Idaho's Geothermal Prospects and Development Potential

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ABSTRACT

Large-scale power generation and related development activities in Idaho have not materialized over the past three decades, despite the state's recognized geothermal potential. Raft River is the only commercial-scale power generating geothermal facility (10 MWe) in the state. Since the last geothermal exploratoion boom in the 1970s and 80s, commercial efforts have primarily focused on direct-use applications such as space heating of public and private buildings and greenhouses, as well as in aquaculture, largely because of easy access to moderate-temperature (35 to 80 °C) fluids from springs and at readily drillable depths. The number of low-temperature direct-use applications has grown steadily over the past 30 years but slowed considerably in the past decade. However, a number of recent trends point to a renewed interest in the state's high-temperature power generating potential that may finally put Idaho "on the map."

Overview

A combination of natural and man-made factors has contributed to the current situation:

a) A large part of Idaho's geothermal power potential is in its "hot-rock" resources, particularly the buried Miocene and Quaternary rhyolites of the eastern Snake River Plain and associated volcanic areas. Reliable heat extraction technologies for developing such resources have yet to mature;

b) The geohydrology of these volcanic rocks makes it difficult to characterize high-temperature reservoirs or hot rock due to the masking effect of cold ground water in the overlying, highly permeable rocks; and

c) Many state regulations pertaining to exploration and development promulgated in the early decades of geothermal exploration today put Idaho at a competitive disadvantage relative to its neighbors.

Figure 1 shows the locations of known thermal springs and wells and current prospects that are considered to have power generation potential (Neely and Galinato, 2007). In central and western Idaho, Vulcan Hot Springs, Big Creek, Crane Creek, and the Magic Reservoir area either have been or are being explored.

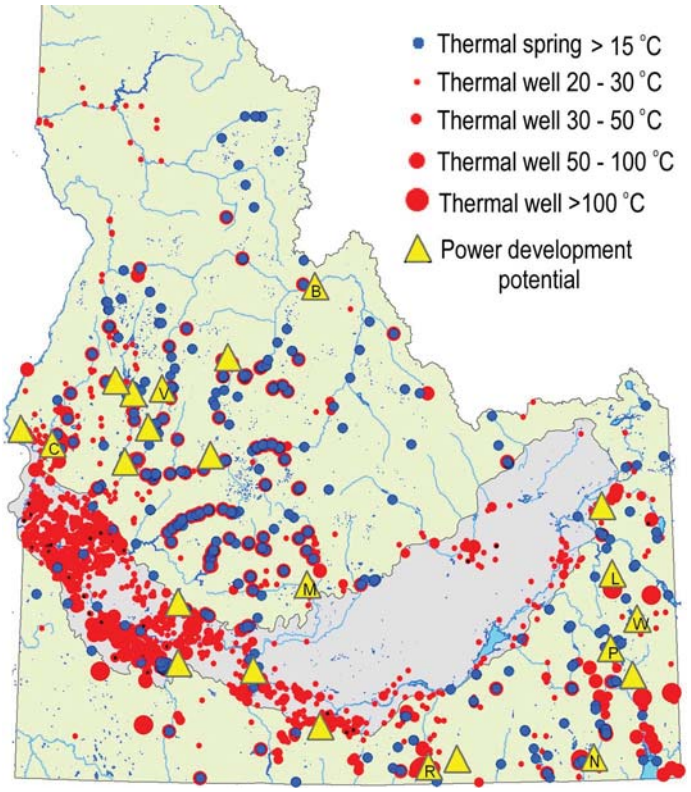

Figure 1. Locations of thermal springs, wells, and power development potential in Idaho. B = Big Creek; C = Crane Creek; V = Vulcan; M = Magic Reservoir; R = Raft River; N = Preston; P = China Hat; W = White Mountain; L = Willow Springs (after Neely and Galinato, 2007).

Southeast Idaho Prospects

In southeast Idaho, geothermal resource potential is undergoing renewed scrutiny. Some of the highest borehole temperatures in the state are found in fluids of the Idaho-Wyoming Thrust Belt (Figure 1), up to 180 - 210 ºC at depths of 4000 - 5000 meters, and often with excellent yields. One of these, in the Willow Creek prospect, generated a great deal of interest in the wake of a tantalizing economic cost / benefit analysis of the impact that a proposed 100 MW generating plant would have on the region and on the state (Peterson et al., 2005). Unfortunately, the lease holders failed to secure financial backing for further site characterization and deep drilling.

A number of other southeast Idaho prospects including China Hat, White Mountain, Sulfur Springs and Maple Grove have been actively evaluated in the past decade. In 2010, the Northwestern Band of the Shoshone Nation announced that it was planning a 96 MW facility at Preston as one of five eventual geothermal power projects in southeast Idaho and northern Utah that would supply electricity to meet power purchase agreements that the Tribe signed with the cities of Riverside and Anaheim, CA. Although that development initiative has stalled over negotiations with financial partners, the Tribe remains committed to developing one or more geothermal power-generating facilities in the near future.

