Geothermal Energy

What is Geothermal Energy?

Excerpt from ***Powering Our Future: An Energy Sourcebook for Sustainable Living.*** The text was modified to fit the website.

Geothermal heat is the only renewable energy source created naturally by the earth itself from the formation of the earth and radioactive decay. Well-designed geothermal systems are some of the most environmentally benign sources of energy. Domestically producible, reliable, renewable, and versatile, geothermal energy offers excellent opportunities to diversify the global energy mix. Furthermore, geothermal heat is abundant. There is 50,000 times more energy in the upper six miles of the earth's crust than in all of the global oil and natural gas reserves combined. While the majority of this energy is inaccessible using current technologies, harnessing even a small fraction of it could significantly contribute to a sustainable energy future. Geothermal heat brings greater security and well-being to people around the world. At the same time, geothermal sources promote greater sustainability and environmental stewardship. The abundant heat emanating from the core of the earth is a wellspring of energy that has been severely underdeveloped. Rest assured, renewable geothermal energy will continue to provide citizens of the world with a clean, reliable source of heat and power long after the fossil fuel economy has faded.

The word geothermal has Greek origins, with *geo* meaning "earth," and *therme* meaning "heat." Some 4.5 billion years ago, during the earth's formation, high concentrations of dust and gas created intense heat. Although the earth's formation is a likely contributor, geologists believe that radioactive decay is primarily responsible for maintaining core temperatures. The earth's core, estimated to be over 7,600 degrees Fahrenheit (4,200 degrees Celsius), ubiquitously radiates heat toward the earth's surface. Across most of the globe, the heat is emitted in imperceptible amounts. Geothermal sources are formed in the inner mantle of the earth where hot molten magma circulates outward while groundwater seeps deep into the earth. As magma and water converge, the groundwater is heated and forced up through faults and cracks toward the surface. In liquid or vapor form, this geothermal source is known as hydrothermal. It sometimes emerges at the earth's surface as hot springs and geysers, though most of it is trapped by impenetrable layers of rock. Saturating porous rock, hydrothermal becomes trapped in geothermal reservoirs until either geologic changes or a drill bit provides an outlet.

Below our feet exists the ultimate source of thermal mass - an immense mass of material, including hot rock, hydrothermal, and molten lava, that has stored energy since the planet's accretion. Although much of the earth's heat evades the ingenuity of engineers to harness, there are still ample opportunities to take advantage of this planetary phenomenon. Geothermal resources offer a prime option for nations that intelligently seek to diversify their energy mixes through three primary applications: electricity production, direct-use systems for heating, and geothermal heat pumps. While some geothermal applications such as geothermal heat pumps may be economically out of reach for much of the developing world, there are opportunities regionally to tap geothermal resources economically and effectively. Geothermal energy is a renewable resource, though as The Geysers in California have shown, not inexhaustible. Well-designed and operated geothermal systems offer a reliable and domestically producible energy source. A few technical and economic barriers remain because the industry has been severely undermined by fossil fuels. Nevertheless, geothermal power offers solid potential for fulfilling the energy needs of people around the world in appropriate regions. It is likely that progressive societies will soon recognize the earth's hidden secret as it seeks to expand its resources. In the meantime, the earth will continue to hold this buried treasure.