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MASTER

FINAL REPORT FOR
MEASUREMENT OF ATTITUDES TOWARD
COMMERCIAL DEVELOPMENT OF GEOTHERMAL
ENERGY IN FEDERAL REGION IX

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EXECUTIVE SUMMARY

The over-all purpose of this study was to investigate attitudes toward commercial development of geothermal energy in Federal Region IX. Two sub-objectives were to provide the San Francisco Operations Office of the Department of Energy with measurements and analyses relevant to:

- Input to a "prospectus" that may be prepared by the municipality to interest industry in commercial development of geothermal energy at that site, and
- Information for DOE decisions and actions, e.g., management of DOE demonstration projects.

Work began in September, 1980 and was completed in June, 1981.

There were seven project tasks:

- Project Initiation and Site Selection,
- Development of the Measurement Methodology,
- Benchmark Measurement of Attitudes,
- Assessment of the Macro-Environment,
- Assessment of Capabilities,
- Analysis of Decision Processes, and
- Final Report Preparation.

Task I, Project Initiation and Site Selection involved the identification and recommendation of two sites for case study. Three sites were recommended: Klamath Falls, Oregon;

Susanville, California; and Imperial Valley/El Centro, California. DOE/SAN made the final study site selection: Klamath Falls, Oregon and Susanville, California. Study sites were evaluated, recommended and selected according to the following criteria:

- Substantial, established commercial development of geothermal energy at the site;
- Significant participation by local government, as promoter, operator and/or regulator at the site; and,
- Site of current DOE geothermal project, limited to: resource assessment (e.g., production wells); field experiment (direct heat application plant); and/or demonstration of electric power production.

Task Two, Development of the Measurement Methodology, involved the development of a procedure and methodology for the semi-quantitative measurement of attitudes. Task Three, Benchmark Measurement of Attitudes, was the implementation of the methodology developed in Task Two. Specifically, the methodology involved the survey of ten target study groups and subgroups:

- Local government
- Industry at the site
 - Current geothermal energy users
 - Potential geothermal energy users
- Relocaters to the site
 - Firms in the relocation decision process without a site decided
 - Firms in the relocation decision process with a site decided

- Financial community
 - Current financiers of geothermal development
 - Potential financiers of geothermal development
- Regulators
- Promoters and developers of geothermal energy
 - Current promoters and developers
 - Potential promoters and developers

The objective of Task Four, Assessment of the Macro-Environment, was to identify and define the macro-environmental conditions, changes, problems and opportunities which will influence industry's criteria for decisions regarding the use of geothermal energy, as well as local government's role as opinion leader, change agent, innovator and regulator. For Task Four a secondary literature review was conducted and macro-environmental attitudes of a sample of local government and industry personnel at the sites were assessed.

Task Five, Assessment of Capabilities, involved two measurements. The first was a measurement of a sample of promoters, developers and industrial service companies active at the sites to determine infrastructure capabilities required by industry for geothermal plants and potentially available at the sites. The second measurement involved analyzing a sample of industry management in the area and defining their requirements for plant retrofit and expansion.

The purpose of Task Six, Decision Processes, was to identify and define processes used by the study group to analyze information in order to reach commitment and regulatory decisions that significantly impact on geothermal energy projects at the site. Task Seven was the preparation of this final report.

Methodology

The methodologies employed for case study of both Susanville and Klamath Falls were identical. Eleven separate survey instruments were developed -- one for each of the six target study groups for Klamath Falls and one for each of the five Susanville target study groups (it was not possible to identify any relocaters specific to the Susanville site). No more than nine persons were administered the same survey instrument. Each questionnaire addressed objectives specific to the relevant target study group including attitudes toward geothermal energy development, decision processes, attributes and barriers in decision-making, experiences with and awareness of geothermal energy and relevant macro-environmental issues.

Potential respondents were identified through personal interviews with individuals at each of the study sites, secondary sources, sub-contractors, consultants and other experts. Each potential respondent received a letter introducing the study which was followed by a phone call eliciting cooperation and setting up an interview time.

A team of executive interviewers conducted personal interviews in Klamath Falls during the last two weeks in January, 1981. Personal interviews were also conducted in Salem, Medford, Eugene and Portland, Oregon. Fifteen respondents who lived outside the State of Oregon were interviewed by telephone. With no more than nine respondents in any target study group being administered the same questionnaire, sixty-six persons were interviewed for the Klamath Falls site.

In order to obtain insights from the results of the interviewing in Klamath Falls, Susanville interviewing took place during the last week in February and first week in March, 1981. Executive interviewers were sent to Susanville, Sacramento, San Francisco and all other areas of California where respondents were located. A total of forty-seven personal interviews were conducted for the Susanville site.

The data for both sites were tabulated for each question for each respondent according to respondent target study subgroup. Means within target study groups were computed for scaler questions. Comparisons were made within and across target study subgroups where relevant. The results are summarized below by task.

Benchmark Measurement of Attitudes

The summary of the results of benchmark attitudinal measurement is presented for each target study group separately. These results reflect the work accomplished for Task Three.

Local Government Personnel

All local government respondents in both Susanville and Klamath Falls were aware of geothermal energy. Most were aware of geothermal energy because they had lived in an area where geothermal energy was available. The vast majority of local government personnel in both Susanville and Klamath Falls considered themselves to be "somewhat knowledgeable" about geothermal energy, all were "very interested" in further development and all but one Susanville respondent saw the City as "very interested" in further geothermal development.

Six out of seven local government respondents in Klamath Falls ranked geothermal energy as their first energy source preference as did six out of eight government respondents in Susanville. Thus, both samples expressed a strong preference for geothermal as an energy source. The most frequently mentioned reasons for this by Klamath Falls respondents were the availability of geothermal energy and its non-polluting nature. In Susanville the most frequently mentioned reasons for geothermal energy preference were low cost and the non-polluting nature of geothermal energy.

Klamath Falls respondents cited more advantages and disadvantages for geothermal energy use than did Susanville respondents. Klamath Falls respondents frequently mentioned non-polluting, low cost, renewable and little system upkeep as advantages. Disadvantages were seen as potential depletion, unknown resource location, waste products and pollution problems. With the exception of system upkeep, Susanville respondents cited the same advantages most frequently, but the only disadvantage cited was the unknown cost of retrofitting for geothermal energy use.

Awareness of the DOE demonstration project was high in both Susanville and Klamath Falls, although many government officials in both areas did not know details of the project, such as cost and sources of funding. Representatives of both sites expected to be or were satisfied with geothermal as an energy source.

Decision factors for the use of geothermal energy varied between Klamath Falls and Susanville. Susanville respondents focused more on benefits to the economy than did Klamath Falls respondents. In Klamath Falls there was a concern

about environmental factors and existing well-owners being "hurt" (depletion of existing wells). Cost savings were also important decision factors. Susanville local government personnel considered employment and community economic benefits to a considerable extent, as well as savings in the cost of energy.

A main difference between local government respondents in Susanville and Klamath Falls was their perception of the role of the DOE sponsored geothermal project in the overall program for developing geothermal energy in the area. In Klamath Falls, the project was an attractive opportunity for the City in terms of the availability of government funds and they did not have the expectation that the project would be the center of geothermal development in the area (as geothermal energy is already well-developed in the area). Susanville City Officials, however, saw their demonstration project as shaping the development of geothermal energy in the area and strongly influencing the economic future of the area. These are probably accurate perceptions of the role that the projects do, in fact, play in the respective areas.

Industry at the Sites

All current and potential users in both Klamath Falls and Susanville were aware of geothermal energy, although awareness was for a slightly longer period of time in Klamath Falls than in Susanville. Klamath Falls respondents considered themselves much more knowledgeable about geothermal energy than did Susanville respondents, with current users perceiving themselves to be more knowledgeable than did potential users. However, Susanville current users considered themselves to be considerably less knowledgeable than did Klamath Falls current users.

All current and potential users in Susanville were "very interested" in geothermal development. While two Klamath Falls respondents were "somewhat interested" in geothermal development, the vast majority were "very interested". Both Susanville and Klamath Falls industry respondents most frequently cited the low cost, local nature of the resource and conservation (of other energy sources) as the reasons for their interest in geothermal development.

In both Klamath Falls and Susanville geothermal energy was the most preferred energy source. The most frequently cited advantages by respondents at both sites were that geothermal was economical, available and non-polluting. Klamath Falls respondents saw possible depletion, maintenance and lack of technical information as the major disadvantages. Potential users were also concerned about the high initial cost. Many respondents at both sites did not perceive any disadvantages. Possible depletion and lack of technical information were mentioned most frequently as disadvantages of geothermal energy use by potential users in Susanville. Depletion, maintenance costs and low temperature water was mentioned by current users in Susanville.

Costs and availability were the most frequently mentioned decision factors in geothermal use decisions by Susanville current users. Current users in Klamath Falls also mentioned cost savings and availability as decision factors, as well as existing use in the community, possibility of hitting a dry well and costs of retrofit.

Current users in Klamath Falls and Susanville were satisfied with geothermal as an energy source. Potential users expected to be satisfied. Potential users in

Susanville were more ambivalent toward the possibility of future use than were potential users in Klamath Falls. Many current users in both areas had plans for expansion of use.

In general, Susanville's industry is waiting for the DOE demonstration project to provide them with available geothermal energy. Their posture is one of being dependent on someone else to provide the resource. Once it is available, then potential users will determine whether they will utilize the resource. Klamath Falls industry faces a different situation. They do not currently have an ordinance whereby the City has auspices over geothermal resource development and are not dependent on another entity supplying the resource. In addition, Klamath Falls has a history of more individual development of the local geothermal resource than does Susanville.

Relocaters to Klamath Falls

No relocaters were surveyed for the Susanville site. There are negotiations in process with some firms who are potential relocaters to Susanville and it was not possible to obtain the names of firms for interview. Responses of the firms interviewed who were potential relocaters to Klamath Falls who had not already decided on a site may also be relevant to the Susanville site.

All relocaters were aware of geothermal energy as a potential energy source. Over half of the relocaters were "very interested" in geothermal energy development and perceived the City of Klamath Falls to be "very interested" in geothermal energy development. All but one respondent considered themselves to be knowledgeable about geothermal energy; however, none of the firms surveyed currently used geothermal energy.

Sources of information cited by relocaters were: local zoning agencies and planning commissions, real estate agencies, Chamber of Commerce, consulting firms, banks and local residents. The initial information obtained from these sources may be important to initial attraction of a firm to an area, but other factors may determine the final location decision.

The most important factors to a relocation decision cited by the relocaters were: labor supply, cost of land and/or construction, transportation, raw materials and a market for products. Alternative sources of energy or availability of geothermal energy did not emerge as determinants of a relocation decision. Although conclusions are restricted to the sample and methodology herein, the results indicate that municipalities attempting to attract firms to their area should emphasize the decision factors. Municipalities should determine a match between the attributes of the community and the needs of the firm or industry.

In general, relocaters were unwilling to trade-off raw material availability and labor supply for other decision attributes. There was also concern about being "wanted" by a community. It appears to be important that a community project a genuine interest in attracting a firm to the area. Barriers to relocation are the exact opposite of the attributes necessary for relocation (e.g., lack of a labor supply, lack of transportation, etc.).

The most significant implication appears to be that a community must be able to attract industry on the basis of having the basics necessary to produce the firm's product. Critical factors are labor supply, availability of raw

materials and transportation. Energy, while "important" is not likely to be the major determinant of relocation for most firms. Geothermal may be viewed as an "incentive" of an area. Other incentives are lack of restrictions and regulations, tax incentives and availability of financing. Of course, this will vary by industry and it is critical that a municipality appeal to the specific needs of a firm or industry.

Financiers

There was widespread awareness of geothermal energy among current and potential financiers with all financiers being aware of geothermal energy. Awareness generally occurred because of job responsibilities and living in areas having geothermal energy resources.

Among all financiers there was a high level of interest in geothermal energy. Klamath Falls financiers were interested because of the advantages of use, its potential to attract industry and the perception that it was good for the economy. Susanville financiers expressed interest because of their job, geothermal energy was good for the economy, there was a personal interest or because it was an inexpensive energy alternative. Both Susanville and Klamath Falls financiers thought that the respective Cities were interested in geothermal energy development. However, Klamath Falls financiers gave economic reasons for the City's interest and Susanville financiers did not give specific reasons other than thinking Susanville was interested because financiers got that impression from contacts with the City. Generally, Susanville financiers tended to think the City was interested because of the City's involvement with geothermal energy, while Klamath Falls financiers were able to identify specific motivations for the City's interest, such as heating of government buildings.

Potential financiers for Klamath Falls and all financiers for Susanville ranked geothermal energy as their number one preferred energy source, as did two of the four current financiers in Klamath Falls. Reasons for geothermal energy preference given by Klamath Falls financiers were: availability, low cost, clean, non-depletable and efficiency. Susanville financiers also mentioned that geothermal energy would help the economy of the community.

Susanville and Klamath Falls financiers perceived slightly different advantages and disadvantages for geothermal energy. Advantages most frequently mentioned by Klamath Falls financiers were: low cost, renewable, job and industry growth, reduced dependence on foreign oil and environmental cleanliness. The most frequently mentioned advantage for Susanville financiers was the economical nature of geothermal use. The most frequently mentioned disadvantages by Klamath Falls financiers were development costs and limitation of knowledge and technology. The only disadvantage mentioned by more than one Susanville financier was the depletion potential.

Financiers were asked what decision factors influenced involvement in any type of project. Susanville and Klamath Falls financiers all mentioned return on investment and risk factors. These factors were also mentioned when asked about decision factors influencing geothermal financing. Primary decision factors were various forms of risk from technology related risks to environmental risks and the risk of loan non-payment. Return on investment was more of a stated concern in Klamath Falls than in Susanville; however, Susanville financiers expressed more interest in geothermal energy helping the economy of the area.

Local government had an all pervasive effect on financing in Susanville, but the local government was less important to Klamath Falls financiers. Awareness of

government regulations and programs was mixed. Highest awareness occurred for the Investment Tax Credit and the Geothermal Loan Guaranty Program among both Susanville and Klamath Falls financiers. Awareness was not as high for the Depletion Allowance and the Additional Energy Credit.

Susanville financiers' requirements for financing were much more reflective of government regulation requirements than were those of Klamath Falls financiers. However, the Susanville sample contained a large number of government respondents.

Current and potential financiers for Susanville are likely to be located outside of the community. This is not the case for Klamath Falls where local banks may be involved in financing. This is an artifact of the fact that development in Susanville is not done on a relatively small scale (done by individual users) as it may be in Klamath Falls. The development restrictions in Susanville which give the City authority over development may have influenced the potential sources of financing.

Regulators

All Klamath Falls regulators and all but one Susanville regulator said they were "very interested" in the further development of geothermal energy. However, the majority of all regulators considered themselves "somewhat knowledgeable."

Susanville regulators perceived more advantages and disadvantages to geothermal energy use than did Klamath Falls regulators. The most frequently mentioned advantages by Susanville regulators were: low cost, renewable, clean, domestic, disperse sources of energy, reduce dependence on oil and renewable. Except for the non-transportable nature of the resource, disadvantages mentioned by Susanville regulators were related to some type of pollution (water, air, etc.). Klamath Falls regulators mentioned pollution in water and stream and inconvenient locations most frequently as disadvantages of geothermal energy.

The factors influencing regulation and regulatory roles cited by the regulators were specific to the agencies that the respondent represented. These were determined by the policies and laws governing the specific agency.

Most respondents in both Susanville and Klamath Falls said that there were no legislative constraints on their regulatory role. Constraints mentioned for Susanville were: Porter-Cologne Act and the wording of the Clean Air Act. In Klamath Falls the constraints mentioned were the well log and drilling permit and the condition of critical ground water determinants. One Klamath Falls regulator said that the ten dollar permit to regulate waste disposal was an organizational constraint and two Susanville regulators said there were organizational constraints. These were The Basin Plan and the delegation of PSD decision-making authority to the regional administration and the enforcement division director. Klamath Falls respondents saw no other limitations to regulations, but two Susanville regulators did see the fact that there is Federal land and the Resource Conservation Service as further limitations on regulation.

Klamath Falls regulators tended to predict an increase in regulation in the area, although a minority saw an easing of regulations to encourage development. Susanville regulators, on the other hand, more frequently saw a relaxation of regulations in that area. There may be an increase in regulation in Klamath Falls due to concern about depletion of the resource and pollution. Use is not yet widespread in Susanville and development is under the auspices of the City such that these are not the topics of concern in Susanville that they are in Klamath Falls.

The majority of regulators in both Susanville and Klamath Falls said that they did or would cooperate with other agencies in performing their regulatory roles. Susanville regulators were asked about their evaluation of the management of geothermal development in Susanville. Seven had no response and the two who did said they were skeptical of City and County management or that there wasn't enough use of geothermal yet to manage it.

Promoters and Developers

Promoters and developers for both Susanville and Klamath Falls were aware of geothermal energy. All but one current promoter in Susanville who was "somewhat interested" were "very interested" in the development of geothermal energy. Klamath Falls respondents considered themselves to be slightly more knowledgeable about geothermal energy than did Susanville respondents and all but one Susanville respondent thought that the respective Cities were "very interested" in geothermal development.

Preference for geothermal energy as an energy source was high for both Klamath Falls and Susanville promoters and developers. All but four promoters and developers in Susanville ranked geothermal energy as their number one preference and only one Klamath Falls respondent did not rank geothermal energy as the first preference. Those not citing geothermal as the first preference ranked it second. Cost, availability and cleanliness were the reasons cited by respondents from both areas for their preference.

Susanville respondents mentioned more advantages and disadvantages to geothermal energy use than did Klamath Falls respondents. Susanville respondents most frequently mentioned low cost, renewability, cleanliness and availability as advantages of geothermal energy use. Klamath Falls respondents most frequently cited cost, availability, non-polluting, renewability and conservation of other energy sources as advantages. Disadvantages perceived by Klamath Falls promoters and developers were: initial costs, depletion, disposal problems, crossover and dry holes. Susanville respondents mentioned: pollution, remote location, costs, government restrictions, the speculative nature, depletion, low temperatures and large investors having control of the resource as disadvantages.

In Susanville over half of the respondents suggested that their involvement in geothermal energy development was derived from personal satisfaction resulting from providing an alternative energy source that would benefit the community. Other reasons for involvement were economic based and business related. Most Klamath Falls promoters and developers were involved for business reasons; however, nearly half also said that they felt they were breaking new ground,

helping conserve energy or that it was interesting work. Most promoters and developers expected the same type of return (profit margin) from geothermal energy development projects as from other development projects.

Costs and profitability were prime decision factors for promoters and developers in both Susanville and Klamath Falls. Other factors were those that would influence success such as availability and location.

Local government had a stronger influence on Susanville promoters and developers than it did on Klamath Falls promoters and developers. Outside of regulatory restrictions, most promoters and developers said that local government influence was "positive" in that it encouraged development.

Susanville promoters and developers were asked to compare the management of geothermal development in Susanville and Klamath Falls. Six respondents were aware of management in both areas and three volunteered opinions. One preferred Susanville's organization, one preferred the organization in Klamath Falls and another was essentially neutral.

Assessment of the Macro-Environment

Task Four involved assessment of the macro-environment for Susanville and Klamath Falls. Secondary data indicated that between these two sites, Klamath Falls has a much broader economic base, industrial development potential, skilled manpower and greater prospect for geothermal resource development than does Susanville.

The larger economic base of Klamath Falls, aided by the presence of U.S. installations is, no doubt, one of the principal reasons for Klamath Falls' superior potential for geothermal resource development. However, other factors contribute also, principally, a more diversified economy. As the result of this diversification, Klamath Falls has also a more experienced and skilled labor force.

Another factor which plays an important role is the presence of the Oregon Institute of Technology (OIT) in Klamath Falls. Not only the faculty and students add to the demand for local goods and services and therefore increase the local economy, but the presence of OIT also enhances the technical, scientific, business and management skill potential of Klamath Falls. Susanville, in contrast, does not currently have such an institute; however, Lassen Community is orienting toward this role and may, in the future, influence geothermal energy development in Susanville as OIT has done in Klamath Falls. Still another factor which contributes to the Klamath Falls economic base is the growing tourism and recreational sector, which is larger and more rapidly increasing than in Susanville. The availability of relatively large tracts of industrial land, fully served by utilities and transportation systems in Klamath Falls is still another factor which suggests that this area has better economic growth potential than does Susanville.

Finally, the aggressive policy of Klamath Falls to allow private developers to explore and exploit geothermal resources attracts considerably more interest to the use of geothermal resources. In Susanville, the ordinance giving the City auspices over development of the geothermal resource may

reduce the number of potential new industrial ventures entering the Susanville area in order to take advantage of this energy resource.

Local government and industry personnel in Klamath Falls and Susanville were surveyed about macro-economic conditions in these two areas. Respondents generally perceived economic conditions to be favorable for geothermal energy development in each of these areas. The political environment was generally seen as favorable for the development of geothermal energy in Klamath Falls. However, there is widespread concern over pollution and new drilling depleting the resource of existing wells and a movement in Klamath Falls to require re-injection, opposed by some. Respondents cited the availability of labor and transportation alternatives as favorable for industry re-location in Klamath Falls and the general attitude of all groups in both areas toward the attraction of industry is positive.

Local government officials were more positive than industry representatives toward economic conditions in Susanville and perceptions regarding the political, social and institutional conditions were mixed. Some question the organization of geothermal development in Susanville and the County is not perceived as taking as much of a lead in geothermal development as is the City. There are "mixed" public attitudes and friction between some City and County officials over geothermal energy development in Susanville.

A major regulatory issue among both local government and industry in Susanville is City Ordinance 79-605 which grants the City auspices over geothermal energy development. Other issues revolve around land use and the Park of Commerce that was denied development by LAFCO, a County Board.

The macro-environment in Susanville is not overwhelmingly conducive to the attraction of industry, although certainly not prohibitive. The relatively isolated location and hence, lack of transportation pose potentially major problems to development. There appears to be a generally favorable attitude toward development and attraction of industry to Susanville among local residents, although this is dependent upon the type of industry attracted. Many respondents preferred the attraction of light industry, such as electronics firms or greenhouse firms.

Assessment of Capabilities

The purpose of Task Five was to examine the infrastructure existing in Susanville and Klamath Falls. The infrastructure in Klamath Falls is potentially more conducive to development of geothermal energy than is the infrastructure in Susanville. However, in both areas the desired development can be accomplished.

Simply because of size and the widespread development already existing in Klamath Falls, Klamath Falls has a larger number of firms involved in industries related to the development of geothermal energy. The level of technical expertise and availability of local consultants is also higher in Klamath Falls than in Susanville.

Klamath Falls has a major asset: the Oregon Institute of Technology. The Oregon Institute of Technology has a Geo-Heat Center which disseminates information about geothermal energy development and which employs a number of experts in the area who are available as consultants.

Klamath Falls also has a relatively large number of drillers and persons involved in the development of geothermal energy. Development has been widespread in Klamath Falls for over fifty years and it is not yet widespread in Susanville. In addition, Susanville development centers around the DOE demonstration project and widespread use of the resource is also dependent upon this project. Thus, there is a relationship between the relative lack of local infrastructure for development in Susanville and the degree of current development. However, Susanville has a centralized City office for geothermal development and the promotion of that development which Klamath Falls does not. Geothermal development in Susanville revolves around the City and this is not the case in Klamath Falls.

Analysis of Decision Processes

Task Six involved an analysis of the decision processes for each of the six target study groups. Decision processes and factors considered are generally specific to the target study group; however, the decision processes may be considered under the halo of the hierarchy of effects model. This model is presented below:

All Susanville and Klamath Falls respondents had passed through the awareness and knowledge stages of the hierarchy of effects model. However, the stated degree of knowledge about geothermal energy is somewhat higher in Klamath Falls than in Susanville.

Stated interest in and preference for geothermal energy was also high for both Susanville and Klamath Falls. It is at the intention phase of the model that Susanville and Klamath Falls differ most sharply. Many Susanville respondents were ambivalent in their intentions, waiting for the availability of the geothermal resource. Implementation of intentions in Susanville is dependent upon performance by a third party (i.e., the delivery of a pipeline) whereas implementation of intentions in Klamath Falls is dependent upon the successful drilling for geothermal energy by the firm. The decision factors considered are, thus, somewhat different. The general rubric of costs and availability is applicable to both sites, but for Susanville availability means availability of the pipeline and for Klamath Falls it means "striking" the geothermal resource.

Expected and actual satisfaction is high for both Susanville and Klamath Falls respondents, but commitment is difficult to assess. Behavioral use of the resource does not necessarily imply attitudinal commitment. That is, a person using geothermal energy does not necessarily have a favorable attitude toward geothermal energy or a commitment to use of the resource. However, attitudes toward geothermal energy in Klamath Falls are extremely positive. In Susanville, attitudes appear to be more mixed. This may be because the use of the resource has not yet been shown to a considerable extent in Susanville. People seem to be "waiting" to see what geothermal energy can do. Thus, it may be speculated that among the general population in Klamath Falls commitment to

geothermal energy is stronger than is the case for Susanville. Again, this may simply reflect the stage of development at each site. And, local government in both areas appears to be committed to the development of geothermal energy.

The development decision process for both Susanville and Klamath Falls local government centers around the City Council. The City Council made the final decision in both areas on the DOE demonstration project. In both areas there was a City Council deliberation, some assessment of public attitudes, budget considerations and then implementation.

Industry at the site considers costs and availability. The decision-makers, as expected, are senior management. Both current and potential users have difficulty describing an actual set of decision steps implemented in a geothermal energy development decision, but tend to cite decision factors instead. In Klamath Falls the location of the resource is a factor whereas in Susanville it does not tend to be since the City will bring the resource to the user. Opinions of other users may also be considered in a geothermal use decision. Opinion leaders for both Susanville and Klamath Falls include the local government and current users.

Relocaters to Klamath Falls also were not able to describe an actual process by which a relocation decision would be made. However, among factors considered would be: labor availability, transportation availability, costs and a market for products.

These factors are going to vary by firm and industry in their nature and degree of importance. It appears that relocaters decide to relocate and then look for sites having the requirements of that particular firm or industry. The decision-maker or set of decision-makers then evaluates and weighs the decision factors. Also important may be the perception that an area would like to have the firm locate there.

Financiers decisions are strongly dominated by risk and return on investment. The major phases of this decision process are simply stated as:

- Feasibility analysis,
- Cost-benefit analysis, and
- Risk analysis.

Critical is the applicant's ability to repay the loan and the process seems to vary little depending on the type of financier. The project purpose, location, size and other parameters are important considerations.

Decision processes of regulators are strongly determined by the regulatory role of the agency. In general, the regulatory guidelines determine the process and the factors considered.

The decision factors used by promoters and developers are similar to those used by financiers. Risk and return on investment are important considerations. The degree to which the decision process is formalized and/or routine depends in large part on the size of the firm and the type of firm. Some drillers reported that they would attempt to drill the well as long as the client had the ability to pay. For larger developers the analysis is more similar to one that a financial firm would implement when evaluating a project.

In general, a municipality attempting to attract industry to their site must consider the attributes of the community and the needs of the firm or industry they are attempting to attract. "High cube" industries are likely targets for the use of geothermal energy. A community must be extremely familiar with the needs of the industry or firm before attempting to attract them. In a sense, someone must become an "expert" in that industry so as to know what decision factors are likely to be important. The same approach is applicable when attempting to encourage expansion of geothermal energy use within a community. It is necessary to know how geothermal energy can meet the needs of the firm.

Susanville and Klamath Falls are very different in their approaches to geothermal energy development. However, there is a proposed reservoir management ordinance in Klamath Falls and, if enacted, the City would have more control over resource development. The City of Klamath Falls does not currently control development to the extent that the City of Susanville does. Development centers around the City in the City of Susanville. Private development is encouraged in Klamath Falls but in Susanville the City is the primary supplier of the resource. Thus, in Susanville users are dependent upon the City's development and have a more "passive" attitude toward their own development of geothermal energy. The Susanville organization, however, does reduce the risk of development by providing more than a known resource to potential users having access to the pipeline. The City has taken the responsibility for making the resource accessible. Due to the proposed reservoir management ordinance, the City of Klamath Falls may be moving in the direction of the type of geothermal management that Susanville now has.

SECTION I

INTRODUCTION

The San Francisco Operations Office of the United States Department of Energy contracted with Market Facts, Inc. to conduct a study of attitudes toward commercial development of geothermal energy in Federal Region IX. As a result of recommendations made in Task One of the work plan, two sites were selected for case study analysis: Klamath Falls, Oregon and Susanville, California.

Klamath Falls and Susanville represent two diverse types of geothermal sites. Both areas currently have a DOE geothermal demonstration project and both have a history of geothermal usage for at least fifty years. However, the extent and treatment of geothermal usage differs significantly. The usage of geothermal energy is much more widespread and much less centralized in Klamath Falls than it is in Susanville. Residents and business have drilled wells and used the energy source for many years. The drilling and use of geothermal wells in Klamath Falls is so widespread that there is a growing concern that one neighbor's well may be depleting the resource in another neighbor's well. Thus, there is a call in Klamath Falls among some citizens that the drilling of wells be more restricted than it currently is.

The situation in Susanville contrasts sharply. The City tightly regulates and restricts the drilling of geothermal wells. Unlike Klamath Falls, the development of geothermal energy in Susanville centers around the DOE demonstration project and there is an office of geothermal development in Susanville which supervises and conducts geothermal drilling and development projects. Other than the geothermal well for the DOE project (and other proposed projects) there are only four other geothermal wells currently being used in Susanville. Three have been in existence for decades and one, currently used to heat the City swimming pool, has existed since the 1930's. At least two of the currently existing four wells were drilled for cold water purposes, but instead the geothermal resource was tapped.

Thus, Susanville is an area in which geothermal development is closely regulated and centralized. Klamath Falls is an area where there is little or no centralization of geothermal development. The contrast in the treatment of geothermal energy between these two areas provides an opportunity for case study analysis that may assist other municipalities in deciding which type of structure is most appropriate for their own development of geothermal resources.

Purpose of the Research

The overall objective of the work was to provide DOE with detailed information about the situation faced at sites such as Susanville, California and Klamath Falls, Oregon for geothermal direct use (non-electric). Two subobjectives were to provide DOE with measurements and analysis relevant to:

- Input to a "prospectus" that may be prepared by the municipality to interest industry in commercial development of geothermal energy at that site, and
- Information for DOE decisions and actions, e.g., management of DOE demonstration projects.

In order to do this, interviews were conducted with no more than nine respondents from each of the target study groups in Klamath Falls and Susanville. Some of the study groups contain subgroups; thus, there were a total of ten groups under investigation. The study groups and subgroups were:

- Local government
- Industry at the site
 - Current geothermal users
 - Potential geothermal users
- Relocaters to the site
 - Firms in the relocation decision process without a site decided
 - Firms in the relocation process with a site decided
- Financial community
 - Current financiers of geothermal development
 - Potential financiers of geothermal development
- Regulators
- Promoters and developers of geothermal energy
 - Current promoters and developers
 - Potential promoters and developers

Work Plan and Organization of the Draft Report

The work plan consisted of seven tasks which were interrelated and interdependent. Figure 1-1 delineates the seven tasks. Task One involved recommending two sites to DOE for study. The work accomplished for Task One is described in Section II of this report.

FIGURE I-1
PROJECT TASKS

Task Two was the development of a procedure and methodology for the semi-quantitative measurement of the attitudes of the six study groups concerned with the development of geothermal energy at the sites. Task Two, Methodology, is described in Section III of this report for both Susanville and Klamath Falls.

Task Three was concerned with the benchmark measurement of the attitudes of the six study groups. The results and discussion for the benchmark attitudinal measurement for Klamath Falls are contained in Sections IV through IX of this report. Section IV discusses the results of benchmark measurement for the local government of Klamath Falls, Section V discusses the results of benchmark measurement for industry located in Klamath Falls, Section VI discusses results of benchmark measurement for relocaters to Klamath Falls, Section VII discusses results for Klamath Falls' financiers, Section VIII discusses results for regulators of geothermal energy in Klamath Falls, and Section IX discusses results for promoters and developers of geothermal energy in Klamath Falls.

The results of Task Three for Susanville local government, industry at the site, financiers, regulators, and promoters and developers are reported in Sections XIII through XVII, respectively. No relocaters were surveyed for Susanville. It was not possible to obtain the names of firms in the relocation decision process to Susanville, because there are negotiations currently in process. The results for potential relocaters to Klamath Falls who have not yet decided on a site may also be applicable to potential relocaters to Susanville.

There were two aspects to Task Four, Assessment of the Macro-Environment. The first aspect of Task Four involved conducting a detailed review of the secondary data available at the sites to determine:

- Industry presently located at the sites,
- Geothermal resource characteristics,
- Demographic characteristics and trends,
- Socio-economic conditions and trends, and the
- Political, institutional and regulatory environment at the sites.

The second aspect of Task Four involved measuring the attitudes of a sample of local government and industry personnel at the sites to determine:

- Economic conditions, issues and outlook,
- Political, social and institutional conditions, issues and outlook,
- The regulatory environment and issues, and
- Conditions affecting the relocation of industry.

The overall objective of Task Four was to identify and define the macro-environmental conditions, changes, problems and opportunities which will influence industry's criteria for decisions regarding the use of geothermal energy, as well as local government's role as opinion leader, change agent, innovator, and regulator. The results of the work accomplished for Task Four are described in Section X for Klamath Falls and in Section XVIII for Susanville.

Task Five also had two aspects. The first was to measure a sample of promoters, developers and industrial service companies active at the sites to determine the infrastructure capabilities required by industry for geothermal plants and potentially available at the sites. The second aspect involved analyzing a sample of industry management in the area and defining their

requirements for plant retrofit and expansion at the sites. The results for Task Five, Assessment of Capabilities, is discussed in Section XI for Klamath Falls and in Section XIX for Susanville.

The purpose of Task Six, Decision Processes, was to identify and define processes used by the six study groups to analyze information in order to reach commitment and regulatory decisions that significantly impact on geothermal projects at the sites. The decision processes are described in Section XII for Klamath Falls and in Section XX for Susanville.

Throughout Sections XIII to XX, reporting Susanville data, comparisons are made between Klamath Falls and Susanville. However, Section XXI of this report provides an over-all comparison of the situation and data for Klamath Falls, Oregon and Susanville, California.

The final task, Task Seven, is the preparation of a final report. This report represents the accomplishment of Task Seven.

SECTION II

SITE RECOMMENDATION

The first task of this study was the identification and recommendation of geothermal sites suitable for measuring attitudes toward a DOE geothermal project. Market Facts' subcontracted Gruy Federal, Inc. to accomplish Task I. The charge was to recommend sites to DOE for case study analyses and DOE made the final site selection. This section describes the site selection recommendation process and recommendations. DOE chose Klamath Falls, Oregon and Susanville, California for study.

The majority of this section is excerpted from Gruy Federal's site recommendation report given to Market Facts. The report was current as of October, 1980.

Site Selection Criteria

The contract work statement lists three criteria which potential study sites should meet. These are as follows:

1. Substantial, established commercial development of geothermal energy.
2. Significant participation by local government as promoter, operator, or regulator.
3. Site of a current DOE geothermal project. The project should be in one of the following areas: resource assessment (e.g., production test wells), field experiment (such as a direct-use application plant), or the demonstration of electric power generation.

In addition to these criteria, it was desirable that the sites should be in or near Federal Region IX, composed of the States of Arizona, California, Nevada, and American Samoa (including Hawaii).

Data Sources

The initial phase of the site-identification task was a review of the status of geothermal electric power generation projects and direct-use applications that are in service or proposed. The principal data source for this review was the Geothermal Progress Monitor published quarterly by DOE's Division of Geothermal Energy. Additional site data were extracted from Gruy Federal's own files, the Transactions of the Geothermal Resources Council, U.S. Geological Survey Circular 790, and published summaries of DGE geothermal projects. Telephone interviews were also conducted with David Anderson, Geothermal Resources Council; Gene Culver, Oregon Institute of Technology; Eric Peterson, DOE/DGE; and Dr. Duncan Foley, University of Utah Research Institute.

Preliminary Site Selection

Ultimately, three geothermal sites were identified for detailed study in a preliminary selection process: El Centro/Imperial Valley and Susanville in California and Klamath Falls, Oregon. These three sites best meet the three selection criteria.

Geothermal areas considered in the initial screening are listed in Table 2-1. Included are most sites in or near Federal Region IX where geothermal exploration and development projects were underway as of October, 1980. Many of the sites do not meet the third criterion of being the site of a current DOE development project. Of those that do, several of the sites, e.g., Raft River, Idaho; Fenton Hill, New Mexico; and Coso Hot Spring, California, are federally managed projects and not appropriate for further study. Sites not meeting the third criterion at the time of this study were deleted from further consideration.

TABLE 2-1
GEOTHERMAL SITES CONSIDERED
IN INITIAL SCREENING

ARIZONA

DOUGLAS
SUPERIOR FARMS
TUCSON
WILLIAMS AFB

CALIFORNIA

AQUAFURS INT'L
BOSTON'S WARM SPRINGS
CALISOTGA
CAMINO DEL RAE
COSO
FT. BIDWELL
GEYSERS
IMPERIAL VALLEY
INDIAN RESERVATION
INDIAN VALLEY HS
KELLY HS
LITTLE HOT SPRINGS
MAMMOTH LAKES VILLAGE/
MAMMOTH LAKE
MECCA
MODOC
MONO LONG VALLEY
PASO ROBLES
RIVERSIDE
SUPRISE VALLEY
SUSANVILLE
WENDEL AMEDEE

HAWAII

PUNA

IDAHO

ADAMS
BANBURY'S HS
BAUMGARTNER HS
BEARDSLEY HS
BEAR LAKE HS

IDAHO

BLAINE
BOISE
BONNEVILLE HS
BRANDT'S HS
BRUNEAU
BUTTE CITY
CALDWELL
CAMAS
CAMAS HIGH SCHOOL
CAMPGROUND HS
CASSIA
CLARENDON HS
COOK'S
COROS D'ALESE
CORRAL
CROOK'S
CROUCH
CUSTER
DONLAY LODGE HS
DONNATA HS
EASLEY STORE &
PLUNGE
ELLSWORTH
FAIRFIELD
FARRAGUT ST. PRK.
GIVENS HS
GOODING
HAILEY
HAVEN LODGE HS
HEISE HS
HORSE CREEK
IDAHO FALLS
INDIAN SPRINGS
JACOBSON'S FEED LOT
KETCHUM
KIMBERLY
KIRKMAN HS
LAVA HS
MAGIC RES.
MALAC
MALAC HIGH SCHOOL
MIDDLE FORK LODGE
MIRACLE HS
NEW MEADOWS

IDAHO

OAKLEY HS
ONEIDA
OWYHEE
PARADISE HS
POWER
RAFT RIVER
REXBURG/MADISON
COUNTY
ROBINSON BAR
ROCKY MTN. RANCH
STANLEY
STARKEY'S HS
SUNBEAM HS
TERRACE LAKE
TWIN FALLS
TWIN FALLS BUHL
TWIN SPRINGS HS
WARM SPRINGS VILLAGE
WEISER HS
WHITE ARROW RANCH
WHITE LICK'S HS
ZIM'S RESORT

NEVADA

BEOWAWE
BRADY HS
CALIENTE
CALIENTE HS
CARSON CITY
CARSON HS
CRESENT VALLEY
DESERT PEAK
ELKO
FALLON
FALLON AIR STATION
HAWTHORNE
HOT SPRINGS ROAD
MINERAL HS
RENO
RUMBOLDT
S. OF GOLCONDA
STEAMBOAT HS

TABLE 2-1 (cont.)

NEVADA

TRUCKER MEADOWS
VALLEY'S HS
WABUSKA HS
WINNEMUCCA

NEW MEXICO

ALBUQUERQUE
ANIMAS VALLEY
APACHE TEJO HS
BURGETT FLORAL
DONA ANA
FAYWOOD HS
FENTON HILL
GILA HS
HIDAIGO
JEMEZ HS
LAS CRUCES
LOS ALTURAS
OJO CALIENTE SPRINGS
SAN ANTONIO HS
SILVER CITY
SOCORRO
TAOS
TRUTH OR CONSEQUENCES
VALLES CALDERA
WEST MESA

OREGON

BELKNAP HS
BITTER HS
BLUE MOUNTAIN HS
BRIENTENBUSH HS
HOT LAKE
HUNTER'S HS
KLAMATH FALLS
LAGRANDE
LAKEVIEW
MEDICAL HS
MODOC
MT. HOOD
RADION HS
SUMMER LAKE HS
TREASURE VALLEY
VALE/ONTARIO

UTAH

COVE FORT
CRYSTAL HS
HILL AFB
LAVERKIN HS
MARYVALE
MIDWAY HS
MONROE
NEWCASTLE
SARATOGA HS
UTAH HS

Table 2-2 presents the sites that meet the third criterion (an active DOE project) and their evaluation on the other two site selection criteria. Thus, sites on Table 2-2 received further evaluation and were the locations of direct-heat demonstration projects, electric generation demonstrations, DOE/DGE-funded reservoir production tests, or site specific studies performed by state-coupled resource assessment teams (e.g., Hill Air Force Base, Las Cruces, and Caliente) at the time of study.

Only two sites in Region IX -- Imperial Valley/El Centro area and Susanville -- meet the three contract criteria to a substantial degree. Three areas outside of Region IX -- Boise, Idaho; Klamath Falls, Oregon; and Monroe, Utah -- meet all three selection criteria. The Monroe area has not been a successful demonstration project to date, but attitudinal study in at least one of the remaining two areas appears justified because of their great importance as geothermal demonstration sites. Of the two, geothermal development and municipal involvement is significantly more advanced at Klamath Falls, and consequently, Klamath Falls was included with the two Region IX sites in the final site recommendation process.

Summary of Site Characteristics

Each of the three most suitable sites, Klamath Falls, Susanville and Imperial Valley have unique characteristics. These are described below.

Klamath Falls

Geothermal development at Klamath Falls, Oregon stands alone in the United States in terms of large-scale community involvement with geothermal resources. Upwards of 400 wells have been drilled to recover thermal energy from the earth, and approximately 500 structures use this energy for heating

TABLE 2-2

OTHER CRITERIA QUALIFICATIONS FOR
SITES WITH ACTIVE DOE PROJECTS

<u>State</u>	<u>Site</u>	<u>Significant local government participation¹</u>	<u>Substantial commercial development²</u>
CA	Imperial Valley	Yes	Yes
	Kelly Hot Spring	No	No
	Mecca	No	Yes
	Susanville	Yes	Yes
HI	Puna	No	Yes
ID	Boise	Yes	Yes
	Rexburg	Yes	No
NV	Caliente	Yes	No
	Elko	No	No
	Reno	No	Yes
NM	Las Cruces	No	No
	Valles Caldera	No	Yes
OR	Klamath Falls	Yes	Yes
UT	Crystal Hot Springs	No	No
	Monroe	Yes	Yes

¹Participation of city, town or county government as promoter, operator, or regulator.

²Substantial commercial development has been interpreted to include the length of time geothermal resources have been known at a site and the intensity of exploration/development efforts rather than the number of users or the amount of energy used.

or industrial purposes. The Oregon Institute of Technology, a Klamath Falls hospital, and almost all of the City's schools are heated geothermally. A laundry and a dairy use geothermal energy for space heating and in their commercial operations. Other uses include swimming pool heating and melting snow from pavements.

The geothermal resource at Klamath Falls appears to be associated with faults in a setting quite similar to the Basin and Range area where the majority of United States geothermal resources are located. Water at temperatures of 100° to 230°F is found in wells that are from 100 to 2000 feet deep. The resource area underlies a substantial portion of the city and extends to its north and south.

The City government of Klamath Falls is significantly involved with the continuing development of geothermal energy in the area. The City is the operator of a DOE-funded geothermal district-heating demonstration. The City's interest in geothermal is largely responsible for the passage of state statutes enabling the development of municipal district-heating programs. Local ordinances which expedite geothermal development within the City have been established, legislation providing tax incentives for geothermal operations has been approved, and a revolving loan fund has been established to provide funds for retrofit costs. A master plan has also been prepared to ensure that the orderly development of geothermal resources at Klamath Falls will continue.

Susanville

As the seat of Lassen County and with a population of 6,600 (1970 census), Susanville is the principal community of northeastern California. At least four geothermal wells are known to be in use in the area. They heat a swimming pool and a church and provide hot water for cleaning equipment. A fourth well is used to heat a flower boutique.

Susanville's geothermal resource is located beneath the southern section of the town, south of the Susan River. Recent drilling indicates there may be potential north of the river as well. The resource appears to be associated with Basin and Range-type faulting and leakage into near-surface reservoirs. The highest temperatures found in the area to date are about 180°F.

The local government in Susanville has been involved with geothermal development since the early 1970's, benefiting from studies carried out by consultants, the U.S. Bureau of Reclamation (now the Water and Power Resources Service), and Lawrence Berkeley Laboratory. These efforts culminated in a DOE-sponsored district-heating demonstration project.

Industrial users and financial activities are limited around Susanville because of the area's low population and distance to a major trade area. Reno, Nevada -- the closest large population center -- is about 90 miles from the town.

Potential geothermal users would likely have to be found among the current business and residential population. Major sources of employment are county, state, and federal organizations, particularly the U.S. Forest Service. Agriculture and lumber are the major established industries. Fir seedlings cultivation for reforestation is a possible new industry.

Imperial Valley

The geothermal resources of the Imperial Valley have not been utilized over as long a period as at Klamath Falls or Susanville. However, in the last ten years the money expended for geothermal development in the Imperial Valley exceeds that of any other area in the United States except

The Geysers*. Both direct-use and electric power generation projects are underway, so the area is well acquainted with the potential of geothermal technology.

El Centro is a city with a population of 25,600 located within Imperial County which has a population of 94,500. Originally, El Centro was a community that supplied farmers in the surrounding area with equipment, materials, services, and consumer goods. Now, El Centro and Imperial County have significant industry, as well as extensive farming.

Geothermal resources in the Imperial Valley are significant. Six areas within the valley have estimated reservoir temperatures of 320°F or greater. The Heber anomaly, about three miles south of El Centro, has an estimated temperature of 350°F. A DOE-sponsored electrical generation demonstration project has been funded at this anomaly. It is uncertain whether the temperature anomaly extends near enough to El Centro to be used for direct-use applications within the city.

Imperial Valley geothermal resources are atypical of most resources found in the western United States. The location of production zones for the majority of western geothermal systems appears to be strongly controlled by faulting. Imperial Valley resources occur in sedimentary reservoirs quite similar to oil and gas deposits, and faulting does not appear to dominate as the controlling mechanism.

The City of El Centro is currently the operator of a geothermal direct-use application demonstration. However, geothermal development in the area is more county than city-operated.

*Geothermal-powered electrical generating units at The Geysers, California are currently rated at 792 megawatts.

The resource potential of the Imperial Valley primarily underlies rural agricultural lands. Hence, the Imperial County government, rather than the municipal governments within the county, has been the leader in planning for, promoting, and regulating geothermal development. The Imperial County Irrigation District has also been closely involved with geothermal development because it controls much of the available water supply, has a substantial need for electricity, and must monitor the effect that geothermal developments might have on the extensive irrigation system in place in the valley.

Geothermal rights in the valley have largely been acquired by established geothermal exploration firms. Electrical generation will to a large extent be controlled by these firms and by the major southern California utilities -- San Diego Gas and Electric, and Southern California Edison. The 50-megawatt, binary-cycle, generating plant near Heber that was partially funded by DOE will be operated by San Diego Gas and Electric.

Burns and Roe, TRW, and Westec have performed geothermal direct-use feasibility studies with industrial clients in the area under DOE sponsorship. The fact that large companies are involved as both producers and potential users of geothermal energy in the area is important because it means that financial institutions will also have become familiar with geothermal operations through association with these firms.

Major industrial activities in the El Centro area include farming and produce storage, packing, and shipping. The area's principal industrial firms are Desert Seed (ships seeds worldwide), Holly Sugar (sugar, molasses), Valley Nitrogen (fertilizer), U.S. Gypsum (gypsum products), and Douthitt Steel (industrial products, oxygen and medical gases).

Although there has been no recent new industry in the area, the City of El Centro is developing a new industrial park which will almost certainly raise numerous issues that are relevant to a study of geothermal commercialization attitudes. In addition, neighboring industrial and financial institutions also will be aware of the opportunities geothermal resources provide and should therefore have the background necessary to respond to an attitude survey.

Site Evaluation

Evaluating two geothermal areas for a commercialization attitude survey from the three qualified candidates is a difficult task. Each of the three sites considered has unique characteristics that make it a desirable choice for study. No site clearly stands out when all the factors determining site suitability are considered.

The differences and similarities of the sites with regards to their possible inclusion in a survey are enumerated below.

1. When the regions -- as opposed to the municipalities themselves -- are considered, geothermal resources in Imperial Valley are significantly greater than at Klamath Falls. The smallest resource is in the Susanville area.
2. However, the likelihood of adequate resources being present for municipal use is greatest in Klamath Falls where significant utilization is already present. At Susanville, some municipal projects are in operation and the reservoir is known to exist beneath and in close proximity to the community. At El Centro (in the Imperial Valley), the best resource is several miles from the City. A low-temperature resource close to El Centro for direct-use applications has not yet been proven through drilling and may not be found.

3. Consequently, the resources at Klamath Falls and Susanville are better suited for involvement by municipal governments. Imperial County, rather than the City of El Centro, is the primary local government involved with the resource near El Centro.
4. Klamath Falls and Susanville are located above low-temperature geothermal resources useful only in direct-use applications. El Centro is near a high-temperature resource suitable for both direct-use and electrical generation.
5. Geothermal energy has been utilized longer in Klamath Falls and Susanville. However, the intensity of development in the Imperial Valley around El Centro during the last ten years eclipses the longer geothermal history at the other two sites.
6. The small size and relative remoteness of Susanville make it more typical of other geothermal areas in the west than either Klamath Falls or El Centro/Imperial Valley.
7. Imperial County has a large industrial-agricultural base so that potential users can readily relocate to El Centro to be near the resource. No such infrastructure exists at Susanville or Klamath Falls and industrial relocation to these sites would be more difficult.
8. The local financial community is most developed in El Centro and access to outside financial support is likely to be better than at the other sites because of the high visibility of the resource in the Imperial Valley.
9. Klamath Falls has the most comprehensive municipal regulatory structure relative to geothermal utilization. Imperial County has the greatest county involvement in regulation of geothermal development. State and Federal involvement should be similar at all three sites.

10. With respect to the first criterion -- substantial commercial development of geothermal energy -- El Centro does not have the current commercial users that Susanville and Klamath Falls have. However, "substantial" was interpreted as length of time geothermal energy was "known" at the site rather than the number of current users. In this regard, El Centro meets the first criterion as there has been established commercial development in the exploration stage since the early 1970's.

Recommendations: Klamath Falls and El Centro

It is recommended that Klamath Falls be included as one of the two sites in the attitude survey. We consider Klamath Falls to be clearly superior to Susanville, which in a best two out of three selection, makes it a finalist.

Klamath Falls and Susanville are quite similar in terms of their geothermal resources and types of industry. But Klamath Falls has far greater resource development potential, more community involvement, and a more varied industrial base. For these reasons we recommend Klamath Falls over Susanville, even though it is not in Region IX. In a rank ordering, Klamath Falls would be ranked as the number one candidate for study.

We also recommend El Centro/Imperial Valley over Susanville, although a choice between Susanville and El Centro/Imperial Valley is more difficult because of the great dissimilarity of the two sites. El Centro/Imperial Valley has considerably greater resource potential, a more varied and larger industrial-agricultural base, greater opportunity for intra-regional relocation and retrofit, the possibility of both electrical and direct-use geothermal applications, and the participation of both local and regional resource developers. Moreover, given the rationale for studying two sites -- to provide contrast and reduce the potential for

implications unique to a particular site -- El Centro offers a better contrast to Klamath Falls characteristics than does Susanville. It is for these reasons that we recommend El Centro as the second site for study. Thus, the rank ordered recommendation of suitable sites would be: Klamath Falls, El Centro/Imperial Valley and Susanville, respectively.

However, a strong case can also be made for including Susanville as the second study site. The resource is more closely tied to the municipality; geothermal development at El Centro/Imperial Valley is primarily on a county-wide basis. Moreover, the low-temperature resources found in areas such as Susanville may require more government support before widespread use is obtained than high-temperature resources such as those of the Imperial Valley.

To sum up, Klamath Falls and El Centro are recommended as the two study sites. But if strong municipal involvement in resource utilization is of primary concern, Susanville should replace El Centro.

Because of the varied nature of Susanville and Klamath Falls geothermal development DOE/SAN selected Susanville and Klamath Falls as case study sites. This DOE decision was further supported by the fact that there is more substantial commercial development in Susanville and Klamath Falls than in Imperial Valley/El Centro.

SECTION III METHODOLOGY

The general methodology used for Klamath Falls and Susanville was identical. However, based upon information obtained from Klamath Falls interviewing, the in-depth survey instruments were revised for the Susanville sample. Thus, while both sets of questionnaires addressed the objectives of the study, they were dissimilar.

There were four general phases to the methodology:

- Development of the in-depth survey instrument
- Sample identification and selection
- Interviewing
- Data analysis

The first two phases for both Klamath Falls and Susanville were conducted simultaneously and the last three phases were sequential. The survey instruments and the general methodology were approved by DOE (Task Two) prior to implementation of Task Three (Benchmark Measurement) which involved the administration of the questionnaire.

Development of the In-Depth Survey Instrument

Eleven separate survey instruments were developed--one for each of the six target study groups for Klamath Falls and one for each of the five Susanville target study groups (no relocaters were surveyed for Susanville). A copy of each of these in-depth survey instruments is included in the Appendix. Questions were asked differently and skip patterns were utilized

to provide for separate instruments (in-depth interview schedules) for the sub-study groups within the six target study groups. Thus, no more than nine people were administered the same in-depth survey instrument.

The questionnaires were designed to permit a rating of attitudes toward the development of geothermal energy by the six study groups in terms of needs, hierarchy of effects (awareness, knowledge, interest, preference, intentions and satisfaction) and commitments. Measurement validity and reliability were considered in developing the instruments and the methodology.

The questionnaires were developed to be unique to each of the target study groups; however, there were similarities across questionnaires. Questions relating to the hierarchy of effects and decision processes (Task Six) were included in each of the questionnaires. In addition, awareness was measured in two distinct manners. First, an unaided awareness question was asked which simply queried the respondent on what sources of energy came to mind. Interviewers did not mention any sources, but simply circled those mentioned by the respondent. If geothermal energy was not mentioned in Question 1, then an aided awareness question was asked, "Are you aware of geothermal energy?" (Question 2).

In addition, the questionnaires elicited information on decision factors or attributes and trade-offs among attributes. The factors were obtained from open-ended questions which do not force any respondent to answer according to any pre-determined categories. Trade-offs were elicited on a pair-wise basis for each attribute a particular respondent mentioned. Thus, trade-offs were specific to the set of attributes or factors mentioned by each respondent.

To provide further in-depth information, questions (such as length of time the respondent was familiar with geothermal) were added which go beyond the requirements of the contract. These are presented in results sections, but without in-depth discussion. They simply provide additional insight into the reactions and responses to geothermal energy. Further, some topics were addressed more than once in a slightly different question format to provide a form of test re-test reliability. Extensive probing was used throughout the in-depth interviews.

Inspection of the questionnaires in the Appendix will detail the nature of questions asked of each respondent. The next sections provide an overview of the general questionnaire content for each of the six study groups. The results section for each of the six study groups further describes the questions in the context of presenting the results of the data analysis.

Local Government

Local government officials were surveyed on the following topics:

- Awareness of geothermal and other energy sources,
- Knowledge, interest, preference and intentions regarding geothermal and other energy sources,
- Commitments to capital projects utilizing geothermal energy,
- Decision processes used to arrive at commitment,
- Attitudes concerning economic, political, social, institutional and regulatory conditions, issues and outlooks,
- Incentives and disincentives to the use of geothermal energy by industry and relocaters, and
- Future needs of the municipality.

As with all questionnaires for all groups, energy source preference was presented in a ranking format and many of the attitudinal questions were formatted according to a three-point scale.

Industry at the Site

The questionnaire for industry at the site was structured so that it was appropriate for both current and potential users of geothermal energy. Versioning was accomplished through skip patterns for current and potential users. Questions on the following topics were included.

- Future energy needs
- Energy costs
- Decision processes
- Factors and trade-offs among factors in the decision process
- Attitudes concerning economic, political, social, institutional and regulatory conditions, issues and outlooks
- Requirements for plant retrofit and expansion
- Hierarchy of effects
- Preferences among alternative energy sources
- Geothermal well characteristics of users
- Energy sources currently used
- Perceptions of the city's role in geothermal energy
- Information sources
- Advantages and disadvantages of geothermal energy
- Suggestions for attracting new industry to the area and use of geothermal energy

Relocaters to the Site

As with industry at the site, the survey instrument was designed to be appropriate for both relocaters in the decision process and relocaters who have made a decision to relocate at the site. Although specific questions varied for each subgroup, the general areas surveyed are delineated below.

- Role of alternative energy sources and the community in the relocation decision process
- Needs of the firm
- Attributes and barriers considered in relocation and trade-offs among decision factors
- Decision process and responsibility
- Information sources
- Suggestions for attracting new industry to the area and the use of geothermal energy
- Preferences among alternative energy sources
- Current energy usage
- Advantages and disadvantages of geothermal energy
- Hierarchy of effects

Financial Community

The financial community included current and potential financiers of geothermal energy. The questionnaire was structured so as to be appropriate for both groups. The following topics were included in the instrument:

- Financing objectives
- Hierarchy of effects for financing decisions
- Attributes and risks considered in the investment decision and the trade-offs among factors
- Preferences for alternative energy sources
- Advantages and disadvantages of geothermal energy
- Perceptions of specific programs regarding financing of geothermal energy

Promoters and Developers

The questionnaire was designed so as to be applicable to both current and potential promoters and developers. The following areas were surveyed.

- Needs and objectives
- Attributes, barriers and risks, and trade-offs among factors
- Hierarchy of effects
- Decision processes
- Advantages and disadvantages of geothermal energy
- Resources and skills required
- Conditions affecting plant retrofit, expansion and relocation

Regulators

The in-depth survey instrument for regulators was designed to focus on the following topic content areas.

- Responsibilities of the regulatory agency as relevant to the site

- Hierarchy of effects
- Attributes and risks considered in the decision process and trade-off among factors
- Relevant legislative and organizational constraints and limitations affecting decisions and/or actions regarding the project and the site
- Advantages and disadvantages of geothermal usage
- Future trends in the regulation of geothermal energy

Sample Identification and Selection

A variety of sources were used to identify potential respondents. Market Facts' Project Director, Dr. Linda L. Golden, visited both Susanville and Klamath Falls and conducted personal interviews with representatives from industry and local government, as well as other citizens of the area. In addition, secondary sources, sub-contractors, consultants and other experts assisted in sample identification. The process of sample identification was identical for both Susanville and Klamath Falls. Within firms or agencies the person who would be the decision-maker or have a strong influence on energy use decisions (e.g., the President or owner) was the person targeted for interview.

For all individuals identified as potential respondents for both Susanville and Klamath Falls, a letter was sent introducing the study and Market Facts. The letter identified the study as being sponsored by the Department of Energy and as surveying individuals about alternative forms of energy and energy use. No mention was made of geothermal energy in the

letter so as not to bias the awareness questions of the in-depth interview. This letter told the individual that they would be contacted by telephone. Market Facts' field representative contacted each potential respondent to arrange for an interview. Each person who agreed to be interviewed received a confirmation call the day prior to the interview time. Specific details for the Klamath Falls and Susanville samples are described below.

Klamath Falls

In Klamath Falls there are a large number of firms using geothermal energy for direct heat purposes. Thus, there were many firms that fell into the category of "industry at the site--current users". While it is necessary to preserve the anonymity of the sample frame and the sample, eighteen firms were identified as potential respondents in this category. These eighteen were chosen so as to represent a variety of types of firms or institutions and a variety of types of uses for geothermal energy where possible. These same criteria were applied in the selection of potential users at the site and eighteen firms were identified as potential users.

There were nine firms or individuals identified who were currently involved in geothermal financing. These included banks, private financiers, insurance companies, the Small Business Administration and the Department of Energy. There were also nine entities identified as potential financiers. These included banks, savings and loans, mortgage companies, private individuals and the Federal Housing Administration.

Klamath Falls has a variety of promoters and developers involved in geothermal energy. Some of these people are also financiers; however, no individual was interviewed for two target study groups. Although there was over-lap between appropriate study group assignments for some respondents (e.g., users also being promoters and developers), people were assigned to the study groups for which they had the most involvement. Eighteen currently active promoters and developers were identified. These included private individuals and firms who had developed geothermal energy resources, and engineering and drilling firms. Twelve potentially active promoters and developers were identified. These fell in the same general categories as did currently active promoters and developers.

Seven regulators were identified. The individuals selected for interview represented the Department of Energy, Department of Geology, Department of Environmental Quality (Air Quality), Department of Environmental Quality (Water Quality), Department of Water Resources, Division of State Lands and a local building official.

Nine local government officials of Klamath Falls were identified for interview. These included top level city officials and judges. The sample frame was composed of individuals who could have some degree of involvement in matters relating to geothermal energy in Klamath Falls.

Relocaters to the site were the most difficult to identify. These firms varied vastly in size from very small firms to very large national firms. It should be noted that some of these firms were not relocaters in the sense that they were moving their offices, but were, instead expanding their facilities (i.e., branch "offices" or plants) to a site in Klamath Falls. Types of firms represented in the sample frame of potential relocaters who have made a decision to relocate but

who have not yet relocated were: electronics firms, an industrial park, a vegetable drying firm, and a mobile home firm. Six firms were identified as being in a relocation decision process but who had not yet decided on a site. One was a greenhouse operation, one was in the wood products industry, one was a real estate firm, another was in the field of aquaculture and two were actually potential developers and financiers (being interested in developing the resource and land for rent or resale).

Susanville

Unlike Klamath Falls, Susanville has a small number of current users -- four. The usage of geothermal by these users are for a tomato greenhouse, the City swimming pool, a church and a flower boutique. All four current users were included in the sample frame.

Potential users in Susanville are many. Highest potential users are located in the area of direct access to the City's DOE project pipeline -- along Main Street from Grand to McDow. Twenty-one firms or institutions were identified for the potential user sample frame. Some were government or local institutions and other were businesses. The twenty-one were chosen to represent a variety of types of firms and extent of usage of geothermal energy.

Three current financiers and five potential financiers were identified and included in the sample frame. Represented were: government agencies, banks and a stock brokerage firm.

Eight current promoters and developers were included in the sample frame. Large development corporations, drillers and the Chamber of Commerce are currently involved in Susanville promotion and/or development of geothermal energy. Some government representatives could also be considered promoters or developers, but were included in the local government sample.

Five potential promoters and developers were identified for survey. These firms have characteristics and potential similar to current promoters and developers (e.g., engineering, drilling, promotional involvement through planning, etc.), but some of the firms were smaller than those currently involved in Susanville promotion and development.

Nine regulators were identified for the Susanville regulator sample frame. The individuals represented the Department of Energy, the Environmental Protection Agency, the Solid Waste Management Board, the State Air Resources Board, the Department of Water Resources, the California Regional Water Quality Control Board, the Air Pollution Control District, the Division of Oil and Gas and the City Planning Commission.

Ten local government officials of Susanville were identified for interview. These included top level City officials who would have involvement in matters influencing geothermal energy use in Susanville.

Relocaters were the most difficult group to identify. There is one firm who has decided to locate to Susanville (and use geothermal energy); however, because negotiations are currently in process, it was not possible to interview a representative of this firm. In addition, there are several firms investigating relocation to Susanville that have not yet decided on a site. The names of these firms were not made known to Market Facts. Thus, no relocaters were included in the sample frame for Susanville.

Interviewing

While the interviewing process used for Klamath Falls and Susanville were similar, there were specifics to each site. These are described below along with the resultant sample for each site.

Klamath Falls

Interviewing in Klamath Falls took place during the last two weeks of January, 1981. An interviewing team was sent to Klamath Falls and remained there until interviewing was completed in that area. Interviewers were also sent to Salem, Medford, Eugene and Portland. All interviewing of respondents in the State of Oregon was done by personal interviewing. Fifteen respondents lived outside the State of Oregon. These persons were either relocators or financiers. Interviews with respondents outside the State of Oregon were conducted by telephone. No more than nine respondents were administered the same survey instrument.

As would be expected, not all potential respondents were interviewed. In fact, agreement to an interview was quite high; however, several respondents were forced to cancel their interview at the last moment due to illness or a change in travel plans. The final sample size for each study group is presented below.

- Industry at the site
 - Current users--Nine current users were included in the sample.
 - Potential users--Seven potential users were included in the sample.
- Local Government--Seven of the nine local government officials identified for interview were included in the final sample. The two who were not interviewed agreed to be interviewed, but one cancelled due to a change in travel plans and another cancelled because of illness.
- Regulators--Six of the seven regulators identified were interviewed. Since one of the seven regulators was also applicable to the Susanville site (a DOE representative) this individual will be interviewed during Susanville interviewing in California and included in that sample.

- Relocaters--Relocaters were interviewed by telephone. This was the study group with the lowest propensity to cooperate. The final sample consisted of three firms who indicated that they were in the relocation decision process and had decided on a site. Although Market Facts obtained information to the contrary, five other firms who agreed to be in the sample said they were not in the decision process to relocate. The responses of these five firms are so identified and included in the results of this study group.
- Financiers--Many of the respondents in this group were interviewed by telephone, since they lived outside of the State of Oregon. As with the relocaters, the cooperation rate was lower for the telephone interviews than for the personal interviews. Much of this, however, is due to the nature of the samples.
 - Current Financiers--There were four current financiers who were interviewed and included in the final sample. Individuals in this category were reluctant to take the time for an hour interview over the telephone or had extensive travel schedules.
 - Potential Financiers--Seven of the nine potential financiers identified were included in the final sample.
- Promoters and Developers
 - Current Promoters and Developers--There were nine firms interviewed for this target study group.
 - Potential Promoters and Developers--Nine respondents were interviewed in this category.

Sections IV through IX provide additional information on the respondents for each of the Klamath Falls target study groups. In general, there was a very high cooperation rate for respondents living in Klamath Falls and Oregon. Interviews lasted approximately one hour and there were no terminations during the interviewing process. The longest interview lasted one and one-half hour and the shortest forty-five minutes. Respondents were generally most cooperative, but some were reluctant to provide too much detail in some areas.

Susanville

Interviewing took place in Susanville during the last week in February and first week of March, 1981. Unlike Klamath Falls, all respondents for Susanville were personally interviewed, as all lived within the State. Interviewing teams were sent to Susanville, Sacramento, San Francisco and all other California areas where respondents were located.

As was true with Klamath Falls, cooperation rates were high. The final sample size for each study group is presented below.

- Industry at the site
 - Current users -- All four current users were included in the sample.
 - Potential users -- Nine potential users were included in the sample.
- Local Government -- Nine local government officials were interviewed.
- Regulators -- Nine regulators were included in the sample.
- Financiers
 - Current financiers -- All three current financiers identified were interviewed.
 - Potential Financiers -- Cooperation and response rates were not as high for this group as for others. Two of the five potential financiers identified were interviewed.
- Promoters and Developers
 - Current promoters and developers -- Seven of the eight current promoters and developers in the sample frame were interviewed.
 - Potential promoters and developers -- Four of the five potential promoters and developers in the sample frame were interviewed.
- Relocaters -- As previously stated, no relocaters were interviewed for the Susanville site, because none were included in the sampling frame.

Sections XIII through XVII provide additional information on the Susanville respondents. In general, the cooperation rate was high. Interviews lasted approximately one hour and respondents were cooperative.

Data Analysis

Data analysis procedures were identical for both Susanville and Klamath Falls. Thus, this discussion is applicable to both sites.

The data were tabulated for each question for each respondent according to respondent target study subgroup. Since the questionnaire consisted of a large number of open-ended questions (see Appendix) responses to open-ended questions were categorized for tabulation. Means within target study subgroups were computed for scaler questions. Comparisons were made across respondents within any target study subgroup and across current and potential (subgroup) categories where appropriate.

Sections IV through IX present the results of these analyses within study group. Section XII of this report presents the results of the decision process analysis within and across study groups.

SECTION IV

RESULTS OF BENCHMARK MEASUREMENT FOR LOCAL GOVERNMENT PERSONNEL IN KLAMATH FALLS

There were seven representatives of local government surveyed. These represented County officials, administrators of the City government and judges. All persons interviewed were "top level" local government officials.

This section describes the results of questions related to general attitudes toward energy sources (specifically, geothermal), factors related to these attitudes and perceptions of the DOE geothermal project in Klamath Falls. Some of the information herein is related to decision processes and will be discussed further in Section XII. The questionnaire administered to local government officials is included in the Appendix.

Awareness, Knowledge and Interest Regarding Geothermal Energy

Not surprisingly, all local government respondents were aware of geothermal as a potential source of energy. As indicated in Table 4-1, all seven government respondents mentioned "geothermal" in response to an unaided question that asked energy sources that immediately come to mind (Question 1). "Solar" and "water" were also mentioned frequently as potential energy sources.

When asked what had prompted their initial awareness of geothermal (Question 3), most respondents said that the existence of geothermal energy in the area had first made them aware of the energy source. Only one respondent, a mining engineer, had first learned of geothermal in college classes. All respondents had known about geothermal energy for at least five years, with one respondent claiming he had known about it all of his life. These results are presented in Table 4-1.

TABLE 4-1

LOCAL GOVERNMENT: AWARENESS OF GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
1	Energy sources that come to mind	
	Solar	6
	Water	7
	Geothermal	7
	Petroleum	4
	Wind	4
	Nuclear	2
	Biomass	-
	Coal	2
	Other	5
2	Aware of geothermal if not mentioned for Question 1	N/A
3	How first aware?	
	When first moved to town	4
	Live in geothermal area	2
	In engineering school	1
4	Number of years ago first aware	
	Forty or more	1
	30 - 39	2
	20 - 29	2
	10 - 19	1
	Less than 10	1
	Average = 27.07	

As described in the summary table below, most government respondents felt they were "somewhat" knowledgeable about geothermal energy. Only one respondent regarded himself as "very" knowledgeable.

<u>How Knowledgeable</u>	<u>Number Responding</u>
Very	1
Somewhat	6
Not very	-

Table 4-2 displays responses regarding interest in further geothermal development in the Klamath Falls area. Government respondents appear to be enthusiastic advocates of further development and use, with all seven claiming to be "very interested" (Question 8). The most frequently cited reason for their high level of interest was the immediate need for alternative energy sources (Question 9). In addition, one-half of the respondents mentioned the low cost of geothermal and one-half mentioned its local availability.

Government respondents also perceived the City of Klamath Falls itself as "very interested" in further geothermal use and development. Usually, the relatively "low cost" of geothermal was cited as a reason for the City's interest. Three respondents also mentioned geothermal's local availability and three mentioned the City's extant funding for geothermal development (Question 11).

Preference for Energy Sources

Table 4-3 describes preference patterns for various energy sources. Geothermal emerged as the overall favorite with six of the seven government respondents ranking it as their number one energy source preference (Question 13). Solar and water also ranked high while petroleum, nuclear and coal were generally viewed as undesirable sources of energy.

TABLE 4-2

LOCAL GOVERNMENT: INTEREST IN GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
8	Interest in further development and use in Klamath Falls	
	Very	7
	Somewhat	-
	Uninterested	-
9	Why... (very interested)?	
	Alternative source/gas is scarce/ save other energy sources	5
	Cost/less expensive	3
	Availability/potential in area	3
	Aid economy/bring in industry	2
	Non polluting	1
	My job on line	1
10	Interest of City of Klamath Falls	
	Very	7
	Somewhat	-
	Uninterested	-
11	Why City... (very interested)?	
	Cost/dollar savings	5
	Availability/our history/ geothermal already being used	3
	City is funded for development/ have committed dollars in experimental projects/ DOE contract	3
	It's an alternative energy source	1
	Will bring in more industry	1
	Less polluting	1

LOCAL GOVERNMENT: PREFERENCE FOR ENERGY SOURCES

IV-5

TABLE 4-3 (cont.)

LOCAL GOVERNMENT: PREFERENCE FOR ENERGY SOURCES

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
15	Why least prefer:	
	Foreign dependence/opposed to OPEC (petroleum)	1
	Erratic fluctuations in economy (petroleum)	1
	Air pollution (coal)	2
	Transportation problems (coal)	1
	Public fear/potential for accidents/sabotage (nuclear)	2
	Health hazards (nuclear)	1
	Waste storage problems (nuclear)	1
	Expensive (nuclear)	1
	No technology for mass production (wind)	1
16	Why geothermal...Sixth choice	
	Not hot enough to generate electricity	<div style="display: inline-block; border: 1px solid black; padding: 2px; text-align: center;">1</div> <div style="display: inline-block; border: 1px solid black; padding: 2px; text-align: center;">1</div>
	Need to further investigate extent and availability	
		Two reasons given by one respondent

When asked why they preferred geothermal (Question 14), most respondents mentioned its availability and clean, non-polluting features. Low cost, easy access, and efficiency were also frequently cited as reasons for geothermal preference. In addition, lack of maintenance, availability, knowledge and freedom from oil company ownership were mentioned by one respondent each. The single respondent who had ranked petroleum as his most preferred energy source, simply explained "...everything is currently geared this way".

Respondents offered a broad array of reasons for why they least preferred certain energy sources (Question 15). Opponents of petroleum (n = 2) mentioned the problem of foreign dependence and oil's erratic impact on the economy. Respondents who had least preferred coal (n = 2) cited pollution and transportation problems. Respondents opposed to nuclear (n = 2) claimed that health hazards, high cost, public fear of accidents and sabotage and waste storage problems were all reasons that nuclear energy should not be used. One government respondent had ranked wind as his least preferred energy source, mentioning that there was currently "no technology for mass production".

The single respondent who had not selected geothermal as his most preferred energy source had ranked it sixth. He commented that further research on geothermal's availability and extent was needed. He also said that geothermal energy was not hot enough to generate electricity.

Perceived Advantages and Disadvantages of Geothermal Energy

Table 4-4 displays respondent comments regarding the relevant advantages and disadvantages of geothermal energy. Given the broad popularity of geothermal among government respondents, it is not surprising that the number and type of perceived advantages far outweighed the perceived disadvantages.

TABLE 4-4

LOCAL GOVERNMENT: PERCEIVED ADVANTAGES AND
DISADVANTAGES OF GEOTHERMAL ENERGY USE

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
41	Perceived advantages of geothermal use:	
	Clean/non-polluting	5
	Low cost/savings	4
	Appears inexhaustible/renewable	3
	Very little upkeep after system set-up	2
	Availability	1
	Helps balance of trade by reducing need for importing high price crude	1
	Not dependent on power lines	1
	To heat and supply energy for greenhouses	1
42	Perceived disadvantages of geothermal use:	
	Potential depletion	1
	Difficulty in successfully identifying resource sites	1
	Waste products can cause thermo-pollution	1
	Unknown source is sometimes corrosive	1
	Causes heat environment in storm system which promotes biotic growth/possibly kill fish	1
	Steam and vapor cause visibility problem for city driving	1
	None	2

The most frequently mentioned advantages of geothermal (Question 41) included its "clean, non-polluting" aspects and its relatively "low cost". Each of these two advantages was volunteered by over half of the seven government respondents. In addition, three of the seven respondents mentioned the "renewability" of geothermal as a major advantage and two cited the "low maintenance" requirements of an installed system. Additional miscellaneous advantages included geothermal's availability, independence of power lines, balance of trade effects, and its use for greenhouses.

The perceived disadvantages were few in number. Two of the government respondents claimed there were absolutely no disadvantages associated with geothermal. One respondent mentioned the possibility of eventual depletion, while another argued that it was often difficult to successfully identify appropriate geothermal sites. Several others mentioned possible environmental hazards, like thermo-pollution caused by water waste products, fish-killing, biotic growth promoted by the system's heat environment, and driver visibility problems caused by associated steam and vapor. One respondent also claimed that the system's water could be corrosive. By and large, however, government respondents were highly positive about geothermal, citing many more advantages than disadvantages.

Use and Potential Use of Geothermal Energy in Klamath Falls

As was expected, government respondents were well-informed regarding uses of geothermal by local government (see Table 4-5). All confirmed that the City did, in point of fact, use geothermal energy (Question 12b). In describing how the energy was used (Question 12c), the majority of respondents (5) mentioned the heating of public buildings. In addition, three respondents described the de-icing of public roads. One respondent claimed that geothermal was used for air-conditioning in public buildings.

TABLE 4-5

LOCAL GOVERNMENT: KNOWLEDGE OF THE USE AND POTENTIAL
USE OF GEOTHERMAL ENERGY IN KLAMATH FALLS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
12b.	Does City/County currently use geothermal?	
	Yes	7
	No	-
12c.	What used for?	
	Space heating/heat public and county buildings	5
	De-ice roads/keep State Highway frost free/Road Dept. has a well	3
	Air conditioning of public buildings	1
12d.	Where used?	
	County/City buildings	5
	County museum/museum	4
	College/campus	4
	Nursing homes	3
	Streets/State highway/Esplanade St.	3
	Hospitals	2
	Juvenile Home	2
	Schools/County schools	2
	County road shops	1
	Health Dept.	1
	Mental Health Center	1
	Homes	1
12e.	How long been used?	
	Years and years	1
	Many, many years	1
	30 years	2
	20 years	1
	10 years	1
	8 years	1

Average number of years = 19.6 years

TABLE 4-5 (cont.)

LOCAL GOVERNMENT: KNOWLEDGE OF THE USE AND POTENTIAL
USE OF GEOTHERMAL ENERGY IN KLAMATH FALLS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
12a.	Klamath Falls activities to promote further geothermal development and use:	
	Encourage private development	2
	Monitoring for private homes for space heating	2
	Developing areas with intent to heat whole City/pilot project of 1600 homes & downtown and county buildings	2
	Determine methods of use	2
	Offer tax relief	1
	Encourage non-profit economic development	1
	Drilled a well for City building and plan to sell excess	1
	Determining capability of existing wells	1
	Moving carefully until we realize future problems	1

In explaining where geothermal energy was used (Question 12d), government respondents volunteered a surprisingly broad array of different public places. The majority generically mentioned "county or city buildings". In addition, over half (4) mentioned the museum and over half mentioned the local college. Several respondents indicated that nursing homes, city streets, hospitals, the Juvenile Home and schools were heated by geothermal energy.

Respondents averaged 19.6 years in their estimate of the length of time the Klamath Falls government had been using geothermal energy (Question 12e). Individual responses ranged from 8 to 30 years. Two respondents simply offered non-numerical answers of "many, many years" or "years and years".

In addition to awareness of local government's use of geothermal, respondents were also somewhat knowledgeable regarding commercial uses of geothermal in Klamath Falls. The tabulation below summarizes respondents perceptions of current and potential uses of geothermal in the area (Questions 6 and 7).

