NC SUSTAINABLE ENERGY ASSOCIATION

Geothermal Fact Sheet

Benefits of Geothermal Energy:

- Continuously available resource
- Most energy efficient means of controlling internal temperatures.
- Very low emissions
- Low heating cost

Challenges of Geothermal Energy:

- Difficult to find suitable large scale production sites
- Not easily transported (highly localized)
- May release some hazardous gases and minerals

Geothermal Energy Defined

Geothermal energy is the heat trapped in the rocks and fluid in the Earth's crust. People around the world use geothermal energy to heat their homes and produce electricity by digging deep wells and pumping the heated underground water or steam to the surface. The stable temperatures near the surface of the Earth can also be used to heat and cool buildings.

How Geothermal is Used to Create Energy

Geothermal resources can be found in shallow ground beneath the crust, several miles below the Earth's surface, or even farther down to the extremely hot molten rock called magma. Mile-or-more-deep wells can be drilled into underground reservoirs to tap steam and very hot water that can be brought to the surface for use in a variety of applications:

- **Geothermal heat pumps** use stable ground or water temperatures near the Earth's surface to control building temperatures above ground.
- **Direct use and district heating systems** use hot water from springs or reservoirs near the surface.
- **Electricity generation power plants** require water or steam at very high temperature (300° to 700°F). Geothermal power plants are generally built where geothermal reservoirs are located within a mile or two of the surface.

Ground Source Heat Pumps

The ground just below the surface stays relatively constant year round – between 50° and 60°F. In the winter months, the underground temperature is warmer than the air temperature. In the summer, the reverse is true – the underground temperature is cooler than the air temperature. A ground source heat pump can be used to draw heat from the ground in the winter and act as a release for heat in the summer. All regions of the US – including North Carolina – are suitable for ground source pumps.

Geothermal heat pump image courtesy of DOE/EERE

Additional Resources:

U.S. Energy Information Association (EIA), Energy Explained
http://tonto.eia.doe.gov/energyexplained

U.S. Dept. of Energy
http://www1.eere.energy.gov/geothermal/

EERE Energy Savers
www.energysavers.gov

Geothermal Exchange Organizations
www.geothermal.org/

Electric Power Generation

In the US, the most extensive geothermal resources are in the western states. In this region, deep wells can tap hydrothermal resources that contain steam or hot water that can drive electrical turbines.

Three types of geothermal power plants exist:

- **Dry steam plants** use geothermal steam directly to turn the turbines that produce electricity.
- **Flash steam plants** pull high-pressure hot water into lower-pressure tanks and use the resulting flashed steam to drive turbines.
- **Binary-cycle plants** pass moderately hot geothermal water by a secondary fluid with a much lower boiling point than water. This causes the secondary fluid to flash to vapor and drive the plant's turbines.

Geothermal steam plant courtesy of DOE/NREL

North Carolina Impact

The United States leads the world in electricity generation with geothermal power. In 2008, U.S. geothermal power plants produced 14.86 billion kilowatt-hours, or 0.4% of total U.S. electricity generation. In North Carolina, large scale geothermal resources are relatively scarce, however many residential homes can be heated and cooled using the stability of geothermal energy.

North Carolina Projects