Proceedings World Geothermal Congress 2005
Antalya, Turkey, 24-29 April 2005

The United States of America Country Update

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Keywords: The Geysers, electric power, direct-use, heat pumps, energy savings, well drilled

ABSTRACT

Geothermal energy is used for electric power generation and direct utilization in the United States. The present installed capacity (gross) for electric power generation is 2,534 MWe with about 2,000 MWe net delivering power to the grid producing approximately 17,840 GWh per year for a 80.4% gross capacity factor. Geothermal electric power plants are located in California, Nevada, Utah and Hawaii. The two largest concentrations of plants are at The Geysers in northern California and the Imperial Valley in southern California. The latest development at The Geysers, starting in 1998, is injecting recycled wastewater from two communities into the reservoir, which presently has recovered about 100 MWe of power generation. The second pipeline from the Santa Rosa area has just come on line. The direct utilization of geothermal energy includes the heating of pools and spas, greenhouses and aquaculture facilities, space heating and district heating, snow melting, agricultural drying, industrial applications and ground-source heat pumps. The installed capacity is 7,817 MWt and the annual energy use is about 31,200 TJ or 8,680 GWh. The largest application is ground-source (geothermal) heat pumps (69% of the energy use), and the next largest direct-uses are in space heating and agricultural drying. Direct utilization (without heat pumps) is increasing at about 2.6% per year; whereas electric power plant development is almost static, with only about 70 MWe added since 2000 (there were errors in the WGC2000 tabulation). A new 185-MWe plant being proposed for the Imperial Valley and about 100 MWe for Glass Mountain in northern California could be online by 2007-2008. Several new plants are proposed for Nevada totaling about 100 MWe and projects have been proposed in Idaho, New Mexico, Oregon and Utah. The total planned in the next 10 years is 632 MWe. The energy savings from electric power generation, direct-uses and ground-source heat pumps amounts to almost nine million tonnes of equivalent fuel oil per years and reduces air pollution by almost eight million tonnes of carbon annually (compared to fuel oil).

1. INTRODUCTION

Geothermal resources capable of supporting electrical generation and/or direct use projects are found primarily in the Western United States (Figure 1). However, geothermal heat pumps extend the utilization to all 50 states. The total identified potential for electrical production, estimated by the United States Geological Survey, stands at 22,990 MWe (Muffler, 1979). A recent evaluation of potential in just California and Nevada by GeothermEx, Inc. (Lovekin, 2004) places the most likely combined total for those two states at 6,200 MWe. This would be nearly triple the existing capacity.

Achieving this electric capacity potential will be dependent upon a number of factors including competing prices for energy and incentive programs that encourage development of renewable energy resources. Recently passed Renewable Portfolio Standards in a number of western states should have a significant impact on renewable development in general and could well result in increased interest in geothermal exploration and development. A production tax credit recently passed by Congress and signed into law in October 2004 provides for a 1.8 cent per kilowatt hour credit, greatly improves geothermal's ability to compete with fossil fuel generation (Gawell, 2004).

In addition to these incentives programs, the United States Department of Energy (USDOE) continues to provide support for research and development of geothermal resources through cost sharing with industry and through research being conducted at a number of the national laboratories. Some ongoing efforts are directed at enhanced geothermal system, downhole diagnostics, enhanced evaporative cooling, mixed binary working fluids, corrosion resistant coatings and co-production of minerals. USDOE has recently cost shared the drilling of geothermal production wells through the Geothermal Resource Exploration and Definition (GRED) program. Three different solicitations have been offered to date. The USDOE is also funding a number of state programs aimed at removing barriers to geothermal development. Finally, USDOE continues to provide technical assistance to direct-use, and small-scale electrical project developers and users with their GeoPowering the West program (Hill, 2004) (www.eere.energy.gov/geothermal/deployment_gpw.html) through national laboratories and organizations such as the Geo-Heat Center at Oregon Institute of Technology (http://geoheat.oit.edu) and the Center for Distributed Generation and Thermal Distribution at Washington State University (www.energy.wsu.edu).

The United States continues to lead the world in installed geothermal power capacity as well as in electrical generation, and considering geothermal heat pumps, is one of the leaders in direct-use applications.

Geothermal energy remains, however, a small contributor to the electric power capacity and generation in the United States. In 2004, geothermal plants constituted about 0.27 percent of the total operable power capacity, and those plants contributed an estimated 0.48 percent of the total generation due to their high load factor.

On a state level, geothermal electric generation is a major player in California and Nevada. The generation in California provides about 6% of the state's energy