Of the blind geothermal resource prospects in southeast Idaho, the China Hat and Gray's Lake areas show particular promise because of their geologic setting, evidence of very young tectonic activity and ongoing seismic activity. The White Mountain prospect, eight km northwest of Grey's Lake is a Quaternary rhyolite-trachyte-basaltic trachyandesite complex associated with a regional Bouger gravity low and centered on a moderately strong aeromagnetic high (C. Austin and R. Austin, 2010, written comm.; Zietz et al., 1978; Vankey et al., 1985). Nearby oil and gas exploratory boreholes encountered temperatures of 187 ºC (Gentile Valley 9-1, centered in the White Mountain prospect) and 200 ºC (CPC Minerals 17-1, 15 km northeast). The area is also very active seismically (Figure 2). The intensity of one seismic swarm beneath Gray's Lake in November, 1992 led the USGS Volcano Crisis Assistance Team to move to standby status temporarily because of the association of very low frequency surface waves with some large-magnitude events (M4.8-4.9) and events suggestive of "spasmodic tremors" like those observed at Long Valley caldera and other volcanic centers (Ryall and Ryall, 1983).

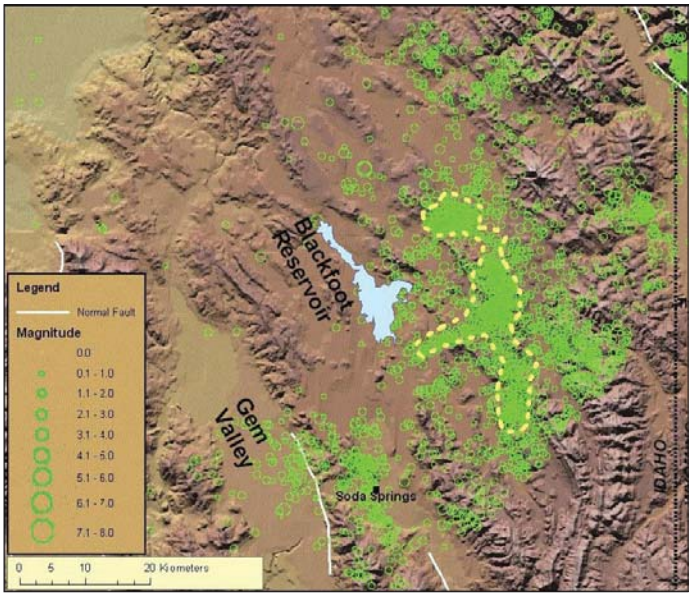

Figure 2. Seismic events recorded in the Blackfoot-Gem Valley-Gray's Lake area between 1972 and 2004 by the Idaho National Laboratory's regional seismic monitoring network. Area of greatest event frequency is shown as a dashed polygon, the northernmost part of which is centered beneath Gray's Lake. After S. Payne, written comm., 2005.

China Hat, the largest of a group of five rhyolite domes located in the Blackfoot volcanic field north of Soda Springs, is only 58 Ka old and is associated with even younger surface rifting of the basalts. Ongoing geologic and structural analysis suggests that the rifting may be an expression of very young dike intrusions (McCurry et al., 2011). China Hat itself has whole-rock uranium and thorium contents that are among the highest observed in Quaternary rhyolites of the western U.S. An 8000-foot deep geothermal exploration well drilled in 1980 (SunHub 25-1) encountered a zone of hot water at 1840-2200 meters depth. Unfortunately, the maximum temperature recorded (96 ºC) represents non-equilibrated bottom-hole conditions, and a temperature log was never run due to borehole instability. The China Hat group, together with a late-Quaternary rhyolite dome 125 km to the NW on the eastern Snake River Plain, represents some of the few young rhyolite volcanic centers in the western U.S. whose thermal reservoirs are not currently generating power. This, despite the fact that based on youth and volume, the China Hat rhyolite may retain a sixth of the latent heat content of the Coso rhyolites (Smith et al., 1978).

Regulatory and Other Factors

On the regulatory side, Idaho's Geothermal Resources Task Force recently forwarded a number of recommendations to the Idaho Strategic Energy Alliance, a cabinet-level arm of the Governor's Council, proposing a number of changes intended to stimulate exploration and development of the state's geothermal resources. The recommendations include

(i) incentives for power generation

(ii) incentives for transmission infrastructure development

(iii) the training of state agency staff and education of geothermal professionals to meet future workforce needs, and

(iv) the creation of a revolving research fund to encourage the state's R&D community (universities, the Idaho National Lab, the Center for Advanced Energy Systems, and the Idaho Geological Survey) to investigate promising geothermal prospects and subsequently hand-off the results to industry who would reimburse the fund once a prospect became a revenue generator.

Currently, several proposed changes to the state's leasing and royalty statutes are before the Idaho Legislature, including an increase in the cap on acres leased, a lengthening of the 10-year lease retirement period, and a reduction in the 10 percent royalty rate required of operators on state lands.

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