NOTICE CONCERNING COPYRIGHT RESTRICTIONS

5396

SITE SPECIFIC DEVELOPMENT PLANNING IN IDAHO

David W. McClain

Idaho Office of Energy
Boise, Idaho 83720

ABSTRACT

A site specific development plan is a qualitative and quantitative analysis of technical, economic, environmental and institutional factors which influence the scale and timing of geothermal development. The plan is based on current information available from local sources, field examination, and literature research. The resource data is provided by the Idaho Department of Water Resources and the U.S. Geological Survey. Current socio-economic data and technical papers are reviewed to determine the scale and feasibility of a project. State and Federal policies and local planning reports are reviewed to determine the institutional factors affecting the development processes. To this date, six sites have been studied and site specific development plans have been prepared. This paper discusses what types of elements are considered in the site specific plans, what conclusions the six existing plans have drawn and what results have materialized since the studies were conducted.

INTRODUCTION

All of Idaho's petroleum products, natural gas, coal, and a substantial part of its electrical power are imported from other states and nations. Hydroelectric power, solar energy, and geothermal energy are Idaho's major native energy resources. Much of the high-head hydroelectric potential in Idaho has already been developed or is protected by wilderness classification.

Idaho has a significant but largely undeveloped geothermal energy potential. Idaho Department of Water Resources has identified over 300 thermal wells and springs in Idaho. Most of the known geothermal resources in the State are below 150°C (302°F) temperature. Although at this time it is impractical to generate electric power from these resources, low to moderate temperature geothermal resources have significant potential in Idaho for direct applications such as food processing and space heating.

Geothermal energy is Idaho's major undeveloped energy resource. Idaho is fortunate that its geothermal resources underlie its highest concentration of people, industry, and commerce. Approximately two-thirds of Idaho's population lives in areas with geothermal energy potential. Twenty-two of Idaho's major food processing plants are located along the Snake River Plain in areas with geothermal resource potential

The Idaho Office of Energy, in a cooperative agreement with the U.S. Department of Energy, has completed an overview of geothermal resource development potential and institutional barriers to development. After sixteen months of research, it is the conclusion of this program that there is significant opportunity, interest, and potential for geothermal resource development throughout the State of Idaho. Development potential is most significant along the Snake River Plain Region of southern Idaho, while opportunities for development are more limited in the interior mountainous regions of the State.

The Idaho Office of Energy has identified fourteen prospective hydrothermal reservoir sites with significant economic and resource potential for the development of geothermal industrial parks. Also, forty-four Idaho communities which have been identified are located within five kilometers of a 20°C or higher thermal spring or well. All of these sites are considered potential space heating locations. The total population of these sites is 272,736 people. This represents 33 percent of the state's total population and approximately 50 percent of the urban/community population.

In order to stimulate a rapid development of this potential energy resource, the Idaho Office of Energy has conducted a series of site specific development analyses on selected prospective geothermal resource locations. All sites are direct use (non-electric) projects. Seven sites have been studied in detail and development analysis reports have been issued by the Office of Energy. In all cases studied, geothermal energy was found to be competitive with the available conventional forms of energy.

The site specific development plans consist of four specific subject analyses which are interrelated. The four subject areas analyzed are: 1. resource, 2. market, 3. economics, and 4. institutional.

RESOURCE EVALUATION

Basic information essential to any site specific development analysis is the resource evaluation. The first step in a resource evaluation is a literature search to determine the general physiography, and structure of the resource area.

A survey of well data from water wells and oil and gas wells can help determine the depth of both cold and hot water aquifers, temperature and geochemistry. Because Idaho has a historical record of developing thermal waters for irrigation purposes a great deal of thermal well data already exists. Other geophysical data is also incorporated in the resource evaluation such as seismic, aeromagnetic, gravity and resistivity data. Geochemical analysis is provided by the Idaho Department of Water Resources and is useful in predicting aquifer temperatures.

Basically, the resource evaluation determines a probable drilling depth and an estimated water temperature. The location of the drill site is usually based on fault controlled geology. The estimated depth of drilling is derived from a combination of existing well data, geothermal gradient and heat flow data. Aquifer temperatures are predicted using geochemical analysis and existing well data. The productive capability of a thermal aquifer is estimated based on the productive capabilities of similar developed wells in the area and throughout the State.

MARKET EVALUATION

The second major evaluation conducted at a study site is the market evaluation. General social economic indicators at the local and county level are examined to determine the rate of growth, potential for future growth and economic stability for the area being studied. Local energy needs are also evaluated. When considering a space heating system for a community, the current price of conventional energy forms is considered as well as the projected future price of those energy forms. Heating degree days, the number of units to be heated and actual fuel bills are analyzed. If geothermal is to be a viable resource it must be able to: 1) be competitive with conventional energy forms, and 2) be able to meet the demand for energy.

The market evaluation estimates the annual energy demand at a site and determines the current and projected price of energy at the study area. Once these variables are known a cost comparison with geothermal energy can be made.

