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Geothermal Power in the Pacific Northwest: Market Prospects for the 1990s

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ABSTRACT

Geothermal resources are significant in the Pacific Northwest United States. But no geothermal power plants operate in the region today. Lack of such development is due to area power markets. This paper first looks at past geothermal actions by area utilities. It discusses current and future electricity market conditions. The paper concludes with a look at competing power supplies and challenges facing geothermal developers in the next decade.

Introduction

The Pacific Northwest United States is defined as the region of Oregon and Washington, and portions of adjoining states. Figure 1 shows the region, surrounding states, and adjacent Canadian province of British Columbia. Geothermal resources are significant in the Pacific Northwest. This is shown by direct use applications (Lienau, 1988), research (Muffler, 1979), and recent industry drilling. Yet no geothermal power plants operate in the region today. The reason: lack of an electricity market.

Prior research by the author documents sources of utility electricity in 1980 for the western United States, (Sifford, 1988). The dominance of large (mostly government-owned) hydroelectric projects distinguishes the Pacific Northwest from other states with geothermal resources. These "hydro" sources provide about 75 percent of the electric generating capacity of the region, (Sparring, 1987). Combined with low population growth and other factors, the market for all new power sources was nonexistent in the last decade. That market is only now changing. Cheap hydroelectric power still dominates the Pacific Northwest, but new power supplies must come from other sources. (All good hydro sites are either developed or unavailable.)

What are the prospects for geothermal power plants in the future of the Pacific Northwest? This paper offers one view of those prospects. It does so by first recalling past utility geothermal efforts. Activities undertaken by Northwest utilities show how serious some were about geothermal energy. Next is an examination of current power market conditions, and competing supply options. Those utilities that seriously considered geothermal energy in the past, need new supplies in the future and haven't precluded geothermal energy as a supply source emerge.

We must also recognize that no region is isolated. Areas adjacent to the Northwest are critical: utilities buy power supplies from them, utilities make power sales to them, and transmission lines connect us. This "electric integration" affects significantly the Pacific Northwest power market, and with it, future geothermal development.

Utility Geothermal Work To-Date

Both investor-owned utilities and public utilities have over the past decade shown interest in geothermal power supplies. Their actions include leasing geothermal rights on public lands, exploratory drilling, purchasing power from small experimental plants, and other activities. Most utilities investigated geothermal energy as a supplemental source to their existing power plants.
Active investor-owned utilities in the region include Pacific Power and Light, and Portland General Electric. Both are headquartered in Portland, Oregon. They supply over two thirds of that state’s power. Other investor-owned utilities in the region include Idaho Power, Puget Sound Power & Light and Washington Water Power.

Pacific Power and Light (PP&L) efforts to date focused on experimental plant output purchases, and joint venture plant development. It has not applied for any geothermal leases. In May 1982, PP&L contracted to buy the output of a 40 kW binary cycle power plant located in Lakeview Oregon (Barnette, 1982). PP&L bought electrical output for six months to demonstrate plant technical feasibility using 176°F water. Results were largely negative. In March 1984, PP&L again contracted to purchase the plant output of a larger (2.1 MW) project. Utility goals were similar to the prior demonstration. No significant operation at the larger plant ever took place. PP&L was a major participant in NORNEV, discussed further below.

(As a result of recent utility mergers, PP&L now owns a geothermal power plant via its Utah Power subsidiary. A Pacific Northwest utility does indirectly own the 20 MW Blundell plant in Roosevelt, Utah.)

Portland General Electric (PGE) was an early geothermal lease applicant in the Northwest. In 1976 PGE applied for almost 40,000 acres of leases in the Deschutes and Mt. Hood National Forests of Oregon. PGE later dropped all acreage at Mt. Hood in 1983 and 1985. In 1985 PGE applied for another 8,300 acres of leases adjacent to the Deschutes applications. Bend Highlands is the name of the 29,000 acre lease block. Leases were awarded to PGE in both 1983 and 1989 (BLM, 1990). In 1984, California Energy Company sublet the Bend Highlands block. Cal Energy is now the designated operator for the area, (BLM, 1969). Future activities at Bend Highlands include temperature gradient drilling in 1990 or 1991. To date, PGE geothermal activities have been leases.