<u>Use</u>	<u>Current Users</u>	<u>Potential Users</u>
Space heating	7	7
Direct process	3	3
Generation of electricity	-	-
Other	2	-

Respondents unanimously agreed that space heating was and would continue to be an important use of geothermal. In addition, three respondents mentioned that direct process heat, or industrial heating, (e.g., in the creamery) was a current geothermal use. Two respondents offered such miscellaneous current uses as "snow removal" and "raising shrimp". Somewhat inexplicably, more current uses than potential uses were given by respondents, perhaps more a function of question sequencing than anything else. No respondent felt that geothermal would be used to generate electricity, either now or in the future.

Comments concerning what the County was doing to promote geothermal use were diversified across local government respondents (see Question 12a on Table 4-5). The encouragement of private development, existence of pilot projects and the exploration of the appropriate methods of use were among the more frequently mentioned activities.

Current Energy Uses and Needs

Respondents acknowledged that the local government currently used a variety of different energy sources. As described in Table 4-6, all respondents mentioned the use of petroleum, six mentioned geothermal and four each mentioned water and natural gas.

In general, the energy sources were reported to have different uses: petroleum was used for heating, to fuel automobiles, and for electricity; water was used exclusively to generate electricity; geothermal was used for space heating; and natural gas was used for space and hot water heating. Except for a few rare instances, respondents claimed to be "very satisfied" with the way Klamath Falls was using its energy sources.

TABLE 4-6

LOCAL GOVERNMENT: CURRENT ENERGY USES AND NEEDS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
17	<u>Energy Sources Used by Local Government</u>	
	Solar	1
	Water	4
	Geothermal	6
	Petroleum	7
	Biomass (wood)	2
	Coal	1
	Other (e.g., natural gas, electricity)	6

	<u>Number Responding</u>		<u>Number Responding</u>
18	Uses of Energy source...	Satisfaction With Use...	
	Solar for hot water on forage dryer	Dissatisfied	1
	Water for electricity	Very Satisfied	4
	Geothermal for space heating	Very Satisfied	5
	Petroleum for heating	Very Somewhat Dissatisfied	1 1 1
	Petroleum for transportation	Very Somewhat	3 1
	Petroleum for electricity	Very	1
	Biomass for heating airport	--	-
	Biomass for heating	Somewhat	1
	Coal for space heating and electricity	Very	1
	Natural gas for space heating	Very Somewhat No Response	1 1 1
	Natural gas for hot water heating	Very	1
	Electricity for building heat	Somewhat	1
	Electricity for lights	Don't know	1

Potential Energy Use Changes and Future Needs

Table 4-7 describes future energy projections and needs reported by local government respondents. Four of the seven respondents predicted changes in the energy source used by local government (Question 20a). All four expected an increased reliance on geothermal (Question 20b) although one respondent also felt that methane conversion and hydroelectric use would increase.

When asked to describe the future energy needs of Klamath Falls, (Question 43) most respondents replied, naturally enough, that more energy would be needed. Five respondents offered general comments, like more energy was needed to keep up with population growth, to attract industry and to simply expand. One respondent felt that wood, as an energy source, would become a critical need. Another cited agricultural needs for energy -- to provide better crops and frost protection. Another respondent mentioned the need for a good geothermal pumping technique while another respondent mentioned automobile energy consumption.

Over and above the DOE project and existing geothermal projects, roughly half (3) of the respondents knew of plans for other geothermal projects (Question 39), but there was no general consensus on just what those plans were (Question 40). One respondent, for example, mentioned a snow removal project, a second spoke of a low-income heating project, while a final respondent discussed three separate agricultural projects.

Knowledge, Awareness and Attitude Regarding DOE Project

Table 4-8 displays comments germane to the DOE project. Five of the seven respondents claimed to be aware of the City's commitment to capital projects for developing geothermal energy (Question 21). When asked to describe the project (Question 22), all five

TABLE 4-7

LOCAL GOVERNMENT: PROJECTED ENERGY USE CHANGES AND FUTURE NEEDS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
20a.	Are changes planned in sources of energy?	
	Yes	4
	No	2
	Don't know	1
20b.	What changes?	
	Expand geothermal use/dig more wells/switch from natural gas to geothermal	4
	Expand hydroelectric	1
	Convert more methane to natural gas	1
43	Future energy needs	
	Need additional energy for growing population/to attract industry/to expand	5
	To operate cars	1
	Greater dependency on wood	1
	For agriculture; grow better crops	
	frost protection	1
	Pumping technique for geothermal	1
39	Plans for future geothermal projects	
	Yes	3
	No	3
	Don't know	1
40	What plans?	
	Natural hot springs on agricultural lands	1
	Develop a greenhouse for foodstuffs	1
	OIT commercial venture for shrimp-raising	1
	Snow removal	1
	Heating projects in low income areas	1

TABLE 4-8

LOCAL GOVERNMENT: KNOWLEDGE, AWARENESS AND ATTITUDE
REGARDING DOE PROJECT

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
21	City commitment?	
	Yes	5
	No	1
	Don't know	1
22	Project description	
	R1: Exploring wells with reinjection feature	
	R2: \$2M renting project	
	R3: Cooperative effort to heat all city & county buildings with eventual hook-up to homes	
	R4: Heat county buildings	
	R5: Heat 14 government buildings	
23a	Opinion of project	
	Excellent	2
	Very good	1
	Worthwhile	1
	Wonderful	1
23b	Should city/county be involved?	
	Yes	5
	No	-
24	Why did city get involved?	
	Savings element of low cost heat	2
	As a geothermal demonstration/private investors were unwilling without knowledge	2
	Felt responsible for developing an available resource	1

zeroed in on the DOE project, variously depicting it as a "cooperative effort to heat public buildings," "exploratory wells with reinjection features," or a "two million dollar heating project". In addition, two respondents mentioned extraneous projects that involved "alcohol production" or "roadshop heating". Comments on these projects have been excluded from further analysis. Opinions of the DOE project were extremely positive (Question 23a) with comments ranging from "worthwhile" to "very good", "excellent," and "wonderful".

Among respondents aware of the geothermal project, all five felt that the City should be involved (Question 23b). When asked what had prompted the City's involvement, respondents supplied a variety of different motivating factors. Two mentioned the City's interest in the cost savings of geothermal heat. Two others indicated the City had undertaken the project as a demonstration of geothermal's potential, a risk that private investors were as yet unwilling to undertake. One final respondent felt the City's motives were somewhat altruistic in that it "felt responsible for developing an available resource".

There was no respondent unanimity in how the project was being funded. Table 4-9 displays perceived dollar allocation and sources of funding, separately for each respondent.

In terms of overall dollar allocation, perceived totals ranged from a low of \$120,000 to a high of \$2,000,000. While respondents generally recognized that government funds, predominantly federal funds, were being used for the project, they were not in agreement as to the specific agency. One respondent claimed that a government grant supplied total project funding, while another thought that the sum total came from federal revenue sharing. Two respondents thought the cost of funding was divided among Federal, State, County and City governments, with the Federal government supplying half the needed dollars. Thus, some of the efforts of DOE are not being recognized by, at least, local government officials. However, some

TABLE 4-9

LOCAL GOVERNMENT: FUNDS AND FUNDING SOURCES FOR DOE PROJECT

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>			
25	Dollar Allocation to Project				
	\$2M				1
	\$1M				1
	\$155K				1
	\$120K				1
	Don't know				1
26	Source of Funds and Percent Contribution	<u>R1</u> %	<u>R2</u> %	<u>R3</u> %	<u>R4</u> %
	DOE State	2.5			
	DOE Federal	50			
	Federal agencies	10			
	Klamath County	7.5			
	City of Klamath Falls	30			
	Government Grant		100		
	Federal Revenue Sharing			100	
	Federal				50
	State				
	City				
	County				50

local government officials, such as judges, would not be expected to be as knowledgeable as other officials more directly involved in planning, such as councilpersons.

As reported in Table 4-10, the City of Klamath Falls is portrayed as having a very favorable attitude toward the geothermal project. All five respondents claimed the City to be "very supportive" (Question 28), citing cost savings, enhancement of future growth, and geothermal's potential as reasons for administrative support (Question 29). In addition, all five respondents said they personally agreed with the pursuit of the project (Question 30). Again, lower costs, potential community benefits and energy savings were mentioned as reasons for their personal endorsements (Question 31).

When it came to describing the City's ultimate satisfaction with the use of geothermal resulting from the project, respondents unanimously predicted that the City would be "very satisfied." Ultimate satisfaction would rely heavily on long-term cost savings, a factor mentioned by four of the five respondents.

Decision Factors and Trade-off Among Decision Factors

Four respondents were able to recall factors that were influential in the City's decision to undertake the DOE geothermal project. As shown in Table 4-11, respondents were not necessarily in agreement as to the particular factors. Cost, however, appears to have been the single most critical factor, with three out of four respondents listing it. One respondent, for example, mentioned four separate factors but they all dealt with cost, in one way or another. In addition to cost, energy savings and maintenance considerations were mentioned by at

TABLE 4-10

LOCAL GOVERNMENT: CITY ATTITUDES TOWARDS DOE PROJECT

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
28	City/county supportive	
	Very supportive	5
	Somewhat supportive	-
	Unsupportive	-
29	Why "very supportive"?	
	Realize potential savings	2
	Enhance city for future growth	1
	City leaders have investment in wells; see potential	1
	Good use of available resource	1
	Recognize need for alternative energy sources	1
30	Personal agreement with project pursuit?	
	Yes	5
	No	-
31	Why "agree" with project pursuit?	
	Lower costs/economy	2
	Overall benefit to city	1
	No one else would manage and develop it	1
	Good use of available resource	1
	Energy savings	1
32	Satisfaction of city/county with project	
	Very satisfied	5
	Somewhat satisfied	-
	Dissatisfied	-
33	Why city/county "very satisfied"?	
	Long-term cost savings	4
	Benefit to industry	1
	Geothermal heat is comfortable, no cold spots	1
	Relatively easy project to work with	1
	Energy savings	1

TABLE 4-11

LOCAL GOVERNMENT: DECISION FACTORS AND THEIR IMPORTANCE

<u>Order of Mention</u>	<u>Factor Question 36</u>	<u>Importance Question 37</u>
First	Environmental factors	Very
Second	Existing well-owners being hurt	Very
Third	Longevity of well	Somewhat
Fourth	Maintenance	Somewhat
First	Savings in heat source	Very
Second	Overall project cost	Very
First	Initial Investment	Somewhat
Second	Cost Savings	Very
Third	Maintenance & operation costs	Very
Fourth	Availability of federal grant money	Very
First	Dollar savings	Very
Second	Energy savings	Very

least two respondents. One respondent, somewhat atypical of the group, claimed that the City had considered such things as the environment, well longevity, and possible financial harm to existing well owners. The researcher's speculation is that the project may never have commenced without DOE participation, at least financial.

In terms of who had been involved in the decision (Question 34), most respondents agreed that a joint group of City and/or County officials concurred to enter the project. One respondent mentioned a survey conducted by the City Council while others mentioned such groups as the Chamber of Commerce, Board of Commissioners, County Budget Committee and Oregon Institute of Technology.

Table 4-12 summarizes, by respondent, the anticipated trade-off among decision factors (Question 35). Maintenance and maintenance costs emerge as less important factors; respondents would be willing to waive these factors for overall cost savings and environmental considerations. One respondent felt the availability of federal grant money was the most critical decision determinant, a factor that would not be waived in lieu of cost savings, maintenance and operations costs and the cost of initial investment.

Summary of Benchmark Measurement for Local Government Personnel in Klamath Falls

Overall, local government administrators can be profiled as enthusiastic advocates of geothermal energy. They prefer geothermal above all other energy sources and greatly value its low cost, non-polluting aspects, local availability, and renewability. All claimed to be "very interested" in further geothermal use and development and fully half predicted that the community would expand its use of geothermal in the coming years.

TABLE 4-12

LOCAL GOVERNMENT: TRADE-OFF AMONG DECISION FACTORS

<u>Respondent</u>	<u>Trade-off Factors</u>	<u>Willing to Trade-Off</u>
1	Existing well-owners being hurt for environmental factors	No
	Longevity of well for environmental factors	No
	Maintenance for environmental factors	Yes
	Longevity of well for existing well-owners being hurt	No
	Maintenance for existing well-owners being hurt	Yes
	Maintenance for longevity of well	Yes
2	Overall cost of project for savings in heat source	Yes
3	Cost savings for initial investment	Yes
	Maintenance and operation costs for initial investment	Yes
	Availability of federal grant money for initial investment	No
	Maintenance and operation costs for cost savings	Yes
	Availability of federal grant money for cost savings	No
	Availability of federal grant money for maintenance and operations costs	No
	Energy savings for dollar savings	Yes

Not surprisingly, all local administrators seemed well-informed regarding the government's current use of geothermal (e.g., for space heating in public buildings or for de-icing public roads). They were less conversant in the community's commercial uses of geothermal -- for manufacturing, shrimp-raising and agriculture. Acquisition of further information in this area may facilitate attraction of industry by local government.

Although five of the seven respondents expressed awareness of the DOE project, they were unfamiliar with the project details. For example, estimates of the project costs ranged widely across respondents from a low of \$120,000 to a high of \$2,000,000. Respondents also disagreed as to the source of funding, with reports of federal contributions ranging from 50 percent to 100 percent of the total funding. A broader dissemination of the details of the DOE project appears to be in order.

The overriding rationale for the City's interest and support of geothermal were the perceived cost savings and economic benefits. Respondents also felt that geothermal development would attract industry and foster the overall growth of the community. Outreach and educational efforts which feature these two key incentives may prove fruitful to DOE in encouraging other U.S. municipalities to develop geothermal. Better instruction regarding commercial uses, especially among local administrators, is an additional requisite strategy.

SECTION V

RESULTS OF BENCHMARK MEASUREMENT FOR INDUSTRY IN KLAMATH FALLS

The sample included nine firms who currently use geothermal energy, and seven firms who are potential users. Current users include a large farm, an apartment building, a school system, an engineering firm, a cold storage plant, a medical center, a university, a shopping center and a wood products company. Potential users include a medical service bureau, a school district, a church, a timber company, a fair ground, a lumber company and an airport. Within each firm, a senior official (e.g., president, manager, superintendent) was interviewed who was knowledgeable about the firm's current energy costs and projected energy requirements. An important fact to note is that service rather than industrial firms predominate in the sample, which is a fair representation of the distribution of commercial and municipal users of geothermal energy in Klamath Falls.

Awareness, Knowledge and Interest Regarding Geothermal Energy

An outstanding feature of the area in which these firms are located is that geothermal energy has been available and extensively exploited for over 50 years. As a consequence, the level of awareness, knowledge and interest of most respondents was quite high. Table 5-1 presents responses for the first four questions which concern awareness and self-reported knowledgeability about geothermal energy. Question 1 was an unaided awareness question that asked respondents to name all

TABLE 5-1

ENERGY COMMUNITY AWARENESS OF GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
1	Energy sources that come to mind		
	Solar	5	4
	Water	8	5
	Geothermal	8	7
	Petroleum	7	3
	Wind	6	3
	Nuclear	7	4
	Biomass	3	4
	Coal	3	4
2	Aware of geothermal if not mentioned for Question 1	1	N/A
3	How first aware		
	Around it	7	5
	Through friend	2	3
4	Number of years ago first aware		
	3	-	1
	5 1/2	1	-
	6 1/2	-	1
	7 1/2	1	-
	8	1	-
	9	-	1
	10	1	-
	15	1	1
	19	1	-
	21	-	1
	25	1	-
	26	1	-
	36	-	1
	40	-	1
	50	1	-

Average = 18.5 years ago

energy sources that come to mind. Eighty-eight percent of current users and one hundred percent of potential users mentioned geothermal energy. The one respondent who failed to mention geothermal energy at first indicated when asked that he too was aware of it (Question 2). Most of the respondents became aware of geothermal energy by simply living in the area where it is widely used. Long-term residents have been aware of it for a long time, while others became aware of geothermal energy when moving into the area. None of the respondents reported becoming aware of geothermal energy through news sources, technical journals or promotional campaigns.

Probably because it is such a widely discussed topic in the community, both current and potential users knew a good deal about geothermal energy and its various applications. Table 5-2 presents responses to several questions dealing with self-reported and actual knowledge about general and specific applications of geothermal energy. Both current and potential users considered themselves intermediately knowledgeable. All respondents knew about the main application of geothermal energy (space heating) and most were familiar with additional applications. Current users reported knowing more about geothermal energy and were able to list more applications for geothermal energy than potential users.

Respondents were equally aware of efforts within the local community to promote geothermal energy use. All potential users and all but one current user reported knowing about at least one activity by the city to promote and develop geothermal energy. The majority of respondents knew about the geothermal heating district project company sponsored by the City and DOE, and they reported on a number of other activities: providing information and assistance to industry, holding public meetings (respondents were mainly aware of meetings concerning the ongoing controversy on the impact of new deep wells and production from older shallow wells and the reinjection requirements that were being formulated),

TABLE 5-2
KNOWLEDGE ABOUT GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current Users</u>	<u>Potential Users</u>
5	Knowledgeable about geothermal		
	Very (1)	2	1
	Somewhat (2)	7	4
	Not very (3)	-	2
	(Average)	(1.8)	(2.1)
6, 7	What are some applications of geothermal (actual and potential)		
	Space heating	9	7
	Direct process heat	7	5
	Generation of electricity	2	2
	Other (specific instances)	6	1
	(Average)	(2.7)	(2.1)
12	What types of things is the city (county) doing to promote geothermal energy?		
	Forming a geothermal heating district	4	5
	Trying to attract industry	3	2
	Public meetings	3	1
	Exploring and drilling wells	2	3
	Trying to get grants	1	1
	Using it in schools	1	-

and exploring and drilling new wells. Potential users were equally if not better informed of these activities than current users.

Both current and potential users reported a very high level of personal interest in the further development of geothermal energy. They also reported that their firms were very interested in its use and saw the local community as being very interested in more development (Table 5-3 presents these results). The major reasons given for the high levels of interest in geothermal energy were the low cost and availability of geothermal energy in the area, and to a lesser extent the belief that it is a clean source of renewable energy. A potentially, significant result was that almost half of the reasons given for the high level of interest (49 percent) relate specifically to local circumstances (local availability, local experience, promotion of local industry).

Preferences for Energy Sources

Respondents were asked to rank order their preferences for eight major forms of energy including geothermal energy and give reasons for their first and last choice, as well as for their ranking of geothermal (if not first or last). Table 5-4 presents the results of these questions. Geothermal energy was far and away the most preferred source of energy. Perhaps this is not surprising, given the selected population of respondents and the heavy focus throughout the interview on geothermal energy, but the magnitude of respondents' preference for geothermal over other forms of energy is impressive. The second most preferred source of energy was very clearly solar. In their preferences, the respondents indicated a strong bias toward clear, renewable and inexpensive sources of energy. The top four energy choices were geothermal, solar, wind and water, respectively, with biomass, nuclear, coal and petroleum being their four least preferred choice.

TABLE 5-3
INTEREST IN GEOTHERMAL ENERGY

Question Number	Question and Answers	Number Responding	
		Current Users	Potential Users
8	How interested are you		
	Very (1)	8	6
	Somewhat (2)	1	1
	Not very (3)	-	-
	(Average)	(1.1)	(1.1)
10	How interested is the city		
	Very (1)	7	7
	Somewhat (2)	2	-
	Not very (3)	-	-
	(Average)	(1.2)	(1.0)
45a	How interested is your firm		
	Very (1)	8	7
	Somewhat (2)	1	-
	Not very (3)	-	-
	(Average)	(1.1)	(1.0)
9, 11, 45b	Reasons given for interest in geothermal		
	Low cost	8	6
	Local energy resource	8	6
	Conservation	2	4
	Clean source of energy	2	1
	Renewable form of energy	4	-
	Promote new industry	2	1
	Local experience	2	-
	Became independent of other forms of energy	1	1
	Safer	1	-

TABLE 5-4
INDUSTRY PREFERENCE FOR ENERGY SOURCES

<u>Question Number</u>	<u>Question and Answers</u>	<u>Respondent Ranking</u>	
		<u>Current Users</u>	<u>Potential Users</u>
47	Ranking of energy sources		
	Solar	2 3 2 2 2 4 1 3 2	5 2 2 6 2 2 2
	Water	8 4 8 4 3 2 4 5 5	3 5 4 5 5 5 3
	Geothermal	1 1 1 1 1 1 2 1 1	2 1 1 3 1 1 1
	Petroleum	6 6 7 8 5 3 7 7 7	8 8 3 7 7 6 6
	Coal	5 7 6 5 7 6 8 6 6	7 7 5 2 6 7 7
	Wind	3 8 3 7 4 5 3 4 3	6 6 6 4 3 4 4
	Nuclear	7 2 4 6 6 7 5 2 8	4 4 7 8 4 3 8
	Biomass	4 5 5 3 8 8 6 8 4	1 3 8 1 8 8 5

In part, these preferences reflect the special circumstance in the area (abundance of geothermal energy and high frequency of sunny days), but they also indicate a distinctive belief profile for people who are interested in geothermal. Particularly significant is the high preference for solar over most other energy sources given that very few of the respondents are presently using or plan to use solar energy. Geothermal energy seems to appeal to those who place a high value on decentralized, renewable and non-polluting forms of energy.

Advantages and Disadvantages of Geothermal Energy

Respondents were asked to indicate what they thought were the major advantages and disadvantages associated with geothermal energy use. Table 5-5 presents the results for these open-ended questions. Both current and potential users saw more advantages than disadvantages. The low cost, availability and non-polluting characteristics of geothermal energy were recognized as advantages, while the chief disadvantages were that the resource might become depleted through overuse or that shallower wells might be pre-empted by deeper wells.

Although both current and potential users are generally very positive toward geothermal energy, they differ somewhat in the factors they emphasize. Current users compared to potential users were more likely to cite the non-polluting character of geothermal energy as an advantage and maintenance problems due to corrosive water as a disadvantage. Potential users were somewhat more likely than current users to see the high initial costs of installing a geothermal energy system as a disadvantage.

TABLE 5-5

ADVANTAGES AND DISADVANTAGES OF GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current Users</u>	<u>Potential Users</u>
51	Advantages		
	Economical	9	7
	Available	4	4
	Non-polluting	8	3
	Renewable	3	1
	Reliable	2	-
52	Disadvantages		
	High initial cost	1	2
	Might be depleted	4	3
	Maintenance	3	-
	Lack of technical information	2	1
	Inexperienced contractors	1	-

Current and Future Energy Use and Needs

Respondents answered a number of questions concerning their current patterns of energy use and their plans for the future. Table 5-6 summarizes the characteristics of current energy use patterns for current and potential users of geothermal energy.

Of most interest was the use pattern that emerged for geothermal energy. It was used almost entirely for heating. This trend was even stronger than it would first appear from Table 5-5, since the one respondent who reported industrial process applications for geothermal energy also reported that this application was being phased out and the one respondent who reported using geothermal energy for cooling was a main advocate and technical advisor for geothermal energy use in the area.

The modal situation for current users was to heat with geothermal and use electricity for their other energy needs. (Most respondents do not include fuel for transportation among their energy needs.) However, there was some indication this limited range of application for geothermal energy may be changing. Three of the nine current users reported plans for expanding their use of geothermal energy into industrial processes (a gasohol plant), cooling and electrical generation.

Two factors were seen by these respondents to be crucial to the realization of non-space heating applications of geothermal energy. First, the availability of wells with water temperatures in excess of 180° is seen as necessary. All respondents who plan innovative uses of geothermal energy have such wells. And second, various forms of government assistance, in the form of subsidies, loans and technical advice, were seen as important to the realization of these plans.

TABLE 5-6

PROFILE OF USE BY ENERGY SOURCE FOR CURRENT
USERS OF GEOTHERMAL

	<u>Heating</u>	<u>Cooling</u>	<u>Lighting & power tools</u>	<u>Self- generated electricity</u>	<u>Industrial processes</u>	<u>Transport.</u>
Geothermal	8	1	-	-	1	-
Electricity ¹	-	-	6	-	-	-
Petroleum	1	-	-	-	2	3
Solar	1	-	-	-	-	-
Water (hydro- electric)	-	-	-	1	-	-
Wood	-	-	-	-	-	-

PROFILE OF USE BY ENERGY SOURCE FOR POTENTIAL
USERS OF GEOTHERMAL

	<u>Heating</u>	<u>Cooling</u>	<u>Lighting & power tools</u>	<u>Self- generated electricity</u>	<u>Industrial processes</u>	<u>Transport.</u>
Electricity ¹	2	1	4	-	-	-
Petroleum	5	-	-	-	-	1
Water (hydro- electric)	1	-	-	2	2	-
Wood	2	-	-	-	-	-

¹Respondents mentioning electricity only did not indicate the energy source from which the electricity was generated.

The profile of current use patterns for potential users of geothermal energy was revealing when compared to the profile for current users. Potential users rely mainly on petroleum for heating, and to a lesser extent on electricity, biomass and self-generated electricity. Geothermal energy, in other words, mainly replaces petroleum as a source of heat. Potential users saw geothermal energy as a way of reducing their reliance on petroleum products. In Klamath Falls geothermal energy does not replace electricity, nor was it seen as appropriate for the kinds of applications for which electricity is used.

Respondents were asked to estimate the percentage of operating costs their firms spent on energy (Question 17). The share of costs due to energy was surprisingly low. Current users reported that, on the average, 14 percent of their total costs were allocated to energy while potential users estimated an even lower share due to energy, approximately 8 percent.

Table 5-7 presents the results for questions about the costs associated with the various types of energy currently used by both current and potential users of geothermal energy. Table 5-7 underlines the chief difference between current and potential users. Petroleum costs constitute the major portion of energy costs for potential users (67 percent). When geothermal replaces petroleum for heating applications, the portion of energy costs due to the petroleum goes down (or disappears), and the portion due to electricity rises sharply as the total energy costs are greatly reduced.

A significant and surprising aspect of current users' reports about their patterns of energy use were their cost estimates for geothermal energy. In the majority of cases (six out of the nine firms) the cost estimates for geothermal energy are only 0-1 percent of total energy costs. In other words, most current users saw geothermal energy as virtually free. This cost

TABLE 5-7

ENERGY COSTS¹ BY TYPE OF ENERGY FOR CURRENT USERS

	Respondent									Average Cost
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	
Geothermal	0	100%	0	0	1%	0	33%	30%	0	18%
Electricity	100%	NA	66%	100%	99%	NA	67%	70%	67%	81%
Petroleum	NA	NA	35%	NA	NA	80%	NA	NA	33%	49%
Other	NA	0	NA	NA	NA	20%	NA	NA	NA	10%

ENERGY COSTS¹ BY TYPE OF ENERGY FOR POTENTIAL USERS

	Respondent							Average Cost
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	
Geothermal	NA	NA	NA	NA	NA	NA	NA	NA
Electricity	NA	100%	3%	48%	NA	NA	5%	39%
Petroleum	77%	NA	90%	52%	NA	100%	18%	67%
Other	23%	NA	6%	NA	100%	NA	77%	52%

¹As a percentage of total energy costs

estimate fails to take into account the initial costs of developing a geothermal energy system and the costs of maintenance, or the cost of operation (cost of electricity for running pumps and blowers), but it does indicate the high level of enthusiasm these respondents have toward geothermal energy. There was no doubt in the minds of these respondents about the actual and potential cost advantages of geothermal energy.

Respondents were also asked to discuss their projected energy needs and their plans for meeting those needs (Questions 18 and 19). There were obvious differences between current and potential users on these open-ended questions. Most current users (78 percent) expected slow to normal growth in the near term and projected only modest increases in their future energy requirements. The "slow growth" firms expected geothermal energy to take care of any future needs. Several respondents in this group mentioned the need to conserve energy and "optimize" their energy consumption. Two current users did project high growth rates. In both instances, they were counting heavily on geothermal energy to supply their increased energy requirements. In one instance, the expansion was directly related to the availability of geothermal energy sources. None of the current users had any plans for increasing their use of other energy sources besides geothermal.

The picture for potential users was quite different. Most of these respondents (67 percent) anticipated levels of growth in excess of 30 percent annually over the near term. They were actively seeking alternatives to their current mix of energy sources (chiefly they wanted to reduce reliance on petroleum products), and were exploring other energy sources beside geothermal such as biomass, electricity, coal and looking into energy efficient equipment and self-generated electricity.

Factors Considered in the Use or Non-Use of Geothermal Energy

An attempt was made to elicit from current users a list of factors that entered into their decisions to use geothermal energy. Table 5-8 presents both barriers to geothermal use as well as incentives for use. The rising cost of alternative or conventional energy sources was an incentive whereas the cost of retrofit or drilling was a barrier to use. Many users seem to use it "because geothermal was available"; however, given the availability, costs appear to be the major reasons for both using and not using the source. Use of geothermal, at least for space heating, should expand significantly at any site, if the municipality reduces the cost of acquisition.

It was interesting that only one user mentioned "chance you might not hit" (i.e., hitting a dry well). Possibly this was because this risk has been forgotten since all users have drilled a successful well.

The trade-off analyses provided little further information (Question 29b). Respondents were consistently willing to trade-off other factors for economies or costs. Thus, cost remained a critical determinant of the decision to use geothermal energy.

Economic advantages of geothermal energy and the availability of usable geothermal energy sources in the area emerged, once again, as the two paramount factors taken into account in decisions to develop geothermal capability. Unfortunately these questions did not elicit detail from respondents about how they broke down cost and availability factors into various components. It is fair to assume that cost and availability are substantially related, since the main cost in developing geothermal energy is the cost of finding it.

TABLE 5-8

GEOTHERMAL USE DECISION FACTORS FOR
CURRENT USERS

<u>Order of Mention</u>	<u>Factors</u>	<u>Importance</u>
First	Chance you might not hit	Very
Second	Future cost of energy	Very
Third	Tenants would pay more rent	Very
Fourth	Better heat	Somewhat
First	Existing use in community	Very
Second	Location along fault	Very
Third	Economies	Very
First	Costs of retrofit	Very
Second	Energy savings	Somewhat
First	Rising utility costs	Very
Second	Availability	Somewhat
First	Quick defrost for ice	Very
Second	Available at site	Very
First	Available at site	Very
First	Economics	Very
First	Cost	Somewhat
First	High cost of conventional energy	Very

Only two out of the nine respondents reported that the availability of geothermal sources was a factor in locating in the area (Question 22). Since most of the current areas were municipal entities or local businesses who have always been in the area, this result may underestimate the potential attraction of a ready supply of geothermal energy to potential users. However, for this sample the question did not investigate the relative importance of geothermal to other decision factors in a relocation decision. The data for relocaters indicated that energy sources are relatively important in the decision process, except "at the margins". For most firms, they will not be attracted to an area because of geothermal, it appears from these data.

Potential users were asked what factors their firms would consider in the decision making process to use geothermal energy (Question 46). These results are presented below.

<u>Decision Factors</u>	<u>Number Responding</u>
Cost	7
Availability (of geothermal well)	2
Financing	2
Maintenance	1

Here again, the key factor in the decision making process mentioned by all respondents was cost, with availability and financing being the next most frequently mentioned concern. Most respondents did not try to distinguish between the relatively high costs of exploration and installation for geothermal energy, financing costs, its very low cost of operation, or the relative costs of geothermal energy compared to other energy sources. All these factors tended to be lumped together under the general rubric of costs.

Users' Well Characteristics

The factor that ultimately determines whether geothermal energy will be effectively utilized in any given area is the availability of hot water well sites with temperatures high enough to achieve the desired applications. Uncertainty about costs associated with drilling a successful well (the possibility of "dry holes") and finding sufficiently hot water are probably the greatest risks facing a potential user of geothermal energy. In this regard, the most significant reduction of uncertainty that a potential user can have and a necessary ingredient for promoting increased development of geothermal energy, is a proven "track record" of successful geothermal energy ventures.

Current users were asked to describe the characteristics of their hot water wells. Table 5-9 presents these results. Of most interest are differences that emerge between those users who have high temperature wells (180°) and those who have low temperature wells (150°). Users who had high temperature wells had more wells, and they had more ambitious plans for future expansion of their use of geothermal energy. All the innovators who planned to extend the use of geothermal energy beyond space heating were in this group. Users who had low temperature wells tended to have only one well, and they were much more cautious about future expansion. One user, the one with the lowest temperature well, was planning on dropping their use of geothermal energy in the future, as they have found more efficient means for melting ice than long-term geothermal use.

Satisfaction and General Attitudes Toward Geothermal Energy

For the most part, current users of geothermal energy were satisfied with the performance of the energy source. All but two respondents reported their firms were "very satisfied" with geothermal energy (Question 34). In one of the cases where a

TABLE 5-9
USERS' WELL CHARACTERISTICS

<u>Number of Wells Owned</u>	<u>Depth of Well(s) in Feet</u>	<u>Temperature of Well(s) in Fahrenheit</u>
1	1060	106°
1	-	-
1	1508	112°
1	1130	140°
5	450, 300, 300, 250, 625	between 186° and 199°
1	1584	191°
3	1805, 1790, 1250	all 192°
8	250, 550, 280, 1200	200°, 190°, 191°, 141°
1	120	100°

respondent reported being only somewhat satisfied, the application of geothermal energy (melting ice) was being phased out of the company's operations, and in the other case the firm's supply of hot water had been greatly reduced by the presence of a new deeper well in the area. The reasons cited for the high levels of satisfaction (Question 31) were primarily economy and the non-polluting character of the resource. Eight users mentioned economy and three out of the nine respondent users mentioned non-polluting. Other factors mentioned were the reliability of geothermal energy, its efficiency and the fact that it was a renewable resource.

An identified pattern of responses was found to questions about the favorability of the firm's attitude toward geothermal energy (Questions 46a, 46b). On this question, only one respondent reported his firm as being less than "very favorable" toward geothermal energy.

Potential users were a hundred percent "very favorable" toward geothermal energy and they mentioned essentially the same kinds of reason. Six out of seven considered it economical, and three out of seven thought it was non-polluting. One difference between current and potential users was the relatively higher percentage of potential users who considered conservation to be a reason why they were very favorable. Four out of seven potential users mentioned this as a reason for being favorable toward geothermal, but only one out of nine current users offered conservation as a reason.

Potential Users' Future Plans and Information Seeking

Potential users were asked about the status of their plans for developing a geothermal capability (Question 36), whether they expected to actually realize this capability (Question 44), and what sources and types of information about geothermal development they were now seeking (Question 39). At the time

they were interviewed, all respondents indicated their firms had done preliminary studies and received professional advice on the costs and feasibility of moving toward geothermal energy use. Five of the seven firms had recently completed or were in the process of drilling test wells. Five respondents said they had employed outside consultants (engineers, architects), and four respondents reported seeking advice from DOE and other governmental entities.

The majority of respondents (five out of the seven) reported that they were now exploring financial aspects of geothermal energy development. They were contacting private and governmental agencies, primarily DOE, about the possibilities of loans, grants and other forms of financial aid. Several respondents said their plans depended on their ability to get acceptable financial support.

Given the relatively advanced stage of their preparation for moving toward geothermal energy, potential user respondents were surprisingly cautious when asked to estimate the likelihood of their firms actually using this energy source in the future. Four respondents indicated it was "very likely" they would eventually be using geothermal energy, but three respondents considered eventual use only "somewhat likely". One of these cautious respondents had reservations about the high projected cost of installing a geothermal energy system and questioned the cost-effectiveness of geothermal energy, while the other two were mainly concerned about the availability of acceptable financing for the necessary installation costs. Attitudinally, potential users were very favorable toward geothermal energy use, but faced with the high initial costs of geothermal energy systems in the real world, they were significantly more sober about geothermal prospects.

Summary of Industry in Klamath Falls

A number of public and private firms who were current or potential users of geothermal energy were interviewed in Klamath Falls, Oregon, an established geothermal energy site, in order to provide benchmark measures of attitudes toward geothermal energy, to determine typical use patterns and future energy needs of such firms, and to identify those factors used by these firms in deciding to develop a geothermal capability. Nine current users and seven potential users agreed to participate in the survey. The results for current and potential users were analyzed separately and contrasted where appropriate. Results are highlighted in the following sections.

- Profile of current and potential users
- Benchmark measures of attitudes toward geothermal energy
- Decision factors for developing geothermal resources

Profile of Current and Potential Users

The firms making up the sample include municipal and educational institutions, commercial businesses and industrial companies. However, only four out of the sixteen companies could be classified as industrial producers, and one of these was a farm and another was a cold storage plant. Overwhelmingly, our sample of current and potential users of geothermal energy represented the service sector of the local economy. Partially as a consequence of this fact, the proportion of total costs due to energy was fairly low. On the average, energy costs account for 14 percent of total costs for current users and only 9 percent of total costs for potential users. The major uses for energy for both groups were space heating and applications requiring electricity (lighting, operating small machines, cooking).

Geothermal energy was used almost exclusively by current users for space heating and for the most part, potential users plan to replace their current space heating energy source (which was usually petroleum) with geothermal energy. Geothermal energy does not at present replace electricity to any significant extent, although some current users have tentative plans to move toward electrical generation and direct process applications of geothermal energy.

Current user firms anticipate slow to normal growth in the near term, and they intend to meet future energy requirements by conservation and somewhat more intensified reliance on geothermal energy. Potential user firms anticipate normal to high growth in the next few years, and they were seeking alternatives to their current reliance on petroleum products as energy sources. They saw geothermal energy as the most attractive alternative to petroleum-based energy sources. Self-imposed expansion by firms of geothermal use appeared to be going to occur naturally. Usage does appear to be projected to expand in Klamath Falls.

Attitudes Toward Geothermal Energy

Attitudes toward geothermal energy in Klamath Falls were conditioned by over 50 years of successful experience with using geothermal wells for heating. Many residences, a major school system and the local university relied primarily on geothermal energy for space heaters. In a widely publicized project, the local government with DOE assistance was in the process of creating a local heating district which was designed to provide seventeen government buildings and eventually a large portion of the City with centrally produced hot water. Possibly as a consequence of this local experience the respondents in the sample were quite knowledgeable and very favorable toward geothermal energy. By a wide margin, geothermal energy was the most preferred energy source, particularly when compared with coal, petroleum, nuclear or biomass energy sources. Geothermal energy was perceived as a clean and renewable energy source which

can replace scarce supplies of oil and gas, but its greatest advantage according to the respondents was its low cost compared to other alternatives.

It is inadequate to say that the respondents were merely favorable toward geothermal energy. A theme that emerges from respondents' statements was they seemed to have an almost proprietary interest in promoting geothermal energy development. It is not just that they were impressed by favorable cost and benefit analyses, they seemed to truly believe that geothermal energy was a superior form of energy and that its use is an act of civic responsibility. So, for example, the costs associated with geothermal energy were perceived to be extremely low by most current users who tend to exclude the initial cost of exploration and installation or even the normal costs of upkeep in their cost calculations. (Five of the nine current users reported only 0-1 percent of their energy costs were expended on geothermal energy.) One respondent who had only the highest praise for geothermal energy mentioned apologetically that the firm's hot water well had gone dry. Several respondents emphasized the unique opportunity available to Klamath Falls to become energy self-sufficient through increased use of geothermal energy, and a pride of ownership and local boisterism permeates the comments of many respondents. At the least, it will be very easy to collect enthusiastic testimonials from local industry in favor of geothermal energy use.

The capacity of geothermal energy to inspire such enthusiastic support and allegiance is probably not limited to Klamath Falls. Because of its character as a hard to transport, only available at the site form of energy, geothermal energy will generally be closely linked to the area in which it is produced. Development of geothermal energy, therefore, should be politically popular and a positive act of public relations for any interested developer. Relocaters did report (two of eight) that they would or did consult local citizens for information on relocation sites. In this regard, because of their esteem and enthusiasm for

geothermal, current and potential users at the site might be excellent promoters of the energy source. Municipalities hosting perspective relocaters to their site may do well to have the firms' representatives speak with local current and potential users at the site.

Decision Factors

The factors that were most important to making the decision to move toward the development of geothermal energy follow from certain characteristics of the energy source. Proximity to a producing hot water well is a necessary starting point for anyone interested in geothermal applications. Unless a producing well is close by, the difficulties of transporting the corrosive hot water are usually sufficient to discourage geothermal applications. One respondent, for example, reported that it was uneconomical to tap into a neighboring well that was only 800 feet away. Although some attempts are currently underway in Klamath Falls to demonstrate the feasibility of distributing hot water from a central source, most geothermal development in the area involves on-site wells. All the respondents either owned their own producing wells or were planning to drill their own. Given the existence of a hot water producing well, there was no question about the attractiveness of geothermal energy to a potential user. The cost comparison between energy supplied from a producing geothermal well and any alternative energy source (oil, natural gas, electricity) was so favorable to geothermal that a problem sometimes arises of how to price geothermal energy fairly. However, the more common situation was one where a potential user was located in an area with proven geothermal potential, but without a producing well. In this instance, the costs of exploring for, and drilling a well have to be taken into account, but even more influential to the decision process was the uncertainty attached to finding a successful well. Unfortunately, finding a geothermal well is not

an exact science, and the potential users are painfully aware of the possibility of a "dry hole". An indication of the magnitude of the problem was that one of the respondents reported spending \$70,000 in an unsuccessful well.

The difficulty of quantifying the risk associated with finding an accessible, producing hot water well that presents the most serious obstacle to potential developers of geothermal energy. An additional and related problem is that the bulk of costs associated with developing geothermal energy are incurred only in the development process (exploring, drilling, retrofitting). Thus, there is a premium on the ability to finance such costs at favorable terms. After availability of a geothermal well, the most frequently mentioned decision factor was the cost and availability of financing. Current credit conditions and government attempts to subsidize geothermal development through grants and loan programs have made potential users very sensitive to this factor. Over half the respondents considered their plans for developing geothermal to be contingent on some form of government assistance.

SECTION VI

RESULTS OF BENCHMARK MEASUREMENT FOR POTENTIAL RELOCATORS TO KLAMATH FALLS

The final sample of relocators consisted of eight firms. There was one mobile home company, a wood pellet manufacturer, two firms involved in vegetable drying, an engineering firm, two electronics firms and one developer (in the area of geothermal energy).

Three of the eight relocators identified (electronics, engineering and developer) indicated that they were currently in the relocation decision process and that a site decision had been made. As previously stated in Section III, no firm indicated that they were in a relocation decision process, but had not decided on a site.

Two of the firms having decided on a site are locating in Klamath Falls and the other firm is expanding to four different sites: Northeast California, Imperial Valley, Nevada and Idaho. No firm said they were using an outside real estate firm or consulting firm to help identify potential sites (Question 17d).

Although the other five "relocators" said they were not in a relocation decision process, their responses are described in this report. Other information indicates that these five firms have been considering relocation. Whether in the decision process or not, their responses, nonetheless, provide additional information on relocation decisions.

The results of the in-depth interviews will be presented and discussed in this section. Some of the data presented herein is also relevant to Section XII, Decision Process, and will be discussed further in that section. The in-depth interview instruments for relocaters is included in the Appendix.

Awareness, Knowledge and Interest
Regarding Geothermal Energy

Table 6-1 presents responses for the first four questions which concern awareness. Question 1 was an unaided awareness question that asked the respondent to name all the energy sources that came to mind. The number of persons indicating each source is listed in the table.

Only one respondent did not mention geothermal as an energy source (Question 1). When asked aided awareness in Question 2, this respondent was aware of geothermal energy. Thus, all relocaters were aware of geothermal energy, as would be expected.

Seven relocaters indicated they were first aware of geothermal energy by being around it and one said he read about it in a technical magazine. In addition, all interviewees had been aware of geothermal for at least five years.

Two relocaters with site decided considered themselves to be "very knowledgeable" (Question 5a) about geothermal energy. The distribution of responses is presented below.

<u>How Knowledgeable</u>	<u>Site Decided</u>	<u>Others</u>
Very (1)	2	1
Somewhat (2)	1	3
Not very (3)	-	1

TABLE 6-1

RELOCATER AWARENESS OF GEOTHERMAL ENERGY

Question Number	Question and Answers	Number Responding	
		Site Decided	Others
1	Energy sources that come to mind		
	Solar	3	4
	Water	3	4
	Geothermal	3	4
	Petroleum	3	5
	Wind	2	3
	Nuclear	2	3
	Biomass	2	3
	Coal	2	2
2	Aware of geothermal if not mentioned for Question 1	N/A	1
3	How first aware		
	Around it	2	5
	Technical magazine	1	-
4	Number of years ago first aware		
	40	1	1
	30	-	1
	15	1	1
	10	1	1
	5	-	1
Average = 20.63 years ago			

The average across all six respondents (using the weightings in parentheses) is 1.5, indicating that the sample considered themselves "knowledgeable" about geothermal energy.

Table 6-2 presents responses to questions regarding interest in geothermal energy. The relocaters with site decided who were moving to Klamath Falls were "somewhat interested" in the further development of geothermal in that area or "very interested".

As indicated by the responses to Question 9, three of the respondents were interested in geothermal development in Klamath Falls because of the advantages of geothermal energy use, such as clean resource and low cost. There are more than eight responses to Question 9 because some respondents gave more than one answer.

All respondents answering Question 9 thought that the City of Klamath Falls was "very interested" in geothermal development. And, two ($n = 2$) of the relocaters thought this was because of the need for energy. One thought Klamath Falls was interested because of the downtown heating district.

Relocation Decision Responsibility and Information Sources

Five of the relocaters were owners of the firm. One was the Vice President of a firm who said the firm was not in a relocation decision process and two respondents were Presidents of their firms. Table 6-3 presents responses to questions regarding the relocation decision responsibility and information sources.

TABLE 6-2
RELOCATER INTEREST IN GEOTHERMAL

Question Number	Question and Answers	Number Responding	
		Site Decided	Others
8	Interest in further development and use in Klamath Falls		
	Very (1)	1	3
	Somewhat (2)	1	1
	Uninterested (3)	1	-
	Average = 1.38		
9	Why interest/uninterest		
	Useful resource	-	1
	No interest in Klamath Falls (interest in Raft River, Idaho)	1	-
	Have or plan development well in Klamath Falls	1	1
	Benefits my business (real estate)	-	1
	Advantages of use (clean, low cost, etc.)	1	2
	Eliminate dependence on petroleum	1	-
	Benefit economy of Klamath Falls	-	1
10	Interest of City of Klamath Falls		
	Very (1)	3	3
	Somewhat (2)	-	-
	Uninterested (3)	-	-
	No answer	-	1
	Average = 1.0		
11-12	Why City interested/uninterested		
	To attract industry	1	-
	Increase land prices	1	-
	Because of OIT	1	-
	Need for energy	-	2
	Advantages of use (clean, low costs, etc.)	-	1
	Good investment	-	1
	Because of downtown geothermal heating district	-	1
	No answer	-	1

TABLE 6-3

RELOCATION DECISION RESPONSIBILITY
AND INFORMATION SOURCES

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Site Decided</u>	<u>Others</u>
18	Who involved in relocation decision		
	Owner (respondent) only	1	3
	Firm's geologists and owner (respondent)	1	-
	Vice President (respondent)	-	1
	President and Chairman of Board	1	1
19	Site decision-maker		
	Owner	1	3
	Board of Directors	1	1
	Chairman of Board	-	1
	President	1	-
20a	Site information sources		
	Self knowledge	1	-
	Planning Commissions	1	-
	Firm's geologists	1	-
	Local zoning agency	-	1
	Farmers or local people	-	2
	Real estate agents or brokers	-	2
	Banking institutions	-	1
	Economic Development Association/Commission	1	1
	Chamber of Commerce	1	1
	Relocation consulting firm	1	-
	No answer	-	1

Four of the eight respondents indicated that the owner would be solely involved in the relocation decision. One said the firm's geologists and the owner would be involved, another said the Vice President, while two others said the President and Chairman of the Board.

With respect to the site decision-maker, half of the respondents said the owner would make the relocation decision and half said the Board of Directors, Chairman of the Board or President. In one of these instances, the Board of Directors was also described as the "owners". Thus, it appears that whomever would be considered uppermost management would be the best target for relocation information.

Question 20a asked about sources of information for a relocation decision. Of the firms in a relocation decision process, one respondent said he would not consult any source, but use his own knowledge about sites and the knowledge of the firm's geologists. Another relocater with site decided said that he would consult Planning Commissions, as he would not want his firm to locate where they were not wanted. Responses from other relocaters were: local zoning agency, farmers or local people, real estate agents or brokers, Chamber of Commerce, Economic Development Association, consulting firm and banking institutions. This list identifies persons who might be most likely to be contacted by firms interested in relocating.

Preference for Energy Sources

Table 6-4 describes relocater responses to questions regarding energy source preferences. Attitudes toward geothermal energy are very positive, as three-fourths of the relocaters indicated that geothermal was their number one energy source preference.

Five of the eight respondents preferring geothermal did so because they considered it to be accessible, inexpensive and/or clean. The remaining respondent preferring geothermal did so because he thought geothermal and biomass provided the "best of both worlds".

Petroleum, coal, wind, nuclear and biomass were the least preferred energy sources. Coal was least preferred by one respondent because of cost and transportation problems. Another respondent thought nuclear power was unsafe. Two respondents thought biomass was dirty and the resource could be better used in other ways. One of the two respondents who least preferred petroleum thought it was either too expensive and limited and the other thought its use made us import-dependent. The respondent preferring wind energy least thought the resource was too limited.

Of the two respondents who did not list geothermal as their preferred energy source, one thought it was "too risky" (because of the uncertainty in knowing where the resource is) and another thought it was too costly to develop. The respondents listed geothermal as their fourth and second preference, respectively.

TABLE 6-4

RELOCATER PREFERENCE FOR ENERGY SOURCES

Question Number	Question and Answers	Respondent Ranking							
		Site Decided				Other			
13	Ranking of energy sources								
	Solar	4	2	6		2	3	5	3
	Water	3	4	3		3	7	3	6
	Geothermal	1	1	1		1	1	4	2
	Petroleum	7	5	5		8	2	1*	8
	Coal	8	6	4		5	6	7	6
	Wind	5	7	7		4	8	6	4
	Nuclear	6	8	2		7	4	2	7
	Biomass	8	3	8		6	5	8	1
	*Natural gas indicated by respondent								
14	Why most prefer								
	Accessible	2				2			
	Inexpensive	2				2			
	Clean	2				1			
	Best of both worlds to use geothermal and biomass together	1				-			
	Firm has wood by-products (biomass)	-				1			
	Clean, neat and not scarce as they say (nat. gas)	-				1			
15	Why least prefer								
	Transportation problems (coal)	1				-			
	Other cheaper resources (coal)	1				-			
	Unsafe (nuclear)	1				-			
	Dirty/resource could be used other ways (biomass)	1				1			
	Too expensive (petroleum)	-				2			
	Makes us import dependent (petroleum)	-				1			
	Limited/unavailable	-				2			
16	Why geothermal (4th or 2nd) choice								
	Too risky	N/A				1			
	Too costly to develop	N/A				1			

Advantages and Disadvantages
of Geothermal Energy

Table 6-5 lists the perceived advantages and disadvantages of geothermal energy. Across all respondents, four advantages were listed: renewable, low cost, abundant or available and clean. For municipalities interested in attracting industry to geothermal use, these advantages are likely ones to emphasize.

There was a wider diversity of disadvantages than advantages cited for geothermal energy. The most frequently mentioned disadvantages were the fixed location of the resource and the high initial capital investment. Other disadvantages mentioned were: development risk, heat exchanger maintenance and lack of public knowledge. One respondent thought there were no disadvantages.

Use and Potential Use of
Geothermal Energy in Klamath Falls

To obtain some information on the respondents' knowledge of geothermal use in Klamath Falls, they were asked about current geothermal use in Klamath Falls (Question 6). All respondents indicated that current use was for space heating. There are, however, some limited uses in Klamath Falls for direct process heat.

Question 7 asked about potential uses. The responses were as follows:

	<u>Site Decided</u>	<u>Other</u>
Space Heating	3	3
Direct Process Heat	-	2
Generation of Electricity	1	2

Expansion of space heating use was mentioned most frequently.

TABLE 6-5

RELOCATER PERCEIVED ADVANTAGES AND
DISADVANTAGES OF GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Site Decided</u>	<u>Others</u>
5b	Advantages		
	Renewable	-	2
	Low cost	2	3
	Abundant/available	-	4
	Clean	3	1
5c	Disadvantages		
	Not transportable/ fixed location	1	2
	High initial capital investment	1	2
	Development risk	1	1
	Heat exchanger maintenance	1	
	Public lack of knowledge	-	2
	No disadvantages	-	1

Current Energy Use and Needs

As shown in Table 6-6, five of the eight relocaters knew their 1980 energy costs. Two of the firms that did not know indicated that they were not yet operating. The amount spent on energy ranged from \$6,000 to \$3,000,000. This is a direct reflection of the size of the firm.

Most relocaters did not know the percentage of energy costs to over-all operation costs. Two respondents indicated one percent or less and one indicated twenty percent.

None of the relocaters interviewed was currently using geothermal energy. The major explanation for this is their current geographical location. The most frequently mentioned energy sources were natural gas and electricity. Several of the firms used a combination of energy sources. The uses for the energy sources are also described in Table 6-6.

Attributes and Barriers Considered in the Relocation Decision

This and the remaining parts of this section address the major questions posed for relocaters:

- Needs of potential relocation industry or company,
- Attributes and barriers considered,
- Role of attributes and barriers and,
- Trade-offs among attributes and barriers.

The attributes considered reflect the needs of the firm; however, as described in later parts of this section, this question was addressed several ways.

TABLE 6-6
RELOCATERS' CURRENT ENERGY USE

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Site Decided</u>	<u>Others</u>
26	Dollars spent on energy in 1980		
	\$ 6,000	-	1
	\$ 8,500	1	-
	\$ 100,000	-	1
	\$2,000,000	1	-
	\$3,000,000	1	1
	Don't know	-	2
27	Percentage of total operating cost		
	One percent or less	1	1
	Twenty percent	-	1
	Don't know	2	3
28	Current energy sources		
	Natural gas	1	2
	Propane	-	1
	Gasoline	-	2
	Electricity	1	2
	Water	-	2
	No answer	2	1
29	Uses of energy sources		
	Natural gas for heating	1	1
	Water for electricity	-	3
	Gasoline to run machinery	-	2
	Electric for lights	-	1
	Propane for heating	-	1
	Natural gas for drying potatoes	-	1
	No answer	2	1

Factors in the Relocation Decision and Their Importance

Table 6-7 describes the relocation decision factors (attributes) elicited from the relocaters interviewed. The table indicates the order in which the factors were mentioned, as well as whether each factor was said to be "very important," "somewhat important" or "unimportant".

Availability of labor and raw materials were the most frequently mentioned factors. Only two respondents mentioned energy. One said "cheaper energy" and the other said "power to meet our needs". Transportation was also a frequently mentioned factor, as were costs. No respondent mentioned the availability of geothermal energy.

Table 6-7 lists the responses verbatim. Categorizing these responses, it is possible to see the relative importance of various factors (as presented in the tabulation below).

<u>Factor</u>	<u>Number Responding</u>
Labor supply	4
Costs of land and/or construction	4
Transportation	3
Raw Materials	3
Market for products	2

TABLE 6-7

RELOCATION DECISION FACTORS

<u>Respondent</u>	<u>Order of Mention</u>	<u>Factor</u>	<u>Importance</u>
Site decided	First	Availability of technicians and engineers	Very
	Second	Quantity of labor	Very
	Third	Cost of land	Somewhat
	Fourth	Cost of construction	Somewhat
	Fifth	Lower taxes overall	Somewhat
	Sixth	Clean environment	Somewhat
Site decided	First	Resources accessibility	Very
	Second	Market for firm's products	Very
	Third	Cost	Somewhat
Site decided	First	Financial backing	Very
	Second	Reasonable property	Very
Other	First	Raw materials	Very
	Second	Market for firm's products	Very
	Third	Cost of land	Very
	Fourth	Availability of labor	Very
	Fifth	Transportation	Very
Other	First	Railroad site	Somewhat
	Second	Raw materials	Very
	Third	Highly productive area	Very
	Fourth	Cheaper energy	Very
Other	First	Power to meet our needs	Somewhat
	Second	Close to airport	Very
	Third	Price of locations	Somewhat
	Fourth	Labor force guarantee	Very
Other	First	Raw materials	Very
	Second	Availability of labor	Very
Other	First	Market research findings	No answer

All other factors received one mention: lower taxes, financial backing, productive area, market research, clean environment, resources, costs, cheaper energy and "power to meet our needs".

Thus, it appears that the most important factors in a relocation decision are labor supply, costs of land and/or construction, availability of transportation and availability of raw materials. A municipality wishing to attract industry should emphasize the presence of these factors or take steps to acquire the necessary factors. Of course, needs will vary by industry type and size. It may be important to focus on attracting industry whose needs are consistent with the current levels of these factors already existing in the community. This will require the municipality to identify those industries that it will be most likely to attract.

Trade-Off Among Attributes and Barriers

Table 6-8 lists the factors and trade-offs among factors each respondent identified. The first respondent, an electronics firm, was willing to trade-off quantity of labor, cost of land and construction and lower taxes for availability of technicians and engineers. Clearly, for this respondent, the availability of technicians and engineers is more important than the other attributes named in a relocation decision. In addition, this respondent was willing to trade-off cost of land, construction and lower taxes for quantity of labor. The third most important attribute was cost of land. The respondent was willing to trade-off cost of construction and lower taxes for cost of land. Finally, cost of construction was more important than lower taxes.

TABLE 6-8

TRADE-OFF AMONG RELOCATION DECISION FACTORS

<u>Respondent</u>	<u>Trade-Off Factors</u>	<u>Willing to Trade-Off</u>
Site decided	Quantity of labor for availability of technicians and engineers	Yes
	Cost of land for availability of technicians and engineers	Yes
	Cost of construction for availability of technicians and engineers	Yes
	Lower taxes for availability of technicians and engineers	Yes
	Cost of land for quantity of labor	Yes
	Cost of construction for quantity of labor	Yes
	Lower taxes for quantity of labor	Yes
	Cost of construction for cost of land	Yes
	Lower taxes for cost of land	Yes
	Lower taxes for cost of construction	Yes
Site decided	Market for products for resource accessibility	No
	Cost for resource accessibility	Yes
	Cost for market for products	Yes
Site decided	Reasonable property for financial backing	No

TABLE 6-8 (Continued)

<u>Respondent</u>	<u>Trade-Off Factors</u>	<u>Willing to Trade-Off</u>
Other	Market for firm's products for raw materials	No
	Cost of land for raw materials	Yes
	Availability of labor for raw materials	Yes
	Transportation for raw materials	No
	Cost of land for market for firm's products	Yes
	Availability of labor for market for firm's products	Yes
	Transportation for market for firm's products	No
	Availability of labor for cost of land	Yes
	Transportation for cost of land	No
	Transportation for availability of labor	No
Other	Raw materials for rail-road site	No
	Highly productive area for railroad site	No
	Cheaper energy for rail-road site	No
	Highly productive area for raw materials	No
	Cheaper energy for raw materials	Yes

TABLE 6-8 (Continued)

<u>Respondent</u>	<u>Trade-Off Factors</u>	<u>Willing to Trade-Off</u>
	Cheaper energy for highly productive area	No answer
Other	Close to airport for power to meet our needs	No
	Price of location for power to meet our needs	Yes
	Labor force guarantee for power to meet our needs	No
	Price of location for close to airport	Yes
	Labor force guarantee for close to airport	No
	Labor force guarantee for price of location	No
Other	Availability of labor for raw materials	Yes

The second respondent was unwilling to trade-off a product market for resource accessibility; however, he was willing to trade-off cost for both resource accessibility and the market for the firm's products. Thus, resource accessibility appears to be the most important factor for this respondent. The third respondent would not trade-off reasonable property for financial backing, indicating that the two factors "go hand in hand". The last respondent with site decided was not willing to trade-off reasonable property for financial backing, preferring a lower cost of property.

The remaining four respondents who answered this question fall into the "other" category. The first respondent was unwilling to trade-off a market for products or transportation for raw materials, but was willing to trade-off cost of land and availability of labor for raw materials. This respondent was willing, however, to trade-off cost of land and availability of labor for a market for the firm's products, but was unwilling to trade-off transportation for a market for the firm's products. Apparently, transportation is critical to this firm, followed by a market for the firm's products. The respondent was unwilling to trade-off transportation for any other factor.

The second respondent in the "other" category also implied the critical importance of transportation, being unwilling to trade-off a railroad site for raw materials, a highly productive area or cheaper energy. This respondent was willing to trade-off a highly productive area for raw materials, as well as cheaper energy.

Labor force guarantee appears to be more critical to the third "other" respondent than any other factor, being unwilling to trade-off labor force guarantee for power, proximity to airport or price of location. He was unwilling to trade-off proximity to airport for power, but was willing to trade-off price of location for power. And, he was willing to trade-off price of location for being close to the airport.

The final respondent was willing to trade-off availability of labor for raw materials. One respondent declined an answer to the question.

Other Attributes and Barriers in the Relocation Decision

Approaching the decision factor information from another perspective, Question 24 asked respondents to indicate what characteristics a community must have to make it a desirable location. The following responses were elicited from the three relocaters with site decided.

- "...if the county wants us."
- Geothermal.
- "Availability of people to work, attitude of community toward new manufacturers, and basic services such as schools, shopping and recreation facilities."

The "other" respondents' answers were mostly redundant of the factors they had listed previously. These included:

- Labor supply,
- Raw materials, and
- Transportation,

Some factors were cited that were not previously mentioned. These were:

- Lively social and cultural climate,
- Attitude of community and businesses needed to support (supply) the firm, and
- Desirability of living conditions.

When asked what characteristics would eliminate a community from consideration (Question 25), the answers varied, but were generally the opposite of the desired attributes. Barriers identified by the three relocaters with site decided were:

- Lack of geothermal
- Community that doesn't want new energy changes/ fear of something new ("...which a lot of places have.")
- Lack of qualified labor force
- Open hostility to new manufacturers
- Regulations designed to discourage new manufacturers
- Inadequate services

The last four responses were all given by the same respondent. Being "wanted" by the community appears to be extremely important to relocaters.

All the barriers mentioned by the "other" respondents were the reverse of the attributes that were seen as desirable. Basically, a community would be eliminated from consideration if it did not have the attributes that were desired.

Energy Specific Questions

While several respondents mentioned energy in attribute and barrier questions, four questions asked specifically about energy. Table 6-9 arrays the responses to these questions.

Six of the eight respondents rated the availability of alternative energy sources as "very" or "somewhat important". Reasons given for "very important" ratings were that it's the only reason to move, to lower costs and because of the high cost of electricity. One firm said energy sources were "unimportant" because they make their own and another stated that alternative energy sources are only a fringe benefit. Across respondents, alternative energy sources, in and of themselves, do not appear to be a critical determinant of relocation. They are probably more important at the margins and when specific advantages can be shown.

Geothermal energy availability was rated as slightly less important than was availability of alternative sources of energy. The relocaters with site decided all said geothermal was "very" or "somewhat important" whereas, the majority of "other" respondents thought it was "unimportant".

TABLE 6-9
IMPORTANCE OF ENERGY AND GEOTHERMAL ENERGY

Question Number	Question and Answers	Number Responding	
		Site Decided	Others
22b	Importance of Alternative Energy Sources		
	Very Important (1)	2	1
	Somewhat important (2)	1	2
	Unimportant (3)	-	1
	No answer	-	1
	Average = 1.71		
22c	Why?		
	Contracts for low electric rates expiring (1)	1	-
	Would not move for any other reason (i.e., to have availability of alternative energy sources) (1)	1	-
	Energy is only a fringe benefit (2)	1	-
	Make our own energy (3)	-	1
	Low cost (1)	-	2
	No answer	-	2
31	Importance of Geothermal		
	Very important (1)	2	1
	Somewhat important (2)	1	1
	Unimportant (3)	-	3
	Average = 2.0		
32	Why?		
	Low energy user (2)	1	-
	Is my business/investment (1)	2	-
	Do not need it (2)	-	1
	Costs (1)	-	1
	Not best energy source for drying (3)	-	1
	High costs of tapping the resource (3)	-	2

The reason given by the two site decided respondents who thought geothermal was "very important" was that it was their business. One was an engineering firm and the other was a development/real estate firm. It was not important to them as a source of their own energy. The "other" respondent said it was "very important" because of low costs.

One vegetable drying firm indicated that there were better sources of energy for their purposes and two other firms indicated geothermal was "unimportant" because of the costs of drilling. Firms saying geothermal was "somewhat important" said they were a low energy user or they did not need geothermal because they produced their own energy (biomass).

Thus, it appears that the availability of geothermal energy is not generally a critical relocation factor. Other factors such as transportation, raw materials and labor force availability are more important. Geothermal may be important at the "margins" given that other factors are present, according to implications of this sample.

Incentives

Relocaters were asked a series of questions about incentives that might influence a relocation decision. The first of these questions (Question 33) asked how important the availability of financing assistance would be for developing geothermal energy. The responses and number responding are described on the next page.

<u>Importance</u>		<u>Site Decided</u>	<u>Other</u>
Very important	(1)	1	2
Somewhat important	(2)	1	-
Unimportant	(3)	1	3

In general, the importance of financing may depend on the firm and their initial interest in developing geothermal energy (Question 34). Some respondents said they would be more likely to use geothermal energy if they could get financing. One person thought that community financing was an indicator of the community backing the firm. Others thought getting financing was a "pain" and the firm should finance their own endeavors. It appears that for some firms financing can stimulate development, given an interest in the use of geothermal. Availability of financing appears to be more important to relatively smaller firms.

Question 35 asked what incentives a community could provide to interest a firm in relocating. Half of the respondents said "tax incentives". One said "guarantee of bank financing" and another said "guarantee of ample labor and energy". From this survey, it appears that tax incentives may be an important source of attraction of a firm to a community.

Question 36 asked what the local community could do to interest the firm in using or expanding their use of geothermal energy. Only three respondents had responses to this question. One said geothermal insurance, another said to form a utility district and another suggested financial assistance.

The last question in the survey asked if the respondent had any additional comments: several did. One person stated how important regulations were and that Oregon had the "highest workman's comp in the nation". Another person thought that government grants were "excellent". Still another (wood products firm) said they were interested only in developing biomass. Three respondents complained about government red tape and commented that the government should let private enterprise do the financing and developing.

Summary of Potential Relocaters to Klamath Falls

Awareness of geothermal energy was high, with all respondents aware of the energy source. Respondent interest in the development of geothermal energy in Klamath Falls was also high with over half being "very interested". The City of Klamath Falls was perceived as being "very interested" in the development. All but one respondent considered themselves to be knowledgeable about geothermal energy. Thus, geothermal is an energy source that was known to people interested in relocating in the area. In addition, geothermal was a preferred energy source by the majority of respondents, primarily because it was accessible, inexpensive and clean. However, none of the firms surveyed currently used geothermal energy.

Municipalities interested in attracting firms to the area should, as would be expected, contact top officials in the firm, as these persons (President, Owner or Board of Directors) are likely to be the decision agents. Relocaters tend to rely on a variety of sources for information on potential sites.

Important sources of information will likely be:

- Local zoning agencies and planning commissions,
- Real estate agents, and
- Chamber of Commerce.

Other sources include: relocation consulting firms, banks and local residents. The information dispersed by these sources may be important to the initial attraction of a firm, however, other factors may determine the final location decision.

The most important factors to a relocation decision, according to this sample were:

- Labor supply
- Cost of land and/or construction
- Transportation
- Raw materials
- Market for products

Alternative sources of energy or availability of geothermal energy did not emerge as important determinants in a relocation decision.

From this sample it appears that energy is a factor that is likely to be an attraction "at the margins". A municipality will first have to demonstrate that an area offers an ample supply of labor and raw materials, as well as the necessary means of transportation. This, of course, will be industry specific, and a community will have to determine the industries that it is most likely to attract. This will necessitate becoming an "expert" on the needs of the particular industry and firm.

Industries most likely to need less expensive forms of energy are "high cube industries" and these may be most attracted to areas offering geothermal potential. Such firms include indoor agricultural firms (greenhouses) and electronic firms. Wood products firms frequently have their own sources of energy as a by-product (biomass) as was revealed in this survey. Other firms likely to be attracted are developers of geothermal, although not as users.

In general, trade-off analysis revealed that the relocaters were unwilling to trade-off raw materials and labor supply for other attributes. Some respondents were very concerned about being "wanted" by the community. It appears necessary that the community project a genuine interest in attracting a firm to an area. Tax incentives, district utility projects, lack of regulations and availability of financing appear to be interpreted as projections of such interest.

Barriers to relocation appear to be just the opposite of factors in the decision process. For example, lack of an adequate labor supply, transportation and raw materials.

In conclusion, the most significant implication appears to be that a community must be able to attract industry on the basis of having the basics necessary to produce the firm's product. Critical factors are labor supply, availability of raw materials and transportation. Energy, while "important" is not likely to be the major determinant of relocation for most firms. Geothermal may be viewed as an "incentive" of an area. Other incentives are lack of restrictions and regulations, tax incentives and availability of financing. Of course, this will vary by industry and it is critical that a municipality appeal to the specific needs of a firm or industry.

SECTION VII

RESULTS OF BENCHMARK MEASUREMENT FOR KLAMATH FALLS' FINANCIERS

Four currently involved financiers and seven potentially involved financiers were surveyed. Currently involved financiers included the Federal Land Bank, a local savings and loan, a local bank and a bank located in San Francisco. Potentially involved financiers included the FHA, three local banks, two local savings and loans and a mortgage company.

Awareness, Knowledge and Interest Regarding Geothermal Development

Awareness of geothermal as an energy source was widespread among the eleven respondents from the financial community. As shown in Table 7-1, all but one respondent recalled geothermal on an unaided basis (Question 1) and even that one respondent, a potential geothermal financier, recognized the source when prompted with an aided question (Question 2). Petroleum, water, solar and wind were also frequently mentioned as potential energy sources.

When asked what had prompted their initial awareness of geothermal, most respondents (8) claimed that the presence of geothermal in the area had first made them aware of the energy source. One respondent had first learned about geothermal in college, another through a customer and still another by reading Popular Science. All respondents had known about geothermal for at least five years. Not surprisingly, current investors in geothermal had been aware of the energy source for a longer average period of time (23.5 years) than had potential investors (14.0 years).

TABLE 7-1
FINANCIERS' AWARENESS OF GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
1	Energy sources that come to mind		
	Solar	3	6
	Water	4	6
	Geothermal	4	6
	Petroleum	4	6
	Wind	3	5
	Nuclear	2	2
	Biomass	3	2
	Coal	1	3
2	Aware of geothermal if not mentioned for Question 1	N/A	1
3	How first aware?		
	Around it	2	6
	In college	1	-
	Through customer	1	-
	Reading <u>Popular Science</u>	-	1
4	Number of years ago first aware		
	5	1	1
	10	-	1
	11	-	1
	12	-	1
	15	-	1
	25	1	2
	30	1	-
	34	1	-
	Average	23.5 years	14.0 years

As described in the summary table below, half of the current investors felt they were "very" knowledgeable about geothermal. Only one of the seven potential investors similarly regarded himself as "very" knowledgeable, with most claiming to be "somewhat" knowledgeable.

<u>How Knowledgeable</u>	<u>Current</u>	<u>Potential</u>
Very	2	1
Somewhat	1	5
Not very	1	1

Table 7-2 displays responses regarding interest in further geothermal development in the Klamath Falls area. Members of the financial community appear to be staunch advocates of further development and use. Ten of the eleven reported they were "very" interested (Question 8). The reasons cited for this high level of interest included geothermal's low cost, renewability, and non-polluting aspects. In addition the financial investors felt that geothermal development would attract industry to the community and promote the area's economic welfare (Question 9).

Beyond their personal interest, all financiers perceived the City of Klamath Falls itself as "very interested" in further geothermal use and development (Question 10). Consistent with their own professional perspectives, the majority of financiers claimed that the City's interest stemmed from the economic growth advantages that geothermal development would create for the community. They also mentioned geothermal-specific advantages, like its availability and low cost. In addition, three respondents mentioned the City's unique interest in the downtown heating project for public buildings.

TABLE 7-2
FINANCIERS' INTEREST IN GEOTHERMAL

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
8	Interest in further development and use in Klamath Falls		
	Very	4	6
	Somewhat	-	1
	Uninterested	-	-
9	Why interest/uninterest?		
	Advantages of use (clean, non- depletable, inexpensive, etc.)	2	5
	Attract industry	-	3
	Good for economy	2	5
10	Interest in City of Klamath Falls		
	Very	4	7
	Somewhat	-	-
	Uninterested	-	-
11	Why City interested/uninterested?		
	Benefits economy and growth	2	4
	For heat downtown	2	1
	Advantages of use (inexpensive and available)	2	4

Financial respondents can thus be characterized as highly aware and very much interested in geothermal. Current investors were more knowledgeable regarding geothermal than were potential investors. Much of the financiers' interest resided in the potential economic and industrial growth advantages that it can bring to the community.

Preference for Energy Source

Table 7-3 displays preference patterns for various energy sources. Geothermal emerged as the overall favorite, with nine of the eleven financial respondents ranking it as their number one energy source preference (Question 13). Interestingly, the two who did not select geothermal as their overall favorite were current investors in geothermal. They chose solar and petroleum instead, although they still ranked geothermal high. Overall, petroleum, coal, biomass and nuclear were viewed as undesirable energy sources by both current and potential geothermal investors.

When asked why they preferred geothermal (Questions 14 and 16), most respondents mentioned its availability and clean, non-polluting aspects. Low cost was also frequently cited as a reason for preference. The one respondent who chose solar as his favorite energy source highlighted its unlimited supply and non-pollutant qualities. The advocate of petroleum simply replied that it was efficient and easy to handle.

Respondents offered a wide array of reasons for why they least preferred certain energy sources. Opponents of petroleum (n = 4) cited its diminishing supply, high cost, and dependence on foreign countries. Respondents who had least preferred wind (n = 2) cited its experimental status, uncertain cost-effectiveness and the dearth of strong consistent winds. Respondents opposed to nuclear (n = 2) argued the problems of high cost, inadequate technology,

TABLE 7-3
FINANCIERS' PREFERENCE FOR ENERGY SOURCES

<u>Question Number</u>	<u>Question and Answers</u>	<u>Respondent Ranking</u>	
		<u>Current</u>	<u>Potential</u>
13	Ranking of energy sources		
	Solar	1 6 5 2	2 6 2 2 3 3 2
	Water	4 2 2 3	5 2 3 3 2 4 3
	Geothermal	2 3 1 1	1 1 1 1 1 1 1
	Petroleum	6 1 8 8	7 7 8 6 7 8 7
	Coal	7 7 3 6	6 5 7 7 8 7 6
	Wind	3 8 4 5	4 9 4 5 6 6 5
	Nuclear	8 4 7 7	8 4 6 4 4 5 4
	Biomass	5 5 6 4	3 8 5 8 5 2 8
		<u>Number Responding</u>	
14	Why most prefer geothermal?		
	Available	1	6
	Inexpensive	1	3
	Clean/Non-polluting	-	6
	Non-depletable	-	1
	Efficient	-	2
	Why most prefer solar?		
	Clean, non-polluting	1	-
	Unlimited supply	1	-
	Why most prefer petroleum?		
	Easiest to handle	1	-
	Very efficient	1	-

TABLE 7-3 (cont.)

FINANCIERS' PREFERENCE FOR ENERGY SOURCES

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
15	Why least prefer?		
	Foreign dependency (petroleum)	1	1
	Get away from fossil fuel (petroleum)	1	-
	Diminishing resource/non-renewable (petroleum)	1	2
	Costly (petroleum)	-	1
	Not environmentally sound (Petroleum)	-	1
	Polluting (coal)	-	1
	Still in experimental stage (wind)	1	-
	May not be cost-effective (wind)	1	-
	Winds not consistent nor strong enough (wind)	-	1
	Hazards of accidents (nuclear)	1	-
	Cost (nuclear)	1	-
	Lack of adequate technology (nuclear)	1	-
	Inadequate waste treatment (nuclear)	-	1
	Eventual depletion (biomass)	-	2
	Dirty/air pollution (biomass)	-	2
16	Why geothermal? (2nd or 3rd)		
	Availability	1	N/A

inadequate treatment of waste and potential for accidents. Opponents of biomass (n = 2) spoke of eventual depletion and air pollution. The single respondent who had least preferred coal mentioned its polluting feature.

Perceived Advantages and Disadvantages of Geothermal

In general, financial respondents appeared to present a balanced picture of the relevant advantages and disadvantages of geothermal. Not surprisingly, they focused more heavily on the cost and economic features of geothermal than did other respondents. As displayed in Table 7-4, potential investors are similar to current investors in their overall perception of the relevant advantages and disadvantages.

Among the most frequently mentioned advantages were the low overall cost and renewability. Many respondents also spoke of the economic benefits in terms of more jobs and heightened industrial growth. Still others mentioned reduced dependence on foreign oil and other energy sources while others spoke of environmental advantages and geothermal's local availability.

When it came to describing disadvantages, cost factors were again pre-eminent. The overriding disadvantage, perceived by seven of the eleven financiers, was the high initial cost of development. Two respondents for example, volunteered that the costs for initial installation and for drilling were prohibitive without a loan and especially hard on the homeowner. Despite the high initial cost, however, respondents were quick to point out that it constituted a "short-term" disadvantage. As one respondent argued, "...over the long haul, you recapture that investment".

TABLE 7-4

FINANCIERS' PERCEIVED ADVANTAGES AND DISADVANTAGES
OF GEOTHERMAL ENERGY USE

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
41	Perceived advantages		
	Low cost overall	2	2
	Renewable/dependable	2	2
	Economic benefits -- jobs and industry growth	1	2
	Reduces dependence on foreign oil and other services	1	2
	Environmentally sound/clean	-	2
	Local availability	1	1
	Growth potential	1	-
	Continuous heat source	1	-
	Diversity of applications	-	1
42	Perceived disadvantages		
	High initial cost/capital cost/ development costs	3	4
	Limitations of knowledge and technology	-	2
	Waste water disposal/ brine problem	1	1
	Over-utilization with unknown future supply	1	-
	Resource not always clean	-	1
	Remote areas/site-specific	1	-
	None	-	1

Other perceived disadvantages mentioned by at least two respondents included the problem of waste water disposal and current limitations in knowledge and technology. One respondent spoke of possible over-utilization of a resource whose future supply was unknown while another complained that the resource was not always clean. Finally, one respondent noted that geothermal sources tended to exist in remote areas and transporting over long distances was not possible.

Use and Potential Use of Geothermal Energy in Klamath Falls

Table 7-5 displays responses concerning the present and future use of geothermal energy in the Klamath Falls area. Knowledge of different uses did not appear to vary by current and potential investors.

The most frequently cited current use (Question 6) was space heating which was mentioned by nine of the eleven financiers. Home heating, a form of space heating, was mentioned by three respondents. Two respondents reported that geothermal had been used for greenhouses. One respondent each cited the use of geothermal for direct process heat, fresh water shrimp and hot water.

