Geothermal Power

Geothermal, wind, and solar power are our best hope for sustainable energy in the amounts needed to meet our energy needs.

The surface of the earth is a solid crust that, compared to the diameter of the earth, is relatively thin. As you descend, at first the earth is cool. (Missouri's famous caverns boast year-round temperatures of 55°). But you don't have to go too far down before the temperature starts climbing, and soon it reaches the point at which minerals melt into lava. Most of the inside of the earth is a viscous soup of super-hot molten rock circulating slowly under tremendous pressure.[i]

On average worldwide, the temperature climbs 50-87° for each mile you descend into the earth. But that is just an average. In some places the earth's crust is thinner than in others. The crust is thinner under the entire western half of the U.S. than under the eastern half. Thus, in the West, temperature climbs more quickly as you descend. In some locales the molten rock of the earth's core rises in a plume that breaks through the crust, causing volcanic eruptions. In these places, the very ground can be hot as you walk on it. Alternatively, surface water can seep into cracks, percolating down until it becomes so hot that it flashes into steam, which then vents back to the surface as a geyser or fumarole.[ii]

Traditional geothermal plants capture steam by sinking pipes into geyser complexes. If the steam is hot enough, it can be used directly to spin a turbine, which turns a generator. If it is not hot enough, it can be used to heat an industrial liquid (isobutane) that flashes into gas at a low temperature and spins the turbine.[iii]

The amount of heat available from the earth is sufficient to satisfy our energy needs for thousands of years. The limiting factor is water: geothermal power plants often vent steam out of geyser complexes faster than it is replenished by nature. The result is that production declines over time, much as production from an oil field declines over time. Enhanced geothermal plants inject water into the geyser complex in an attempt to reverse the decline.[iv]

Geothermal power currently generates about 7,000 mW of power worldwide, about 2,700 mW in the U.S. (about 0.3% and 0.6% of demand respectively).[iii] The Geysers, located northwest of Napa Valley, California, is the largest geothermal field in the world. First developed for power production in 1921, it now provides 70% of the average electrical demand along the California coast from the Golden Gate Bridge to the Oregon state line. In response to declining production, operators began injecting waste water into the geyser complex in 1997, stopping the decline and solving a waste water treatment problem at the same time.[v]

The potential of geothermal as a sustainable energy source for the future will be discussed in the next white paper.

[i] Earth. (2007). In Encyclopædia Britannica. Retrieved December 23, 2007, from Encyclopædia Britannica Online: http://www.britannica.com/eb/article-54199.
[ii] Nersesian, Roy. (2007). *Energy for the 21st Century.* Armonk, NY: M.E. Sharpe.
[iii] *Geothermal energy facts.* Geothermal Education Office. Retrieved online 12/20/2007 at http://geothermal.marin.org/pwrheat.html.
[iv] *Geothermal power.* Wikipedia. Retrieved online 12/20/2007 at http://en.wikipedia.org/wiki/Geothermal_power.
[v] *Calpine receives 2004 green power leadership award from DOE and EPA.* Retrieved online at http://phx.corporate-ir.net/phoenix.zhtml?c=103361&p=irol-newsArticle&ID=642201&highlight=.