ECONOMIC EVALUATION

The third major evaluation in a site specific development analysis is the economic evaluation. If a geothermal system is to replace conventional fuels then two questions must be answered. First, is geothermal energy economically attractive relative to other fuels; that is, is it cheaper? Secondly, is geothermal energy economically attractive relative to other investments? These two questions are linked; both must be answered positively for geothermal development to take place. Even though a projected geothermal system could supply energy cheaper than conventional fuels, it probably will not be developed if the rate of return is not high relative to other uses of investment funds.

The first step in the economic evaluation is to estimate the total capital cost of development which includes an estimated well field cost, pipeline cost, and disposal system cost which is based on data obtained in the resource evaluation. The resource evaluation has predicted estimated drilling depth, water temperature and flow rates and the location of the well relative to the end user. Based on the information available from the resource evaluation and the market evaluation, a system can be sized to optimize the supply and demand ratio which is estimated to exist at the location. An operation and maintenance cost is also estimated.

Basic to analysis of the economic worth of an investment in geothermal direct-use is the concept of geothermal saving. The direct-user of geothermal generally does not sell energy and generate revenues. But the geothermal direct-user avoids conventional fuel costs. The real saving from geothermal is the value of conventional fuel cost avoided minus the operating costs incurred in running the geothermal system. The savings generated through conversion to geothermal are evaluated just like the revenue from an ordinary investment. These dollar savings are also available for spending. Like other investments a geothermal system operates over a span of years (20 is probably realistic). This means that there is a stream of savings spread over 20 years. By escalating conventional fuel cost, pump power cost and maintenance at some assumed growth rate over time (8%) we can generate that stream of savings. However, savings in 1990 are not worth the same as savings in 1980.

All the future savings need to be discounted (reduced) to convert them to present worth. For most present worth analysis an appropriate discount rate is the interest rate currently being paid on fairly conservative investments. We have used 10% in our examples. The higher the discount rate used, the lower the present worth (value) of savings.

To determine how the cost of geothermal heat compares with the cost of conventional fuels we first determine the cost per usable therm of the conventional fuel by considering the price and conversion efficiency.

To estimate the cost per therm for geothermal we take the annual geothermal cost and divide it

by the annual geothermal heat used. The annual geothermal cost is a combination of operating cost (maintenance and electricity for the pump) and the debt service necessary to amortize the original capital investment. However, the system will not be pumping all year at a maximum rate. Over a year a space heating system would utilize roughly 20% of that maximum amount. Dividing annual geothermal costs by therms of geothermal energy utilized gives a price per therm of geothermal. Any increase in utilization of the BTUs which could be pumped from the well, through supplemental uses, would spread the annual geothermal costs over more BTUs, thus further decreasing the cost per therm for geothermal. Due to high initial capital costs and low annual expenses more use of available heat means lower cost. A simple comparison of the cost per therm of geothermal with other energy forms determines if the geothermal is cheaper and thus competitive with available conventional energy.

This technique can, and probably should, be applied in the same way to calculation of the payback period in terms of present worth. The present worth method accounts for the lesser value of future saving. Though there are no absolute guidelines for how long a payback period should be, anything less than 5 years is probably very attractive. The payback period indicates the time it takes for the geothermal investment to pay for itself through yearly savings.

INSTITUTIONAL EVALUATION

After determining that a project is feasible the next major analysis is a review of institutional factors which would affect the development process; we conduct a general title search of the resource ownership to determine if there are any federal or state interests in the resource area. A review of required permits and bonds regarding exploration drilling and the status of water rights is also conducted. Local planning and zoning and right-of-ways are reviewed to determine if there are any local institutional barriers.

The final section of institutional analysis is a projection of the time requirement for bringing a project on line. Generally the construction phase of a project can be completed in 12 to 16 months if the resource is privately or municipally owned. If state or federal resource ownership is involved then timelines for development can be doubled and tripled due to increased institutional encumbrances.

SITE SPECIFIC STUDIES

The Office of Energy has studied two locations for the development of a geothermal industrial park. These locations are Weiser Hot Springs in Washington County and Magic Hot Springs in Blaine County. An industrial park site specific analysis basically determines an estimated cost of resource development, in terms of cost per million deliverable BTUs.

This cost is then compared with the deliverable price of natural gas which is currently available in the general area. In general, this cost comparison determines if the prospective hydrothermal resource site will be competitive with the conventional energy form currently used in Idaho's industries. The industrial site specific analysis also examines location, transportation, labor force, social economic conditions and institutional conditions. All this information is then presented in a report format which summarizes the controlling parameters which will determine if this geothermal resource location can compete with other industrial locations for industrial facility siting.

In both the Weiser and Magic Hot Springs cases the cost of geothermal energy was considerably less than the cost of the conventional alternative, natural gas. The Weiser location was determined to have adequate transportation and labor force to support an industrial facility but the site would be limited to processing agricultural products.