Apparently, members of the financial community are convinced that geothermal use has significant potential, as they volunteered a broad array of potential geothermal uses (Question 7). In addition to the continued use of geothermal for space heating, over half the respondents predicted the use of geothermal for direct process heat. Three financiers argued that geothermal could ultimately be used to generate electricity. Four forecasted the use of geothermal for greenhouses. In addition, individual respondents volunteered such miscellaneous uses as alcohol production, fish ponds, industrial heating districts, institutional heating, as well as the use of geothermal for agricultural needs and industrial products.

TABLE 7-5

FINANCIERS: USE AND POTENTIAL USE OF GEOTHERMAL
IN KLAMATH FALLS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
6	Current uses		
	Space heating	4	5
	Direct process heat	-	1
	Fresh water shrimp	1	-
	Greenhouses	1	1
	Home heating	-	3
	Hot water	-	1
7	Potential uses		
	Space heating	4	5
	Direct process heat	2	3
	Generation of electricity	-	3
	Fresh water shrimp	1	-
	Greenhouses	1	3
	Agricultural uses	-	1
	Alcohol production	-	1
	Fish ponds	-	1
	Industrial heating district	-	1
	Institutional heating	-	1
	Industrial products	-	1

Decision Factors and Trade-Off Among Factors

Prior to discussing factors that influence the financing of geothermal projects, respondents were asked what factors, in general, influenced their decisions to finance any project or development (Question 17). The summary table below describes the major factors.

Decision Factors in Financing Any Project or Development

	<u>Number Responding</u>	
	<u>Current</u>	<u>Potential</u>
Credit standing/meet loan requirements	3	5
Return on investment/future marketability of loan	2	2
Project feasibility/loan purpose	2	2
Person's character/reputation of promoter	1	1
Other	2	3

The borrower's credit standing was the single most important decision factor, mentioned by eight of the eleven respondents. Return on investment and project feasibility were also often viewed as critical. The reputation or character of the persons involved in loan application was also mentioned by at least two respondents.

Not surprisingly, the factors critical to usual project investment were also deemed critical for investment in geothermal projects. Table 7-6 offers a respondent-by-respondent breakdown of factors that would be taken into consideration prior to geothermal investment (Questions 21 and 22). Except for a few geothermal-specific comments (e.g., knowledge of geothermal usage, environmental soundness, and continuous source availability) the decision factors closely parallel those for usual financial investment. Current investors in geothermal appear to evidence the same concerns as potential investors.

TABLE 7-6
FINANCIER DECISION FACTORS

<u>Respondent</u>	<u>Order of Mention</u>	<u>Factor</u>	<u>Importance</u>
Current	First	Purpose of loan	Very
	Second	Eligibility of borrower	Very
	Third	Security	Very
	Fourth	Borrower repayment	Very
Current	First	Resource evaluation	Very
	Second	Management	Very
	Third	Market for product	Very
Current	First	Feasibility	Very
	Second	Financial strength of company	Very
	Third	Availability and continuous source of energy	Very
Current	First	Costs	Very
	Second	Accessibility of source	Very
	Third	Efficiency	Very
Potential	First	Need	Very
	Second	Feasibility	Very
	Third	Environmentally sound	Very
Potential	First	Chance of success in area	Very
	Second	Collateral offered	Very
	Third	Ability to repay	Somewhat
Potential	First	Knowledge of geothermal use	Very
	Second	Character	Very
	Third	If project is economically feasible	Very
Potential	First	Credit of borrower	Very
	Second	Cost of project	Very
	Third	Appraisal	Very
Potential	First	Economically feasible	Very
	Second	Contribution to community	Very
Potential	First	Ability to repay loan	Very
	Second	Economic feasibility of project	Very
Potential	First	Cost-justifiable	Very

Members of the financial community took a rather hard line in emphasizing credit standing and investment feasibility over "less economic" decision factors. Table 7-7 displays factor-by-factor trade-offs in investment decisions regarding geothermal development (Question 23a). In general, investors would not trade-off the borrower's eligibility and other cost considerations for the overall purpose of the project. Alternatively, they would waive the environmental soundness of the project, as well as availability and resource evaluation for corporate financial strength and promising product marketability. As one respondent remarked, "[If the costs were completely satisfactory],... they can [always] do something about accessibility". Another respondent rather harshly stated that if the borrower's character was good, but the project was less than satisfactory in terms of economic feasibility, then the person should be told "to apply for a government grant".

Other Factors that Influence Geothermal Investment Decisions

Financial respondents were specifically quizzed regarding the influence of several extraneous factors on their decision to invest in geothermal. These results are presented in Table 7-8. Six of the eleven respondents claimed the local government had an influence on their involvement (Question 26a). Most viewed the local government as an information channel, fostering awareness and knowledge of geothermal through its involvement with the heating district.

When asked to describe the "state of the art" in geothermal development, respondents unanimously agreed on its "infancy" status. Their comments were punctuated with remarks on the insufficiencies of money, time and experience that had been thus far expended. The use of heat pumps, hot dry rock technology and broader applications were cited as underdeveloped aspects that signified the wave of the future.

TABLE 7-7

TRADE-OFF AMONG FINANCIERS' DECISION FACTORS

<u>Respondent</u>	<u>Trade-Off Factors</u>	<u>Willing to Trade-Off</u>
Current	Eligibility of borrower for purpose of loan	No
	Security for purpose of loan	No
	Borrower's repayment for purpose of loan	No
	Security for eligibility of borrower	Yes
	Borrower's repayment for eligibility of borrower	(Same factors)
	Borrower's repayment for security	No
Current	Management for resource evaluation	No
	Market for product for resource allocation	No
	Market for product for management	No
Current	Financial strength of company for feasibility	Yes
	Availability and continuous source of energy for feasibility	DK
	Availability and continuous source of energy for financial strength	Yes
Current	Accessibility of source for costs	Yes
	Efficiency for costs	Yes
	Efficiency for accessibility of source	No Response
Potential	Feasibility for need	No
	Environmentally sound for need	Yes
	Environmentally sound for feasibility	Yes

TABLE 7-7 (cont.)
TRADE-OFF AMONG FINANCIERS' DECISION FACTORS

<u>Respondent</u>	<u>Trade-Off Factors</u>	<u>Willing to Trade-Off</u>
Potential	Collateral offered for chance for success in area	No
	Ability to repay for chance for success in area	Yes
	Ability to repay for collateral	Yes
Potential	Character for knowledge of geothermal	No
	Economic feasibility of project for knowledge of geothermal	No
	Economic feasibility of project for character	No
Potential	Cost of project for credit of borrower	No
	Appraisal for credit of borrower	Yes
	Appraisal for cost of project	Yes
Potential	Contribution to community for economic feasibility	No
Potential	Economic feasibility of project for ability to repay loan	No

TABLE 7-8

OTHER FACTORS INFLUENCING DECISIONS IN GEOTHERMAL INVESTMENT

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
26a.	Any local government influence?		
	Yes	2	4
	No	1	3
	Don't know	1	-
26b.	How local government influence?		
	Their efforts keep us informed and aware of aspects of geothermal/encourage thought	1	3
	Taxation	1	-
	Have requested help with funding	-	1
29	Current stage of development		
	Infancy/primitive/basic/ beginning/early/not far enough	4	7
30	How affect investment willingness?		
	No influence/obviously not important/ not affect decision at all	2	1
	Big influence/definitely consider/ do not provide speculative capital/ we're not risk capital lenders/ don't like to finance at bottom of learning curve	2	3
	Have enough development for sound credit judgment/on limited basis	-	2
	N/A do not fund geothermal from this office	-	1
32a	Insurance availability affect financing?		
	Yes	2	1
	No	2	6
35	How do intangible drilling costs affect financing?		
	Considerable	2	1
	Somewhat	-	1
	Greatly/a great deal	1	1
	Intangibles could be secured by collateral, or financial capability of borrower/could set top limit	-	3
	Depends on whether resource is known and proven	-	1
	No barrier/only for investor looking for tax advantages	1	-

Interestingly, respondent opinion diverged on whether geothermal's "beginning" status would affect financial investment (Question 30). Half the current investors, naturally enough, reported that it had no impact. The other two current investors claimed it had a key influence or was at least a "definite consideration". Potential investors also had mixed opinions, but overall, they appeared more cautious. Only one potential financier, for example, claimed geothermal's incipient status had no effect on financial decisions. Three argued that speculative investment, risk capital lending and financing at the bottom of the learning curve were serious pitfalls. Two potential investors provided a more moderate perspective, suggesting that there was sufficient development to determine financial investment on a case-by-case basis.

Regarding insurance availability (Question 32a), only three investors, two current and one potential, felt it affected their willingness to finance geothermal development. One current investor claimed insurance "reduced the risk", while another cautioned that it had to be "provided in the right circumstances". The potential investor felt that insurance would be helpful in the case of an "SBA insured loan" which reduced his institution's risk to 10 percent.

Only one respondent, a current investor, found "intangible drilling costs" (Question 35) to pose no barrier to geothermal financing. Most respondents felt its impact ranged from "a great deal" to "somewhat". Several respondents, particularly potential investors, presented modified viewpoints: intangible costs could be secured by collateral or the borrower's financial capability; or a known and proven resource could render drilling costs "less intangible".

Since intangible drilling costs refer to non-asset costs (such as labor) they are only meaningful to equity investors for tax purposes. The responses of bank financiers who said intangible drilling costs were "important" and who answered the question, "Why?" all (n = 4, with both current financiers who said "considerable" represented) related the intangible cost to risk in some way. One said, "...because it is cost basic -- must be acceptable and reasonable -- the individual has to have the ability to repay the loan". Thus, intangible drilling costs were related to uncertainty of cost estimates in some financiers' response to this question.

Of the four extraneous factors studied, "intangible drilling costs" appear to most seriously deter geothermal investment. The "infancy" status of geothermal bothered the majority of investors, particularly potential ones. The availability of insurance had little effect. The role of local government, as a geothermal promoter and information disseminator, was viewed as positively influencing financial decisions for half the respondents.

Perceived Role of Government Regulations

There was no general consensus on the overall impact of government regulations on geothermal investment (Question 25). Two current investors mentioned permits, another spoke of the usefulness of grants and guarantees, while another simply replied that regulations were "very significant". Among potential investors, three merely stated that the project must conform to government regulations. Two potential financiers criticized regulations as "strangling" and requiring too much "paperwork". Another spoke highly of government guaranteed loans and still another claimed there were no regulations. These results are described in Table 7-9.

TABLE 7-9

FINANCIER PERCEIVED ROLE OF GOVERNMENT REGULATIONS IN
GEOTHERMAL INVOLVEMENT

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
25	General role of government regulations		
	Permits are very important	1	-
	Very significant	1	-
	Great, if in form of grants and guarantees	1	-
	State government - just a matter of licenses	1	-
	Project must conform/abide by regulations	-	3
	Government regulations are often so restrictive they strangle accomplishment	-	1
	Could prevent our involvement - we're too small to handle paperwork	-	1
	Depends -- there are no regulations now	-	1
	Government guaranteed loans allow larger loans, longer terms and more economically feasible projects	-	1
26	At-site government regulations and their influence		
	Project must conform to all regulations/must uphold	-	2
	None/no current regulations/no influence/not applicable	1	2
	Permit is essential/need government approval to dig well	1	1
	Make sure they benefit project	1	-
	We'd be unable to make loan if regulation prevented borrower from utilizing geothermal	1	-
	Environmental regulations make economic feasibility difficult	-	1
	Don't know	-	1

In a later question (Question 40), respondents were asked about the specific impact of on-site regulations on their willingness to invest. Again, opinion was divergent. Three financiers felt regulations played no role at all. Two simply mentioned the project had to conform to regulations. Two others spoke of government permits and approval. Several financial respondents offered miscellaneous comments like "ensuring regulations benefited the project", and the lack of "economic feasibility" in environmental regulations.

Awareness of and Attitudes Toward
Specific Government Regulations and Programs

Table 7-10 displays responses regarding awareness of and attitudes toward specific government financial programs. Of the four programs, only one, the Tax Credit Program was well known to the financiers. Among aware respondents, opinion of the four programs was generally positive. Current and potential investors displayed few differences in overall program awareness.

Familiarity with the Geothermal Loan Guaranty Program (Question 36a) was limited to two respondents - a current investor and a potential investor. The current investor found the program extremely influential, in fact, it was the "only reason" his firm had invested in geothermal. The potential investor felt the program's impact could be significant, rendering a given project more feasible by extending the term of payment. Both respondents expressed high positive regard for the loan program (Question 36c).

The majority of financiers (8 out of 11) were aware of the Geothermal Investment Tax Credit (Question 37a). Regarding its impact on their willingness to invest (Question 37b), most financiers complained that it benefited only the borrower, not the lender. Despite this widespread complaint, however, overall opinion of the Tax Credit was favorable (Question 37c). All but one of the eight aware respondents offered favorable comments, suggesting that it supplied a needed incentive for the developer.

TABLE 7-10
FINANCIERS AWARENESS OF AND ATTITUDES TOWARD SPECIFIC
GOVERNMENT PROGRAMS AND REGULATIONS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
36a	Aware of Loan Guaranty Program		
	Yes	1	1
	No	3	6
36b	Influence of Loan Guaranty Program		
	Very much; the <u>only</u> reason we're involved	1	-
	Significantly; makes project feasible by extending term of payment	-	1
36c	Opinion of Loan Guaranty Program		
	High esteem	1	-
	Experience was good; DOE plaudits for project analysis and collaboration with both parties	-	1
37a	Aware of Investment Tax Credit		
	Yes	2	6
	No	2	1
37b	Influence of Tax Credit		
	Benefits investor only; not bank	2	4
	Aids developer's cash flow	-	1
	Affects borrower's ability to pay by lowering total cost	-	1
37c	Opinion of Tax Credit		
	Good/positive/in favor/ needed/good for purchaser/great	2	5
	No comment	-	1

TABLE 7-10 (cont.)

FINANCIERS AWARENESS OF AND ATTITUDES TOWARD SPECIFIC
GOVERNMENT PROGRAMS AND REGULATIONS

Question Number	Question and Answers	Number Responding	
		Current	Potential
38a	Aware of Depletion Allowance		
	Yes	2	1
	No	2	6
38b	Influence of Depletion Allowance		
	Gives bonds to bank	1	-
	Benefits borrowers; not bank	1	-
	Don't know	-	1
38c	Opinion of Depletion Allowance		
	Incentive; encourages investment	2	-
	Don't know	-	1
39a	Aware of Additional Energy Credit		
	Yes	1	4
	No	3	3
39b	Influence of Energy Credit		
	Benefits borrower; not bank	1	-
	Consideration in borrower's ability to pay	-	1
	Helps investor to start project	-	1
	Helps offset high initial cost (bank will use well)	-	1
	Don't know	-	1
39c	Opinion of Energy Credit		
	Good; favorable; needed to stimulate investment	1	2
	Opposed; too many programs financed by government	-	1
	Don't know	-	1

Only three financiers were aware of the Geothermal Depletion Allowance (Question 38a). Regarding its impact on investment decisions (Question 38b), one respondent mentioned that it "gave bonds to banks", another criticized the program as an aid to borrowers, not to lenders, and a third respondent "did not know". When opinions of the Depletion Allowance were volunteered, they were positive and sparked with mentions of its use as an incentive to encourage investment.

About half the financiers claimed awareness of the additional energy credit (Question 39a). Most felt it would positively influence their investment decision - by enhancing the borrower's credit standing, encouraging project initiation, offsetting high initial costs and the like (Question 39b). Most opinions of the tax credit were favorable although one financier opposed it, stating that the government was already financing too many investment programs.

Requirements for Financing Geothermal Projects

Most financiers felt the requirements for geothermal investment should parallel those for other ventures. Table 7-11 supports this perspective.

Financial respondents varied widely in their preferred payback periods (Questions 27 and 28), offering such responses as the "shorter the better" to "20 years or more". However, regardless of their preferred timeframe, all but two respondents were consistent in expecting the same payback period for geothermal as for other ventures. For those two inconsistent financiers, one expected a longer payback for geothermal; the other a shorter payback period.

Regarding the information required prior to financing (Question 31), half the respondents desired some type of professional certification - from an engineer, geologist, or the like. In addition, half wanted some knowledge of the availability and dependability of the source. Three financiers wanted to know the

TABLE 7-11

FINANCIER REQUIREMENTS FOR FINANCING GEOTHERMAL PROJECTS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
27	Payback period for geothermal projects		
	More than 20 yrs	1	1
	16 - 20 yrs	1	-
	11 - 15 yrs	1	1
	10 yrs or less	-	2
	Depends on individual project	1	2
	Shorter the better	-	1
28	Payback period for other ventures		
	More than 20 yrs	1	2
	16 - 20 yrs	1	-
	11 - 15 yrs	1	-
	10 yrs or less	-	3
	Depends on individual project	1	2
	Shorter the better	-	1
31	Information needed before financing		
	Professional certification/ engineering report	2	3
	Availability/dependability of source	2	3
	Financial strength/ability to repay loan	1	2
	Project Feasibility	1	2
	Cost-benefit	1	1
	Use of project/need	1	1
	Source, purity and temperature of water	1	-
	Meeting of government regulations	1	-
	Would not finance it	-	1

TABLE 7-11 (cont.)

FINANCIER REQUIREMENTS FOR FINANCING GEOTHERMAL PROJECTS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
33	Security Requirements		
	Real estate/real estate as collateral	2	2
	Mortgage/second mortgage	2	2
	Bankable credit/normal collateral	1	2
	Project access/demonstration	1	1
	Developer's equipment	1	1
	Completion guarantee	1	-
	Cash flow projection	1	-
	SBA guarantee	-	1
	Signature	-	1
	Real property	-	1
	House and well on same property	-	1
34a	Difference in security requirements for geothermal		
	Yes	1	1
	No	3	6
34b	What differences?		
	Greater risk factor for undeveloped resource	1	-
	Long-term payback might require government guarantee	-	1

borrower's loan qualifications. Three were concerned with project feasibility. Several other miscellaneous requirements emerged while one respondent flatly proclaimed his firm "would not finance" any geothermal project.

In general, security requirements for geothermal were similar to those expected for other ventures (Question 33). Real estate, mortgages, bankable credit and the developer's equipment were the most frequently mentioned requirements. Only two financiers anticipated differences in security requirements for geothermal (Question 34a). One respondent indicated a greater risk factor accompanied geothermal; another felt the long term payback might require a government guarantee.

Summary of Benchmark Attitudes for Klamath Falls' Financiers

The emerging profile of Klamath Falls' financiers indicates a staunch advocacy for geothermal development. Overall awareness and knowledge of geothermal use was widespread and most respondents claimed geothermal as their preferred energy source. Respondents appeared convinced that geothermal was possessed of a bright future - they forecast a broad array of potential applications, ranging from heating and agricultural uses to alcohol production, shrimp raising and the generation of electricity. In terms of relevant advantages and disadvantages, financiers presented a balanced picture, focusing heavily on cost and economic factors. The key advantages included low overall cost, availability and heightened economic growth for the community. The most serious perceived drawback was the high initial cost of development.

In describing factors critical to decisions on geothermal financing, respondents marshalled forth the usual investment criteria: credit standing, returns on investment, ability to pay-back loan, and borrower's reputation. When other criteria were

mentioned (e.g., environmental soundness, source availability), financiers took a hard line in de-emphasizing these features relative to the pre-eminent cost and economic considerations. In addition, most respondents felt that "intangible drilling costs" significantly deterred investment. Although respondents unanimously agreed on the "infancy" status of geothermal technology, opinion diverged regarding whether this impacted on financial decisions. Potential investors were, naturally, more cautious, claiming not to be "risk capital lenders" nor wanting to invest "at the bottom of the learning curve". Local government was viewed as a positive force in geothermal investment encouraging awareness and knowledge of the energy source. The availability of insurance had a negligible effect on financing.

Awareness of specific government financial programs was somewhat limited. While the majority knew about Investment Tax Credits, only half were aware of additional energy credits and very few were appraised of the Depletion Allowance and Loan Guaranty Program. Although overall opinion of the programs was positive and financiers felt they helped encourage initial development, many complained that the programs were designed to benefit the borrower, not the lender.

Requirements for geothermal financing were viewed as similar to those for other ventures. Most respondents felt that both the payback periods and security requirements should be the same. Perhaps the only requirement differences were the financiers' desire for professional engineering certification and some verification of source availability.

Current and potential investors were remarkably similar in their overall responses. Though, by their own admission, potential financiers claimed to be "less knowledgeable" regarding geothermal, their understanding of potential uses of financial programs, and

relevant advantages and disadvantages was as broad as the current investors. One single discriminating response was the perceived impact of the "infancy" status of geothermal's technology. Potential investors were much more skeptical than current investors, claiming they were not "risk capital lenders" nor interested in financing at the "bottom of the learning curve". Educational efforts aimed at dispelling insecurities regarding geothermal technology might be targeted to this group of potential financiers.

SECTION VIII

RESULTS OF BENCHMARK MEASUREMENT FOR KLAMATH FALLS' REGULATORS

Six regulators were included in the sample. This included representatives from the Oregon Department of Geology, Department of Environmental Quality (both Air Quality and Water Quality), Oregon Department of Water Resources, Division of State Lands and a City regulator. Representatives from the Department of Energy were interviewed for the Susanville site, since the functions are similar for both sites.

Respondents in this sample were not asked the awareness questions. Since they are involved in the regulation of geothermal, it is obvious that they would also be aware of the resource.

Interest and Knowledge Regarding Geothermal

As shown in Table 8-1, all six respondents from regulatory agencies expressed avid interest in further geothermal development (Question 15). Reasons for this high level of interest varied (Question 16). Two respondents mentioned the clean, non-polluting features of geothermal. Two others spoke of its relatively low cost. Still others mentioned their personal involvement through well-ownership or past published papers on the topic. Other miscellaneous reasons included geothermal renewability, its contribution to agency income, the conservation of fossil fuels, its potential for hydraulic connections and its ability to improve the overall quality of life.

Only two regulators considered themselves to be "very" knowledgeable regarding geothermal energy (Question 17). The majority felt they were "somewhat" knowledgeable.

TABLE 8-1

REGULATOR INTEREST AND KNOWLEDGE REGARDING GEOTHERMAL

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
15	Interest in further geothermal development	
	Very interested	6
	Somewhat interested	-
	Uninterested	-
16	Why very interested?	
	Clean/non-polluting	2
	Inexpensive	2
	Own a well	1
	Source of income to agency	1
	Renewable	1
	Have published papers	1
	Conservation of fossil fuels	1
	Potential for hydraulic connections	1
	Will improve life	1
17	How knowledgeable?	
	Very	2
	Somewhat	4
	Not very	-

Perceived Advantages and Disadvantages

Table 8-2 displays regulator opinions of the relative pros and cons of geothermal development. Consistent with their high level of interest in further development, the regulators cited many more advantages than disadvantages.

The predominant advantage (Question 8) was geothermal's low cost, a factor mentioned by five of the six respondents. In addition, half the respondents cited geothermal's renewability as a clear-cut advantage. Two respondents each mentioned geothermal's low pollution potential, its availability and its welcome use as an alternative energy source that would conserve fossil fuels.

In terms of disadvantages, two key complaints dominated the regulators' responses. Three respondents mentioned potential pollution problems from the water and steam by-products of geothermal energy. Other respondents expressed concern over the locations of geothermal sources, frequently in remote rural areas, far from a population base that could readily utilize the resource. One regulator mentioned that geothermal was not hot enough to generate electricity. Another expressed fear that the water resources would be over-utilized.

In general, however, regulators appear to be staunch supporters of further geothermal development and use. The perceived advantages clearly outweighed the perceived disadvantages.

Regulatory Role of Agency

The respondents surveyed performed a wide range of regulatory activities. Table 8-3 describes these activities and highlights specific involvement with the Klamath Falls area.

TABLE 8-2

REGULATOR PERCEIVED ADVANTAGES AND DISADVANTAGES

<u>Question Number</u>	<u>Questions and Answers</u>	<u>Number Responding</u>
8	Perceived advantages	
	Low cost/inexpensive	5
	Renewable/unlimited source	3
	Clean/low pollution	2
	Availability	2
	Alternative source/conserves fossil fuels	2
	Space heating	1
	Meets heating and electric needs	1
	Homeowners can share well	1
9	Perceived disadvantages	
	Pollution in water and steam	3
	Inconvenient locations/rural/sparsely populated	3
	Not hot enough to generate electricity	1
	Over-utilization of water resource	1
	None	1

TABLE 8-3
REGULATORY ROLE OF AGENCY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
1	Description of regulatory role	
	Require drilling permits	3
	Require well log	1
	Control drilling for resource discovery of 250°+ wells	1
	As public landowner, review and limit drilling	1
	Only involved in shallow (-2000 ft.) low temp (-250°) wells	1
	Staff work for Citizen's Board on large developments	1
	Passive; support of Dept. of Geol. & Minerals in administration of Statute #522	1
2	Exercised regularatory role in Klamath Falls?	
	Yes	4
	No	2
3	Involvement in Klamath Falls	
	Issued permits	3
	Monitored drilling	1
	Required well log	1
	Encourage reinjection so permit not required	1
	Administered Oregon Ground Water law under Statute #537	1
11a	Impact of Klamath Falls Government on regulation	
	Yes	1
	No	5
11b	What impact?	
	Provide input to state legislature for resolutions on spent geothermal fluids	1

When asked to describe their overall role in regulating geothermal energy (Question 1), respondents from half the agencies mentioned that they issued drilling permits. Other regulatory role descriptions were highly diversified across respondents. One respondent, for example, claimed his agency was only involved in high temperature (+250°) exploratory wells, while another respondent only dealt with shallow low temperature wells. One of the agencies required a well log of drilling activities. Another agency reviewed and limited drilling on public lands. Two of the respondents claimed their role was largely passive: one performed "staff work" for the Citizen's Board on large developments; the other provided support to the Department of Geology and Minerals in administering Oregon Statute #522.

Four of the six respondents had been directly involved in regulation in Klamath Falls (Question 2). The types of activities mirrored the agencies' usual role in geothermal regulation (Question 3). Three regulators had issued permits. Other activities included monitoring of drilling, well log requirements, the encouragement of reinjection to circumvent permits, and administration of a previous Ground Water Law under Oregon Statute #537.

When asked whether the Klamath Falls government had affected their regulatory activities (Question 11a), five of the six respondents replied "No". The one respondent replied that the City provided input to the state legislature for resolutions regarding spent geothermal fluids.

Factors Influencing Regulatory Decisions

Table 8-4 displays key decision factors, their importance and their respective corrective factors. Only three of the six regulators were able to label specific factors that influenced their regulatory decisions (Question 12). Those who did not volunteer factors either referred the interviewer to an interagency document or otherwise indicated that the question did not apply. Among the

TABLE 8-4
FACTORS INFLUENCING REGULATORY DECISIONS

<u>Order</u>	<u>Factor</u>	<u>Importance</u>	<u>Compensation</u>
1	Completeness of Permit Application	Very	Would need to meet all standards, including bond
2	Other Agency's Restrictions on Permit	Somewhat	Meeting to mitigate restrictions leading to mutually agreeable solution
3	Adequacy of Drilling Equipment	Very	Applicant must upgrade equipment
4	Proper Completion and Abandonment	Very	Inspection required prior to release of bond
1	Impact on Current Well-owner	Very	Current owners want city to use closed coil system
2	Input from General Public	Very	If enough adverse criticism, city would drop project
1	Need for Power	Site-dependent	N/A
2	Air Quality	Site-dependent	Off-sets or mitigation
3	Water Quality	Site-dependent	Re-design to meet standards
4	Owner's Ability to Build or Operate	Site-dependent	Redefine owner & grant involvement
5	Local Government Concerns	Site-dependent	Depends on issue
6	Safety	Site-dependent	Re-design to meet standards

Refer to inter-agency document
We do not regulate
N/A

three respondents who cited decision factors, there was little general consensus regarding what those specific factors were. This is due, in part, to the diversity of regulatory functions reported by respondents. Case-by-case responses are reviewed in the text below.

One regulator, who issued permits, mentioned four factors in the decision process: completeness of the permit application; restrictions on the permit by other agencies; adequacy of the driller's equipment; and proper completion and abandonment. He regarded all but "other agency restrictions" as "very" important to the decision process. Corrective factors, for the most part, represented common-sensical solutions (e.g., having the driller upgrade inadequate equipment, holding a meeting to mitigate restrictions so that all regulating agencies were in agreement, and the like).

A second respondent who issued permits and required well logs cited two "very" important decision factors: the impact on current well-owners and input from the general public. Current well-owners, for example, could require the city to use a closed coil system. If the public generated enough criticism, the city could be forced to drop pursuit of the project.

A final respondent who did "staff work for the Citizen's Council" mentioned six site-specific factors that influenced regulatory decisions. These included: air quality, water quality, safety, owner's development ability, local government and power needs. If any of these conditions were unsatisfactory, some re-design or re-definition would be required so that standards were met.

Constraints and Limitations on Regulatory Activities

As indicated on Table 8-5, very few regulators reported constraints - legislative, organizational or otherwise, - on their ability to regulate in Klamath Falls. Of the two respondents who reported legislative constraints (Question 5a) one merely mentioned

TABLE 8-5

CONSTRAINTS AND LIMITATIONS ON REGULATORY ACTIVITY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
5a	Any legislative constraints?	
	Yes	2
	No	4
5b	What legislative constraints?	
	Well log and drilling permit	1
	Condition of critical ground water determinations	1
6a	Any organizational constraints?	
	Yes	1
	No	5
6b	What organizational constraints?	
	Costly (\$10) annual permit to regulate waste disposal	1
7a	Other limitations in Klamath Falls?	
	Yes	-
	No	6

"well log and drilling permits" while the other spoke of the "condition of critical ground water determinations" (Question 5b). Only one regulator reported organizational constraints, (Question 6a) in the form of a somewhat costly (\$10) annual permit to regulate waste disposal (Question 6b).

Perception of Future Trends and Collaborative Efforts

As Table 8-6 indicates, regulators predicted a broad and divergent array of future regulatory trends (Question 10). One respondent foresaw no changes whatsoever in the regulatory process. Another predicted a relaxation of regulations in an effort to foster further development. Still others predicted changes like ordinances for closed coil systems, increased local regulation, increased county and city involvement, and more regulations to clarify shallow and deep well distinctions and high and low temperature distinctions. One respondent forecasted a regulated sharing of current wells for the city's heating district.

Comments on inter-agency collaborative efforts were also highly divergent. The majority of respondents rather blandly explained that they would cooperate and work closely with others. They then proceeded to outline some specific past and future collaborative activity. Some respondents, for example, had already interfaced with such groups as the Department of Water, Department of Geology, the Public Works Director and other State bodies. Still others spoke of the need to exchange information and avoid duplication.

Summary of Benchmark Measurement for Regulators of Klamath Falls

As a group, the regulators can be characterized as avid supporters of future geothermal development. Their high level of interest stems from geothermal's low costs, renewability, low

TABLE 8-6

REGULATORS' PERCEPTION OF FUTURE TRENDS AND COLLABORATIVE EFFORTS

<u>Question Number</u>	<u>Question and Answer</u>	<u>Number Responding</u>
10	Future trends in regulation	
	May require ordinance for closed coil system	1
	City's heating district may require well-owner to hook into system others can use	1
	Eased regulations to encourage development	1
	More counties or cities involved in regulating	1
	More local control close to resource	1
	More regulations to clarify shallow/deep, high/low temperature, environmental	1
	Allow to take as much for as long from regional ground water flow system for space heating	1
	No change	1
18	Cooperative efforts with other agencies	
	Would cooperate/would work closely	4
	Our relationship is similar to that of private land-owner and regulatory agency	1
	Try to avoid duplication	1
	Exchange information	1
	Know of waste water disposal	1
	Well logs for under 250' are filed here	1
	Refer to inter-agency document	1
	Dept. of Geology notifies us of applications for exploration wells	1
	City permit requires prior approval of Public Works Director	1
	Worked with Dept. of Water	1
	Worked with quality and state levels	1
	Do not regulate under 250' wells which pre- dominate in Klamath Falls	1

pollution potential, availability and use as an alternative energy source. Perceived drawbacks of geothermal energy were few in number and tended to reference potential wastewater pollution problems, as well as the remote, sparsely populated locales of most geothermal sources. By their own admission, regulators viewed themselves as only "somewhat" knowledgeable regarding geothermal.

Regulatory functions varied across respondents although the chief role was to issue permits for drilling. Some respondents played a supporting role in regulations, offering staff work for a Citizen's Board or supporting another department in administering state laws. Four of the six respondents had performed their usual regulatory function in the Klamath Falls area. Very few respondents reported influences from the Klamath Falls government or other legislative and organizational constraints that affected their regulation activity.

There was very little consensus among respondents regarding the key factors that influence a regulatory decision. Prediction regarding future regulatory trends also diverged strongly. Some respondents expected no change or a relaxation of current regulations. Others predicted more local control and increased regulations.

Regulations are defined by agencies in response to laws enacted by the legislative branch of government. Regulation follows from the applicant's compliance with these procedures and requirements. Other regulatory information is included in Section X.

SECTION IX

RESULTS OF BENCHMARK MEASUREMENT FOR KLAMATH FALLS' PROMOTERS AND DEVELOPERS

A sample was constructed of firms in the Klamath Falls area who were currently active in promoting and developing geothermal energy or who had the potential to become involved in geothermal developments in the near future. Nine active promoters and nine potential promoters agreed to participate in the survey. The nine active promoters included an architect, a consulting engineering firm, a developer, a paving firm which owns several geothermal sites, three drillers and two pump companies. The nine potential promoters included six developers, a construction firm, an engineering firm and a realty company. Geothermal service companies make up the majority (78 percent) of the current promoters, while developers make up the majority (78 percent) of the potential promoters.

Awareness, Interest and Knowledge of Geothermal Energy

Since all firms in the sample were currently or potentially involved in geothermal energy development, it was not surprising that they demonstrated a high level of familiarity with the resource and reported high levels of interest and knowledge about geothermal energy. Table 9-1 reports the results for questions concerning awareness, interest and knowledge. Geothermal energy, along with petroleum products, was the most frequently recalled potential source of energy. Nuclear energy was among the least frequently mentioned of the energy possibilities. Awareness of geothermal energy was linked to living in, moving to or visiting Klamath Falls. Only one respondent reported becoming aware of geothermal energy from books or articles. The remainder reported that they found out about geothermal energy because it was a common aspect of life in the area. Respondents considered

TABLE 9-1

AWARENESS, INTEREST AND KNOWLEDGE OF GEOTHERMAL ENERGY

Question Number	Question and Answers	Number Responding	
		Active Promoters	Potential Promoters
1	Energy sources recalled		
	Solar	6	7
	Water	8	6
	Geothermal	9	9
	Petroleum	8	9
	Wind	4	3
	Nuclear	3	4
	Biomass	6	5
	Coal	3	6
2	Do you consider yourself knowledgeable about geothermal?		
	Very knowledgeable (1)	5	4
	Somewhat knowledgeable (2)	4	4
	Not very knowledgeable (3)	-	1
3	How interested are you in further development and use of geothermal energy?		
	Very interested	9	9
	Somewhat interested	-	-
	Uninterested	-	-
	Reasons for interest in geothermal energy		
	Business opportunity	6	6
	Cost advantages	4	3
	Conservation	4	3
	Availability	2	2
	Energy self-sufficiency	2	2
	Non-polluting	-	1
	Renewable	1	1
	Promote growth	2	1

themselves to be either very knowledgeable or somewhat knowledgeable about geothermal with one exception: a potential promoter who did not live in the area and who was mainly interested in geothermal energy for personal rather than commercial use.

All respondents were very interested in the further development and use of geothermal energy. The major reason for this high level of interest was that they saw geothermal development as an attractive business opportunity. They also cited the positive advantages associated with using geothermal energy: lower operating costs, less reliance on scarce fossil fuels, less environmental impact and energy self-sufficiency. Although several promoters thought geothermal development would promote growth in the area, and several others cited the availability of geothermal energy as a reason for their interest, the promoters in the sample, at least compared to current and potential users in the Klamath Falls area, did not put as much emphasis on local factors nor did they demonstrate the "pride of ownership" that seemed to underlie the interest of many users of geothermal energy. Not surprisingly, the interest of promoters in geothermal energy seems to depend primarily on "bottom line" factors.

Preference for Energy Sources

Respondents rank ordered eight sources of energy and gave reasons for their rankings. Table 9-2 presents these results. Geothermal energy was by far the most preferred source of energy for both active and potential promoters. The major reasons given for favoring geothermal energy were its relative cost advantages over other forms of energy given a producing well, its availability in the area and the belief that it was a clean energy source.

Solar, water and geothermal were the three most preferred sources of energy. Petroleum, coal, nuclear and wind were the four least preferred energy choices; petroleum and coal because they were scarce and produced pollution, nuclear because it was

TABLE 9-2

ACTIVE AND POTENTIAL PROMOTERS' PREFERENCES FOR ENERGY SOURCES

<u>Question Number</u>	<u>Question and Answers</u>	<u>Active Promoters</u>	<u>Potential Promoters</u>
13	Ranking of energy source		
	Solar	2 2 2 6 3 7 2 2 2	3 2 2 2 2 1 2 2 2
	Water	5 3 3 5 4 2 5 3 8	4 4 3 3 4 3 4 3 3
	Geothermal	1 1 1 1 1 1 1 1 1	1 1 1 1 1 2 1 1 1
	Petroleum	7 5 8 3 2 5 6 4 7	8 7 8 5 8 7 6 8 4
	Coal	6 6 7 4 8 3 3 5 5	6 5 5 8 7 6 5 6 3
	Wind	3 7 6 7 7 8 8 6 6	5 8 6 6 5 4 3 5 5
	Nuclear	8 8 4 8 6 6 4 8 4	7 6 7 4 3 8 8 7 7
	Biomass	4 4 5 2 5 4 7 7 3	2 3 4 7 6 2 7 4 8
16	Reasons given for preferring geothermal		
	Cost advantages	7	5
	Availability	7	7
	Non-polluting	4	5
	Renewable	2	1
	Conserves scarce fuels	1	2
	Promotes local economy	1	-

expensive and potentially dangerous, and wind because it was a technologically unproven source of energy. There were no overall differences on energy preferences between active and potential promoters. Both indicated a general preference for non-polluting, decentralized forms of energy.

Advantages and Disadvantages of Geothermal Energy

Respondents were asked open-ended questions about the advantages and disadvantages of geothermal energy (Questions 28 and 29). Table 9-3 summarizes the answers to these questions. The key factors that emerge for both active and potential promoters in favor of geothermal energy were its great cost advantages over other forms of energy as a source of heating, its appeal as an essentially non-polluting source of energy, and the perception that it is a renewable resource that will substitute for scarce reserves of fossil fuels. Promoters were also sensitive to certain drawbacks associated with geothermal development. Chief among these were the high initial costs associated with exploring and drilling hot water wells and the dreaded possibility of "dry holes". Concern about the long-term possibilities of depletion of the resource due to over-use was also mentioned by a number of respondents. For the most part, both active and potential promoters saw many more advantages than disadvantages to the use of geothermal energy.

Use and Potential Use of Geothermal Energy in Klamath Falls

Respondents were asked what they knew about current uses of geothermal energy in the Klamath Falls area (Question 6) and also what they saw as potential uses for geothermal energy in the area (Question 7). All respondents knew that space heating was the number one application for geothermal. Most respondents were also aware of some direct process applications including the use of geothermal energy for pasteurization, fish ponds, greenhouses and frost prevention. Active and potential promoters were equally aware of these kinds of applications. Several respondents

TABLE 9-3

ADVANTAGES AND DISADVANTAGES OF GEOTHERMAL ENERGY

<u>Advantages</u>	<u>Number Responding</u>	
	<u>Active Promoters</u>	<u>Potential Promoters</u>
Cost advantages	8	9
Availability	1	3
Non-polluting	6	9
Renewable	3	2
Conserves	4	2
Promotes local economy	1	-
 <u>Disadvantages</u>		
Initial costs	4	6
Possible depletion	3	3
Disposing of water	1	2
Crossover	1	-
Dry holes	1	3

mentioned gasohol production as a possible future use for geothermal energy. Surprisingly, few mentioned the possibility of producing electricity from geothermal, perhaps because the hot water available in Klamath Falls is not sufficiently hot for this application. Further, the direct heat and electric production developers are substantially different communities. The direct heat developers tend to be relatively smaller firms than do electric production developers (requiring a larger scale development at significantly more cost).

City of Klamath Falls' Involvement in Geothermal Energy

Respondents were asked to rate how interested the City of Klamath Falls was in the further development of geothermal energy (Question 10), to explain why the City was so interested (Question 11), and to list the types of things that the City was doing with respect to geothermal energy (Question 12). Table 9-4 presents the response to these questions. All respondents agreed that the City was very interested in further development of geothermal energy.

However, the motives ascribed to the City for its interest in geothermal varied a good deal. Approximately 75 percent of the promoters considered the City's interest as benign. They thought the City was interested because increased geothermal energy use would save money, conserve energy, benefit the community and promote industrial growth in the area. These respondents tended to believe that the City was trying to guide development of geothermal energy in an orderly way. A substantial minority of the respondents, on the other hand, thought the City was out to control the development of geothermal energy for its own benefit. These respondents were suspicious, for example, that the heating district project would develop into a profit-making utility for the City.

TABLE 9-4

INVOLVEMENT OF THE CITY OF KLAMATH FALLS IN GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Active Promoters</u>	<u>Potential Promoters</u>
10	How interested is the City of Klamath Falls in the further development and use of geothermal energy?		
	Very interested (1)	9	9
	Somewhat interested (2)	-	-
	Uninterested (3)	-	-
11	Reasons for City's interest		
	Control/development	4	2
	Financial benefits	3	2
	Cost advantages	2	2
	Promote industry	3	1
	Conserve energy	-	1
	Commitment to community	-	1
12	City's activities to promote geothermal energy		
	Forming a heating district	7	5
	Drilling wells/testing	6	2
	Discussing regulations	-	3
	Expediting grants/		
	providing information	1	2
	Actually using geothermal	3	1

The factor that seemed to discriminate between those promoters who looked favorably on the City's involvement with geothermal energy and those who were distrustful of the City's involvement was previous experience in dealing with the City. Those promoters, most suspicious of the City's motives reported the City had previously blocked their plans, by imposing strenuous regulations denying them access to their source, and in one case by competing with the promoter for available government grants. Most promoters did not report this kind of previous involvement with the City, and they tended to view the City's role in geothermal development more favorably.

Promoters and Developers' Involvement in Geothermal Energy

Several questions (17a and 17b) in the interview asked respondents to describe their involvement in geothermal energy development and tried to identify important factors in the involvement decision. Table 9-5 presents a profile of the kinds of involvement that the respondents have with geothermal energy and the reason they give for their involvement. Active promoters were mainly in the business of providing services to geothermal projects and they saw more geothermal energy development as good for business. To a lesser extent they saw energy conservation and the quality of work as factors in their involvement. Potential promoters were more likely to own land with geothermal potential and have interests in promoting commercial deals involving geothermal energy. They cited return on investment and increased business as major reasons for involvement with geothermal energy, but they were almost as likely to mention energy conservation and the attraction of being involved in a new area as reasons.

Predictably, respondents were reluctant to give much detail about the kinds of profits they were looking for in geothermal energy developments. Active promoters, probably because they were largely service firms, were somewhat more forthcoming than

TABLE 9-5

PROMOTERS' INVOLVEMENT WITH GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Active Promoters</u>	<u>Potential Promoters</u>
17a	What has been your involvement in the development of geothermal resources?		
	Provide services	7	2
	Own geothermal property	1	5
	Commercial development	1	3
17b	Reasons for involvement		
	Increase business	8	3
	Return on investment	-	4
	Conserve energy	2	4
	Breaking new ground	-	2
	Interesting work	2	-

potential promoters. Active promoters estimated their profits on geothermal projects to be between 10-20 percent and typically claimed that this is a normal range for their type of business. Potential promoters refused, as a rule, to talk about profits and it is impossible to estimate what kinds of profit margins they were anticipating.

Decision Factors and Trade-off Among Factors

Respondents were asked to list the factors they would take into consideration when deciding whether or not to be involved in a geothermal project (Question 21). Table 9-6 presents the responses to this question. For active promoters, location (the likelihood of finding usable hot water at a convenient site) was far and away the most important factor. It was the first factor mentioned by six out of nine respondents. Expected profit was the first factor mentioned by two respondents. These respondents also mentioned expected profit as the second or third factor. Feasibility (whether the hot water source would be appropriate for the desired application) was mentioned by two respondents as a secondary factor, and one respondent mentioned environmental impact as a secondary factor. One current promoter and one potential promoter did not respond to the question.

Potential promoters have essentially the same set of emphases. Four respondents reported locations would be their first factor, in making an involvement decision about geothermal development while two respondents mentioned location as a very important secondary factor. Expected profit was seen by three respondents as their first decision factor, while two respondents mentioned it as a secondary factor. Initial cost, feasibility and financing were also mentioned by some potential promoters as secondary decision factors.

TABLE 9-6
DECISION FACTORS FOR INVOLVEMENT IN A
GEOTHERMAL DEVELOPMENT PROJECT

<u>Active Promoters</u>		
<u>Order of Mention</u>	<u>Decision Factor</u>	<u>Importance</u>
First	Location	Very
Second	Economics	Somewhat
Third	Environmental impact	Somewhat
First	Location	Very
Second	Use for geothermal heat	Very
Third	Profit margin	Somewhat
First	Profit	Very
Second	Risk	Somewhat
First	Cost effective	Very
First	Location	Very
First	Area	Very
First	Location	Very
<u>Potential Promoters</u>		
First	Cost	Very
Second	Return on investment	Very
Third	Area of potential geothermal	Very
First	Certainty of hot water	Very
Second	Cost	Very
Third	Availability of financing	Very
First	No installation barriers	Very
Second	Availability of users	Very
Third	Financing	Very
First	Availability	Very
Second	Initial costs	Somewhat
First	Amount of resource	Very
Second	Location	Somewhat
First	Cost	Very
Second	Return and risk	Very
First	Location	Very
Second	End use of energy	Somewhat
First	Financial	Very

Table 9-7 presents the factors and trade-offs for promoters and developers who answered the question and who identified more than one factor. It appears that there is little cost elasticity for promoters and developers, possibly because costs may be passed on to the users. Promoters and developers were generally willing to trade-off (low) cost for other factors such as: location, use for geothermal, environmental impact, no barriers, availability of qualified users, purity of hot water, and return on investment.

There were a couple of exceptions to this tendency. One respondent said he was willing to trade-off costs for certainty of hot water, would not trade-off availability of financing for certainty of hot water and would not trade-off costs for availability of financing. Another respondent, a "self-developer", would trade-off return on investment for cost.

Other Decision Factors

An attempt was made to assess the role of government regulations and local government on decisions to become involved in geothermal development. Half of the respondents (four of the nine active promoters and five of the nine potential promoters), reported being influenced by the local government. Basically, there were three kinds of influence reported. Five of the nine respondents saw local government encouraging their involvement, either by providing useful information or more frequently by using their services. Two respondents did not find the local government to make much difference in their plans, though they did report having contact about applicable regulations and codes. Two respondents reported conflicts with the local government that substantially hindered their plans. In one case, a developer was prevented by the City from drilling a proposed well because the City claimed that it would impact on existing wells, and in

TABLE 9-7

TRADE-OFF AMONG DEVELOPMENT DECISION FACTORS

<u>Trade-Off Factors</u>	<u>Willing to Trade-Off</u>
Economics for location	Yes
Environmental impact for location	No
Environmental impact for economics	Yes
Use for geothermal heat for location	Yes
Profit margin for location	Yes
Profit margin for use for geothermal heat	Yes
Risk (feasibility of project) for profit	No
Return on investment for cost	Yes
Area of potential geothermal for cost	No
Area of potential geothermal for return on investment	No
Costs for certainty of hot water	Yes
Availability of financing for surety of hot water	No
Availability of financing for costs	No
Availability of qualified users for no barriers	No
Low cost financing for no barriers	Yes
Low cost financing for availability of qualified users	Yes
Initial cost for availability of resource	Yes
End use of energy for location	Yes
Return and risks for cost	No
Location for amount of resource	Yes

another instance the developer claimed that the City had competed against him for a government award and was now attempting to prevent him from developing his property. In this later case, the developer was filing a law suit against the City.

Respondents mentioned a number of impacts of government regulations on their development plans in response to an open-ended question about the role of government regulation (not necessarily local government) on their plans. Active promoters were mainly aware of government regulation through the need to comply with appropriate codes and regulations. Three of the nine active promoters did not see any problems due to such regulations, but two active promoters complained about government procedures that slowed down their plans, three complained about "red tape" in general and one thought regulations increased costs. Potential promoters did not have as much experience with regulation of geothermal activities, but two potential promoters thought regulations slowed the development process, two thought regulations restricted geothermal development, one said regulations increased costs and another said regulation resulted in a loss of control by the developer. One potential promoter thought the availability of government grants was positive for geothermal development.

Summary of Benchmark Results for Klamath Falls' Promoters and Developers

Active and potential promoters of geothermal energy in the Klamath Falls area demonstrated a high level of awareness, knowledge and interest in this energy resource. Geothermal energy was recognized as having substantial advantages over other forms of energy that far outweighed any problems in its development. Low cost, conserving scarce supplies of fossil fuels, and minimal environmental impact were seen as the major advantages while high initial development costs and uncertainty about being able to find usable hot water wells were the major disadvantages.

Promoters were fairly conservative in their views about the potential uses for geothermal energy. Although they were aware of a number of applications for geothermal energy, their plans included basically only heating applications. While this might be interpreted as timidity on the part of these promoters, it can also be interpreted as a realistic appraisal of the possible applications for geothermal energy, at least in the Klamath Falls area. The latter interpretation is probably more appropriate given the relatively low water temperatures in Klamath Falls.

Except for two instances, the attitudes of promoters toward government regulation and local government were surprisingly positive. There was a litany of comments against regulation: it slows us down, too much red tape, and it restricts development, but the responses were generally quite mild. Several respondents considered regulations as a benign or even a positive aspect of the geothermal development process.

It is not very difficult to describe the main factors governing promoters' decisions to develop geothermal energy. They mainly see it as an excellent business opportunity which offers the promise of a good return on investment. The fact that they see Klamath Falls as a rapidly developing area with resources relevant to the nation's energy problem is added reinforcement for the overriding economic motivations. Promoters more than users, for example, stress economic factors (business profit) as important to their involvement, with the exception of the economics of lower energy costs for users.

SECTION X
MACRO-ECONOMIC ENVIRONMENT OF KLAMATH FALLS AND
KLAMATH COUNTY

Review of Secondary Data

This section of the report discusses the economic macro-environment of Klamath Falls. Specifically, issues related to:

- industry structure;
- geothermal resource characteristics;
- demography;
- socio-economic characteristics; and the
- political, institutional and regulatory environment are addressed.

While the focus in this section is on Klamath Falls, because of widespread data availability and because some issues are regional in implication, significant portions of this discussion are devoted to the whole of Klamath County. Much of this data was not specifically available for the City of Klamath Falls.

Klamath County, located in the southeastern portion of Oregon, is the fourth largest county in the state with a total land area of over 6,100 square miles or 3.8 million acres. The principal city is Klamath Falls.

The county has a substantial agricultural base, with 725,000 acres of farmland out of a total of 3.6 million acres. In 1980 approximately 200,000 acres of the agricultural land was under irrigation. The other principle economic resources of Klamath County are timber and wood products. The County boasts some 2.6 million acres of

commercial timberland with an inventory in excess of 20 billion board feet. This timber resource is also the basis of the County's economic development, as employment and manufacturing data indicate.

Between 1970 and 1978 the population of the County increased from 50,000 persons to an estimated 58,700 persons in 1978. This 17 percent increase, by far, surpasses the increase of only 5.4 percent for the entire decade between 1960 and 1970. Most of this increase is a direct result of increased harvesting and processing of lumber and wood products.

The future prospects for Klamath County and the Klamath Falls area are mixed. On the one hand, there will be a decline in employment, and therefore population, due to closing of the Kingsley Air Force Base, a major source of employment in the County, and a reduction of employees engaged in manufacturing timber and wood products. On the other hand, there is an increase expected in employment in certain other industry sectors such as those processing local food products, as well as in service sectors providing various services to the recreational sector of the economy and various trade and personal service establishments.

Some impact on the Klamath County economy can be also expected from the increasing development of geothermal resources. At the present time geothermal activity exists in various locations in Klamath County. It is being actively exploited by various interest groups, manufacturing establishments, certain establishments within the agricultural sector, greenhouse operators and owners of private housing, as well as local and federal governments.

Industrial Development

As already indicated, manufacturing activities in Klamath County are centered on the lumber and wood products industry, which employs 5,080 individuals out of the total manufacturing labor force of 5,650 or 90 percent. Some 150 additional individuals are employed in the manufacture of food products, mostly those derived from local agricultural activities. Other manufacturing activities employ only 520 individuals in some 39 firms producing a wide range of products primarily for local consumption. Thus, the lumber and wood products industry essentially comprises the economic base of the County at the present time. This sector has over 50 firms engaged in activities ranging from logging to the manufacture of plywood and various lumber and wood products. The size of the firms range from those employing only a few individuals to as large as those employing 2,400 individuals.

The lumber and wood products industry has in the past been a principle factor affecting the growth of local economy, and it remains the most dynamic factor in the Klamath County and Klamath Falls area. As indicated in Table 10-1, the total employment in the Klamath County has grown from 20,600 in 1975 to 24,100 in 1980, and is expected to increase to 30,050 by the year 2000 with interim increases to 27,690 in 1990 and 28,850 in 1995. However, the manufacturing sector employs relatively few people, representing less than 20 percent of the total employment in the County. In 1980, for example, out of the total employment of 24,100, manufacturing employment was represented by only 5,100 employees.

As the data in Table 10-2 indicate, the major manufacturing sector in the County, employing over 90 percent of the total employment manufacturing workforce, is that of lumber and wood products, which in 1975 employed 4,075 persons

TABLE 10-1

KLAMATH FALLS, OREGON
EMPLOYMENT PROJECTIONS
1975-2000

	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Total Employment (Household)	20,600	24,100	26,200	27,600	28,850	30,050
Total Employment (Establishment)	21,200	24,900	27,050	28,500	29,800	31,050
Agriculture	1,400	1,325	1,250	1,175	1,125	1,075
Non-Agricultural Self-Employment	2,350	2,525	2,550	2,625	2,675	2,725
Total Non-Agricultural Employment	17,450	22,050	23,250	24,700	26,000	27,250
Mining	---	---	---	25	25	25
Construction	525	725	800	850	875	900
Manufacturing	4,500	5,100	4,975	4,600	4,300	4,025
Food and Kindred Products	(125)	(125)	(125)	(125)	(140)	(150)
Lumber and Wood Products	(4,075)	(4,575)	(4,375)	(3,925)	(3,600)	(3,325)
Paper and Allied Products	---	---	---	---	---	---
Primary Metals	---	---	---	---	---	---
Transportation Equipment	---	(25)	(25)	(25)	(25)	(25)
Other Manufacturing	(300)	(375)	(450)	(525)	(525)	(525)
Transportation and Public Utilities	1,425	1,550	1,650	1,725	1,775	1,800
Wholesale and Retail Trade	3,950	5,225	6,250	7,050	7,800	8,525
Finance, Insurance, and Real Estate	625	875	1,075	1,250	1,400	1,550
Services	2,575	3,250	3,800	4,200	4,575	4,950
Government	3,850	4,325	4,700	5,000	5,250	5,475

SOURCE: U.S. Department of Energy, Bonneville Power Administration, Population, Employment and Households Projected to 2000, September, 1979.

TABLE 10-2

SIGNIFICANCE OF MANUFACTURING TO
KLAMATH COUNTY ECONOMY

Manufacturing Sector	Sector Employment ¹ as % of Manufacturing Employment	Sector Payroll ² as % of Manufacturing Payroll	Sector Employment ¹ as % of Total County Employment	Sector Payroll ² as % of Total County Employment
Lumber and Wood Products	90.5	92.9	23.9	37.0
Food and Kindred Products	3.0	2.0	0.8	0.8
Printing and Publishing	2.6	1.5	0.7	0.6
Stone, Clay and Glass Products	0.7	0.5	0.2	0.2
Manufacturing (ext. electrical)	1.8	1.8	0.5	0.7
Total Manufacturing	N.A.	N.A.	26.4	39.9

Note: Manufacturing categories listed + other manufacturing = manufacturing totals.

¹Calculated by Pacific Economica from Table 6-9.

²Calculated by Pacific Economica from data in Oregon Covered Employment and Payrolls, Oregon State Department of Human Resources, Employment Division, Research and Statistics Section, using quarterly reports and the 1977 Summary.

out of a total manufacturing employment of 4,500. In 1980 this sector accounted for 4,575 persons out of the total manufacturing employment of 5,100.

Projections of the manufacturing employment in the County indicated that it is expected to decrease from 4,500 in 1975 to 4,025 in the year 2000. Most of this decrease will result from reduced employment in lumber and wood products section, as employment is expected to decrease from 4,575 in 1980 to 3,325 in the year 2000. Thus, the lumber and wood products sector is the dominant industry in Klamath County, with 90.5 percent of total manufacturing employment and 92.2 percent of the total manufacturing payroll.

The other manufacturing sectors are relatively marginal, with the food and kindred products sector employing approximately 3 percent of the total manufacturing employment, followed by the printing and publishing sector with employment of 2.6 percent, followed further by stone, clay and glass products with 0.7 percent of the total employment. As indicated in Table 10-3, the total manufacturing employment in Klamath County is expected to decline from 5,100 in 1980 to 4,025 in the year 2000. Most of this decline will be the result of the reduced employment in the lumber and wood products sector. Conversely, there is expected to be some increase in the employment of the food and kindred products sector, with the other manufacturing sectors remaining essentially stable.

In summary, the official projections of the Klamath County employment (by the U.S. Department of Energy, Bonneville Power Administration) indicate a decline in total manufacturing employment in this county between 1980 and the year 2000. Conversely, there are several factors which may result in increasing manufacturing employment in Klamath County. As projected by the Oak Ridge National Laboratory

TABLE 10-3

BPA PROJECTIONS OF MANUFACTURING EMPLOYMENT
KLAMATH COUNTY, 1980-2000

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Manufacturing	5,100	4,975	4,600	4,300	4,025
Food and Kindred Products	125	125	125	150	150
Lumber and Wood Products	4,575	4,375	3,925	3,600	3,325
Transportation Equipment	25	25	25	25	25
Other Manufacturing	375	375	375	375	375

SOURCE: U.S. Department of Energy, Bonneville Power Administration,
Requirements Section, Population, Employment, and Households:
Projected to 2000 for Oregon, September, 1979.

using their Multi-Region Employment Projection Model (prepared for the Department of Energy), the total manufacturing employment in the Eugene, Oregon region, which included Klamath County, is expected to increase from about 46,000 in 1970 to over 65,000 in 1995 (Table 10-4). Significant increases in employment are expected in such sectors as food and kindred products, printing and publishing, machinery, transportation equipment, and fabricated metal. It is not unreasonable to expect that some of this increase may occur in Klamath County, because of a number of favorable location factors. Among such factors are the availability of geothermal resources which provides a relatively inexpensive source of energy, and the availability of a highly skilled local labor force. This principally results from the Oregon State Institute of Technology (located in Klamath Falls) which provides training in numerous highly technical and skilled disciplines.

Non-Manufacturing Employment. The non-manufacturing employment in Klamath County is relatively marginal and underdeveloped as compared to manufacturing employment in the state of Oregon. The contract construction, wholesale trade, services and finance and insurance and real estate sectors are under-represented in the economy of Klamath County. The transportation and public utilities, retail trade and government sectors appear adequately represented. Federal government employment in Klamath County has been declining because of a reduction in force at Kingsley field, the local Air Force Base, which employed a sizeable number of local residents in the early 1970's. The projections of non-manufacturing employment prepared by the U.S. Department of Energy's Bonneville Power Administration (Table 10-5) indicate an increase in nonmanufacturing employment, from approximately 16,000 in 1980 to 23,200 in the year 2000.

TABLE 10-4

KLAMATH COUNTY EMPLOYMENT BY INDUSTRY

	Historical			Projected			Annual Growth Rates		Percent
	1950	1960	1970	1985	1990	1995	1950-1970	1970-1985	1985-1995
Population	363.	459.	541.	708.	748.	779.	2.02	1.80	0.97
Employment	133.	161.	192.	298.	323.	337.	1.86	2.97	1.25
Employment/Population Ratio	.37	.35	.35	.42	.43	.43			
Employment Pressure Index	.58	.61	.59	.65	.68	.68			
Employment by Industry									
Agriculture, Forestry and Fisheries	15.90	11.58	11.47	11.76	11.58	11.47	-1.62	0.17	-0.25
Agriculture	14.9	10.0	9.0	7.5	7.1	6.8	-2.52	-1.20	-0.90
Forestry and Fisheries	1.0	1.6	2.5	4.3	4.5	4.6	4.89	3.64	0.80
Mining	0.56	0.61	0.45	0.46	0.46	0.47	-1.08	0.13	0.11
Metal			0.08	0.07	0.08	0.08		-0.35	0.26
Coal			0.0	0.0	0.0	0.0		0.0	0.0
Crude Petroleum and Natural Gas			0.01	0.01	0.01	0.01		0.0	0.0
Nonmetallic, except fuels			0.37	0.38	0.38	0.38		0.23	0.08
Contract Construction	9.49	10.02	10.55	14.56	14.40	14.82	0.53	2.17	0.18
Manufacturing	41.34	49.05	46.28	59.55	63.26	65.47	0.57	1.70	0.95
Food and Kindred Products	1.89	2.68	2.79	2.79	2.84	2.94	1.97	0.01	0.50
Textile Mill Products	0.04	0.02	0.03	0.11	0.08	0.10	-0.98	8.38	-1.08
Apparel	0.03	0.04	0.14	0.17	0.22	0.29	8.78	1.22	5.76
Printing and Publishing	1.11	1.99	2.06	2.80	3.03	3.04	3.15	2.05	0.85
Chemicals and Allied Products	0.13	0.14	0.67	0.58	0.67	0.54	8.44	-0.98	-0.68
Lumber Products and Furniture	36.35	40.88	34.22	37.80	37.88	36.73	-0.30	0.67	-0.29
Machinery	0.52	1.08	1.63	5.48	7.05	8.60	5.83	8.44	4.61
Transportation Equipment	0.10	0.31	0.80	1.92	2.38	3.01	10.81	6.00	4.57
Paper and Allied Products	0.33	0.36	1.03	1.79	2.04	2.25	5.82	3.76	2.32
Petroleum Refining	0.02	0.02	0.03	0.03	0.02	0.01	2.84	-0.81	-11.63
Primary Metals	0.09	0.24	0.55	1.34	1.45	1.55	9.64	6.14	1.46
Fabricated Metals and Ordnance	0.16	0.25	1.15	2.82	3.19	3.46	10.35	6.18	2.08
All Other Manufacturing	0.57	1.03	1.17	1.92	2.40	2.95	3.72	3.33	4.38
Transportation	6.66	7.12	6.91	8.99	9.53	9.92	0.19	1.77	0.98
Communications	1.41	1.85	2.42	3.64	3.94	4.12	2.72	2.78	1.23

TABLE 10-4 (cont.)
KLAMATH COUNTY EMPLOYMENT BY INDUSTRY

	<u>Historical</u>			<u>Projected</u>			<u>Annual Growth Rates</u>		<u>Percent</u>
	1950	1960	1970	1985	1990	1995	1950-1970	1970-1985	1985-1995
Public Utilities	2.28	2.48	2.82	3.52	3.50	3.60	1.05	1.49	0.24
Wholesale and Retail Trade	25.17	30.51	41.26	62.23	66.27	67.45	2.50	2.78	0.81
Finance, Insurance and Real Estate	3.14	4.74	7.27	14.71	16.23	16.79	4.28	4.81	1.33
Services	23.19	35.40	53.14	104.76	119.51	128.62	4.23	4.63	2.07
Lodging and Personal Services	4.75	5.53	6.70	12.27	13.61	14.30	1.73	4.12	1.54
Business and Repair Services	3.86	3.77	5.20	9.65	10.53	10.73	1.50	4.20	1.07
Amusement and Recreation Services	0.89	1.02	1.75	4.19	5.00	5.57	3.44	6.10	2.89
Private Households	2.63	4.34	2.83	2.23	2.24	2.36	0.38	-1.57	0.55
Professional Services	11.07	20.74	36.66	76.42	88.12	95.66	6.17	5.02	2.27
Government	3.76	7.38	9.48	13.85	14.63	14.73	4.74	2.56	0.62

SOURCE: Olene Ridge National Laboratory.

TABLE 10-5

BPA PROJECTIONS OF NON-MANUFACTURING EMPLOYMENT
KLAMATH COUNTY, 1980-2000

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Non-manufacturing	15,950	18,275	20,075	21,675	23,200
Construction	725	800	850	875	900
Transportation and Public Utilities	1,550	1,650	1,725	1,775	1,800
Wholesale and Retail Trade	5,225	6,250	7,050	7,800	8,525
Finance, Insurance, and Real Estate	875	1,075	1,250	1,400	1,550
Services	3,250	3,800	4,200	4,575	4,950
Government	4,325	4,700	5,000	5,250	5,475

SOURCE: U.S. Department of Energy, Bonneville Power Administration,
Oregon: Population, Employment, and Households Projected to 2000,
September, 1979.

The most dramatic increase in non-manufacturing employment is expected in the wholesale and retail trade sectors, where employment is expected to increase from 5,200 in 1980 to 8,525 in the year 2000. This increase is reasonable in light of the fact that Klamath Falls represents a large regional shopping center which serves the local population, as well as tourism and recreational sectors.

In summary, employment in Klamath County is dominated by wood and timber products, which accounts for approximately 95 percent of the entire manufacturing employment. The remaining manufacturing sectors are relatively marginal and provide employment for very few individuals. While at present the non-manufacturing sector in Klamath County is relatively small in relation to manufacturing employment levels, it is expected to increase in size.

The above clearly suggests that the development of geothermal resources in Klamath Falls and County would significantly impact on the industrial development by providing additional incentives for the industry to locate in this area because of this inexpensive source of energy.

Geothermal Resources

Geothermal resources are closely allied to the groundwater resource. In Klamath Basin geothermal energy is brought close enough to the surface to be utilized through groundwater movement. Fluctuations or seasonal changes that affect the groundwater may also affect geothermal source, although this statement is not made from specific data so indicating.

Geothermal resources are a potential source of energy in the county. Most of the County is classified as a Prospective Geothermal Resource Area.

A study prepared by the Oregon Institute of Technology shows that geothermal systems in the county have a high potential for industrial processing and for heating homes, institutions, commercial buildings and industrial complexes.¹ This geothermal energy, however, is not great enough for use in generating electricity.

Two hypotheses have been used to explain the occurrence of geothermal energy in the basin.² The first suggests that there are upper and lower geothermal reservoirs, the lower of which, heated by a hot rock or magma intrusion close to the surface, transfers heat to the upper reservoir. The second suggests that groundwater infiltrates through fracture zones deep into the earth, where it is heated; the heated water rises towards the surface by convection and mixes with and heats the groundwater.

Area where potential for use of geothermal is greatest are shown on Figure 10-1. This figure also shows areas where geothermal resources are already being utilized; an estimated 500 structures in Klamath County are being heated by geothermal energy.

The greatest potential for use of geothermal heat is in the Olene Gap area, where temperatures of springs at the surface have been measured at from 160°F to 189°F. Temperatures rise as the depth below the surface increases. The temperature increase in Klamath County is generally 167°F every 3,300 feet.

¹Paul J. Lineau, et al., Agribusiness Geothermal Energy Utilization Potential of Klamath and Western Snake River Basins (U.S. Department of Energy, May 1978), p. 12.

²G.M. Reistad, et al., An Evaluation of Uses for Low to Intermediate Temperature Geothermal Fluids in the Klamath Basin, Oregon (Oregon State University, Corvallis, Bulletin No. 55, March 1978).

Reprinted from U.S. Geological Survey
Merrill and Klamath Falls, Oregon
Columbia, Modoc Point, Oregon
1:62,500, 1957

MAP SHOWING TEMPERATURE OF GROUND WATER,
DEPTH OF WELLS AND LINES OF EQUAL TEMPERATURE

Geothermal wells are widespread in the City of Klamath Falls. Individuals and firms have drilled wells in their "backyards" primarily for space heating and melting snow from pavements. Approximately 400 shallow-depth wells ranging from 27 to 549m in depth are used to heat approximately 500 structures.³ The KGRA in which Klamath Falls is located is about 50 miles long and 10 miles wide. Figure 10-1 illustrates wells in the Klamath Falls area, temperature, depth and lines of equal temperature.

Demographic Characteristics and Trends

As indicated in Table 10-6, the total population in Klamath County increased from 42,150 in the year 1950 to 58,700 in the year 1978. Recent population trends indicate an increase in migration of out-of-state workers, primarily from California. Many of these immigrants possess well-developed manual labor skills which add to the local labor force. As indicated in Table 10-7, population projections for Klamath County indicate increase in population to 67,300 by the year 2000. In general, the population, while increasing, has followed conventional trends for urbanized areas in the U.S., that of decreasing population within the highly urbanized areas of the County and increased population concentrations in the suburban areas (shown in Table 10-8). Within this trend of population movement toward areas outside the highly concentrated urban areas, there has been a general trend of declining rural farm population and somewhat increasing trend of rural non-farm population. The population in Klamath County is predominantly white (95.3 percent of the total population), followed by American Indians at 2.84 percent and the remaining represented by other ethnic groups.

³Paul J. Lineau and John W. Lund, Utilization and Economics of Space Heating in Klamath Falls, Oregon, Geo-Heat Utilization Center, Oregon Institute of Technology, Klamath Falls, Oregon.

TABLE 10-6
KLAMATH COUNTY'S POPULATION 1950 - 1978

<u>YEAR</u>	<u>TOTAL POPULATION</u>
1950	42,150 (1)
1960	47,187 (1)
1961	49,782 (2)
1962	49,096 (2)
1963	47,465 (2)
1964	47,499 (2)
1965	48,100 (2)
1966	48,300 (2)
1967	48,000 (2)
1968	49,100 (2)
1969	49,760 (2)
1970	50,021 (1)
1971	50,500 (2)
1972	51,940 (2)
1973	52,700 (2)
1974	53,400 (2)
1975	54,400 (2)
1976	55,500 (2)
1977	56,500 (2)
1978	58,700 (2)

1970 Census Population Characteristics Summary:

Minority Population - 4.7%
 Prime Working Age Group (16-64) - 60.8%
 Median Family Income - \$8,645
 Families with Income Below Poverty Level - 10%
 Median Age - 27.9 years
 Median Education Level of Over-25 Population - 12.2 years
 59.7% high school graduates
 9.0% college graduates

- (1) U.S. Bureau of Census
 (2) Estimates by Center for Population Research & Census,
 Portland State University.

TABLE 10-7
POPULATION PROJECTIONS
KLAMATH COUNTY

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
(1)	56,200	59,100	61,900	64,600	67,300
(2)	56,163	58,089	59,596	60,213	

- (1) Center for Population Research & Census,
Portland State University
- (2) Bonneville Power Administration

TABLE 10-8
POPULATION ESTIMATES OF INCORPORATED CITIES,
KLAMATH COUNTY, 1950, 1960, 1970, AND 1978

Area	1950	1960	1970	1978	Change Number	1950-1978 Percent
Klamath County	42,150	47,475	50,021	58,700	16,550	.39
Bonanza	259	297	230	265	6	.02
Chiloquin	668	945	826	850	182	.27
Klamath Falls	15,875	16,949	15,775	18,300	2,425	.15
Malin	592	568	486	595	3	.005
Merrill	835	804	722	900	65	.08
Incorporated	18,229	19,563	18,039	20,910	2,681	.15
Unincorporated	23,921	27,912	31,982	37,790	13,869	.57

SOURCE: 1950, 1960, and 1970 figures - U.S. Bureau of Census.
1978 - Center for Population Research & Census.

The major occupational characteristics of Klamath County are shown on Tables 10-9 and 10-10. Table 10-11 presents a detailed breakdown of employment in each of these categories by sex and minority status. As shown, the concentration of female workers is consistent with the traditional occupational patterns. Particularly heavy concentrations of females appear in selected professional technical occupations, notably house services and teaching and retail sales jobs. The unemployment rate in Klamath County in 1978 was 6.1 percent for the total population, although this employment rate was considerably higher for minority groups such as blacks, with an unemployment rate of 26.4 percent, and other races, with unemployment of 24.6 percent (see Table 10-12). The latest income level and distribution data indicate that in January of 1979 the median family income in Klamath County was estimated at \$17,283, compared with the state-wide median of \$17,993. Klamath County ranked 10th among all counties in Oregon.

Total personal income in the county had reached 353.1 million in 1977, the most recent year for which such information is available. In 1970 per capita income in the county was \$3,499, but by 1977 the per capita income had increased to \$6,288. However, while Klamath County's population has increased its income in relative terms, increases in this county have fallen behind the income increases for the entire state of Oregon. The income distribution in the county for the year 1976, the most recent year for which such data are available, are shown in Table 10-13.

Seven conclusions can be derived from the data shown in Table 10-13. In the lowest income group, 30 percent of the population controls 6 percent of the income earned in the county. In the high income groups 8 percent of the population controls 25 percent of income in the county. The mid-level income group, from \$15,000 to \$25,000, accounts for only 24 percent of the population but earns more than 37 percent of the County's income.

TABLE 10-9

OCCUPATIONAL CATEGORIES, NUMBER OF EMPLOYED
AND PERCENTAGE SHARE OF TOTAL EMPLOYMENT,
KLAMATH COUNTY

<u>Occupational Category</u>	<u>Number of Workers Employed</u>	<u>Percentage Share</u>
Total, all occupations	23,160	--
Professional, Technical, and Kindred	2,544	11.0
Managers and Administrators	2,210	9.5
Sales Workers	1,509	6.5
Clerical Workers	3,213	13.9
Craftsmen, Foremen, and Kindred	3,428	14.8
Operators (except transport)	2,104	9.1
Transport Equipment Operators	1,218	5.2
Laborers (except farm)	1,941	8.4
Service Workers	3,386	14.6
Agricultural Workers	1,612	7.0

SOURCE: Klamath County Master Plan

TABLE 10-10
OCCUPATIONS OF EMPLOYED PERSONS BY SEX AND MINORITY STATUS FOR 1978 IN KLAMATH COUNTY

	TOTAL	Percentages											
		TOTAL		WHITE		BLACK		OTHER RACES		SP AMER		TOT MIN	
		F	M	F	M	F	M	F	M	F	M	F	M
Total All Occupations	23200	36.9	63.1	36.1	61.4	0.3	0.3	0.5	1.4	0.8	1.5	1.6	3.2
Professional Technical & Kindred	2549	49.0	51.0	48.1	49.9	0.6	0.0	0.3	1.1	0.7	1.4	1.6	2.4
Medical and Health Workers	393	67.8	32.2	66.1	32.2	1.7	0.0	0.0	0.0	0.0	0.0	1.7	0.0
Teachers	959	67.3	32.7	66.5	21.8	0.8	0.0	0.0	0.8	1.1	2.1	2.0	2.9
Technicians except Health	139	13.6	86.4	13.6	86.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Professional Workers	1058	30.1	69.9	29.4	68.1	0.0	0.0	0.8	1.8	0.0	1.4	1.4	3.0
Managers and Admin. except Farm	2229	23.4	76.6	23.4	76.2	0.0	0.0	0.0	0.4	0.0	0.5	0.0	0.8
Sales Workers	1513	48.4	51.6	48.4	51.2	0.0	0.0	0.0	0.4	0.6	0.5	0.6	1.0
Retail Trade	983	62.1	37.9	62.1	37.2	0.0	0.0	0.0	0.7	1.0	0.0	1.0	0.7
Other than Retail Trade	530	22.8	77.2	22.8	77.2	0.0	0.0	0.0	0.0	0.0	1.5	0.0	1.5
Clerical Workers	3202	77.2	22.8	76.1	22.2	0.4	0.0	0.6	0.6	1.6	0.2	2.6	0.8
Bookkeepers	561	95.2	4.8	95.2	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Secretaries, Stenos, Typists	742	96.2	3.8	94.4	3.8	0.9	0.0	0.9	0.0	3.6	0.0	5.3	0.0
Other Clerical Workers	1899	64.4	35.6	63.4	34.5	0.4	0.0	0.7	1.1	1.3	0.3	2.3	1.3
Craftsmen, Foremen and Kindred	3471	4.0	96.0	4.0	94.2	0.0	0.2	0.0	1.6	0.9	2.9	0.9	4.7
Operatives Exec Transport Worker	2122	20.3	79.7	20.3	76.9	0.0	0.5	0.0	2.3	0.8	1.8	0.8	4.6
Durable Goods Manufacturing	1231	4.5	95.5	4.5	91.7	0.0	0.9	0.0	3.0	0.0	1.3	0.0	5.0
Nondurable Goods Mfg.	93	18.8	81.2	18.8	81.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nonmanufacturing Industries	799	44.8	55.2	44.8	53.5	0.0	0.0	0.0	1.7	2.0	2.7	2.0	4.4
Transport Equipment Operatives	1227	8.9	91.1	8.9	90.4	0.0	0.4	0.0	0.3	0.0	2.0	0.0	2.7
Laborers, except Farm	1964	10.5	89.5	9.3	86.0	0.0	1.0	1.2	2.5	0.5	4.6	1.8	8.0

TABLE 10-10 (cont.)
OCCUPATIONS OF EMPLOYED PERSONS BY SEX AND MINORITY STATUS FOR 1978 IN KLAMATH COUNTY

	TOTAL	Percentages											
		TOTAL		WHITE		BLACK		OTHER RACES		SP AMER		TOT MIN	
		F	M	F	M	F	M	F	M	F	M	F	M
Service Workers	3376	73.1	26.9	70.3	25.3	1.0	0.2	1.8	1.4	1.3	0.8	4.0	2.4
Private Household Workers	186	100.0	0.0	94.9	0.0	0.0	0.0	5.1	0.0	4.3	0.0	8.7	0.0
Cleaning Service Workers	658	50.1	49.9	48.9	47.4	0.0	1.2	1.2	1.2	3.7	2.9	4.9	5.1
Food Service Workers	1393	84.3	15.7	79.9	13.3	1.9	0.0	2.4	2.4	0.8	0.0	5.1	2.4
Health Service Workers	440	98.5	1.5	96.9	1.5	1.5	0.0	0.0	0.0	0.0	0.0	1.5	0.0
Personal Service Workers	295	72.6	27.4	72.6	27.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protective Service Workers	233	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Service Workers	172	75.8	24.2	70.3	24.2	0.0	0.0	5.5	0.0	0.0	0.0	5.5	0.0
Agricultural Workers	1627	16.6	83.4	15.7	78.6	0.0	1.6	0.9	3.2	0.0	0.5	0.9	5.3

NOTES: "TOT MIN" is sum of Spanish American and all races except White. Some duplication is possible since Spanish American includes non-White races in addition to White.

