Geothermal power plant process pdf

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Geothermal power plant cycles and main components, United Nations University, geothermal training program organized by UNP-GTP and LaGeo, in Santa Tecla, El Salvador, January 16-22. p. 1–24.Vuataz RS. Properties of geothermal liquids in Switzerland: a new interactive database. Geothermal. 2008;37:496-509.Google article Scholar Yang K, Zhang H, Wang Z, Zhang J, Yang F, Wang E, Yao B. Study of zeotropic orc mixtures (Organic Rankine cycle) under various engine operating conditions. Energy. 2013;58:494–510.Article Google Scholar Yari M. Exergetic analysis of different types of geothermal power plants. Refresh the power. 2010;35:112–21.Article Google Scholar Younas U, et al. Pakistan geothermal renewable energy potential for electricity generation: a survey. Renewal of Sustain Energy Rev. 2016;63:398–413.Article Google Scholar Page 2 Geothermal power plants use hydrothermal resources that have both water (hydroelectric) and heat (thermal). Geothermal power plants require high-temperature hydrothermal resources (300°F to 700°F) from either dry steam wells or hot water wells. People use these resources by drilling wells into the earth and then piping steam or hot water to the surface. Hot water or steam feeds a turbine that generates electricity. Some geothermal wells are two miles deep. A geothermal power plant emitting steam Source: Stock photo (copyright) Types of geothermal power plants Dry steam plants use steam directly from a geothermal tank to convert generator turbines. The first geothermal power station was built in 1904 in Tuscany, Italy, where natural steam exploded from the earth. Flash steam plants take high-pressure hot water from deep into the earth and convert it into steam to drive generator turbines. When the steam cools, it condenses into the water and is injected back into the ground to be used again. Most geothermal power plants are flash steam plants. Binary cycle power plants transfer heat from geothermal water in another liquid. The heat causes the second liquid to turn into steam, which is used to drive a turbine generator. The differences between dry steam, flash steam, and binary cycle power stations are shown in the charts below. Source: U.S. Department of Energy, Energy Efficiency & Renewable Energy (public sector) Last updated: December 5, 2019 There is a natural energy source located beneath the earth's surface that has been around for some time Underground, far below us, there are pools of water heated by magma (or melted rocks). These water lakes make up our geothermal reservoirs. Harnessing the power of earth's temperatures to power, heat or cool our homes and businesses is the essence of geothermal power. There are currently geothermal installations in over 80 countries, according to the Geothermal Energy Association and although the United States is currently the world leader in geothermal energy, other countries such as Indonesia, Turkey and Kenya are all in the process of expanding their energy capabilities as well. The first geothermal plant in the United States was built by Pacific Gas and Electric in 1960 in an area called The Geysers. Located in the Mayacamas Mountains north of San Francisco, California is the largest geothermal field in the world. It is now home to 22 geothermal power plants, known as the Geysers Complex, and is considered the largest geothermal plant in the world. Geothermal energy does not require the burning of fossil fuels. The hot water or steam used is returned to the ground after being used where it can be used again, which makes it a renewable energy source as well. Geothermal power plants There are three main types of geothermal power plants that generate energy in slightly different ways. Dry steam plants are the most common types of geothermal power plants, accounting for about half of the installed geothermal plants. They operate by piping hot steam from underground tanks directly into turbines from geothermal tanks, which power generators to supply electricity. After feeding the turbines, the steam condenses into water and is pumped back into the earth through the injection well. Flash steam plants differ from dry steam because they pump hot water, rather than steam, directly to the surface. These flash steam plants pump hot water at a high pressure from below the earth into a flash tank on the surface. The flash tank is at a much lower temperature, causing the liquid to flash quickly into the steam. The steam produced the forces of the turbines. The steam is cooled and condensed into water, where it is pumped back into the ground through the injection well. In these binary cycle plants, the main difference is that water or steam from below the earth never comes into direct contact with turbines. Instead, water from geothermal tanks is pumped through a heat exchanger, where it heats a second liquid-like isobutene (which boils at a lower temperature than water.) This second liquid is heated to steam, which feeds the turbines that drive a generator. The hot water from earth is recycled on earth through injection well, and the second liquid is recycled through the turbine and back into the heat exchanger where it can be used again. Geothermal heat pumps that power your home with a geothermal heat pump allow you to take advantage of temperatures below the earth's surface to heat or cool a structure. Although temperatures soil fluctuates during seasons over the years, the temperature below the surface remains consistent between 50°F-60°F throughout the year. There are four types of pumps, three closed loop systems and open loop systems. Each depends on the type of soil, climatic conditions and available land. Horizontal closed loop systems are the most cost-effective for residential areas. For larger commercial buildings, vertical closed loop systems are most often used. These can sometimes go down 400 feet deep. Closed loops built under or in a pond or pond are usually the cheapest. In closed loop systems, a mixture of water/antifreeze circulates through a pipe loop underground (or under an aqueous system) and in a building. In winter (as shown above), the underground temperatures are warmer than the air, so the pumping fluid is warmer. The electric compressors and heat exchangers then transfer the heat through ducts to the building. In summer, the pipes draw heat away from the building and are absorbed by land or water. Since the liquid is already cool in summer and warmer than the air in winter, the heating/AC system doesn't have to work nearly as hard. In open loop systems, water is taken directly from a water source and into the heat pump, where it can then either be recycled back to the same source or pumped to another water source (without pollution). The only difference with water going in and out is a slight change in temperature. Although these can be cheaper, they also require a steady flow of water capable of your home. These four types of geothermal heat pumps can be used throughout the country due to constant temperature below the surface, but vary in efficiency and cost savings. One of the big developments for the future of geothermal energy is called enhanced geothermal system (ES). Traditionally, geothermal energy has to be taken where there are geothermal reservoirs, which are mainly in the Western United States. In fact, geothermal energy already provides about 60% of the energy along the Northern California coast, according to the U.S. Department of Energy. Thus, EGS creates mechanical geothermal tanks by pumping cold water thousands of feet underground to gain access to hot water and generate steam needed for power plants on the surface. Since geothermal energy is a renewable natural resource, think of it as a gift from the earth that continues to give. Although over time it is often necessary to drill additional wells to maintain energy production levels, the earth continuously emits heat that When our planet was formed billions of years ago. Next time you see a geyser like Old Faithful in Yellowstone National Park baking hot steam and water high in the air, imagine that same power used to generate electricity. Learn more about geothermal energy and other types of energy for your home with SaveOnEnergy. Sources: Sources: Sources: