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# COOPERATIVE EXTENSION

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**Fact Sheet-04-70**

# Nevada's Renewable Energy Resources: Geothermal

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**What is Renewable Energy?**

Renewable energy is result of natural atmospheric, geologic, and biological processes on the earth. Renewable energy sources include solar, wind, geothermal, and biomass. They are available in abundance in the western US and continually renew themselves, although they vary spatially and temporally within and between years. In other words, these energy sources cannot be depleted. Heat and light from the sun, wind, thermal gasses, and organic waste can all be harnessed to produce electricity, power machinery and automobiles, while working towards a cleaner environment, better air quality, and water use in comparison to traditional fossil fuel energy sources.

Just over 50% of the power used in the western US is generated with fossil fuels. Fossil fuels include coal, natural gas, and oil, all of which are non-renewable energy sources. These fuel sources will eventually be depleted, causing the costs of these sources to increase dramatically as supplies fall. There are many environmental and public health costs associated with non-renewable energy sources. Coal and gas extraction often necessitate land and natural environment degradation. Additionally, fossil fuels used to operate power plants and generate electricity produce 40% of total US carbon dioxide emissions, 63% of US sulfur dioxide emissions, and 20% of US nitrogen oxide emissions. The latter two of which cause urban haze, brown clouds, and acid rain.

**Why is Renewable Energy Development Important?**

In addition to the health and environmental benefits of renewable energy sources, there are also economic related benefits. Many renewable energy development projects are completed in rural areas, which may lead to economic development in terms of new business generation and employment opportunities. For example, wind farms that harness wind power and convert the power to electricity are often located in large open areas including rangeland, crop land, and mountain ridges.

Additionally, renewable energy can provide reliable energy sources to rural areas where electricity was previously unreliable or unavailable.

Renewable energy may also reduce the long-term costs of power and stabilize energy prices due to its renewable nature. Market prices for energy as well as most other goods change in accordance with supply and demand. Renewable energy sources can provide a constant supply of energy, stabilizing energy prices. Studies show that renewable energy sources will need to be evaluated as a option in order to accommodate the increasing US population and its growing demand for energy in the western US.

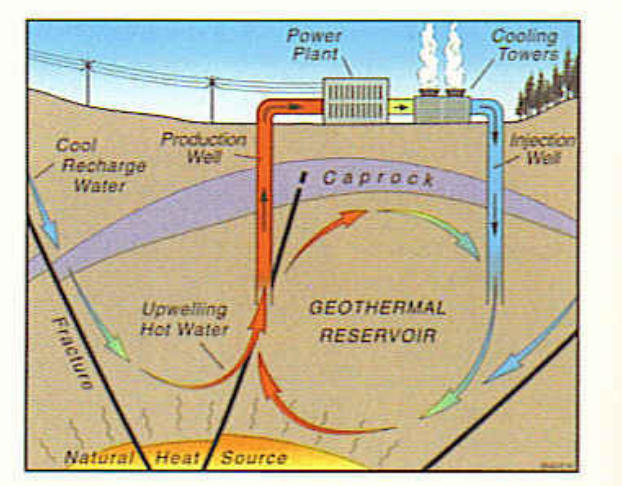
Although the potential for renewable energy sources are great, there are many issues which must be addressed before these resources can be fully developed. These include, but are not limited to technology, transmission capabilities, and environmental impact studies.

The State of Nevada has abundant solar, wind, and biomass energy sources, but has more potential for geothermal energy production than any other state. In 2001, Nevada implemented the most aggressive renewable portfolio standard, calling for 15% of the state's energy usage to come from renewable sources by 2013 (Senate Bill No. 372). This fact sheet is the last in a series of four publications, which provide an overview of renewable energy sources and current projects in Nevada, including resources for further information, and funding for renewable energy project development.

**What is Geothermal Energy?**

Geothermal comes from the Greek words geo (earth) and therme (heat). So, geothermal means earth heat. Geothermal energy is a sustainable, renewable source derived from the heat of the earth's core. Whether using this source of energy for electrical generation or direct use, it is important to understand the dynamics of geothermal energy. It develops from the earth's internal heat, which increases with depth. At the earth's core, the estimated temperature is more than 7600 degrees Fahrenheit. This internal heat naturally moves from hotter, deep levels, to cooler levels at the earths surface. As the earth's geologic structure of plates and faults move over time, heat is transferred from the lower depths via magma and water. In most cases, the magma itself stays below the earth's surface, but it does heat surrounding rocks and subterranean water. Some of this heated water makes its way to the surface through faults and cracks, creating hot springs and/or geysers. However, when rising hot water and steam is trapped in the permeable rock under a layer of non-permeable rock, a geothermal reservoir is created, (Figure 1.). Through the identification and development of these reservoirs via geological and hydro-geological studies, as well as geophysical surveys, geothermal energy sources can be identified.

**Figure 1. Geothermal Schematic**.




**How is Geothermal Energy Used?**

The primary applications of geothermal energy include electricity generation, direct heat, and ground source heat pumps. Electricity generation is used for large utility scale operations. Direct uses include smaller scale operations including the heating of buildings or greenhouses and drying of food products. Additionally ground source heat pumps utilize the soils heat reservoir for the heating and cooling of buildings.

The development of this resource is very expensive because of the extreme temperatures and corrosive nature of geothermal fluids. Electrical generation cost estimates range from $1 to 4 million dollars for each geothermal well. Depending on the resource and the demand, 10-100 wells may be established on a given resource. Systems requiring low to medium temperatures will drill from 50 to 500 feet in depth, while high temperature systems may require drilling to a depth of 1,000 feet or more. Direct use systems are often smaller scale and therefore less expensive to develop. Again total project cost depends on the size and depth of the identified resource.

**What is the Status of Geothermal in Nevada?**

According to the Geothermal Power Issue Brief, "Nevada's geothermal plants produce about 210 MW of electricity, saving energy imports equivalent to 800,000 tons of coal or 3 million barrels of oil each year. In 1993, Nevada's geothermal power plants paid $800,000 in county taxes and $1.7 million in property taxes. The U.S. Bureau of Land Management collects nearly $20 million each year in rent and royalties from geothermal plants producing power on federal lands in Nevada, half of these revenues are returned to the state." According to U.S. Department of Energy's Geothermal Today, "Nevada has the largest untapped, usable geothermal resource in the United States-3700 megawatts (MW), enough to supply electricity to 3.7 million households".

The location graph as overviewed in Figure 2 (page 3), outlines geothermal electric generation in Nevada which currently produces 265 MW of power from 7 power plants. Direct uses include four fish farms, two district heating sites, five industrial sites, six spa and resort facilities, and two space heating sites, accounting for an additional generation of 69 MW. Nevada's potential for geothermal power generation is outstanding (see Figure 3, page 4).

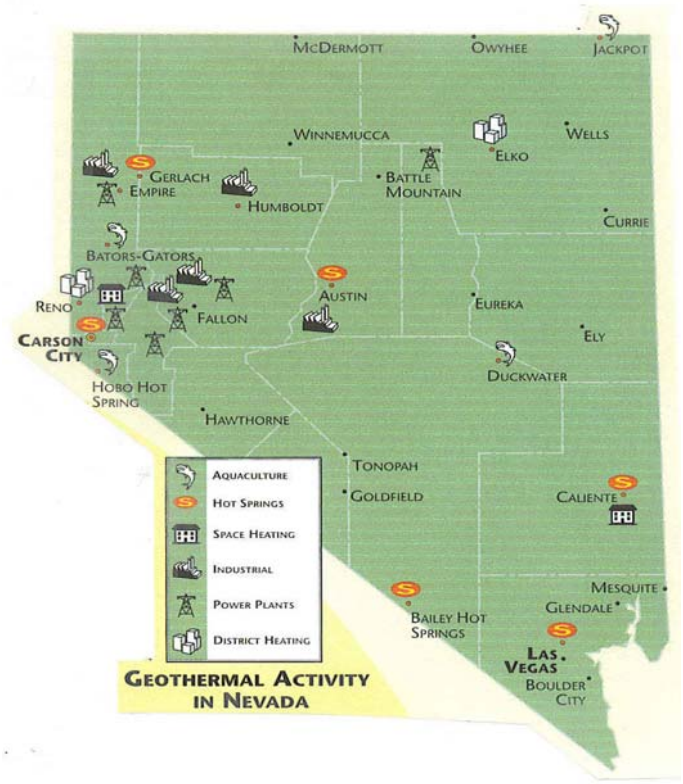
**Where Can I Find Funding for Geothermal Projects?**

