

# PACIFIC NORTHWEST GEOTHERMAL 1978 REVIEW—1979 OUTLOOK

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## INTRODUCTION

Discernible progress was made in 1978, both on the national and Pacific Northwest scenes toward geothermal development. Nationally, the passage of the 1978 Energy Bill now allows geothermal exploration and development the same tax considerations given oil and gas. Intangible drilling costs can be written off as expended, and geothermal resources are given a depletion allowance. A number of other potentially helpful legislative adjustments to existing geothermal statutes were not under consideration by the 1978 Congress, but have since been assembled by Randall C. Stephens, Chairman, Institutional Barrier Panel, Interagency Geothermal Coordinating Council, for the Department of Energy. These various provisions are grouped together under a bill now identified as the Geothermal Energy Omnibus Bill, and scheduled for introduction, and hopefully, enactment, at this (1979) session of the Congress. Included are several particularly important amendments, among which is the raising of the acreage limitation from the current 20,400 per company or individual per state, to 50,200. The 20,400 acreage limitation is clearly not a viable one for the geothermal industry, which is still finding out the dry hole hard route the way in which the resource occurs, and where both exploration and drilling costs are commonly higher than comparable activities in the oil industry. Originally intended to help the smaller producer and individual, the 20,400 acre limitation tends to do just the opposite. Costs of exploration and drilling for geothermal resources are so high that most small firms and individuals have to depend on farming out their lease positions to larger organizations with greater resources and capabilities. The current acreage limitation severely limits these possibilities.

Another provision would preclude KGRA designation for lands under noncompetitive lease application. The KGRA concept may have been useful at the initial stages of the leasing program, but further implementation of that regulation into the rank wildcat noncompetitive areas, particularly where state, private, and federal lands are intermingled and leases are being issued at different times for these respec-

tive tracts, clearly will hamper geothermal development. Mr. Stephens has gathered together a number of other useful amendments also, and is pursuing the matter of having these heard, and acted upon. As the need and value of developing our own energy resources becomes ever more clear, emphasized recently by the Iranian situation, Mr. Stephen's work has material national significance.

The passage of the several geothermal tax provisions of the 1978 Energy Bill has encouraged explorationists. The geothermal industry is in a modest upsurge of activity, which may continue, given further encouragement through the amendments being drafted by Mr. Stephens, together with the rapidly increasing price of petroleum. Those of you who may have read previous years' editions of these annual Review-Outlook articles will find the more optimistic tone of this present report somewhat of a contrast. It is a pleasure to be more positive.

The following paragraphs review some of the more important geothermal exploration and development activities in Washington, Oregon, and Idaho in 1978, and make a projection of what may be expected in these areas in 1979.

## WASHINGTON

Increased interest in the geothermal potential of the State of Washington was evident during 1978, and is likely to continue at an accelerated rate this year. In eastern Washington, well temperature gradients were catalogued and mapped by Battelle Northwest Laboratories. Crown Zellerbach Corporation, the largest single industrial energy consumer in Washington, proposed to evaluate the geothermal potential in the vicinity of Camas, along the Columbia River, with intention of using any resource found for process and space heating in their Camas paper plant (See Figure 1 for location of Camas, and other places cited in this article).

Under the sponsorship of the U.S. Department of Energy, the Oregon Institute of Technology has undertaken a program to analyze the geological, environmental, economic, and legal issues affecting geothermal development in Washington. Final report is due out mid-1979.

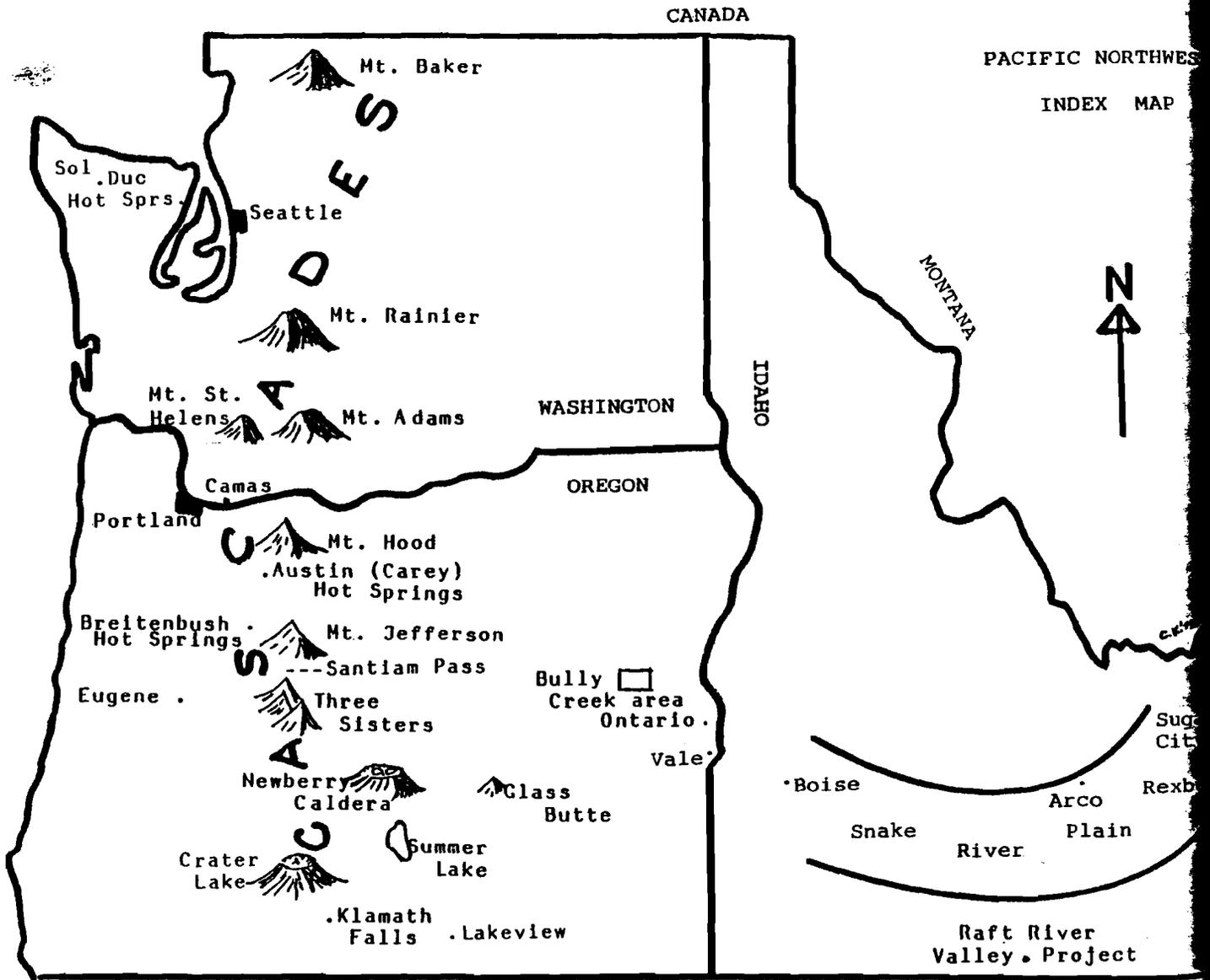


FIGURE 1. Pacific Northwest Index Map.

A study of the possible utilization of lower temperature resources at Sol Duc Hot Springs in Olympic National Park was begun in 1978 by the Park Service, and is expected to continue in 1979. Assisting in this work are Oregon Institute of Technology, and the Washington State Division of Geology and Earth Resources.

Under a grant from the U.S. Department of Energy, the Washington Division of Geology and Earth Resources will continue both regional and site-specific assessment of the geothermal potential throughout the state, including the inventory and geochemical analysis of thermal springs, subcontracted geophysical studies, and the drilling of heat flow holes in the South Cascades in and north of the Cowlitz River Valley, in the vicinity of Mt. St. Helens, and in the Camas area. Further information on these and other activities can be had by contacting the Washington Division of Geology and Earth Resources, Olympia, Washington 98504. J. Eric Schuster, and Michael Korosec of that organization are assigned particularly to geothermal matters.

A considerable number of federal lease applications were filed in Washington in 1978, and the Seattle City Light has advertized for proposals to assess geothermal resources, and both the Burlington Northern and Washington Public Power Supply System have shown interest in geothermal prospects in Washington. Whereas no deep drilling programs are known to be scheduled for Washington in 1979, interest and activity in geothermal exploration will apparently continue on the upswing.

## OREGON

The most recent deep geothermal test drilled in Oregon was in 1976 by Thermal Power Company in the Klamath Hills area. A deep well tentatively scheduled in 1978 in the Bully Creek area of eastern Oregon was not drilled, but may be drilled in 1979. It, at the moment, is the only deep test which appears likely to be drilled in Oregon in 1979. Late in 1978, an intermediate depth well was bottomed at 4,042 feet at Old Maid Flat on the northwest flank of Mt. Hood. The U.S. Department of Energy and Northwest Geothermal Corporation, a subsidiary of Northwest Natural Gas Company, supplied funds for the well designed to test the feasibility of bringing hot water into the Portland area. Bottomhole temperature of this well is 81°C (180°F) and seems adequate for purposes projected. Flow tests on the well are scheduled for 1979, and it may be deepened another 1,000 feet. Additional sites in this area may also be drilled this year with 500-foot gradient holes.

On Mt. Hood proper, three projects were active in 1978. One, funded by the Department of Energy, is an evaluation of a typical Cascade volcano, Mt. Hood

presumed to quality. A number of geophysical studies were completed and a telluric-magnetotelluric (T-MT) survey was put in final form and results published through the Lawrence Berkeley Laboratory in June 1978 as LBL-750. Another geophysical study under this program by Drs. Richard Couch and K. Keeling of Oregon State University involved extensive gravity measurements and as a result a complete Bouger gravity map of Mt. Hood will be published in 1979.

The Oregon Department of Geology and Mineral Industries completed the last of 11 heat flow holes in the Mt. Hood area to depths ranging from 250 to 500 feet. These holes are equipped so that temperature gradients can be measured. Data are on open file in Portland with that Department.

In a third Mt. Hood project, on the Wy'East Exploration Company lease near Timberline Lodge, the U.S. Department of Energy funded a heat flow hole to target depth of 2,000 feet. Drilling difficulties were encountered due to caving, and water flows in high permeability zones. Total depth of 1,340 feet was reached but a twist-off occurred while trying to free stuck pipe. Observation pipe was set to about 735 feet. Indications are that below the zone of cold surface water, temperatures increase rapidly. Further geophysical studies are planned in this area in 1979 and further drilling planned if a satisfactory target can be identified.

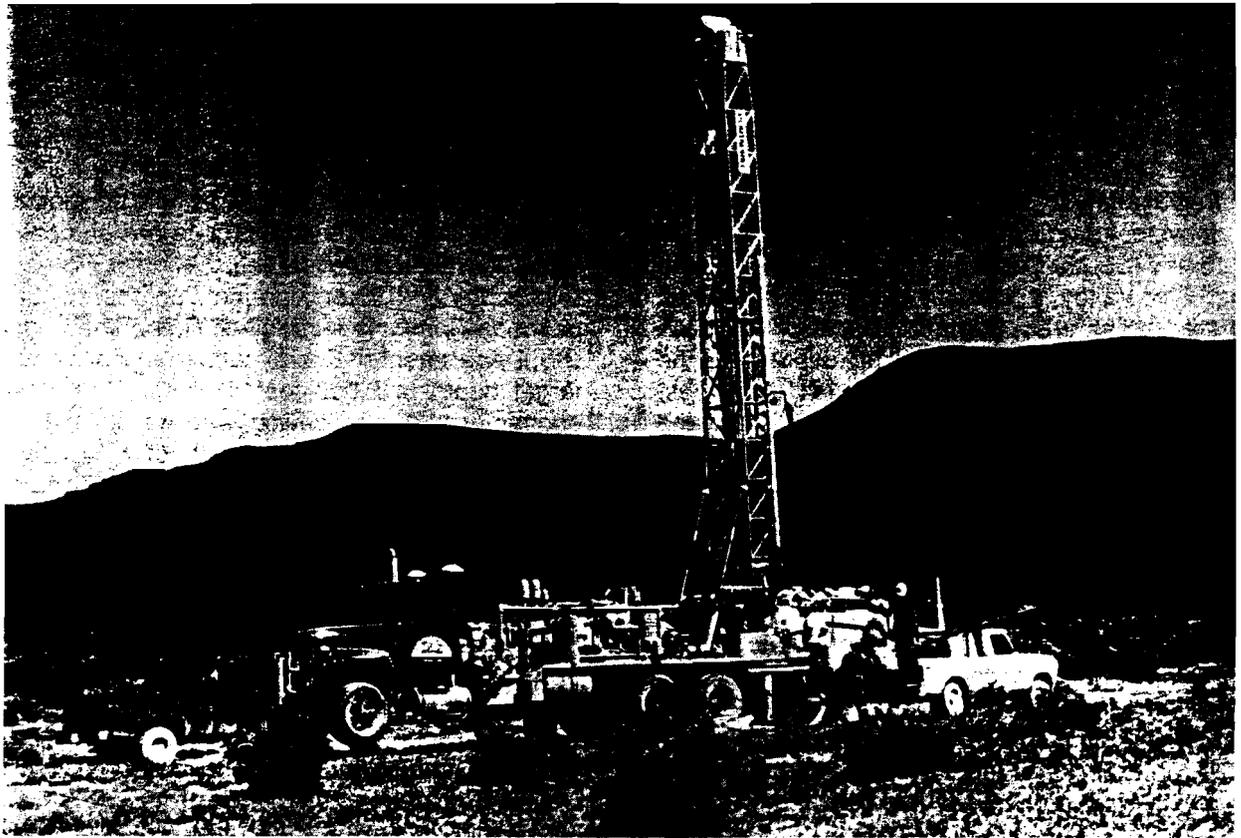
Infrared and side-looking airborne radar (SLAR) studies will continue on Mt. Hood in 1979. A 1,500 to 2,00-foot gradient hole may be drilled as part of the Department of Energy program.

The U.S. Geological Survey drilled a 1,000-foot gradient hole in Newberry Crater and plans to deepen this hole to 3,000 feet in 1979, and perhaps drill an additional hole in the crater area.

In various valleys in eastern Oregon Aminoil, Phillips Petroleum, Union Oil, Hunt Energy, Chevron Resources, and Anadarko Productions Company (Figure 2) drilled a number of gradient holes, mostly to 500 foot depths, but a few were deeper.

Studies were initiated in 1978 and will continue in 1979 in both Lakeview, and Klamath Falls to determine the feasibility of community space heating projects. A complex of greenhouses, Klamath Greenhouses, was expanded in the Klamath Falls in 1978 in which tree seedlings are now being raised under contract for the U.S. Forest Service, Bureau of Land Management, and private firms.

In late 1978, Ore-Ida Foods, Inc., and the U.S. Department of Energy agreed to a 3-year cost-sharing demonstration program to discover and utilize geothermal energy as a substitute for a portion of that firm's processing plant's energy requirements at Ontario, Oregon. Drilling of the initial well is scheduled for April, 1979.



**FIGURE 2.** Southwest Drilling and Exploration Company contract drill rig on location for Anadarko Production Company in

northern portion of Alvord Desert, Harney County, Oregon August 1978.

An apparently very successful mushroom growing operation was established using geothermal resources at Vale, Oregon in 1978.

A large lease play has been developing in the Cascades Mountains in the vicinity of Austin and Breitenbush hot springs, and in the Santiam Pass area. Altogether, more than 330 square miles of federal lands are under lease or lease application. Small tracts of private lands scattered through the Santiam Pass area have been under firm lease for several years. Early in 1978 Sunoco Energy Development Company completed a 1,500-foot gradient hole near Austin (also called Carey) Hot Springs, results of which have not been released. This is in the area where the Oregon Department of Geology and Mineral Industries had earlier drilled two wells, one showing a gradient of 224 °C/Km, and the other 2½ miles away with a gradient of 164 °C/Km. Two proprietary geophysical surveys were conducted in this Cascade region in 1978, one east of

Austin Hot Springs, and one west of Santiam Pass. deep tests are scheduled in this region in 1979. However, because of lack of substantial federal leases on which to operate. At the Breitenbush KG sale held in 1978, Sunoco was the sole bidder (to hold the predominant application position in the area) of four of the five tracts offered, and acquired geothermal rights on 5,800 acres, at a cost ranging from \$3.65 to \$24 an acre. Additional geophysical work and heat flow hole drilling is scheduled in the Cascades in 1979. Also, the U.S. Geological Survey as one of its two geothermal research priorities in 1979 and beyond, is moving a mapping party into the Cascades. It should also be noted that USGS Circular 790, recently issued, lists some 27 regions of Western United States with geothermal potential, and ranks the Cascades as number 4. It is anomalous, therefore, that not a single deep well has so far been drilled in this very attractive geothermal region, which also is adjacent to the major population centers of Oregon.