Although the Magic Hot Springs site has adequate transportation access it is somewhat isolated from its labor force and a supply of raw products such as agricultural products for processing. Both the Weiser and Magic Hot Springs sites appear to be ideal geothermal locations for siting alcohol fuel production facilities.

The Office of Energy has completed site specific development analyses on space heating for five sites. The five sites are: the Idaho Capital Mall, Boise, Idaho; City of Fairfield in Camas County; the City of Hailey in Blaine County; the City of Stanley in Custer County; and the City of Grand View in Owyhee County. At all sites studied, it was determined that a publicly-owned geothermal district heating system would be competitive with all conventional energy forms available today. Privately-owned district heating systems do not appear to be economically attractive until the 1990s. This is not a general conclusion but merely a reflection of the information currently available to us. The difference between publicly- and privately-owned systems is basically due to the difference in the cost of capital, taxes, and return on investment.

Table 1 lists the general conclusions that have been made at each of the seven sites studied. It should be noted that the payback periods for two sites, Magic Hot Springs and the City of Fairfield were found to be greater than 10 years. In the Magic Hot Springs case, only one low temperature process was considered. If one additional processor could be located at the site, the payback period is substantially reduced. If high temperature resources (140°C) were developed at the Magic Hot Springs site, for ethanol production, then a payback of approximately 3 years is expected.

At Fairfield, Idaho, the payback period for a space heating system was approximately 20 years. This is largely due to the small size of the community and the excessive cost of a 2 mile pipeline. Two major conclusions can be drawn for Fairfield. If a drill site closer to the community could be found then the economics of the project becomes much more favorable. Secondly, if high temperatures were discovered at the targeted drill site, a proposed industrial park could be located there and a district heating system would be a feasible secondary use on the thermal fluids.

CURRENT PROJECT STATUS

All seven site specific development plans were completed in 1979 and early 1980. The degree to which this research has stimulated geothermal development varies from location to location and, to a large degree, has been slowed by a spiraling inflationary cost of money. The current status of the seven projects studied by the Office of Energy are as follows:

At Weiser Hot Springs, several private industrial development interests have been attracted to this area as a result of the Weiser study. Actual development activities have been limited to leasing activity and preliminary geophysical work. An exploration and development program is anticipated by the Office of Energy to be initiated in the area by late 1981.

At Magic Hot Springs, private developing interests anticipate drilling a 1500 foot exploration well in late summer 1980.

At the Idaho State Capital Mall, the Idaho State Legislature has appropriated funds for the retrofit of its buildings to geothermal heat and appropriated funds for an exploration hole at the Capital Mall. Drilling of this exploration well is expected to be completed by the end of June, 1980. If this well is successful it is anticipated that further production drilling will occur within twelve months and complete retrofit of the Capital Mall to geothermal heat could conceivably come on line by 1983.

At the City of Fairfield, Idaho, Camas County has recently completed a geophysical survey to select a probable drilling site. Additional funds will be sought from public sources to complete the project including the exploration drilling for an industrial park.

At the City of Hailey, Idaho, some private development interests have been shown but to this date no major actions have occurred.

At the City of Stanley, Idaho, the city and the Bonneville Power Administration are currently examining the feasibility of BPA developing the system as part of their conservation program in their preference customer service area.

At the community of Grand View, Idaho, the city has contracted an engineering firm to develop preliminary designs and seek federal assistance funds for the construction of the project.

SUMMARY

In summary, preliminary site specific analyses similar to those conducted by the Idaho Office of Energy have been shown to stimulate development interests in geothermal direct use projects. A good preliminary analysis and planning will define the degree of economic risk, resource availability and institutional factors. Once these points are defined or placed in a given range, both public and private entities, who are not familiar with geothermal development, can begin to address the problem of obtaining sufficient financial backing to initiate the exploration and development process. In all cases studied local public and private interests do not fully understand the interrelationships involved with geothermal development. Once the various factors have been defined, local public and private interests seem capable of addressing geothermal resource development in the same manner they would any other capital construction project such as sewage or water systems. The utility of conducting a site specific analysis is that it provides the local interests with the outline of a project plan which takes a great deal of the myth out of geothermal resource development.

TABLE 1 ECONOMIC CONCLUSIONS

Site Name	Conventional Energy Cost	Annual Geothermal Cost*	Total Project Cost	Payback (Years)
	$/MBTU	$/MBTU		
Weiser Hot Springs Industrial Park	$2.83	$0.57	$ 687,000	3
Magic Hot Springs Industrial Park (one process only)	5.10	5.35	208,860	3 high temp. 16 low temp.
Idaho State Capital Mall	3.38	2.74	451,200	6.4
City of Fairfield (Space Heating only)	6.33	1.89	542,056	20
City of Hailey Public Heating System	4.78	2.67	2,156,700	8.1
City of Stanley Public Heating System	7.96	1.00	111,164	2
City of Grand View	Not completed at press time			

* Geothermal cost = Amortization, Operation and Maintenance.