SOURCE: Klamath County Economic Development Commission

TABLE 10-11

OCCUPATIONS OF EMPLOYED PERSONS BY SEX AND MINORITY STATUS FOR 1979 IN KLAMATH COUNTY

	TOTAL	Percent Total		Percent Total White		Percent Minorities	
		F	M	F	M	F	M
Total, All Occupations	23,160	37.4	62.6	36.6	60.9	1.6	8.2
Professional Technical & Kindred	2,544	49.6	50.4	48.7	49.4	1.6	2.4
Medical and Health Workers	394	68.4	31.6	66.7	31.6	1.7	0.0
Teachers	961	67.8	32.2	66.9	31.4	2.0	2.9
Technicians, except Health	137	13.7	86.3	13.7	86.3	0.0	0.0
Other Professional Workers	1,050	30.6	69.4	29.8	67.6	1.4	3.1
Managers and Admin. except Farm	2,210	23.8	76.2	23.8	75.9	0.0	0.8
Sales Workers	1,509	48.8	51.2	48.4	50.7	0.6	1.0
Retail Trade	984	62.5	37.5	62.5	36.8	1.0	0.7
Other than Retail Trade	525	23.2	76.8	23.2	76.8	0.0	1.5
Clerical Workers	3,213	77.6	22.4	76.5	21.8	2.6	0.8
Bookkeepers	566	95.3	4.7	95.3	4.7	0.0	0.0
Secretaries, Stenos, Typists	748	96.2	3.8	94.4	3.8	5.4	0.0
Other Clerical Workers	1,899	64.9	35.1	63.9	34.0	2.3	1.3
Craftsmen, Foremen and Kindred	3,428	4.1	95.9	4.1	94.1	0.9	4.8
Operatives except Transport Workers	2,104	20.6	79.4	20.6	76.5	0.8	4.6
Durable Goods Manufacturing	1,217	4.6	95.4	4.6	91.5	0.0	5.1
Nondurable Goods Mfg.	91	19.1	80.9	19.1	80.9	0.0	0.0
Nonmanufacturing Industries	796	45.3	54.7	45.3	53.0	2.2	4.4
Transport Equipment Operatives	1,213	9.1	90.9	9.1	90.2	0.0	2.8
Laborers, except Farm	1,941	10.7	89.3	9.5	85.8	1.8	8.1

TABLE 10-11 (cont.)

OCCUPATIONS OF EMPLOYED PERSONS BY SEX AND MINORITY STATUS FOR 1979 IN KLAMATH COUNTY

	TOTAL	<u>Percent Total</u>		<u>Percent Total White</u>		<u>Percent Minorities</u>	
		F	M	F	M	F	M
Service Workers	3,386	73.5	26.5	70.7	24.9	4.1	2.4
Private Household Workers	188	100.0	0.0	95.0	0.0	9.3	0.0
Cleaning Service Workers	655	50.7	49.3	49.5	46.8	4.9	5.1
Food Service Workers	1,402	84.5	15.5	80.1	13.1	5.2	2.4
Health Service Workers	444	98.5	1.5	97.0	1.5	1.5	0.0
Personal Service Workers	295	72.7	27.3	72.7	27.3	0.0	0.0
Protective Service Workers	229	0.0	100.0	0.0	0.0	0.0	0.0
Other Service Workers	173	76.0	24.0	70.5	24.0	5.4	0.0
Agricultural Workers	1,612	16.9	83.1	16.0	78.3	0.9	5.3

NOTES: "Minorities" is sum of Spanish-American and all races except white. Sum of individual items may not equal total due to rounding.

SOURCE: State of Oregon Employment Division, Affirmative Action Program, 1980: Klamath County.

TABLE 10-12

1978 WORK FORCE AND EMPLOYMENT BY SEX AND MINORITY STATUS FOR KLAMATH COUNTY

Sex and Minority Status	Work Force	Employed	Unemployed	Percent Distribution			
				Work Force	Employed	Unemployed	Unemployment Rate
Both Sexes							
1. TOTAL	24,780	23,280	1,500	100.0	100.0	100.0	6.1
2. White	24,012	22,704	1,308	96.9	97.5	87.2	5.4
3. Black	178	131	47	0.7	0.6	3.1	26.4
4. Other Races	590	445	145	2.4	1.9	9.7	24.6
5. Spanish American	557	523	34	2.2	2.2	2.3	6.1
6. Minority Group*	1,325	1,099	226	5.3	4.7	15.1	17.1

SOURCE: Klamath County Economic Development Commission

TABLE 10-13
DISTRIBUTION OF INCOME,
KLAMATH COUNTY, 1976

<u>Income Group</u>	<u>Percent of Population</u>	<u>Percent of Income</u>
\$ 0 - 2,999	19.1	2.5
3,000 - 4,999	11.1	3.7
5,000 - 6,999	8.3	4.2
7,000 - 9,999	10.4	7.3
10,000 - 14,999	18.7	19.4
15,000 - 24,999	23.7	37.3
25,000 - 49,999	6.7	17.3
50,000+	1.3	8.3

SOURCE: Derived from statistics presented in Oregon Department of Human Resources, Socio-Economic Indicators, pp. 229-230.

As the data in Table 10-14 indicate, the largest average payroll per employee that contributed to the income of the County was the lumber and wood products sector, where the average payroll per employee was \$15,000. All other manufacturing sectors contributed a smaller average payroll per employee.

As the demographic data clearly indicated, Klamath Falls and County contains an ample labor force. This, of course, provides another attraction, in addition to the supply of geothermal resources, for prospective industrial firms to locate in this area.

Social Economic Conditions and Trends

Recent studies of Klamath County's economy and socio-economic trends suggest that the major impetus behind population growth in Klamath county is no longer employment opportunities, but rather the environmental recreational viability of the area coupled with the availability of reasonably priced land and housing.

The Klamath County rate of population growth exceeded that of the state of Oregon, but the rate of job creation lagged behind causing an unemployment rate which was well above the state average for the last several years. A comparison of the structure of employment in the county over the 1970 to the 1978 period (shown in Table 10-15) affords an illustration of the basic components of the county's economy with its dependence on agriculture, transportation and tourism. Lumber and wood products provide the largest segment of primary employment as already discussed.

Agriculture employment declined over the decade with increasing mechanization and the elimination of smaller producers. The largest percentage of increase in employment over the 1970 to

TABLE 10-14
AVERAGE ANNUAL PAYROLL PER EMPLOYEE¹
KLAMATH COUNTY

	<u>Average Payroll Per Employee (1977)</u>	<u>Average Payroll Per Employee as a % of County Mean</u>
Klamath County	10,940	1.00
Manufacturing	15,060	1.38
Lumber & Wood	15,500	1.42
Food & Kindred	11,160	1.02
Printing & Publishing	9,660	0.88
Stone, Clay & Glass Products	10,530	0.96
Machinery	15,520	1.42

1. Data prepared by Pacifica Economica from data in 1977 Oregon Covered Employment & Payrolls, Research and Statistics Section, yearly summary, Oregon State Department of Human Resources, Employment Division.

TABLE 10-15

KLAMATH COUNTY RESIDENT LABOR FORCE, 1970 & 1978 AVERAGES

	<u>1970</u>	<u>1978</u>	<u>% Change</u>
Civilian Labor Force	19,310	25,160	+30.3%
Unemployment	1,350	1,820	+34.8%
Percent of Labor Force	7.0%	7.2%	---
Total Employment	17,960	23,340	+30.0%

NON-AGRICULTURAL WAGE AND SALARY EMPLOYMENT BY PLACE OF WORK

Total Wage and Salary	15,240	20,520	+34.7%
<u>Manufacturing Total</u>	3,870	5,360	+38.5%
Food Products	150	150	0.0%
Lumber and Wood Products	3,460	4,820	+39.3%
Other Manufacturing	260	390	+50.0%
<u>Non-manufacturing Total</u>	11,370	15,160	+33.3%
Contract Construction	470	750	+59.6%
Trans., Comm., Utilities	1,460	1,550	+6.2%
Wholesale & Retail Trade	3,290	4,660	+41.6%
Finance, Ins., Real Estate	610	860	+41.0%
Services	2,260	2,990	+32.3%
Government	3,280	4,350	+32.6%

SOURCE: Klamath County Economic Development Commission

1978 period occurred in manufacturing industries. However, in the recent years growth in non-manufacturing employment has exceeded the manufacturing growth rate. The rapid climb in construction and finance points to the accelerated population growth of the past few years. The increase in services and government reflects a public demand for services of a large scope and variety, as well as an increase in tourism activities.

Wages and salaries in manufacturing and agriculture tend to be roughly equivalent to state-wide averages. Entry rates in the lumber and wood products industry currently average approximately \$7.50 per hour while those in agriculture average from \$3.00 to \$3.50 per hour. Wages for clerical and services occupations are generally lower in Klamath County than other metropolitan areas due to competition resulting from labor surplus created by lack of employment opportunities for the growing number of women entering the labor force. Few manufacturing jobs are available for women and competition for these jobs is dominated by women who have previous experience. Summer employment for youth is limited because the County's agricultural base is not of the type which employs large amounts of hand labor.

Except for the utilities and government, unions are not predominant in the area. The wood products industry is approximately 50 percent unionized and establishes the wage pattern for the industry. The labor force in Klamath County is exceptionally well skilled. Table 10-16 summarizes the salient data of the social economic variables in Klamath County.

In summary, the socio-economic conditions in Klamath County indicate gradual increases in income levels measured either on a per capita basis or for the County as a whole. Conversely, the increases in these income levels are modest and still below that

TABLE 10-16

SALIENT SOCIO-ECONOMIC VARIABLES
FOR KLAMATH COUNTY

Total Adjusted Gross Income reported
on 1976 Tax Returns: \$236,593,000
(2.1% of state total)

1976 Average Adjusted Gross Income:
\$12,136, 6th among Oregon Counties

Advalorem Tax Rate (Rate per \$1000):
\$14.29

Percent of Population below Poverty
Level: 12.1%

Average Number of Food Stamp
Recipients: 3018

1975 Median Family Income: \$17,283

1975 Average Employee Earnings:
\$10,867

1977 Assessed Property Value:
\$981,279,000

Dollars per Capita: \$15,962

Number of Occupied Dwellings, 1977:
20,780

Number built prior to 1939: 7003,
or 33.7% of total

Annual Number of Building Permits for
all Dwelling Units: 825 (460 homes,
229 mobile homes, 136 apartment
units) 1977 Data

Income Tax Returns Adjusted
Gross Income, 1976

<u>Rate</u>	<u>Number</u>	<u>% of County Total Number</u>
\$0- 999	1124	5.8
\$ 1,000- 2,000	1370	7.0
\$ 2,000- 3,000	1227	6.3
\$ 3,000- 5,000	2203	11.3
\$ 5,000- 8,000	2433	12.5
\$ 8,000-10,000	1307	6.7
\$10,000-15,000	3648	18.7
\$15,000-25,000	4628	23.7
\$25,000-50,000	1310	6.7
\$50,000 +	244	1.3

of the state of Oregon averages. The unemployment in Klamath County remains relatively high, certainly higher than that of the state of Oregon.

The employment opportunities in Klamath County are limited because of a very narrow current economic base. However, the presence of the relatively high unemployment and low wage rates is still another factor which would encourage industrial firms to locate in Klamath Falls and County, especially when these factors are combined with the availability of geothermal resources.

Political, Institutional and Regulatory Environment¹

After a site for geothermal resource development has been identified, land surface and subsurface ownership must be determined. In many cases, ownership of the surface and geothermal or mineral rights is the same. The would-be geothermal developer must identify and secure all resource rights required for the proposed project.

It is important to consider the legal definitions of geothermal resources at the state and federal level. The federal Geothermal Steam Act of 1970 defines geothermal resources as:

Geothermal steam and associated geothermal resources means (i) all products of geothermal process, embracing indigenous steam, hot water and hot brines; (ii) steam and other gases, hot water and hot brines resulting from water, gas or other fluids artificially introduced into geothermal formations; (iii) heat or other associated energy found in geothermal formations; and (iv) any by-product derived from them.

In establishing geothermal legislation, Oregon drew from the federal Geothermal Steam Act of 1970 and the California Geothermal Resources Act of 1967. The Oregon definition is:

¹ A large part of the information in this section is from Oregon: A Guide to Geothermal Energy Development by D. Justus, N. Basescu, G. Bloomquist, C. Higbee, and S. Simpson published by the Oregon Institute of Technology, Geo-Heat Center, June, 1980.

Geothermal resource means the natural heat of the earth, the energy, in whatever form, below the surface of the earth present in, resulting from, or created by, or which may be extracted from the natural heat, and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases, and steam, in whatever form, found below the surface of the earth, exclusive of helium or of oil, hydrocarbon gas or other hydrocarbon substances, but including, specifically:

- a. all products of geothermal processes, embracing indigenous steam, hot water brines;
- b. steam and other gases, hot water and hot brines resulting from water, gas or other fluids artificially introduced into geothermal formations;
- c. heat or other associated energy found in geothermal formations; and
- d. any by-product derived from them.

Oregon Revised Statutes (ORS) 522.005(7)

The Oregon Geothermal Resources Act of 1975 grants ownership rights of geothermal resources to the surface owner. The Act states:

Ownership rights to geothermal resources shall be in the owner to the surface property underlain by the geothermal resources unless such rights have been otherwise reserved or conveyed. However, nothing in this section shall divest the people or the state of any rights, title or interest they may have in geothermal resources.

(ORS 522.035)

Access to private land can be obtained by purchase, lease, permit, option or any other mutual agreement with the owner of the surface property and geothermal estate.

The State Land Board, through the Division of State Lands, is authorized to issue leases for geothermal resources underlying state-owned lands. A geothermal resources lease is required to explore, develop or dispose of any state-owned geothermal resources.

However, casual exploration activities can be carried out before lease acquisition under a geothermal exploration permit issued by the Division of State Lands. The procedure requires the applicant to submit a description of the exploration plan, evidence of compliance with insurance and bonding requirements and other information deemed necessary. The permit is used for a one year period and allows nonexclusive access to state land for geothermal exploration. An exploration permit does not give preferential right to lease.

To obtain a lease, application must be filed with the Division of State Lands with a nonrefundable \$50 fee and \$1 per acre advance rental fee for a minimum of 40 acres. To maintain lease application status, the applicant is required to submit, within 120 days of filing the application; a geologist's preliminary survey report and ground water report, environmental impact report, evidence of compliance with insurance requirements, corporate surety bond of at least \$10,000, copies of permits issued by state or local regulatory agencies, and any other information required by the Division of State Lands.

Preparation of the Environmental Impact Report (EIR) is the responsibility of the applicant. The following information is required.

- technical description of proposed geothermal operations
- common effects of all geothermal operations
- description of resources peculiar to the site involved
- possible means to mitigate adverse effects

The Division of State Lands has prepared a statement to meet the first two requirements, and has issued instructions for estimating environmental impact.

The pre-lease environmental report is required to address the potential effects of proposed exploration, development and production activities for the lease in terms of environmental and socio-economic acceptability. The lease applicant pays for the assessment. Cost and time related to preparation of the EIR will vary depending on the scope of the proposed action.

The Division also requires: An archaeological survey before entry for exploration, proposed program for monitoring and surveillance of the geothermal resource and ground water quality and quantity during production, program for subsidence monitoring, revegetation for disturbed areas, and compliance with Department of Environmental Quality (DEQ) standards governing air and water quality, noise and waste disposal.

Salient features of the regulations covering leasing of state-owned land include:

Lease limitations

40 acres minimum.

No limitation on maximum lease size or total state holdings.

Primary term

Ten years.

Lease renewal

Leases may be renewed for up to an additional five years if a geothermal discovery has been made nearby or a discovery is deemed imminent by the Division director.

Leases may be renewed for an additional ten years if the royalties of any preceding year equal or exceed the annual rental rate.

Maximum lease term is fifty years, but lessee may have a first right of refusal.

Annual fees

Rental rates are:

\$1 per acre annually for the first three years
\$3 per acre for the fourth year
\$5 per acre for every year thereafter

Lease terms may be renegotiated. Annual rental is deducted from production royalties in any given year once production has commenced.

Surface access and the right to explore, develop and use geothermal resources on federal lands are acquired with a geothermal lease issued by the U.S. Bureau of Land Management (BLM). Pursuant to the Geothermal Steam Act of 1970, the Secretary of the Interior can issue leases for the development and use of geothermal resources on certain federal lands. Exempted from leasing are lands within the National Park System, national recreation areas, fish hatcheries, identified wildlife areas (e.g., refuges, ranges, management areas, waterfowl production areas), Indian lands, Department of Defense lands, and other lands selected by the Secretary. Wilderness areas may be leased in accordance with terms of the Wilderness Act of 1964.

Limited exploration involving casual-use activities and other preliminary evaluation operations may be conducted before securing a lease by obtaining a temporary use permit from the local BLM District Office or the Forest Supervisor's Office. Casual use refers to activities such as geologic mapping that are transitory and do not appreciably disturb the land.

Pre-lease exploration activities including test drilling up to 152 meters (500 feet) may begin upon approval of a "Notice of Intent and Permit to Conduct Exploration Operations" from the District Manager of the BLM, who coordinates with the USGS. The notice requires site specific information concerning exploration

plans and a \$5,000 bond or other bond assurance. The approved notice requires compliance with all applicable federal and state laws and local ordinances. When the exploration activities are complete, a "Notice of Completion of Exploratory Operations" must be filed with the BLM. Similar procedures are required by the U.S. Forest Service, which issues Prospecting Permits on National Forest Land for exploratory operations.

Casual-use and exploration under a Notice of Intent gives the nonexclusive right to conduct operations on federal land, but no preference for a lease. A geothermal lease give the exclusive right to drill for, develop and use geothermal resources under the causal-use operations. Persons other than the lessee, who wish to lease lands may gain access by obtaining an exploration permit from the appropriate surface management agency.

The Bureau of Land Management has primary responsibility for issuing geothermal leases on all available federal lands. The U.S. Geological Survey and U.S. Forest Service also have responsibilities governing the issuance and administration of federal geothermal leases.

Lands designated by the USGS as KGRA's may only be leased through competitive bidding. In Oregon 431,936 acres have been so classified. The Geothermal Steam Act defines a KGRA as:

...an area in which the geology, nearby discoveries, competitive interest or other indicia would, in the opinion of the Secretary (of Interior), engender a belief in men who are experienced in the subject matter that the prospects for extraction of geothermal steam or associated geothermal resources are good enough to warrant expenditure of money for the purpose.

Competitive interest will also exist if at least one-half of the lands in an application are covered by another application filed during the same month.

The BLM State Office manages leasing on KGRA lands. The appropriate surface management agency, BLM or Forest Service, conducts the necessary pre-lease environment review and determines which areas will be available for leasing. The BLM sets the lease sale data on published public notices. Prior to the day of the sale, each bidder must submit a statement of qualifications for leasing and a sealed bid which includes payment for at least one-fifth of the bid amount. Leases generally are awarded to the highest bidder. The federal government reserves the right to reject any and all bids.

Regulations governing KGRA status and access to federal lands are found in Title 43, Chapter II of the Code of Federal Regulations (43 CFR Part 3200). Federal lands which have not been classified as a KGRA or excluded from leasing are available to qualified applicants on a noncompetitive basis. The procedure begins with the filing of an "Application to Lease Geothermal Resources". The application requires a site description, map, proposed plan, methods for diligent operation, proof that an individual, corporation or municipality is qualified to hold a lease, and other specified information. Each application must be filed with the BLM State Office in a sealed envelope marked "Application for a Lease Pursuant to 43 CFR 3210" and accompanied by a \$50 filing fee. Applications will be considered, environmental assessments conducted and leases awarded for lands found suitable for geothermal development on the basis of priority by date of filing.

Salient features of the federal lease terms include:

Lease limitations

Geothermal lease not to exceed 2,560 acres.
640 acres minimum.
20,480 acres maximum/total state holdings.

Primary term

All federal leases are issued for a primary term of ten years.

Lease renewal

Leases may be continued for the extent of commercial production up to an additional forty years. Leases may be renewed for a second forty-year term if commercial production continues and the acreage is not required for other use.

Lease extension

A lease that is being "diligently" drilled before the end of the primary term, will be extended for five years and for the duration of commercial production up to 35 years.

Annual fees

\$1 per acre minimum rental (exact amount set in lease).

\$1 per acre escalation annually after the fifth year until the tenth year, or until commercial production begins.

\$2 per acre minimum during production.

Exploration expenditures during the first five years, and those in subsequent years, may be credited to the escalated portion or rent due. Rentals are paid to the BLM.

Exploration and Development Regulations. When clear title has been secured for a particular geothermal resource area, exploration and development should follow. Before initiating any activity the geothermal developer must obtain the necessary permits from the appropriate local, state and federal regulators. The length of permit application review time and the number and type of permits required will vary depending upon the size of the project and the environmental sensitivity of the area.

The following section describes the general types of permits that may be required. It is suggested that the developer contact the local, state and federal agencies which may have regulatory authority for a specific project for additional details. The Oregon Department of Energy can also provide information regarding permitting requirements for a particular project.

Private Land -- The following types of permits may apply to a geothermal project:

- Conditional land use permits may be required from cities or counties to comply with local zoning ordinances and Land Conservation and Development Commission goals and guidelines. Contact the local planning department for information regarding applicable laws and regulations.
- Construction permits and building inspections to insure compliance with state and local codes should be coordinated through the local building and safety division.
- Drilling permits will be required from the Department of Water Resources of the Department of Geology and Mineral Industries, depending on expected well depth and temperature.
- A permit is required from the DEQ for disposal of liquid wastes such as drilling muds, equipment oils, geothermal fluids and solid wastes.
- A Water Pollution Control Facilities permit from the DEQ may be required for injection wells.
- Other permits may be required from the DEQ to set limits on air emissions and fluid discharges. Contact the local or state DEQ office for specific information.
- An energy facility site certificate is required for large facilities.

State Lands -- When a lease has been issued, exploration and development activities are subject to state, federal and local regulations governing land use, well drilling, facility siting and waste disposal, as outlined in the preceding section.

In addition, to develop a geothermal resource on state land, the Division of State Lands requires: a proposed testing program, certified copies of all tests and measurements, legal

confirmation of the well's primary purpose, design alternatives considered in development planning and measurement of the quality and quantity of all production.

Federal Lands -- When BLM has issued the lease, the U.S. Geological Survey assumes primary responsibility for exploration and development operations within the federal lease area. The surface managing agency is responsible for all other areas of the lease. The USGS Conservation Division Area Geothermal Supervisor maintains regulatory control pursuant to the Geothermal Resources Operational Orders. The BLM is responsible for licensing electrical power generating facilities of 20 MW or more.

Oregon Well Permitting Procedures -- The State regulates well drilling regardless of land ownership. In Oregon, regulatory responsibilities for geothermal resources are divided between two state agencies; Department of Geology and Mineral Industries (DOGAMI) and Department of Water Resources (DWR). DOGAMI regulates geothermal prospect and geothermal wells. Shallow (less than 2,000 feet) low-temperature wells are regulated by DWR, essentially in the same manner as common water wells.

If the intent is to explore for and produce geothermal fluids with temperatures of 200°F or greater, then the necessary permits are obtained from DOGAMI. The agency issues blanket prospecting permits which may cover numerous gradient wells 2,000 feet deep or less.

The following sections outline the general procedures for obtaining well drilling permits.

1. Well Drilling Permitting Procedure for Shallow Low-Temperature Resources (Wells less than 250°F BHT and/or 2,000 feet deep)

Responsible agency: Department of Water Resources

Relevant laws: Oregon Administrative Rules (OAR)

- A permit is not needed before drilling.
- Contact a licensed well contractor.
- The contractor will file a start card with the local Water-master describing location, proposed use and expected depth.
- A \$2,000 bond is required.
- Drilling and completion procedures must conform to OAR Chapter 690 "Rules and Regulations Prescribing General Standards for the Construction and Maintenance of Water Wells in Oregon".

2. Well Drilling Permitting Procedures for Geothermal Resources (Prospect or geothermal wells drilled for fluids hotter than 250°F)

Responsible agency: Department of Geology and Mineral Industries

Relevant laws: ORS Chapter 522, OAR Chapter 632, Division 20

DOGAMI issues permits for prospect and geothermal wells as defined below. All drilling permits are conditional upon approval of local authorities.

- a. Prospect wells include any wells drilled as a geophysical test well, seismic shot hole, mineral exploration drillings, core drilling or temperature gradient test well, less than 2,000 feet in depth, and drilled in prospecting for geothermal resources.
 - File a plan of operation and hole locations (letter form).
 - Filing fee - \$100 per permit.
 - File a bond or security deposit in the sum of not less than \$5,000 or a blanket bond of \$25,000.
 - DOGAMI sends notice of permit application to relevant state and local agencies who have a 15 day period in which to comment.

- A permit is granted within 30 days of receipt of application. Restrictions are added to the permit if agency comments require them. General stipulations are made a condition of every permit. Casing and abandonment requirements are also made conditions of each permit.
- Permitting of shallow holes is done on a blanket basis, area-by-area under one permit. As many as 100 holes may be drilled under one permit.
- Formation logs and notations of water zones encountered are required of every operator. Blowout Prevention rules require operators to monitor hole temperatures. If the temperature exceeds 125°F, drilling is to cease and the hole completed as an observation hole, abandoned or equipped with safety devices as prescribed by rule.
- A final statement is required of the operator describing plugging procedure. Final locations are to be submitted.

Facility Siting. The Oregon Energy Facility Siting Council (EFSC) maintains siting jurisdiction for certain energy facilities on all lands, private, state or federally owned. Site certificates are required for a geothermal power plant with a nominal electric generating capacity of more than 25 megawatts (ORS 469.300(10) (a)) or a pipeline transporting geothermal fluids which is six inches or greater in diameter, and five miles or longer in length (ORS 469.300 (e) (A)). The Attorney General has determined that construction of a geothermal pipeline six inches or greater in diameter which is intended or can be reasonably expected to have an ultimate length of five miles or longer cannot begin until a site certificate has been issued, even if the first stage of construction will be shorter than five miles. EFSC also maintains siting jurisdiction for high voltage transmission lines of more than ten miles in length with a capacity in excess of 230,000 volts.

The EFSC has the power to conduct investigations into all aspects of site selection, designate areas within the state as suitable or unsuitable for geothermal power plants, and to

establish standards and promulgate rules which must be satisfied in order to obtain a site certificate. Suitable and unsuitable sites for geothermal development are listed in "Oregon Nuclear and Thermal Energy Council Statewide Siting Task Force Report 1974."

Unlike most electrical plants, a notice of intent is not required for a geothermal pipeline. The certification process begins by submitting a site application and the necessary fees to the EFSC (ORS 469.340, 469.350 and 469.420). If the specific site is within an area designated as unsuitable, the application is not accepted. However, the suitability classification may be amended by the Council's own motion or petition.

Specific standards for geothermal site certificates have not been established. General standards, which apply to all energy facilities, require the following mandatory findings: need for the proposed facility based on energy demand and economic prudence, protection of public health and safety, environmental protection, beneficial use of wastes and by-products, conformance with statewide planning goals and comprehensive land-use plans, protection of historical and archaeological sites, no infringement on existing water rights, necessary expertise to operate, construct and retire the facility, reasonable assurance of obtaining the necessary funds, and identification of foreseeable socio-economic impacts in the vicinity of the proposed facility (OAR 345-74-025). Specific standards for the siting of geothermal power plants and pipelines are likely to be developed in the next few years.

When a site application has been filed, EFSC distributes copies to twelve state agencies and any local governments affected by the application. This coordination with other agencies makes siting a one-stop process for the applicant to satisfy Oregon requirements. The agencies must make provisions that they

would normally make in their own permitting process in the site certification process. Any stipulations must be included as site certificate conditions, and once a site certificate is granted, the agency permits or licenses must be granted as a matter of course. The applicant, however, does need to apply directly for the necessary permits and licenses. The permitting agency retains the authority to enforce the requirements of the license.

The EFSC investigates each site application to determine satisfaction of mandatory finding and may commission independent studies of any proposed aspect of the facility. Costs of studies are paid from the filing fee; however, if costs exceed the fee, all additional expenses are borne by the applicant. Any unused portion of the filing fee is returned to the applicant.

Public hearings in the affected area and elsewhere are required as deemed necessary by the EFSC. The EFSC then, either approves or rejects the application. The EFSC is required to make a decision within nine months after filing of an application for a geothermal power plant and within twelve months for a pipeline. Rejection or approval of an application is subject to direct judicial review by the Supreme Court.

A site certificate authorizes the applicant to construct and operate a geothermal facility under conditions set forth in the certificate. The signed certificate binds the state and all affected political subdivisions to the approval of the site for construction and operation of the facility. All necessary permits and licenses must be issued, subject only to the conditions of the site certificate. The EFSC can only initiate changes in a site certificate based upon a clear indication of danger to the public health and safety. The holder of the site certificate is required to pay a fee each year during construction and operation of the facility. EFSC maintains continuing authority over the site.

Klamath County and Klamath Falls. Klamath County has a Board of Commissioners type of government with the major decision making powers vested in this body. The Commissioners serve at large with no specific areas of representation. They serve for a four year staggered term and no limit exists on the number of terms which can be served by an individual. The County Commissioner's assorted duties include formulation and approval of the County budget, approving zoning changes, handling all business transactions, and appointing various committees. The Commissioners also serve as an Advisory Board to the state legislature and private citizens. In addition, the Commissioners serve as a senior management team for the County government departments. The County commissioners are assisted by a County clerk who serves in an elected office for a six year term, acting as official recorder for all legal documents in the county. In addition the clerk is in charge of voter registration, marriage licenses and other pertinent county records.

The County Assessor is responsible for establishing real values of properties in the county. He is also responsible for reappraisals within a five year period and posting notices concerning assessment.

A number of county officers are of specific importance in the economic development of the County. The County Planning Department is headed by the Planning Director and is considered part of the Executive Branch of the County government. The Planning Director is mainly responsible for zoning and its environmental impact in the county. Thus, the County Planning Department is responsible for zoning, land use, regulations regarding building setbacks, land partitions and other controls. The Building Department is responsible for approving building plans, plot plans, application fees and is also responsible for reviewing health and safety regulations.

The County Public Works Department is responsible for street alignment, driveway permits, construction of culverts and other street projects, accessibility permits, moving permits and solid waste disposal.

The County Health Department is responsible for sanitation regulations pertaining to restaurants and other public places, medical buildings, water supply other than that approved by central systems, and regulations pertaining to public health hazards.

The Central Water Supply Department is responsible for water hook-up approval from various water companies located in the County.

The County contains several Fire Departments which have mutual agreements to assist each other when necessary within the County boundaries.

The principle Fire Departments are those of Klamath Falls Fire Department which covers the City of Klamath Falls, the Klamath County Fire Department which covers the entire county, and the Stuart Lennon Fire Department which covers specific regions of the County.

The Klamath County Chamber of Commerce provides the usual functions in assisting business establishments in Klamath County, as well as planning for economic growth and development. Klamath Falls revenues for their annual budgets for the years 1978 and 1979 were over \$12 million while the expenditures amounted to \$8.5 million.

The government of Klamath County, described above, has been active in promoting expansion of industrial base and in the use of geothermal energy, as can be readily seen from the goals and policies adopted in the Master Plan for the County and quoted below.

GOAL 9. COUNTY ECONOMY

To diversify and improve the economy of the county.

Plans and policies shall contribute to a stable and healthy economy in all regions of the state. Plans shall be based on inventories of areas suitable for increased economic growth and activity after taking into consideration the health of the current economic base; materials and energy availability; labor market forces; availability of renewable and nonrenewable resources; availability of land; and pollution control requirements. Economic growth and activity in accordance with such plans shall be encouraged in areas that have underutilized human and natural resource capabilities and where increased growth and activity is wanted. Alternative sites suitable for economic growth and expansion shall be designated in such plans.

Policy Rationale

- To use the potential of the geothermal resources in the county for industrial processing and for heating homes, commercial buildings, and industrial complexes.
- To take advantage of the low cost of geothermal heat a cost which will not increase because of inflation.
- To reduce dependence on high-cost fossil fuels and to strengthen the local and regional economy (further Goal 9).

Implementation:

- The county shall draft geothermal use regulations that outline criteria and standards for utilizing geothermal resources.
- The county geothermal floating zone will accomplish this policy.⁴

⁴Klamath County Planning Department, Comprehensive Master Plan for Klamath County, Oregon, May 1980.

Klamath Falls has a city manager form of government. There is a City Manager, Assistant City Manager, Mayor and City Council. Well reports and drilling permits are filed through the City Building Official's Office.

Transportation and Accessibility

Klamath County has excellent transportation facilities and high degree of accessibility. All transportation in and out of Klamath Falls is rapid and diverse. Table 10-17 provides information on the time required for shipments of goods from Klamath County to various destinations in the United States by truck.

The Southern Pacific Transportation Company and Burlington Northern, Inc. operate from Klamath Falls to all regional trans-continental destinations on a daily basis. A piggyback ramp is available to service the surrounding community. The National Railroad Passenger Corporation (Amtrak) operates daily and is available north to Vancouver, British Columbia, and south to Los Angeles.

In addition, Oregon, California and Eastern Railroad operates 63 miles of track and connects Klamath Falls with western cities. Table 10-18 provides the salient information as to the time requirement from Klamath Falls to various points in the U.S. for shipping by railroad.

Klamath Falls is served by Hughes Airwest which flies to western states, Canada and Mexico. Air Oregon, another airline, offers interstate flights plus direct airfare services to Reno and Portland. The Klamath County airport has northwest and south-west runway facilities which are 10,300 feet with a gross weight capacity of 680,000 pounds. The north-south and east-west runways are 5,200 feet. The airport is equipped with 24-hour lights for landing facilities. Table 10-19 provides the flying times from Klamath Falls to major cities in the U.S.

TABLE 10-17

TRUCKING FREIGHT TIMES FROM KLAMATH FALLS

<u>Destination</u>	<u>Working Days*</u>
Atlanta	7
Boston	8
Chicago	5
Cleveland	7
Dallas	6
Denver	4
Kansas City	5
Los Angeles	3
Miami	8
Minneapolis	5
New Orleans	6
New York City	8
Oklahoma City	6
Omaha	5
Phoenix	5
Portland	1
San Francisco	2
Seattle	2
St. Louis	5

*5 1/2 days per week.

SOURCE: Consolidated Freightways

TABLE 10-18

RAIL PASSENGER AND FREIGHT TIMES FROM KLAMATH FALLS

<u>Destination</u>	<u>Freight*</u>	<u>AMTRAK</u>	<u>Train Changes</u>
Atlanta	10-14	4 1/2	2
Boston	10-14	4 1/2	2
Chicago	6-8	3	1
Cleveland	7-9	3	1
Dallas	5-7	2 1/2	1
Denver	3-5	2	1
Kansas City	4-6	2	1
Los Angeles	2-3	19 hrs	none
Miami	10-14	4 1/2	2
Minneapolis	3-5	3	1
New Orleans	7-9	3	1
New York City	10-14	4	2
Oklahoma City	4-6	2 1/2	2
Omaha	4-6	2 1/2	1
Phoenix	3-5	1 1/2	1
Portland	1-2	6 hrs	none
Seattle	2-3	10 hrs	none
San Francisco	2-3	8 hrs	none
St. Louis	7-9	2 1/2	1

*Time periods listed in days unless otherwise noted

SOURCE: District Traffic Representative, Southern Pacific Transportation, and AMTRAK.

TABLE 10-19

HUGHES AIR WEST AIR PASSENGER AND
FREIGHT TIMES FROM KLAMATH FALLS

<u>Destination</u>	<u>Time</u>
Los Angeles	1 hr., 23 min.
Palm Springs	3 hr., 26 min.
Portland	2 hr., 39 min.
San Francisco	2 hr., 14 min.
Seattle	2 hr., 42 min.
Tucson	6 hr., 12 min.

SOURCE: Hughes Air West System Timetable, March 15, 1979

Industrial Land Availability

Klamath County has an adequate supply of industrial land either undeveloped or improved and served by electricity and other utilities in various locations in the county. A large number of these properties are in close proximity to the highway exits and/or rail facilities. In addition, the county also has ample land in close proximity to the county airport.

Electricity

Two power companies serve Klamath County--Pacific Power and Light and Midstate Electric. Pacific Power and Light serves the southern part of the county where most of the population, commercial activities and industry are located. Midstate Electric serves the less populous northern part of the county.

By law, power company must serve customers within the boundary of the area assigned to it. However, in constructing new lines, power companies are required to expend only eight times the amount of the potential annual revenue from extending service to that customer. The customer must bear any cost in excess of this expenditure. The cost of line extension is estimated at \$3.60 to \$4.00 per foot, part of which is refundable if more subscribers come into the line within five years. Theoretically, the utility can serve any subscriber in its service area within the limitations of cost or right-of-way, but the cost of extending electrical service can be prohibitive in areas far removed from existing lines.

There are three hydroelectric plants in Klamath County. The largest is the John C. Boyle Plant, which generates 79,990 kilowatts of power. Two smaller plants, the Eastside Plant and the Westside Plant, are located along the Link River and generate 292 kw and 419 kw of power, respectively. This is a total of about 80 mega-watts of power produced in the county. Any demand for power exceeding what is produced locally must be satisfied by power brought in from sources outside the county.

Construction of the new 500 KV line connecting the southern Oregon region with other power sources should provide adequate power to meet present demand. However, the demand for electrical power in this region is increasing at a rate of around 6 percent per year. (Irrigation alone created an additional 7,460 mega-watts of demand per year from 1975-1979. The peak power demand in the Pacific Power service area is 153 mega-watts per half hour during the winter and 143 mega-watts per half hour in the summer--an unusual similarity in peak loads caused by the demand for power for irrigation systems during the summer.) If demand for electricity in this region continues to increase at the present rate, new sources of power will have to be planned to meet future demand. Conservation measures or the development of alternative energy sources could help lessen the increase in demand for electricity.

Because northern Klamath County is a less populous area and has not grown as rapidly, demand for power in the Midstate Electric service area has not been as great as in the Pacific Power and Light service area. All power is purchased by Midstate from the Bonneville Power Administration (BPA). Any future increase in power demand would have to be met by the BPA.

Natural Gas

Two natural gas service areas have been designated in Klamath County, although only CP National delivers gas through local pipelines. At this time, Klamath Falls and portions of the contiguous suburban area are the only locations in the county with natural gas line service. Presently, there are no plans to extend these lines beyond the area now served. Natural gas utilities are required to expend three times the annual revenue of a potential subscriber to extend service.

A major line carrying natural gas from Canada to markets in California and Oregon runs through the county from north to south. A second major line is proposed and if built will run parallel to the first.

A majority of households and commercial establishments in Klamath County obtain their water from central water systems. The remainder of the county obtain their water from individual wells, or, in some instances, several homes may obtain water from a shared well. Many large industrial plants in the county, such as Weyerhaeuser, use such large volumes of water that they have their own water systems.

All of these water systems use groundwater to supply their users. Groundwater in Klamath County is, for the most part, plentiful and of very good quality.

Most of the systems have yet to reach their capacity even during periods of peak demand. However, some systems have inadequate storage facilities, and areas supplied by these systems may experience temporary shortages during extended dry spells. Shortages occurred in both the Moyina Heights Water Company and the Southern Suburban Area in the summer of 1979. The Klamath Falls City Water Company system, which supplies water to the county residents in the South Suburban Area, has adequate storage but has problems in distribution. Water mains carrying water to the South Suburban Area, the areas of greatest growth in the county, have nearly reached their capacity. At this time the Klamath Falls City Water Company is seeking new well sites near the South Suburban Area. New well sites are also being sought northeast of Klamath Falls. These are needed to supply water to the huge Basin View development when it is constructed. Unlike the power and gas utilities, water companies may refuse service to sites within their service area.

With a few exceptions, there should be an adequate water supply for future growth in the County. In areas where there are problems, water could be transported from other sources.

About half of the homes in Klamath County dispose of their sewage through central sewer systems. The remainder of the county uses individual septic tanks. Community sewer systems are not as numerous or as widespread as community water systems, and many areas, such as Stewart-Lennox, have community water systems but no community sewer systems.

In two of the systems, Weyerhaeuser and Henley High School, more people are using the system than it is designed to handle. However, these systems are used only during part of the day, so sewage is probably adequately treated. Systems that serve domestic users receive much greater volumes of effluent per person in a single day. Most of the systems still have capacity to serve more users, although the South Suburban Sanitary District is operating close to its capacity. If growth in the South Suburban Area continues, new facilities will be needed to handle the additional sewage generated.

Throughout most of the county, garbage must be taken to disposal sites by individuals. The Solid Waste Management Plan calls for phasing out many of the present disposal sites and using them as transfer sites where trash would be collected in the container and periodically transported by long-haul trucks to central waste disposal sites. In the area immediately surrounding Klamath Falls and in a portion of northern Klamath County, however, franchised collection service areas have been designated by the county. Private collection firms provide collection service in these areas.

As the above clearly indicates, Klamath County has an excellent supply of the necessary energy, water and sewerage for industrial development. Further, the county also has good access to surrounding areas.

Attitudes of Local Government and Industry Personnel
Toward Macro-Environment Conditions

Another aspect of the study of the macro-environment for geothermal energy use and development was to investigate attitudes of local government and industry personnel toward macro-environmental conditions. The macro-environmental conditions investigated were:

- Economic,
- Political, social and institutional,
- Regulatory, and
- Conditions affecting relocation of industry.

A question asked both of local government (Question 44) and industry personnel (Question 56) was what they thought were the most important influences on the industrial use or non-use of geothermal energy. Three of the seven local government respondents thought that availability of the resource would be an important influence on industrial use. Three also thought that cost savings would facilitate the use of geothermal energy. In addition, one local government representative thought that use would be influenced by the scientific determination of the longevity of the resource.

Local government officials listed more inhibitors to use than facilitators. Two respondents mentioned that they thought use would be inhibited by current well owners not wanting further development. There is concern in Klamath Falls about one well causing depletion of a neighboring well and a local citizens' action group has been organized. Other inhibitors were mentioned by one respondent each. They were:

- Fear of pollution caused by dumping wastes in the lake,
- Fear of well depletion,
- Lack of knowledge about dumping waste, and
- Cost of equipment and drilling.

Five of the nine current users mentioned availability as an important incentive to use. One person mentioned the general economics of use and another thought that successful or unsuccessful projects would influence use. This person thought that if potential users saw a successful well drilled, they would be more likely to use geothermal. Other influences mentioned were inhibitors:

- Local citizen action against further development,
- Government restrictions, and
- Fear of well depletion.

Two persons mentioned fear of depletion.

Potential users all mentioned inhibitors to use. Four of the seven named cost (of drilling) as an inhibitor. Other factors were mentioned by one person each:

- Difficulty of obtaining financing,
- Problems with discharge of water underground (reinjection),
- The gamble (i.e., uncertainty of obtaining geothermal),
- Reluctance to change from past energy sources, and
- Temperatures too low for industrial use.

Thus, local government officials see cost savings and availability as important influences, and current users cite availability as the most important influence on use. The

movement by well owners and citizens was seen by all groups as a deterrent to development. In Klamath Falls, because of extensive development, fear of depletion and pollution, there is a growing movement to more closely regulate further development, calling for more City regulation. Thus, while Susanville is strongly regulated and development is in its infancy, Klamath Falls has less regulation/ restrictions on development and more prevalent development, but may be moving more toward the Susanville situation of tighter control on use.

Currently, Oregon Institute of Technology is planning to test the impact of one well on another to see if depletion occurs. This is becoming a major concern of Klamath Falls' citizens and well owners. In addition, there is a movement to require systems that are likely to be "less polluting" by having to put the fluid back into the ground. Concerns here are that this will cause lower temperatures eventually (through "cold water breakthrough").

Economic Conditions

Local government (Questions 45 and 57) were asked, "What economic conditions, local or otherwise, do you see as affecting the use of geothermal energy by industry?" Five conditions were mentioned by local government representatives.

<u>Condition</u>	<u>Number Responding</u>
High cost of other energy	4
Scarcity of fossil fuels	2
New industry coming in	1
High interest rates	1
High cost of drilling	1

The high cost of other energy sources is seen as the major economic condition influencing the use of geothermal energy. While interest rates were mentioned, other respondent groups saw this as a more important factor.

Current users mentioned the following economic conditions:

<u>Condition</u>	<u>Number Responding</u>	
	<u>Current Users</u>	<u>Potential Users</u>
High cost of other energy	2	4
Scarcity of other energy	-	1
Low cost of geothermal	1	-
High cost of drilling	2	-
high cost of financing	4	3
Need to attract industry to Klamath falls	1	-

The most important factor to current users was the high cost of financing. Local government officials were not as cognizant of this as users, probably because they have not tended to encounter this as did users.

Potential users mentioned only three economic conditions: high cost of other energy (four respondents), scarcity of other energy sources (one respondent) and interest rates (three respondents). Thus, all groups thought the high cost of other energy was an important economic condition influencing the use of geothermal. Potential and current users were more likely to mention high interest rates. These two factors appear to be thought of as the strongest economic influences.

Both local government (Questions 46 and 47) and current and potential users (Question 58) were asked about the future direction of economic conditions. All but one of the local

government officials saw the direction of economic conditions as "favorable" for the future development of geothermal energy. The reasons given for this was the projection that costs (inflation) would continue to rise and further accentuate the advantages of geothermal energy.

Current users are mixed in their expectations for the future. Two persons thought that prices will go higher and higher. One person simply said "grim" and another expected the economy to get worse instead of better. Four persons were optimistic and one attributed his optimism to geothermal energy.

One potential user saw the economic conditions getting "worse and then better," another saw higher prices and four said "worse." It appears that current users are generally more optimistic than potential users and local government sees the economic conditions "worsening," but favorably for geothermal energy.

Political, Social and Institutional Conditions

Local government and current and potential users were asked to identify political, social and institutional conditions affecting the development and use of geothermal in Klamath Falls. All local government officials described the political environment as favorable for geothermal (Question 53). One person stated that there was "no strong opposition to development." In addition, they all saw the outlook for political and social conditions as good (Question 54). One person said, "Fine if private well owners don't get in the way," and another said, "...if the city makes a 'go' of their well and doesn't damage the resource." Thus, the climate for development is seen by city officials as very positive.

In responding to the political, social and institutional issues (Question 59), one current user said, "If it gets too political it will bring us to a standstill. The State has talked about taking over our wells--they claim State water rights and we (Klamath Falls) claim its mineral rights." This respondent expected lawsuits if this were to occur. Thus, one issue is well ownership. Another respondent saw zoning as an influence, while another favored stronger regulations. One respondent saw politics affecting interest rates and thought that social attitudes may be against more industrial use unless it can be demonstrated that industry will not affect the individual well owner. (Again, the issue of depletion of other wells.)

Another current user saw lack of collaboration among regulating officials as a problem. This person also saw regulations as being too restrictive at the present time and full of "red tape." The leasing procedures of State and Federal governments was also cited as a deterrent to geothermal development.

A final current user stated that private interest groups or environmentalists could have a strong effect on geothermal development. He thought that they would discourage the use of geothermal without having the knowledge of how to extract the heat without wasting enormous amounts of water.

In response to Question 59, two potential users mentioned the issue of one well causing depletion of another well as an issue. Other issues mentioned by one respondent each were:

- Limits on drilling permits,
- Increased regulation,
- Grant availability,
- Pollution concerns, and
- Availability of incentives.

Three of the nine current users said that someone outside their firm had influenced their decision to use geothermal (Questions 31a and 31b). The influencers listed were:

- Oregon Institute of Technology,
- State geologist,
- Department of Water and Mineral Resources,
- Local well drillers, and
- Developer (real estate).

Thus, when a firm is already "interested" in development, these were the influence sources cited.

Consistent with the fact that local government was not a "top of mind influencer," when asked about the role of local government in their decision or plans to use geothermal energy, the majority of users said the government had no role or effect (Question 32). Three respondents said local government had an influence. One had contacted the Economic Development Association as a result of a local government referral. Another person said that because their project was a county project, a county clearance was required, and another said the local government encouraged their use of geothermal.

Approximately half of the respondent users said "Yes" local government had an effect on their current or planned use (Question 33a). The effect was primarily as a result of a drilling permit requirement. One said he would be required to re-inject waste and another said the drilling was encouraged by the City. One respondent mentioned a project that was on "hold" because the "City Fathers" were concerned about the effect on other wells (depletion). This person supported the City's concern. In general, it appears that about half of the respondents

found the effect of local government on them to be regulatory and/or one of encouragement. The remaining respondents did not think local government had any influence on their use of geothermal energy. Thus, the opinion leadership of local government may be important.

In further probing the effect of local government on the development and use of geothermal, current and potential users were asked what effect they saw the local government as having on industrial use of geothermal energy in Klamath Falls (Question 60). Current users had the following types of responses to this question.

- All positive--government has promoted geothermal and industry coming into the area.
- Helpful, but limited in what they can do.
- Major impact because they are coming up with codes and restrictions (that are needed).
- Bad example for industry because of problems with their own well.
- Could have good influence--regulations they are developing and they are promoting geothermal.
- Local government could use some guidance in utilizing geothermal energy.
- If it regulates too much then industry will "back-off."

Only one respondent did not support increased regulation. Most respondents thought that local government does or would have a positive effect, but a couple were concerned about the example local government was setting because of problems with their own well.

Potential users were not as positive on the efforts of local government. They do not make strong statements favoring the restrictions as do current users. Current users may feel

"protected" (from depletion) by tighter restrictions whereas potential users could be "inhibited" by restrictions. However, potential users did not seem to complain about a potential increase in restrictions, either. Possibly, they anticipate the regulations to be beneficial as they become users!

Reflective of the attitudes of potential users are the following comments.

- Local government is carefully and prudently moving industry toward geothermal
- Major effect is promoting geothermal and recommending it for industry
- "Not much"
- Need more tax incentives
- Could limit drilling

Both current and potential users saw local government having an effect through regulation and promotion of geothermal energy. No one seems really to be opposed to further development, but more in favor of restricted development.

Local government officials were asked what they thought the attitudes of citizens toward geothermal development were (Question 50). Six out of seven said, "Very favorable," with the seventh saying, "Somewhat favorable."

All government officials said, "Yes," there were special interest groups in Klamath Falls focusing on geothermal energy (Question 51a). The groups mentioned were diverse (Question 51b) and are listed below.

- Agricultural group for processing purposes
- Individual well owners concerned about their well depletion caused by other wells
- Oregon Institute of Technology

Several respondents mentioned the well owners were concerned about depletion. These people were identified as being against City expansion. All respondents thought these entities "could be influential."

When asked about agencies or organizations involved in the promotion of geothermal energy (Questions 52a and 52b), the local government officials names the:

- Chamber of Commerce,
- City drilling a well,
- Group of downtown churches thinking of drilling a well,
- Oregon Institute of Technology, and
- Klamath County (Economic Development Association).

These organizations were seen as encouraging the further development of geothermal.

Current and potential users were also asked about local groups or agencies influencing the use of geothermal energy (Questions 61a and 61b). Five of nine current users said there were groups (other than local government) influencing geothermal use and three of seven potential users said there were. Groups listed were:

- Current users that are businesses,
- Chamber of Commerce,
- Committee that follows what is happening with business,
- Economic Development Association, and
- Oregon Institute of Technology.

These "organizations" were seen as providing useful information about geothermal energy.

Regulation

While many respondents discussed regulations in responding about conditions in the political, social and economic environment, specific questions about the regulatory environment, only four local government officials said there were regulatory issues being debated (Question 57a). All four mentioned issues of depletion or pollution (Question 57b). There is concern about re-injection and the depletion of other wells. In describing this, two persons mentioned the City's geothermal project and the development procedures used, but did not elaborate further.

All potential users said either there were no current regulatory issues influencing the development of geothermal energy or they did not know of any (Questions 63a and 63b). Four current users said there were regulatory issues. All four mentioned the re-insertion of water back into the ground. As might be expected, there is a current debate over whether this should be a requirement. It is interesting to note that only current users and local government representatives said there were current regulatory issues.

Local government officials were asked whether they thought the local government structure and regulatory environment provided strong leadership in the geothermal area (Questions 48a and 48b). Five said "Yes" and two said "No."

Reasons given by the respondents saying "No" were that government is too busy and only responds to a crisis and that leadership should be turned over to the private sector. The reason given by all respondents making the statement that government does provide strong leadership was the involvement in the geothermal heating district. This project is seen as providing leadership in the area of geothermal.

Local government officials were also asked about who regulated geothermal development locally (Question 55). Three did not know. Two said the City and the State and two said the State.

When asked the posture or attitude of local regulators toward geothermal energy (Question 56), two local government officials said "Very good" and two did not have a response. Three other local government officials said that the attitude is one of encouragement and/or wanting to thoroughly explore geothermal use.

Conditions Affecting Relocation of Industry

Current and potential users were asked what current conditions they see in Klamath Falls affecting the relocation of industry (Question 64). The responses received reflect the attributes and barriers to relocation.

The conditions cited by the current users were:

- High interest rates
- Reasonable land cost
- Reasonable labor market
- Clean air
- Sunshine/weather
- Community wanting it
- Availability of transportation
- Pleasant people
- Economic disaster
- High unemployment
- Geo-heat

Generally, the conditions cited were positive attributes of the community. The only negative aspects mentioned were high interest rates and economic disaster which are a national phenomenon. Labor market and transportation were also listed as important decision factors by relocaters (Section VI). Except for mention of schools and availability of geothermal energy, the conditions mentioned by potential users were identical to those mentioned by current users.

Current and potential users were asked what the City of Klamath Falls could do to attract users of geothermal (Question 55). The suggestions were similar for both groups. Most respondents said to either promote or advertise. That is, to provide information on the availability of geothermal energy. Other responses given by one individual each were:

- Keep regulations at a minimum,
- Tax credits,
- Establish amount of power available,
- Pilot projects, and
- Provide inexpensive financing.

Local government officials were asked what the City is now doing (Question 49). One person said "not much except working through the Chamber of Commerce" and another said "publicity." All five remaining respondents mentioned the City's financing of the County Economic Development Association as their only response.

Six of the seven local government respondents said that industrial users of geothermal energy are increasing in Klamath Falls (Question 58a). Four of the six believe this is true because of the inexpensive nature of using geothermal (Question 58b); one believed it was true because geothermal is available and another attributes the increase to more public buildings.

The incentives cited for industrial users to move to Klamath Falls (Question 59) were: cost (inexpensive) and availability. Six local government officials mentioned cost and three mentioned availability.

When asked about barriers to relocation (Question 60), three local government respondents mentioned regulations. Each of the following factors was mentioned by one respondent apiece:

- Not major population area,
- Lack of geothermal knowledge,
- High drilling costs, and
- Costs of relocation.

Three local government respondents thought nothing was being done to overcome the barriers (Question 61). Other respondents mentioned:

- Studies by City,
- Shared well use,
- Improved technology,
- Industrial revenue bonds, and
- Promoting to attract industry to Klamath Falls.

All local government respondents saw the attitude of local government toward attracting more industrial users as "very good" (Question 62). Four saw the attitude of local citizens as "very good" and three thought their attitudes were "fair" or "mixed" (Question 63).

Three local government respondents thought there were other groups whose attitudes were relevant to attracting industrial users to Klamath Falls (Questions 64a and 64b). All three cited the

Chamber of Commerce and one also included the home builders. All thought their strength was in being in favor of industrial expansion and/or representing a broad base of people.

Summary of Macro-Environment for Klamath Falls

Local government officials see cost savings and availability as important influences on the use of geothermal energy, whereas current users cite availability as the most important influence. Both groups see movements by well owners and citizens toward stronger regulations as a potential deterrent to increased use.

The economic conditions seen by local government as most strongly affecting the use of geothermal were high costs of other energy and scarcity of fossil fuels. Current users mentioned the high costs of financing most often and potential users mentioned the high interest rates which are the same to the extent that interest rates are the reason for the high cost of financing. (Other factors, such as financing requirements may be part of the high cost of financing.) Interest rates would be an inhibitor to development while cost of alternative sources of energy would be a facilitator of geothermal development. These two factors do emerge as seen to be the most critical economic factors.

The political environment is generally seen as favorable to the development of geothermal energy in Klamath Falls. There is widespread concern over pollution and new drilling depleting the resource of existing wells. In fact, there has been a citizens' action group formed in Klamath Falls to address this issue. As a result of this concern, there is a movement toward more regulation in Klamath Falls. Specifically, there is a movement to require re-injection (which some do oppose).

The macro-environment is mixed for the further expansion of geothermal energy in Klamath Falls. Respondents cited the availability of labor and transportation alternatives as favorable for re-location in Klamath Falls.

In general, the attitude of all groups toward attraction of additional industry to Klamath Falls is favorable. This was an important factor to many relocators, as described in a previous section. However, there is the movement toward increased regulation. While this may be beneficial to users it is not clear what impact, if any, this will have on firms interested in relocating to Klamath Falls.

The availability of labor is partly due to the unemployment rate in Klamath Falls. As with many other parts of the nation, the area is not thriving economically. This could be a deterrent to relocation, depending on the importance of this attribute to a firm. However, this does not appear to be a critical factor to the relocators surveyed (Section VI).

SECTION XI

MEASUREMENT OF CAPABILITIES FOR KLAMATH FALLS

The sample of promoters, developers and industrial service companies were queried concerning the infrastructure capabilities required by industry for geothermal plants and potentially available at the sites (Task V). The purpose was to determine:

- Skills and services required and available,
- Resources, and
- Conditions affecting plant retrofit, expansion and relocation.

In addition, the sample of industry management at the sites was analyzed to define their requirements for plant retrofit and expansion.

The first two parts of this section discuss survey results from the benchmark measurement phase of the study which provide information on respondents' perceptions of some aspects of the infrastructure in Klamath Falls. The final part of this section describes additional investigations into the infrastructure capabilities in Klamath Falls that directly access the existing infrastructure.

Promoters, Developers and Industrial Service Companies

Respondents were asked what resources were needed for the development of geothermal energy (Question 30), and how Klamath Falls was evaluated in terms of these resources (Question 31). Because the answers were so varied on these questions, Table 11-1 presents a paraphrasing of responses given by currently active respondents, and Table 11-2 presents the same information for potentially active respondents.

TABLE 11-1

RESOURCES NEEDED AND EVALUATION OF KLAMATH FALLS FOR CURRENTLY
ACTIVE PROMOTERS, DEVELOPERS AND INDUSTRIAL SERVICE COMPANIES

Resources

Has to be developed with
strict guidelines

More information and government
tax credits

Need well drilling machine and
two men -- don't need many men

Need more steam engineers and
well drillers

Need more engineering experience

Need more geologists, technical
people and engineers

More research

We have all the technical
knowledge needed -- it's
not complicated

Klamath Falls Evaluation

Keeping a forward mind --
need to take a chance to
get ahead

Best in State

Has enough drillers, now

Fine in terms of space
heating, but poor in
terms of steam develop-
ment

Lots of manpower
available

Limited in terms of man-
power -- geologists and
engineers

Don't know

Know a lot that's not
shared with private
enterprises

TABLE 11-2

RESOURCES NEEDED AND EVALUATION OF KLAMATH FALLS FOR POTENTIALLY
ACTIVE PROMOTERS, DEVELOPERS AND INDUSTRIAL SERVICE COMPANIES

<u>Resources</u>	<u>Klamath Falls Evaluation</u>
Expertise	Slowly improving
Equipment and expertise	Fine -- OIT helpful
Technical expertise and financing	OIT is useful
What is presently available	City and OIT doing a great job
Wells, pipe, labor -- the technology is available	Great
Have manpower and technical expertise through OIT	Has everything needed
Stubborn and persistent project managers are needed more than technical expertise	Has international reputation for resource
OIT engineers and lots of labor for a short period of time	Has adequate manpower and technically skilled people

As Table 11-1 indicates, current promoters and developers were mixed in their responses. Several said more information or expertise was needed, and the majority thought there was plenty of manpower already available. Respondents did not provide further detail, and raw materials were never mentioned as needed. One respondent did not answer the question.

One potential promoter and developer did not have an answer to the questions. As can be seen from Table 11-2, technical expertise was a resource mentioned by a majority of respondents. Others were: equipment, wells, manpower and pipe. The Oregon Institute of Technology was seen as a resource held in high esteem and all respondents thought that Klamath Falls possessed the resources they saw as required.

To provide a perspective on infrastructure needs of respondents, promoters and developers were asked what conditions or factors they saw as influencing industry's use of geothermal (Question 32). The following factors were identified:

- Government grants and incentives
- Costs of other fuels
- Availability
- Proven resource
- Inexpensive
- High cost of drilling

These factors were mentioned by both current and potential promoters and developers, with almost all potential promoters and developers mentioning cost factors. Other factors were each mentioned by several respondents.

The same factors were mentioned for Questions 33 and 34, regarding plant retrofit and expansion and plant relocation, respectively. In addition to those factors, "location" was also mentioned as a factor influencing relocation. The final part of this section will discuss availability of these factors.

In summary, promoters and developers see the need for technical skills in the most abundance, but the majority of respondents thought Klamath Falls had an adequate supply (possibly because of OIT). The conditions seen as affecting plant retrofit and development were very similar to those mentioned by other target study groups as factors affecting industrial use of geothermal energy. Specifically, availability, cost of other fuels, low cost of geothermal and the proven nature of resource use were seen as facilitating conditions already present. The inhibiting condition mentioned were the high cost of drillings, and government grants. In addition, incentives were seen as necessary.

Industry Management at the Site

Six of the nine current users included geothermal use capabilities in their facilities when their building was built (Question 23). Two retrofitted an existing structure (County service institutions) and one current user did both.

Six of the nine current users also had plans for changes or expansion in their use of geothermal energy (Questions 20a and 20b). Two of the firms are going to build more buildings and use their existing well for space heating purposes. One firm did not use their twenty-year old well until recently and discovered geothermal space heating was economical. They are currently looking into using geothermal energy for other purposes, but at this time are uncertain as to what purposes. One firm is going into new businesses and is planning to use geothermal in a greenhouse and

for an aquafarm. Another firm is investigating use of geothermal for electrical power generation. The most extensive expansion was planned by a firm who is retrofitting an existing system by adding a Rankin engine to produce electricity, an air conditioning unit and a heat exchanger.

Current and potential users were asked about incentives available for the use of geothermal energy (Questions 53a and 53b). With the exception of one potential user, all current and potential users were aware of incentives. The incentives mentioned by both study groups were similar.

<u>Incentive</u>	<u>Number Responding</u>
Loan guarantee	1
Technical assistance	1
Federal matching funds	1
Grants	5
Tax incentives	7

Seven respondents mentioned DOE as the source of incentives, and eight mentioned State and/or Federal governments.

When asked what could be done to increase industrial use of geothermal energy, current users gave the following responses.

<u>Incentive</u>	<u>Number Responding</u>
Tax incentive or credit	3
Technical assistance	2
Pilot projects	2
Provide education or knowledge	2
Financial assistance	1

Potential users' responses were somewhat similar. Three persons said provide grants, two said complete the water district, one said less regulation and another said provide more information.

In summary, the major requirement for plant retrofit or expansion seemed to be financial assistance. There were numerous comments about the high cost of the initial investment, even when utilizing an existing well. Another important requirement was more technical assistance and more knowledge. Industry management appears to be very interested in obtaining more knowledge and technical assistance.

A final comment which emerged frequently was to "increase availability." This relates to the desire for more technical assistance. Industry, particularly users, appears to be aware of the "state of science" regarding geothermal. That is, they made numerous comments concerning the lack of knowledge of the location of the resource. Industry is actually requesting an improvement in the state of technology to "increase availability" (through knowledge of where to drill to locate geothermal). The next section more specifically addresses infrastructure capabilities in Klamath Falls.

Description of Infrastructure for Geothermal Development in Klamath Falls

As the data in Table 11-3 indicates, the Klamath Falls area contains a wide variety of technical, business, legal and financial services. However, most of these firms do not have actual experience in geothermal development.

TABLE 11-3

AVAILABILITY OF TECHNICAL SERVICES FOR GEOTHERMAL
DEVELOPMENT IN KLAMATH FALLS

<u>Technical, Business, Financial and Legal Services/Firms</u>	<u>Number of Firms¹</u>
<u>Technical</u>	
Air Conditioning Contractors	22
Architects	7
Building Contractors	51
Dealers in Construction Materials	24
Concrete Contractors	29
Dealers in Contractors' Equipment	23
Drilling and Boring Contractors	10
Electric Contractors	16
Civil Engineers	17
Environmental Engineers	1
Industrial Engineers	1
Mechanical Engineers	1
Structural Engineers	5
Excavating Contractors	28
Heating Contractors	14
Dealers in Industrial Equipment	2
Testing Laboratories	3
Machine Shops	14
Plumbing Contractors	14
Steel Fabricators	8
<u>Financial/Legal</u>	
Attorneys	74
Bankers	5
Business Consultants	4
Financial Institutions (Other Than Banks)	12
Insurance Agents	127
Real Estate Appraisers	17
Accountants	38

¹Includes multiproduct/service firms

Source: Klamath Falls Yellow Pages

A brief telephone survey of twenty-two of the technical firms in Table 11-3 indicated that only two firms, both drilling and boering contractors, have had actual experience in geothermal energy development. However, a large proportion of technical services firms identified the Oregon Institute of Technology (OIT) as a local technical resource which could readily provide technical expertise in geothermal resource development areas.

OIT's Geo-Heat Utilization Center is one of the nation's leading institutions in geothermal resource development. It is both a source of consultants and publications in the area of geothermal energy development. Table 11-4 indicates curricula and degrees of OIT, and Table 11-5 shows 1978-1979 OIT's graduate analysis. The technical infrastructure for geothermal energy development in Klamath Falls is relatively well developed and significantly benefits from the presence of OIT.

Conversely, a telephone survey of legal, business and financial firms suggested that these services, with respect to geothermal energy development, have only marginal knowledge of such developments. However, Klamath Falls does have local financial assistance available (in the form of bank and mortgage company loans) for the development of geothermal energy. While local financial assistance is not abundant or available in large amounts, there is some availability.

With the presence of OIT, experienced drillers (and required manpower) and some local financial assistance, the infrastructure in Klamath Falls does provide a positive environment for the development of geothermal energy. This may be one of the reasons why there has been extensive development of geothermal energy in Klamath Falls. The infrastructure for Klamath Falls will be further discussed in Sections XIX and XXI in comparison with that of Susanville.

OIT CURRICULA AND DEGREES

	2-year Associate Degree	4-year Bachelor's Degree in Technology	(Option)* B.S. Degree in Industrial Management
--	-------------------------------	--	--

DIVISION OF ALLIED HEALTH TECHNOLOGIES

Dental Assistant (9-month Certificate)			
Dental Assistant	x		
Dental Hygiene	3 years		
Environmental Health Technology		x	
Water Quality Control	x		x
Medical Technology		x	x
Associate Degree Nursing	x		
Medical Radiologic (X-ray) Technology	x	x	x
Radiologic Electronics Technology	3 years		x

DIVISION OF ENGINEERING TECHNOLOGIES

Electronics Engineering Technology	x	x	x
Computer Systems Engineering Technology	x	x	x
Civil Engineering Technology			
Public Works Technology	x	x	x
Structural Engineering Technology	x	x	x
Surveying Engineering Technology	x	x	x
Construction Engineering Technology		x	x
Engineering Drafting Technology	x	x	x
Mechanical Engineering Technology	x	x	x

DIVISION OF INDUSTRIAL TECHNOLOGY

Automotive Technology	x	x	x
Diesel Technology	x	x	x
Machining Processes Technology	x	x	x
Gunsmithing	x	x	x
Welding Processes Technology	x	x	x

DIVISION OF ALLIED ARTS AND SCIENCES

Business & Industrial Management			x
Accounting Technology	x		
Secretarial Science Technology			
Options: Industrial	x		
Legal	x		
Medical	x		
Liberal Arts Transfer	x		

* BS degree awarded is entitled "Manufacturing Technology."

*Students desiring B.S. degrees have the option of either ad-
vanced Technology OR Industrial Management track.

LIBERAL ARTS TRANSFER

Designed for persons who wish a liberal arts education. Student receives an Associate of Arts degree, transferrable to other institutions. Excluding foreign language requirements, the following subject areas may be taken at OIT:

	1st Year	2nd Year
Agriculture	x	x
Biology	x	
Business Administration	x	x
Education (Elementary)	x	x
Engineering (Pre)	x	
Forestry	x	
General Studies in Social Science	x	x
Physics	x	x
Political Science	x	x
Pre-Dental	x	
Pre-Law	x	
Pre-Medical	x	
Pre-Pharmacy	x	
Pre-Veterinary	x	
Psychology	x	x
Sociology	x	x
Chemistry	x	
Economics	x	x
General Studies in Arts and Letters	x	
General Studies in Science	x	x
Geography	x	x
History	x	x
Journalism	x	x
Mathematics	x	x
Pre-Nursing	x	

PRE-ENGINEERING

In cooperation with Oregon State University OIT offers a 2-year Pre-Engineering program. The pure Engineering concepts deal more with the-
oretical rather than applied aspects of technology.

TABLE 11-5

OREGON INSTITUTE OF TECHNOLOGY
GRADUATE ANALYSIS BY DEGREE AND MAJOR

	<u>1978 - 79</u>		<u>Total</u>
	M	F	
<u>Associate of Arts</u>	3	8	11
<u>Associate of Applied Sciences</u>	102	94	196
Accounting Technology	5	14	19
Associate Degree - Nursing	0	23	23
Automotive Technology	14	0	14
Auto Tune-up Technology	1	0	1
Dental Assistant Technology	0	2	2
Dental Assistant (one year)	0	3	3
Dental Hygiene Technology	0	11	11
Diesel Technology	28	0	28
Environmental Tech. - Water	8	1	9
Machining Processes Technology	14	0	14
Medical Radiologic Technology	13	23	36
Physical Science Technology	0	0	0
Radiologic Electronics Technology	2	0	2
Secretarial Science Technology	0	17	17
Small Arms Processing Technology	5	0	5
Welding Processes Technology	12	0	12
<u>Associate of Engineering</u>	102	2	104
Air Quality Control	0	0	0
Computer Systems Engineering Tech.	15	0	15
Electronics Engineering Tech.	28	1	29
Engineering Drafting Technology	3	0	3
Highway Engineering Technology	6	0	6
Mechanical Engineering Technology	18	0	18
Public Works Engineering Technology	1	0	1
Structural Engineering Technology	11	0	11
Surveying Engineering Technology	20	1	21
<u>TOTAL ASSOCIATE DEGREES</u>	<u>207</u>	<u>104</u>	<u>311</u>
<u>Bachelor of Technology</u>			
Auto-Diesel Technology	13	0	13
Civil Engineering Technology	47	1	48
Computer Systems Technology	9	1	10
Dental Hygiene	0	0	0
Electronics Engineering Technology	25	0	25
Environmental Technology	3	1	4
Industrial Processes Technology	5	0	5
Mechanical Engineering Drafting Tech.	0	0	0
Mechanical Engineering Technology	16	1	17
Medical Laboratory Technology	2	8	10
Medical Radiologic Technology	1	2	3
<u>TOTAL BACHELOR OF TECH. DEGREES</u>	<u>121</u>	<u>14</u>	<u>135</u>
<u>TOTAL DEGREES AWARDED</u>	<u>328</u>	<u>118</u>	<u>446</u>

XI-12

SECTION XII
DECISION PROCESSES
FOR KLAMATH FALLS' RESPONDENTS

Task Six was designed to draw on Tasks One through Five to identify and define the processes used to analyze information in order to reach commitment and regulatory decisions that significantly impact geothermal projects at the sites. This section will draw on and extrapolate from data described in previous sections. The purpose is not to report specific results, but rather to use previously reported data to draw conclusions and implications on decision processes.

While the decision processes for the target study groups may vary in terms of input parameters, there are generalities that apply to all groups (but are less relevant to regulators as they follow formal agency procedures). It is first appropriate to discuss the groups in the macro sense for the hierarchy of effects model.

Hierarchy of Effects

The model for the hierarchy of effects is presented below.

While respondents do vary in terms of their stage in the hierarchial model, there are macro-similarities that exist within and across groups. All respondents in all groups have passed through the awareness stage. The vast majority, well over ninety percent, mentioned geothermal as a source of energy when asked an unaided recall question. The remainder were aware of geothermal when asked an aided question.

All respondents had also passed through the knowledge stage of the hierarchial model. However, there were varying degrees of knowledge. No one was unknowledgeable, but approximately forty percent were "somewhat" knowledgeable, as opposed to "very" knowledgeable. Knowledge needs are somewhat study group specific.

Interest in geothermal development varied even more widely. Relocaters tended to be the least interested in geothermal development than other study groups.

Preference for geothermal as an energy source was very high. The vast majority of respondents in all groups ranked geothermal as their number one preference as an energy source. This is probably due to the availability at the site and extreme awareness of geothermal's advantages (low cost of use was cited as a primary advantage consistently across target study groups). Thus, respondents have all tended to have transcended the awareness, knowledge, interest and preference stages of the model.

It is important that while the model phases are presented as sequential, beyond the awareness stage, the stages are largely interactive. For example, being exposed to information that is attended to (received in a communication sense) may stimulate interest. A good example is observing a successful pilot project. Many respondents mentioned pilot projects,

such as those undertaken by DOE, as a way of promoting increased use of geothermal. Being exposed to such projects may thus generate interest where no information may have otherwise been sought. New industry or current industry may be attracted to use via this method. It may be critical for relocaters visiting a potential relocation site to be exposed to current uses of the resources.

Since the stages in the hierarchical model are not necessarily sequential, it may be more appropriately stated as below.

This restatement allows for more feedback among model phases, although it does differ from conventional conceptualizations. In addition, it shadows the decision-making stage.

Intention with regard to geothermal varied also. Several current users were exploring uses beyond space heating, such as for electricity generation or air conditioning. In this regard, water temperature is a "problem" in Klamath Falls. Some potential users had intention for use. Only one user (ice firm) intended to discontinue use. It is, thus, at the preference stage that most respondents began to truncate the phases of the hierarchical model.

However, satisfaction or expected satisfaction was high. Again, the ice firm who used geothermal to melt ice was discontinuing use, as they found better sources.

Users were extremely satisfied with geothermal as a source of direct heat. Satisfaction was high. Even one respondent whose well went dry was very satisfied with geothermal as an energy source. All other respondent groups reported satisfaction with geothermal as an energy source or expected satisfaction if used.

In the Klamath Falls area all the data suggests a strong commitment to geothermal energy, at least in terms of a dollar decision to construction and commercial, industrial and residential uses. There is a high degree of perceived usefulness and repeatedly respondents spoke of being "proud" that their area possessed the resource.

The consistently stated preference for geothermal energy as a favored source of energy may be the strongest indicator of commitment. This reflects commitment beyond the "simple" act of use. Use does not necessarily imply attitudinal commitment, but attitudinal commitment may, in fact, follow from use. Over-simplifying somewhat, we can identify two paradigms for achieving attitudinal commitment.

1. Attitudinal commitment $\Rightarrow$ Use

2. Use $\Rightarrow$ Attitudinal commitment

Behavior (satisfaction with use) may be an appropriate measure of commitment in this instance. However, due to the non-transportability of the resource, this commitment may also be transitory. This may be best exemplified by the lower "commitment" among relocators. In fact, availability of the resource may be the critical determinant of commitment for residents in Klamath Falls. Relocators are unlikely to be attracted to the resource for geothermal alone. It appears to be a marginal factor rather than a determining (where to locate) one.

While the hierarchy of effects can be generally applied to target study groups, it is useful to discuss the decision processes further for each study group individually. From the data gathered, the next sections will develop a decision model analyzing factors (facilitators and inhibitors) used to reach commitment and regulatory decisions. This will then be applied to specific study groups.

General Model of Decision Process

Figure 12-1 presents a general decision model which can be applicable to target study groups. Aspects of the model will be weighted differently for different study groups. There are notable similarities between this model and the hierarchy of effects model.

After awareness there must be some match between the needs of the firm and the resource capabilities. A municipality seeking to attract industry or expand usage must carefully assess the needs of the firms or industries to determine the relevant appropriateness of the available resource in their area.

FIGURE 12-1
DECISION PROCESS*

*Stages may not be sequential.

Concomitant with a match between energy needs and resource capacity is access to a usable well. Obviously, this is made easier if it is possible to tap into an existing well, as in the Susanville instance and the Klamath Falls geothermal heating district.

Given these three factors, it is then necessary that a firm be actively considering geothermal use. This may be termed "interest" in the hierarchy of effects model.

The next series of analyses involve social benefit and influences, cost-benefit analysis and risk analysis. Observation of proven geothermal usage success appears to be an important influence (such as pilot projects). Klamath Falls is particularly strong in this realm because of the large number of operating wells. Citizens are well aware of the potential of geothermal for space heating and snow removal which reduces perceived risk of (un)successful use.

The cost benefit analysis factors will and do vary across target study groups. As one moves from potential to current user, perceived benefits increase and costs decrease, at least in terms of stated awareness. Risk is also higher in some realms for potential users--as there may be no "proven" well. For users there is a more eminent risk of resource depletion.

If all these factors result in a "go" decision, then an attempt will be made to develop the resource. The process could be truncated at any point, for example, because of lack of financing. The result will be satisfaction or dissatisfaction with the project and/or resource. Although not directly reflected in the model, this may or may not result in commitment to geothermal energy.

Figure 12-1 is a very simplified, general model and must be adapted to specific situations. Each of the boxes is a complex decision process in itself, aspects of which will be described for particular target study groups.

In addition, each target study group was asked a question regarding their decision process. Respondents had considerable difficulty describing the decision process. Since each group has a different end goal (e.g., regulators make decision as to allow drilling and users make decision as to usage) the ultimate decisions being made do vary by target study groups.

Local Government

The decision to be involved in the DOE project is the decision under consideration for the target study group. Question 35 asked, "Thinking back to what you remember about the time when the decision was made, could you please describe the process by which the decision was made?"

The answers varied somewhat. Synthesizing the answers, the process was recalled as follows:

- Realization of availability of Federal grants
- Meeting (City Council) to discuss requirements for grant
- Survey of taxpayers who ultimately voted "yes"
- Public hearings
- City Council budget meeting
- Engineering report for best location

In terms of the model, taxpayers and the Federal government seemed to have a strong influence on involvement in the geothermal project. In addition, there was no reference to risk factors and the benefit was perceived to be cheaper energy costs.

There apparently (an inference on the researcher's part) was considerable interaction among local administrators about involvement in the project. However, it appears that it was strongly supported and discussion centered considerably around grant procurement.

This project was frequently mentioned by other target study groups as a "model" they were watching. The success of this project may likely influence further geothermal development in the area. It may be further speculated that it could increase "well sharing", as in Klamath Falls the climate is largely one of individual wells for an individual user.