Delay in issuing federal Forest Service land leases has been and continues to be the major problem. It seems unlikely that any of the KGRA sales originally scheduled for the Cascades of Oregon in 1979 will be held. However, a few non-competitive leases have been issued in the Breitenbush unit of the Willamette National Forest, and a few more may be forthcoming in 1979.

The Oregon Department of Geology and Mineral Industries, with matching funds from the U.S. Department of Energy, plans to drill a number of heat flow holes (some 500-foot, some 1,500 to 2,000 feet) in the Cascade region. Private industry also has some heat flow hole drilling scheduled. Assessment of the geothermal resources of this large area, with high geothermal potential, is urgently needed.

A number of geothermal environmental conferences, workshops, hearings, and committee meetings were held in Oregon in 1978. No substantial geothermal resources were located as a result of any of these conferences to my knowledge.

#### IDAHO

More than 25 percent of the potential geothermal resources of the Western United States, according to USGS Circular 790, lie in the Snake River Plain of Idaho. Evaluation of this highly prospective region, however, is proceeding slowly. In 1978, three 2,000-foot gradient holes were drilled in the eastern Snake Plain. One of the holes was drilled at Sugar City, which several years ago, suffered a disastrous flood as a result of the failure of the Teton Dam. It was hoped that starting anew, a district heating system might be developed here as the city was rebuilt. But the gradient hole information was not encouraging. A district heating program, however, is being prepared in Madison County with respect to possible use of geothermal resources by Rogers Foods (potato) for process heat, and for space heating by the City of Rexburg and Ricks College. Test drilling is expected in 1979.

Surveys in 1978 on the Idaho National Engineering Laboratories (INEL) site near Arco, Idaho resulted in locating a deep well some 20 miles southwest of Arco, and this well was drilling as of March, 1979.

No additional wells were drilled in the Boise space heating project, but contracts have been drawn up with the Warm Springs Heating District preparatory to heating some of the State of Idaho with hot water. One state laboratory is already so heated.

At the Raft River Valley Project, the Geothermal Power Development Corporation was set up which includes Idaho Power, Washington Public Power Supply System, Raft River Co-op, Snake River Power Association, and Portland General Electric Company. This organization has an interim contract with the U.S.

Department of Energy to plan for final construction and operation of a 5 megawatt power plant. All wells are already drilled and tested. This plant should be on line in 1980. A second 5 megawatt plant for the same area is in the early design stage.

#### SUMMARY AND OUTLOOK

There is currently a general upsurge in geothermal interest and activity in the Pacific Northwest. More equitable tax treatment of geothermal resources with respect to competing energies provided by the passage of the 1978 Energy Bill is one of the principal bases for this trend. Further legislative amendments to existing rules and regulations are anticipated this year and will be additionally helpful. Slowness in processing federal (chiefly Forest Service) lease applications, however, continue to be a problem. Also, drilling and exploration are expensive in the volcanic terrains of this region, and very large areas (e.g., Oregon Cascade Mountain, Idaho Snake River Plain) still have either no or few deep wells in them, and need to be so evaluated. An increased emphasis in U.S. Department of Energy funding toward putting holes in the ground which is the ultimate and only way to locate new geothermal resources, and a decreased emphasis on holding meetings, in this writer's view, would be most timely and appropriate.

For Idaho, and Oregon, at least, geothermal resources may be the major indigenous energy resource. Oregon currently suffers a more than one billion dollar oil and gas bill each year. Any Btu's which can be produced within the state would surely be welcome. Hopefully, the evaluation of the large and highly prospective geothermal terrains which are the Cascade Mountains and the Idaho Snake River Plain will proceed more rapidly than in the recent past.

#### ACKNOWLEDGMENTS

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