USDA-Rural Development: This grant authorized by the 2002 Farm Bill, provided funds ($22.8 million in 2004) to ranchers, farmers, and rural small business for renewable energy projects, including wind, solar, biomass, and geothermal sources. Grant funds, which can be used for up to 25% of total project costs, are awarded annually. For more information see http://www.rurdev.usda.gov/rbs/farmbill/index.html

HUD-RHED: Rural housing and economic development grants provide funding for buildings, educational programs, economic development activities, and feasibility studies with an emphasis on energy efficiency. For more information see http://www.hud.gov.

USDA-SBIR: Community development grants to small business for new technology studies, market and feasibility studies. For more information see http://www.csrees.usda.gov.

**Figure 2. Geothermal Activity in Nevada**




***Rebate Programs***

There are several rebate programs in Nevada, including business and personal property tax rebates, sales tax rebates, and utility bill rebates. The Federal Government also provides rebates including corporate tax credits such as the business energy tax credit of 10% available to commercial businesses that invest in solar or geothermal equipment and structures. A complete listing of all State and Federal programs is available at http://www.dsireusa.org/.

Sierra Pacific Power and Nevada Power purchase renewable energy credits from solar and geothermal energy producers. For more information see http://www.nevadapower.com.

**Where Can I Find Additional Information?**

***Web Resources***

U.S. Department of Energy GeoPowering the West:
http://www.eren.doe.gov/geopowering/west
Geothermal Energy Program:
http://www.eren.doe.gov/geothermal
Geo-Heat Center:
http://www.oit.osshe.edu/~geoheat/
Idaho National Engineering and Environmental Laboratory:
http://geothermal.id.doe.gov
National Renewable Energy Laboratory:
http://www.nrel.gov/geothermal/
Geothermal Energy Association:
http://www.geo-energy.org
Geothermal Resources Council:
http://www.geothermal.org
Nevada State Office of Energy: http://energy.state.nv.us/
Sandia National Laboratories: http://www.sandia.gov

***Geothermal System Contractors/Providers***

**Alternative Energy Solutions**
195 N. Edison, Suite 16
Reno, NV 89502
775-857-1157

**Nevada Division of Minerals**
400 W. King Street, #106
Carson City, NV 89703
775-684-7040

**Nevada Geothermal Power Inc.**
409 Granville Street, Suite 900
Vancouver, BC V6C 1T2
604-688-1553

**References**

Hulen, J.B and P.M. Wright. Geothermal Energy- Clean Sustainable Energy for the Benefit of Humanity and the Environment. Brochure produced by the Energy & Geoscience Institute at the University of Utah, May 2001.

