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Employment Involved in the US Geothermal Industry

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Keywords

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ABSTRACT

In 2004, the US geothermal industry accounted for an estimated 4400 jobs. This corresponds to an average 1.7 jobs per MW of power production capacity. Forty-four percent of these jobs are directly related to power plant operation and maintenance. The remaining 56 percent correspond to jobs related to other geothermal activities (e.g. research, consulting and supply services; environmental, legal and government issues, etc.) The relative importance of geothermal activities for companies involved in the business is fairly variable and only 16 percent are exclusively working on geothermal issues. The workforce size of geothermal organizations also varies significantly; a couple of large companies account for a significant part of the total workforce while a significant number of small businesses have less than five employees. Private companies and independent consultants account for 88% of total employment. Since very few power plants were built during the last 12 years, the above employment number does not consider power plant construction and equipment manufacturing jobs. These were estimated at 3.1 and 3.3 jobs respectively per MW of new capacity installed. Should the industry follow the Energy Information Administration's (EIA) projected growth rate, the geothermal sector would generate 34,077 new person-year employments during the next 20 years.

Introduction

Employment is an important socioeconomic benefit of the geothermal industry. The last survey assessing employment involved in the geothermal sector occurred in the late 1970's and no recent data addressed this issue thoroughly or appeared reliable. A new survey was thus conducted by the Geothermal Energy Association (GEA) in order to update this information

and provide new employment estimates. Part one of this article presents the results of this survey and the major findings about geothermal employment. Some additional information about the structure and characteristics of the industry, also gathered from the survey, are provided in the following section. Finally, part two of the article estimates the potential employment impact of future industry growth.

Survey Results and Analysis

Survey Methodology

The survey conducted by GEA aimed to assess total employment involved in the US geothermal industry and gather updated information about the structure and workforce size of organizations and companies involved in the geothermal business. All available lists and directories of geothermal organizations were used to compile contact information of any stakeholders active in the industry. This information was used to mail the survey questionnaire. Follow-up emails and, as a last recourse, phone calls were made to enhance the response rate. A clear distinction is made between the responses obtained during phone calls (which typically only addressed total employment numbers for the company) and responses that consisted of a completed survey questionnaire. One hundred ninety-five companies filled-out the entire survey questionnaire thereby providing information about the company's type, workforce, activities, and relative importance of geothermal activities for their business. Twenty-two additional companies active in the geothermal sector provided employment data during follow-up phone calls.

Survey Results and Analysis

The 195 answers obtained from the survey questionnaire accounted for 2642 jobs. The average geothermal workforce of companies that responded to the survey is 13.5. This figure may however misrepresent the distribution of employment inside the geothermal sector since a majority of answers declared to have 5 or less employees working on geothermal issues while

Table 1. Distribution of responses according to the company's workforce size.

Percentage of companies	Geothermal workforce size
65.6%	1 to 5 employees
16.7%	6 to 10 employees
8.9%	11 to 20 employees
3.6%	21 to 50 employees
2.1%	51 to 10 employees
3.1%	Over 100 employees

few companies have over 50 workers involved in geothermal issues. Table 1 illustrates this.

The survey also investigated the types of organizations involved in the geothermal business. Table 2 presents these results and links each type to its relative importance as employer.

Table 2. Frequency of company type and respective importance as employer.

	Frequency of responses (% of respondents)	Relative importance as employer (% employment captured by each category)
Private Company	45.1 % (88 out of 195)	80.4% (2123 jobs out of 2642)
Independent / Consultant	25.6 % (50 out of 195)	7.2 % (190 jobs out of 2642)
Government Agency	14.1 % (28 out of 195)	7.1 % (187 jobs out of 2642)
Research Institution	8.2 % (16 out of 195)	3.5 % (93 jobs out of 2642)
Non Profit Association	4.1 % (8 out of 195)	0.8 % (22 jobs out of 2642)
Other	2.6 % (5 out of 195)	1.0 % (27 jobs out of 2642)

Table 2 suggests that private companies and independents and consultants account for 71% of all responses and 88% of total employment captured in the survey. Private companies constitute the largest group of respondents and accounts for an overwhelming majority of geothermal employment. Table 2 also allows to estimate the average workforce size of each category. If the different kinds of employers are sorted in descending order according to this criterion, private companies come first with an average workforce of 24 employees (i.e. 2123 jobs / 88 responses), followed by government agencies (6.7 employees), research institutions (5.8), others (5.4), independents and consultants (3.8) and non-profit associations (2.75).

A distinction was also made between full-time and part-time positions as well as between temporary and permanent jobs. The distribution of employment captured by the survey between these various characteristics is detailed in Table 3 and demonstrates that full time permanent positions constitute 86% of geothermal employment.

The survey results also revealed that 15.6 % of organiza-

Table 3. Classification for Geothermal Employment.

	Full time	Part time	Total
Permanent jobs	2274	224	2498
Temporary jobs	52	92	144
Total	2326	316	2642

tions involved in geothermal activities did not have activities outside the geothermal sector. On the other hand, 20% of the responses indicated that geothermal activities accounted for less than 1% of their business activities. Generally speaking, 58% of the responses, corresponding to 55% of the employment captured by the survey, stated that geothermal activities account for less than 50% of their corporate activities.

The section investigating the various activities of geothermal organizations also showed that:

- 46 % of the organizations are active in research and development.
- 14% of the companies are directly involved in power plant operation and maintenance (32% of these companies directly own a geothermal power plant).
- 14% of the responses indicated that the organization is involved in direct use applications of geothermal resources.

Assessing Employment That Could Not Be Captured by the Survey

Employment Related to Companies That Did Not Respond to Survey

All companies that have been contacted did not provide responses and many of those did not respond to the follow-up phone calls. However, based on the percentage of companies that declared themselves to be active in geothermal activities obtained during the follow-up phone calls, an estimated 94 additional companies are active in the geothermal field. Should the average employment ratio (i.e. 13.5) be applied to these 94 companies, this suggests that 1269 geothermal jobs were not captured in the survey results.

Subcontracted Employment

Although the survey questionnaire included a section investigating subcontracted employment, data provided by this section was judged unusable. This information was indeed scattered, showed significant inconsistencies, and comprised only 12% of the responses. However, since power producers were expected to employ a significant amount of subcontracted workers, specific investigation to assess total workforce involved in subcontracted activities was achieved with the collaboration of the major US geothermal power producers.

This research showed that the subcontracted workforce typically represents 42% of the power plant operator's own workforce. Geothermal power producers typically have 0.52 employees per MW of power capacity and require an additional 0.22 subcontracted workers to fulfill power production related services. The investigation also revealed that only 12% of that employment had been captured with the initial survey. This is explained by the fact that most subcontracted activities are not specific to geothermal power production and that subcontractors are typically providing specialized services applicable to other economic sectors. (e.g. drilling, trucking, power equipment overhaul and repair, etc.) Given the current US geothermal power production capacity, the industry is expected to count for 1317 O&M workers directly working for the power producers as well as an additional 553 subcontracted workers. Since the survey captured 12% of these jobs, subcontracted employment that could not be captured in the survey is estimated to account for 478 additional jobs directly related to geothermal activities.

Conclusions

The above analysis suggests that the geothermal industry accounts for an estimated 4389 workers. It is however important to keep in mind that this employment figure results from estimates that consider the following assumptions and restrictions:

- The average number of employees for companies that did not respond to survey is considered to be equal to the number obtained from companies that did respond.
- Some companies not appearing on lists and directories could not be reached or contacted.
- Subcontracted employment involved in activities other than power production has been ignored.

As a result, the employment figure provided above is thought to be somewhat conservative and should be considered with an upwards variability range of an estimated 15%.

Potential Employment Impact of Future Industry Growth

The construction of new geothermal power plants has three distinct employment impacts. First, power plant equipment and other construction material have to be produced by manufacturing industries. This job impact appears in the analysis below as the "manufacturing" employment impact. Second, on-site construction workers have to prepare the site and build the geothermal power plant. The third employment impact results from new O&M positions created at new power plants.

Power plant construction typically last from 17 to 27 months. In order to reflect the temporary nature of Manufacturing and Construction (M&C) employment impacts, they are expressed in person-year (P-Y) per MW of new power capacity installed. One person-year corresponds to the employment of one person during one year. On the other hand, since geothermal power plants are expected to have a 30-year lifetime, O&M position are considered to be long-term employment.

Part one of this article states that geothermal power plants typically employ 0.74 O&M workers per MW of power capacity. Further research and analysis of Environmental Impact Studies for new geothermal power plant projects suggested that 3.1 person-year "on-site construction workers" are required to build one MW of new power capacity. In a recent research project, the Renewable Energy Policy Project (REPP, 2005) also estimated that employment related to geothermal power plant equipment manufacturing is 3.3 jobs per MW.

When these numbers are applied to the "reference case" projections for the geothermal industry growth of the Energy Information Administration, the expected employment impact of the industry for the next 20 years corresponds to 34,077 new jobs. This figure is however expressed in "person-years" and corresponds to an actual increase of 2813 long-term positions. Figure 1 describes the different components of the employment impact of future industry growth.

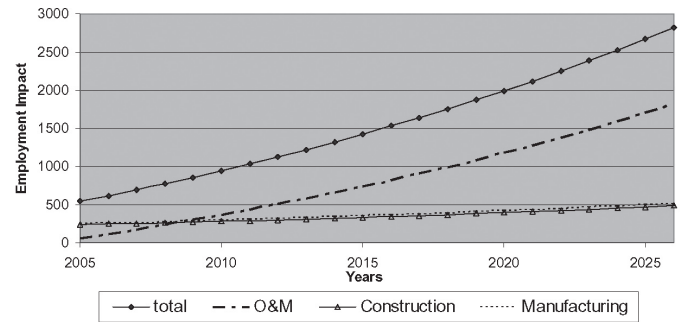


Figure 1. Long-Term Permanent Impact of the Geothermal Power Industry Growth.

Socioeconomic impact studies of new power projects often estimate the indirect and induced employment benefits of the economic activities related to the power plant construction and operation. An extensive literature review revealed that most articles presenting the results of input-output models consider a 1.7 economic multiplier for the local or state economy. This means that \$1 spent on the project results in \$1.7 economic output for the regional economy. Should the employment impact be equal to the economic impact, the actual employment impact of new geothermal power projects would be significantly higher and correspond to the creation of 4782 new permanent employments during the next 20 years. It is important to note that some analysts consider employment multipliers to be much larger than economic multipliers. This discussion was however considered beyond the scope of the present article.

Conclusions

The geothermal industry consists of a series of companies and organizations with great differences in workforce size, nature, and relative importance of geothermal activities in their businesses. Private companies constitute the largest category of geothermal organizations and account for an overwhelming majority of its employment. Over 86% of geothermal jobs are full-time permanent jobs. Compared to the 1978 survey results, the industry power capacity has quadrupled, but its total workforce has only grown by 31 percent. In the late seventies, given the oil crisis, the industry was enjoying great interest and support from oil companies and the government, which invested intensively in many research and exploration programs. Nowadays, few of these programs remain and power producers were forced to adopt more efficient management practices due to increased competition from traditional power technologies. This resulted in lower O&M employment requirement as well as in an increased use of subcontracted workers.

Future industry growth perspective should result in the creation of a significant number of new jobs. Most of these positions are related to power plant O&M and are thus well paid, long-term full-time jobs. Geothermal employment benefits are even more valuable since most geothermal power plants are located in remote and/or rural areas characterized by high unemployment rates.

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