Industry at the Site

Potential Users. Potential users were asked what steps they would follow in the decision to use geothermal energy (Question 41). They were unable to delineate clear "steps", but the following responses were given by individual respondents.

- See if financing feasible, see if you could dig well, check tax credits.
- Availability then costs.
- Go to OIT for free engineering feasibility, see State for financial assistance and develop costs from this. Costs determine commitment.
- Dig well--no decision to it.
- Find grant.
- Seek information--determine costs and if in budget.

Costs appear to be critical to potential users. It appears that if there's availability and financing they will develop geothermal. Since social influences are so positive, they probably play a small role in the decision.

As with the current users, the potential users' potential decision to use geothermal (Question 38) would be determined by top management, such as the President and Board of Directors or owner of the firm. Across study groups top managers are the appropriate contact persons for expansion or relocation.

Current Users. The current users (Question 30) were somewhat more reluctant to describe the actual use decision process. There is a very strong implication that the process is an interactive one and to break it down into distinct phases is marginally useful. Responses tend rather to be in terms of factors considered instead of a step-by-step process.

Responses are as follows.

- Owner and plant supervisor made the decision based on availability and increased production.
- President decided because of existing wells and favorable location.
- Board of Directors made decision because of gloomy energy forecasts.
- Because it was successful in area
- Board of Directors made decision as source of heat. Manager of plant and developer encouraged it as source of heat. The developer participated in the initial cost of well.
- County Commission made decision because of rising energy costs.
- School Staff and Board decided this was an economical resource to be used.
- President decided conventional energy costs were too high.

For current users the strongest influences in the decision seem to be social (the fact that there is successful use in the area) and the rising cost of alternative forms of energy (cost-benefit analysis). There is an implication that the decision to use geothermal energy is "made" by the availability and strongly perceived advantages (primarily economic). Risk factors are discounted by current users because the risk has already been taken.

Relocaters

Relocaters were asked to describe in detail the process by which their firm would make a relocation decision (Question 20b). Again, respondents, even when probed were unable to describe the process. Most answers involved factors considered.

The following are paraphrased answers regarding the relocation decision. These are responses of persons answering the question who have already decided on a site.

- Geothermal is the only reason to locate in Klamath Falls--also have financial help here.
- Resource availability and if community agrees to use.
- Major consideration is availability of technically trained people. The Chairman of the Board said we had to move and the President started looking for sites. Oregon has no corporate taxes and no inventory taxes. Maybe other states don't either, but they never said so. Oregon offered training funds for production workers. Cost of land and cost of construction were cheaper here.

Some "relocaters" not having said they were involved in a relocation decision declined to answer the question. Those who did gave the following responses.

- Check availability of power to meet our needs; close to other transportation sources; Chairman of Board would check into price and we would want a labor force guarantee.
- Community set-up and raw material would be checked out. Second would be a place for waste water and want a good site checked with environmental aspects.
- Market research.
- Look for railroad setting. Next we want to know where there are lots of supplies available and a highly productive area with cheap energy.

It seems that relocaters decide to relocate and then look for sites having the requirements for their particular firm or industry. The decision-maker then evaluates and weighs these factors. The decision process seems very analagous to the important attributes of a location.

Energy does not appear to be a prime consideration. A municipality "must" promote itself on the basis of the needs of a particular firm with respect to other resources initially. Prime among these appear to be transportation, raw materials and a qualified labor force.

Financiers

Current and potential financiers were asked to describe in detail the process by which their firm would make a decision about financing a geothermal resource development project (Question 24). Across both current and potential financiers the cost-benefit analysis and risk analysis of the decision model were prime concerns.

A paraphrasing of decision processes presented by respondents is presented below. For each, the responses are put in a flow chart format, where applicable.

Respondent A: A demonstrated need
 ↓
 Do we have money available
 ↓
 Can the firm develop geothermal
 (feasibility)
 ↓
 Check laws on the environment
 ↓
 Does the firm have the capital

Respondent B: Consider firm's knowledge, experience
 and character
 ↓
 Ability to pay back loan

Respondent C: Is there an area for hot water
 ↓
 Is it cost justifiable

Respondent D: Break down costs of project
 ↓
 Appraisal on collateral to determine
 percentage of loan
 ↓
 Appraisal on borrower
 ↓
 Submission to head office

Respondent E: Feasibility study
 ↓
 Cost-benefit analysis
 ↓
 Evaluation of end use

Some respondents declined a response to the question and implied that applications were evaluated.

In terms of the financiers, the major phases of the decision process considered seem to be:

- Access to resource -- feasibility of successful well
- Cost-benefit analysis
- Risk analysis

Included in this cost-benefit analysis is the applicants ability to repay the loan and evaluation of character, experience and knowledge. The process seems to vary little depending on the type of financier (e.g., bank, savings and loan or mortgage company) and the factors considered are similar.

Regulators

Regulators were asked to describe the process by which a site is regulated (Question 4). This is actually discussed more fully from secondary literature presented in the Macro-Environment section of this report (Section X). However, the responses received from respondents will be presented here.

Oregon Division of State Lands. They regulate leases to use geothermal rights associated with mineral rights and also issue permits for exploration. Leases are on a first come, first serve basis subject to administrative rules. Leases require environmental analysis, rates are set out and there's a bid procedure.

Klamath Falls Permitting. The respondent indicated that an ordinance may be instated requiring a closed care system to conserve underground resources. In terms of permitting, there was no information available on a permitting decision process.

Well reports are filed, but the system is apparently not highly organized. The "real" regulatory decisions are at the State level. It appears that the City, at this point, is more oriented toward obtaining information on wells than strictly regulating. This is in the process of change.

Promoters and Developers

Current promoters and developers were asked, "Please describe in detail the process by which you or your firm would make a decision on involvement in a geothermal resource development project," (Question 24). The potential promoters and developers were much more prolific in their responses. However, many respondents in both target sub-study groups were unable to describe the process.

The respondents for current users simply listed factors that would be involved in the decision process. They all said it boiled down to "dollars and cents" (economics), but some did indicate that this was not that important because the costs were passed on. "Factors" mentioned were:

- Someone else decides (the implication was that the decision to drill was decided by someone else and the firm just did the work)
- Availability of the resource (developer)
- Costs and grants (developer)
- Dollars and cents
- Economics and feasibility

Three potential promoters and developers provided information on the decision process. In flow chart format two engineering firms said:

Firm #1

Look at plans

Study specifications

Submit estimate of labor and materials

Firm #2

Through economical process find site and user

Look at resource and quality

Conduct economic analysis -- is it a deep well, dirt, water, etc.

Check into financing

A developer described the following decision process.

Have OIT make feasibility study

Make sure financing is available at a reasonable rate

Seeing there is other prospecting in the neighborhood

Select best site from OIT analysis.

It appears that for promoters and developers availability (related to risk analysis) and cost-benefits (especially the importance of financing) are prime aspects of the decision process. Only one person explicitly mentioned other wells being prospected in the neighborhood, but this may be related to availability and feasibility for other respondents.

Concluding Decision

Factor Comments

Figure 12-1 presented a general model of a decision process applicable to the study groups. The model is "over-simplified and generalized" as the factors in the model do appear to change for individual respondents as for target study groups. However, the general factors in the model do appear to be appropriated across situations, although stage weightings may vary. Before concluding comments on the target study groups, it is relevant to point out some methodological considerations.

Methodological Considerations

The study was done as a case study of a small number of respondents in each target study group. In many ways the study can be described as a pilot study. This is primarily so because of the predominance of open-ended questions and other scaler questions leading to semi-quantitative analysis. Obviously, the unstructured questions (open-ended) lead to a wide variety of responses. Hence many responses were presented as paraphrases of actual respondent quotes. This gives more of a "flavor" of the data than some of the categorizations also presented.

It is further important to note that the study is based on a limited sample from a specific area, Klamath Falls. While frameworks may be generalized, each site is likely to have differences. Care must be taken in generalizing from this type of study and implications and conclusions are specific to the sample and methodology employed.

Summary of Decision Process and Factors

To derive a decision model for each target study group, while possible, is likely to misrepresent actual cognitive processes. Decisions are not necessarily sequential. Further, it is difficult for people to verbalize decision processes. They seem to think in terms of decision factors. In simple terms, there is first, problem recognition (where an actual state differs from an ideal state). Information is then sought to solve the problem and alternatives are delineated. In the standard adoption process model there is:

Adoption is the final stage which may be analagous to commitment. Adoption occurs when, after trial, the person decides to continue using the "product".

In Klamath Falls there appears to be a stong commitment to geothermal and it is considered an asset of value to the community of which they are proud. There appears to be committment both in terms of use of and attitudes toward geothermal. An ordering of degree of commitment maybe as follows:

1. Local government and current users
2. Current promoters and developers
3. Current financiers
4. Potential users
5. Government regulators
6. Relocators having site decided
7. Potential promoters and developers
8. Potential financiers
9. Potential relocators with undecided site

Obviously this ranking is a generalization from the data, and some judgements have been made by the researcher.

In terms of the diffusion process, which is the process by which groups of people adopt an innovation (the adoption process is one an individual goes through), the adopter categories can be stated as follows.

Source: Everett M. Rogers, Diffusion of Innovations
(New York: The Free Press, 1962), p.162.

The adopter groups can be defined as follows:

- Innovators -- Few people who are the first to adopt an innovation (2 1/2 - 5 percent).
- Early Adopters -- ahead of majority in trying an innovation (10-12 percent).
- Early Majority -- Perhaps one-third of the total market and are the key to substantial market success.
- Late Majority -- Perhaps one-third of the market and typically need persuasion.
- Laggards -- The last 10-15 percent to adopt.

Respondents in all target study groups vary in their stages in the adoption process. All are through awareness and interest stages. The current users could be considered in the early majority stage of the diffusion process, having reached adoption. Current users are in the evaluation stages of the adoption process primarily and are not really a part of the diffusion categories. Current financiers are innovators while potential financiers may just be entering the interest stage.

Local government have become adopters and are also innovators or early majority, while current promoters and developers are adopters, with drillers being late or early majority and other types of developers being in the early majority stages of the diffusion process.

Many relocaters are in the interest stage and have not necessarily made the transition to evaluation. Some potential users are in the evaluation stage for expansion of geothermal use.

The paradigm may not apply to regulators. Their decision process is a formalized one and the relevance is meeting the criteria for regulations. The development of the criteria for regulation requirements was beyond the scope of the study, although information has been provided on reasons for potential Klamath Falls re-injection regulations (well depletion concerns).

Implications for Municipal "Prospectus"

What does this mean for municipalities trying to attract industry? The over-riding criteria is to understand the industry and their needs. Specifically, what competitive advantage does the community have to attract industry? While geothermal is a competitive advantage, it is likely to be a secondary consideration for most firms. In order to identify target industries most likely to relocate or expand there is a need to match industry needs with the municipalities' attributes. Foremost factors in relocation decision process are raw materials, labor and transportation to market.

Expansion of use of geothermal by industries presently at the site appears to be highly influenced by cost. Tax incentives and grants are helpful, as well as seeing other successful users in the area. The Oregon Institute of Technology has been a tremendous asset to use of geothermal and is viewed as "the experts" in the area. OIT is an excellent promoter of the use of geothermal for areas even beyond Klamath Falls. They, when known, appear to have high credibility and are drawn on as a resource. Attention has also been directed to the success of the DOE project. Attitudes are favorable, but citizens appear to be closely watching the success. Geothermal heating districts seem to be a very viable avenue for increasing use (by example).

Financiers are concerned about costs-benefits and risks, as well as the applicants' ability to pay. Municipalities who are able to provide assistance in arranging financing may well have an advantage over other communities attempting to attract industry. Financing was important to industry study groups.

Broad Issues From Related Studies¹

Studies of three other sites have developed six broad issues underlying geothermal development. These are interrelated and may be categorized in terms of planning, policy and administrative/managerial issues. They have both macro and micro implications. The broad issues are:

- Present production, current capacity and future potential
- Scientific and technical issues
- Comparative economics
- Environmental issues
- Social-political issues
- Administrative/managerial issues

It is easy to see how these issues developed from other studies relate to the model developed for this study (Figure 12-1). However, in terms of pragmatic and actionable information, the factors considered within these broad issues may be most beneficial to municipalities attempting to further develop geothermal resources and attract users.

Concluding Comments for Klamath Falls

While in some ways general development of geothermal is in the "infancy" stages, Klamath Falls is an area that may generally be considered well into (possibly early majority) the diffusion process. Opportunities for further expansion, although limited by resource temperature, include new users for the resource and the attraction of industry. Both attempts toward use expansion and industry attraction should include market planning and a systemized, strategic approach to such planning. Cursory stages might be:

¹Louis J. Goodman and Ralph N. Love (editors), Geothermal Projects Planning and Management, Pergamon Policy series (1980), p. 211.

- Identify relevant target industry with a match between the area's resource potential and other industry needs
- Contact of key decision-makers in the firm
- Emphasize attributes of the area relevant to the firm
- Offer relevant incentives
- Demonstrate community interest
- Expose the prospect to potential advantages of geothermal

These are only simplified guidelines, but a key ingredient is the identification of relevant tactics and strategies. It is absolutely critical that the industry and their needs be fully understood by the community. Also, that the relevant targets have some potential for relocation or expansion of energy source use.

Further, many respondents in this study expressed a need for more technical expertise in terms of scientific advancement in the area of geothermal. However, all attitudes toward the Oregon Institute of Technology, as well as toward the general environment of Klamath Falls, were extremely positive.

In addition, the community appears to be very supportive of DOE involvement and views the project as a stimulator of further use and development.

Prime issues appear to be pollution (from dumping of waste) and well depletion, as well as cooling of the resource by re-injection systems. There is a move toward regulation for re-injection regulations. The Oregon Institute of Technology is planning to study the potential of one well depleting another.

Although gleaned from non-survey interviews, there is also concern about lack of knowledge of equipment maintenance. This could hurt further development as problems could develop in this area. DOE could undertake projects to disseminate information to avoid problems before they occur.

In general, the climate for further geothermal development in Klamath Falls is favorable. It is a valued resource although a major prohibitor of usage is initial costs.

Government grant applications were said to be cumbersome and costly, so smaller users tend to avoid application. This information came from many sources. This appears to be a major barrier to less financially capable users. Many have been advised by others to find other means of financing initial costs. This is a contribution that could be made by DOE to expand usage. One person said, "the paper work is so extensive and requirements costly that you could drill the well for the same amount....." (that you could apply for a grant). These are not isolated perceptions. However, use is still extensive.

In spite of all the private wells in Klamath Falls, the DOE project is viewed favorably and, if monetary problems are solved (as they apparently have been) and the project continues successfully it will be (and is) viewed by the community as an asset. Due to the lack of extensive wells in Susanville, the DOE project may be even more critical here as a model for further development than it is in Klamath Falls. The remainder of this report focuses on Susanville data and the comparison of Susanville and Klamath Falls.

SECTION XIII
RESULTS OF BENCHMARK MEASUREMENT FOR LOCAL
GOVERNMENT PERSONNEL IN SUSANVILLE

Nine representatives of the City and County government were surveyed including the current Mayor of Susanville, two ex-mayors, two members of the City Council, a member of the local planning commission, two City employees closely associated with the Susanville Geothermal Development Project and a member of the County Planning Commission. The respondent representing the County refused to answer most of the interviewer's questions, indicating a great deal of suspicion about the City's role and the purposes of the interview. He was dropped from the analysis because his questionnaire was not considered usable.

This section describes the results of questions related to general attitudes toward energy sources and the attitudes and perceptions of the DOE geothermal project in Susanville. The questionnaire administered to local government officials is included in the Appendix.

Awareness, Interest and Knowledge
Regarding Geothermal Energy

As shown in Table 13-1, all respondents who answered the question mentioned geothermal energy when asked about energy sources that came to mind (Question 1). One respondent did not answer Question 1 or 2, but was obviously aware of geothermal energy from his answers to other questions.

Most respondents reported they had been aware of geothermal energy for a long time, either because they lived in the area or because they had worked with geothermal energy previously. Several respondents, however, were relative newcomers to geothermal energy, being aware of it for four, seven and five years

TABLE 13-1

LOCAL GOVERNMENT: AWARENESS OF GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
1	Energy sources that come to mind	
	Solar	6
	Water	5
	Geothermal	7
	Petroleum	7
	Wind	5
	Nuclear	3
	Biomass	5
	Coal	3
	No answer	1
3	How first aware?	
	When first moved to town	1
	Live in geothermal area	5
	Attended conference/workshop	2
4	Number of years ago first aware	
	30 or more	4
	25-30	1
	10-20	0
	less than 10	3

respectively. Of these newcomers, two had learned about geothermal energy from conferences or workshops organized by the City, while the remaining respondent learned of geothermal energy when she moved to the area.

Most government respondents felt they were "somewhat" knowledgeable about geothermal energy. One respondent regarded himself as "not very" knowledgeable and two respondents considered themselves "very" knowledgeable.

<u>How Knowledgeable</u>	<u>Number Responding</u>
Very	2
Somewhat	5
Not very	1

Table 13-2 displays responses regarding interest in further geothermal development in the Susanville area. As was the case with Klamath Falls' local government representatives, all respondents reported they were "very" interested in the further development and use of geothermal energy (Question 8). All but one respondent thought the City of Susanville was also "very" interested in geothermal energy. The most common reason given for their personal interest in geothermal energy was its ability to replace scarce fossil fuels and promote energy independence. The potential for local development and cost advantages were the next most frequently mentioned reasons.

The responses to these questions were very similar to those obtained from the Klamath Falls' government sample. Thus, awareness, interest and knowledge surveyed in both groups tended to be parallel and at the same level.

TABLE 13-2

LOCAL GOVERNMENT: INTEREST IN GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
8	Interest in further development and use	
	Very	8
	Somewhat	-
	Uninterested	-
9	Why(interested)?	
	Conserve scarce resources	4
	Cost/less expensive	2
	Availability/potential	3
	Aid economy	2
	Non-polluting	1
10	Interest of City of Susanville	
	Very	7
	Somewhat	1
	Uninterested	-

Preference for Energy Sources

Table 13-3 describes preference patterns for various energy sources. Geothermal energy emerged as the most preferred energy source with six of the eight respondents ranking it as their number one energy source (Question 13). Solar and biomass also ranked high while petroleum, nuclear and coal were generally viewed as undesirable sources of energy.

When asked why they preferred geothermal (Question 44), most respondents mentioned its cost advantages and non-polluting quality. One respondent rated solar higher than geothermal though he considered them essentially similar in that both were relatively inexpensive and clean sources of energy. Another respondent rated biomass as his first preference because it was readily available in the area. This respondent felt that geothermal resources in the area were not hot enough to generate electricity, and that this was a serious drawback.

Respondents least preferred energy sources such as petroleum, coal or nuclear which they considered increasingly scarce and expensive, dirty or dangerous. Again, energy source preferences among the local government representatives sampled in Susanville were nearly identical to those of the local government representatives sampled in Klamath Falls. Both groups showed a strong preference for geothermal energy.

Perceived Advantages and Disadvantages of Geothermal Energy

Table 13-4 displays respondent comments concerning the relevant advantages and disadvantages of geothermal energy. As to be expected from respondents who are actually promoting a large geothermal development project, there are many more perceived advantages than disadvantages of geothermal energy.

TABLE 13-3

LOCAL GOVERNMENT ENERGY SOURCE PREFERENCES

<u>Question Number</u>	<u>Question and Answers</u>	<u>Individual Respondent Ranking</u>
13	Ranking of energy sources	
	Solar	1 4 2 3 5 3 3 2
	Water	4 3 3 4 4 5 2 7
	Geothermal	2 1 1 1 1 4 1 1
	Petroleum	7 7 8 5 8 7 5 5
	Coal	6 6 6 6 7 6 7 6
	Wind	3 8 5 7 3 2 6 3
	Nuclear	8 5 7 8 6 8 8 8
	Biomass	5 2 4 2 2 1 4 4
		<u>Number Responding</u>
14	Why most prefer?	
	<u>Geothermal</u>	
	Availability	3
	Non-polluting	4
	Cost/less expensive	5
	Conservation	1
	<u>Wood</u>	
	Plant fuel resource	1
16	Why is geothermal your 2 or 4 choice?	
	Inadequate heat	1

TABLE 13-4

LOCAL GOVERNMENT: PERCEIVED ADVANTAGES AND DISADVANTAGES OF
GEOTHERMAL ENERGY USE

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
41	Perceived advantages	
	Clean/non-polluting	5
	Low cost/savings	4
	Availability	3
	Renewable	2
	Conservation	2
	Promote growth	1
42	Perceived disadvantages	
	Unknown costs involved in retrofitting and transporting	3

The advantages mentioned most frequently were the non-polluting character of geothermal energy, its low cost and availability. Only three respondents mentioned any disadvantages associated with geothermal use. The unknown costs of transporting and retrofitting heating systems for hot water was seen to be the biggest disadvantage.

The Susanville local government sample did vary from the Klamath Falls local government sample in terms of perceived advantages and disadvantages of geothermal energy. Susanville respondents perceived many fewer disadvantages, citing only the unknown costs, than did Klamath Falls respondents who cited depletion and pollution problems. This may reflect differences in the stage of development between the two areas. Since geothermal does not currently have widespread usage in Susanville, costs of retrofitting are "unknown" and potential problems may not be as well-known.

Use and Potential Use of Geothermal Energy in Susanville

Table 13-5 presents the results of questions concerning knowledge of use and potential use of geothermal energy in Susanville. Most respondents (seven out of eight) were aware that the City used geothermal energy to heat the municipal swimming pool. Further, respondents were aware of some aspect of the several geothermal development projects that the City was involved with. Seven out of the eight respondents mentioned the DOE heating district project to provide City buildings with access to a hot water pipeline. Half the respondents were aware of plans for extending the pipeline to serve an industrial park. However, three respondents did not know how long the City had been using geothermal energy and those remaining thought the City had been using geothermal energy for between 10 to 50 years.

TABLE 13-5

KNOWLEDGE OF USE AND POTENTIAL USE OF GEOTHERMAL ENERGY
IN SUSANVILLE

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
11a	Types of things city is doing to promote geothermal energy	
	DOE energy project	7
	Drilling wells	1
	Engineering studies	1
	Heating for residences	3
	Industrial park	4
	Put in pipeline	2
11b	Does the city currently use geothermal energy?	
	Yes	7
	No	1
11c	What is it used for?	
	Swimming pool	7
11d	How long has city been using geothermal energy?	
	More than 45 years	3
	35-45	1
	10 years or less	1
	Never used	1
	Don't know	2

In addition to being aware of local government's use of geothermal, respondents were also knowledgeable regarding actual and potential commercial uses of geothermal in Susanville. The tabulation below presents the number of respondents who cited each energy use as currently in use in Susanville and as potentially a geothermal energy use in Susanville (Questions 6 and 7).

<u>Use</u>	<u>Number Responding as Current Use</u>	<u>Number Responding as Potential Use</u>
Space heating	7	6
Direct process	4	6
Generation of electricity	-	1

Most respondents recognized that space heating was and would remain an important use of geothermal energy. Direct process applications of geothermal (e.g. in municipal swimming pool or greenhouses) were seen to be more likely in the future. More respondents saw direct process as a potential use in Susanville than did Klamath Falls' respondents.

Current Energy Uses and Needs

Respondents were asked to list all sources of energy used by the City of Susanville. Table 13-6 presents the responses to these questions.

All respondents reported that hydroelectric/electricity and petroleum were the two main energy sources used by Susanville. According to respondents, hydroelectric power was used exclusively for generating electricity. Petroleum was used mainly for heating, but several respondents mentioned that it was also used to generate electricity for direct process applications. Only five respondents indicated that the City used geothermal energy,

TABLE 13-6

SUSANVILLE LOCAL GOVERNMENT: CURRENT ENERGY USES AND NEEDS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>				
17	Energy source used?					
	Geothermal					5
	Hydroelectric/electricity					8
	Petroleum					8
	Biomass					2
	Coal					2
18	Uses of energy source...					
	Geothermal		heating		electricity	
	Hydroelectric					direct
	Petroleum					
	biomass					
	Coal					
19	Satisfaction with use...					
	Very					
	Somewhat					
	Dissatisfied					

and of these five, four reported that geothermal was used for heating while one reported that it was used as a direct process application. All of them apparently had the municipal swimming pool in mind.

Two respondents mentioned biomass and coal as additional energy sources used for heating by the City. Of the five respondents who reported that the City used geothermal, all were very satisfied with it as an energy source. This was not the case for either petroleum or hydroelectric power. For each of these energy sources, only half the respondents were very satisfied, two were somewhat satisfied and two were dissatisfied.

Potential Changes in Energy Use and Future Needs

Respondents were asked if the City of Susanville planned any changes in future energy use (Question 20a), what type of changes were planned (Question 20b) and why were these changes planned (Question 20c). Table 13-7 presents the results for these questions.

All respondents mentioned the increased expansion of geothermal use planned by the City--primarily the geothermal heating district for government buildings as being the main change. They were more divided about the reasons for this development. Six respondents mentioned the economic advantages of geothermal use as a reason for geothermal development and three respondents said that it was being done to reduce dependence on oil and electricity. One respondent thought it was being done because geothermal was non-polluting, and another respondent offered that it was being done because the City had adopted a policy of geothermal development.

TABLE 13-7
POTENTIAL ENERGY USE CHANGES AND FUTURE NEEDS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
20a	Are there any changes planned?	
	Yes	8
	No	-
	Don't know	-
20b	What type of changes are planned?	
	Increased expansion of geothermal	8
20c	Why are these changes planned?	
	Reduce dependence on oil and electricity	3
	Economic advantages	6
	Clean energy	1
	City's decision to develop geothermal	1
39	Are there any plans for additional geothermal projects?	
	Yes	6
	No	-
	Don't know	2
40	What are these plans?	
	Electrical generation	2
	Commercial uses	3
	Homeheating (low-income housing)	5
	Expansion of DOE project	4
	State correction facility heating	1
	Greenhouse development	1
43	What are the future energy needs of Susanville?	
	Growing	5
	Reduce cost	2
	Don't know	1

Respondents were also queried about their awareness of additional geothermal energy projects (Question 39), knowledge about their plans (Question 40) and their sense of what the main energy needs for Susanville would be in the future (Question 43). Six of the eight respondents were aware of some type of plans for additional geothermal energy development. Five mentioned a project pending with HUD for extending the hot water pipeline to serve low-income housing. Four respondents mentioned further expansion of the hot water heating district, and three more respondents specified future commercial uses for the City's hot water pipeline. Two respondents said that geothermal energy would be used in the future to generate electricity. Most of the energy developments anticipated by respondents were possible spinoffs from the hot water pipeline that was the centerpiece of the City/DOE geothermal project.

Five local government representatives saw an expansion of Susanville's energy needs in the future. Two respondents thought the future energy need was to reduce energy costs, and one was uncertain about what the energy needs of Susanville would be (Question 43).

Knowledge, Awareness and Attitudes Regarding City/DOE Geothermal Projects

Table 13-8 presents the results for several questions concerning respondents' awareness and feelings toward the City/DOE project. All respondents were aware of the project (Question 21). Their descriptions of the project (Question 22) varied according to the projected uses they saw for the hot water pipeline. Six respondents mentioned heating public buildings. Four respondents mentioned the development of an industrial park. Three mentioned low-cost housing. One respondent thought the hot water pipeline would eventually supply the nearby state correctional facility, and still another thought that it would be used for promoting light industry like greenhouses or meat production.

TABLE 13-8

KNOWLEDGE, AWARENESS AND ATTITUDES REGARDING DOE PROJECT

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
21	Does Susanville have any commitments to capital geothermal projects?	
	Yes	8
	No	-
	Don't know	-
22	Describe the project	
	Heating city buildings	6
	Industrial park	4
	Heating low-cost housing	3
	State correction facility	1
	Greenhouse & meat production	1
23	What is your opinion of the project?	
	Excellent/highly feasible	6
	Lack of regional cooperation	1
	In engineering phase	1
	Speed it up	1
	Shouldn't use tax dollars	1
	Do you think Susanville should be involved?	
	Yes	7
	No	-
	No answer	1
	Why?	
	Source of revenue	1
	City is proper institution to promote geothermal	3
	City originated, initiated program	1
	No other entity is qualified	2
	Promote jobs	1
24	Why did Susanville undertake DOE project?	
	No one else would do it	1
	Provide jobs for the area	2
	Cost advantages	3
	Provides income for City	1
	Don't know	2

On the whole, respondents had a high opinion of the City's geothermal project (Question 23). Six of the eight local government representatives gave their opinion as excellent or highly favorable. This result is to be expected from respondents who, for the most part, are directly responsible for the City's involvement.

Several neutral or even negative comments were received. One respondent complained about how long it was taking to get the program started. Another said the program was only in the engineering phase. Another complained about the lack of regional cooperation, while another commented that more tax dollars should not be diverted to the project. On balance, however, seven out of eight respondents said they thought that Susanville should be involved in the geothermal projects.

There was a wide range of reasons given for the City maintaining its involvement with the geothermal project (Question 23). Three respondents said that the City was the only proper institution to promote geothermal development in the area. Two additional respondents said that no other entity in the community had the resources or personnel to undertake this kind of project. Another respondent said that the City was the originator of the program and should continue to support it, and one respondent each mentioned that the geothermal project would provide a source of revenue for the City, or that the project would promote jobs in the area. Most of the reasons given by respondents for continued involvement with the geothermal project derived from their perception that the City of Susanville was uniquely qualified to promote geothermal development in the area. This contrasts sharply with the respondents from Klamath Falls who saw no special expertise or qualifications for their City government to lead geothermal development.

Respondents were also asked to state their perceptions of the reasons why the City decided initially to undertake the geothermal energy project (Question 24). Two of the respondents reported they did not know why Susanville had originally supported the project. Three respondents said it was for the cost advantages of having a cheap energy source for heating. Two respondents said it was done to help provide jobs for the area. One said it was done to provide income for the City and another said that there was no one else who would do it. None of the local government respondents said that it was done for reasons of promoting general geothermal development or providing an attractive example to other developers. Instead, the reasons focused on the direct benefits that might accrue from the heating district project.

Respondents were also asked about the amounts of money that were allocated to the geothermal projects (Question 25) and the sources of this funding (Question 26). Table 13-9 presents these results. There seemed to be a lot of variation in respondents' knowledge about these matters. Two respondents, probably the most knowledgeable, estimated the cost of the program(s) to be over five million dollars. One respondent said four to five million dollars, while two others said two to three million dollars. Three respondents claimed they didn't know how much money was involved.

Respondents were in somewhat more agreement about the source of funding. All respondents who claimed to know anything reported the main share of the funding (89 percent on the average) was supplied by the federal government. Three respondents thought the local government was, on the average, responsible for ten percent of the funding, while two respondents thought the state was, on the average, responsible for approximately six percent of the funding.

TABLE 13-9

KNOWLEDGE ABOUT AMOUNT AND SOURCES OF FUNDING FOR DOE PROJECT

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
25	How much money is allocated?		
	\$5 million or \$6 million or more	2	
	\$4-5 million	1	
	\$2-3 million	2	
	Don't know	3	
		<u>Number Responding</u>	<u>Percentage of Total</u>
26	What are the sources of funding?		
	Fed/DOE/HUD/Bureau of Reclamation	5	84, 80, 90, 100, 92
	State	2	10, 3
	Local/City	3	15, 5, 10
	Don't know	3	

Respondents were asked a series of questions concerning their attitudes regarding the current DOE project. The results for these questions are presented in Table 13-10. All respondents thought the City administration was very supportive of the geothermal project (Question 28), and they also unanimously agreed that the project should be pursued (Question 29). Their reasons for pursuing the project (Question 30) were mainly because of the cost advantages of geothermal energy over alternative energy sources for heating (mentioned by five of eight respondents), because the project might promote the local economy (mentioned by two of the eight respondents) and because geothermal energy was readily available in the area (mentioned by two of the eight respondents). A number of other reasons were mentioned by a single respondent, including energy conservation, good use of tax money, help for family housing and that geothermal was the wave of the future.

Seven of the eight local government representatives thought the City would be very satisfied with the geothermal project (Question 31). One respondent said the City would only be somewhat satisfied. Their reasons for this belief were quite varied (Question 32). Five respondents mentioned the long-term cost advantages of geothermal power. Three thought it was because geothermal development would promote the local economy and two mentioned tax advantages (reducing local taxes by providing additional income to the City). Two others mentioned the need to conserve energy and become more energy self-sufficient. One person also thought that the City would be pleased by the non-polluting nature of geothermal energy.

Susanville respondents also mentioned several reasons why the City might be less than very satisfied with the geothermal project. Two respondents thought the fact that the hot water pipeline would not be available to everyone would cause problems and one respondent was worried that the water would not be hot enough for desired applications.

TABLE 13-10

ATTITUDES TOWARD THE SUSANVILLE GEOTHERMAL PROJECT

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
28	How supportive is the City Administration?	
	Very supportive	8
	Somewhat supportive	-
	Unsupportive	-
29	Do you personally agree with pursuing this project?	
	Yes	8
	No	-
30	Why do you agree with pursuing this project?	
	Conserve energy	1
	Cost advantages	5
	Promote local economy	2
	Availability	2
	Wave of the future	1
	Good use of tax money	1
	Help family housing	1
31	How satisfied do you think the City will be?	
	Very satisfied	7
	Somewhat satisfied	1
	Dissatisfied	-
32	Why will the city be satisfied/dissatisfied?	
	Promote local economy	3
	Cost advantages	5
	Tax breaks	2
	Ensured supply/become self-sufficient	2
	Non-polluting energy	1
	Water not hot enough	1
	Not available to everybody	2

Decision Factors and Trade-off Among Factors

Five respondents were able to identify factors involved in the decision to be involved in the DOE project (Question 35). These factors and their importance rankings (Question 36) are presented in Table 13-11 for each respondent. The factors are stated in the respondents' own terms.

As shown in Table 13-11, respondents frequently cited similar factors. Employment factors and resource availability were each cited by three respondents. Three respondents also mentioned either energy costs or the need to lessen dependence on other energy sources. Two respondents mentioned funding or the availability of grant funds. Other factors that were each mentioned by one respondent were: reasonableness of the City doing it, economic, needs of the community, feasibility and diversifying the economy.

The factors mentioned by the local government of Susanville were substantially different from those mentioned by the local government of Klamath Falls. The similarity was in the mention of energy costs or savings and availability of grant funds. Klamath Falls local government respondents frequently mentioned factors related to the cost of development while this was not the case with Susanville respondents. This difference may be due to the fact that there is extensive private development of geothermal in Klamath Falls, unlike Susanville; hence, residents of Klamath Falls are more aware of costs.

Table 13-12 describes the trade-offs among factors that Susanville local government respondents cited. The order of respondent presentation corresponds to that of Table 13-11.

TABLE 13-11

LOCAL GOVERNMENT: DECISION FACTORS AND THEIR IMPORTANCE

<u>Order of Mention</u>	<u>Factor Question 36</u>	<u>Importance Question 37</u>
First	Reasonableness of City doing it	Very
Second	Employment factor	Very
Third	Economic	Very
Fourth	Resource availability	Very
First	Needs of community	Very
Second	High cost of energy	Very
Third	Unemployment	Very
First	Availability of resource	Very
Second	Availability of grant funds	Very
Third	Desire to lessen dependence on other energy sources	Very
First	Availability of resource	Very
Second	Funding	Very
Third	Feasibility	Very
First	Creating of jobs	Very
Second	Diversifying the economy	Very
Third	To create cheaper energy sources	Somewhat

TABLE 13-12

TRADE-OFF AMONG DECISION FACTORS

<u>Respondent</u>	<u>Trade-Off Factors</u>	<u>Willing to Trade-Off</u>
1	Employment factor for reasonableness of City doing it	Yes
	Economic factor for reasonableness of City doing it	Yes
	Resource availability for reasonableness of City doing it	Yes
	Economic factor for employment factor	Yes
	Resource availability for employment factor	Yes
	Resource availability for economic factor	Yes
2	High cost of energy for needs of community	Yes
	Unemployment for needs of community	Yes
	Unemployment for high cost of energy	Yes
3	Availability of grant funds for availability of resource	No
	Desire to lessen dependence on other energy sources for availability of resource	No
	Desire to lessen dependence on other energy sources for availability of grant funds	No
4	Funding for availability of resource	Yes
	Feasibility for availability of resource	Yes
	Feasibility for funding	Yes
5	Diversifying the economy for creation of jobs	Yes
	To create cheaper energy sources for creation of jobs	Yes
	To create cheaper energy sources for diversifying the economy	Yes

The first respondent was willing to trade-off all other factors for "reasonableness of City doing it". In addition, this respondent was willing to trade-off economics and resource availability for the employment factors, although it is difficult to "trade-off" resource availability. The respondent discussed the importance of having a higher level of employment. In addition, this respondent would trade-off resource availability for economics, in order "to gain any limited advantages possible".

The second respondent was willing to trade-off the high cost of energy and unemployment for community needs, as well as unemployment for high cost of energy. The reason given was the hope that further development of geothermal energy would lessen dependence on fossil fuels.

The third respondent would not trade-off resource availability for an availability of funds or desire to lessen dependence on other energy sources. Nor would this respondent trade-off availability of grant funds for a desire to lessen dependence on other energy sources. The respondent stated that there was no reason why we cannot become less dependent on other energy sources, and that there was a need for grant funds if Susanville were to have the DOE demonstration project.

The fourth respondent would trade-off funding and feasibility for resource availability, as well as feasibility for funding. He stated that it did depend on how much less the funding was and whether there were alternative sources of funding. This respondent also thought that feasibility of one project did not mean that geothermal use was infeasible.

The last respondent would trade-off diversifying the economy and cheaper energy sources for creation of jobs. The respondent would also trade-off cheaper energy sources for diversifying the economy.

The way in which some of the factors were stated makes many of the trade-offs seem "only reasonable" (e.g., trading-off unemployment for community needs). In addition, without further explanation of some of the factors cited (e.g., economics), it is difficult to more fully interpret the trade-offs.

Summary of Benchmark Measurement for
Local Government Personnel in Susanville

Local government administrators in Susanville were broadly similar to their counterparts in Klamath Falls. Both were enthusiastic advocates of geothermal energy who preferred geothermal above all other energy sources and greatly valued its low cost, non-polluting aspects and local availability.

It is difficult to separate the attitudinal and perceptual differences between the government personnel in the Cities of Susanville and Klamath Falls from the overall differences between geothermal development in the two cities. The local city representatives in Susanville are the custodians of geothermal development in the area. Virtually all the efforts toward increasing use of geothermal energy in Susanville are concentrated within the City government.

Private development has been actively discouraged by restrictions imposed by the City on drilling for hot water. It was not clear from the present interview responses why the City has chosen to so restrict private development. Indeed, some of the most noteworthy aspects of responses from City personnel were the

omissions. There was clearly some antagonism toward the City for its handling of the DOE sponsored geothermal project. This was evident from the refusal of the County representative to cooperate with the interviewer, and it shows clearly in some of the responses from local industry respondents. Yet there is little hint of this kind of discontent in interview responses from City personnel.

The chief difference between local government respondents in Susanville and Klamath Falls was their perception of the role of the DOE-sponsored geothermal projects in the overall program for developing geothermal energy in the area. For Klamath Falls respondents, the DOE project was an attractive opportunity for the City in terms of the availability of government funding. The project promised direct benefits on the City's energy expenditures and dovetailed nicely with the increased interest in geothermal development in Klamath Falls. Klamath Falls respondents did not have the expectations that the project would be the centerpiece of future geothermal development in the area. Other development is taking place apart from the DOE project and the City is increasingly becoming involved with conflicts between users and the proper management of geothermal resources.

By contrast, the dominant theme of local government personnel in Susanville was that the DOE project would lead the way for all future geothermal development. Susanville City officials saw the project, and themselves, as shaping the economic future of the area. They had great expectations that the DOE project would lead the Susanville economy into a more prosperous era. It appears that the local government sponsors in Susanville see the economy of Susanville as much more closely aligned with the DOE demonstration project than do the sponsors in Klamath Falls, although both communities are apparently watching the "success" of their projects.

SECTION XIV

RESULT OF BENCHMARK MEASUREMENT FOR SUSANVILLE INDUSTRY AT THE SITE

All four current users of geothermal energy in Susanville were included in the survey. These included a church, a greenhouse operation, a municipal swimming pool and a florist/boutique. Nine potential users were also surveyed. These included a dance studio, the Sanitation District, a correctional institution, the Fire Department, a bank, a real estate firm, an automobile dealership, an automotive repair shop and a savings and loan association. Most of the potential users were located such that they would have good access to the pipeline planned for downtown as part of the City's DOE Geothermal Project (along Main from Grand to McDow).

Awareness, Interest and Knowledge Regarding Geothermal Energy

Table 14-1 presents the results for Questions 1,2,3,4 and 20 which dealt with the respondent's awareness about geothermal energy. Most respondents listed geothermal energy among the energy sources that came to mind. It is interesting to note the initial source for this awareness. Actual users, like those in Klamath Falls, became aware of geothermal energy because they were associated with its uses in the area. For example, a minister learned about it when he came to his geothermally heated church. A life long resident recalled hearing stories about how hot water was used to keep the mill pond from freezing. By contrast, the awareness of most potential users can be traced to a specific event. Two-thirds of the potential users reported that they first became aware of geothermal energy through the City geothermal development program that was started in 1972.

TABLE 14-1
AWARENESS OF GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
1	Energy sources that come to mind		
	Solar	2	5
	Water	3	7
	Geothermal	3	7
	Petroleum	3	8
	Wind	2	4
	Nuclear	1	3
	Biomass	2	4
	Coal	2	2
2	Aware of geothermal if not mentioned for Question 1	1	2
3, 20	How did you first become aware of geothermal energy?		
	Familiar with its use in the area	4	3
	The City began its development program	-	6
4	Number of years ago first aware		
	35	1	0
	16-34	0	0
	11-15	0	1
	8-10	2	1
	7	1	0
	6	0	3
	5	0	1
	4	0	1
	2-3	0	1
	Average	15.5	7.1

Both current and potential users reported a very high level of personal interest in the further development of geothermal energy. They also reported their firms were very interested, and with two exceptions reported that the City of Susanville was very interested in geothermal development. Table 14-2 presents these results. Table 14-2 also displays the reasons that respondents gave for their interest.

The reasons given by current and potential users in Susanville, differed from those given by Klamath Falls respondents in several respects. Susanville respondents placed relatively greater emphasis on the economic advantages of geothermal energy than those in Klamath Falls. Fifty-two percent of all reasons given by Susanville respondents related directly to cost considerations, while only twenty-nine percent of reasons given by Klamath Falls respondents could be so classified. While Klamath Falls respondents recognized local benefits as a major category of reasons for the development of geothermal resources, along with cost consideration, these kinds of reasons were given much less frequently by Susanville respondents than Klamath Falls respondents. Susanville respondents did not cite many reasons related to local conditions, and they gave fewer reasons for interest in geothermal energy development than did Klamath Falls respondents.

On the whole, current and potential users in Susanville were less knowledgeable about geothermal energy than those in Klamath Falls. Table 14-3 presents the results for Questions 5 and 39 concerning self-reported knowledgeability about geothermal energy and Questions 6, 7 and 11 dealing with respondents' actual knowledge about applications for geothermal energy and the City's role in its development. Although current and potential users reported levels of personal knowledge about geothermal energy (Question 5) comparable to those reported by respondents in

TABLE 14-2
INTEREST IN GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
8	How interested are you?		
	Very (1)	4	9
	Somewhat (2)	-	-
	Not very (3)	-	-
42a	How interested is your firm?		
	Very (1)	4	9
	Somewhat (2)	-	-
	Not very (3)	-	-
10	How interested is the City of Susanville?		
	Very (1)	4	7
	Somewhat (2)	-	1
	Not very (3)	-	1
	Average/respondent	1.0	1.3
9, 42b	Reasons given for interest in geothermal		
	Low cost	4	9
	Local energy source	2	3
	Conservation	2	4
	Make a profit by selling it	1	-
	Clean source of energy	1	1
	Committed a lot of resources already	1	1
	Benefit community	-	1
	Easy access to pipeline	-	1

TABLE 14-3
KNOWLEDGE OF GEOTHERMAL ENERGY

Question Number	Question and Answers	Number Responding	
		Current	Potential
5	How knowledgeable are you?		
	Very (1)	1	1
	Somewhat (2)	3	5
	Not very (3)	-	3
	(Average)	1.8	2.2
6, 7	What are some applications of geothermal (actual and potential)?		
	Space heating	4	8
	Direct process heat	2	2
	Generation of electricity	-	1
	Other (specific instance)	3	2
	(Average)	2.2	1.4
11	What types of thing is the City doing to promote geothermal?		
	Heating district project	3	6
	Engineering studies	2	5
	Apply for grants	2	5
	Industrial park	1	1
	Residential space heating	3	2
	Hired a promoter	1	3
	(Average/respondent)	3.0	2.4
39	How knowledgeable is your firm?		
	Very (1)	-	3
	Somewhat (2)	-	4
	Not very (3)	-	2
	(Average)	-	1.9

Klamath Falls, they did not list as many applications for geothermal energy. Potential users, in particular, seemed to have relatively limited knowledge of the various possible uses for geothermal energy. On the other hand, respondents in Susanville were able to report on a greater number of activities by the City with regard to promoting geothermal energy than were respondents in Klamath Falls. Most likely, this latter finding reflects the much larger role taken by the City of Susanville in geothermal development compared to the City of Klamath Falls.

Preference for Energy Sources

Respondents were asked to rank order their preferences for eight major forms of energy and give reasons for their first and last choice. Table 14-4 presents the rankings that respondents gave to the various energy sources. Essentially, the same belief profile toward energy sources emerged for current and potential users in Susanville as appeared in Klamath Falls. Geothermal and solar energy sources were by far the most preferred. Respondents considered these forms of energy to be cheaper, reasonable and non-polluting, and they saw them as attractive solutions to energy problems. The least preferred energy sources according to Susanville respondents were coal, nuclear, petroleum and biomass. These energy sources were seen as dirty, expensive, scarce and dangerous to varying degrees. Clearly, the tendency was to favor alternatives to some of the predominant forms of energy now being utilized in the nation.

Advantages and Disadvantages of Geothermal Energy

Respondents were asked to indicate what they thought were the major advantages and disadvantages associated with geothermal energy use. Table 14-5 presents the results for these open-ended questions. The pattern of responses for current and potential

TABLE 14-4
PREFERENCES FOR ENERGY SOURCES

Question Number	Question and Answers	Respondent Ranking	
		Current Users	Potential Users
44	Ranking of energy sources		
	Solar	2 4 2 2	3 3 1 2 2 2 4 3 1
	Water	4 2 4 5	5 2 8 4 4 3 1 4 5
	Geothermal	1 1 1 1	1 1 2 1 1 1 2 2 2
	Petroleum	8 3 6 7	7 5 4 6 5 8 7 1 4
	Coal	7 6 7 6	8 8 5 7 6 4 8 7 7
	Wind	6 7 3 3	4 6 3 3 7 5 5 5 6
	Nuclear	5 5 8 8	6 7 7 8 3 7 3 6 3
	Biomass	3 8 5 4	2 4 6 5 8 6 6 8 8

TABLE 14-5

ADVANTAGES AND DISADVANTAGES OF GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
48	Advantages		
	Economical	4	9
	Available	1	5
	Non-polluting	4	3
	Renewable	1	1
	Stimulate economic growth	1	-
49	Disadvantages		
	High initial cost	-	1
	Possible depletion	1	4
	Maintenance	1	1
	Lack of technical information	-	2
	Water not hot enough	1	-

users in Susanville was essentially similar to the responses of Klamath Fall respondents. The economic advantages of geothermal energy were foremost in the minds of Susanville respondents. They also recognized the availability and non-polluting character of geothermal energy sources as major advantages. It was somewhat surprising, however, that the chief disadvantage mentioned by Susanville respondents, was the possible depletion of the resource through overuse. The Susanville experience with geothermal energy has been quite limited compared to Klamath Falls, and there has been little opportunity for residents to observe perceived examples of overuse or interactive effects between wells as there has been in Klamath Falls. Yet, Susanville respondents seemed equally, if not more, conscious of the problems associated with overuse.

Another aspect of this pattern of responses was the slightly different interpretations given to the notion of availability of geothermal energy for Susanville and Klamath Falls respondents. In Susanville, "availability" was used to mean access to the City's hot water pipeline, while in Klamath Falls "availability" meant the existence of underground geothermal reservoirs which could be tapped by drilling a well. This difference is understandable since private drilling is so restricted in Susanville.

Current and Future Energy Use and Needs in Susanville

Respondents answered a number of questions concerning their current patterns of energy use and their plans for the future. Table 14-6 summarizes the characteristics of current energy use patterns for current and potential users of geothermal energy in Susanville and Table 14-7 summarizes the results for questions about the costs associated with the various types of energy currently used by both current and potential users of geothermal energy in Susanville.

TABLE 14-6

PROFILE OF USE BY ENERGY SOURCE FOR CURRENT USERS
OF GEOTHERMAL ENERGY IN SUSANVILLE

	<u>Heating</u>	<u>Cooling</u>	<u>Lighting & equipment</u>	<u>Self- generated electricity</u>	<u>Industrial processes</u>	<u>Transport</u>
Geothermal	4	-	-	-	3	-
Electricity	-	-	2	-	-	-
Petroleum	1	-	-	-	-	-
Solar	-	-	-	-	-	-
Water (hydro- electric)	-	-	2	-	-	-
Wood	-	-	-	-	-	-

PROFILE OF USE BY ENERGY SOURCE FOR POTENTIAL USERS
OF GEOTHERMAL

	<u>Heating</u>	<u>Cooling</u>	<u>Lighting & equipment</u>	<u>Self- generated electricity</u>	<u>Industrial processes</u>	<u>Transport</u>
Electricity	1	-	3	-	-	-
Petroleum	7	-	-	-	-	-
Solar	1	-	-	-	-	-
Water (hydro- electric)	-	-	6	-	-	-
Wood	-	-	-	-	-	-

TABLE 14-7

ENERGY COST BY TYPE OF ENERGY FOR CURRENT USERS

	1	2	3	4	Average Cost
Geothermal	NA	23%	0	9%	11%
Electricity	NA	77%	100%	70%	82%
Petroleum	NA	-	-	21%	21%
Other	NA	-	-		
Total cost	3,000	1,300	3,000	17,000	

ENERGY COSTS BY TYPE OF ENERGY FOR POTENTIAL USERS

	1	2	3	4	5	6	7	8	9	Average Cost
Geothermal	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Electricity	17%	53%	67%	100%	56%	78%	29%	70%	54%	58%
Petroleum	83%	47%	NA	NA	44%	22%	71%	30%	46%	49%
Other	NA	NA	(solar) 33%	NA	NA	NA	NA	NA	NA	33%
Total Cost	720,000	10,000	5,500	4,000	14,000	13,000	256,000	2,000	12,000	

The firms in the Susanville sample were mainly service-oriented government agencies and businesses which probably explains why they reported parochial patterns of energy use. The uses reported by respondents include heating, lighting, running light equipment (typewriter, stoves, xerox machines and air conditioners) and some industrial processes involving relatively low temperatures. Geothermal energy was used primarily for heating and for light industrial processes such as greenhouse heating and heating water for a swimming pool. Power for lighting and equipment, including air conditioning, was provided exclusively by electricity. Most respondents reported their electricity came from a hydro-electric source.

As in Klamath Falls, the actual and intended role for geothermal energy was to replace petroleum products as a source of heating. Current and potential users did not consider geothermal energy to be a possible replacement for electricity. Because costs for electricity were higher in Susanville than in Klamath Falls and accounted for a larger share of respondents' total energy costs (58 percent of total costs for potential users in Susanville compared to 39 percent of total costs for potential users in Klamath Falls), the potential for geothermal development to reduce energy cost was somewhat lower in Susanville than in Klamath Falls. In part, this may be why respondents in Susanville seemed somewhat less enthusiastic about geothermal energy development than respondents in Klamath Falls.

Respondents were also asked to discuss their projected energy needs and their plans for meeting those needs (Questions 17 and 18). There were some notable differences in responses to these questions between the Klamath Falls and Susanville samples.

In Klamath Falls, current users projected modest growth and intended to maintain existing energy use patterns, while potential users projected ambitious plans for expansion which

counted on developing geothermal energy to control the projected increase in energy costs. In contrast to this pattern, current users in Susanville reported plans to expand their operations, replace existing equipment, and generally take advantage of what they saw to be a coming boom in geothermal energy development. One current user mentioned possibly selling his well to the City for use in a planned industrial park. Another reported plans to move into residential heating if an arrangement could be worked out with the City.

Potential users in Susanville have quite modest growth plans. Seven of the nine firms reported there was little prospect for future expansion. Most potential users were mainly interested in reducing their energy costs through conservation. Geothermal energy was appropriate to their plans because it promised reductions in energy costs but their attitudes toward it were essentially passive. If it were easily available, and if it were economical, they would use it, but it was not a major component in their future plans.

Factors Considered in the Use or Non-Use of Geothermal Energy and Trade-Offs Among Factors

Current users were asked to list factors that their company considered when deciding whether or not to use geothermal energy and rate how important each factor was to the decision. Table 14-8 presents the results for these questions (Questions 27, and 28a). Although there were only four current users in the Susanville sample, the decision factors mentioned by respondents appeared very similar to those mentioned by Klamath Falls respondents. The perceived cost advantages of geothermal energy over alternative energy sources and the availability of geothermal resources were the two dominant decision factors.

TABLE 14-8

GEOTHERMAL USE DECISION FACTORS FOR CURRENT USERS

<u>Order of Mention</u>	<u>Factor</u>	<u>Importance</u>
First	Availability	Very
Second	Cost	Very
First	Cost of alternative fuels	Very
Second	Non-polluting	Very
Third	Availability	Very
First	Cost	Very
First	Cost	Somewhat
Second	Availability	Very

Questions 28b and 28c asked respondents to make trade-off judgments between the decision factors that they mentioned. Two respondents were willing to trade off availability for cost, one respondent was willing to trade off cost for availability, while still another respondent was willing to trade off both cost and availability factors for a non-polluting energy source. One should be cautious in interpreting these results since cost and availability are not really independent factors either logically or in the minds of the respondents.

Potential users were asked to respond to an open-ended question about the factors they would take into consideration during the decision making process about developing geothermal energy (Question 37). Table 14-9 presents the results for this question. Cost factors emerged very clearly as most important factors. Potential users in Susanville did not attribute as much importance to availability as did current users in Susanville or in Klamath Falls. This finding probably reflects the fact that potential users in Susanville tended to see the availability of geothermal hot water as a service provided by the City. None of the potential users in Susanville had plans to drill their own wells; instead they expected to be hooked up to the City's pipeline that was nearby. The cost of the service, rather than the availability of underground supplies of hot water appeared to be the crucial factor in their decision process.

Users' Well Characteristics in Susanville

The four current users in Susanville were asked to describe the characteristics of their hot water wells (Questions 24, 25a, 25b and 26). Table 14-10 summarizes these results. Each current user in Susanville reported having only one well. Three of the four users reported having relatively old wells (average 32.7 years). There was one recently drilled hot water well that was

TABLE 14-9

GEOTHERMAL USE DECISION FACTORS FOR POTENTIAL USERS

<u>Question Number</u>	<u>Factors Mentioned</u>	<u>Number Responding</u>
37	Cost (unspecified)	7
	Cost of retrofit	4
	Cost of maintenance	4
	Availability	2
	Water temperature	1
	Non-polluting	1

TABLE 14-10

USERS' WELL CHARACTERISTICS IN SUSANVILLE

<u>Number of Wells Owned</u>	<u>Age of Well(s) in years</u>	<u>Depth of Well(s) in feet</u>	<u>Temperature of Well(s) in degrees Farenheit</u>
1	18	120	129°
1	50	600	150°
1	30	600	102°
1	2	250	145°

only two years old. Here again, the effect of the City's ordinance against drilling can be seen. (The most recently drilled well was reportedly not intended to be a geothermal well.) All the wells mentioned by respondents are relatively shallow (average 390 ft.) and have relatively low temperatures (average 131°) compared with wells in Klamath Falls.

Satisfaction With and General Attitudes Toward Geothermal Energy and District Heating Projects in Susanville

Current users were asked how satisfied their companies had been with geothermal as an energy source (Question 32), how favorable their firm's attitude was toward geothermal energy (Question 43a), and their reasons for these attitudes (Questions 33 and 43b). Table 14-11 summarizes the results for these questions.

As can be seen from the Table, current users were very satisfied with geothermal energy, citing mainly its economic advantages. Both current and potential users reported very favorable attitudes toward geothermal energy. Again, the reasons mentioned consisted mainly of the economic benefits to be designed from geothermal energy use, the fact that it was easily available in Susanville, that it was non-polluting and that it replaced increasingly scarce fossil fuels as a source of energy.

Respondents in Susanville were asked an open-ended question about what they thought about the City's geothermal projects (Question 62). Generally, most respondents were favorable toward the City's activities. Two-thirds of the potential users and half of the current users saw the City's plans for developing geothermal energy as a progressive step for the community, exploiting an available resource to their benefit, promoting growth in the area, and conserving scarce energy supplies.

TABLE 14-11

SATISFACTION AND GENERAL ATTITUDES TOWARD GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
32	How satisfied has your firm been with geothermal?		
	Very (1)	4	NA
	Somewhat (2)	-	NA
	Dissatisfied (3)	-	NA
43a	How would you describe your firm's attitude toward geothermal energy?		
	Very favorable (1)	4	8
	Somewhat favorable (2)	-	1
	Unfavorable (3)	-	-
43b	Reasons for firm's attitude toward geothermal		
	Economical	4	7
	Available	2	3
	Conservation	1	3
	Non-polluting	2	1
	Promote economy	1	-

The main complaint mentioned by respondents was that the projects were behind schedule. Several respondents expressed concern that the federal money would be exhausted before the heating district project could be fully implemented. The remaining respondents were either non-committal or noticeably more negative toward the City's efforts to develop geothermal energy. There was an apparent relationship between a firm's attitudes toward the City geothermal projects and the extent to which that firm might benefit from these projects. Those potential users who were not too enthusiastic about the City's projects were also those firms who had no definite plans to retrofit for the City's pipeline.

In particular, two of the current users, who did not expect to derive much benefit from the City's hot water pipeline, made comments about the City's attempt to stifle private development and the use of outside consultants and contractors for the City's projects. Of the remaining current users, one was a City agency and another expected to sell his well to the City.

Potential Users' Future Plans and Information Seeking

Potential users were asked a number of questions about the status of their plans to use geothermal energy in the future (Questions 34a and 34b), who would be responsible for decisions (Question 35) and where they were seeking information on geothermal energy (Questions 36a and 36b). One finding that emerged from these questions was that one-third of the sample of potential users in Susanville did not currently have plans to use geothermal energy. Only the four government agencies and the two downtown banks were actively planning to take advantage of the City's hot water pipeline. All the small businesses that were included in the sample reported they had no definite plans to use geothermal energy in the future.

Of those firms who had active plans to utilize geothermal energy, all reported that the City and the engineering consultants hired by the City were the prime sources of information they had contacted. For the most part, these respondents reported they were mainly interested in information about retrofitting their heating systems for geothermal use.

All the firms who had definite plans to use geothermal energy indicated it was "very likely" they would successfully complete these plans. However, several respondents mentioned that their timing was contingent on the completion of the City's pipeline project which had experienced a number of delays in the past.

Summary of Susanville Industry at the Site

A number of public and private firms who are current or potential users of geothermal energy were interviewed in Susanville, California. All four current users and nine potential users were surveyed.

The firms making up the Susanville sample are a more limited group than those in Klamath Falls in several respects. The few current users in Susanville were relatively small operations that used geothermal either for space heating or light industrial processes like heating greenhouses or heating water for a municipal swimming pool. For the most part, these operations were taking advantage of long existing hot water wells that happened to be convenient and suitable for their purposes. Only one respondent could be said to have actively exploited geothermal energy.

The potential users in Susanville were, if anything, more passive toward the possibility of developing geothermal energy. In order to qualify as potential users they had to be in proximity to the City's hot water pipeline. While this made them potential recipients of the advantages to be derived from the pipeline, it did not guarantee their active interest. One-third of the potential users in the sample did not intend to add a geothermal capability in the near future. What made this finding even more striking was that the potential users who had plans to go ahead with geothermal development were mainly the local government agencies who were following the City's development plan and they had little discretion in the matter. Of these respondents who could be considered free agents, only two, both downtown banks, were definitely planning on moving toward the use of geothermal energy. Compared to Klamath Falls, where interest in geothermal was widespread across both municipal and commercial users, the interest and enthusiasm for geothermal use in Susanville seemed restricted to the municipal community.

The outstanding feature of the Susanville community with regard to geothermal energy, particularly when compared to Klamath Falls, is that geothermal development is at a relatively early stage. Susanville, unlike Klamath Falls, does not have an established infrastructure of residential and commercial geothermal uses. The DOE demonstration project with the local city government to establish a hot water heating district is essentially the entire geothermal energy development effort in Susanville at the present time. Private development has been discouraged by the very stringent restrictions that have been placed on local drilling for hot water wells. Accordingly, the City's plan dominates most thinking and planning about geothermal development in Susanville.

Respondents in Susanville do not appear quite as knowledgeable or interested in geothermal energy development as those in Klamath Falls, but their attitudes toward geothermal are still essentially favorable. Most Susanville respondents recognize the economic advantages of geothermal energy and consider it superior to other forms of energy because it is inexpensive, pollution-free and renewable. The main difference between Klamath Falls and Susanville respondents is not in their intellectual appreciation of the advantages and disadvantages of geothermal energy, but in their motivation and in their opportunity to exploit the resource. Klamath Falls respondents seemed eager to get involved in geothermal development. They want to promote it and they are going so. Susanville respondents, on the other hand, are prevented from becoming too involved with active efforts to develop geothermal energy because the City is monopolizing these efforts. Susanville respondents see themselves as dependent on the outcome of the City's projects, they are waiting for the heating district to be completed, frustrated by delays, uncertain about the ultimate potential for geothermal energy, hopeful that it will be good for the community, and somewhat resentful of the tight restrictions placed on private development. This problem partially explains why current and potential users in Susanville are somewhat less enthusiastic about geothermal energy development than those in Klamath Falls.

SECTION XV

RESULTS OF BENCHMARK MEASUREMENT FOR SUSANVILLE FINANCIERS

The financiers sample for Susanville, California included three current financiers and two potential financiers. Included in the current financiers were the Department of Energy, a bank and the California Energy Commission. The potential financiers were representatives from a stock brokerage firm and a bank.

The Department of Energy is involved in financing in Klamath Falls, Oregon, as well as Susanville. Further, the potential financiers for Susanville may also be potential financiers for Klamath Falls.

Awareness, Knowledge and Interest Regarding Geothermal Energy

Table 15-1 depicts Susanville financiers' awareness of geothermal energy. All financiers mentioned geothermal energy in the "unaided awareness" question. In general, current financiers were "more aware" of solar energy (with all being aware) than were potential financiers.

As indicated by the results of Question 3, all current financiers were aware of geothermal through their jobs. Potential financiers were "always aware" or aware because of a client doing exploration. Eighty percent of the financiers were aware for seven or fewer years. Length of time aware was shorter for Susanville than for Klamath Falls.

TABLE 15-1

FINANCIERS' AWARENESS OF GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
1	Energy sources that come to mind		
	Solar	3	1
	Water	3	2
	Geothermal	3	2
	Petroleum	3	2
	Wind	2	1
	Nuclear	2	1
	Biomass	2	1
	Coal	2	1
3	How first aware?		
	"Always aware"		1
	Through client doing exploration		1
	Through respondents' job	3	
4	Number of years aware		
	3	1	-
	5	1	-
	6	-	1
	7	1	-
	"many"	-	1

Question 5 asked financiers how knowledgeable they thought they were about geothermal energy. All current financiers said they were "very knowledgeable", as did one potential financier. The other potential financier thought he was "somewhat knowledgeable".

Table 15-2 describes the results of questions concerning the respondents' interest in geothermal energy development in Susanville and their perceptions of Susanville's interest. Financiers were all interested in further development in Susanville and all but one, who "did not know" because of lack of contact with the City. All other financiers thought the City was interested because of their contact with the City or because of the City's geothermal projects. Klamath Falls was also perceived to be "very interested" in geothermal development.

Preference for Energy Sources

Table 15-3 details each respondent's preference ranking for alternative energy sources (Question 13) and the reasons for first, (Question 14a), second (Question 14b), and least preferred source (Question 15) preferences. Geothermal energy was the most preferred source of energy by all financiers. In Klamath Falls nine out of eleven had preferred geothermal energy.

Reasons for preferring geothermal for Susanville were somewhat similar to Klamath Falls. In Susanville, as with Klamath Falls, availability was important. Two financiers mentioned that geothermal would be helpful to the Susanville economy.

It appears that California respondents tended to think of Susanville when they thought of geothermal energy. Possibly, earlier questions about Susanville caused this, but specific mention of Klamath Falls did not occur for the financiers of that sample area. The financiers seemed to be quite aware of the economy of Susanville.

TABLE 15-2
FINANCIERS' INTEREST IN GEOTHERMAL

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
8	Interest in further development and use in Klamath Falls		
	Very	3	1
	Somewhat	-	1
	Uninterested	-	-
9	Why interest?		
	Because of job	2	1
	Good for economies of small towns	2	-
	Personal interest	1	-
	Form of cheaper energy	-	1
10	Interest in City of Susanville		
	Very	3	1
	Somewhat	-	-
	Uninterested	-	-
	Don't know	-	1
11	Why City interested		
	Through contact with City	3	
	Use of geothermal (projects)	-	1
	No contact with them	-	1

TABLE 15-3
FINANCIERS' PREFERENCES FOR ENERGY SOURCES

<u>Question Number</u>	<u>Question and Answers</u>	<u>Respondent Ranking</u>	
		<u>Current</u>	<u>Potential</u>
13	Ranking of energy sources		
	Solar	3 2 3	- -
	Water	5 5 2	2 -
	Geothermal	1 1 1	1 1
	Petroleum	4 6 8	- -
	Coal	8 7 4	3 -
	Wind	6 4 6	- -
	Nuclear	7 8 7	8 -
	Biomass	2 3 5	- -
		<u>Number Responding</u>	
14a	Why most preferred (goethermal)?		
	Available	2	-
	Accessible	1	-
	Economical	1	1
	Environmentally acceptable	1	-
	Help Susanville economy	1	1
14b	Why second most preferred?		
	Clean (water)	-	1
	Renewable (water)	-	1
	Inexpensive (water)	1	-
	Proven technology (water)	1	-
	Environmentally acceptable (water and solar)	2	-
	Help economy of Susanville (biomass)	1	-
14c	Why least preferred?		
	Concern about waste disposal (nuclear)	1	1
	Bad for environment (coal)	1	-
	Foreign source and expensive (petroleum)	1	-

Second most preferred energy sources were water, solar and biomass. Table 15-3 indicates the reasons why these sources were second most preferred.

For respondents answering the question (one did not have a least preferred source indicating nothing could compare to geothermal), nuclear, coal and petroleum were the least preferred sources of energy. Environmental concerns predominated as reasons for dislike (coal and nuclear) and petroleum was least preferred by one current financier because it represented reliance on a non-domestic resource and was increasing in price.

Perceived Advantages and Disadvantages of Geothermal Energy

Table 15-4 presents the perceived advantages and disadvantages of geothermal energy. Current financiers gave more advantages than did potential financiers, in spite of their relatively small number.

Current financiers seemed, again, to consider the economy of Susanville. However, the most frequently mentioned advantage was economy. No potential financier mentioned economy. In fact, one potential financier said that a disadvantage was that the resource was "marginally, if at all, economical".

Most disadvantages centered around lack of technical knowledge for a variety of factors from corrosion to depletion of the resource. Unlike Klamath Falls, no financier mentioned (directly) the high cost of the initial investment. Possibly, this is because of the differences in resource development (nature and extent) between Susanville and Klamath Falls.

TABLE 15-4

FINANCIERS' PERCEIVED ADVANTAGES AND
DISADVANTAGES OF GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
41	Perceived advantages		
	Economical	3	-
	Usable	1	-
	Local to the State	1	-
	Freedom from OPEC	1	-
	Creates jobs	1	-
	Environmentally safe and clean	1	-
	Alternative to other energy sources	1	1
	Can control annual costs (low risk of inflation)	-	1
42	Perceived disadvantages		
	Potential environmental problems	1	
	Land use impact	1	
	Depletion potential	1	1
	Lack of transportability	1	
	Lack of knowledge of corrosive effects	-	1
	Lack of knowledge of depletion	-	1
	Marginally, if at all, economical	-	1
	General lack of technical knowledge	-	1
	Small	-	1
	Brine problem	-	1

Use and Potential Use of Geothermal
Energy in Susanville

Table 15-5 describes the results of questions concerning current and potential use of geothermal energy in Susanville. One current financier said geothermal was not currently in use in Susanville.

Both potential financiers said geothermal was currently used for space heating. Among both current and potential financiers (with one exception) there appears to be some awareness of the uses of geothermal energy in Susanville currently.

When asked about potential uses, generation of electricity was mentioned by two financiers. All of the potential and two-thirds of the current financiers mentioned space heating as a potential use.

Financing Decision Factors and
Trade-Off Among Factors

Question 17 asked financiers what factors would be considered in financing any type of project or development. The response across respondents were similar, but many. And, current and potential financiers did not tend to differ in their requirements.

The list of responses to Question 17 that were not specific to geothermal energy are presented below.

- Return on investment
- Risk
- Fit of investment with over-all strategy
- Amount of loan
- Economic viability

TABLE 15-5

FINANCIERS' USE AND POTENTIAL USE OF
GEOTHERMAL ENERGY IN SUSANVILLE

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
6	Current uses		
	Space heating	1	2
	Direct process heat	1	1
	Generation of electricity	-	-
	Water (City swimming pool)	1	-
	Greenhouse	1	-
	Agricultural use	-	1
	Not currently in use in Susanville	1	-
7	Potential uses		
	Space heating	2	2
	Direct process heat	1	1
	Generation of electricity	1	1
	Greenhouses	1	-

Several respondents referred specifically to geothermal energy in answering the question. These factors were repeated for the following question, so geothermal specific factors are not reported here.

Questions 21 and 22 asked about the factors considered when financing a geothermal project and their importance. Table 15-6 reports these results.

As is evident from the table, the factors are similar to those for any project, but do go beyond. Although stated by the respondents in a variety of terms, for both Susanville and Klamath Falls, the probability of a successful drilling, the borrower's financial position, and return on investment appear to be important decision factors. In simplistic terms, many of the criteria cited were various forms of risk.

Table 15-7 describes the trade-offs each respondent was willing to make among financing decision factors. Tables 15-6 and 15-7 show respondents in identical order. The first respondent described indicated that his trade-offs "depended"; that is, there were trade-offs among these factors, but in essence it depended on the "level" of each factor (e.g., how "good" or "bad" the situation on each factor was).

The second respondent as indicated by the trade-offs, said that return on investment would be "most important". In addition, this respondent would not put environmental risks second to technological risks or over-all strategy, reporting that she did not think the project would be a success in Susanville if the environmental risks were put second. Finally, the general plan (fit with over-all investment strategy) would be more important than the environmental impact.

TABLE 15-6
FINANCING DECISION FACTORS
AND IMPORTANCE

<u>Respondent</u>	<u>Order of Mention</u>	<u>Factor</u>	<u>Importance</u>
Current	First	Technical feasibility	Very
	Second	Economic attractiveness	Very
	Third	Willingness of co-funders	Very
	Fourth	Existence of known resource	Somewhat
	Fifth	Potential use	Somewhat
Current	First	Return on Investment	Very
	Second	Technological risk	Very
	Third	Environment risk	Somewhat
	Fourth	Fit with over-all investment strategy	Very
Current	First	Economic viability	Very
	Second	Resource risk	Very
	Third	Applicants' financial strength	Very
	Fourth	Financial connections	Very
	Fifth	Market for output	Somewhat
	Sixth	Significance of project to area serviced	Somewhat
Potential	First	Outside source of security	Very
	Second	Size of financing	Very
Potential	First	Costs	Very
	Second	Regulatory Commission approval	Very

TABLE 15-7

TRADE-OFFS AMONG FINANCIERS'
DECISION FACTORS

<u>Respondent</u>	<u>Trade-Off Factors</u>	<u>Willingness to Trade-Off</u>
Current	Economic attractiveness for technical feasibility	Yes (depends)
	Willingness of co-funders for technical feasibility	Yes (depends)
	Existence of known resource for technical feasibility	Yes (depends)
	Potential use for technical feasibility	Yes (depends)
	Willingness of co-funders for economic attractiveness	Yes (depends)
	Existence of known resources for economic attractiveness	Yes (depends)
	(This respondent was unable to identify further trade-offs)	
Current	Technological risk for return on investment	Yes
	Environmental risk for return on investment	Yes
	Fit with over-all investment strategy for return on investment	Yes
	Environmental risk for technological risk	No
	Fit with over-all investment strategy for technological risk	No
	Fit with over-all investment strategy for environmental risk	No
Current	Resource risk for economic viability	No
	Applicant's financial strength for economic viability	Yes
	Financial connections for economic viability	Yes
	Market for output for economic viability	No
	Applicant's financial strength for resource risk	Yes
	Financial connections for resource risk	Yes
	Market for output for resource risk	No

TABLE 15-7 (Cont'd)

<u>Respondent</u>	<u>Trade-Off Factors</u>	<u>Willingness to Trade-Off</u>
Current	Financial connections for applicant's financial strength	Yes
	Market for output for financial strength	No
	Market for output for financial connections	No
Potential	Size of financing for outside source of security	No
Potential	Regulatory Commission approval for costs	No

The third current financier would trade-off the applicants' financial strength and connections for economic viability, but would not trade-off market for output or resource risk for economic viability. The market for output appears to be a critical criterion, as this would not be traded-off for resource risk, applicant's financial strength or applicant's financial connections.

All current financiers listed more factors than did potential financiers. The first potential financier would not trade-off size of financing for outside source of security, because he said there were other opportunities to pursue. The second potential financier would not trade-off regulatory approval for costs, because one could not go through with the project without approval.

Other Factors that Influence Geothermal Investment Decisions

Table 15-8 describes the responses to questions regarding other factors that might influence financiers' decisions to invest in geothermal energy development. Unlike the Klamath Falls sample, all Susanville financiers said local government would influence a financing decision (Question 26a). All three current financiers and one potential financier said this was because they only work with local government (Question 26b).

There were somewhat mixed reactions on geothermal energy's current stage of development (Question 29). Generally, these financiers were more positive than was the Klamath Falls sample. The current level of technological development (Question 30) tended to be a barrier to investment among potential financiers, but this was not a concern of current financiers.

TABLE 15-8

OTHER FACTORS INFLUENCING DECISIONS
IN GEOTHERMAL INVESTMENT

Question Number	Question and Answers	Number Responding	
		Current	Potential
26a	Any local government influence?		
	Yes	3	2
	No	-	-
26b	How local government influence?		
	Would not want involvement without local government approval	-	1
	Only work with local government (or involved in any funded project by us)	3	1
29	Geothermal's current stage of development		
	Satisfactory level of technological engineering development	1	-
	Depends on area	1	-
	Engineering is very developed/ resource knowledge is not	1	-
	Dynamic--frequent raw developments	1	-
	Commercially proven but unsatisfactory technology for solving problems such as corrosion	1	-
30	How affect investment willingness?		
	Requires external support	1	-
	Increase willingness--need government help because of current risk	1	-
	Depends on area	1	-
	Discourages it/increases uncertainty about investing	-	2
32a	Insurance availability affect financing?		
	Yes	1	1
	No	2	1
35	How do intangible drilling costs affect financing?		
	Not at all	3	1
	Large extent--need DOE assistance	-	1

One current financier and one potential financier said insurance availability would affect investment (Question 32a). However, when asked "How?" (Question 32b), only one current and one potential financier responded (those saying "Yes" it did increase willingness to invest). Both said insurance would reduce risk or security required.

Intangible drilling costs did not affect any current financier's willingness to finance (Question 35). However, intangible drilling costs would affect one (of two) potential financier's willingness to invest. Klamath Falls' financiers were more varied on the effects of intangible drilling costs. Again, it would not be expected that intangible drilling costs would influence financiers' decisions, as this is a benefit to equity investors for tax purposes.

Perceived Role of Government Regulations

Question 25 asked, "What role would government regulations play in your decision to be involved in a geothermal project?" All current financiers said that government regulations played an important role.

One potential financier said he would need approval from the regulatory agencies. The other potential financier said government regulations complicate their involvement and eliminate their ability to use tax exempt financing for the loan.

Question 40 asked to what extent government regulations at the site influenced willingness to invest. The responses for potential financiers were similar to those for Question 25. One potential financier said, "it discourages it," and the other said it was a factor that would be considered. Two current financiers said regulations were "not applicable" and the other said "minimal". Thus, local regulations appear to have little influence on these financiers' decisions.

Awareness of and Attitudes Toward
Specific Government Regulations and Programs

Table 15-9 displays financiers' awareness of and attitudes toward specific government regulations and programs. All but one financier (current) was aware of the Geothermal Loan Guaranty Program (Question 36a). Two current financiers said it influenced their willingness to finance (these were government financiers) and both potential financiers said it had no influence (Question 36b).

One current financier (government) thought too much data was required (Question 36c), and one thought the data was essential. One current and one potential financier had no opinion and another potential financier thought there was too much red tape, but a good concept.

All financiers were aware of the Investment Tax Credit (Question 37a) and all said it had no influence on them (Question 37b). All three current financiers thought the Tax Credit was useful or helpful (Question 37c). One potential financier thought it was good for industry and one had no opinion.

Both potential financiers were aware of the Depletion Allowance (Question 38a) and two current financiers were. It had little or no influence on investment decisions. (Question 38b) and those with opinions were favorable (Question 38c).

Two current financiers were aware of the Additional Energy Credit and one was not. Both potential financiers were aware of the Additional Energy Credit (Question 39a). The influence on decisions was small or non-existent (Question 39b) and the one respondent (potential financier) with an opinion was in favor of the Energy Credit.

