The Milgro Nurseries greenhouse near New Castle, Utah, is one of the approximately 40 greenhouses nationwide that benefit from the direct use of geothermal energy

The Heat Beneath our Feet

Geothermal energy is the heat contained within the earth— a sizable, nationwide energy resource that has been left virtually untapped. Geothermal energy is a clean, reliable and renewable resource that can be used as a direct source of heat and to generate baseload electric power.

Geothermal energy offers a number of advantages over traditional fossil fuel-based sources. The heat source requires no purchase of fuel and is reliable and secure. Little or no greenhouse gases are emitted by geothermal energy use. The development and application of new and advanced geothermal technologies will enable geothermal energy to become a major contributor to the United States energy supply portfolio.

The Geothermal Technologies Program

The U.S. Department of Energy's (DOE) Geothermal Technologies Program (GTP) conducts research, development, and demonstration to establish Enhanced Geothermal Systems (EGS) as a major contributor for baseload electricity generation. While GTP's mission reflects the longer-term goal of cost-competitive power production, demonstrating EGS technical readiness in the near-term is essential. Research projects are performed under cost-shared awards to private companies and academic institutions via competitive solicitations and through work with the national laboratories.

The Promise of Enhanced Geothermal Systems

The EGS energy potential in the U.S. is enormous. EGS reservoirs are created by drilling wells into hot rocks, fracturing the rock, and circulating a fluid through the fractured rock to extract the heat (Figure 1). This means of "heat mining" mimics naturally-occurring, conventional hydrothermal reservoirs. DOE will be conducting multiple system demonstrations in different regions of the country to reduce risk and uncertainty in EGS with the goal of having 50,000 MW of geothermal energy online by 2030.

Near-Term Advancement of Hydrothermal

As of March 2009, the United States was the largest geothermal electricity producer in the world with installed hydrothermal power capacity over 3,000 MW. Research efforts in EGS technology will support near-term scale-up of traditional hydrothermal capacity, as many hydrothermal tools and techniques are also used in EGS development.

Low-Temperature Geothermal Energy Production

Low-temperature geothermal resources with fluids that are not hot enough to boil water also present an enormous opportunity for geothermal power generation. These systems employ binary cycle technology to generate electricity.

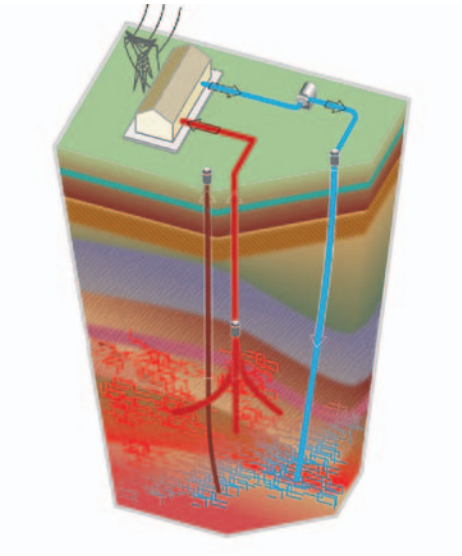

Figure 1. Enhanced Geothermal System

Fluid is circulated through an injection well (blue) and pumped up to a power plant through a production well (red).

Geothermal power plant at The Geysers near Santa Rosa in northern California, the world's largest electricity-generating geothermal development

Advances in binary cycle technology have lowered the temperature requirement for geothermal electricity production. The Chena Hot Springs Resort in Alaska generates electricity from water with temperatures as low as 74°C. In addition, 40 billion barrels of water, much of it hot enough to generate electricity with binary cycle units, is co-produced every year with oil and gas[1].

National Geothermal Data System

Much of the risk of geothermal energy development is associated with exploring for and confirming the available geothermal resource. GTP will help mitigate this upfront risk by sponsoring a National Geothermal Data System. The data system will serve as a central repository for geothermal data as well as a link to distributed data sources. Assessing and categorizing the nation's geothermal resources and consolidating all geothermal data in a publicly accessible data system will stimulate public interest, market acceptance, and in turn the growth of the geothermal industry.

Direct Use and Ground Source Heat Pumps

Another opportunity to utilize heat from the earth is through direct use and ground source heating and cooling. Working with EERE Building Technologies Program, GTP is seeking to accelerate the deployment of highly efficient ground source heat pumps for commercial and residential applications.

Education and Collaboration

A trained and motivated workforce is essential to maximizing the full potential of geothermal energy. To that end, GTP will establish education and workforce development projects to meet the needs of a growing geothermal industry through geothermal research and education, university curriculum development, and co-sponsored internship programs.

Collaborating with other industries and governments has yielded great advances for geothermal energy. As a founding member of the International Partnership for Geothermal Technology, the United States plans to increase technology transfer and expand international market penetration. In addition, the DOE's National Laboratories provide research and development assistance to the GTP.

The GTP Geothermal Research & Development Strategy

The GTP strategy is to use current technologies and resources to develop the advanced technologies and knowledge required for deployment of EGS. This will require a systematic, sustained R&D effort and field demonstrations in a variety of geologic environments.

GTP funding opportunities for research, development, and demonstration of geothermal technologies can be found on our Web site listed below. Questions regarding GTP activities should be directed to geothermal@ee.doe.gov.

For More Information

Contact the EERE Information Center 1-877-EERE-INF or 1-877-337-3463 or visit www.geothermal.energy.gov

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[1] Richard B. Wanty, 1997, *USGS Research on Saline Waters Co-Produced with Energy Resources*. U.S. Geological Survey.

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