuels, many alternate sources are considered for employing the untapped energy sources of the sun and the earth for generation of power. Some alternate sources used are solar power, geothermal power, wind power, tidal power, and biomass. The motivation for bulk generation of power in the future is the nuclear fusion. If nuclear fusion is harnessed economically, it would provide clean energy from an abundant source of fuel, namely water.

Transformers – The transformer transfers power with very high efficiency from one level of voltage to another level. The power transferred to the secondary is almost the same as the primary, except for losses in the transformer. Using a step-up transformer will reduce losses in the line, which makes the transmission of power over long distances possible.

Insulation requirements and other practical design problems limit the generated voltage to low values, usually 30 kV. Thus, step-up transformers are used for transmission of power. At the receiving end of the transmission lines step-down transformers are used to reduce the voltage to suitable values for distribution or utilization. The electricity in an electric power system may undergo four or five transformations between generator and consumers.

Transmission Subsystem

An overhead transmission network transfers electric power from generating units to the distribution system which ultimately supplies the load. Transmission lines also interconnect neighboring utilities which allow the economic dispatch of power within regions during normal conditions, and the transfer of power between regions during emergencies.

Standard transmission voltages are established in Russian Federation transmission voltage lines operating at more than 35 kV are standardized at 110 kV, 220 kV, 330 kV, 500 kV, and 750 kV line-to-line. Transmission voltages above 220 kV are usually referred to as extra-high voltage (EHV).

High voltage transmission lines are terminated in substations, which are called high-voltage substations, receiving substations, or primary substations. The function of some substations is switching circuits in and out of service; they are referred to as switching stations. At the primary substations, the voltage is stepped down to a value more suitable for the next part of the trip toward the load. Very large industrial customers may be served from the transmission system.

Distribution Subsystem

The distribution system connects the distribution substations to the consumers' service-entrance equipment. The primary distribution lines from 4 to 34.5 kV and supply the load in a well-defined geographical area. Some small industrial customers are served directly by the primary feeders.

The secondary distribution network reduces the voltage for utilization by commercial and residential consumers. Lines and cables not exceeding a few hundred feet in length then deliver power to the individual consumers. The secondary distribution serves most of the customers at levels of 380/220 V.

Distribution systems are both overhead and underground. The growth of underground distribution has been extremely rapid and as much as 70 percent of new residential construction is via underground systems.

Load Subsystems

Power systems loads are divided into industrial, commercial, and residential. Industrial loads are composite loads, and induction motors form a high proportion of these loads. These composite loads are functions of voltage and frequency and form a major part of the system load. Commercial and residential loads consist largely of lighting, heating, and cooking. These loads are independent of frequency and consume negligibly small reactive power.

Conclusion

Generation subsystem includes generators and transformers they are essential components of power. An overhead transmission network transfers electric power from generating units to the distribution system which ultimately supplies the load. The distribution system connects the distribution substations to the consumers' service-entrance equipment. Power systems loads are divided into industrial, commercial, and residential. Now, you know what a power system is, how every subsystem works.

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