Turbine generator working principle pdf

The main condenser condenses the exhaust steam of the low-pressure stages of the main turbine and also of the steam dumping system. The depleted steam is shortened by past tubes containing water from the cooling system. The pressure within condensator is given by the amended air temperature (i.e. temperature of water in the cooling system) and by steam ejections or vacuum pumps, which draw the gases (non-condensibles) from the surface condenser and eject them to the atmosphere. The lowest feasible condenser pressure is the saturation pressure corresponding to the ambient temperature (e.g. absolute pressure of 0.008 MPa, corresponding to 41.5°C). Note that, there is always a temperature difference between (around MT = 14°C) the condenser temperature and the ambient temperature, which comes from limited size and efficiency of condensers. Since the condenser is 100% effective heat slurry, there is always a temperature difference between the saturation temperature (secondary side) and the temperature of the cooler in the cooling system. Moreover, there is a design inefficiency, which reduces the overall efficiency of the turbine. Ideally, the steam would have exhausted in the condenser no subcolody. But actual condensers are designed to subcoel the liquid by a few degrees from Celsius in order to avoid the suction cavitation in the condensate pumps. However, this subcoage increases the inefficiency of the cycle because more energy is needed to heat the water. Reducing the turbine exhaust pressure increases the net work per cycle, but also covers the vapor quality of exhaust steam. The purpose of maintaining the lowest practical turbine exhaust pressure is a primary reason for the inclusion of the condenser in a thermal power plant. The condenser provides a vacuum that maximizes the energy extracted from the steam, resulting in a significant increase in net work and thermal efficiency. But also this parameter (condenser pressure) has its engineering limits: Reducing the turbine exhaust pressure reduces the vapor quality (or dryness fraction). At some point, the extension must be terminated to avoid damage that can be caused to avoid blades of steam turbines through a low quality steam. Reducing the turbine exhaust pressure significantly increases the specific volume of depleted steam, which requires large blades in the last rows of a low-pressure stage of the steam turbine. In a typical wet steam turbine, the exhausted steam condenses in the condenser and it is at a pressure well below atmospheric (absolute pressure of 0.008 MPa, corresponding to 41.5°C). This steam is in a partially abbreviated state (point F), typical of a quality near 90%. Note that, the pressure within the condenser is also of the magnitating atmospheric conditions: air temperature, pressure and humidity in case of cooling in the atmosphere water temperature the flow rate in case of cooling in a river or sea an increase in the ambient temperature causes a proportionate increase in pressure of depleted steam (MT = 14°C is usually a constant) from there reducing the thermal efficiency of the power conversion system. In other words, the electrical output of a power plant can vary with adrecient conditions, while the thermal power remains constant. The condensed steam (now called condensate) is collected in the condenser's hotwell. Condenser's hotwell also offers a water storage capacity, necessary for operational purposes such as feedwater bearing. The condensate (saturated or slightly subsoled liquid) is delivered to the condensate pump and then pumped to the death toll by feedwater heating system. The condensate pumps usually increase the pressure to approximately p = 1-2 MPa. There are usually four one-third capacity centrifugal condensate pumps with general suction and discharge headings. Three pumps are usually in operation with one in the backup. The system of feedwater pumps usually contains three parallel lines (3×50%) feedwater pumps with general suction and discharge headings. Each feedwater pump consists of the booster and the main feed water pump. The feedwater pumps (usually driven by Steam turbines) increase the pressure of the condensate (~1MPa) to the pressure in the Steam generator (~6.5MPa). The booster pumps provide the required main feedwater pump suction pressure. These pumps (both feedwater pumps) are usually high pressure pumps (usually from the centrifugal pump type) that take suction of the deadly water storage tank, mounted directly under the docker and supply the main feed water pumps. The water export from the feedwater pumps flows through the high pressure feedwater heaters, goes the container and then flows into the steam generators. Feed water flow to each steam generator is controlled by feed water regulating valves (FRVs) in each feed water line. The regulator is automatically controlled by Steam generator level, Steam flow and feedwater flow. The high pressure feedwater heaters are heated by extraction steam from the high pressure turbine, HP Turbine. Draining of the high-pressure feedwater heaters is usually routed to the deaerator. Steam Generator – vertical The feedwater (water 230°C; 446°F; 6,5MPa) is