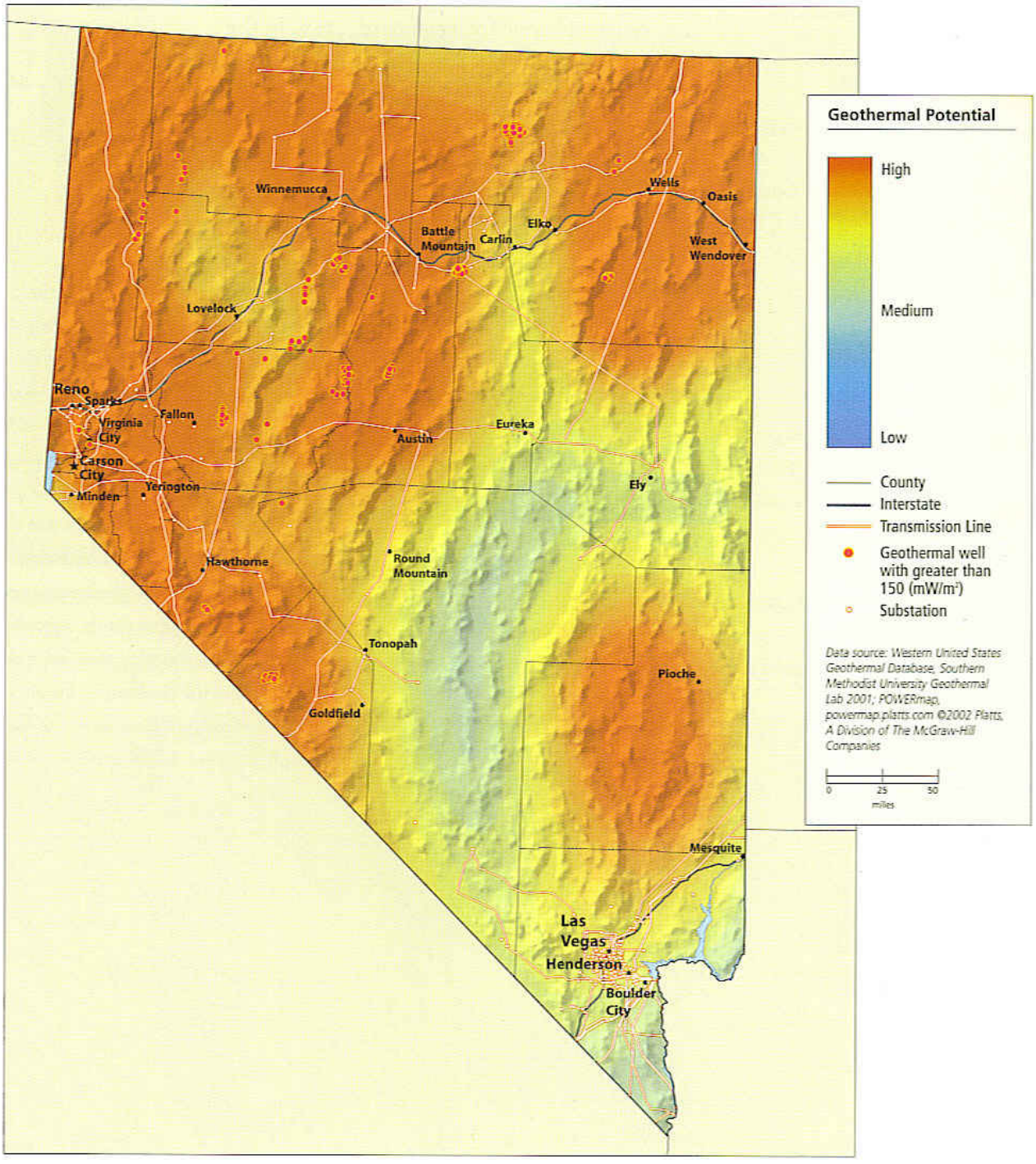
Geothermal Today, Geothermal Energy Program Highlights, U.S. Department of Energy, August 2001. http://doe.gov/bridge/home.html.

Nevada Geothermal Power Inc. (see above contact information.)

Nielson, John, Susan Innis, Leslie Kaas Pollock, Heather Rhoads-Weaver, and Angela Shutak. Renewable Energy Atlas of the West: A Guide to the Region's Resource Potential. A project of the Hewlett Foundation and The Energy Foundation. Produced by Land and Water Fund of the Rockies and Northwest Sustainable Energy for Economic Development. http://www.EnergyAtlas.org.

Shibaki, M., and F. Beck, Geothermal Energy for Electric Power. A REPP Issue Brief, Renewable Energy Policy Project, Washington D.C. December 2003. http://www.repp.org.

**Figure 4. Nevada's Geothermal Potential**




www.EnergyAtlas.org

This project is sponsored in part by the University of Nevada Cooperative Extension, the University of Nevada Agricultural Experiment Station, and the Nevada State Office of Energy.