TABLE 15-9

FINANCIERS' AWARENESS OF AND ATTITUDES
TOWARD SPECIFIC GOVERNMENT PROGRAMS
AND REGULATIONS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
36a	Aware of Loan Guaranty Program?		
	Yes	2	2
	No	1	-
36b	Influence of Loan Guaranty Program		
	Preferred credit	1	-
	Key item in some projects	1	-
	No influence	-	2
	No answer	1	-
36c	Opinion of Loan Guaranty Program		
	Essential	1	-
	Too much data required/too expensive to collect/don't know what to do with data	1	-
	Good concept, but too much red tape	-	1
	No opinion	1	1
37a	Aware of Investment Tax Credit?		
	Yes	3	2
	No	-	-
37b	Influence of Tax Credit		
	No effect	3	2
37c	Opinion of Tax Credit		
	Useful/helpful	3	-
	Good for industry	-	1
	No answer	-	1
38a	Awareness of Depletion Allowance?		
	Yes	2	2
	No	1	-
38b	Influence of Depletion Allowance		
	None	1	2
	Little significance	1	-
	Not aware (so no answer)	1	-

TABLE 15-9 (Cont'd)

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
38c	Opinion of Depletion Allowance		
	Useful as tax shelter	2	-
	In favor because it credits equality with oil and gas	-	1
	No opinion	-	1
	Not aware (so no answer)	1	-
39a	Aware of Additional Energy Credit?		
	Yes	1	2
	No	2	-
39b	Influence of Energy Credit		
	Minor and indirect influence	1	-
	No influence	-	2
	Not aware (so no answer)	2	-
39c	Opinion of Energy Credit		
	In favor	-	1
	No opinion	1	1
	Not aware (so no answer)	2	-

Requirements for Financing Geothermal Projects

Question 24b asked how geothermal projects were generally financed. All respondents mentioned through government assistance or grants. Five mentioned DOE specifically and the Geothermal Loan Guaranty Program was described.

Table 15-10 describes responses to questions regarding financier requirements for geothermal energy projects. Question 27 asked about the payback periods for geothermal energy projects. Requirements varied across respondents. One potential financier said less than fifteen years and one current said five to seven years. Other financiers' requirements were not year specific.

With respect to the payback period for other projects (Question 28), three current financiers had no answer. One potential financier said 30 years and another was uncertain, but said, "maybe 3 to 5 years".

The information needed for financing (Question 31) varied somewhat, but generally the requirement was a KGRA for current financiers and some "proof" of resource. One current financier required a geologist's report and development plan. One potential financier wanted to "feel comfortable" and the other had extensive requirements.

Security requirements identified by current financiers (Question 33) were more detailed than those identified by potential financiers. Only two respondents said there were differences in security requirements between geothermal energy ventures and other ventures (Question 34a). One respondent (a current financier) did not identify the difference (Question 34b), but said it was because of increased risk (i.e., thus, higher security requirements for geothermal energy development). The potential financier indicated security requirements would be reduced when resources were proven (i.e., "proven availability").

TABLE 15-10

FINANCIER REQUIREMENTS FOR
FINANCING GEOTHERMAL PROJECTS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
27	Payback period for geothermal projects		
	Less than 15 years	-	1
	5 to 7 years	1	-
	Sufficient to amortize loan	1	-
	Don't know--the shorter the better	1	-
	No answer	-	1
28	Payback period for other ventures		
	30 years	-	1
	Maybe 3 to 5 years	-	1
	No answer	3	1
31	Information needed before financing		
	Geologist's report and resource development plan	1	-
	Proof of quantity and quality of resource, if available	1	-
	Certification of quantity of production available over life of the project	1	-
	Enough to feel comfortable	-	1
	Location of plant, costs of development, regulatory approval ("Size of project would be important as we are a small firm")	-	1

TABLE 15-10 (Cont'd)

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
33	Security requirements		
	Combination of government grant, security interests in assets, assignment of relevant costs, greenlight from sponsor or purchaser of output	1	-
	Some cost participation by developer	1	-
	Nothing less than 100% unless other source of funds/assurances of loan payment	1	-
	Depends on project	-	1
	None required	-	1
34a	Difference in security requirements for geothermal		
	Yes	1	1
	No	1	1
	No answer	1	-
34b	What differences?		
	Uncertainty of resource/risk	1	-
	In other situations would finance on project revenue, but with geothermal would not because resource would be proven	-	1
	Not applicable	2	1

Knowledge and Comparison of Susanville and Klamath Falls

Questions 43a, 43b and 43c asked financiers if they were familiar with geothermal energy management in Susanville and/or Klamath Falls and their opinions of the geothermal energy management at each site. Both potential financiers and one current financier said they were (personally) unfamiliar with geothermal management at both sites.

The two current financiers familiar with both sites were government respondents. Their responses to the comparison question (43c) are paraphrased below.

- Susanville management has been very effective. Support from government regulation agencies and firms has been strong.
- In Klamath Falls there has been much more development so they have a bigger management effort and some problems because people don't want geothermal managed by the City. Susanville has been managed by the City from the beginning and should have a much smoother development.

Thus, the one respondent actually comparing the two sites expected development in Susanville to be smoother because of "tighter City management".

Summary of Susanville Financiers

As would be expected, all financiers were aware of geothermal energy, and overwhelmingly preferred it as an energy source. In contrast to Klamath Falls, Susanville respondents had been aware of geothermal energy for relatively short periods of time.

However, comparisons between the Susanville financier sample and the Klamath Falls financier sample must be made with extreme caution. The Susanville sample ($n = 5$) is less than half the size of the Klamath Falls sample ($n = 11$). Further, the Susanville sample contains a significantly higher percentage (40 percent) of government financiers than did the Klamath Falls sample (less than 10 percent).

Current and potential Susanville financiers, as with Klamath Falls financiers, were strong advocates of geothermal energy and expressed high interest in geothermal development in Susanville. The City was also perceived to be very interested in geothermal development.

Geothermal energy was perceived to be economical, but a major disadvantage was lack of knowledge of various kinds from corrosive effects of the resource to depletion. The majority of respondents saw space heating as the primary use for geothermal in Susanville.

Decision factors varied somewhat among Susanville financiers. Primary concerns were various forms of risk from technology related risks to environmental risks and the risk of loan non-payment. Return on investment was more of a concern in Klamath Falls, probably because of the nature of the sample. Further, Susanville respondents expressed more interest in geothermal energy helping the economy of the area. They thought it would be beneficial.

Local government had an all pervasive effect on the financiers. They reported working primarily through local government. As would be expected, local government influence appears to be somewhat stronger in Susanville than in Klamath Falls.

Financiers were generally in favor of government programs and incentives. Awareness was high for the Loan Guaranty Program, Investment Tax Credit and Depletion Allowance, but somewhat less for the Additional Energy Credit. However, these programs tended to have little or no effect on willingness to finance. Again, the nature of the Susanville sample may be relevant here.

The payback period for geothermal varied from fifteen years to "the shorter the better". Financiers wanted geologist's reports, development plans and other resource certification information prior to financing and cost participation of developer or other security for financing.

In general, Susanville financiers' requirements were much more reflective of government regulations than were Klamath Falls' financiers. Possibly due to the nature of the sample in Susanville (large percentage of government respondents), responses reflected government funding source requirements to a larger extent than in Klamath Falls.

Another difference between Susanville and Klamath Falls financiers is that potential (and current) financiers are more likely to be on-site for Klamath Falls than for Susanville. The size of financing required may be prohibitive for many local branches of banks or other "commercial" lending institutions in Susanville. Susanville is a much smaller community. Thus, in this area focus may be more appropriately directed "off-site".

SECTION XVI

RESULTS OF BENCHMARK MEASUREMENT FOR SUSANVILLE REGULATORS

Nine regulators were included in the Susanville sample. These included representatives from the Environmental Protection Agency, the Solid Waste Management Board, the State Air Resources Board, Department of Water Resources, California Regional Water Quality Control Board, Lassen Air Pollution Control District, Division of Oil and Gas and the Susanville City Planning Commission. Because of differing responsibilities, two regulators from the Environmental Protection Agency were included. DOE/SAN was represented in the financiers sample for Susanville.

Respondents in this sample were not asked the awareness questions. Since they are involved in the regulation of geothermal, it is obvious that they would also be aware of the resource.

Interest and Knowledge Regarding Geothermal Energy

As shown in Table 16-1, eight of the nine regulators said they were "very interested" in the further development of geothermal energy (Question 15). The most frequent reasons given for this strong interest (Question 16) were the inexpensive nature of geothermal, the need to develop alternative forms of energy and the clean/non-polluting qualities of geothermal energy.

TABLE 16-1

REGULATOR INTEREST AND KNOWLEDGE REGARDING GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
15	Interest in further geothermal development	
	Very interested	8
	Somewhat interested	1
	Uninterested	-
16	Why interested?	
	To reduce energy costs/inexpensive	3
	To develop alternative energy sources	3
	Clean/non-polluting	2
	To invite small industry	1
	Good for economy	1
	Domestic resource	1
	Better than nuclear	1
	Reliable source of energy	1
	Need to develop a properly planned local based energy resource in California	1
17	How knowledgeable?	
	Very	2
	Somewhat	6
	Not very	1

Only two regulators considered themselves to be "very" knowledgeable regarding geothermal energy (Question 17). The majority felt they were "somewhat" knowledgeable, with one respondent considering himself to be "not very knowledgeable" about geothermal energy.

The avid interest in geothermal development and the tendency to be "somewhat knowledgeable" regarding geothermal energy is consistent with the results for Klamath Falls' regulators. Susanville regulators, however, gave more "economic based" reasons for their interest than did Klamath Falls' regulators.

Perceived Advantages and Disadvantages of Geothermal Energy

Table 16-2 delineates respondents' perceived advantages and disadvantages of geothermal energy. The inexpensive and clean nature of geothermal energy and the fact that it is a domestic resource were the most frequently mentioned advantages. The potential for co-generation mentioned by Susanville regulators was not mentioned by Klamath Falls regulators. The low cost of geothermal energy was the most frequently cited advantage for Klamath Falls regulators.

Except for pollution problems, the disadvantages listed by Susanville regulators contrasted with those given by Klamath Falls regulators. Seven of the disadvantages given by five Susanville regulators mentioned some type of pollution problem as a disadvantage (odor, hydrogen sulfide, saline, air quality, contaminants). Three of the Klamath Falls' respondents mentioned pollution. Four Susanville respondents said there were no disadvantages and the non-pollution oriented disadvantages mentioned were surface

TABLE 16-2
REGULATOR PERCEIVED ADVANTAGES AND DISADVANTAGES

<u>Question Number</u>	<u>Questions and Answers</u>	<u>Number Responding</u>
8	Perceived advantages	
	Inexpensive	4
	Clean	4
	Domestic	3
	Disperse sources of energy production	2
	Reduce dependence on oil	2
	Potential for co-generation	2
	Renewable	2
	Uses already developed small scale energy technology	1
	Reliable	1
	Abundant	1
9	Perceived disadvantages	
	Odor	2
	Emissions of hydrogen sulfide (H ₂ S)	2
	Saline content in some areas	1
	Steamers have air quality problems	1
	Non-transportable	1
	Surface area disruption	1
	"Generation" of substantial amounts of contaminants (e.g., brine and heavy metals)	1
	None/none that cannot be overcome with today's technology	4

area disruption and the non-transportable nature of geothermal energy. More so than Klamath Falls regulators, Susanville regulators appear to see no disadvantages or see some form of pollution as a disadvantage. Only one Klamath Falls regulator said there were no disadvantages.

Regulatory Role of Agency

Table 16-3 describes the regulatory role of the agencies included in the sample. As indicated by the responses to Question 1, three regulators said they had a "passive" or indirect role in the regulatory environment. Two of the agencies were involved in permitting and the remainder described their role as regulating with respect to their particular area (e.g., air quality, water, air pollution).

Most regulators (n = 5) indicated that they had not yet exercised a regulatory role in Susanville (Question 2). The four respondents who had direct regulatory involvement in Susanville did, of course, describe their involvement in terms of their regulatory domain. One person said he had been involved in regulation of test well drilling.

Similar to Klamath Falls' results, seven of the nine respondents indicated that the government of Susanville did not have an impact on regulation and one person did not know (Question 11a). The respondent who indicated that local government did have an impact on regulation said his Board was sensitive to counties on that side of the Sierra Mountains and their impact was through "influence" due to this sensitivity.

TABLE 16-3
REGULATORY ROLE OF AGENCY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
1	Description of regulatory role	
	Air quality (PSD)	1
	Direct permit authority with drilling muds and emission clean-up	1
	Beneficial use of surface and ground water	1
	Lead agency for all geothermal exploratory projects	1
	Assist local air pollution control districts	1
	Grant use permits	1
	Passive/no direct regulatory role/strictly enforcement of regulations	3
2	Exercised regularatory role in Susanville?	
	Yes	4
	No	5
3	Involvement in Susanville	
	Test wells drilled	1
	Issuing drilling permits and monitoring drilling	1
	Renewing waste discharge in accordance with requirements	1
	Questions regarding the applicability of the PSD for a wood-geothermal plant	1
11a	Impact of Susanville Government on regulation	
	Yes	1
	No	7
	Don't know	1
11b	What impact?	
	They have an influence on what we do as we are sensitive to the counties on that side of the Sierra Mountains	1

Factors Influencing Regulatory
Decisions

When asked what factors are taken into consideration before a regulatory decision is made, one respondent did not answer the question. Table 16-4 lists the factors, their importance and compensating factors for the other eight regulators (Questions 12, 13 and 14, respectively).

Similar to Klamath Falls, there was considerable variety in the factors influencing the regulation decision process. As would be expected, a commonality across several regulators in both Susanville and Klamath Falls was the citation of "laws" or "regulations" as a major factor influencing regulatory decisions.

Two respondents mentioned only regulations as the factor(s) influencing regulatory decisions. Both said they were very important and there were no compensating factors.

One respondent mentioned the location of the well site as the only factor influencing regulatory decisions. This was "very important" and the only compensating factor was well relocation.

Another respondent cited the environmental impact and drilling program proposal as both "very important" factors. Again, the only compensation was to modify the project to meet California regulations.

One respondent mentioned three factors: proposal for waste disposal, geology and ground water and detail of actual plan and facilities. The first and third were rated as "very important", whereas information on geology and ground water

TABLE 16-4
FACTORS INFLUENCING REGULATORY DECISIONS

<u>Order of Mention</u>	<u>Factor</u>	<u>Importance</u>	<u>Compensation</u>
First	Location of well site	Very	Relocation of well site
First	All local rules and regulations	Very	None -- no permit
First Second	Environmental impact Drilling program proposal	Very Very	Project modification Change drilling program to meet California regulations
First Second	State law Federal law	Very Very	None None
First	Proposal for water disposal	Very	Vaporization and or cooling tower
Second	Geology and ground water	Somewhat	Just wanted for information because of interest in character of ground water
Third	Details of actual plan and facilities	Very	Looking for proper design and manpower in case of emergency--trying to avoid problems before they arise
First	Need for facility	Somewhat	Development of centralized disposal facility
Second	Compliance with policy	Very	Abandonment of policy of county plan/expanded and better justification of project
Third	Environmental impact	Somewhat	Overriding economic or social reasons
Fourth	Compliance with Board Regulation	Very	Re-design facility

TABLE 16-4 (cont.)

<u>Order of Mention</u>	<u>Factor</u>	<u>Importance</u>	<u>Compensation</u>
First	Air quality impact	Very	Emission offset
Second	Known and developing control technology	Very	None
Third	Input from applicant and public	Very	More attempts to solicit input from applicant and public
Fourth	Input from other regulatory agencies	Very	None
First	Type of operation/process	Somewhat	Change process
Second	Receiving water	Very	Only revision of regulation
Third	State and local regulations and policy	Very	Only revision
Fourth	Federal regulations and policy	Very	Only revision
Fifth	Best professional judgment	Very	Industry could provide additional information to demonstrate that judgment was correct

was wanted primarily for information purposes. If waste disposal were not appropriate, steps would have to be taken to provide for adequate waste disposal. The details of the actual plan and facilities were considered to avoid problems before they arose.

The first respondent who mentioned four factors rated the two factors dealing with policy or regulation compliance as "very important". Non-compliance with Board regulations would require re-design of the facility, whereas a compensation for deviation from County Policy would be an expanded or better justification of the project. The need for the facility and environmental impact were "somewhat important" factors.

The other respondent mentioning four factors said all four were "very important". They included: air quality impact, known and developing control technology, input from applicant and public and input from other regulatory agencies. There were no compensating factors to regulatory agency input and control technology. The air quality impact could be compensated for by emission offset and more attempts to solicit information from the public were advocated.

One respondent cited five factors two of which were regulations that were said to be "very important" and the compensating factor given was a revision of regulations. The nature and character of receiving water and professional judgment were "very important" factors that could be compensated by regulation revision or further information, respectively. Input from other regulatory agencies was "somewhat important" and there was no compensating factor.

Constraints and Limitation on Regulatory Activities

Table 16-5 reports responses to questions concerning constraints and limitations on regulatory activities. As was true with Klamath Falls' regulators, very few regulators reported constraints on their regulatory activities in Susanville.

Of the two respondents reporting legislative constraints one cited the Porter-Cologne Act and another cited the wording of the Clean Air Act. The same two respondents reported organizational constraints. One cited the Basin Plan and the other cited the re-delegation of PSD decision-making authority.

Two regulators said there were other limitations to their regulatory activities in Susanville. One mentioned the fact that Federal land limits their regulatory authority and the other cited the City, County and Resource Conservation Service.

Perceptions of Future Trends, Collaborative Efforts and Susanville Geothermal Energy Management

Table 16-6 displays the results of questions concerning perceptions of future trends, collaborative agency efforts and geothermal energy management in Susanville. Susanville regulators gave diverse responses for the future trends in regulation (Question 10). Two respondents saw an increase in regulations and two saw a streamlining, shortening and simplification of regulations. One saw a relaxation of environmental regulations and another saw the small facilities being exempted from the permitting process. Thus, four respondents foresaw some type of simplification or relaxation of regulations.

TABLE 16-5
CONSTRAINTS AND LIMITATIONS ON REGULATORY ACTIVITIES

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
5a	Any legislative constraints?	
	Yes	2
	No	6
	Don't know	1
5b	What legislative constraints?	
	Porter-Cologne Act	1
	Wording of Clean Air Act	1
6a	Any organizational constraints?	
	Yes	2
	No	7
6b	What organizational constraints?	
	The Basin Plan (Water Quality Control Plan Report for the North Lahonton Basin-- adopted July, 1975)	1
	Delegation of PSD decision-making authority to the regional administration and the enforcement division director	1
7a	Other limitations in Susanville?	
	Yes	2
	No	7
7b	What limitations?	
	The fact that there is Federal land limits what we can do	1
	City, County and Resource Conservation Service	1

TABLE 16-6

REGULATORS' PERCEPTIONS OF FUTURE TRENDS,
COLLABORATIVE EFFORTS AND SUSANVILLE
GEOTHERMAL ENERGY MANAGEMENT

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
10	Future trends in regulation	
	Increase in regulation	2
	More incentives for use (e.g., tax incentives)	1
	Streamlining, shortening and simplifying regulations	2
	Relaxation of environmental regulations	1
	Exemption of permits (waste) for small facilities	1
	Better coordination of permit (waste) system between State and local agencies	1
	Consolidation of redundant review procedures by various agencies	1
	None	1
18	Cooperative efforts with other agencies	
	Exchange of information	1
	Assistance to local air pollution districts, the California Energy Commission and sometimes the applicant	1
	Board has memo of understanding with State Water Resources Control Board and the Department of Health Services Hazard Materials Management Section for expediting of permitting	1
	Work with agencies involved with fish and wildlife to ensure that receiving waters are adequately protected	1
	Hold public hearings and work as consultant to permitting agencies	1
	Work with other agencies through State Clearing House for water quality	1
	Work closely with County Planning Department, Department of Water Resources, State Air Resource Board and State Office of Planning and Research	1
	No response	2

TABLE 16-6 (cont.)

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>
19	Knowledge of Management of geothermal use in Susanville	
	They have a geothermal planning agency	1
	They are in early exploration stage	1
	The City is promoting and managing it in the respect of issuing permits, but there isn't enough use of manage it	1
	The city is attempting to control geothermal which is wrong. It should be left to private industry	1
	No knowledge	5
20	Opinion of Susanville geothermal management	
	Skeptical of City and County management--it might work better with a Board of Directors	1
	There isn't enough use of it yet to manage	1
	No response	7

Two other respondents mentioned some type of inter-agency coordination, as one mentioned coordination of permitting and another mentioned consolidation of review procedures. One regulator foresaw more incentives for geothermal use (to encourage development of alternative energy sources) and one foresaw no future trends. In general, Susanville regulators saw more relaxation of regulations and Klamath Falls' regulators predicted a higher quantity of increased regulation.

The responses to Question 18 were diverse and, of course, agency specific. Two regulators had no answer for this question. The remaining seven, like Klamath Falls' regulators, said they worked with other agencies and most cited specific agencies.

The majority of Susanville regulators were not familiar with the management of geothermal energy use in Susanville (Question 19). The four who were said either Susanville had a geothermal planning agency, Susanville was in the exploratory stages of geothermal development, or mentioned the City management/control of geothermal energy development.

Two regulators gave an opinion of Susanville geothermal management. One said there was nothing to manage, yet, and the other was skeptical of City and County management. It is interesting to note that he described management as being by both the City and County.

Six of the nine regulators gave comments beyond the survey instrument. These are paraphrased as follows:

- I would be interested in knowing how this survey contributed to any decisions or policies. What is the purpose and benefit?
- We are dealing with electrical generation via geothermal energy.
- The Board is very willing to cooperate in the development of geothermal energy.
- I wish I could have been more help. The geothermal world is growing and we all need more knowledge of it.
- I am glad to see Susanville develop this resource. I wish some of the questions were more specific.
- Stay in existence -- we need your help. As a country, we need to use our geothermal resource and get away from relying on other countries.

Summary of Susanville Regulators

As was the case in Klamath Falls, Susanville regulators may be characterized as avid supporters of geothermal energy. Their interest is largely due to the cost advantages, the need to develop alternative energy sources, and the clean non-polluting nature of geothermal energy. In general, Susanville regulators considered themselves to be "somewhat knowledgeable" regarding geothermal energy.

The most frequently mentioned advantages of geothermal energy were that it is inexpensive, clean and a domestic resource. Disadvantages tended to focus around some form of pollution -- odor, emissions of H₂S, air quality or contaminants.

Regulatory roles varied across respondents with controlling air or water quality and permitting being the most frequently mentioned roles. The majority of respondents had not exercised their regulatory role in Susanville. Only one regulatory said local government had an impact on regulation and that was because his board was sensitive to counties on that side of the Sierra Nevada Mountains.

Factors cited that influenced regulatory decisions also varied by regulator. However, many mentioned regulations or policy as a factor and regulatory decision factors obviously revolved around the jurisdiction of the specific agency (e.g., environmental impact).

The vast majority of regulators said there were no legislative or organizational constraints. In addition, there were no other limitations to regulation in Susanville cited by all but two regulators. The two regulators indicating there were constraints or limitations mentioned the Porter-Cologne Act or the wording of the Clean Air Act as legislative constraints, the Basin Plan or PSD decision-making authority delegation for organizational constraints and for limitation in Susanville identified the City, County and Resource Conservation Service or the existence of Federal lands as limitations.

Most regulators saw some type of relaxation in the regulatory process as a future trend, although two saw an increase in regulation. All but two regulators indicated that they cooperated with other agencies in the regulatory process.

Seven regulators had no stated knowledge of the management of geothermal in Susanville. The two who had an opinion were either skeptical of City/County control or said there was nothing to manage, yet.

Thus, regulators were supporters of geothermal development. Their regulatory process is subject to the policies and regulations for specific agencies.

SECTION XVII

RESULTS OF BENCHMARK MEASUREMENT FOR SUSANVILLE PROMOTERS AND DEVELOPERS

Four potential promoters and developers were included in the sample. These included a college, a real estate firm, an engineering firm and a private individual potentially involved in geothermal development.

Seven current promoters and developers were surveyed. The firms included were: an engineering firm, a drilling firm, three real estate development firms, a Chamber of Commerce representative and an individual from a local government agency primarily involved in promotion and development.

Awareness, Knowledge and Interest Regarding Geothermal Energy

Awareness of geothermal as an energy source was evident among promoters and developers. As displayed in Table 17-1, all but two respondents recalled geothermal energy on an unaided basis (Question 1), and all respondents were familiar with geothermal energy when prompted with an aided question (Question 2).

In describing how they first became aware of geothermal energy (Question 3), Susanville respondents offered a broad range of sources. Unlike Klamath Falls respondents, who had typically learned of geothermal by living in the area, Susanville promoters and developers learned through a variety of highly individualized experiences. Four respondents learned of geothermal energy through their jobs, two had read about geothermal in the

TABLE 17-1
AWARENESS OF GEOTHERMAL ENERGY

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
1	Energy sources that come to mind		
	Solar	4	1
	Water	7	2
	Geothermal	5	4
	Petroleum	5	4
	Wind	4	3
	Nuclear	3	1
	Biomass	2	3
	Coal	5	3
	Other	2	2
2	Aware of geothermal if not mentioned for Question 1		
	Yes	2	-
	No	-	-
3	How first aware?		
	Through work	3	1
	Newspapers	2	-
	At school	-	1
	Using a private swimming pool	1	-
	Volcanoes near Yellowstone	-	1
	All my life from Klamath falls	1	-
	Through local geothermal offic publication	-	1
4	Number of years ago first aware		
	More than 20	1	1
	16 - 20	1	-
	11 - 15	1	1
	6 - 10	3	1
	5 or less	1	1

Average = 11.1 years ago

newspapers and one had first learned of it in school. Others had first become aware of geothermal energy by using a private swimming pool, by visiting volcanoes, through a local geothermal office publication, or from Klamath Falls. On the average, respondents had known of geothermal energy for eleven years (Question 4).

As described in the summary table below, most promoters and developers (7) considered themselves "somewhat" knowledgeable about geothermal energy. Three felt they were "very" knowledgeable while only one respondent claimed to be "not very" knowledgeable about the energy source.

<u>How knowledgeable</u>	<u>Number Responding</u>	
	<u>Current</u>	<u>Potential</u>
Very	1	2
Somewhat	6	1
Not Very	-	1

Not surprisingly, promoters and developers articulated a high level of interest in further geothermal energy use and development. As shown in Table 17-2, ten of the eleven respondents claimed to be "very" interested in the use of geothermal energy in Susanville (Question 8). The reasons cited for this high degree of interest generally reflected business and economic concerns (Question 9). Four respondents, for example, claimed geothermal use would help their individual businesses. Three mentioned overall economic benefits, such as increased employment, while two spoke of the reduced costs of geothermal energy relative to other energy sources. In addition, energy diversification, use of a valuable resource and geothermal energy's environmental soundness were cited as reasons for interest.

TABLE 17-2

INTEREST IN GEOTHERMAL ENERGY

Question Number	Question and Answers	Number Responding	
		Current	Potential
8	Interest in further development and use in Susanville		
	Very	6	4
	Somewhat	1	-
	Uninterested	-	-
9	Why ... (interested)?		
	Business interest/will give us more business	3	1
	Economic benefit/provide jobs	3	-
	Alternative source of power/energy diversification	1	1
	Lower cost	-	2
	Use of valuable asset	2	-
	Through committees and local government service	2	-
	Environmentally sound	1	-
	Improve overall quality of life	1	-
10	Interest of the City of Susanville		
	Very	6	4
	Somewhat	1	-
	Uninterested	-	-
11	What Susanville doing to promote development?		
	Heating plans for public buildings - hospitals, schools, prison, low-cost housing	4	3
	Planning industrial park/Park of Commerce for businessmen	3	-
	Attracting industry/seeking private funds/joint venture with private industry	3	-
	Have full-time geothermal investigator	-	2
	Disseminate info/encourage interest	1	1
	Research and grant applications/DOE funds	2	-
	Heat Roosevelt Pool	1	-
	Seeking WPRS involvement	1	-
	Drilling wells	1	-
	Exploring farm uses	1	-

Beyond their personal interest, most respondents also perceived the City of Susanville itself as "very" interested in further geothermal energy use and development (Question 10). When asked what the City was doing to promote geothermal development, respondents displayed knowledge of Susanville's activities (Question 11). The majority, for example, mentioned Susanville's plans to heat public buildings. In addition, three respondents mentioned plans for a Park of Commerce and three mentioned Susanville's collaborative efforts with private industry. Other frequently mentioned activities included Susanville's employment of a full-time geothermal investigator, the dissemination of information, and research and grant applications, including DOE funds. One respondent each mentioned the heating of the Roosevelt Pool, the pursuit of WPRS involvement, well-drilling and the exploration of agricultural uses.

Preference for Energy Sources

Table 17-3 displays preference patterns for various energy sources. Like their counterparts in Klamath Falls, the Susanville promoters and developers selected geothermal energy as their preferred energy source. All eleven respondents chose geothermal energy as either their first or second preferred choice (Question 12). Solar, water and wind also emerged as popular energy sources, while nuclear was viewed as the most undesirable energy source. There were no notable differences between current and potential promoters in their overall preference patterns.

When asked why they preferred geothermal energy (Questions 13 and 14), most respondents mentioned its availability, cleanliness or economical aspects. In addition, one respondent pointed out that geothermal energy was a commodity frequently under study and another volunteered that funds were available for development while still others spoke of accessibility and environmental features.

TABLE 17-3
PREFERENCE FOR ENERGY SOURCES

<u>Question Number</u>	<u>Question and Answers</u>	<u>Individual Respondent Ranking</u>	
		<u>Current</u>	<u>Potential</u>
12	<u>Energy sources</u>		
	Solar	3 - 2 2 3 2	2 3 6 1
	Water	4 1 4 4 8 3	5 5 4 6
	Geothermal	2 2 1 1 1 1	1 1 2 2
	Petroleum	7 8 6 7 6 6	6 4 1 4
	Coal	8 - 7 6 5 7	7 7 5 7
	Wind	1 - 3 5 4 4	4 6 7 5
	Nuclear	6 - 8 8 7 8	8 8 8 8
	Biomass	5 - 5 3 2 5	3 2 3 3
		<u>Number Responding</u>	
13 & 14	Reasons for preferring geothermal		
	Availability/convenience	4	3
	Cleanliness	3	1
	Economical	1	2
	Large quantities	-	2
	Steady commodity	1	-
	Accessibility	1	-
	Funds available for development	1	-
	Meets environmental criteria	1	-
	National resource that should be used	1	-

TABLE 17-3 (cont.)

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
15	Why least prefer <u>Nuclear</u>		
	Unsafe/dangerous	2	1
	Insufficient control and technology	-	2
	Moral issue	-	1
	Expense of plant set-up	1	
	Negative publicity	1	
	Disposal problem	-	1
	No practical location for technology	-	1
	<u>Water</u>		
	Unavailability	1	-
	Need for it exists for farm purposes in arid & semi-arid lands	1	-
	<u>Coal</u>		
	Dirty	1	-
	Limited resource	1	-
	High transportation costs	1	-
	<u>Petroleum</u>		
	High costs	1	-
27	Overall opinion of geothermal as an energy source		
	Very good/excellent/ very desirable	2	2
	Potentially good/fairly good/ reasonably good alternative source	3	1
	Debatable practicality; must be proven	1	-
	Restricted to areas where found	1	1

Respondents offered a wide array of reasons for why they least preferred certain energy sources (Question 15). Nuclear was the least popular source overall, with seven of the eleven respondents claiming it as their least preferred source. This unpopular status was attributed to nuclear's perceived dangers, insufficient technology, negative publicity, initial plant set-up expenses and waste disposal problems. One respondent had ranked water as his least preferred source, citing its unavailability and lack of appropriateness to Susanville. The one opponent of petroleum cited high costs, while the opponent of coal mentioned that it was a dirty, limited resource with high transportation costs.

Favorable attitudes toward geothermal were further reflected in overall opinions about the source (Question 27). Most responses ranged from "fairly good" to "excellent." Only three respondents volunteered negative comments: Two respondents felt that geothermal sources were too frequently located in remote areas; and one felt geothermal's practicality was dubious and needed further exploration.

Perceived Advantages and Disadvantages of Geothermal Energy

Susanville promoters and developers appeared to present a balanced picture of the relevant advantages and disadvantages of geothermal. Unlike their Klamath Falls counterparts who perceived many more advantages than disadvantages, the Susanville respondents reported geothermal advantages and disadvantages in equal numbers. Table 17-4 summarizes these responses.

The low cost of geothermal emerged as a key advantage, with eight of the eleven respondents citing it. In addition, five respondents mentioned the "cleanliness" of the resource and four spoke of its renewability. Other advantages included geothermal's energy availability, its environmental manageability, its aid to economic development and its cost-effectiveness after initial drilling costs.

TABLE 17-4

PERCEIVED ADVANTAGES AND
DISADVANTAGES OF GEOTHERMAL ENERGY USE

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
28	Perceived advantages of geothermal use:		
	Reasonably low costs/ economical/cheap	4	4
	Clean	5	-
	Renewable/not depletable	2	2
	Availability	2	-
	After initial drilling costs, it's cost-effective	2	-
	Environmentally manageable	1	1
	Aids economic development	1	-
29	Perceived disadvantages of geothermal use:		
	Dirty water or steam/high chemical content/hydrogen, sulfide and other problem chemicals in water	3	1
	Frequent remote locations/not dispersed in large enough areas	2	1
	Costs/expensive and difficult to tap source/expensive when in remote areas	1	2
	State and local government restricting use/individual losing control	2	-
	Not proven/speculative	1	1
	Source could run out	1	-
	Possible mineral crustation of pipes	1	-
	Air quality - rotten egg smell not in high (300°+) temperature area	1	-
	Large investors hold source as reserves rather than turning over to sincere developers	-	1
	None, yet	1	-
		-	1

In general, the pattern of advantages, in number and type, closely mirrored that of the Klamath Falls promoters and developers. However, in terms of disadvantages, the Susanville and Klamath Falls respondents diverged sharply.

Susanville respondents raised issue with several potential problem areas that were never mentioned as disadvantages by Klamath Falls respondents. Pollution was the main concern. For example, four Susanville respondents mentioned water contaminants, like hydrogen, sulfide and other chemicals. Another respondent spoke of air quality damage, while still another spoke of mineral crustation in the pipes. Besides pollution, complaints of remote source locations, encroaching government control and the speculative nature of geothermal development were prominent disadvantages mentioned by the Susanville respondents.

Use and Potential Use of Geothermal Energy in Susanville

Table 17-5 displays responses concerning the present and future uses of geothermal energy in Susanville. Knowledge of different uses did not vary appreciably by current and potential promoters. Except in a few rare instances, the uses of geothermal in Susanville were quite similar to those reported and projected for Klamath Falls.

Predominant among current Susanville uses (Question 6) was space heating, which was mentioned by eight of the eleven promoters and developers. The heating of greenhouses and swimming pools, as well as direct process heat applications were also cited frequently. One respondent mentioned the demonstration well and another spoke of hydroponic uses. Somewhat paradoxically, two current promoters claimed they were unsure whether geothermal energy was being used in Susanville.

TABLE 17-5

CURRENT AND POTENTIAL USE OF GEOTHERMAL ENERGY
IN SUSANVILLE

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
6	Current uses		
	Space heating	4	4
	Direct process heat	-	2
	Generation of electricity	-	-
	Heat and develop greenhouses	3	1
	Heat swimming pool	2	1
	Not sure used in Susanville	2	-
	Hydroponic	1	-
	Demonstration well	1	-
7	Potential uses		
	Space heating	4	3
	Direct process heat	2	2
	Generation of electricity	2	1
	Water heating/hot water for personal use	2	-
	Agriculture	1	1
	Hot house/vegetables and flowers	2	-
	Agri-business	1	-
	Dehydration	1	-
	Hydroponic	1	-
	Obtain industrial land and usage	-	1
	Attract industry to community	1	-
	Park of Commerce	1	-
	No limit	-	1

In describing potential uses of geothermal energy, Susanville respondents painted an optimistic picture with a broad array of projected applications. Over one-half of the respondents mentioned space heating and one-third mentioned direct process heat. Three felt that geothermal energy could ultimately be used to generate electricity. In addition to these generic applications, respondents also cited specific applications like hot water heating, dehydration, hot houses, agri-business uses, agricultural uses, a Park of Commerce and the use of geothermal to attract industry to the community. One respondent optimistically proclaimed that there was absolutely "no limit" to the potential of geothermal energy in Susanville.

Geothermal Involvement and Anticipated Benefits and Profit Margins

Respondents were asked to describe the nature of their involvement with geothermal, both in general (Question 17a), and in Susanville (Question 18b). Responses to both questions were similar. The two most common activities were well drilling (n = 3) and preliminary design and feasibility studies (n = 4). Other activities included grant proposal writing, engineering for Susanville's system, issuing of permits, training, supplying personnel for projects, information dissemination, building a greenhouse and working in the Park of Commerce.

Table 17-6 displays responses on the perceived benefits of geothermal involvement. Over half the respondents suggested that they derived personal satisfaction from providing an alternative energy source that would benefit the community (Question 18b). Other perceived benefits focused on economic and business-related factors. Two respondents, for example, claimed geothermal involvement would bring them more contracts and work. Two other respondents simply said that "money" was the "gain" they expected from geothermal involvement. Another respondent spoke of tax

TABLE 17-6

ANTICIPATED BENEFITS AND PROFIT MARGIN
FROM GEOTHERMAL ENERGY

Question Number	Question and Answers	Number Responding	
		Current	Potential
18b	Benefits from geothermal involvement		
	Satisfaction of providing resource to best benefit community/personal gratification/finding alternative energy source	4	2
	Economic benefits/provide jobs	1	2
	Lower energy costs/cheaper rates	1	1
	More contracts/more work	2	-
	Money	1	1
	Educate selves & others/knowledge	-	2
	Application to other fields/might develop new drilling technique	1	1
	Tax benefits	-	1
	Agricultural benefits	-	1
	Improved quality of life	1	-
	No personal gain	1	-
19	Expected profit margin or return on investment from geothermal project?		
	10%	1	-
	12.5%	-	1
	15%	1	-
	20%	1	-
	2.1 margin	-	1
	Return on investment due to risk of venture capital	-	1
	Reinvest 500-600K per year	1	-
	Profits result from engineering	-	1
	N/A	3	-

TABLE 17-6 (cont.)

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
20a	Expected profit margin or return on investment from other projects		
	Same/similar	3	3
	In land deals, 30-40%	-	1
	Degree of return is based on risk: lower risk - lower return		
	higher risk - higher return	1	-
20b	How similar or different?		
	Same/have same approach to all contracts	2	3
	Same/return needed to appreciate our drill rigs	1	-
	Different - have higher risk due to % drilling success; need higher return	-	1
	Different - geothermal has tax benefits	-	1

benefits. Two respondents expected that geothermal involvement might advance technology by offering applications for other fields or allowing the discovery of a new drilling technique. Other benefits included lower energy costs, agricultural applications, an increase in knowledge, overall economic benefits and an improved quality of life.

Susanville promoters and developers did not expect excessive profit margins from geothermal involvement (Question 19). Of the eight respondents for whom the question was applicable, four anticipated an overall profit in the usual range of 10 to 20 percent. Another expected a 2 to 1 margin, another hoped to reinvest \$500,000 to \$600,000 a year, while another expected a return on the investment based on the risk of capital venture.

Compared to other projects, most respondents expected a similar profit margin for geothermal involvement (Questions 20a and 20b). In fact, only two of the eight promoters felt that geothermal would yield a different profit margin. One felt that geothermal would yield a lower profit than his land deals which reaped 30 to 40 percent. The second felt that geothermal should yield a higher than average profit due to the high risk associated with geothermal ventures. There were no noticeable differences between current and potential promoters and developers on the perceived benefits and anticipated profit margins of geothermal involvement.

Decision Factors and Trade-Off Among Factors

Susanville promoters and developers offered a wide range of factors which they deemed critical for undertaking geothermal projects (Question 21). As shown in Table 17-7, respondents diverged sharply on what they felt were the important decision-making factors. Aside from the expected cost and profitability factors, which were volunteered by six of the eight respondents, there was little general consensus on what motivated a decision to

TABLE 17-7
DECISION FACTORS FOR GEOTHERMAL INVOLVEMENT

<u>Respondent</u>	<u>Order of Mention</u>	<u>Factor</u>	<u>Importance</u>
Current	First	Risk	Very
	Second	Profitability	Very
Current	First	Profit margin	Very
	Second	Time constraints	Very
Current	First	Geological information	Very
	Second	Geophysical studies	Very
	Third	Surface	Somewhat
	Fourth	Geochemical angles of surface water	Somewhat
	Fifth	Thermal drilling programs	Very
Current	First	Legal	Very
	Second	Environmental	Very
	Third	Private gain	Very
Potential	First	Availability and characteristics of resource	Very
	Second	Continued reliability	Very
	Third	Financial	Very
Potential	First	Like to do that kind of work	Very
	Second	Concerns with our engineer's construction	Very
	Third	Enjoy people we see	Somewhat
	Fourth	Offer us professional assignments	Somewhat
Potential	First	Availability of source	Very
	Second	Overall economics	Very
Potential	First	Potential savings	Very
	Second	Long-term energy requirements	Very
	Third	Development of community resource	Very
	Fourth	Potential Vocational- Technical programs	Very
	Fifth	Cost	Very
	Sixth	Availability of grants	Somewhat

launch a geothermal venture. Two respondents felt that source availability was an important component. Two indicated that resource characteristics were critical, one describing in detail the need to know geochemical aspects of surface water and other geophysical information. Other respondents mentioned such factors as time constraints, legal issues, enjoying the work and the people, and the opportunity to develop vocational and technical programs. The diversity of decision factors perhaps aptly reflects the diversity of the respondents themselves who represented government, industry, academic, and real estate sectors.

Unlike Klamath Falls promoters and developers, the Susanville respondents appeared relatively unconcerned about the location of the resource. Six out of the nine Klamath Falls respondents had offered source location as their first top-of-mind decision factor while only two of eight Susanville respondents even mentioned resource availability.

Susanville respondents took a rather hard line in emphasizing cost and profitability factors over "less economic" decision factors. Table 17-8 displays factor-by-factor trade-offs for decisions regarding geothermal involvement (Question 23a). In general, promoters and developers would not trade-off profits and private gain for legal and environmental considerations. Alternatively, they would waive source availability and time constraints for overall economics and profit margin. There was a single exception to this trend. One respondent, a potential promoter and developer, was willing to sacrifice financial considerations for continued source reliability and availability.

Other Decision Factors

The attitudes and opinions toward the role of government in geothermal decisions was mixed. Table 17-9 summarizes the perceived role of government, either via regulations or on a local level.

TABLE 17-8
TRADE-OFF AMONG DECISION FACTORS

<u>Respondent</u>	<u>Trade-Off Factors</u>	<u>Willing to Trade-Off</u>
Current	Profitability for risk	No
Current	Time constraints for profit margin	Yes
Current	Geophysical studies for geological information	Yes
	Surface for geological information	Yes
	Thermal drilling programs for geological information	No
	Surface for geophysical studies	Yes
	Geochemical angles of surface water for geophysical studies	Yes
	Geochemical angles of surface water for surface	Yes
	Thermal drilling programs for geochemical angles of surface water	No
Current	Environmental for legal	No
	Private gain for legal	No
	Private gain for environmental	No
Potential	Continued reliability for resource availability and characteristics	Yes
	Financial for resource availability and characteristics	Yes
	Financial for continued reliability	Yes
Potential	Concurs with engineers construction for liking that kind of work	Yes
	Enjoying people you see for liking that kind of work	Yes
	Offering professional assignment for liking that kind of work	Yes
	Enjoying people you see for concurring with engineer's construction	Yes
	Offering professional assignments for concurring with engineers construction	Yes
	Offering professional assignments for enjoying the people we see	Yes
Potential	Overall economics for availability of source	No

TABLE 17-9
OTHER DECISION FACTORS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
25	Role of government regulations		
	Determined on case by case basis	1	-
	More regulations means more cost	1	-
	If permit process too long might not take job	1	-
	Hopefully, less than exist now	1	-
	Determine legal and environ- mental aspects as well as eligibility for funds	1	-
	Very important - must comply	-	1
	Quite a bit/Need government close to project	-	2
	Minor part	-	1
	None/no influence	2	-
26a.	Influence of local government on involvement		
	Yes	5	4
	No	1	-
	N/A	1	-
26b.	How has local government influenced?		
	Promote resource/positive attitude/cooperative spirit	2	2
	City calls for bids	2	-
	Participation in community development program	1	-
	Permits	-	1
	Susanville serves as project manager	1	-

When asked to predict the role of regulations in future geothermal decisions (Question 25), current promoters were far more negative than potential promoters. One current respondent, for example, complained that more regulation simply meant increased costs. Another current promoter argued that if the permit process were too lengthy, his firm might not undertake the project. Still another current respondent commented that in the future, there would, hopefully, be fewer regulations than now. Two current promoters and developers simply reported that regulations would have no influence on future geothermal ventures.

Potential promoters, on the other hand, viewed regulations as necessary and even helpful. One potential respondent, for example, claimed the regulatory function to be "very important". Two perceived that regulation would have "quite a bit" of influence on future decisions. One even maintained that the government should remain close to geothermal projects. The negative attitude of current promoters, as contrasted with the positive perspective of potential promoters, suggest some unfortunate past experiences with government regulations. Future educational efforts aimed at highlighting beneficial aspects of regulations might be directed toward current or past promoters and developers.

When asked if local government had any influence on geothermal involvement decisions (Question 26a), nine of the eleven respondents replied "Yes." For nearly half these respondents, the local influence had been in the form of positive promotion and a cooperative spirit on the City's part. For two respondents, local influence had been in the form of requests for bids for projects. Other miscellaneous influences included permits, project management and a community development program.

Awareness of Geothermal Management in
Susanville and Klamath Falls

Eight respondents claimed to be aware of how Susanville managed geothermal energy (Question 35), and six expressed familiarity with how Klamath Falls managed geothermal (Question 36). Table 17-10 displays these responses as well as opinions regarding City management in these two locales (Question 37).

Of the six respondents who were aware of management in both places, only three volunteered opinions germane to the issue of centralized versus de-centralized control. Of these three, one preferred Susanville's style, a second preferred Klamath Falls' management style, and the third was essentially neutral. The proponent of Susanville argued that it was in the public interest for the government to control knowledge and regulate. The Klamath Falls advocate questioned Susanville's legal right to control all wells. The neutral respondent claimed that Susanville's limited resource required City management while the diversity of Klamath Falls' geothermal sources allowed for independent well ownership.

Summary of Susanville Promoters and Developers

The emerging profile of Susanville promoters and developers displays a staunch advocacy for future geothermal involvement. Overall awareness and knowledge of the resource were widespread and most respondents claimed geothermal as their preferred energy source. Economic and business factors predominated as reasons for the high level of interest. Respondents appeared convinced that geothermal was possessed of a bright future and forecasted a broad array of potential applications, ranging from general space heating and direct process heat applications to such highly specific uses as hot water heating, dehydration, hot houses, generation of electricity, and agri-business and agricultural uses.

TABLE 17-10

AWARENESS OF GEOTHERMAL MANAGEMENT IN
SUSANVILLE AND KLAMATH FALLS

<u>Question Number</u>	<u>Question and Answers</u>	<u>Number Responding</u>	
		<u>Current</u>	<u>Potential</u>
35	Aware of Susanville management?		
	Yes	5	3
	No	2	1
36	Aware of Klamath Falls management?		
	Yes	3	3
	No	4	1
37	Opinion of City management		
	Aware of Susanville only		
	Good	1	-
	Good, considering Susanville's setbacks	1	-
	Aware of both Susanville and Klamath Falls		
	Klamath Falls has right idea; Susanville tries to control all well rights - not sure they have legal right	1	-
	Klamath Falls is more experienced; proximity to OIT is important factor	1	-
	Klamath Falls is further ahead; Susanville in formative stage; Klamath Falls has more community commitment, a Geothermal Center and regulate to develop potential and reduce waste	-	1
	Prefer Susanville's way - more control of knowledge. need to regulate public. On own, people get greedy. Need management	-	1
	Susanville has limited resource so City must manage; Klamath Falls more diverse	-	1
	No opinion	1	-

In terms of relevant advantages and disadvantages, promoters and developers presented a balanced picture, citing equal numbers of pros and cons. The key overall advantage was geothermal's low cost although resource cleanliness and renewability were also frequently mentioned. Pollution emerged as the most serious perceived drawback, in the form of chemical water contaminants, air quality and mineral crustation of pipes. Other prime disadvantages included encroaching government control, remote source locations, and the speculative nature of the resource.

In describing past experiences with geothermal, most respondents mentioned well-drilling or preliminary feasibility and concept studies. Perceived benefits of geothermal involvement included both personal satisfaction and such business-related gains as more work, more contracts, increased employment and additional revenue. For the most part, Susanville promoters expected that geothermal involvement would yield the same profit margin (typically 10-20 percent) as other projects.

In terms of critical factors that launched a geothermal venture, cost and economic concerns predominated. In fact, promoters took a rather hard line in emphasizing cost and profitability when discussing possible trade-offs in the decision process. In nearly all cases, respondents were willing to sacrifice such factors as environment, source availability, time constraints and legal issues for the sake of favorable profits and economics.

The role of government regulations met with mixed reviews. Several promoters perceived regulations as time-consuming, indicative of higher costs and, in general, something they could use less of. Others felt regulations were very important and had quite a bit of impact, especially in keeping the government close to the project. Still others felt regulations would have little or no impact on their decisions relative to geothermal involvement.

The role of local government was generally viewed with high positive regard. Susanville's encouragement of geothermal, its cooperative spirit, and its requests for bids were seen as positively influencing involvement decisions. Regarding comparison of Susanville's tightly controlled management versus Klamath Falls' de-centralized control, only three respondents were well appraised of the differing management styles. Of these three, the first preferred Susanville's tight control, the second questioned Susanville's legal authority to control all wells and the third non-committally explained that Susanville's limited resources required tight government control.

Current promoters differed appreciably from potential promoters on only one issue. Attitudes toward government regulations were far more negative among the current promoters than among potential promoters. Current promoters were far more likely to complain of the higher costs, time lags and lack of necessity of regulations while potential promoters viewed regulations as rather important. This difference suggests unfortunate experiences with regulations in the past.

Compared to their counterparts in Klamath Falls, Susanville promoters and developers were largely similar in attitudes, awareness, knowledge and expected profit margins for geothermal energy. Susanville respondents were more likely to have first learned of geothermal energy from individualized experiences, like work, school, and publications rather than having lived in the area. Unlike Klamath Falls respondents, Susanville respondents expressed fears of potential pollution, remote source locations, encroaching government control and the speculative nature of the resource. They also were more likely to mention disadvantages of geothermal, whereas, for Klamath Falls respondents, the perceived advantages clearly outweighed the disadvantages. Lastly, the critical determinant for geothermal involvement among Susanville

respondents rested in the financial gain and overall profitability of the venture. For Klamath Falls respondents, source location was the critical decision factor cited.

To some extent, these few differences merely reflect different positions on the learning curve. Klamath Falls respondents are relatively savvy regarding geothermal and are more relaxed and experienced with the resource. Susanville respondents have not been exposed to local resource use as long as Klamath Falls respondents and hence, perhaps a little more wary.

XVIII-26

SECTION XVIII

MACRO-ECONOMIC ENVIRONMENT OF SUSANVILLE

There were two aspects to the study of the macro-environment of Susanville. The first involved a review of secondary literature and the second was a survey of attitudes of local government and industry toward macro-environmental issues.

Review of Secondary Data

This section of the report discusses the secondary literature review of the economic macro-environment of Susanville. Specifically, issues related to:

- industry structure;
- geothermal resource characteristics;
- demography;
- socio-economic conditions and trends; and
- political, institutional and regulatory environment are addressed.

While the focus in this section is on Susanville, because of widespread data availability and because some issues are regional in implication, significant portions of this discussion are devoted to the whole of Lassen County. In addition, some information was available on a County basis that was unavailable for Susanville.

Lassen County is located in northeastern California at the meeting of the Sierra Nevada and Cascade Mountains. To the west lie the densely forested mountains of the Cascades

and the Trinity Alps; to the east the broad volcanic Modoc Plateau and the Great Basin desert. The County is entirely mountainous with most of it at an elevation of 4,000 feet or higher and some peaks over 8,000 feet.

The climate is relatively severe, with a growing season of only two to four months depending on location. Precipitation is considered light. Susanville is at the dividing line between the forests and the Modoc Plateau and has a mean annual precipitation of sixteen inches, increasing to over twenty inches at the west County line and dropping to less than five inches in the desert area at the Nevada State line.

Lumbering has long been one of the economic mainstays of the County. Forty-two percent of the County is forested, with Ponderosa Pine being the dominant species. The other major factor in Lassen's economy has been the raising of beef cattle. This has taken place in the open country of the east County with much grazing on public lands.

Over sixty percent of the County is in public ownership. The largest amount (35.0 percent) is administered by the Bureau of Land Management followed by the Forest Service (20.9 percent), the Sierra Army Depot, and other agencies.

Due to the relative isolation of Lassen County and the sparse nature of settlement within the County, freight and transportation have been and continue to be problems for the local economy. Freight is presently carried primarily by truck to outside markets. Lack of adequate rail and air service continues to be a hindrance. Transportation within the County is costly and energy consuming due to the spread-out nature of communities and the lack of adequate transportation services.

There is no commercial airport in Susanville, with Reno, Nevada (approximately seventy miles to the east) being important to Susanville for air and trucking transportation to commercial markets. During the 1800's Susanville "grew up" as the "last" stage coach stop before entering the Sierra Nevadas (to the west) as people travelled from the east. Many products flow through Reno, Nevada to Susanville and one likely distribution pattern of products produced in Susanville would be by truck to final distribution points via transportation available in Reno, Nevada.

Industrial Development

As the data in Table 18-1 indicates, employment in the Susanville labor market area has shown slight increase, from 5,225 in 1972 to 6,550 in 1979. However industrial, i.e., manufacturing employment comprises only about 10 percent of total employment and consists principally of lumber and wood products manufacturing; the near term forecast (Table 18-2) indicates relatively stable employment trends. On the other hand, employment projections for Mount Shasta region (Table 18-3), of which Lassen County is a part, indicate a somewhat larger growth rate in the 1976 to 1985 period. It is therefore reasonable to anticipate some increase in the area's industrial base.

The most important shift in the industrial structure for Lassen County has been its rapidly rising dependency on service employment. In 1940, only thirty-two percent of all employment in Lassen County was service oriented, compared with 66 percent of the total employment only twenty years later. In 1960, service activities also accounted for sixty-six percent of California's employment. The implications of

TABLE 18-1

WAGE AND SALARY EMPLOYMENT
SUSANVILLE LABOR MARKET AREA (LASSEN COUNTY)
ANNUAL AVERAGE

	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Total, all industries	5,225	5,075	5,175	5,400	5,775	5,825	6,350	6,550
Agricultural wage and salary	150	150	175	150	150	125	125	125
Nonagricultural wage and salary	5,075	4,925	5,000	5,250	5,625	5,700	6,255	6,425
Construction and mining	75	75	75	75	100	125	225	250
Manufacturing	600	600	525	500	600	600	725	725
Lumber and wood products	575	575	475	450	550	550	650	650
Other manufacturing	25	25	50	50	50	50	75	75
Transportation and public utilities	250	250	300	325	325	275	275	275
Wholesale trade	75	100	100	75	100	100	100	100
Retail trade	600	600	650	650	675	775	850	875
Finance, insurance, and real estate	125	125	125	125	125	175	175	200
Services	475	400	425	450	500	500	675	725
Government	2,875	2,775	2,800	3,050	3,200	3,150	3,200	3,275
Federal	1,375	1,175	1,025	1,075	1,050	1,075	1,075	1,100
State	400	425	500	525	525	525	525	525
Local and education	1,100	1,175	1,275	1,450	1,625	1,550	1,600	1,650

SOURCE: Lassen County, General Plan, 1980.

TABLE 18-2

LASSEN COUNTY
WAGE AND SALARY EMPLOYMENT
1979-1981 ANNUAL AVERAGE

Industries	1979	Forecast	
		1980	1981
Total, all industries*	6,550	6,375	6,550
Agricultural wage and salary: Agricultural services, forestry & fisheries	125	125	125
Nonagricultural wage and salary workers	6,425	6,250	6,425
Construction and mining	250	250	250
Manufacturing	725	675	700
Lumber and wood products	650	600	625
Other manufacturing	75	75	75
Transportation and public utilities	275	275	275
Wholesale trade	100	100	100
Retail trade	875	825	875
Finance, insurance, and real estate	200	175	200
Services	725	700	750
Government	3,275	3,250	3,275
Federal	1,100	1,100	1,125
State	525	525	525
Local and Education	1,650	1,625	1,625

March 1979 Benchmark

*Employment reported by place of work and does not include persons involved in labor-management trade disputes.

SOURCE: State of California, Employment Development Department.

TABLE 18-3

EMPLOYMENT AND GROWTH RATES BY INDUSTRY
1976, 1980, 1985 -- MOUNT SHASTA REGION

Industry ¹	Number of Employed Individuals ²			Compound Annual Average Growth Rate	
	1976	1980	1985	76-80	80-85
1	2	3	4	5	6
Total, All Industries	81,000	92,100	103,600	3.3	2.4
Agriculture, Forestry, Fisheries	8,700	9,300	9,500	1.7	0.4
Mining	300	300	300	0.0	0.0
Construction	5,600	6,600	7,200	4.2	1.8
Manufacturing	12,400	13,600	14,300	2.3	1.0
Lumber and Wood Products	9,500	10,200	10,500	1.8	0.6
Other Manufacturing	2,900	3,400	3,800	4.1	2.2
Transportation, Communications, and Utilities	6,400	7,000	7,600	2.3	1.7
Transportation	3,700	4,000	4,300	2.0	1.5
Communications & Utilities	2,700	3,000	3,300	2.7	1.9
Trade	16,600	19,200	22,400	3.7	3.1
Wholesale Trade	1,800	2,100	2,400	3.9	2.7
Retail Trade	14,800	17,100	20,000	3.7	3.2
General Merchandise	1,400	1,600	1,900	3.4	3.5
Food and Dairy Stores	2,100	2,400	2,800	3.4	3.1
Auto Dealers, Gas Stations	3,000	3,300	3,700	2.4	2.3
Eating and Drinking Places	4,300	5,200	6,300	4.9	3.9
All Other Retail Trade	4,000	4,600	5,300	3.6	2.9
Finance, Insurance, Real Estate	2,600	3,200	3,600	5.3	2.4
Finance	1,100	1,400	1,600	6.2	2.7
Insurance	400	400	400	0.0	0.0
Real Estate	1,100	1,400	1,600	6.2	2.7
Services	22,800	26,700	31,800	4.0	3.6
Hotels and Lodging Places	2,600	3,200	3,900	5.3	4.0
Medical, Other Health	5,300	6,400	7,500	4.8	3.2
Education	6,800	8,200	10,400	4.8	4.9
All Other Services	8,100	8,900	10,000	2.4	2.4
Public Administration	5,600	6,200	6,800	2.6	1.9
Federal Public Administration	1,500	1,700	1,800	3.2	1.2
State Public Administration	1,100	1,100	1,100	0.0	0.0
Local Public Administration	3,000	3,400	3,900	3.2	2.8

¹Major industries are aggregated here according to the census classification method. All classes of civilian workers are included (private wage and salary, self-employed, unpaid family, and government). A major proportion of government workers are assigned to the various industries in which they would appear if they were in private employment; i.e., construction crafts workers employed by government agencies are counted with construction; municipal utility workers are counted with transportation, communications & utilities; and public schools employees are included with education as part of the services industries. Remaining in public administration are such groups as public officials, police officers and fire fighters, and employees of regulatory agencies.

²Industry totals have been rounded to the nearest hundred.

this for Lassen County are for faster and certainly more stable growth of employment than has been enjoyed in the past. Most of the area's recent economic growth has been, and will continue to be, in tertiary activities such as government, services and trade.

To a considerable extent the growth in the service employment in this area has been due to the local tourism activities. Tourism has long been considered a significant contributor to the local economy. Employment levels are very seasonal and this is a large contributing factor to that seasonality.

Those sectors within the economy to which tourism is a particular contributor are the trade and service sectors. Available figures indicate that trade and services have increased in total numbers employed, in total labor proprietor incomes and through taxable retail sales between 1977, 1978, and 1979. Estimates provided by EDD for the number employed in the trade and service sector during 1978 was 1600, or twenty-five percent of the total labor force; in 1979 the number jumped to 1700, or twenty-six percent.

As already noted, the dominant manufacturing activity in the area is manufacture of various wood products. Even though the timber industry in Lassen County has declined during the past years, it continues to be a significant segment of the local economy.

In 1948, Lassen County had thirteen active sawmills and produced over 360 million board feet of timber which was 9.1 percent of the State's total production. In 1968, the County had eight active sawmills and over 88 million board feet were cut, 1.7 percent of the State's total. At present there are

four major sawmills and several smaller private operations in the county.¹ Outputs from Forest Service lands within the County (the primary source for timber) were 57.9 million board feet in 1978 and 74.5 million board feet in 1979. Of the timber sold, 41.9 million board feet were purchased in 1978 and 28.9 million board feet were purchased in 1979 by Lassen County firms.²

Lumbering has been, and continues to be, the main manufacturing activity in Lassen County. EDD figures showed an average of approximately 725 persons working in manufacturing during 1978 or roughly twelve percent of the County's work force. In 1979, it had remained at 725 persons, but decreased to eleven percent. During the first quarter of 1980 an estimated 625 persons were employed in manufacturing.

Government Employment. In addition to the service employment already discussed, government related employment is a significant factor in Lassen County's economy. In past years government has been the primary contributor to Lassen County's economy. In 1978 the EDD estimated fifty percent of Lassen County's wage and salary earners were employed in one branch or another of the Federal, State, or local government. In 1979, the figure remained at fifty percent. The number of government employees has remained fairly steady during 1977, 1978 and 1979.³

¹Overall Economic Development Plan, Lassen County, California, June 1980.

²Ibid.

³Ibid.

Due to the significance of government within the local economy further analysis of some of the major government agencies located within the County are provided in this section.¹ Figures are provided wherever possible for the total numbers employed, the amount paid in wages and salaries and benefits paid into the local economy. Most of the figures are estimates. The total shown for wages, salaries and benefits paid are not adjusted for Federal or State income taxes, nor are they adjusted for benefits such as Social Security, retirement or insurance. These payments may account for twenty to thirty percent of the total paid in salaries, wages and benefits, a percentage that generally leaves the local economy.

Sierra Army Depot -- A report from the Office of the Secretary of Defense prepared in 1973 states, "Since 1942, the Sierra Army Depot has been an integral part of the area's life as the largest employer in Lassen County The Depot employment has surged forward and back with the tides of war."² The Sierra Army Depot, a principal West Coast ammunition storage installation, had a personnel strength of 1,132 and an operating budget of \$12,368,000 in 1973. Approximately \$10.5 million of the annual budget was paid in wages and fringe benefits. In 1972, approximately 1,046 civilians worked at the Base, 55 percent of them lived in the Herlong area, 30 percent in Susanville or other points north of the Base and 15 percent lived in Reno or points south.

During fiscal year 1979, the Sierra Army Depot averaged a total personnel strength of approximately 955. Three hundred twenty-five were military and 620 were civilian. The

¹These are summarized from Overall Economic Development Plan, op. cit.

²Ibid.

payroll cost to military was approximately three dollars and to civilian employees it was approximately ten million dollars. The value of contracts was approximately one and one-half million dollars. Of the Depot's total personnel force, approximately seventy people presently live between Doyle and Reno, fifty-five live between the Herlong Junction and Doyle, 212 live between the Herlong Junction and Susanville, and 618 live on or adjacent to the Depot.

California Correctional Center -- The California Correctional Center is a medium security State prison with a capacity for twelve hundred inmates. During the 1979/80 fiscal year, 363 persons were employed at the facility, most of whom live in the County. The annual budget is \$13,656,030, including a payroll of \$10,712,423. All of these figures represent slight increases over the figures provided for fiscal year 1978/79. Many purchases made by the Center are from outside the local County.

Lassen Community College -- Lassen Community College, located adjacent to the City of Susanville, had an enrollment during the 1979/80 school year of 3,266 full- and part-time students. The college is presently experiencing a decrease in day-time attendance and an increase in evening attendance.¹

	<u>Full-Time Enrollment</u>	<u>Part-Time Enrollment</u>
	(Students carrying 15 units or more)	(Students carrying less than 15 units)
Spring 1977	972	2073
Spring 1978	901	2313
Spring 1979	799	2655
Spring 1980	702	2564

¹ Ibid.

At present the College employs fifty-five certified full-time faculty and management, fifty-six full-time classified staff and management, 265 part-time employees and 211 students. Of an operating budget of approximately \$5,500,000, approximately 85 percent of \$4,675,000 is paid into the local economy through wages, salaries and fringe benefits. An additional estimated \$750,000 is provided through federal student grant programs. The college is presently involved in, or finishing, five significant construction projects. The funds being released for these projects total approximately \$5,937,000. Funding sources are generally 70 percent from the State, 30 percent from the local district and approximately \$300,000 from secured property taxes. Materials are provided for the projects from both local and non-local sources. Many contractors hired are not local; however, some skilled labor is provided from the local labor force. Due to a recent recommendation by the Chancellor's Office that the Education Code be changed, additional community college growth may be minimal to non-existent by 1980. This is seen as a direct result of Proposition 13. Also, in spite of the proposed action, the college will continue to seek alternative sources of funding for projects that meet the community's needs such as a newly proposed community center.

United States Forest Service (USFS) -- During 1978, the U.S. Forest Service employed approximately 227 man-years in Lassen County and paid approximately \$3,046,612 in wages and salaries. In 1979, 252 man-years were employed and approximately \$4,196,979 were paid in wages and salaries. During the first quarter of 1980, approximately forty-nine man-years have been employed and wages have totaled \$934,949. Purchases and contracts made with Lassen County firms were \$179,845 in 1978, \$272,511 in 1979 and have totaled \$51,795 for the first quarter of 1980.¹

¹Ibid.

California Division of Forestry (CDF) -- The California Division of Forestry, Lassen-Modoc Ranger Unit, employs approximately forty-two permanent employees and sixty-eight seasonal employees. Wages and salaries paid to permanent employees total approximately \$909,276. Wages paid to seasonal employees total approximately \$58,258. Most permanent employees live in Lassen County. Many seasonal employees maintain permanent addresses outside the County, and thus much of their earnings are spent elsewhere. Excluding wages and salaries, CDF has a present operating budget of approximately \$188,105, eighty percent to ninety percent of which is spent locally.¹

United States Bureau of Land Management (BLM) -- The U.S. Bureau of Land Management has jurisdiction over approximately 1,000,200 acres or thirty-four percent of the total lands in Lassen County. Due to increased requirements for Environmental Impact Statements, on-the-ground inventories and the wilderness review process, the number of Susanville district employees in Lassen County has increased in recent years. In 1979, the BLM employed approximately eighty-four permanent employees and 117 seasonal employees in Lassen County and paid approximately 2.5 million dollars in salaries. In 1980, their employment has increased to eighty-five permanent employees, 140 seasonal employees and approximately 2.3 million dollars will be paid in salaries. Approximately, 1.5 million dollars of their remaining expenditures are spent in Lassen County.²

Lassen County Government -- The number of persons employed by Lassen County has averaged approximately four hundred since 1977. Estimated County expenditures during fiscal year 1979/80 were \$13,180,143. Of this total, approximately

¹Ibid.

²Ibid.

\$6,434,241 were paid in salaries and benefits. Roughly three million of the total paid in salaries and benefits goes directly into the local economy. The remainder goes out in Federal and State income taxes, retirement, Social Security, etc. The difference between the total estimated budget and the amount paid in wages, salaries and benefits (approximately \$6,745,902) is spent both inside and outside the local economy. It includes welfare payments, public works and road projects, and operating expenses. Of the total estimated budget for 1979/80, approximately nine million dollars were provided by revenues other than property taxes.

Summary of Industry Structure. In summary, with the exception of contract construction, every major category of government employment has experienced at least modest growth since 1960, and several sectors have been expanding at rates considerably faster than in the rest of the State. Clearly, the direction of Lassen County's economy is no longer being determined by the lumber industry, but by decisions of the Federal and State government. Lassen County's net gain in employment since 1960 has been 1,225 jobs, of which 1,000 have been contributed by government alone.

The Federal Government has emerged as the largest single employer in the County. In 1960, with 1,625 workers, it represented more than twenty-six percent of the work force. In 1967, with 1,000 workers, the percentage share increased to almost thirty percent. The Sierra Army Depot grew from 800-900 in 1967 to almost 1,600 in 1967.

The growth and decline of the lumber industry and the subsequent rise of the Federal government as the dominant employer in Lassen County have important implications for

Lassen County's future. While never sharing in California's general prosperity, Lassen County's patterns of employment have begun to resemble those which have produced affluence in most parts of the country.

The most important shift in the economic structure for Lassen County has been its rapidly rising dependency on service employment. In 1940, only thirty-two percent of all employment in Lassen County was service oriented, compared with sixty-six percent of the total employment only twenty years later. In 1960, service activities also accounted for sixty-six percent of California's employment.¹ The implications of this for Lassen County are for faster and certainly more stable growth of employment than has been enjoyed in the past. Most of the nation's recent economic growth has been, and will continue to be, in tertiary activities such as government, services and trade.

The employment trends in Susanville and Lassen County indicate only marginal increases in manufacturing employment. Conversely, non-manufacturing employment has been increasing in this area. However, as discussed in another subsection of this section, unemployment rate remains high in Susanville and Lassen County and when combined with a relatively low wage rate, offers significant inducement for establishing additional industrial establishments in this area. This is especially the case because of the availability of geothermal resources in this area as described in the following subsection.

¹Ibid.

Geothermal Resources in Susanville and Lassen County¹

Susanville lies at the intersection of three major geologic regimes, the Sierra Nevada Range to the southwest, the Modoc Plateau to the northwest, and the Basin and Range Province which extends into Nevada. The subsurface geology is characterized by interbedded basalt flow, agglomerates, and alluvial conglomerates. Subsurface and surface geologic structure indicate extensive block faulting, with the dominant trend in a northwestern direction. Subsurface temperature contours indicate the occurrence of the geothermal anomaly is fault related.

While four current users were identified, information indicates that six geothermal wells were drilled in Susanville before the 1970s. Several of these wells have been used for heating a greenhouse, space heating, and heating the City swimming pool. Because these wells (Naef well, LDS Church well, Roosevelt Swimming Pool, and Davis Well) were drilled long ago little detailed information on well lithology, temperature, completion, and total depth is available.

The United States Bureau of Reclamation has drilled twelve exploratory wells and five shallow temperature gradient holes. Locations of the twelve exploratory wells are shown in Figure 18-1. Well sites were chosen in an attempt to define the areal extent of the geothermal anomaly. Well depths ranged from 135 to 640 m. Diameters were 6 in. and completed with a 2-in. sealed casing. Two of the wells, Suzy-4 and Suzy-6, were completed with 4-in. and 6-in. casings, respectively.

¹Most of the material in this section is derived from S.M. Benson, et al., "Evaluation of the Susanville, California, Geothermal Resource, 1979" Lawrence Berkeley Laboratory, Geothermal Energy Development Annual Report, 1979.

GEOHERMAL WELL LOCATIONS IN SUSANVILLE, CALIFORNIA

Detailed interpretation of the formation lithology and geophysical bore logs have been completed by the Bureau and several distinct units, probably offset by faults, have been identified. All of the wells, however, penetrated a sequence of basalt, mud-flow and ash-flow agglomerates. Several of the wells in the southern portion of the anomaly penetrate alluvial conglomerates. The contact zones between the basalt layers and the conglomerates have been identified as the major geothermal production zones.

Temperature Distribution. Temperature profiles obtained from the wells are shown in Figures 18-2, 18-3 and 18-4. Several of the wells in the southwest portion of the anomaly display temperature reversals with depth. The temperature reversals take place at depths between 100 and 150 m. The reversals nearly coincide with the contact zones between the basalt and the conglomerate, which is further evidence that the producing aquifer(s) occur at the contact zones in those wells. Maximum temperatures range from 35°C to 70°C. The hottest wells are Suzy-9 and Suzy-9a. No temperature reversals take place, indicating the possibility of higher temperature with depth. However, the productivity of this section of the reservoir is unknown. Further testing in this area will indicate the productivity of these higher-temperature zones.

The occurrence of the Susanville geothermal resource appears to be fault related. Temperature contours and temperature profiles suggest that heated fluids are upwelling on a northwest-trending fault. The heated fluids are then dispersed into the reservoir along the highly permeable (fracture) agglomerate-basalt interface. The geothermal anomaly is larger in lateral extent than was first estimated. However, studies by the Bureau show that the portion of the resource that is above 40°C is partially

FIGURE 18-2

TEMPERATURE PROFILES IN WELLS SUZY-1 TO SUZY-7

FIGURE 18-3

TEMPERATURE PROFILE FOR WELLS SUZY-8 TO SUZY-9 AND
SEVERAL OLDER WELLS IN SUSANVILLE,
CALIFORNIA

FIGURE 18-4
TEMPERATURE PROFILES FOR SUZY-9a THROUGH SUZY-11

confined both laterally and vertically. The lateral confinement is on three sides of the northwest. The vertical confinement appears to be related to the presence of fractures at the basalt interface in the southwest portion of the anomaly.

Well tests show a high lateral permeability related to the fractured basalt-agglomerate interface. Porosity values are low, supporting evidence of a fracture-dominated producing aquifer. Drilling in the northwestern portion of the anomaly has encountered fluids of higher temperatures than found in the southern portion of the geothermal anomaly. Further well testing will be required to determine productivity of the higher temperature fluids in this area of the anomaly.

As the above clearly indicates, Susanville has considerable geothermal resources ready to be utilized by various industrial users. As discussed in Section XIV, at least one of the current well owners indicated willingness to sell his well to the City.

Demographic Characteristics and Trends

Population increase in Lassen County has essentially kept pace with population trends in California and is expected to do so -- although at a slower rate to the year 2000 (Figure 18-5). U.S. Bureau of Census statistics indicate that the population of Lassen County was approximately 16,796 in 1970 based on 1970 census information. The California Department of Finance has projected that the County's population increased to 21,500 in 1980. This is an increase of approximately twenty-two percent. Between January 1, 1979, and January 1, 1980, County population increased approximately four percent. Between April 1, 1970 and July 1, 1977, the

FIGURE 18-5

POPULATION OF LASSEN COUNTY AND CALIFORNIA, 1940-2000

SOURCE: Population Research Unit, California Department of Finance, 1977-1978

natural increase in population (births minus deaths) was 1,676. The California Employment Development Department has reported, "The lower birth rate during the past several years has resulted in an upward skewing of the population curve with a larger portion of younger ages. This will lower the proportion of school age children and increase the percentage of older individuals". Based on California Department of Finance estimates, approximately 28.8 percent of the County's population is less than 20 years of age and approximately 9.6 percent is 65 or older.

Table 18-4 projects total population and population within Census County Divisions of Lassen County to 1990. The following assumptions were made: Total County population in 1990 will be approximately 27,300 persons per Basic Research projections; Susanville will continue its trend to become the dominant population center at the expense of the Honey Lake Census County Division which will remain relatively static; Westwood Census County Division includes both the town of Westwood and Eagle Lake and should exhibit a fairly substantial growth rate in the planning period; Big Valley and Madeline Census County Divisions should see some additional recreational home activity and introduction of some agricultural processing industry during the planning period and experience a moderate population increase.

During 1979, employment in Lassen County rose to 7,375, to the highest level on record. At the same time, the number of jobseekers rose to 825, causing the unemployment rate to reach ten percent.

Total employment in the County is expected to continue the upward trend, at a reduced rate of growth due to depressed economic conditions. On an annual average basis it is expected to grow from 7,375 workers in 1979 to 7,600 in 1981. The number of jobless is expected to increase from 825

TABLE 18-4

ACTUAL AND PROJECTED POPULATION WITHIN
CENSUS COUNTY DIVISIONS OF LASSEN COUNTY

<u>Census County Division</u>	<u>1960</u>	<u>CCD as percent of total County</u>	<u>1965</u>	<u>CCD as percent of total County</u>	<u>1990</u>	<u>CCD as percent of total County</u>
Susanville	8,060	59.3	10,968	64.3	19,500	71.5
Honey Lake	2,632	19.4	2,653	15.6	3,000	11.0
Westwood	1,525	11.2	1,971	11.6	2,850	10.5
Big Valley	1,028	7.6	1,205	7.1	1,600	5.8
Madeline	<u>352</u>	<u>2.6</u>	<u>256</u>	<u>1.5</u>	<u>350</u>	<u>1.2</u>
TOTAL COUNTY	13,597	100.0	17,053	100.0	27,300	100.0

SOURCE: Employment Development Department, State of California

in 1979 to 1,100 in 1980, and then recede slightly in 1981 to 1,000. These movements in the labor force will cause the unemployment rate to be 12.9 percent in 1980 and then 11.6 percent in 1981, as presented in Table 18-5.

As already indicated, while the employment in Susanville and Lassen County is expected to increase, this increase will not keep pace with the growth of labor force. Unemployment rates in this area therefore are expected to remain relatively large. This in turn can provide an incentive for new industrial firms to locate in this area because of availability of labor force as well as the presence of geothermal energy resources.

Social Economic Conditions and Trends

In very general and broad terms socio-economic conditions in Lassen County have been below those experienced in other regions in the State of California. For example, between 1950 and 1964, Lassen County's total personal income increased only forty-three percent, a gain substantially less than in almost every other part of the State. After adjusting for inflation, we would also find that Lassen County failed to match the gains in real income enjoyed by most Californians. The critical source of personal income for most regions is wages and salaries which increased by only sixteen percent in fourteen years, and if adjusted for inflation, actually amounted to a net loss of wage and salary income. Such losses were only partially compensated for by a more than doubling of transfer payments (including Social Security payments and unemployment compensation) to Lassen County residents.

TABLE 18-5

LASSEN COUNTY

CIVILIAN LABOR FORCE, EMPLOYMENT AND UNEMPLOYMENT
1979 - 1981 ANNUAL AVERAGE

ITEMS	1979	Forecast	
		1980	1981
Civilian Labor Force ¹	8,200	8,500	8,600
Employment	7,375	7,400	7,600
Unemployment	825	1,100	1,000
Unemployment Rate ²	10.0	12.9	11.6

March 1976 benchmark

¹Labor force by place of residence. Employment includes persons involved in labor-management trade disputes.

²The unemployment rate is computed from unrounded data; therefore, it may differ from rates using rounded figures in this table.

SOURCE: Employment Development Department, State of California.

Most of Lassen County's employment gains have been in fields which pay lower-than-average California wages. This situation is unlikely to improve as long as Northeastern California is unable to attract higher paying industries. In other words, a strong dependency on government and tourist-generated employment will keep per capita incomes in Lassen County lower than in the rest of the State.

Nevertheless, total personal income in the County is expected to increase from \$90 million in 1980 to \$147 million in 1990 and per capita income from \$4,000 to \$5,400 during the same period (Table 18-6). Because of the relatively low income levels, about 1800 persons in the County (and 8 percent) have income below poverty levels (Table 18-7) and 370 households receive aid to families with dependent children (Table 18-8). The dominant race of the population in the County is white, which represented eighty-five percent of total population, followed by hispanics with nine percent of the population (Table 18-9); total minority population in the county comprises fifteen percent of the County's total population.

