GEOTHERMAL PIPELINE

Progress and Development Update
Geothermal Progress Monitor

WASHINGTON

Mount St. Helens Quakes on the Increase Under Dome

Mount St. Helens is Twitching again. Earthquake activity below the mountain gradually has increased in recent months, with the pace accelerating in May. Seismic activity has increased from about 60 quakes a month last winter to 165 in May, scientists at the Cascades Volcano Observatory in Vancouver, WA report. The earthquakes are small and unfelt, with only three of them greater than magnitude 2, according to William E. Scott, acting scientist in charge of the observatory. He stressed that no evidence indicates the closely monitored volcano is heading fro a return to large explosive eruptions. None of the quakes is typical of the large number of shallow quakes that typically occur before an eruption.

The quakes are occurring in two clusters below the 920-foot-high lave dome in the volcano's crater. One cluster is about 1.25 to 3 miles below the dome, and the other is about 4.75 to 5.5 miles beneath the surface. Scott said the most recent quakes might indicate that new magma is entering the volcano or that cooling magma from a series of eruptions in the 1980s is releasing gas and building up pressure. The last steam and ash plume from the lava dome occurred in February 1991. The last dome-building eruption, in which magma reached the surface and added to the huge mound of lava on the crater floor, was in October 1986. (Richard L. Hill - Oregonian, 3 June 1998).

GERMANY

Use of Earth Heat in Germany (Erdwärmenutzung in Deutschland)

By the end of 1995 direct thermal use of geothermal energy in Germany amounted to an installed thermal power of roughly 323 MWt. Of this sum, approximately 48 MWt are generated in 24 major centralized installations. Small, decentralized earth-coupled heat pumps and groundwater heat pumps are estimated to contribute an additional 285 MWt. By the year 2000 an increase in total installed power of about 144 MWt is expected: 115 MWt from major central and 29 MWt from small, decentralized installations. This would bring direct thermal use in Germany close to an installed thermal power of 467 MWt. At present no electric power is produced from geothermal resources in Germany, who annual final energy consumption at present amounts to about 9,200 PJ (8.73 quads). Final energy is defined as the fraction of primary energy which is supplied to the final consumer. It is less than the corresponding primary energy because of losses, mainly due to conversion and distribution. Related to one year this is equivalent to a total consumed power of approximately 290,000 MW. Almost 60% of this energy is required as heat.

The maximum technical potential for direct thermal use of geothermal energy in Germany is estimated to be 2,580 PJ/yr (2.45 quad/yr) from hydrothermal applications and shallow heat exchanger systems; this is equivalent to a maximum thermal power generation of about 81,800 MWt. This corresponds to about 29% of the country's annual final energy consumption, or roughly 49 % of it demand for heat. However, at present only about 0.4% of the existing maximum technical potential for direct thermal use of the geothermal energy meets the demand for heat. If the vast potential of geothermal energy for direct thermal use was utilized to substitute fossil fuels, roughly 110 million tonnes less of CO_2 would be released to the atmosphere annually, equivalent to about 12% of Germany's CO_2 output in 1994. (Christoph Clauser - Geothermische Energie, nr. 21, May 1998).

JAPAN

Efficient Use of Geothermal Hot Water

Kokonoe Town in Oita Prefecture, Kyushu, is the largest geothermal power generation area in Japan. It hosts three commercial geothermal power stations, totaling 147.5 MW, belonging to the Kyushu Electric Power Co: the 12.5 MW Otake station, operational since 1967; the 110 MW Hatchobaru station (the biggest geothermal power station in Japan); and the 25 MW Takigami station which began operation in 1996. In addition, there are two small-to-medium-sized demonstration test plants operated by the New Energy and Industrial Technology Development Organization (NEDO) for binary cycle power generation. The town government of Kokonoe intends to exploit as far as possible the geothermal hot water from these power stations, together with thermal energy from the many hot springs existing in the town, to develop agriculture and tourism, and to improve the living environment.

The use of geothermal hot water associated with geothermal power generation started in 1965 when, in response to a request from a local farmer, Kyushu Electric Power Co made hot water from exploration wells available in the Yutsubo area of the town to heat greenhouses. In the beginning, raw geothermal hot water was supplied to users but, because the geothermal hot water contains arsenic, regulations were introduced which stated that all raw geothermal hot water must be reinjected deep into the ground. As a result, since 1974, river water heated by heat exchange from the geothermal fluid is supplied to a large number of users for horticulture, domestic heating and hotel and leisure facilities. Since 1988, the Kokonoe Bio Center has been using hot water supplied at a flow rate of 20 tonnes/hour from the Otake Station about 5 km away to produce inexpensive, virus-free seed and saplings for farmers in the town.

A floriculture partnership organized by five farmers invested JPY 153 million (approximately US$1.2 million) in constructing an energy-saving rose farm consisting of 10 greenhouses with a total floor area of 5,723 m^2 (1.4 acres). The farm grows roses all year round, and started shipments of flowers in 1984. The rose farm is provided with hot water (inlet temperature at 73° C - 163°F), exchanging heat with geothermal hot water at a flow rate of 16 tonnes/hour. The partnership now enjoys sales of roses exceeding the planned sum of JPY 38 million/year (approx. US$0.3 million/year) and completed the repayment of investment in 12 years.

In 1994, a new floriculture partnership organized by 10 farmers began to grow roses in 20 newly-built greenhouses with a total floor area of 19,278 m^2 (4.8 acres) using geothermal hot water. JPY 678 million (approx. US$5.2 million) was invested in this new farm, which is expected to sell roses worth JPY 180 million (approx. US$1.4 million) annually. Because the supply of geothermal hot water to the new farm is limited to 6 tonnes/hour, the farm receives hot water in a storage tank and then circulates the water repeatedly through heating circuits (finned tubed radiators), thereby making hot water at 50°C (122°F) flow through the greenhouses at a rate of 37 tonnes/hour.

The changes in outdoor temperature at the site of the rose farms are similar to those in colder, more northerly regions. Thus, when the temperature inside the greenhouses is kept at 18°C (64°F) throughout a year, the degree-hours of heating are 60,210°C-hours (4,516°F-days). Each year, in total, geothermal energy saves 884 kL (5,560 bbl) of fuel oil and JPY 41.5 million (approx. US$0.32 million) of fuel cost (fuel oil price at JPY 47/ L - US$1.37/gal).

Geothermal energy is also supplied to a muncipal community center (75°C - 167°F at 3 tonnes/hour) and the prefectural recreational lodge for boys and girls (80°C - 176°F at 7 tonnes/hour). Waste water from all the uses is discharged at 28°C (82°F) when the outside temperature is 8°C (46°F). (CADDET - Renewable Energy Newsletter, May, 1998).