Active public utilities include Eugene Water & Electric Board, and Seattle City Light. Both are municipal utilities serving their respective cities. Each utility both generates and purchases power supplies. Many other public utilities exist i the region, most buying power from the Bonneville Power Administration (BPA).

The Eugene Water & Electric Board (EWEB) was also an early lessee of lands in the Northwest. Beginning in 1977, EWEB applied for leases in various Oregon Cascade mountain range locations totalling over 34,000 acres, (BLM, 1990). EWEB then cofunded and managed a drilling program at six Cascade locations in 1979. These wells were all less than 2000 feet deep. Results were generally inconclusive (Youngquist, 1980). The utility later dropped most of their leases and applications. Yet EWEB still holds about 6,700 acres of leases and 2,700 acres of pending applications in the Oregon Cascades (BLM, 1990). EWEB was also an active participant in NORNEV, discussed below.

Seattle City Light (SCL) began geothermal studies in 1981, (Spinney, 1983). In August of that year, SCL applied for almost 93,000 acres of leases around Mt. Baker in the Washington Cascades. SCL soon started environmental and cultural resource studies on those lands too. In 1982 the utility began dropping lease acreage, based on both exploration and environmental studies. In 1986 SCL lease acreage sharply declined. By August 1988, SCL geothermal lease interest dropped to zero (BLM, 1990).

Northwest utilities began a major geothermal joint venture opportunity in 1979. PGE, PP&L, and EWEB joined with Sacramento Municipal Utility District (of California) and Sierra Pacific Power Company (of Nevada) in a geothermal development program. The group's original intent was to build a 50 MW flash plant in northern Nevada (Barnette, 1982). In 1981, these utilities, minus PGE, created the NORNEV Demonstration Geothermal Company. NORNEV goals were to develop a 10 MW binary plant in the same area by mid-1983. NORNEV participants intended only to build a power plant and related equipment. Chevron Geothermal Co. was to supply steam. Expected busbar prices for NORNEV power were estimated at over 10 cents per kilowatt-hour, a high price even today, (Barnette, 1982). NORNEV participants chose to drop the project in 1982.

Bonneville Power Administration (BPA) serves public utilities in the region. BPA is a federal power marketing agency. It owns no energy plants, but sells power, mostly from the large dams on the Columbia and other rivers. BPA also sells power to private utilities in and out of the region. BPA geothermal efforts over the last decade were staff investigations and contractor studies. Studies examined sites in the region to provide BPA with figures of geothermal power potentially available to it. BPA has not applied for leases, participated in drilling, nor bought any power plant output. The federal agency may purchase geothermal power in the future via a solicitation. The solicitation for 30 MW of geothermal power could be out by Spring, 1991. Serious developers would be wise to participate in the solicitation, to demonstrate your resource to other utilities, the public and BPA.

Geothermal Developer Work To-Date

Leasing and well drilling reflect geothermal developer interest in the Northwest. The best resources are on federal land, so public leasing statistics are one good indicator of interest. Table 1 shows year-end figures for federal leases in Oregon and Washington during the 1980s. As shown, acres under lease rose in the early part of the decade and then declined to current levels. The trend is partially explained by lack of a local market and a concurrent large demand in California and Nevada.

<table>
<thead>
<tr>
<th>Year</th>
<th>Oregon</th>
<th>Washington</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>397,400</td>
<td>10,318</td>
<td>407,718</td>
</tr>
<tr>
<td>1982</td>
<td>449,315</td>
<td>62,503</td>
<td>511,818</td>
</tr>
<tr>
<td>1983</td>
<td>652,191</td>
<td>52,866</td>
<td>705,057</td>
</tr>
<tr>
<td>1984</td>
<td>641,499</td>
<td>36,593</td>
<td>678,092</td>
</tr>
<tr>
<td>1985</td>
<td>590,735</td>
<td>53,645</td>
<td>641,380</td>
</tr>
<tr>
<td>1986</td>
<td>526,827</td>
<td>73,263</td>
<td>600,090</td>
</tr>
<tr>
<td>1987</td>
<td>486,631</td>
<td>46,014</td>
<td>532,645</td>
</tr>
<tr>
<td>1988</td>
<td>419,546</td>
<td>0</td>
<td>419,546</td>
</tr>
<tr>
<td>1989</td>
<td>251,826</td>
<td>0</td>
<td>251,826</td>
</tr>
</tbody>
</table>