pumped into the steam power generator by the feedwater inlet. In the steam power generator, the feedwater (secondary circuit) is heated from ~230°C 446°F to the boiling point of that liquid (280°C; 536°F; 6,5MPa). Feedwater is then evaporated and the pressure steam (saturated steam 280°C; 536°F; 6.5 MPa) allows the steam generator to exhaust by steam and continue to complete the steam turbine, thereby completing the cycle. Hydro turbine generators are devices that convert the mechanical energy from moving Energy. Hydro turbine generators can be effective using a large variety of water sources: a small current, a fast flowing river, a waterfall, a small lake, and even some of the oceans. How Hydroelectricity Works Hydroelectric Energy is produced when the kinetic energy of water is converted into electricity using a hydro turbine generator. There are several methods for using water to power a hydro turbine generator, but they generally function in a relatively similar manner, all using the same fundamental laws of physics. And although there are numerous variables that can affect the design of each system, for example head height, water pressure, flow rate, and turbine design, the fundamental rule remains: that the hydro turbine generator is the device that converts the mechanical energy into electrical energy. Once you understand the basics of how hydroelectric works, that knowledge can be translated to the many varieties of hydroelectric energy systems. The device above illustrates a system with a high head height as the water starts at point (1) and a long distance falls to the middle of the system. These high head systems are usually found in geographical locations with regular altitude changes, such as a hilly or mountainous area, and require less volume of water because the high vertical drop of the water provides sufficient power to spimp the turbine. Let's take a step-by-step look at what happens in this hydroelectric system to create electricity. The intake valve, sometimes called the penstock, is the part of the device that captures the flow of water and directs it to the water turbine. The water source may vary depending on the system, for example a man-made reservoir, or a natural source such as a river or more. Then, the water makes its way to a series of curved blades, which capture the power of the water as it goes through, which then causes the turbines to turn. The power of gravity is what provides the falling water with mechanical energy, and the turbine blades are that absorb the energy as the water collides in them. The turbine is then attached to a turbine generator that also turns because it is attached by a rotating shaft to the spining water turbine. As the generator turns, an electric current is created and can eventually be converted into usable electricity. As the water goes through the spining turbine, it is forced to leave by the exit valve as new water falls constantly through the machine to support a continuous flow of water. Calculation of Hydro-Power Output Hydroelectric energy production accounts for nearly a quarter of electricity used in the world, which is enough to provide about 1 billion people with electrical power. Hydro-electricity is the renewable energy resource currently in the United States, which accounts for approximately 6% of all electricity produced, approximately 70% of all electricity resulting from renewable energy sources. The Hooverdam, a well-known and very large hydroelectric dam in the United States, supports 17 main turbine generators and can produce more than 2000 megawatts of electricity. On average, the Hooverdam generated about 4 billion kilowatt-hours electricity per year, which is enough energy to power nearly 1.5 million people. Small hydroelectric turbine generators usually produce up to 10 megawatts of power. Micro hydroelectricity turbines will usually produce 100 kilowatts of electrical power. Two very important factors needed to calculate potential hydropower output of a hydroelectric system are water flow and hydraulic head height. Water flow is the volume of water going through the turbines in a particular amount of time, and head height is the distance the water falls before the turbines are reached. The larger the flow, or the larger the head height, the higher the potential output of hydroelectric. Gravity is the other component needed to complete the power outfit comparison, but gravity is a constant (9.8), so it does not change. With gravity and the two variables after comparison to calculate hydroelectric power outage, Power = Gravity * Water flow rate * Head Height to receive the power outage in watt, gravity in meters per second square, water flow in liters per second is measured, and head height is measured in meters. It is now important to understand that the answer you get the power outfit in watts of a machine that converts 100% of the mechanical energy of water into hydroelectrics. Unfortunately, this is never the case. Hydroelectric production usually works in a 50%-70% efficiency range. So, by multiplying your answer through the efficiency rate of the machine, you will get the actual calculated power outage of your hydroelectric machine. Machine.