In summary, the socio-economic conditions in Lassen County are relatively poor and certainly below those in other regions of the State of California. The principal deterrents in Lassen County's growth and prosperity have been:

1. Its inaccessible location, remote from principal markets and population areas, which has inhibited growth of new industries and, to some extent, growth of recreational activities, and
2. Its economy, based on lumber and cattle production, both of which have been subject to violent fluctuations over several decades.

TABLE 18-6
LASSEN COUNTY PERSONAL INCOME FROM 1966-1990

	Actual 1966 (1965)		Projected		
			1970	1980	1990
Personal Income ¹ (\$ Millions)	\$40.0	Pessimistic	\$53.0	\$78.0	\$117.0
		Probable	53.0	90.0	147.0
		Optimistic	57.0	103.0	187.0
Per Capita Income ¹	\$2,574	Probable	\$3,000	\$4,000	\$5,400

¹Projections are in constant (1965) dollars.

SOURCE: Arthur D. Little, Inc.

TABLE 18-7

LASSEN COUNTY PERSONS BELOW POVERTY LEVEL (a)
1981 (Projected)

	Total	Black Not Hisp.	Hispanic	White Not Hisp.	Other
Total	1,830	(b)	50	1,760	10
Male					
Total	900	(b)	30	880	(b)
14-21	380	(b)	(b)	380	(b)
22-44	190	(b)	10	180	(b)
45-54	80	(b)	20	60	(b)
55-59	30	(b)	(b)	30	(b)
60-64	70	(b)	(b)	70	(b)
65+	150	(b)	(b)	150	(b)
Female					
Total	920	(b)	20	890	10
14-21	130	(b)	(b)	130	(b)
22-44	200	(b)	10	190	(b)
45-54	130	(b)	(b)	130	(b)
55-59	30	(b)	(b)	90	(b)
60-64	90	(b)	(b)	90	(b)
65+	340	(b)	10	310	10

(a) Excludes individuals living in group quarters. Parts may not add to total because of independent rounding.

(b) Less than 5.

SOURCE: Public Welfare in California.

TABLE 18-8

LASSEN COUNTY AID TO FAMILIES WITH DEPENDENT CHILDREN
CHARACTERISTICS OF RECIPIENTS 16 AND OVER
SEPTEMBER 1979

	Total AFDC ^{a)}
Total 16+C)	370
Sex Male Female	80 290
Age 16-19 20-21 22-24 25-29 30-39 40-44 45-54 55-64 65+	100 30 50 60 90 20 20 b b
Ethnicity Black (not Hisp.) Hispanic White (not Hisp.) Other	b 20 320 20

a) AFDC includes children in foster family homes and children in institutions.

b) Under 10.

c) Parts may not add to total because of independent rounding.

SOURCE: Total figure from Public Welfare in California, Department of Social Services. Proportions by sex, age, and race reflected in administrative files.

TABLE 18-9

LASSEN COUNTY TOTAL POPULATION BY RACE, SEX, AND AGE
1981 (Projected)

	Total	Black Not Hisp.	Hispanic	White Not Hisp.	Other
Both sexes Total (a)	23,000	620	2,010	19,620	750
Male Total	12,250	400	1,120	10,340	400
0-13	2,210	40	200	1,870	90
14	160	(b)	10	150	(b)
15	160	(b)	10	150	(b)
16	170	(b)	10	150	10
17	180	(b)	10	160	10
18	190	(b)	10	170	10
19	220	(b)	20	190	10
20	270	(b)	20	240	10
21	260	30	20	200	10
22	260	40	20	180	10
23-24	490	50	30	390	20
25-34	2,270	90	140	1,970	70
35-44	1,170	50	220	1,460	40
45-49	720	10	100	590	20
50-54	660	20	120	500	20
55-59	660	20	90	520	30
60-64	540	20	40	460	20
65+	1,070	10	40	990	20
Female Total	10,750	220	890	9,260	350
0-13	2,110	50	240	1,740	90
14	160	(b)	20	120	10
15	160	(b)	20	120	10
16	170	(b)	10	150	10
17	180	10	10	150	10
18	180	10	10	150	10
19	180	10	10	160	10
20	170	(b)	10	150	10
21	150	(b)	10	130	(b)
22	150	(b)	10	130	(b)
23-24	300	10	20	260	10
25-34	1,740	50	150	1,460	70
35-44	1,470	20	100	1,310	50
45-49	630	10	80	530	20
50-54	580	20	50	500	20
55-59	640	10	50	560	20
60-64	530	10	20	490	10
65+	1,240	10	40	1,170	20

(a) Parts may not add to totals because of independent rounding.

(b) Less than 5.

SOURCE: Employment Development Department, State of California.

Political, Institutional and Regulatory Environment

Lassen County has a Board of Supervisors type of government, with five supervisors. The County Supervisors' assorted duties include formulation and approval of the County budget, approving zoning changes, handling all business transactions, and appointing various committees. The Supervisors also serve as an Advisory Board to the State Legislature and private citizens. In addition, the Supervisors serve as a senior management team for the County government departments. The County Supervisors are assisted by a County Clerk acting as official recorder for all legal documents in the county. In addition, the clerk is in charge of voter registration, marriage licenses and other pertinent County records. The City of Susanville has a mayorial and city council form of government.

A fundamental requirement for the economic development of the Susanville area is the formation of an effective economic development agency to promote and facilitate economic growth in the area. At present there is no central organization to carry out this role.

Currently, the only official bodies focusing on economic development are various City and County committees and the North Cal-Neva Resource Conservation and Development Project. The former are not set up to carry out comprehensive, long-range projects and the latter is concerned with a large geographical area of which Lassen County and Susanville Area is only a small part. However, Lassen County has established an organization to receive assistance from the Small Business Administration through the Hobo Wells Development Corporation, which was established to meet the local development corporation requirements of the SBA. Furthermore, in the

area of geothermal development both the City of Susanville and the County of Lassen have adopted aggressive geothermal energy development policies. The City of Susanville has adopted Ordinance 79-605 which grants the City auspices over geothermal energy development.

In the case of the City of Susanville the basic geothermal development policy adopted on August 11, 1976, is as follows:

OBJECTIVES

- (1) To cause the development and use of geothermal energy in Lassen County and the vicinity of Susanville for the economic and social benefit of the local inhabitants.
- (2) To develop a source of revenue in lieu of increases in local taxation to finance municipal services to local inhabitants, commerce and industry and to finance community and economic development in conformance with the general plan and desires of the local inhabitants.
- (3) Through the development and use of geothermal energy, expand and develop employment opportunities in the private sector in the area.

GUIDELINES & CRITERIA

- PURCHASE, LEASE OR OTHERWISE ACQUIRE SUPPLIES OF GEOTHERMAL ENERGY OR RIGHTS TO SUPPLIES OF ENERGY FROM PRIVATE ENTITIES AT A PRICE THAT ASSURES REASONABLE RATE OF RETURN IN INVESTMENT OR OTHERWISE DETERMINED VALUE OF THE RESOURCE.
- OBTAIN RIGHTS TO PUBLIC OWNED GEOTHERMAL RESOURCES ONLY TO THAT EXTENT REQUIRED FOR THE FULFILLMENT OF THE OBJECTIVES OF THIS POLICY.
- DEVELOP FACILITIES, EQUIPMENT AND UTILITY SYSTEMS ONLY AS REQUIRED TO BENEFIT THE INHABITANTS, COMMERCE AND INDUSTRY OF THE COMMUNITY.

- Encourage private business development in the community through the furnishing of low cost energy, the price of which is established by local control.
- CONTRACT WITH PRIVATE UTILITY SYSTEMS FOR THOSE SERVICES THAT CAN BE MORE ECONOMICALLY FURNISHED BY SUCH ARRANGEMENTS.
- THE CITY, THROUGH LOAN GUARANTEES, LOW INTEREST LOANS AND GRANTS, HAS THE FINANCIAL CAPABILITY TO:
 - Furnish incentives and assistance to private industry and commerce.
 - Furnish heat, light and power to its inhabitants and by policy, this assistance is furnished to encourage rather than compete with private sector.
- IN THAT THE GEOTHERMAL RESOURCES ARE LOCATED PRIMARILY IN THE COUNTY AND IN THAT THE CITY HAS THE RESPONSIBILITY FOR THE ECONOMIC WELL BEING OF THE LARGEST SEGMENT OF THE POPULATION, THE DEVELOPMENT AND USE OF THE RESOURCES IS BEST ACCOMPLISHED THROUGH A JOINT EFFORT BETWEEN THE CITY, THE COUNTY AND THE PRIVATE SECTOR.

The pertinent County of Lassen geothermal development policy adopted on October 2, 1979 is as follows:

RESOLUTION ADOPTING AN "INTERIM GEOTHERMAL POLICY FOR THE COUNTY OF LASSEN"

WHEREAS, Geothermal Energy has become a significant factor in the future growth and development of Lassen County.

WHEREAS, the 1968 Lassen County General Plan lacks any discussion of geothermal energy.

WHEREAS, a Geothermal Element to the General Plan would be necessary to manage and control the development of the geothermal resources within Lassen County.

NOW, THEREFORE, BE IT RESOLVED that it shall be the policy of this Board of Supervisors to seek funding from appropriate State and Federal agencies to prepare the Geothermal Element and necessary environmental documents.

BE IT FURTHER RESOLVED that until such a time a Geothermal Element is prepared and adopted the following shall serve as an "Interim Geothermal Policy for Lassen County":

- (1) Lassen County encourages the development of its geothermal resources by private and public concerns.
- (2) That the development of its geothermal resources should be for the purpose of furthering the goal of the County to be energy independent.
- (3) That the development of its geothermal resources should work for the diversification of our economy and provide employment opportunities for our citizens.
- (4) That the development of its geothermal resources should be in conjunction with other available alternative energy sources whenever possible.
- (5) That the development of its geothermal resources will comply with existing Federal, State and County law, and the California Environmental Quality Act (CEQA), until such time a detailed development strategy can be prepared as a Geothermal Element to our General Plan.
- (6) That the development of its geothermal resources should complement the efforts of the City of Susanville and the Susanville Geothermal Energy Project goals.
- (7) That the usage of the geothermal resources be optimized for the temperatures available without the destruction of the resource.

Furthermore, the City of Susanville has proposed a direct heat application project which envisions in its initial phases the development of a heating district to heat

seventeen public building complexes and to cascade the effluent heat through a Park of Commerce. In 1974, the City of Susanville recognized the necessity to hold down the escalating cost of heating to the local population and to create job opportunities (the local unemployment was reaching a peak of 20 percent in winter months). The existence of a resource had been identified and utilized in a limited manner from the 1920's; its extent and real potential was unknown. The City believed that it was beyond the capacity of private enterprise to establish and develop the resource, so by resolution of Council expressed its intent to develop the resource potential on behalf of the maximum number of residents for their maximum benefit. It was because of this expressed intent that Public Law 94-156 was passed, and BuRec was authorized and funded by Congress to evaluate the resource potential on behalf of the City. This extensive program is currently ongoing and is proving to be successful in its objectives.

It was deemed expedient that the initial development would address publically held buildings, thus spreading the cost savings benefits to the population in general. It was also anticipated that it would be easier to attract grant funds for this objective. The Park of Commerce would be developed concurrent with the heating district. The potential for replicating the program in many western rural areas was identified, and this formed part of the basis of justification of the project.

In January 1978, a proposal was submitted to DOE which projected a DOE contribution of \$2.4 million and a City share of \$1.9 million. The program was expected to extend over a 33-month period. Phase I, the design and engineering effort, is currently under contract, with Phase II, the construction

phase, hopefully under contract in time to develop the first production well in December 1979. The City and its team members believe they have the capacity to have fluid flow and utilization by December 1980. The project is not currently on schedule.

The Park of Commerce is being promoted and developed independently of DOE, but, at the same time, the City is under contractual obligation to DOE to do so if deemed feasible. Currently the City is negotiating for land suitable for such a park (200 to 300 acres). It is the City's intent to secure options on behalf of its nominees (identified industry) but not to be involved in land purchases itself. The City will and has successfully identified potential long-term loan sources for the development of streets, utility reticulation, and sewerage system for the park; the repayment will come from the developers and operators within the park. There have been conflicts between the City and County (LAFCO) over this industrial park.

The City intends that the Park of Commerce will have a feed mill, greenhouses, and confined animal raising units, as well as other types of industry. Some heat augmentation of the residual effluent from the heating district will be necessary for refrigeration, air conditioning, and sterilization of wool, etc. Various alternate energy sources are being investigated (wood waste, city refuse, and methane from the animal fattening units) to accomplish this.

The intent of the City of Susanville is that eventually it will develop a heating district encompassing all buildings within the City. It was intended that a high percentage of Main Street commercial buildings could be heated by December 1981; progress to encompass single family homes could be

considerably slower. It is recognized that the geothermal resource in itself may be insufficient for this ambitious program; however, the City believes that the cost effectiveness of utilizing wood waste from the nearby forest areas will allow it to continue in its objectives of being self-sufficient in energy for heating purposes. Importantly, the City has support in its endeavor from the local population.

In recognition of the fact that a geothermal resource is finite by definition, the City introduced an ordinance to insure orderly and efficient utilization of the resource for the maximum benefit of the residents of the City. It is the declared intent of the Council to make geothermal energy available to private enterprise at the lowest cost possible. The City's ownership of the total supply and distribution system will enhance this position.¹

As the above indicates, the political, institutional and regulatory environment in Lassen County and Susanville is well-disposed towards accelerated development of geothermal resources in this area. The City of Susanville has a geothermal energy development director who is housed in City Hall. Thus, the City has allocated resources to the development of geothermal energy and, as per the above, has maintained control of resource (geothermal) development within the City limits.

Transportation and Accessibility

Due to the relative isolation of Lassen County and the sparse nature of settlement within the County, freight and transportation have been and continue to be problems for the

¹EG&G Idaho, Inc., Direct Heat Application Program, Idaho Falls, Idaho, September, 1979.

local community. Freight is presently carried primarily by truck to outside markets. Lack of adequate rail and air service continues to be a hindrance. Transportation within the County is costly and energy consuming due to the spread-out nature of communities and the lack of adequate transportation services.

Railroads. The area is served by two railroad companies, Western Pacific and Southern Pacific, over routes that perhaps met the needs of the past but definitely do not meet the needs of the present. Westwood, at the extreme western edge of Lassen County, is served by the Western Pacific north-south Feather River Route, which connects points in California with Oregon and the Pacific Northwest, merging with the Great Northern Railroad near Bieber, Lassen County. The Western Pacific also serves Herlong in the extreme southeastern corner of Lassen County on its east-west track connecting California and eastern points via the Feather River Canyon. A mainline of the Southern Pacific comes out of Nevada through eastern Lassen County and north to Klamath Falls, Oregon, and beyond. A branch line connects the City of Susanville with the Southern Pacific mainline at Wendel in eastern Lassen County. The branch line track extends through Susanville westward and connects with the Western Pacific mainline at Westwood. However, the branch line is only operative from Wendel to Susanville, while the Susanville to Westwood portion has been unused for many years.

Despite appeals from local governments and industries, the Interstate Commerce Commission (ICC) has allowed the Southern Pacific Railroad to abandon the Susanville Station and rail line connecting Westwood and Susanville. Although the line has not been used for approximately twenty years, the decision, which was finalized May 27, 1978, ruined local hopes of a rational rail pattern for westward movement of commodities from Susanville and the Honey Lake Valley.

Trucking. This is the principal source of transportation of general commodities for most businesses in the Susanville area. The two major trucking services operating in the area are Consolidated Freightways of Reno, Nevada, and Delta Lines, which is the only major trucking firm presently maintaining a terminal in Susanville. There are a scattering of specialized smaller trucking firms operating in the area for such things as hauling lumber, cattle and heavy equipment. Most shipments of less than car-load size go by truck, while large bulk shipments, mainly lumber, go by rail. Delta Lines provides daily service to points in California and elsewhere. Consolidated Freightways schedules daily service from Susanville. Service is generally considered reasonable, if restricted, and fills most of the needs of the area that are on a planned, routine basis. Pacific Motor Trucking Company, a branch of the Southern Pacific Company, has filed an application with the Interstate Commerce Commission for approval of a proposed route between Alturus, Modoc County, and Reno, Nevada.

Highways. There are no freeways in Lassen County. The major highway passing through the county is U.S. 395, which connects Reno, Nevada, with southeastern Oregon, and traverses eastern Lassen County within six miles of Susanville where it connects with State Route 36. State Route 36 passes through the main business district of Susanville and provides connections with Westwood, Eagle Lake and Lake Almanor. It provides a direct connection between the Susanville Area and Red Bluff and intersects with other highways providing access to Chico and Redding. The most efficient route to Sacramento and the Bay Area from the Susanville Area is through Chico and down Highway 99 or Interstate 5. An alternate route, which is actually closer for traffic originating in the lower Honey Lake Valley, is through Reno and west on Interstate 80.

Traffic in the county is heaviest on U.S. 395, particularly between Keno and Susanville, and has been increasing at a rapid pace in recent years. This traffic accounts for most of the overnight stops in Susanville and provides an increasing volume of business for motels and restaurants in the area.

Air Transportation. There are no commercial air services to the Susanville Area or anywhere in Lassen County. The closest commercial facilities for scheduled flights for the area are in Reno, Nevada. Secondary class airports are available at Susanville, Bieber, Herlong, Ravendale and Spaulding (see Table 18-10).

Utilities

Natural gas is not available in Lassen County. Electric power for the area is supplied by the Lassen Division of California-Pacific Utilities Company. In order to determine the competitive position of the Susanville Area with other areas of California in terms of electricity cost, comparative cost figures from the California Public Utilities Commission estimating differences in billings for various categories of service between Pacific Gas and Electric Company and California-Pacific Utilities Company are provided.

- Domestic: California-Pacific is slightly lower in basic electricity rates than P G & E.
- Small Commercial: The basic charge for this category shows California-Pacific approximately 30 percent higher than P G & E. However, as consumption increases the California-Pacific rated drop below P G & E's. Therefore, depending on the amount of electricity consumed each month, a small commercial customer in the Susanville Area will pay a similar billing to a business purchasing electricity in an area served by P G & E.

TABLE 18-10
AIRPORTS IN LASSEN COUNTY

BIEBER - Southard Field

Runway: Length - 2,980'
Width - 36'
Improvements - Asphalt overlay 1977
Condition - good
Landings - 500 per year

HERLONG

Runway: Length - 3,280'
Width - 25'
Improvements - Asphalt overlay 1979
Condition - good
Landings - 500 per year

RAVENDALE

Runway: Length - 2,890'
Width - 25'
Improvements - Asphalt cover 1978
Condition - good
Landings - 250 per year

SPAULDING (Construction underway - July 1980)

Runway: Length - 4,600'
Width - 50'
Improvements - 2" Asphalt cover 1980
Condition - very good
Landings - 750 per year

SUSANVILLE (CITY) - MUNICIPAL

Runway: (Main): Length - 3,750'
Width - unavailable
Improvements - none- paved
Condition - fair
Landings - 6,120 per year

Runway: (Secondary): Length - 2,900'
Width - unavailable
Condition - fair/poor
Landings - emergency only

- Large Commercial: California-Pacific generally costs about 10 percent more than P G & E for large commercial customers, such as super-markets, with similar load factors.
- Industrial: In this category, for customers with similar load factors, such as lumber mills, California-Pacific charges are approximately 15 percent higher than those of P G & E, and the disparity increases as consumption rises.

The other utilities/services, such as water and sewage, facilities in the City of Susanville, Westwood and Herlong are adequate. There should be no problem providing these services in the area.

Commercial Industrial Land Availability

The City of Susanville is completely zoned for industrial, commercial and residential land uses. The primary undeveloped area zoned for general commercial use is located on a strip of State Route 36 at the eastern entrance of the city. This area is adequate for considerable future development without presenting any additional rezoning problems. A small section on the southwest side of the City is zoned for light industrial use with an access road. A large section on the southeast side of the City is zoned for heavy industrial use. Another portion, of approximately sixty-five acres, could be readied for industrial occupancy in a short period of time. It has an access road, water, electricity and a nearby railroad siding. The remaining portions of the area zoned for heavy industrial use are unoccupied and undeveloped. All industrially zoned land in the City is under private ownership.

The town of Westwood has ample land available for industrial use. A section of land south of town owned by Greater Westwood, Inc., and a section of land east of town

owned by Beaty & Associates are available for either lease or purchase. There is a total of approximately 80 acres of usable land in these two sections. They are presently being rezoned for industrial use. There is a Western Pacific Railroad siding available in Westwood.

Throughout the rest of the Susanville Area, from Westwood to Herlong, there are thousands of acres of land zoned for general agriculture which can be obtained for industrial use through a use permit. The land is relatively inexpensive, although prices are subject to fluctuations depending on the owner and how badly the buyer wants a particular piece of land. Industrial land availability is not a problem in the Susanville Area.

As the above description of the available utilities and accessibility indicates, Susanville and Lassen County have good utility service but fair accessibility to the major market areas because of the location of the city of Susanville and Lassen County. However, while the accessibility of this region to major markets suffers by comparison to other areas in the State of California, the ample supply of labor force and the presence of geothermal resources shall prove to be significant attractions to the expansion of the local industrial base.

Attitudes of Local Government and Industry Personnel Toward Macro-Environment Conditions

In addition to exploring Susanville's macro-environment from secondary sources, this project also directly assessed attitudes toward macro-environmental conditions. Two respondent types, local government and industry personnel, were asked a series of questions on the following four macro-environmental conditions:

- Economic,
- Political, social and institutional,
- Regulatory, and
- Conditions affecting relocation of industry.

An early global question requested that respondents describe the most important influences on the use or non-use of geothermal in the area. Local government respondents (Question 44) appear optimistic, listing more facilitators than inhibitors to use. Four of the nine government respondents, for example, felt that "cost savings" served as a strong incentive for geothermal energy use. Availability was regarded as a prime motivator by two respondents. Other important influences for use included the federal government, the sheer "will to get it done", the high price of other energy sources (e.g., oil and electricity), potential for increased employment and a demonstration project. The few local government representatives who mentioned inhibitors to the use of geothermal energy spoke either about too many regulations or the lack of low cost capital and funding.

Industry personnel (Question 53) also mentioned more facilitators than inhibitors to geothermal energy use. "Low cost" or "cost-effectiveness" was perceived as an important influence by four of the thirteen respondents. The clean, non-polluting aspects of the resource and the maintenance of a closed system through reinjection emerged as important incentives and were mentioned by three respondents each. Others spoke of availability, government regulations, demonstrated system effectiveness, management expertise, and technical application. One potential user cited "general attitudes" as a critical influence, arguing that the public

did not necessarily want industrial development in their "pleasant community". There were no notable differences between current and potential industries in their perceptions of important factors affecting industrial use of geothermal.

The four current industry personnel were asked whether any outside agencies or persons had influenced their decision to use geothermal energy (Question 30a). Only one respondent said "Yes", naming the Susanville Elementary School District that owned and operated the swimming pool his firm was involved with (Question 30b).

Overall, the relatively low cost of geothermal appears to be the key motivator for use. Industry personnel, unlike government respondents, recognized the importance of reinjection, good management, and other technical issues.

Economic Conditions

Descriptions of economic conditions that impact on geothermal use varied for government and industry personnel. The summary table below displays economic factors that local government perceived as important to geothermal use (Question 45).

<u>Condition</u>	<u>Number Responding</u>
Low cost/savings for the city/low initial investment	3
Increased employment/job economics	2
High cost of other fuels	2
Financing through grants	1
Reagan's activities due to our dependence on Federal funding	1
Population growth	1
Need agri-industry	1

One-third of the nine local administrators referenced low costs as a necessary condition for future geothermal use. Two respondents cited increased employment as a likely spur for future use. Two others felt the high cost of other fuels would create a favorable climate for geothermal. Still others mentioned grant financing, Reagan's activities and general population growth as economic factors that would influence geothermal use.

Industry personnel, especially potential users, described economic conditions from a far more "negative" perspective than did local government respondents. The summary table below highlights specific comments. Although some industry personnel mentioned favorable economic factors for geothermal use (e.g., additional jobs, attraction of industry, and the high cost of fossil fuels) roughly half (n = 6) described negative economic conditions that would prevent geothermal use. One potential respondent, for example, felt that the expense of developing geothermal energy would hamper use. Another thought the geothermal energy might be over-used through industrial development, arguing that the actual supply was unknown. Still others claimed Susanville did not have industry and that industry would not become a key employer or that there were no economic changes surrounding geothermal energy use.

<u>Condition</u>	<u>Number Responding</u>	
	<u>Current</u>	<u>Potential</u>
Additional jobs/employment	2	2
Stimulate economy/attract industry	2	2
Geothermal's expense	-	1
High cost of fossil fuels	1	-
Growth will shock Susanville--like when oil was discovered in Evanson, Wy.	-	1
If over-used by too much industry, we'll hurt ourselves	-	1
No changes/ Don't have industry/ will not be big employer	1	3

Both local government (Questions 46 and 47) and current and potential users (Question 55) were asked about the future direction of economic conditions. Seven of the eight local government respondents said future conditions were "favorable" for the development of geothermal energy, while one indicated that future conditions were "unfavorable".

Local government representatives made the following comments about the future direction of geothermal energy, as influenced by economic conditions.

- "The change in Federal Administration and the economy will hurt."
- "Expansion"
- "Expansion toward district heating in homes and government buildings -- agri-industry use will be great."
- "At threshold -- need private dollars and then could dispense with Federal."
- "Will progress with some difficulty of capital funding."
- "Good"
- "Very Good"

Thus, while local government respondents in Susanville see the economic outlook as favorable, there is some concern about financing the development of geothermal energy.

The future economic conditions and their impact on geothermal energy development were perceived somewhat differently by current and potential users. Two current users saw the future economic conditions as unfavorable and not improving in Susanville until industry is attracted to reduce unemployment. Other responses from current users were more favorable. One predicted that geothermal technology would improve

and another said that fossil fuel will become more expensive. One current user suggested that the government offer incentives to promote business use of geothermal energy.

The perceptions regarding the future direction of geothermal energy and economic conditions received from potential users were varied. The responses, each given by one respondent, are listed below.

- "Economic conditions will improve and employment will increase."
- "The new President will hurt us (Susanville) and we need geothermal to offset his policies."
- "Well will over-use geothermal if too much industry comes in."
- "Unless private development is encouraged, there will be no significant increase in the utilization of the resource."
- "No change."
- "Development will move ahead but rather slowly."
- "Don't think economy will force us into using geothermal here."
- "Geothermal will be great cost savings if retrofitting isn't too expensive."
- "More geothermal use if it were not so expensive."
- "Economy will become more healthy."
- "Americans will discover leisure time."

The potential users did not foresee a particularly favorable set of conditions. Some were concerned with costs of retrofitting, but more often than not potential users did not see the economy as spurring leaps in the development of geothermal energy.

Political, Social and Institutional Conditions

Local government respondents were asked to describe the political environment for the development of geothermal energy (Question 53). Two officials refused to answer the question. Six of the remaining seven said the political environment was either "good" or "supportive". Other expansions on the favorable comments were:

- "City has no problem, but City and County knock heads."
- "Could be good if City and County would see fit to work together."
- "There is work to be done and I see the need for the County to take a more active and positive role."
- "To date we have not had any barriers to development."
- "We have elected people who support geothermal."

Several of the comments reflect a conflict between the City and the County. County officials did not respond to the question.

One respondent made an unfavorable comment. He said that the political environment was no longer favorable (because a particular person had been "ousted"), but that the "Statemen are for us".

When asked about the future outlook for political and social conditions that might influence geothermal energy development (Question 54), two respondents declined to answer. Of those responding (n = 7), one saw a change in Federal and State Administration influencing geothermal development, but did not know in what way; three said the outlook was "good" or "supportive" for geothermal development. Two of these respondents also mentioned a need for City and County coordination. The remaining three comments were:

- "May be some concern by County Planners that long-term planning will not keep pace with geothermal development."
- "As the price of oil increases so does interest in geothermal."
- "There is a need to develop geothermal in houses."

Industry representatives were asked what political, social and institutional conditions they saw as influencing the development of geothermal energy (Question 56). The responses received from each of the current users are paraphrased below.

- Small-town, petty politics. It's human nature -- everyone thinks someone else will get the things they are not.
- Ordinance 79-605 has detrimental effect on private development. It restricts drilling and gives power to principal geothermal director as to who can and cannot develop resource.
- City is encouraging some public against it -- they want royalties for its use.
- Definitely political -- governor wants Susanville to lead in new field of geothermal development.

The potential users had slightly different responses. Each of the following was mentioned once as a factor influencing geothermal development.

- City wants tax base
- People want employment
- Institutions want employment
- Energy independence

- There is no public opposition -- nothing negative
- Need government help getting systems off the ground
- Geothermal use will improve the quality of life (decreased energy costs and attractive to industry)
- Need money
- Government and State will use geothermal for heating and electricity
- Geothermal will completely eliminate old structures

Generally, the potential users see political, social and institutions as favorable for geothermal energy development in Susanville and some see geothermal energy development as having a favorable impact on conditions in Susanville.

Current users of geothermal energy were asked what effect local government had on their decision to use geothermal energy (Question 31). Two respondents said "none" and one current user who was part of the local government (Municipal Swimming Pool) said, "Everything -- we are the local government." The remaining current user said that through Ordinance 79-605 the City Council made it very difficult to drill inside the City by limiting depth to 250 feet and claiming a Federal law restricted deeper drilling. He said he has researched the question and is prepared to litigate to have a deeper well (hotter temperature) and that the California Department of Oil and Gas has given him clearance to drill 2,000 feet.

Current and potential geothermal users were both asked what effect they thought the local government had on the use of geothermal energy by industry in Susanville (Question 57).

All respondents thought that local government had a strong effect. Reasons given were as expected -- the City's control over the development of geothermal energy. Obviously, Susanville and Klamath Falls were expected to differ on responses to this question because of the difference in the roles played by the City in the regulation of geothermal development. Klamath Falls' industry respondents did not see the local government as having the impact that Susanville's industry respondents did. Only half of Klamath Falls' respondents said local government had an effect on industry geothermal development.

Local government officials were asked what they thought the attitudes of citizens toward geothermal development were (Question 50). Eight persons answered the question. Five said "Somewhat favorable" and three said "Very favorable". In Klamath Falls, six out of seven respondents had said "Very favorable". The local government officials in Susanville did not perceive the citizens' attitudes to be as favorable as did the Klamath Falls' local government officials.

Four Susanville local government representatives said, "Yes, there are special interest groups in the area focusing on geothermal" (Question 51a). The special interest groups identified (Question 51b) were:

- The Merchants' Association,
- Lassen Community College,
- The School System,
- County government,
- Private industry,

- Developers (to make money), and
- People working on the project at Wendel.

All "groups" were thought to be "influential", except for the people working on the project at Wendel. The respondent said they were not very influential.

When asked about agencies or organizations involved in the promotion of geothermal energy (Questions 52a and 52b), the local government officials named the:

- County,
- School District,
- Private developers,
- Prison,
- City,
- Chamber of Commerce,
- Engineers,
- Citizens' Committee,
- Lassen College, and the,
- Lassen Board of Supervisors.

The City was named by a majority of local government officials.

Industry respondents were asked what local groups or agencies they thought influenced the industrial use of geothermal energy in Susanville (Questions 58a and 58b). Half (n = 6) said they thought no group other than the City influenced geothermal energy use. The two current users identified:

- Lassen Community College,
- Board of Supervisors,
- Wes Davis, and
- LAFCO.

One current user said that Wes Davis had demonstrated a practical application of space heating on a low budget. LAFCO is a County board made up of representatives of the County Supervisors and citizens who can influence energy policies in the County.

Potential users identified the following:

- LAFCO,
- State,
- School District,
- City, and
- Utility and financial firms.

Two of the four potential users responding identified both the City and State.

Regulation

Regulation (City Ordinance 79-605) was cited by several respondents as a social, political and institutional factor influencing geothermal energy development. However, local government officials were also asked if there were any regulatory issues currently under debate (Question 57a). One person declined to answer and four other respondents said "No". Of the four respondents who said "Yes", all cited essentially the same issue differently (Question 57b):

- Land use planning,
- Whether we should add to geothermal development,
- A Park of Commerce proposal outside the City that was denied by LAFCO and taken to court by the City and developer, and
- Conversion of land to hot house industry and use of forest waste to generate electricity because people are afraid they will lose their source of wood fuel.

Basically, the issue appears to be "land use" and further development of geothermal through specific projects.

Eight of the twelve industry respondents said that there were current regulatory issues influencing the development of geothermal energy (Questions 60a and 60b). Five of the eight cited City Ordinance 79-605 which restricts drilling within the City limits. The two other "issues" mentioned were the Lassen Water Control Board and "State regulation", but respondents declined to indicate the specific issues here.

Apparently, the City control over drilling has become a debated issue in Susanville. The industry respondents said that "no one but the City can drill". This appears to be "the regulatory issue in Susanville; thus, Susanville does not have the debates over requirements for drilling (reinjec-tion, etc.) that Klamath Falls has, but rather debates over restrictions on any drilling at all. This is due to the structural differences in the development of geothermal ener-gy between the two areas. Klamath Falls can and does have widespread drilling and Susanville cannot because of the City Ordinance. While drilling in Susanville is not prohibited, some respondents appear to interpret the restrictions as functional prohibitions against drilling. Further, well depletion is not the issue in Susanville that it is in Klamath Falls.

Four industry respondents saw the current regulatory environment as "detrimental to" or "hampering" industrial development of geothermal energy (Question 59). The only other industry representative responding to this question said that the regulatory environment only influences the disposal of waste.

Local government representatives were asked whether they thought that the local government and regulatory environment provided strong leadership in the area of geothermal (Question 48a). Eight respondents said, "Yes", and one said "No".

When asked "Why?" (Question 48b), the person saying, "No", said, "City doesn't have the ability to do it properly but does have the will; the County has the ability but not the interest". Comments received from persons who thought that strong leadership was provided are presented below.

- "It is the only agency (City) that has taken on the leadership of this energy source."
- "We have a very good man there" (i.e., Phil Edwardes).
- "Proven track record."
- "City controls it entirely."
- "We have proven it. We are doing it with the support of our citizens."
- "We have a geothermal office staffed by very competent people. We have geothermal ordinance controlling the use of the resource."

- "They passed an ordinance prohibiting the drilling of geothermal wells by individuals or companies without a permit which they get by without issuing because of a clause on the ordinance that states that a well cannot be drilled if it is not in the best interest of the City or County. Not one permit has been issued! The citizens are very angry because the City is monopolizing it for their use. The citizens see no benefit for themselves."

When asked who regulates geothermal locally (Question 55a), local government officials said either the City, the County or the State. All but one respondent named at least the City and several said "The City in the City and the County in the County". One person named the County Planning Commission.

Local government officials did not elaborate on the regulatory process (Question 55b). One person did not know. Six respondents cited land use and drilling permits with several also mentioning zoning. Another respondent said, "Environmental Review Committee, then the Planning Commission, then City Council; same for County except it goes to the Board of Supervisors".

Local government officials were also asked what the posture or attitudes of local regulators is toward geothermal energy (Question 56). Five persons simply said, "Good," or "Positive". Responses received from the four other local government representatives interviewed are presented below.

- "The City is 100 percent supportive. The County is a question mark. I guess they question the reasonableness of the development."

- "Good at the moment -- no stumbling blocks except red tape."
- "Today, basically good. Lack of understanding and respect threatens positive action."
- "Speculative -- no further response."

In general, it appears that perceptions are more solidified regarding the City than the County. This is probably because the City is seen as having taken some direct action, and the County is not seen as having taken as much "control" over geothermal development.

Conditions Affecting Relocation of Industry

Current and potential users were asked what conditions they saw affecting the relocation of industry to Susanville (Question 61). The responses received reflected attributes and barriers to relocation. The conditions cited were:

- Zoning,
- Transportation difficulties,
- Restrictive attitude of LAFCO and County Planning Commission,
- Lack of significant resource,
- Availability (lack) of capital,
- Lack of planned space,
- Availability of land,
- Low cost of land,
- Availability of geothermal,
- Harsh climate,

- No department is set up to attract industry, and
- Nice community.

Several of the respondents mentioned transportation and weather difficulties.

Over half of the conditions cited were barriers to relocation. While the conditions cited by Klamath Falls respondents were dissimilar to those cited by Susanville respondents, both did mention reasonable land costs. However, Klamath Falls respondents cited more conditions conducive to relocation than did Susanville respondents. Susanville respondents saw more barriers to relocation than did Klamath Falls respondents.

Current and potential users were asked what the City of Susanville could do to attract potential users of geothermal energy (Question 52). Half of the respondents (n = 7) said that the City should finish their development so others can see how geothermal works. Because of development restrictions there is "dependence" on the City to show the usefulness of geothermal energy.

The remaining responses were varied and are described below.

- "Need better transportation and raw materials."
- "Go out and attract industry."
- "Mechandise the fact that we have a geothermal heating district."
- "Use Chamber of Commerce and industrial connections by planning to establish sites."

- "I think they are doing it -- promotion."
- "Could be more helpful in allowing persons or corporations to drill their own wells."

Again, Susanville responses did not overlap those of Klamath Falls respondents.

Local government officials were asked what the City or County is now doing to attract industry to Susanville (Question 49). Two officials did not respond and three mentioned development of the industrial park. One respondent said the City was currently answering private sector inquiries, but that was about all because the project is not yet operational. Other responses are described below:

- "Develop the resource so it will be available. There is also an agreement to attract industry through commercial contracts."
- "We have made a Statewide survey of the hot house industry and maintained communication with people who are interested in producing meat in a controlled environment."
- "County is doing nothing, City is promoting it strongly."

Three of the local government respondents said that industrial users of geothermal energy were increasing in Susanville (Question 58a). When asked why they said this, responses to Question 58b were as follows.

- "They will be shortly. They are awaiting the completion of the Industrial Park -- definitely users are waiting."
- "Because of recent development."
- "There are geothermal hot houses here today that weren't here five years ago."

The incentives cited by local government for relocation to Susanville (Question 59) were:

- Cost savings,
- Guaranteed resource,
- Living in a rural area instead of a city,
- Cheap land, and
- Availability of labor.

Cost (inexpensive) and availability of geothermal energy were the only two incentives mentioned by local government representatives in Klamath Falls.

The barriers to industrial development cited (Question 60) by local government in Susanville were:

- Transportation,
- Availability of low cost land,
- Small labor force,
- County attitude toward industrial land use,
- No property to purchase to build,
- Adverse climate, and
- Inadequate housing.

These barriers were dissimilar to those provided by Klamath Falls' local government. Klamath Falls respondents focused on drilling costs, relocation costs, lack of geothermal knowledge and the fact that Klamath Falls is not a major population area. Susanville respondents were extremely aware of the transportation difficulties (to market) in the area.

Five Susanville local government respondents indicated that "nothing" could be done or was being done to overcome the barriers (Question 61). Other responses were a court battle (to change County attitude), painting a positive picture and developing the resource.

Four local government officials described the attitude of the government toward attracting more potential users of geothermal energy as "favorable" or "good" (Question 62). Other comments were as stated below:

- "After all we can get."
- "Partially support."
- "Would like to see more industry."
- "Cautious optimism."

Question 63 asked local government representatives in Susanville what they thought the attitude of local citizens toward attracting more industrial users of geothermal energy was. Responses varied and are presented below.

- "About 90 percent are enthused. Some are not informed at all on geothermal and say no growth."
- "Indifferent."
- "Good."
- "Divided -- some don't want changes and some would agree if it were the right industry."
- "Partly supportive."
- "About half-and-half for and against."
- "They want more -- more employment."
- "Cautious."

These responses indicate a belief on the part of local government that local citizens have some ambivalence about attracting industry to Susanville. This was also true for Klamath Falls.

Six Susanville local government officials thought that there were other groups whose attitudes were relevant to attracting industrial users (Questions 64a and 64b). The groups cited were:

- Local banks,
- Existing businessmen,
- College System,
- Chamber of Commerce,
- County, and
- Local citizens groups.

The College (Lassen Community College) was mentioned by half of the respondents indicating that the College attitudes are perceived to be particularly relevant to industrial development.

Summary of Susanville Macro-Environment

The economy of Susanville is not prosperous. There is high seasonal unemployment and the lack of transportation facilities, such as railroads and commercial airports is not conducive to the attraction of new industry.

Similar to Klamath Falls, local government and industry representatives in Susanville saw cost savings and availability as important facilitators to geothermal use. Other facilitators were the DOE demonstration project and the clean, non-polluting nature of geothermal.

Few inhibitors to use were mentioned. Regulations, lack of low cost capital and public attitudes against attracting industry were cited as inhibitors to geothermal energy use.

The economic factor cited most frequently by local government as influencing geothermal energy use were the low cost of geothermal energy, potential for increased employment and high cost of other fuels. Susanville respondents were more concerned with employment factors than were Klamath Falls respondents. Industry personnel in Susanville saw a critical need to increase employment and stimulate the economy and cited these economic factors as conducive to geothermal energy development.

Local government respondents in Susanville saw the future economic conditions as favorable for the development of geothermal energy. Users were not as positive. Some were concerned about the new Presidential Administration and overuse of geothermal energy if too much industry were attracted. There were, however, more industry representatives who saw economic reasons for attracting industry but did not see economic conditions as particularly favorable for the attraction of industry to Susanville.

Perceptions regarding political, social and institutional conditions were mixed. The City is generally seen as supportive to geothermal development, although some respondents from both local government and industry question the organization of geothermal development in Susanville. The County is perceived as not taking as much of a lead in development as does the City. There is apparently some friction between the City and the County about the development of geothermal energy in the City and perceived control by a few persons. There is also an awareness of "mixed" public attitudes toward the City's control of geothermal development.

A major regulatory issue among both local government and industry is City Ordinance 79-605 which grants the City "control" over geothermal development. Other issues revolve around land use and the Park of Commerce that was denied development by LAFCO, a County Board.

Current and potential users named several barriers to the relocation of industry in Susanville: zoning, transportation difficulties, restrictive attitude of LAFCO and County Planning Commission, lack of significant resource, lack of planned space, harsh climate, availability of capital and the lack of a specific department whose function is to attract industry. Favorable conditions cited were: availability of geothermal energy and nice community.

Local government representatives were more positive. They cited cost savings, guaranteed resource, cheaper land and energy, the rural environment and availability of labor as positive attributes for the attraction of industry to Susanville. The barriers cited by local government were essentially the same as those cited by industry.

In general, the macro-environment is not overwhelmingly conducive to the attraction of industry to Susanville. The relatively isolated location and hence, lack of transportation pose potentially major problems to development. In addition, the restriction of development by the City does not, and was not intended to encourage private development of geothermal resources (i.e., drilling). The posture is one of expansion, but through controlled development under City auspices.

SECTION XIX

MEASUREMENT OF CAPABILITIES FOR SUSANVILLE

The purpose of Task V was to analyze infrastructure capabilities existing at the two sites. Specifically, the objective was to determine:

- Skills and services required and available,
- Resources, and
- Conditions affecting plant retrofit, expansion and relocation.

During the benchmark measurement phase the samples of promoters and developers and industry management were asked questions concerning their infrastructure capabilities and requirements. The first two parts of this section report those results. The final part of this section discusses other investigations of the infrastructure capabilities in Susanville.

Promoters, Developers and Industrial Service Companies

Respondents were asked what type of resources were needed for the development of geothermal energy (Question 30), and how they would evaluate Susanville in terms of these resources (Question 31). Responses to these questions for each current and potential promoter and developer are paraphrased in Tables 19-1 and 19-2, respectively.

TABLE 19-1

RESOURCES NEEDED AND EVALUATION OF SUSANVILLE FOR CURRENTLY
ACTIVE PROMOTERS, DEVELOPERS AND INDUSTRIAL SERVICE COMPANIES

Resources

Susanville Evaluation

People who are highly qualified
in geothermal and some of the
manpower -- can be unskilled and
trained to do what is necessary

We have some of the
manpower

Typical manpower and knowledge
-- more knowledgeable engineers

Pretty good -- they
are trying, anyway

Capital investment, a proper use for
the resource, profitability for
the developer

Good on all three
counts

Get drilling rigs and pipes in

Low -- they don't
have any industrial
backing that is
producing the types
of material they
need

Improvement of technical methods
to determine resource potential,
refinements in existing technology
and more skilled drilling personnel

Lacking in high
technology but
adequate for
construction

We have it all within our own
community

We have work pool --
it is all here
except for money

TABLE 19-2

RESOURCES NEEDED AND EVALUATION OF SUSANVILLE FOR POTENTIALLY
ACTIVE PROMOTERS, DEVELOPERS AND INDUSTRIAL SERVICE COMPANIES

<u>Resources</u>	<u>Susanville Evaluation</u>
Very limited -- we do have to seek outside technical assistance, but we have had no problems	we can handle it
If local, just pipelines. It is centralized system. Can create jobs. Can be used for growth and stimulation.	Good
Manpower and transportation	Susanville benefits from the remote distance of other sources of energy, thus, transportation becomes an advantage. Manpower requirements are small and have no impact on Susanville.
Not much at all	Good.

As indicated in Table 19-1, current promoters responding to resource needs questions said there was a need for:

- Manpower,
- Knowledge,
- Capital investment,
- Proper resource use,
- Profitability,
- Drilling rigs,
- Pipes, and
- Technical refinements.

Most respondents thought that Susanville had the necessary resources, but some saw Susanville lacking in financial/industrial backing, manpower, and high technology.

The potential promoters and developers identified pipelines, manpower and transportation as needed resources (Table 19-2). Susanville was evaluated as having the necessary resources.

Promoters and developers were asked what factors or conditions they saw influencing industry's use of geothermal energy (Question 32). The four potential promoters and developers said:

- Cheap alternative source of energy,
- Money,
- Small industry, or
- Clean industry.

One current promoter and developer did not answer the question. The other currently active promoters and developers said:

- Cheap, readily available energy,
- Better knowledge of resources and recognition that lower temperatures and direct heat generation has many favorable applications,
- Alternative energy sources,
- Profitability (can geothermal be developed cheaply and with a profit),
- Availability of geothermal, or
- Change City and County zoning.

When asked what factors or conditions they see as influencing industry's use of geothermal energy when retrofitting or expanding a plant (Question 33), one potential promoter and developer said:

- Costs,
- Reliability of the resource, and
- Long range factors.

The other three potential promoters and developers said only the "start-up costs" (i.e., cost of retrofit). Current promoters and developers all said costs, except for one who said a broader knowledge of the resource and tax incentives would influence retrofit and plant expansion.

Promoters and developers were also asked what factors and conditions they saw influencing plant relocation and use of geothermal energy (Question 34). Potential promoters and developers said:

- Costs of moving and retrofit,
- Susanville needs a marketing concept to show what geothermal energy can do and convince people that Susanville is the right place to do it,
- Decision to move, economics and resource capability, or
- Supply of geothermal, economics and decrease government regulations.

Current promoters and developers thought that conditions affecting plant relocation and geothermal use were:

- Resource knowledge,
- Zoning,
- Energy, raw materials and transportation,
- Profitability, or
- Cost savings.

Profitability was mentioned by two respondents and all other conditions were mentioned by a single respondent.

Industry Management at the Site

Three of the four current users of geothermal energy retrofitted an existing plant in order to use geothermal energy (Question 22). One current user, a greenhouse owner, incorporated geothermal energy into the plans when the greenhouse was built.

All current users had plans for changes or expansion in their use of geothermal energy (Questions 19a and 19b). The greenhouse owner plans to add more greenhouses and sell hot water to the industrial park. The flower boutique owner plans to enlarge his well capacity and drill to obtain temperatures in excess of 225 degrees. The Church plans to add a better converter

and get new and better pumps. Finally, tentative plans for the municipal swimming pool include further development of the well to obtain higher temperatures so that pumping costs are lower.

Current and potential users were asked about incentives available for the use of geothermal energy (Questions 50a and 50b). Two current users said there were no incentives available. Of the two who said there were incentives, one did not know what, but thought they were from DOE, EDA and ERDA. The other thought tax incentives were available from the State.

Four potential users thought incentives were available. One said tax incentives were available, and another said some types of incentives were available from the State and Federal Governments. One potential user cited grants from the State and Federal government as incentives. The remaining potential user mentioned the Energy Security Act and that DOE grants pay 90 percent of costs if you do not hit geothermal and 10 percent if there is a successful drilling.

When asked what could be done to increase industrial use of geothermal energy in Susanville (Question 51), current users had the following responses:

- Greater incentives,
- Low cost money for development,
- Tax incentives,
- Less red tape,
- Demonstration projects,
- More education programs,
- Distribution center -- find out who gets to use it and how to reinject hot water, and
- Develop industrial park.

One potential user did not know what could be done, and four said that continued development or availability of the resource would increase industrial use of geothermal energy in Susanville. Other suggestions were as follows.

- "Seek business, charge them no rent and perhaps take 10 percent of profits."
- "Promotion."
- "Get some Federal funding to help develop it."
- "Advantage at a competitive price is essential to any industrial development."

Infrastructure for Geothermal Development in Susanville

As shown in Table 19-3, the Susanville area contains a variety of firms providing technical, legal, business and financial services to potential geothermal energy developers. However, a telephone survey of seventeen of the firms indicated that none of these firms have had any previous experience with geothermal energy development. Furthermore, the telephone interviews strongly suggested the absence of technical knowledge or awareness of technical problems related to geothermal resource development. A large proportion of those interviewed expressed willingness to undertake assignments related to geothermal resource development, but only if explicit and clear directions (i.e. engineering specifications) were provided. Thus, technical infrastructure in Susanville, because of lack of previous experience, is marginal for geothermal resource development.

The legal, financial, and business community in Susanville also has very limited knowledge of the specific issues related to geothermal resource development. Telephone interviews suggested that these firms rely on the local city government for information and leadership in any development effort. Further, there

TABLE 19-3

AVAILABILITY OF TECHNICAL SERVICES FOR GEOTHERMAL
DEVELOPMENT IN SUSANVILLE

<u>Technical Business, Financial and Legal Services/Firms</u>	<u>Number of Firms¹</u>
<u>Technical</u>	
Air Conditioning Contractors	3
Architects	2
Building Contractors	58
Dealers in Construction Materials	10
Concrete Contractors	7
Dealers in Contractors' Equipment	10
Drilling and Boring Contractors	2
Electric Contractors	15
Civil Engineers	6
Environmental Engineers	6
Industrial Engineers	6
Mechanical Engineers	6
Structural Engineers	6
Excavating Contractors	12
Heating Contractors	9
Dealers in Industrial Equipment	1
Testing Laboratories	2
Machine Shops	7
Plumbing Contractors	13
Steel Fabricators	None
<u>Financial/Legal</u>	
Attorneys	31
Bankers	4
Business Consultants	3
Financial Institutions (Other Than Banks)	4
Insurance Agents	54
Real Estate Appraisers	12
Accountants	8

¹Includes multiproduct/service firms

Source: Susanville Yellow Pages

appears to be an absence of strong interest in geothermal resource development in the Susanville area among these types of firms.

The local banks in Susanville are not likely to be sources of financial assistance for geothermal energy resource development. At least, they are not sources of funding for large-scale development. The City projects have been financed outside the local infrastructure.

In general and broad terms, the existing local infrastructure lacks in depth and experience with geothermal resource development activities. In spite of geothermal development activities already undertaken, there is much to be learned by local drilling contractors, engineers, and builders in the development of geothermal resources.

This is more the case for Susanville than Klamath Falls. In Klamath Falls, because of the presence of the Oregon Institute of Technology, there exists more extensive knowledge and understanding of the technical, economic and financial issues related to geothermal development. However, even here, the number of professional firms which have had in-depth experience with various geothermal development issues is limited, although all of the firms interviewed expressed interest and willingness to participate in such development effort when required.

SECTION XX

DECISION PROCESSES FOR SUSANVILLE RESPONDENTS

As previously described in Section XII, Decision Processes for Klamath Falls, Task Six was designed to draw on Tasks One through Five to identify and define processes used to analyze information in order to reach commitment and regulatory decisions that significantly impact geothermal projects at the sites. This Section describes the information gathered on the decision processes of respondents for Susanville, California. Responses to specific decision process questions and data from previous sections will be used to draw conclusions and implications about decision processes regarding the use of geothermal energy. Macro-similarities across target study groups will first be discussed for the heirarchy of effects model.

Hierarchy of Effects

As previously presented in Section XII, the hierarchy of effects model describes states of the decision process from awareness through satisfaction.

Similar to the results for Klamath Falls, all Susanville respondents had passed through the awareness and knowledge states of the hierarchy of effects model. There were, however, varying degrees of knowledge across respondents. The majority of respondents considered themselves to be "somewhat knowledgeable" regarding geothermal energy (approximately 58 percent).

This contrasts with Klamath Falls results, as Klamath Falls respondents rated themselves as "very knowledgeable" approximately 60 percent of the time with no one considering themselves "not very knowledgeable". In Susanville, however, approximately 28 percent of the respondents said they were "very knowledgeable" regarding geothermal energy and approximately 14 percent said they were "not very knowledgeable". Thus, Susanville respondents considered themselves less knowledgeable about geothermal energy than did Klamath Falls respondents, probably because of the differences in use penetration between the two sites.

There were some differences across target study groups for Susanville. The majority of all industry, regulatory, local government and promoters and developers interviewed were, on an average, "somewhat knowledgeable" about geothermal energy. However, the financiers interviewed thought of themselves as "very knowledgeable" about geothermal energy. The financiers perceived themselves to be the most knowledgeable of all the target study groups.

Interest in geothermal development was very high across all target study groups, with the majority of respondents being "very interested" in further geothermal development. In addition, preference for geothermal as an energy source was very high. The vast majority of respondents in all target study groups ranked geothermal energy as their number one

preference as an energy source. Thus, as was true for Klamath Falls, Susanville respondents all tended to have transcended the awareness, knowledge and preferences states of the hierarchy of effects model.

The re-statement of the hierarchical model first presented in Section XII and depicted below is applicable to Susanville as it was to Klamath Falls.

Beyond the awareness stage, the stages of the model are largely interactive. The revised depiction denotes the interactivity and the potential for feedback among phases. For example, post-decision satisfaction (or dissatisfaction) may alter preferences through intentions. This may mark the beginning of a "new" decision process. Being satisfied with current use of geothermal, users in Susanville had plans for expansion or improving their existing equipment.

Intentions toward geothermal energy development varies with the target study group. Current users do have intentions to further develop their use of geothermal energy. Thus, this group of respondents has gone through the intention stage and report having decided on a course of action but have not yet taken it. The same was true in Klamath Falls. Decisions must be solidified through implementation and the model may be re-stated so as to include this shadow phase.

Current users, having already tapped the resource, do have the ability to implement their decision. This is not true for potential users in Susanville, who are waiting for a pipeline to the resource. The intentions among potential users are primarily to evaluate the resource, frequently in terms of economics (energy savings versus cost of retrofit), but they also report that they are likely to use the resource (given availability). Potential users tend to be at the intention phase whereas current users report having made a decision to continue and expand geothermal use.

For current users of geothermal energy in Susanville satisfaction was high. Potential users expected to be "very satisfied" with geothermal energy use.

It is more difficult to access commitment to geothermal energy development in Susanville than in Klamath Falls. In Klamath Falls there is widespread use and development of geothermal energy which is one (behavioral) measure of commitment -- to choose this energy source over other alternatives. Klamath Falls respondents expressed a strong commitment to geothermal energy both in response to attitudinal questions and in terms of a dollar decision to construction and commercial, industrial and residential use. The enthusiasm for geothermal energy in Klamath Falls permeated responses to the survey.

At least partially because of City restrictions on drilling, there is no widespread use of geothermal energy in Susanville. Thus, there is not the opportunity, at this time, for a behavioral measure of commitment, although behavioral commitment to use is evident among current users. The City of Susanville appears to have a high degree of commitment to geothermal energy, as reflected in the local government's attitudes and behavior toward geothermal energy. Attitudes toward geothermal energy are extremely positive among potential users surveyed, but commitment to use, cannot as yet, be accessed fully. There is a commitment to development, as evidenced by the citizen's support of development, whether or not there is agreement with the current method of development as dominated by the City. That is, an issue in Susanville is the City's virtual control over geothermal development; however, while some citizens disagree with the method of development, there appears to be unanimous support for the development of the resource. In this sense, it may be said that Susanville is committed to the development of geothermal energy.

General Model of Decision Process

Each target study group was asked questions about the decision process regarding geothermal energy. Since the ultimate decision being made and the process does vary somewhat by target study group, the survey responses are presented prior to a discussion of the general model.

As was true for Klamath Falls, many respondents had difficulty actually describing the decision process and often described factors considered during the process. As was expected, it is difficult to actually recount a dissection of a thought process since factors are frequently considered simultaneously and traded-off. Thus, many stages of the decision process, unless externally formalized as in the case of a regulatory process, are simultaneous (or there is continuous feedback among factors and phases) rather than sequential and orderly.

Local Government

Local government representatives were asked to describe the process by which the decision was made to be involved in the Susanville DOE demonstration project (Question 34). One person refused to answer and four respondents said they did not know the decision-making process.

The local government officials who responded did not tend to go into detail on the decision process. One person said that the programs were prepared by the geothermal office (City) and approved by City Council. Another said a Committee was formed and gave input to the City Council who held public hearings and made the decision. A third local

government official reported that the City Council acts upon things at each step and the Director (geothermal) assists in understanding. The final local government official reported the following.

In 1973, with the threat of the close of the State Correctional Institute and Army Depot, the economic future of the Community looked bleak. The decision to pursue the project was a consensus of the whole Community to pursue alternatives to give us a competitive edge in attracting private industry in order to provide non-government jobs to offset the high number of government jobs we had or threatened to lose. The City Council determined the best way was to pursue the program that lead to the project.

All respondents, except one who did not respond, whether they knew of the decision process or not, said the City Council made the decision (Question 33). One respondent added that the County Board of Supervisors voted support for the decision.

Synthesizing across respondents, it appears that the macro-process for decision-making can be described as follows.

This does not describe the decision process and factors that an individual citizen or City Council member might have gone through. Rather, it is a description of the macro-process and steps surrounding the actual decision process.

First, there appears to have been problem recognition, as described by one respondent, whereby the community needed to stimulate growth and saw the attraction of private industry as a viable means for so doing. The City Council then took the lead, formed a Committee, held public hearings and decided to pursue the DOE project. Critical to the implementation of this decision was funding. This project is the crux of geothermal energy development in Susanville and its success will be likely to strongly influence further development in the area.

Industry at the Site

Current users of geothermal energy were asked to think back to the decision to use geothermal energy and describe that process (Question 29). One current user did not know the original decision process, but others respond as follows.

- "We had the idea of a greenhouse to grow food. We were looking for the cheapest way and geothermal seemed to come naturally."
- "The elected officials made the decision based upon input from the Community."
- "In 1974 upon information received I was aware that there were geothermal wells drilled in the '30's which were capped and non-productive. I set out to locate these The consideration was to provide low cost produce for the City of Susanville I realized no cash out of the total project which led me to drill my own geothermal resource on property that I owned outright"

The final respondent described above indicated that he did find the wells drilled in the 1930's and that his limited partners continued with the project.

Potential users were asked what steps would be followed in a decision to use geothermal energy (Question 38). Responses are described below.

Respondent A: Gather information

↓
Contact other users

↓
Evaluate information

↓
Study alternative costs

↓
Review data with
School Board

↓
Make recommendation

Respondent B: Run cost analysis on how much money we would save in the long run -- if source were available and if cost were right we would convert.

Respondent C: Develop proposal and "source" kind of initial cost

↓
Submit proposal to the Director of
Correction

↓
Budget legislation

↓
Feasibilities studies

↓
State architect for planning

↓
Construction

Respondent D: Talk with technical management team

I make decision

Respondent E: If it is piped to me, I would then consider the cost of using it

Respondent F: Submit idea to regional office

Evaluation by regional engineers

Respondent G: Consultants evaluate costs of retrofitting and temperature. If either aren't right we will use propane.

Respondent H: We would work with the City to see about availability, water tempeature and cost.

Respondent I: Cost analysis for cost of conversion, cost of fuel we are now using and availability.

The decisions of current users appears to have been strongly influenced by availability and the desire for "cheap energy". One person actually went out to search for wells capped during the 1930s.

Potential users focused heavily on the costs of conversion. In situations where the potential user was a part of the government there was a more rigid process that would be implemented (e.g., respondent A and C). However, in all instances costs were a factor and for some firms water temperature was a critical determinant of use.

Financiers

Current and potential financiers were asked to describe the process by which their firm would make a decision about financing a geothermal resource development project (Question 24a). The process described by each respondent is presented below. The first two respondents were potential financiers and the remaining respondents were current financiers.

Respondent A: Initial contact to make early determination of security and size

Period of three months to three years of work with the client (because of uncertainties) to determine feasibility and ability to repay loan (no commitment is made during this time)

Respondent B: Review possibilities for government assistance and approval

Consider outlay, location and attitude of local people

Respondent C: Analyze financial structure of project: equity base, design, economic liability, resource and contract for sale of output

Obtain credit support

Respondent D: Follow standard State government contract and grant process

Respondent E: Obtain project proposal

Evaluate proposals against pre-established criteria to determine probable success: economic feasibility, environmental soundness, financial capacity of the people involved.

The major phases of the financiers' decision process appears to be the same for Susanville as Klamath Falls:

- Feasibility
- Cost-benefit analysis
- Risk analysis

Critical is the applicant's ability to repay the loan and the process seems to vary little depending on the type of financier. The project purpose, location, size and other parameters are important considerations.

Regulators

Regulators of geothermal energy in Susanville were asked to describe the process by which a site is regulated (Question 4). The responses received from the agency representatives are presented in this section, as taken directly from the answers given to the question.

City Planning Commission. When a drilling site is chosen and a permit is asked for, they study the location to determine if the site is compatible with the surrounding location. The permit is not issued until compatibility is determined, but the respondent did not comment on a probe as to the meaning of compatibility.

California Department of Oil and Gas. As the "lead agency", the California Department of Oil and Gas documents all environmental information necessary to make a decision as to whether the project would cause significant and adverse environmental impacts. Factors taken into consideration are:

- Air quality,
- Geological site stability,
- Terrestrial geology,
- Surface and sub-surface water quality,
- Land use conflicts,
- Socio-economic impact,
- Ecological impacts,
- Historical impact, and
- Cumulative effects or impacts.

Water Control Board. There is a list of waste discharge requirements on which the project is evaluated. Regulation involves two phases: a well development phase and an operational phase. The treatment of return water depends on the type of geological development.

California Solid Waste Management Board. The first phase of regulation is the determination of conformity of the project with the County Solid Waste Management Plan. This is done entirely by Board staff. The second phase involves the issuance of a solid waste facility permit prepared by the appropriate agent: County or City Public Health and Works Department. This is a discretionary decision, but both actions require compliance with environmental NEPA-CEQA impact requirements.

California Department of Water Resources. This Department currently is involved in geothermal projects being constructed in the Geyser area and Imperial County. Feasibility studies are now being conducted for a wood waste project near Susanville (electrical energy generation). The respondent reports no involvement in regulation.

California Air Resources Board. An application for authority to construct is submitted to the local air pollution control district. That application has to contain a description of the project and estimate emission rates of air pollutants, the impact on air quality and the description of the emission controls to be used to moderate the impacts. This is all done at the local level.

Lassen Air Pollution Control District. A drilling permit is required. A set of blueprints for engineer evaluation, a flow chart and plan for what is intended is submitted. The Air Pollution Control Officer looks at these materials and they are then sent to EPA Region IX headquarters in San Francisco. If the EPA engineers determine that the requirements of the Clean Air Act are met then a permit to construct is issued. After the building is constructed, but before it can operate, a one year operation permit must be issued. Each year the site is evaluated for compliance and permit reissue.

Region IX Environmental Protection Agency. Any discharge of pollutants to waters of the United States requires an NPDES permit. Permitting is based upon Federal and/or State regulations and policies. If there are no applicable regulations or policies, limitations are based upon best professional judgement.

The EPA is also involved in the regulation of air quality. Another respondent described this regulatory process.

Regulation is based upon the Clean Air Act, specifically the PSD (Prevention of Significant Alteration of Air Quality). The PSD imposes a limitation as to total degradation of air quality and control technology requirements.

The applicant is encouraged to meet with EPA at which time requirements they might be subject to are outlined. The next step is to submit the PSD application which includes an overview description of the project, potential air pollutants from the project, proposed control technology, data on existing ambient air quality, potential impact of project on ambient air quality and any other potential impacts from the emission of air pollutants. The application is reviewed by EPA and if there is any potential violation (for example, NAAQS), then EPA negotiates with the applicant until problems are resolved to EPA's satisfaction. EPA publishes their findings, gives the public notice and opportunity for comment and then takes all comments received into consideration. A final determination on the project is published.

The decision process of regulators is strongly dominated by the domain and purpose of a specific agency or board. The process is more formalized for this target study group than for any other and generally outside of the control of an individual decision-maker.

Promoters and Developers

As was true for other target study groups, promoters and developers were asked to describe in detail the process by which their firm would make a decision on involvement in a geothermal resource development project (Question 24). While all but one respondent was able to answer the decision process question, many respondents were unable to provide great detail.

One current promoter and developer, a driller, simply said, "If they have the money to pay for their wells, we'll drill them". Another current promoter and developer said his firm considered legality, environmental impact and benefit to the community. Other responses were:

- Decision is made from a project description and in Susanville you have to consider weather constraints.
- First we analyze costs, our capabilities and determine if we can get enough money to cover the costs and risk involved.
- I would work with an investor if my knowledge would be of use (promoter).
- We consider:
 - the probability of a desirable resource use,
 - physical location,
 - probability of environmental problems,
 - rate of return,
 - risk factors,
 - proximity to power system or market, and
 - total economics.

All potential promoters and developers mentioned economics. One said that the decision "in a nutshell" was money--"Is it worth it?" Two other respondents said the decision was based on economics and technical feasibility. The Community College representative reported that they had a management team on campus that would review all relevant decision factors. This includes a review of resource cost, longterm effects, relationship to master plan, funding sources and State laws and procedures.

Promoters and developers appear to be primarily concerned with economic factors in their decision process. Well drillers are concerned about the client's ability to pay for drilling, given project feasibility. Developers who might have an equity investment in the project appear to go through a decision process that is similar to that of financiers: feasibility, cost analysis and risk analysis.

Generalized Decision Process

Figure 12-1 presented a general decision model developed from the Klamath Falls data. This decision model is also applicable to Susanville. However, the situation and environment is different between Susanville and Klamath Falls in many respects. In Klamath Falls, for example, the DOE district heating project was developed for the primary purpose of providing heat to government buildings. In Susanville, a primary purpose is to provide geothermal energy to businesses located in the area of the proposed pipeline and it was also reported that a major thrust was to attract private industry. So, while the process appears to be similar, the purpose and situation varies between the two sites.

Based upon information obtained in Susanville the decision process model presented in Figure 12-1 has been and is depicted in Figure 20-1. Although situations do vary between the two sites, parameters of the model are still applicable to both sites.

After awareness of the resource, there is some type of problem recognition. Problem recognition may take many forms. For potential users in Susanville the problem might be whether or not to retrofit to use geothermal energy. For local government in Susanville one problem was how to use the area's resources to stimulate the economy. Strictly stated, problem recognition occurs when there is a deviation between an actual and an ideal state. Awareness of government funding can stimulate problem recognition in that a community may want to develop a project to attract some of these funds (the ideal state might be to funnel these funds into a particular community).

FIGURE 20-1
DECISION PROCESS

Problem recognition stimulates the evaluation phases of the model that ultimately could lead to a development decision. The model is restricted to geothermal development in its stated stages, but if the problem were to develop less expensive forms of energy, alternatives beyond geothermal energy may also be considered.

In the evaluation of geothermal energy five phases are critical:

- Resource access,
- Match between energy use patterns and geothermal capacity,
- Social benefit and influences,
- Cost benefit analysis, and
- Risk analysis.

These stages are posited to be highly interactive and factors within and across each stage are evaluated against each other and traded-off. Each stage is a decision process in itself and the specific factors evaluated and their trade-offs will vary by target study group and specific needs of the evaluator.

Before active and extensive development consideration can occur, there must first be a match between energy use patterns and geothermal capacity as well as perceived or projected access to a resource. Actual access to a resource may not be determined until drilling commences, but the likelihood of access is evaluated and projected in the risk analysis. For the private well owner in Klamath Falls as well as other target study groups in Klamath Falls and Susanville this is a very important decision process phase. Susanville

potential users access probability is a certainty, given completion of the pipeline and location along the pipeline. Thus, this phase becomes much less important. However, active consideration of geothermal use, given a match between energy use patterns and geothermal capacity, begins in earnest after there is an expectation of resource access.

Evaluation of social benefit and influences, costs and risks will then determine a "go/no go" decision to develop or use geothermal energy. The process may be truncated at any phase where the factors do not meet acceptable levels.

The decision to develop does not ensure development. In the resource development phase the project may be slowed or halted depending on drilling results, funding levels or any other unacceptable variable level. Obviously, the decision-maker, developer or user may be satisfied or dissatisfied with the results of the project at any stage in the process (e.g., dissatisfaction may occur if a successful well is not drilled), but ultimate satisfaction or dissatisfaction with use requires completion of the development project.

The model presented in Figure 20-1 differs from that presented in Figure 12-1 in that it contains problem recognition and resource development stages. The resource development stage is actually an "action stage" rather than a "decision process stage" in that it represents an action taken as result of the decision process. It is thus enclosed in dotted lines, but is a necessary component in the evaluation of satisfaction or dissatisfaction with use. Resource development is not necessary to the evaluation of satisfaction or dissatisfaction with the results of the decision process (which may occur at the truncation of any stage).

Concluding Decision Factor Comments
for Susanville

The standard adoption process model is applicable to both Susanville and Klamath Falls.

However, many more people in Klamath Falls are in the adoption stage (continued use) than is true in Susanville. This is because of the widespread drilling and use of geothermal in Klamath Falls whereas drilling has been more restricted in Susanville. This restriction is only a partial explanation, as the restriction is relatively recent and geothermal development in Susanville was not widespread prior to the restriction. Klamath Falls is larger (population) and more economically active than Susanville.

Individual "users" (potential) in Susanville may be characterized as in the evaluation stage, for the most part. More widespread trial will occur when the pipeline is completed. In a geothermal use situation where "large" capital outlays are required for trial, it is highly probable that adoption will follow trial, as users are likely to continue using.

In general, the commitment to geothermal energy in Susanville does not appear to be as high as in Klamath Falls. Very few people have "tried" geothermal energy in Susanville and many are in the "evaluation stage" in terms of their own use. However, there is a community commitment in Susanville to geothermal development, although most private individuals are not committed to their own development of the resource (as is true in Klamath Falls). People in Susanville have not had the widespread opportunity to witness direct applications of geothermal energy as have the people in Klamath Falls. The target study groups who appear to be most committed to development in Susanville are the local government and current users. Potential users may be awaiting availability to establish their personal commitment and adoption. The diffusion process (process by which groups of people adopt an innovation) has hardly begun in Susanville. It is, however, well along in Klamath Falls.

The Susanville sample did not contain any relocaters. Thus, relocater decision process information is not presented specifically for Susanville. However, the information on decision processes obtained from potential users in Susanville is relevant to the expansion of geothermal energy use by industry already residing in an area.

Industry relocating to Klamath Falls will probably be responsible for drilling their own well. The City of Susanville can make the resource available to potential relocaters by providing access to an existing well. The City of Susanville has created a situation in which they can reduce the risks of resource access for a firm. While the Klamath Falls data does not indicate that geothermal energy is an important factor in the relocation decision process, the City of Susanville may be in a position to use their geothermal energy

resource as much as possible (by providing certain access) to attract industry. However, raw materials, labor and transportation are likely to remain critical factors in the relocation decision process. A match between industry needs and community attributes is likely to be the crux of a relocation decision. Susanville developers and promoters are seeking out firms whose needs are consistent with the offerings of the community. Gasohol manufacturing, greenhouses, electronics and wood products firms are likely targets for the use of geothermal energy.

Section XXI contains further discussion of the implications of Susanville and Klamath Falls data for municipalities seeking to further develop their geothermal resources. The two study sites have vastly different geothermal development situations; yet, some strikingly similar implications emerge. Differences between the two sites also provide insight into the potential effects of the two different approaches to geothermal resource development.

SECTION XXI
CONCLUDING COMMENTS ON THE COMPARISON OF
KLAMATH FALLS AND SUSANVILLE

Comparisons of specific data gathered for Susanville and Klamath Falls are contained in Sections XIII through XX and in the Executive Summary of this report. The purpose of this section is to provide concluding comments and an overview perspective on the data gathered for this study, as well as to provide implications of these data.

The conclusions and implications that can be drawn from the study are restricted to the sample characteristics and the methodology used. The study was a case study of two areas involved in the development of geothermal energy: Susanville, California and Klamath Falls, Oregon. The results may not be able to be generalized to other areas and the unique characteristics of Susanville and Klamath Falls must be considered when interpreting the results. In addition, phenomenon observed for Susanville and Klamath Falls may not be interpretable as cause and effect relationships. That is, characteristics of geothermal energy development at each site may be related to the organization of geothermal energy development at the sites, but it may not necessarily be stated that the nature and direction of development is caused by the organization of geothermal energy development. The type of geothermal energy development management espoused by each area determines the current direction of development, but the past direction of development may have determined the type of geothermal energy management occurring in each area.

Situations Faced at the Sites

In general, this study examined two paths to geothermal resource development. These may be termed a centralized and a decentralized approach. Klamath Falls, Oregon currently has a decentralized approach whereby there is extensive private development of the geothermal resource. Susanville, California, on the other hand, represents a more centralized approach to geothermal resource development. The City is the major developer of the resource and City Ordinance 79-605 gives the City auspices over geothermal resource development. In Susanville, private development is not prohibited, but development is under the authority of the City.

Thus, Susanville and Klamath Falls represent polar opposites in some aspects of their geothermal energy development. In Susanville, geothermal energy development centers around the City management and the City places strict limitations on private development of geothermal energy. However, prior to the City's active involvement in geothermal energy, development of the geothermal resource in Susanville was very limited. With the exception of a very few individuals, the vast majority of citizens in Susanville were apparently not interested in pursuing their own development of the geothermal resource. Development of geothermal energy is very much in its infancy in Susanville and it is the City's involvement that will create the extent of development of geothermal energy likely to emerge in the near future.

Klamath Falls, on the other hand, has enjoyed extensive development of geothermal energy for over fifty years. The number of private wells is quite extensive as is the extent of geothermal energy use. Development has not occurred under the auspices of the City, but has been spurred by

private individuals and corporations. Hence, the infrastructure for geothermal energy development in Klamath Falls is considerably more extensive than in Susanville. Instead of being the centerpiece of geothermal energy development as in Susanville, the DOE demonstration project in Klamath Falls is an extension of already existing development in the City. The City of Klamath Falls is now becoming involved in geothermal energy development for use in its own buildings (heating) and to potentially provide access to the resource for other firms in the area.

Principal Conclusions

There is no "best" way for a municipality to develop its geothermal energy resources. The type of development management adopted by a community must depend on its own situation and preferences.

Using Klamath Falls and Susanville as case study sites, there are several principal conclusions that emerge from this study. Specifically, these may be delineated as areas where major contrasts and comparisons between the two sites may be made.

- Attitude toward City involvement in geothermal resource development
- Attitude toward individual participation in geothermal energy development
- Involvement of developers located outside of the community
- Attraction of industry to the area
- Specific issues surrounding geothermal energy development and use
- Opinion leadership

Attitude toward City Involvement

There appears to be more skepticism of the City's involvement in geothermal energy development in Susanville than in Klamath Falls, but this is strongly influenced by the person to whom one is speaking. Although generally supported by the City residents, geothermal energy development in Susanville is under the auspice of a relatively small number of decision-makers. Since there are not the restrictions upon development in Klamath Falls that there are in Susanville, the residents in Klamath Falls can, more clearly, determine the extent of their own involvement in development. Some Susanville residents appear to resent the City's control over development of geothermal energy.

In Klamath Falls there is a movement toward more City control of geothermal resource development. A proposed reservoir management ordinance would give Klamath Falls' City government tighter control over development. Thus, Klamath Falls may be moving in the direction of Susanville's more centralized City management of geothermal resource development.

Attitude toward Individual Participation in Geothermal Energy Development

Individuals in Susanville are not and have never been as involved in developing the geothermal resource for their own use as have individuals in Klamath Falls. The attitude toward self-involvement in geothermal energy development in Susanville is generally more passive than it is in Klamath Falls for potential users. Susanville residents are "waiting" for the City to develop the resource. Susanville residents do not have the opportunity to see extensive

utilization of the resource as do residents of Klamath Falls. There is less of a familiarity of what "geothermal energy can do" in Susanville than in Klamath Falls. In Susanville, the City's development of the resource will provide an arena for the residents to develop a familiarity with the resource. There appears to be stronger feelings of antagonism toward the nature of development in Susanville than in Klamath Falls, but development in Susanville may have been spurred by the City's involvement.

Involvement of Developers Located Outside of the Community

One source of friction in the Susanville area is the fact that firms outside of the City of Susanville are actively involved in development. Outside firms have been brought in as consultants to attract industry to the area. Some residents feel that "outsiders" are strongly influencing what happens to their community.

The City of Susanville is making an active attempt to involve more local firms in geothermal development. However, the local infrastructure for geothermal resource development in Susanville is not as extensive as in Klamath Falls.

Attraction of Industry to the Area

The City of Susanville is making an active attempt to attract industry to their area through the development of geothermal energy. The City has a Geothermal Energy Office housed in the City Hall which is responsible for the development of geothermal energy for the City, and the Office is involved in actively recruiting industry to the area in conjunction with consultants to the City. Generally, the City is perceived to be more involved in geothermal energy development than is the County.

It appears that in Klamath Falls, the County is more involved in attracting industry to the area than is the City. The City does not have a specific organization set up for the development of geothermal energy. In Klamath County, the Economic Development Association is actively pursuing attracting new industry to the area. This is not to say that the City of Klamath Falls or Lassen County (Susanville) are not involved in the attraction of new industry to the area. There is a relative emphasis intended here.

A municipality who has the geothermal resource and who is seeking to attract industry may potentially be more successful if representatives from the firm or industry are able to see the direct application of the resource. If possible, showing firms the use of the resource by other firms already in residence in the area is likely to be considerably more persuasive than simply emphasizing the fact that the locale has geothermal energy available.

In addition, the existence of an actual program for the attraction of industry would be expected to be more successful than restricting the cultivation of industrial expansion to the answering of inquiries. Relocaters are likely to contact real estate firms, Chamber of Commerces, local government, Economic Development Commissions and other residents of the area when exploring possible relocation sites. Individuals who are likely to be representatives of the area should, thus, be knowledgeable about the potential for use of geothermal energy if geothermal energy is to be presented as a potential assest of the community. Alternatively, these individuals should be able to direct the inquiry to someone who can provide insights into the use of

their resource for that type of firm. It is important that attention be directed toward inquiring firms such that they are made to feel that the community would like to have them relocate there. A "program" for both handling inquiries and planned attraction of industries would facilitate effectiveness of industrial expansion. The City of Susanville provides a working example of just such an attempt.