Source: SLM NGO monthly summary sheets

Most corporate geothermal developers have been active in the Pacific Northwest. Geothermal company activities include leasing, passive exploration and drilling temperature gradient holes. Geothermal fields that either were or are active in Oregon include the following:

- Anadarko Petroleum
- California Energy
- Chevron Geothermal
- Geothermal Resources International
- Magma Power
- Occidental Petroleum
- Oxbow Geothermal
- Phillips Petroleum
- SUNEDCO
- Thermal Power
- Trans-Pacific Geothermal
- UNOCAL Geothermal
Developer temperature gradient well drilling is another obvious indicator of interest in the Pacific Northwest. Drilling trends in Oregon follow leasing patterns. That is, much occurs in the early and middle 1980s, but it tapers off recently. Table 2 lists geothermal wells by year spudded. (Many wells are suspended for a year to monitor temperature gradients, and are continually listed as active.) A "bulge" of drilling occurred in 1986 as unit obligations were met by developers at Newberry volcano and near Crater Lake. The listed wells are at least 2000 ft. (610 m) deep, with one exception. The exception is Anadarko Petroleum's shallow, slim well drilled in 1989.

## Table 2
Geothermal Drilling in Oregon 1980-1989

<table>
<thead>
<tr>
<th>Year</th>
<th>Wells Drilled</th>
<th>Cumulative Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>1981</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>1982</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>1983</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>1984</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>1985</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>1986</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>1987</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>1988</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>1989</td>
<td>2</td>
<td>21</td>
</tr>
</tbody>
</table>

Source: Omlstead, 1990

The most recent development is Anadarko Petroleum's flow test at their Pueblo Valley prospect. The 1480 ft. (450 m) small diameter well flow 320 gallons per minute (1200 l/m) at 305°F (137°C). Such a resource is capable of economic power generation, as shown at many Nevada sites. The discovery is in Harney Rural Electric Cooperative territory. Like many public power agencies in the area, Harney owns no generating sources and buys all power from BPA. It currently pays about 2.1 cents per kilowatt hour (kWh) for wholesale power from BPA. This is the standard wholesale public power cost in the Pacific Northwest. The market is better for private utilities, yet many have large hydro supplies too. Avoided costs vary, but are typically at least 3.0 cents per kWh.

### Current Power Market

The National Association of Regulatory Utility Commissioners (NARUC) annual study residential rates provides a "snapshot" of the United States' electricity market. The NARUC report compares winter 1988-1989 residential electric bills in the largest service territories of the major investor-owned utilities.

Six of the nine least expensive utility service territories are in Oregon, Washington or neighboring Idaho. Average costs for northwest utilities were 4.9 cents per kWh for residential customers. This compares to highs of 11 to 13 cents per kWh for the top ten areas in the country, (NARUC, 1990). The author's experience with both public and private Oregon utility service is that average retail rates are also under a nickel per kWh. Going into the 1990s, Northwest electrical rates are the least expensive in the country.

### Future Power Market

The 1980s were a period of electric energy surplus. Electric utilities in the region entered the decade expecting a shortage that soon vanished. We are now in period of load/resource balance. Those same utilities now enter the 1990s again anticipating growing demand. Barring another recession, energy demand will rise at a modest rate. Growth is the driving force behind need for power in this area.

Areas of high growth within the region need new power supplies first. The Puget Sound area of Washington is experiencing such growth now. It is therefore no surprise that Puget Sound Power & Light is the first utility to need power. Puget adopted the national trend and solicited bids to meet that need. Developers submitted bids to Puget in 1989. It intends to select power suppliers in 1990, for resources to be available in 1993.

Just before submission of this paper, Puget announced that it selected three bids, including one geothermal project. Puget is negotiating with Trans-Pacific Geothermal for the output from two binary cycle plants totalling 10 MW. The plants will be in Surprise Valley, California, about 50 miles (60 km) south of the Oregon border. Trans-Pacific will reportedly receive "a levelized price in excess of 6.5 cents per kWh for 30 years" (IPR, 1990). The project faces major transmission hurdles. Power will have to be wheeled north to Puget via three utilities: Surprise Valley Rural Electric Coop, Pacific Power and BPA. Negotiations are continuing.

Geothermal energy is but one of many supply options for Northwest utilities. For example, Puget also selected a 100 MW gas cogeneration plant, and a 17 MW garbage burner for further negotiation. It did so over a competing bid of conservation from the utility itself! Many investor-owned utilities intend to solicit bids like Puget (and BC Hydro to the north) have. In contrast, most public utilities will continue to purchase power from BPA. There are nine supply options available to all utilities. Table 3 lists those options below.

### Table 3
Utility Power Supply Options

- Conservation
- Transmission & distribution system improvements
- Contract options i.e., recalling power sales
- Power purchases from BPA
- Purchases from other utilities
- Combining nonfirm power with combustion turbines
- Purchases from independents (geothermal here)
- Power plant capacity expansions
- Purchases of other utilities

In order to compete against any and all of these options, geothermal developers must first think like a utility. Ask yourselves "Why should I choose geothermal power over these other options?" Developers should target a utility, and learn the specific needs of it. Once you feel comfortable knowing the utility's needs, then assess competing supply options. Do this "homework" before approaching potential utility customers. The goal is to tailor a proposal to a specific utility, adding value to a geothermal project such that the utility feels it is superior to the other options. Examples might include buying services from the purchasing utility, offering project equity to the utility, and delaying construction to coincide with new demand.

Utilities in the region will need power in the future. The timing of utility needs varies almost as much as types of sources. The investor-owned utilities as a group will need power first, starting in 1993 with Puget. The Oregon Department of Energy (ODOE) estimates that both PGE and PP&L will need new power in 1994. Estimates do not include further utility mergers. BPA expects to need new firm power in 2002, (BPA, 1989).

### Other Market Factors
One development outside the region is important to geothermal developers: the Thousand Springs project. This proposed project is a 2,000 MW coal-fired plant to be located near Wells, Nevada. Project proponents intend to build the plant in 250 MW stages as the need arises. It is to be an independent power project, although the chief proponent is a Nevada utility holding company. Developers intend to sell the power to all areas surrounding the plant, including the Pacific Northwest. This project faces major transmission hurdles, and would need to build a new line into Oregon to sell power in the Northwest. Regardless, competing coal may be a cost standard against which geothermal is measured.

No discussion of the Pacific Northwest is complete without referring to the strong environmental awareness of many area residents. A vocal minority of citizens exists that may be a cost standard against which geothermal is measured.

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The second question to ask is “Am I going beyond minimum requirements to lessen impacts of this project?” Geothermal projects in the Northwest must be better than in other states in limiting such impacts. Environmental organizations are on record opposing geothermal projects located near national parks or endangered species. That is not a surprising stance. Given this forewarning, geothermal developers must clearly go beyond minimum requirements to comply with environmental regulations.

Conclusion

The Pacific Northwest enjoys the cheapest electricity in the country. Changes in this situation will be slow, but they are coming: one geothermal project is on Puget Power’s short list. Investor-owned utilities represent the best market for future power for four reasons. First, many have generation plants and purchase power from independents, hence, have experience with developers. In contrast, most public utilities have no power plants and buy all their power from BPA. Second, growth is causing many investor-owned utilities to need power sooner than the publics. Third, investor-owned utilities actively investigated possible geothermal development. EWEB is the only public utility having many of these same characteristics. Fourth, BPA’s preference rate is likely to stay below 3 cents per kWh for sometime. Public utilities have little incentive to buy geothermal power.

The need for power in the Pacific Northwest will begin in about 1994. Any discussions with utilities should use that time as the earliest power delivery date. Peak growth may occur after the turn of the century.

Geothermal power is but one of many supply alternatives Northwest utilities have. Power prices must be squeezed down to the margin, due to other competing sources and the region’s historically low-cost energy. Power supply proposals or bids will be the norm in future. Successful proposals will offer value above simply supplying electricity to the utility. Some form of added incentive to the utility will be critical.

In sum, market prospects for geothermal power are going to be slim through at least the mid-1990s, but not impossible. Prospects can be improved if developers do the following:

- target individual utilities needing power;
- target utilities with past or current interest in geothermal;
- create geothermal proposals specific to that utility;
- enhance proposals to compete with other supply options.
- participate in the BPA solicitation; and
- think like an environmentalist to site your project.

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