Specific Issues Surrounding Geothermal Energy Development and Use

Partially because of the differing organization of development and extent of geothermal energy development, the issues around the development of geothermal energy differ between Susanville and Klamath Falls. In Klamath Falls there is considerable discussion of pollution problems and well depletion problems which are related to new regulations or impending regulations. Klamath Falls may soon require re-injection, and the dumping of waste into the sewer system has been prohibited. Although some are aware of these issues as potential problems, development in Susanville is not yet extensive enough for these issues to cause disputes among well owners.

Opinion Leadership

In Susanville, opinion leadership is not as diverse as it is in Klamath Falls. The City as well as the current users are among the opinion leaders in Klamath Falls. In Susanville, opinion leadership is much more concentrated in the hands of the City. Residents are looking toward the

City to guide them in geothermal resource development. In Klamath Falls with the infrastructure being more vast the Oregon Institute of Technology is also a strong opinion leader, but Susanville does not currently have an institute nearby that compares with the Oregon Institute of Technology in perceived expertise or potential for opinion leadership. OIT has probably strongly influenced the degree of geothermal energy development in Klamath Falls, as will the City of Susanville in Susanville and possibly ultimately Lassen Community College (in Susanville).

Implications for Municipalities

The development in Susanville may be generally characterized as much more structured than development in Klamath Falls. The presence or absence of structure cannot be said to be desirable or undesirable but does have its effects. The presence of structure in Susanville provides for more "controlled" development. The lack of encouragement of private, individual development does not provide for a "snowballing" of development, as has occurred in Klamath Falls. The "snowballing" (i.e., spread from one person to another) of geothermal energy in Susanville will not come in the form of development of individual wells, but may rather emerge as an impact on use as firms see other firms tap into the proposed pipeline.

The implications for other municipalities that emerge from these case studies do not indicate that one form of geothermal energy development is superior over another. If development is not "controlled", as in Susanville, and is widespread and individual, as in Klamath Falls, then more individual disputes may arise concerning depletion of the resource and lack of control over its development. If, on the other hand, development is more controlled, as in Susanville, then some individuals may feel that their

personal rights to development of resources on their own property have been violated or limited. The ultimate effects of the more controlled, structured development in Susanville can not be discerned at this time, since development is not complete in Susanville. It is too early to tell, as the development of the pipeline is still in process.

Development of geothermal energy was never widespread in Susanville. In an area where the resource has not yet been developed by individuals, such as was the case in Susanville, the development of the resource by the City may be an excellent way of demonstrating the use of the resource. If City ordinances later provide, this may be an effective means of interesting individuals in developing the resource for themselves, which has occurred without DOE demonstration projects in Klamath Falls. The City of Susanville is the agent for diffusion of geothermal energy use, whereas in Klamath Falls the agents of diffusion have been the Oregon Institute of Technology and the users themselves to a great extent. Demonstration of use appears to be critical in areas where the resource has not been utilized.

The research conducted for this study indicates that relocaters are not likely to locate in an area for the specific reason that the area has a particular energy resource available. Such factors as transportation, labor supply, a product market and availability of raw materials are going to be critical to a relocation decision. Energy sources are likely to be important only at the margins. Thus, a municipality should not use geothermal energy as the prime motivator for relocation, but rather study other needs of the firm or industry so that a package of attributes can be presented. Further, the types of industry that a

municipality attempts to attract should be consistent with the assets that a community has to offer. Community assets and industry needs should be well aligned.

In conclusion, there is no single appropriate way for a community to organize geothermal energy development. Both Klamath Falls and Susanville provide models for organization, each with their differing effects. For a community seeking to encourage development the City can be an instrumental opinion leader. The diffusion process has probably been significantly enhanced (and accelerated) in Susanville because of the City's involvement with development of the resource. This City of Susanville, however, has not strongly encouraged individual development (wells), but will encourage individual use by distributing the resource via the pipeline. In both Klamath Falls and Susanville the demonstration project will likely be instrumental in encouraging further use of geothermal energy. In Susanville, the demonstration project is the cornerstone of geothermal energy development and in Klamath Falls the project simply provides an additional use of the resource, but one that is being observed by the community.

APPENDIX A
LOCAL GOVERNMENT QUESTIONNAIRE
FOR KLAMATH FALLS

ENERGY USE STUDY
LOCAL GOVERNMENT
QUESTIONNAIRE

INTERVIEWER: _____

FIELD SERVICE NAME: _____

DATE: _____ TIME BEGAN: _____ AM/PM TIME ENDED: _____ AM/PM

RESPONDENT NAME: _____ RESPONDENT COMPANY: _____

Thank you for taking the time to talk with me. As you know, I'd like to talk with you about your area's use of energy and alternative energy sources.

1. First, there are many potential sources of energy and electricity. By potential sources, we mean the base source from which energy is generated. Please tell me all the energy sources that come to your mind. (DO NOT READ LIST. CIRCLE ALL THAT ARE MENTIONED. IF RESPONDENT MENTIONS OTHER SOURCES PLEASE DESCRIBE THEM EXACTLY AS STATED).

Solar 1
 Water (Hydro-electric). 2
 Geothermal. 3 → (SKIP TO QU. 3)
 Petroleum (gas, oil). 4
 Wind. 5
 Nuclear 6
 Biomass (wood). 7
 Coal. 8
 Other (PLEASE DESCRIBE): _____

2. One potential source of energy is geothermal energy. Geothermal refers to using the internal heat of the earth which is available to man in the form of heated rocks or heated water. Are you aware of geothermal energy?

Yes. 1 No. 2 → (TERMINATE)

3. How did you first become aware of geothermal energy?

4. Approximately how many years ago was it when you first became aware of geothermal energy?

 (WRITE-IN) No. of Years

5. In general, when talking about geothermal energy, do you consider yourself to be (READ LIST)?

Very knowledgeable. 1
 Somewhat knowledgeable. 2
 Not very knowledgeable. 3

6. To the best of your knowledge, how has geothermal energy been used in the Klamath Falls area? (DO NOT READ LIST, CIRCLE AS MANY AS APPLY).

Space heating.1
Direct process heat.2
Generation of electricity.3
Other (PLEASE DESCRIBE): _____

7. What do you see as the potential uses for geothermal energy in the Klamath Falls area?

Space heating.1
Direct process heat.2
Generation of electricity.3
Other (PLEASE DESCRIBE): _____

8. How interested are you in seeing the further development and use of geothermal energy in the Klamath Falls area? Would you say you are (READ LIST) . . .

Very interested.1
Somewhat interested, or.2
Uninterested3

9. Why do you say you are (READ ANSWER FROM QU. 8) in the further development and use of geothermal energy in the Klamath Falls area?

What other reasons? _____

10. In your opinion, how interested is the (city/county) of Klamath Falls in the further development and use of geothermal energy? Would you say the Klamath Falls area is (READ LIST). . .

Very interested1
Somewhat interested, or.2
Uninterested3

11. Why do you say that you think the (city/county) of Klamath Falls is (READ ANSWER FROM QU. 10) In the further development and use of geothermal energy?

What other reason? _____

- 12a. To the best of your knowledge, what types of things is the (city/county) of Klamath Falls doing to promote the further development and use of geothermal energy?

What else? _____

- 12b. Does the city or county currently use geothermal energy?

Yes. 1 No. 2 → (GO TO Q. 13)

- 12c. What is the geothermal energy used for?

- 12d. Where is the city or county using geothermal energy?

Where else? _____

- 12e. How long has the city or county been using geothermal energy?

No. of Years

(WRITE-IN)

13. Considering the following sources of energy: solar, water, geothermal, petroleum (such as gas and oil), coal, wind, nuclear, and biomass (such as wood), which of these would you most prefer to see used in the Klamath Falls area? What would be your second preference? Third? Fourth? Fifth? Sixth? Seventh? Eighth? (SHOW RESPONDENT THE SOURCES LISTED ON THE QUESTIONNAIRE BELOW. NEXT TO EACH SOURCE, WRITE THE ORDER OF PREFERENCE. . . 1st, 2nd, 3rd, etc.)

Solar _____

Water _____

Geothermal _____

Petroleum _____

Coal _____

Wind _____

Nuclear _____

Biomass _____

14. Why do you most prefer (READ 1st CHOICE FROM Q. 13)?

What other reasons? _____

15. Why do you least prefer (READ 8th CHOICE FROM Q. 13)?

What other reasons? _____

IF GEOTHERMAL RANKED AS FIRST OR EIGHTH
CHOICE IN QU. 13, SKIP TO QU. 17.

16. Why did you say geothermal would be your (NUMBER OF GEOTHERMAL CHOICE IN QU. 13) choice?

What other reasons?

17. At this time what sources of energy are used by the (city/county)?
(WRITE-IN UNDER QU. 17 BELOW).

18. (FOR EACH SOURCE MENTIONED, ASK:) For what purpose is it used?
(RECORD BELOW UNDER QU. 18)

Qu. 17	Qu. 18
Energy Source	Purpose
Solar 1 →	
Water (hydro-electric) 2 →	
Geothermal 3 →	
Petroleum (gas, oil, etc.) 4 →	
Wind 5 →	
Nuclear 6 →	
Biomass (wood) 7 →	
Coal 8 →	
Other (PLEASE DESCRIBE):	

19. (FOR EACH SOURCE AND PURPOSE MENTIONED IN QUES. 17 AND 18, ASK:) How satisfied is the (city/county) with the use of (1st SOURCE MENTIONED) for (PURPOSE)? Would you say the city/county is. . .

	1st Source And Purpose	2nd Source And Purpose	3rd Source And Purpose	4th Source And Purpose	5th Source And Purpose
Very Satisfied 1	1	1	1	1	1
Somewhat Satisfied 2	2	2	2	2	2
Dissatisfied 3	3	3	3	3	3

- 20a. Are there any changes planned in the sources of energy used by the (city/county)?

Yes 1
No 2 → (GO TO QU. 21)
Don't know 3

- 20b. What type of changes are planned?

21. Does your (city/county) have any commitments to capital projects developing geothermal energy?

Yes. 1

No 2

Don't know . 3

→ (GO TO QU. 39)

22. Could you please describe the project? (PROBE FOR INTENDED USE AND STAGE OF DEVELOPMENT).

23. What is your opinion of the project?

Do you think the (city/county) should be involved?

24. To the best of your knowledge, why did the (city/county) undertake this project?

25. How much money is allocated to this project?

_____ \$ allocated for project

(WRITE-IN)

26. What are the sources of funding? (PROBE FOR ALL SOURCES. RECORD UNDER QU. 26 BELOW.)

27. (FOR EACH SOURCE MENTIONED IN QU. 26, ASK:) What percentage of the total funding comes from this source? (RECORD UNDER QU. 27 BELOW)

Qu. 26 Funding Source	Qu. 27 Percentage of Total Funds
_____ →	_____ %
_____ →	_____ %
_____ →	_____ %
_____ →	_____ %
_____ →	_____ %

28. In your opinion, how supportive is the (city/county) administration of this project?

Very supportive. 1

Somewhat supportive. . . . 2

Unsupportive 3

29. Why do you say the (city/county) administration is (READ RESPONSE TO QU. 28) of this project?

30. Do you personally agree with pursuing this project?
Yes. 1 No. 2

31. Why? _____

32. How satisfied do you expect the (city/county) to be with the use of geothermal energy resulting from this project? Would you say you are. . . .

Very satisfied. 1
Somewhat satisfied. 2
Dissatisfied. 3

33. Why do you say you are (READ RESPONSE TO QU. 32).

34. When the decision was being made to enter into this project, who or what group of people made the decision?

35. Thinking back to what you remember about the time when the decision was being made, could you please describe the process by which the decision was made?

36. What factors were taken into consideration when deciding whether or not to be involved in this geothermal project? (LIST BELOW AS MANY FACTORS AS MENTIONED. BE SURE TO LIST THEM IN ORDER MENTIONED).

1st Factor _____
2nd Factor _____
3rd Factor _____
4th Factor _____
5th Factor _____
6th Factor _____

37. How important was (READ NAME OF 1st FACTOR FROM QU. 36) when deciding whether or not to become involved in this geothermal development project. Would you say it was (READ LIST). . .
(REPEAT QU. 37 FOR EVERY FACTOR MENTIONED IN QU. 36).

	1st Factor	2nd Factor	3rd Factor	4th Factor	5th Factor	6th Factor
Very important. 1	1	1	1	1	1	1
Somewhat important, or. . 2	2	2	2	2	2	2
Unimportant 3	3	3	3	3	3	3

LOOK BACK TO QU. 36, IF RESPONDENT MENTIONS ONLY ONE
FACTOR SKIP TO QU. 39.

38a. (ASK THIS QUESTION BY PAIRING EACH FACTOR MENTIONED IN QU. 36, UP TO A MAXIMUM OF 10 PAIRS. AN EXAMPLE: IF RESPONDENT MENTIONS 4 FACTORS, ASK THIS QUESTION FIRST FOR FACTORS 1 AND 2, THEN FACTORS 1 AND 3, THEN FACTORS 1 AND 4, etc.) Now, I'd like to present some possible situations and get your reaction. Forgetting for a moment all other considerations, suppose you found a geothermal project that was completely satisfactory in terms of (1st CHOICE), but was less than what you wanted in terms of (2nd CHOICE). Would you still consider being involved in that project? (AFTER ASKING QU. 38a IMMEDIATELY ASK QU. 38b, THEN PROCEED TO THE NEXT FACTOR PAIR, CONTINUE UNTIL QUES 38a AND 38b ARE ASKED FOR ALL FACTOR PAIRS.

38b. (FOR EACH YES/NO ANSWER IN QU. 38a, ASK:) Why? (PROBE FOR OTHER REASONS. RECORD BELOW).

	QU. 38a		QU. 38b
	Yes	No	Why
1st and 2nd Factors	1	2	
1st and 3rd Factors	1	2	
1st and 4th Factors	1	2	
1st and 5th Factors	1	2	
2nd and 3rd Factors	1	2	
2nd and 4th Factors	1	2	
2nd and 5th Factors	1	2	
3rd and 4th Factors	1	2	
3rd and 5th Factors	1	2	
4th and 5th Factors	1	2	

39. Are there any plans for additional projects involving geothermal energy?

Yes 1
No 2 } (GO TO QU. 41)
Don't know 3

40. What are these plans? (PROBE FOR FUNDING AND PRESENT STAGE OF DEVELOPMENT)

41. What do you see as the advantages of geothermal use?

What else?

42. What do you see as the disadvantages of geothermal use?

What else?

43. What do you see as the future energy needs of your (city/county)?
(PROBE FOR HOW MUCH AND WHEN).

44. Now, I'd like to talk a little bit about the environment for the development of geothermal energy in your area. What do you think are the most important influences on the use or non-use of geothermal energy in your area?

What else?

Why?

45. What economic conditions local or otherwise, do you see as having an impact on the use of geothermal energy in your area?

What else?

Why?

46. In terms of economic conditions, what do you see as the future direction for the development of geothermal energy?

47. Do you think this future direction will be favorable or unfavorable for the development of geothermal energy?

- 48a. In your opinion, does the local government structure and regulatory environment of the (city/county) provide strong leadership in the geothermal area?

Yes. 1

No 2

- 48b. Why do you think this?

49. What is the (city/county) doing to attract industrial users of geothermal energy to the area?

What else?

50. In your opinion, what is the attitude of the citizens of your area toward geothermal energy development? (READ LIST)

Very favorable. . . . 1

Somewhat favorable. . 2

Unfavorable 3

- 51a. Are there any special interest groups in your area which seem to be focusing on geothermal energy?

Yes. 1

No 2

Don't know 3

} → (GO TO QU. 52a.)

- 51b. Who are they, and what are they trying to do?

Are they influential?

- 52a. Are there any agencies or organizations involved in the promotion of geothermal energy in your area?

Yes. 1

No 2

Don't know. 3

} → (GO TO QU. 53)

- 52b. Who are they and what are they trying to do?

Are they influential?

53. How would you describe your area's political environment for the development of geothermal energy?

54. What do you see as the future outlook for political and social conditions that might influence the development of geothermal energy in the area?

55. Who regulates, locally, the development of geothermal energy?

56. What is the posture or attitude of these local regulators toward geothermal energy?

57a. Are there any regulatory issues being debated in your area at this time?

Yes. 1
No 2 } → (GO TO QU. 58a)
Don't know . . 3 }

57b. What are they?

58a. To the best of your knowledge, are the industrial users of geothermal energy increasing in numbers in your area?

Yes. 1
No 2 } → (GO TO QU. 59)
Don't know . . 3 }

58b. Why do you think this is?

59. What do you see as the incentives for industrial users of geothermal energy to move into your area?

60. What do you see as the barriers which could discourage industrial users of geothermal energy from moving into your area?

61. What, if anything, is being done to overcome these barriers?

62. What would you say is the attitude of government toward attracting more potential industrial users of geothermal energy to the area?

63. What would you say is the attitude of the local citizens toward attracting more potential industrial users of geothermal energy to your area?

64a. Are there any other groups whose attitudes are relevant to attracting industrial users to the area?

Yes. 1
No 2 } → (GO TO QU. 65)
Don't know . . 3 }

64b. Who are they?

What are their attributes and strengths?

65. Thanks for your time. Do you have any further comments?
(IF YES, RECORD BELOW).

(RECORD TIME ENDED ON PAGE 1)

APPENDIX B
INDUSTRY AT THE SITE QUESTIONNAIRE
FOR KLAMATH FALLS

ENERGY USE STUDY
INDUSTRY AT THE SITE
QUESTIONNAIRE

INTERVIEWER: _____

FIELD SERVICE NAME: _____

DATE: _____ TIME BEGAN: _____ AM/PM TIME ENDED: _____ AM/PM

RESPONDENT NAME: _____

RESPONDENT COMPANY: _____

Thank you for taking the time to talk with me. As you already know, I'd like to talk with you about your firm's use of energy and alternative energy sources.

1. First, there are many potential sources of energy and electricity. By potential sources, we mean the basic source from which energy is generated. Please tell me all the energy sources that come to your mind. (DO NOT READ LIST. CIRCLE ALL THAT ARE MENTIONED. IF RESPONDENT MENTIONS OTHER SOURCES PLEASE DESCRIBE THEM EXACTLY AS STATED).

Solar 1

Water (Hydro-electric). 2

Geothermal. 3 → (SKIP TO Q. 3)

Petroleum (gas, oil). 4

Wind. 5

Nuclear 6

Biomass (wood). 7

Coal. 8

Other (PLEASE DESCRIBE): _____

2. One potential source of energy is geothermal energy. Geothermal refers to using the internal heat of the earth which is available to man in the form of heated rocks or heated water. Are you aware of geothermal energy?

Yes. 1 No. 2 → (TERMINATE)

3. How did you first become aware of geothermal energy?

4. Approximately how many years ago was it when you first became aware of geothermal energy?

 (WRITE-IN) No. of Years

5. In general, when talking about geothermal energy, do you consider yourself to be (READ LIST)?

Very knowledgeable. 1

Somewhat knowledgeable. 2

Not very knowledgeable. 3

6. To the best of your knowledge, how has geothermal energy been used in the Klamath Falls area? (DO NOT READ LIST, CIRCLE AS MANY AS APPLY).

Space heating.1
Direct process heat.2
Generation of electricity.3
Other (PLEASE DESCRIBE): _____

7. What do you see as the potential uses for geothermal energy in the Klamath Falls area?

Space heating.1
Direct process heat.2
Generation of electricity.3
Other (PLEASE DESCRIBE): _____

8. How interested are you in seeing the further development and use of geothermal energy in the Klamath Falls area? Would you say you are (READ LIST) . . .

Very interested.1
Somewhat interested, or.2
Uninterested3

9. Why do you say you are (READ ANSWER FROM QU. 8) in the further development and use of geothermal energy in the Klamath Falls area?

What other reasons? _____

10. In your opinion, how interested is the city of Klamath Falls in the further development and use of geothermal energy? Would you say the Klamath Falls area is (READ LIST). . .

Very interested1
Somewhat interested, or.2
Uninterested3

11. Why do you say that you think the city of Klamath Falls is (READ ANSWER FROM QU. 10) in the further development and use of geothermal energy?

What other reason? _____

12. To the best of your knowledge, what types of things is the city (county) of Klamath Falls doing to promote the further development and use of geothermal energy?

What else?

13. Now, I'd like to talk about the types of energy your firm uses. First of all, what sources of energy does your firm use to operate your plant? (DO NOT READ LIST. RECORD UNDER QU. 13 BELOW).

14. (FOR EACH ENERGY SOURCE MENTIONED, ASK:) What is this energy source used for?

QU. 13	QU. 14
Energy Source	What Used For
Solar. 1 →	
Water (hydro-electric). . . 2 →	
Geothermal 3 →	
Petroleum (gas, oil etc.) . 4 →	
Wind 5 →	
Nuclear. 6 →	
Biomass (wood) 7 →	
Coal 8 →	
Other (PLEASE DESCRIBE): →	

15. What is your best estimate as to the amount of money your firm spent on energy in 1980?

(WRITE-IN) \$ spent on energy in 1980.

16. (FOR EACH ENERGY SOURCE MENTIONED IN QU. 13, ASK:) Of this total amount of money spent on energy in 1980, how much was spent on (READ NAME OF FIRST ENERGY SOURCE MENTIONED IN QU. 13)? (REPEAT QUESTION FOR EACH ENERGY SOURCE MENTIONED IN QU. 13. RECORD BY WRITING NAME OF ENERGY SOURCE AND AMOUNT OF MONEY SPENT.)

Energy Source	Money Spent
	\$
	\$
	\$
	\$
	\$

17. What percentage of your total operating costs are spent on energy?
\$ spent on energy
(WRITE-IN)

18. What do you see as the future energy needs of your firm in terms of expansion or future changes?

Why?

19. What steps or measures is your firm planning to take in order to meet these future energy needs? (PROBE FOR ANY CHANGES IN ENERGY SOURCES AND PERCENTAGE OF USE).

LOOK BACK TO QU. 13, IF USING GEOTHERMAL ENERGY CONTINUE.
ALL OTHERS SKIP TO QU. 36a, PAGE 6

- 20a. You mentioned earlier that your firm uses geothermal energy. Does your firm have any plans for changes in or expansion of your use of geothermal energy?

Yes. 1

No 2 → (GO TO QU. 21)

- 20b. What changes or expansion is planned?

21. How did your firm first become aware of geothermal energy?

- 22a. Did the availability of geothermal energy influence your decision to locate your firm in Klamath Falls?

Yes. 1

No 2 → (GO TO QU. 23)

- 22b. How was that?

23. Did you retrofit an existing plant for geothermal, or did you include geothermal when the plant was built?

Retrofit existing plant. . . . 1

Built new plant. 2

- 24a. Do you lease or own your geothermal wells?

Lease. 1

Own. 2 → (GO TO QU. 25)

- 24b. Who do you lease your wells from?

25. How many wells does your firm use?

(WRITE-IN) Number of wells

IF NO WELLS IN QU. 25
SKIP TO QU. 28

26. (FOR EACH WELL MENTIONED IN QU. 25, ASK:) How many feet deep is this well? (WRITE IN FT. DEEP UNDER QU. 26 BELOW.)

27. (FOR EACH WELL MENTIONED IN QU. 25, ASK:) What is the temperature of the geothermal fluid in this well? (WRITE-IN TEMPERATURE UNDER QU. 27 BELOW.)

	Qu. 26	Qu. 27
<u>Well</u>	<u>Depth</u>	<u>Temperature</u>
1st Well	_____ ft.	_____ degrees
2nd Well	_____ ft.	_____ degrees
3rd Well	_____ ft.	_____ degrees
4th Well	_____ ft.	_____ degrees

28. What factors did your company consider when deciding whether or not to use geothermal energy? (LIST BELOW AS MANY FACTORS AS MENTIONED. BE SURE TO LIST THEM IN ORDER MENTIONED).

1st Factor _____

2nd Factor _____

3rd Factor _____

4th Factor _____

5th Factor _____

6th Factor _____

29a. How important was (READ NAME OF 1st FACTOR FROM QU. 28) when deciding whether to use geothermal energy. Would you say it was (READ LIST. REPEAT QU. 29 FOR EVERY FACTOR MENTIONED IN QU. 28)

	1st Factor	2nd Factor	3rd Factor	4th Factor	5th Factor	6th Factor
Very Important.1	1	1	1	1	1	1
Somewhat Important, or.2	2	2	2	2	2	2
Unimportant3	3	3	3	3	3	3

29b. (ASK THIS QUESTION BY PAIRING EACH FACTOR MENTIONED IN OU. 28, UP TO A MAXIMUM OF 10 PAIRS. AN EXAMPLE: IF RESPONDENT MENTIONS 4 FACTORS, ASK THIS QUESTION FIRST FOR FACTORS 1 AND 2, THEN FACTORS 1 AND 3, THEN FACTORS 1 AND 4, etc.) Now, I'd like to present some possible situations and get your reaction. Forgetting for a moment all other considerations, suppose you found a geothermal project that was completely satisfactory in terms of (1st CHOICE), but was less than what you wanted in terms of (2nd CHOICE). Would you still consider being involved in that project? (AFTER ASKING OU. 29b IMMEDIATELY ASK OU. 29c, THEN PROCEED TO THE NEXT FACTOR PAIR, CONTINUE UNTIL QUES 29b AND 29c ARE ASKED FOR ALL FACTORS PAIRS.

29c. (FOR EACH YES/NO ANSWER IN OU. 29b, ASK:) Why? (PROBE FOR OTHER REASONS. RECORD BELOW).

	OU. 29b		OU. 29c
	Yes	No	Why
1st and 2nd Factors	1	2	_____
1st and 3rd Factors	1	2	_____
1st and 4th Factors	1	2	_____
1st and 5th Factors	1	2	_____
2nd and 3rd Factors	1	2	_____
2nd and 4th Factors	1	2	_____
2nd and 5th Factors	1	2	_____
3rd and 4th Factors	1	2	_____
3rd and 5th Factors	1	2	_____
4th and 5th Factors	1	2	_____

30. Thinking back to what you know or have been told about your firm's decision to use geothermal energy, please describe the decision process, including what was considered and by whom.

31a. Did any agencies or persons outside of your firm influence the decision to use geothermal energy?

Yes. 1

No 2 → (GO TO QU. 32)

31b. Who? _____

Anybody else? _____

32. What role or effect did local government have on your firm's decision to use geothermal energy?

33a. Does local government have any effect on your current or planned use of geothermal energy?

Yes. 1

No 2 → (GO TO QU. 34)

33b. What effect? _____

34. How satisfied has your firm been with geothermal as an energy source?

Very satisfied. 1

Somewhat satisfied. . . . 2

Dissatisfied. 3

35. Why do you say your firm is (READ RESPONSE FROM QU. 34) with geothermal as an energy source?

----- GO TO QUESTION 45 -----

36a. As I understand it, your firm does not now use geothermal energy. Do you currently have any plans to use geothermal energy in the future?

Yes. 1

No 2 → (GO TO QU. 37)

36b. What are your plans? (PROBE FOR DETAILED DESCRIPTION AND PRESENT STAGE OF DEVELOPMENT).

38. Who would be responsible for any decisions regarding the future use of geothermal energy?

- 39a. Has your firm been seeking any information on geothermal energy?

Yes. 1

No 2 → (GO TO QU. 40)

- 39b. From whom? -----

What type of information were you seeking? -----

40. If your firm were considering the use of geothermal energy, what would be the factors that you would take into consideration during the decision making process?

41. What are the actual steps you would follow in this decision process?

42. How knowledgeable would you say your firm is regarding geothermal energy? (READ LIST)

Very knowledgeable. 1

Somewhat knowledgeable. 2

Not knowledgeable 3

43. How satisfied do you think your firm would be if the firm decided to use geothermal energy? (READ LIST)

Very satisfied. 1

Somewhat satisfied. 2

Dissatisfied. 3

44. How likely is it that your firm will use geothermal energy in the future. Do you think it will be . . . (READ LIST).

Very likely. 1

Somewhat likely. 2

Unlikely 3

- 45a. How interested is your firm in the use of geothermal energy? (READ LIST)

Very interested. 1

Somewhat interested, or. . . . 2

Uninterested 3

- 45b. Why do you say your firm is (READ RESPONSE TO QU. 45a) in geothermal energy?

What other reasons? -----

46a. How would you describe your firm's attitude toward geothermal energy?
(READ LIST)

Very favorable. . . . 1

Somewhat favorable. . . 2

Unfavorable 3

46b. Why do you say your firm's attitude is (READ RESPONSE TO QU. 46a)
toward geothermal energy?

What other reasons? _____

47. Considering the following sources of energy: solar, water, geothermal, petroleum (such as gas and oil), coal, wind, nuclear, and biomass (such as wood), which of these would you most prefer to see your firm use? What would be your second preference? Third? Fourth? Fifth? Sixth? Seventh? Eighth? (SHOW RESPONDENT THE SOURCES LISTED ON THE QUESTIONNAIRE BELOW. NEXT TO EACH SOURCE, WRITE THE ORDER OF PREFERENCE. . . 1st, 2nd, 3rd, etc.)

Solar	_____
Water	_____
Geothermal	_____
Petroleum	_____
Coal	_____
Wind	_____
Nuclear	_____
Biomass	_____

48. Why do you most prefer (READ 1st CHOICE FROM QU. 47)?

What other reasons? _____

49. Why do you least prefer (READ 8th CHOICE FROM QU. 47)?

What other reasons? _____

IF GEOTHERMAL RANKED AS FIRST OR EIGHTH
CHOICE IN QU. 47, SKIP TO QU. 51.

50. Why did you say geothermal would be your (NUMBER OF GEOTHERMAL CHOICE IN QU. 47) choice?

What other reasons? _____

51. What do you see as the advantages of geothermal use?

What else? _____

52. What do you see as the disadvantages of geothermal use?

What else? _____

53a. Are you aware of any of the incentives, such as those that might be available from the government, for the use of geothermal energy?

Yes. 1

No 2 → (GO TO QU. 54)

53b. What are they? _____

Who are these incentives available from? _____

54. In your opinion, what could be done to increase industrial use of geothermal energy?

55. In your opinion, what do you think the city of Klamath Falls can do to attract potential users of geothermal energy?

56. Now, I'd like to talk a little bit about the environment for further development of geothermal energy. What do you think are the most important influences on the industrial use or non-use of geothermal energy in your area?

Why do you say that? _____

57. What economic conditions, local or otherwise, do you see as affecting the use of geothermal energy by industry?

Why do you say that? _____

58. What do you see as the future direction of these economic conditions?

Why do you say that? _____

59. What political, social and institutional conditions and issues do you see influencing the industrial use of geothermal energy?

Why? _____

60. What effect do you see the local government having on the use of geothermal energy by industry in Klamath Falls?

Why do you say that? _____

- 61a. Are there any other local groups or agencies that you think influence the industrial use of geothermal energy in Klamath Falls?

Yes.1

No2 → (GO TO QU. 62)

- 61b. Who are they, and how do they influence the industrial use of geothermal energy?

62. In your opinion, what is the influence of the regulatory environment on industrial use of geothermal energy in Klamath Falls?

- 63a. Are there any current regulatory issues that influence or will influence the use of geothermal energy by industry?

Yes.1

No2 → (GO TO QU. 64)

- 63b. What are these? _____

64. In general, what do you think are the current conditions in Klamath Falls that affect relocation of industry?

Why do you say this? -----

65. What criteria would you use or did you use in making a plant relocation decision?

Why? -----

66. Finally, how do you evaluate Klamath Falls on these criteria?

Why? -----

Thank you for your time. Do you have any further comments?
(IF YES, RECORD BELOW.)

(RECORD TIME ENDED ON PAGE 1)

APPENDIX C
REGULATORS QUESTIONNAIRE
FOR KLAMATH FALLS

ENERGY USE STUDY
REGULATORS
QUESTIONNAIRE

INTERVIEWER _____

FIELD SERVICE NAME _____

DATE _____ TIME BEGAN _____ AM/PM TIME ENDED _____ AM/PM

RESPONDENT NAME _____ RESPONDENT COMPANY _____

Thank you for taking the time to talk with me. As you know, I'd like to talk with you about the regulation of geothermal energy.

1. First of all would you please describe the role that you and your agency have in the regulation of the development of geothermal energy.

2. Have you exercised this regulatory role in Klamath Falls, Oregon?

Yes 1

No 2 —→ (GO TO QU. 4)

3. How have you and your agency been involved in Klamath Falls, Oregon? _____

What else have you been doing? _____

4. Please describe the process by which a site is regulated. We are especially interested in the types of decisions that are made at the various stages which lead up to a final regulatory decision.

5a. Are there any legislative constraints which affect your regulatory decisions and/or actions in Klamath Falls?

Yes 1

No 2 —> (GO TO QU. 6a)

5b. What are these constraints? _____

What else? _____

6a. Are there any organizational constraints within your regulatory agency which affect your regulatory decisions and/or actions in Klamath Falls?

Yes 1

No 2 —> (GO TO QU. 7a)

6b. What are these constraints? _____

What else? _____

7a. Are there any other factors that limit regulatory decisions and/or actions in Klamath Falls?

Yes 1

No 2 —> (GO TO QU. 8)

7b. What are they? _____

What else? _____

8. What do you see as the advantages of geothermal use?

What else? _____

9. What do you see as the disadvantages of geothermal use? _____

What else? _____

10. What changes or future trends do you see in the regulation of geothermal energy? _____

What else? _____

11a. Has the local government in Klamath Falls had any impact on your regulation in that area?

Yes 1

No 2 → (GO TO QU. 12)

11b. How? _____

12. What factors are taken into consideration before you or your agency make a regulatory decision? (LIST BELOW AS MANY FACTORS AS MENTIONED.)

1st Factor _____
2nd Factor _____
3rd Factor _____
4th Factor _____
5th Factor _____
6th Factor _____

13. How important is (READ NAME OF 1st FACTOR FROM QU. 12) when making a regulatory decision? would you say it is (READ LIST)...(REPEAT QU. 13 FOR EVERY FACTOR MENTIONED IN QU. 12).

	1st Factor	2nd Factor	3rd Factor	4th Factor	5th Factor	6th Factor
Very important	1	1	1	1	1	1
Somewhat important, or	2	2	2	2	2	2
Unimportant	3	3	3	3	3	3

14. For each of the factors you mentioned, I'd like to find out what would be the compensating or corrective factors. Consider (READ NAME OF 1st FACTOR FROM QU. 12). What, if any, would be compensating or corrective factors if a project did not meet regulatory standards in this area? (RECORD BELOW UNDER APPROPRIATE FACTOR).

1st Factor	2nd Factor	3rd Factor
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

4th Factor	5th Factor	6th Factor
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

15. How interested are you in the further development of geothermal energy?

Very interested 1
Somewhat interested 2
Uninterested 3

16. Why do you say you are (READ RESPONSE FROM QU. 15) in the further development of geothermal energy? _____

17. In general, how much would you say you know about geothermal energy? Would you say you are...(READ RESPONSES.)

Very knowledgeable 1
Somewhat knowledgeable, or 2
Not very knowledgeable 3

18. What kinds of cooperative efforts, if any, go on between your agency and other regulatory agencies? That is, how would you work with other regulatory agencies in the regulation of geothermal development in a site such as Klamath Falls?

Thank you for your time. Do you have any further comments? (IF YES, RECORD BELOW).

(RECORD TIME ENDED ON PAGE 1)

APPENDIX D
FINANCIERS QUESTIONNAIRE
FOR KLAMATH FALLS

ENERGY USE STUDY
FINANCIERS
QUESTIONNAIRE

INTERVIEWER _____
FIELD SERVICE NAME _____
DATE _____ TIME BEGAN _____ AM/PM TIME ENDED _____ AM/PM
RESPONDENT NAME _____ RESPONDENT COMPANY _____

Thank you for taking time to talk with me today. As you know, I'd like to talk about the financing of resource development.

1. First, there are many potential sources of energy and electricity. By potential sources, we mean the base source from which energy is generated. Please tell me all energy sources that come to your mind. (DO NOT READ LIST.) CIRCLE ALL THAT ARE MENTIONED. IF RESPONDENT MENTIONS OTHER SOURCES PLEASE DESCRIBE THEM EXACTLY AS STATED).

Solar 1
Water (Hydro-electric) 2
Geothermal 3 → (SKIP TO QU. 3)
Petroleum (gas, oil) 4
Wind 5
Nuclear 6
Biomass (wood) 7
Coal 8
Other (PLEASE DESCRIBE): _____

2. One potential source of energy is geothermal energy. Geothermal refers to using the internal heat of the earth which is available to man in the form of heated rocks or heated water. Are you aware of geothermal energy?

Yes 1 No 2 → (TERMINATE)

3. How did you first become aware of geothermal energy? _____

4. Approximately how many years ago was it when you first became aware of geothermal energy?

_____ No. of Years
(WRITE-IN)

5. In general, when talking about geothermal energy, do you consider yourself to be (READ LIST)?

Very knowledgeable 1
Somewhat knowledgeable 2
Not very knowledgeable 3

6. To the best of your knowledge, how has geothermal energy been used in the Klamath Falls area? (DO NOT READ LIST, CIRCLE AS MANY AS APPLY).

Space heating 1
Direct process heat 2
Generation of electricity 3
Other (PLEASE DESCRIBE): _____

7. What do you see as the potential uses for geothermal energy in the Klamath Falls area?

Space heating 1
Direct process heat 2
Generation of electricity 3
Other (PLEASE DESCRIBE): _____

8. How interested are you in seeing the further development and use of geothermal energy in the Klamath Falls area? Would you say you are (READ LIST) ...

Very interested 1
Somewhat interested, or 2
Uninterested 3

9. Why do you say you are (READ ANSWER FROM QU. 8) in the further development and use of geothermal energy in the Klamath Falls area? _____

What other reasons? _____

10. In your opinion, how interested is the city of Klamath Falls in the further development and use of geothermal energy in your area? Would you say Klamath Falls is (READ LIST)...

Very interested 1
Somewhat interested, or 2
Uninterested 3

11. Why do you say that you think the city of Klamath Falls is (READ ANSWER FROM QU. 10) in the further development and use of geothermal energy? _____

What other reasons? _____

(QUESTION 12 NOT USED IN THIS VERSION)

13. Considering the following sources of energy: solar, water, geothermal, petroleum (such as gas and oil), coal, wind, nuclear, and biomass (such as wood), which of these would you most prefer to see used in the Klamath Falls area? What would be your second preference? Third? Fourth? Fifth? Sixth? Seventh? Eighth? (SHOW RESPONDENT THE SOURCES LISTED ON THE QUESTIONNAIRE BELOW. NEXT TO EACH SOURCE, WRITE THE ORDER OF PREFERENCE... 1st, 2nd, 3rd, etc.)

Solar _____
Water _____
Geothermal _____
Petroleum _____
Coal _____
Wind _____
Nuclear _____
Biomass _____

14. Why do you most prefer (READ 1st CHOICE FROM QU. 13)?

What other reasons?

15. Why do you least prefer (READ 8th CHOICE FROM QU. 13)?

What other reasons?

IF GEOTHERMAL RANKED AS FIRST OR EIGHTH
CHOICE IN QU. 13, SKIP TO QU. 17.

16. Why did you say geothermal would be your (NUMBER OF GEOTHERMAL CHOICE IN QU. 13) choice?

What other reasons?

17. What factors do you consider when making a decision to finance or not to finance any project or development?

(QUESTIONS 18 - 20 NOT USED IN THIS VERSION)

21. What factors would you take into consideration when deciding whether or not to finance a geothermal project? (LIST BELOW AS MANY FACTORS AS MENTIONED. BE SURE TO LIST THEM IN ORDER MENTIONED).

1st Factor _____
2nd Factor _____
3rd Factor _____
4th Factor _____
5th Factor _____
6th Factor _____

22. How important is (READ NAME OF 1st FACTOR FROM QU. 21) when deciding whether or not to become involved in a geothermal development project? Would you say it is (READ LIST)...(REPEAT QU. 22 FOR EVERY FACTOR MENTIONED IN QU. 21).

	1st Factor	2nd Factor	3rd Factor	4th Factor	5th Factor	6th Factor
Very important	1	1	1	1	1	1
Somewhat important, or	2	2	2	2	2	2
Unimportant	3	3	3	3	3	3

LOOK BACK TO QU. 22, IF RESPONDENT MENTIONS ONLY ONE FACTOR
SKIP TO QU. 24.

- 23a. (ASK THIS QUESTION BY PAIRING EACH FACTOR MENTIONED IN QU. 21, UP TO A MAXIMUM OF 10 PAIRS. AN EXAMPLE: IF RESPONDENT MENTIONS 4 FACTORS, ASK THIS QUESTION FIRST FOR FACTORS 1 AND 2, THEN FACTORS 1 AND 3, THEN FACTORS 1 AND 4, etc.) Now, I'd like to present some possible situations and get your reaction. Forgetting for a moment all other considerations, suppose you found a geothermal project that was completely satisfactory in terms of (1st CHOICE), but was less than what you wanted in terms of (2nd CHOICE). Would you still consider taking on that project? (AFTER ASKING QU. 23a IMMEDIATELY ASK QU. 23b, THEN PROCEED TO THE FACTOR PAIR, CONTINUE UNTIL QUES. 23a AND 23b ARE ASKED FOR ALL FACTOR PAIRS.)
- 23b. (FOR EACH YES/NO ANSWER IN QU. 23a, ASK:) Why? (PROBE FOR OTHER REASONS. ASKED FOR ALL FACTOR PAIRS RECORD BELOW).

	QU. 23a		QU. 23b
	Yes	No	Why
1st and 2nd Factors	1	2	
1st and 3rd Factors	1	2	
1st and 4th Factors	1	2	
1st and 5th Factors	1	2	
2nd and 3rd Factors	1	2	
2nd and 4th Factors	1	2	
2nd and 5th Factors	1	2	
3rd and 4th Factors	1	2	
3rd and 5th Factors	1	2	
4th and 5th Factors	1	2	

24. Please describe in detail the process by which you or your firm would make a decision about financing a geothermal resource development project.

25. What role would government regulations play in your decision to be involved in a geothermal project?

- 26a. Has local government had any influence on your involvement in geothermal development?

Yes 1

No 2 ———▶ (SKIP TO QU. 27)

- 26b. How?

27. What kind of payback period would you like to have for a geothermal venture?

Why?

28. What kind of payback period would you like to have for other ventures?

Why? (PROBE FOR REASONS BEHIND DIFFERENCES, IF ANY, BETWEEN ANSWERS TO QU. 27 and QU. 28)

29. In your opinion, what stage of development in areas such as engineering and resource knowledge do you think geothermal energy is in at this time?

Why?

30. How does this opinion influence your willingness to invest in or finance geothermal resource development?

31. What information would you require on a geothermal resource before considering whether to finance its development?

32a. Does the availability of insurance influence your willingness to finance geothermal development?

Yes 1

No 2 → (GO TO QU. 33)

32b. How? _____

33. What would you require as security on geothermal financing? _____

Anything else? _____

34a. Is there a difference between what you would require as security on geothermal projects and what would be required on other types of ventures?

Yes 1

No 2 → (GO TO QU. 35)

34b. What is the difference? _____

Why? _____

35. In a decision to finance a geothermal project, to what extent would intangible drilling costs influence your willingness to invest? _____

Why? _____

36a. Are you familiar with the Geothermal Loan Guarantee Program?

Yes 1

No 2 → (GO TO QU. 37a)

36b. To what extent does the Geothermal Loan Guarantee Program influence your willingness to invest in geothermal development? _____

Why? _____

36b. What is your opinion of the Geothermal Loan Guarantee Program? _____

37a. Have you heard of the Geothermal Investment Tax Credit on geothermal development?

Yes 1

No 2 → (GO TO QU. 38a)

37b. To what extent does the Geothermal Investment Tax Credit influence your willingness to invest in geothermal development? _____

Why? _____

37c. What is your opinion of the Geothermal Investment Tax Credit? _____

Why? _____

38a. Have you heard of the Geothermal Depletion Allowance?

Yes 1

No 2 → (GO TO QU. 39a)

38b. To what extent does the Geothermal Depletion Allowance influence your willingness to invest in geothermal development? _____

Why? _____

38c. What is your opinion of the Geothermal Depletion Allowance? _____

39a. Have you heard of the additional energy credit when using geothermal energy?

Yes 1

No 2 → (GO TO QU. 40)

39b. To what extent does the additional energy credit influence your willingness to invest in geothermal development? _____

Why? _____

39c. What is your opinion of the additional energy credit? _____

40. To what extent do government regulations at a site influence your willingness to invest in geothermal development? _____

How else do they influence you? _____

41. What do you see as the advantages of geothermal use? _____

What else? _____

42. What do you see as the disadvantages of geothermal use? _____

What else? _____

Thank you for your time. Do you have any further comments? (IF YES, RECORD BELOW).

(RECORD TIME ENDED ON PAGE 1)

APPENDIX E
RELOCATERS QUESTIONNAIRE
FOR KLAMATH FALLS

ENERGY USE STUDY
RELOCATORS
QUESTIONNAIRE

INTERVIEWER _____
FIELD SERVICE NAME _____
DATE _____ TIME BEGAN _____ AM/PM TIME ENDED _____ AM/PM
RESPONDENT NAME _____ RESPONDENT COMPANY _____

Thank you for taking time to talk with me today. As you know, I would like to talk with you about energy resources.

1. First, there are many potential sources of energy and electricity. By potential sources, we mean the base source from which energy is generated. Please tell me all energy sources that come to your mind. (DO NOT READ LIST.) CIRCLE ALL THAT ARE MENTIONED. IF RESPONDENT MENTIONS OTHER SOURCES PLEASE DESCRIBE THEM EXACTLY AS STATED).

Solar 1
Water (Hydro-electric) 2
Geothermal 3 → (SKIP TO QU. 3)
Petroleum (gas, oil) 4
Wind 5
Nuclear 6
Biomass (wood) 7
Coal 8
Other (PLEASE DESCRIBE): _____

2. One potential source of energy is geothermal energy. Geothermal refers to using the internal heat of the earth which is available to man in the form of heated rocks or heated water. Are you aware of geothermal energy?
Yes 1 No 2 → (GO TO QU. 17a)

3. How did you first become aware of geothermal energy? _____

4. Approximately how many years ago was it when you first became aware of geothermal energy?

(WRITE-IN) No. of Years

- 5a. In general, when talking about geothermal energy, do you consider yourself to be (READ LIST)?

Very knowledgeable 1
Somewhat knowledgeable 2
Not very knowledgeable 3

- 5b. What do you see as the advantages of geothermal energy use? _____

What else? _____

- 5c. What do you see as the disadvantages of geothermal energy use? _____

What else? _____

6. To the best of your knowledge, how has geothermal energy been used in the Klamath Falls area? (DO NOT READ LIST, CIRCLE AS MANY AS APPLY).

Space heating 1
Direct process heat 2
Generation of electricity 3
Other (PLEASE DESCRIBE): _____

7. What do you see as the potential uses for geothermal energy in the Klamath Falls area?

Space heating 1
Direct process heat 2
Generation of electricity 3
Other (PLEASE DESCRIBE): _____

8. How interested are you in seeing the further development and use of geothermal energy in the Klamath Falls area? Would you say you are (READ LIST) ...

Very interested 1
Somewhat interested, or 2
Uninterested 3

9. Why do you say you are (READ ANSWER FROM QU. 8) in the further development and use of geothermal energy in the Klamath Falls area? _____

What other reasons? _____

10. In your opinion, how interested is the city of Klamath Falls in the further development and use of geothermal energy in your area? Would you say Klamath Falls is (READ LIST)...

Very interested 1

Somewhat interested, or 2

Uninterested 3

11. Why do you say that you think the city of Klamath Falls is (READ ANSWER FROM QU. 10) in the further development and use of geothermal energy? _____

what other reasons? _____

(QUESTION 12 NOT USED IN THIS VERSION)

13. Considering the following sources of energy: solar, water, geothermal, petroleum (such as gas and oil), coal, wind, nuclear, and biomass (such as wood), which of these would you most prefer to see used in the Klamath Falls area? What would be your second preference? Third? Fourth? Fifth? Sixth? Seventh? Eighth? (SHOW RESPONDENT THE SOURCES LISTED ON THE QUESTIONNAIRE BELOW. NEXT TO EACH SOURCE, WRITE THE ORDER OF PREFERENCE...1st, 2nd, 3rd, etc.)

Solar _____

Water _____

Geothermal _____

Petroleum _____

Coal _____

Wind _____

Nuclear _____

Biomass _____

14. Why do you most prefer (READ 1st CHOICE FROM QU. 13)?

what other reasons? _____

15. Why do you least prefer (READ 8th CHOICE FROM QU. 13)?

what other reasons? _____

IF GEOTHERMAL RANKED AS FIRST OR EIGHTH CHOICE IN QU. 13, SKIP TO QU. 17.

16. Why did you say geothermal would be your (NUMBER OF GEOTHERMAL CHOICE IN QU. 13) choice? _____

what other reasons? _____

17a. Now, I would like to ask you a few questions about relocation. Is your firm currently considering relocating?

Yes 1 No 2 → (GO TO QU. 18)

17b. Has a decision been made, or is your firm still in the decision making process?

Decision made 1

Still deciding 2 → (GO TO QU. 17d)

17c. To where will your firm be relocating? _____

17d. (Did/Are) you using a relocation consulting firm or a real estate agency to help identify potential sites?

Yes 1 No 2 → (GO TO QU. 18)

17e. What (was/is) this consulting firm or real estate agency doing for you?

What else? _____

18. Who in your firm would be involved in a relocation decision? (PROBE FOR POSITIONS, JOB TITLES) _____

19. Who would make the final decision on relocation? _____

20a. Where would you go outside of your company for information to be used as a part of the relocation decision? Who would you talk to? _____

Who else? _____

20b. Please describe in detail the process by which your firm would make a relocation decision. (PROBE FOR WHO IS INVOLVED AND ROLE THEY WOULD PLAY IN THE DECISION MAKING PROCESS). _____

21. What factors would you take into consideration in your relocation decision, please describe all the factors that would be considered in such a decision (LIST BELOW AS MANY FACTORS AS MENTIONED. BE SURE TO LIST THEM IN ORDER MENTIONED).

1st Factor _____
2nd Factor _____
3rd Factor _____
4th Factor _____
5th Factor _____
6th Factor _____

- 22a. How important is (READ NAME OF 1st FACTOR FROM QU. 21) to the final decision on whether to relocate. Would you say it is (READ LIST)...(REPEAT QU. 22a FOR EVERY FACTOR MENTIONED IN QU. 21).

	1st Factor	2nd Factor	3rd Factor	4th Factor	5th Factor	6th Factor
Very important	1	1	1	1	1	1
Somewhat important, or	2	2	2	2	2	2
Unimportant	3	3	3	3	3	3

- 22b. (IF ENERGY WAS NOT MENTIONED AS A FACTOR IN QU. 21, ASK:) How important are the alternative sources of energy available in a community when making a relocation decision?

Very important 1
Somewhat important 2
Unimportant 3

22c. why do you say that? _____

LOOK BACK TO QU. 21, IF RESPONDENT MENTIONS ONLY ONE FACTOR
SKIP TO QU. 24, PAGE 7.

23a. (ASK THIS QUESTION BY PAIRING EACH FACTOR MENTIONED IN QU. 21, UP TO A MAXIMUM OF 10 PAIRS. AN EXAMPLE: IF RESPONDENT MENTIONS 4 FACTORS, ASK THIS QUESTION FIRST FOR FACTORS 1 AND 2, THEN FACTORS 1 AND 3, THEN FACTORS 1 AND 4, etc.) Now, I'd like to present some possible situations and get your reaction. Forgetting for a moment all other considerations, suppose you found a geothermal project that was completely satisfactory in terms of (1st CHOICE), but was less than what you wanted in terms of (2nd CHOICE). Would you still consider taking on that project? (AFTER ASKING QU. 23a IMMEDIATELY ASK QU. 23b, THEN PROCEED TO THE FACTOR PAIR. CONTINUE UNTIL QUES. 23a AND 23b ARE ASKED FOR ALL FACTOR PAIRS.)

23b. (FOR EACH YES/NO ANSWER IN QU. 23a, ASK:) Why? (PROBE FOR OTHER REASONS. ASKED FOR ALL FACTOR PAIRS RECORD BELOW).

	QU. 23a		QU. 23b
	Yes	No	Why
1st and 2nd Factors	1	2	
1st and 3rd Factors	1	2	
1st and 4th Factors	1	2	
1st and 5th Factors	1	2	
2nd and 3rd Factors	1	2	
2nd and 4th Factors	1	2	
2nd and 5th Factors	1	2	
3rd and 4th Factors	1	2	
3rd and 5th Factors	1	2	
4th and 5th Factors	1	2	

24. Many times a relocation decision involves ultimately selecting a community that does not have all the characteristics a firm would want, but enough of the necessary characteristics to make the community desirable. Please tell me what characteristics a community must have to make it a desirable location. _____

25. What characteristics would eliminate a community from consideration as a potential relocation site? _____

26. Now, I'd like to talk about energy more specifically. What is your best estimate as to the amount of money your firm spent on energy in 1980?

_____ \$ spent on energy 1980
(WRITE-IN)

27. What percentage of your total operating cost was this?

_____ % of operating cost
(WRITE-IN)

28. What sources of energy does your firm currently use? (READ LIST. CIRCLE ALL APPROPRIATE UNDER QU. 28 BELOW).

29. (FOR EACH ENERGY SOURCE CIRCLED IN QU. 28, ASK:) What is the energy used for by your firm?

Qu. 28 Energy Sources	Qu. 29 What Used For
Solar 1 →	_____
Water 2 →	_____
Geothermal 3 →	_____
Coal 4 →	_____
Wind 5 →	_____
Nuclear 6 →	_____
Biomass 7 →	_____
Other (Please Describe): _____ 8 →	_____

(QUESTION 30 NOT USED IN THIS VERSION)

31. How important is the availability of geothermal energy to a relocation decision by your firm? (READ LIST).

Very important 1
Somewhat important, or ... 2
Unimportant 3 → (GO TO QU. 37)

32. Why do you say that? _____

33. How important to the relocation decision would be the availability of financial assistance from the community for developing geothermal energy? (READ LIST).

Very important 1
Somewhat important, or ... 2
Unimportant 3

34. Why do you say this? _____

35. Given that a community had acceptable levels of the factors that are important to your firm, what types of incentives could they provide your firm to further interest you in relocating there? _____

What else? _____

36. What incentives could the local community provide which would interest you in using or expanding your use of geothermal energy? _____

What else? _____

37. Thank you for your time. Do you have any further comments? (IF YES, RECORD BELOW).

(RECORD TIME ENDED ON PAGE 1)

APPENDIX F
PROMOTERS/DEVELOPERS QUESTIONNAIRE
FOR KLAMATH FALLS

ENERGY USE STUDY
PROMOTERS/DEVELOPERS
QUESTIONNAIRE

INTERVIEWER _____
FIELD SERVICE NAME _____
DATE _____ TIME BEGAN _____ AM/PM TIME ENDED _____ AM/PM
RESPONDENT NAME _____ RESPONDENT COMPANY _____

1. First, there are many potential sources of energy and electricity. By potential sources, we mean the base source from which energy is generated. Please tell me all the energy sources that come to your mind. (DO NOT READ LIST. CIRCLE ALL THAT ARE MENTIONED. IF RESPONDENT MENTIONS OTHER SOURCES PLEASE DESCRIBE THEM EXACTLY AS STATED).

Solar 1
Water (Hydro-electric) 2
Geothermal 3 — (SKIP TO QU. 3)
Petroleum (gas, oil) 4
Wind 5
Nuclear 6
Biomass (wood) 7
Coal 8
Other (PLEASE DESCRIBE): _____

2. One potential source of energy is geothermal energy. Geothermal refers to using the internal heat of the earth which is available to man in the form of heated rocks or heated water. Are you aware of geothermal energy?

Yes 1 No 2 — (TERMINATE)

3. How did you first become aware of geothermal energy? _____

4. Approximately how many years ago was it when you first became aware of geothermal energy?

(WRITE-IN) No. of Years

5. In general, when talking about geothermal energy, do you consider yourself to be (READ LIST)?

Very knowledgeable 1
Somewhat knowledgeable 2
Not very knowledgeable 3

6. To the best of your knowledge, how has geothermal energy been used in the Klamath Falls area? (DO NOT READ LIST, CIRCLE AS MANY AS APPLY).

Space heating 1
Direct process heat 2
Generation of electricity 3
Other (PLEASE DESCRIBE): _____

7. What do you see as the potential uses for geothermal energy in the Klamath Falls area?

Space heating 1
Direct process heat 2
Generation of electricity 3
Other (PLEASE DESCRIBE): _____

8. How interested are you in seeing the further development and use of geothermal energy in the Klamath Falls area? Would you say you are (READ LIST) ...

Very interested 1
Somewhat interested, or 2
Uninterested 3

9. Why do you say you are (READ ANSWER FROM QU. 8) in the further development and use of geothermal energy in the Klamath Falls area? _____

What other reasons? _____

10. In your opinion, how interested is the city of Klamath Falls in the further development and use of geothermal energy in your area? Would you say Klamath Falls is (READ LIST)...

Very interested 1
Somewhat interested, or 2
Uninterested 3

11. Why do you say that you think the city of Klamath Falls is (READ ANSWER FROM QU. 10) in the further development and use of geothermal energy? _____

What other reasons? _____

12. To the best of your knowledge, what types of things is the city of Klamath Falls doing to promote the further development and use of geothermal energy?

What else? _____

13. Considering the following sources of energy: solar, water, geothermal, petroleum (such as gas and oil), coal, wind, nuclear, and biomass (such as wood), which of these would you most prefer to see used in the Klamath Falls area? What would be your second preference? Third? Fourth? Fifth? Sixth? Seventh? Eighth? (SHOW RESPONDENT THE SOURCES LISTED ON THE QUESTIONNAIRE BELOW. NEXT TO EACH SOURCE, WRITE THE ORDER OF PREFERENCE...1st, 2nd, 3rd, etc.)

Solar _____
Water _____
Geothermal _____
Petroleum _____
Coal _____
Wind _____
Nuclear _____
Biomass _____

14. Why do you most prefer (READ 1st CHOICE FROM QU. 13)?

What other reasons? _____

15. Why do you least prefer (READ 8th CHOICE FROM QU. 13)?

What other reasons? _____

IF GEOTHERMAL RANKED AS FIRST OR EIGHTH
CHOICE IN QU. 13, SKIP TO QU. 17.

16. Why did you say geothermal would be your (NUMBER OF GEOTHERMAL CHOICE IN QU. 13) choice?

What other reasons? _____

- 17a. Now, I'd like to find out a little more about you or your company's involvement in geothermal energy development. First of all what has been your involvement in the development of geothermal resources? (PROBE FOR NUMBER AND TYPES OF PROJECTS AND ROLE PLAYED IN EACH PROJECT). _____

- 17b. Why are you (involved/not involved) in the development of geothermal resources? _____

18. What would you hope to gain from an involvement in geothermal development? _____

What other types of benefits can you see from an involvement in geothermal development? _____

19. What kind of profit margin or return on investment would you be looking for when involved in a geothermal project? _____

Why? _____

- 20a. What kind of profit margin or return on investment would you be looking for when involved in other types of projects? _____

Why? _____

- 20b. How is this profit margin on other projects similar to or different from the profit margin you would be looking for on a geothermal project? (INTERVIEWER WRITE-IN WHETHER RESPONSE IS IN REFERENCE TO SIMILAR OR DIFFERENT).

21. What factors would you take into consideration when deciding whether or not to be involved in a geothermal project? (LIST BELOW AS MANY FACTORS AS MENTIONED. BE SURE TO LIST THEM IN ORDER MENTIONED).

1st Factor _____
2nd Factor _____
3rd Factor _____
4th Factor _____
5th Factor _____
6th Factor _____

22. How important is (READ NAME OF 1st FACTOR FROM QU. 21) when deciding whether or not to become involved in a geothermal development project? Would you say it is (READ LIST)...(REPEAT QU. 22 FOR EVERY FACTOR MENTIONED IN QU. 21).

	1st Factor	2nd Factor	3rd Factor	4th Factor	5th Factor	6th Factor
Very important	1	1	1	1	1	1
Somewhat important, or	2	2	2	2	2	2
Unimportant	3	3	3	3	3	3

LOOK BACK TO QU. 22, IF RESPONDENT MENTIONS ONLY ONE FACTOR
SKIP TO QU. 24.

- 23a. (ASK THIS QUESTION BY PAIRING EACH FACTOR MENTIONED IN QU. 21, UP TO A MAXIMUM OF 10 PAIRS. AN EXAMPLE: IF RESPONDENT MENTIONS 4 FACTORS, ASK THIS QUESTION FIRST FOR FACTORS 1 AND 2, THEN FACTORS 1 AND 3, THEN FACTORS 1 AND 4, etc.) Now, I'd like to present some possible situations and get your reaction. Forgetting for a moment all other considerations, suppose you found a geothermal project that was completely satisfactory in terms of (1st CHOICE), but was less than what you wanted in terms of (2nd CHOICE). Would you still consider taking on that project? (AFTER ASKING QU. 23a IMMEDIATELY ASK QU. 23b, THEN PROCEED TO THE FACTOR PAIR, CONTINUE UNTIL QUES. 23a AND 23b ARE ASKED FOR ALL FACTOR PAIRS.)
- 23b. (FOR EACH YES/NO ANSWER IN QU. 23a, ASK:) Why? (PROBE FOR OTHER REASONS. ASKED FOR ALL FACTOR PAIRS RECORD BELOW).

	QU. 23a		QU. 23b
	Yes	No	Why
1st and 2nd Factors	1	2	
1st and 3rd Factors	1	2	
1st and 4th Factors	1	2	
1st and 5th Factors	1	2	
2nd and 3rd Factors	1	2	
2nd and 4th Factors	1	2	
2nd and 5th Factors	1	2	
3rd and 4th Factors	1	2	
3rd and 5th Factors	1	2	
4th and 5th Factors	1	2	

24. Please describe in detail the process by which you or your firm would make a decision on involvement in a geothermal resource development project.

25. What role would government regulations play in your decision to be involved in a geothermal project?

- 26a. Has local government had any influence on your involvement in geothermal development?

Yes 1

No 2 — (SKIP TO QU. 27)

- 26b. How?

27. What is your opinion of geothermal as an energy source?

Why do you think this?

28. What do you see as the advantages of geothermal use?

What else?

29. What do you see as the disadvantages of geothermal use?

What else?

30. What type of resources such as manpower and technical expertise do you feel will be needed for the development of geothermal energy?

31. How would you evaluate Klamath Falls in terms of these resources?

32. What factors or conditions do you see as influencing industry's use of geothermal energy?

33. What factors or conditions do you see as influencing industry's use of geothermal energy regarding plant retrofit or expansion?

34. What factors or conditions do you see as influencing plant relocation and the ultimate use of geothermal energy?

Thank you for your time. Do you have any further comments? (IF YES, RECORD BELOW).

(RECORD TIME ENDED ON PAGE 1)

APPENDIX G
LOCAL GOVERNMENT QUESTIONNAIRE
FOR SUSANVILLE

ENERGY USE STUDY
LOCAL GOVERNMENT
QUESTIONNAIRE

INTERVIEWER. _____

FIELD SERVICE NAME. _____

DATE. _____ TIME BEGAN. _____ AM/PM TIME ENDED. _____ AM/PM

RESPONDENT NAME: _____ RESPONDENT COMPANY: _____

Thank you for taking the time to talk with me. As you know, I'd like to talk with you about your area's use of energy and alternative energy sources.

1. First, there are many potential sources of energy and electricity. By potential sources, we mean the base source from which energy is generated. Please tell me all the energy sources that come to your mind. (DO NOT READ LIST. CIRCLE ALL THAT ARE MENTIONED. IF RESPONDENT MENTIONS OTHER SOURCES PLEASE DESCRIBE THEM EXACTLY AS STATED).

Solar 1

Water (Hydra-electric). 2

Geothermal. 3

(SKIP TO QU. 3)

Petroleum (gas, oil). 4

Wind. 5

Nuclear 6

Biomass (wood). 7

Coal. 8

Other (PLEASE DESCRIBE): _____

2. One potential source of energy is geothermal energy. Geothermal refers to using the internal heat of the earth which is available to man in the form of heated rocks or heated water. Are you aware of geothermal energy?

Yes. 1 No. 2 → (TERMINATE)

3. How did you first become aware of geothermal energy?

4. Approximately how many years ago was it when you first became aware of geothermal energy?

No. of Years

(WRITE-IN)

5. In general, when talking about geothermal energy, do you consider yourself to be (READ LIST)?

Very knowledgeable. 1

Somewhat knowledgeable. 2

Not very knowledgeable. 3

6. To the best of your knowledge, how has geothermal energy been used in the Susanville area? (DO NOT READ LIST, CIRCLE AS MANY AS APPLY).

Space heating.1
Direct process heat.2
Generation of electricity.3
Other (PLEASE DESCRIBE):.....

7. What do you see as the potential uses for geothermal energy in the Susanville area?

Space heating.1
Direct process heat.2
Generation of electricity.3
Other (PLEASE DESCRIBE):.....

8. How interested are you in seeing the further development and use of geothermal energy in the Susanville area? Would you say you are (READ LIST) . . .

Very interested.1
Somewhat interested, or.2
Uninterested3

9. Why do you say you are (READ ANSWER FROM QU. 8) in the further development and use of geothermal energy in Susanville?

10. In your opinion, how interested is Susanville in the further development and use of geothermal energy? Would you say the Susanville area is (READ LIST). . .

Very interested1
Somewhat interested, or.2
Uninterested3

- 11a. To the best of your knowledge, what types of things is the city of Susanville doing to promote the further development and use of geothermal energy?

What else?

- 11b. Does the city currently use geothermal energy?

Yes. 1 No. 2 → (GO TO QU. 12)

- 11c. What is the geothermal energy used for?

- 11d. How long has the city or county been using geothermal energy?

No. of Years

(WRITE-IN)

12. Considering the following sources of energy. solar, water, geothermal, petroleum (such as gas and oil), coal, wind, nuclear, and biomass (such as wood), which of these would you most prefer to see used in the Susanville area? What would be your second preference? Third? Fourth? Fifth? Sixth? Seventh? Eighth? (SHOW RESPONDENT THE SOURCES LISTED ON THE QUESTIONNAIRE BELOW. NEXT TO EACH SOURCE, WRITE THE ORDER OF PREFERENCE. . . 1st, 2nd, 3rd, etc.)

Solar

Water

Geothermal

Petroleum

Coal

Wind

Nuclear

Biomass

13. Why do you most prefer (READ 1st CHOICE FROM QU. 12)?

What other reasons?

14. Why do you prefer (READ 2nd CHOICE FROM QU. 12) as your 2nd choice?

15. Why do you least prefer (READ 8th CHOICE FROM QU. 12)?

What other reasons?

IF GEOTHERMAL RANKED AS FIRST OR EIGHTH
CHOICE IN QU. 12, SKIP TO QU. 17.

16. Why did you say geothermal would be your (NUMBER OF GEOTHERMAL CHOICE IN QU. 13) choice?

What other reasons?

17. At this time what are all the sources of energy used by the city of Susanville? (WRITE-IN UNDER QU. 17 BELOW).
18. (FOR EACH SOURCE MENTIONED, ASK:) For what purpose is it used? (RECORD BELOW UNDER QU. 18)

Qu. 17	Qu. 18
Energy Source	Purpose
Solar	
Water (hydro-electric).	
Geothermal.	
Petroleum (gas, oil, etc.).	
Wind	
Nuclear	
Biomass (wood).	
Coal.	
Other (PLEASE DESCRIBE).	

19. (FOR EACH SOURCE AND PURPOSE MENTIONED IN QUES. 17 AND 18, ASK:) How satisfied is the (city/county) with the use of (1st SOURCE MENTIONED) for (PURPOSE)? Would you say the city/county is. . .

	1st Source And Purpose	2nd Source And Purpose	3rd Source And Purpose	4th Source And Purpose	5th Source And Purpose
Very Satisfied	1	1	1	1	1
Somewhat Satisfied	2	2	2	2	2
Dissatisfied	3	3	3	3	3

- 20a. Are there any changes planned in the sources of energy used by the (city/county)?

Yes. 1
No 2 } → (GO TO QU. 21)
Don't know . . . 3 }

- 20b. What type of changes are planned?

- 20c. Why are these changes planned?

21. Does Susanville have any commitments to capital projects developing geothermal energy?

Yes. 1
No 2 } → (GO TO QU. 39)
Don't know . 3 }

22. Could you please describe the project? (PROBE FOR INTENDED USE AND STAGE OF DEVELOPMENT).

23. What is your opinion of the project?

Do you think Susanville should be involved? Why?

24. To the best of your knowledge, why did Susanville undertake this project?

25. How much money is allocated to this project?

----- \$ allocated for project
(WRITE-IN)

26. What are the sources of funding? (PROBE FOR ALL SOURCES. RECORD UNDER QU. 26 BELOW.)

27. (FOR EACH SOURCE MENTIONED IN QU. 26, ASK:) What percentage of the total funding comes from this source? (RECORD UNDER QU. 27 BELOW)

Qu. 26 Funding Source	Qu. 27 Percentage of Total Funds
----- →	----- %
----- →	----- %
----- →	----- %
----- →	----- %
----- →	----- %

28. In your opinion, how supportive is the city administration of this project?

Very supportive. 1
Somewhat supportive. . . . 2
Unsupportive 3

29. Do you personally agree with pursuing this project?
Yes. 1 No. 2

30. Why? _____

31. How satisfied do you expect the city of Susanville to be with the use of geothermal energy resulting from this project? Do you think the city will be....

Very satisfied. 1
Somewhat satisfied. . . . 2
Dissatisfied. 3

32. Why? _____

33. When the decision was being made to enter into this project, who or what group of people made the decision?

34. Thinking back to what you remember about the time when the decision was being made, could you please describe the process by which the decision was made?

35. What factors were taken into consideration when deciding whether or not to be involved in this geothermal project? (LIST BELOW AS MANY FACTORS AS MENTIONED. BE SURE TO LIST THEM IN ORDER MENTIONED).

1st Factor _____
2nd Factor _____
3rd Factor _____
4th Factor _____
5th Factor _____
6th Factor _____

36. How important was (READ NAME OF 1st FACTOR FROM QU. 35) when deciding whether or not to become involved in this geothermal development project. Would you say it was (READ LIST). . .
(REPEAT QU. 36 FOR EVERY FACTOR MENTIONED IN QU. 35).

	1st Factor	2nd Factor	3rd Factor	4th Factor	5th Factor	6th Factor
Very important. 1	1	1	1	1	1	1
Somewhat important, or. . 2	2	2	2	2	2	2
Unimportant 3	3	3	3	3	3	3

LOOK BACK TO QU. 35, IF RESPONDENT MENTIONS ONLY ONE
FACTOR SKIP TO QU. 39.

37a. (ASK THIS QUESTION BY PAIRING EACH FACTOR MENTIONED IN QU. 36, UP TO A MAXIMUM OF 10 PAIRS. AN EXAMPLE: IF RESPONDENT MENTIONS 4 FACTORS, ASK THIS QUESTION FIRST FOR FACTORS 1 AND 2, THEN FACTORS 1 AND 3, THEN FACTORS 1 AND 4, etc.) Now, I'd like to present some possible situations and get your reaction. Forgetting for a moment all other considerations, suppose you found a geothermal project that was completely satisfactory in terms of (1st CHOICE), but was less than what you wanted in terms of (2nd CHOICE). Would you still consider being involved in that project? (AFTER ASKING QU. 37a IMMEDIATELY ASK QU. 37b, THEN PROCEED TO THE NEXT FACTOR PAIR, CONTINUE UNTIL QUES 37a AND 37b ARE ASKED FOR ALL FACTORS PAIRS.

37b. (FOR EACH YES/NO ANSWER IN QU. 37a, ASK:) Why? (PROBE FOR OTHER REASONS. RECORD BELOW).

	QU. 37a		QU. 37b
	Yes	No	Why
1st and 2nd Factors	1	2	_____
1st and 3rd Factors	1	2	_____
1st and 4th Factors	1	2	_____
1st and 5th Factors	1	2	_____
2nd and 3rd Factors	1	2	_____
2nd and 4th Factors	1	2	_____
2nd and 5th Factors	1	2	_____
3rd and 4th Factors	1	2	_____
3rd and 5th Factors	1	2	_____
4th and 5th Factors	1	2	_____

38. Please describe the management of the city's DOE project, as you understand it. (PROBE FOR WHO MAKES DECISIONS, ETC.)

39. Are there any plans for additional projects involving geothermal energy?

Yes 1
No 2 } → (GO TO QU. 41)
Don't know . 3

40. What are these plans? (PROBE FOR FUNDING AND PRESENT STAGE OF DEVELOPMENT)

41. What do you see as the advantages of geothermal use?

What else? _____

Why? _____

42. What do you see as the disadvantages of geothermal use?

What else?

Why?

43. What do you see as the future energy needs of your (city/county)?
(PROBE FOR HOW MUCH AND WHEN).

44. What do you think are the most important influences on the use or
non-use of geothermal energy in your area?

What else?

Why?

45. What economic conditions local or otherwise, do you see as having
an impact on the use of geothermal energy in your area?

What else?

Why?

46. In terms of economic conditions, what do you see as the future
direction for the development of geothermal energy?

47. Do you think this future direction will be favorable or unfavorable
for the development of geothermal energy?

48a. In your opinion, does the local government structure and regulatory
environment of the (city/county) provide strong leadership in the
geothermal area?

Yes. 1

No 2

48b. Why do you think this?

49. What is the (city/county) doing to attract industrial users of geothermal energy to the area?

What else?

50. In your opinion, what is the attitude of the citizens of your area toward geothermal energy development? (READ LIST)

Very favorable. . . . 1

Somewhat favorable. . 2

Unfavorable 3

51a. Are there any special interest groups in your area which seem to be focusing on geothermal energy?

Yes. 1

No 2

Don't know 3

→ (GO TO QU. 52a.)

51b. Who are they, and what are they trying to do?

Are they influential?

52a. Are there any agencies or organizations involved in the promotion of geothermal energy in your area?

Yes. 1

No 2

Don know

→ (GO TO QU. 53)

52b. Who are they and what are they trying to do?

Are they influential?

53. How would you describe your area's political environment for the development of geothermal energy?

54. What do you see as the future outlook for political and social conditions that might influence the development of geothermal energy in the area?

55a. Who regulates, locally, the development of geothermal energy?

55b. What is the regulatory process?

56. What is the posture or attitude of these local regulators toward geothermal energy?

57a. Are there any regulatory issues being debated in your area at this time?

Yes. 1
No 2 } → (GO TO QU. 58a)
Don't know . . 3 }

57b. What are they?

58a. To the best of your knowledge, are the industrial users of geothermal energy increasing in numbers in Susanville?

Yes. 1
No 2 } → (GO TO QU. 59)
Don't know . . 3 }

58b. Why do you think this is?

59. What do you see as the incentives for industrial users of geothermal energy to move into your area?

60. What do you see as the barriers which could discourage industrial users of geothermal energy from moving into your area?

61. What, if anything, is being done to overcome these barriers?

62. What would you say is the attitude of government toward attracting more potential industrial users of geothermal energy to the area?

63. What would you say is the attitude of the local citizens toward attracting more potential industrial users of geothermal energy to your area?

64a. Are there any other groups whose attitudes are relevant to attracting industrial users to the area?

Yes. 1
No 2 } → (GO TO QU. 65)
Don't know . . 3 }

64b. Who are they?

What are their attributes and strengths?

65. What suggestions would you make to other cities who are interested in developing geothermal energy. (PROBE: whould you recommend Susanville's type of approach. Why and Why not?)

66. Thanks for your time. Do you have any further comments?
(IF YES, RECORD BELOW).

(RECORD TIME ENDED ON PAGE 1)

APPENDIX H
INDUSTRY AT THE SITE QUESTIONNAIRE
FOR SUSANVILLE

**ENERGY USE STUDY
INDUSTRY AT THE SITE
QUESTIONNAIRE**

INTERVIEWER: _____

FIELD SERVICE NAME: _____

DATE: _____ TIME BEGAN: _____ AM/PM TIME ENDED: _____ AM/PM

RESPONDENT NAME: _____ RESPONDENT COMPANY: _____

Thank you for taking the time to talk with me. As you already know, I'd like to talk with you about your firm's use of energy and alternative energy sources.

1. First, there are many potential sources of energy and electricity. By potential sources, we mean the base source from which energy is generated. Please tell me all the energy sources that come to your mind. (DO NOT READ LIST. CIRCLE ALL THAT ARE MENTIONED. IF RESPONDENT MENTIONS OTHER SOURCES PLEASE DESCRIBE THEM EXACTLY AS STATED).

Solar 1

Water (Hydra-electric). 2

Geothermal. 3

➡ (SKIP TO QU. 3)

Petroleum (gas, oil). 4

Wind. 5

Nuclear 6

Biomass (wood). 7

Coal. 8

Other (PLEASE DESCRIBE): _____

2. One potential source of energy is geothermal energy. Geothermal refers to using the internal heat of the earth which is available to man in the form of heated rocks or heated water. Are you aware of geothermal energy?

Yes. 1 No. 2 ➡ (TERMINATE)

3. How did you first become aware of geothermal energy?

4. Approximately how many years ago was it when you first became aware of geothermal energy?

(WRITE-IN) No. of Years

5. In general, when talking about geothermal energy, do you consider yourself to be (READ LIST)?

Very knowledgeable. 1

Somewhat knowledgeable. 2

Not very knowledgeable. 3

6. To the best of your knowledge, how has geothermal energy been used in Susanville? (DO NOT READ LIST, CIRCLE AS MANY AS APPLY).

. Space heating.1
Direct process heat.2
Generation of electricity.3
Other (PLEASE DESCRIBE): _____

7. What do you see as the potential uses for geothermal energy in Susanville?

Space heating.1
Direct process heat.2
Generation of electricity.3
Other (PLEASE DESCRIBE): _____

8. How interested are you in seeing the further development and use of geothermal energy in Susanville? Would you say you are (READ LIST) . . .

Very interested.1
Somewhat interested, or.2
Uninterested3

9. Why do you say you are (READ ANSWER FROM QU. 8) in the further development and use of geothermal energy in Susanville?

10. In your opinion, how interested is the city of Susanville in the further development and use of geothermal energy? Would you say Susanville is (READ LIST). . .

Very interested1
Somewhat interested, or.2
Uninterested3

- What else?**

QU. 12	QU. 13
Energy Source	What Used For
Solar.1 →	
Water (hyro-electric). . .2 →	
Geothermal3 →	
Petroleum (gas, oil etc.).4 →	
Wind5 →	
Nuclear.6 →	
Biomass (wood)7 →	
Coal8 →	
Other (PLEASE DESCRIBE):	
_____ →	

- (WRITE-IN) \$ spent on energy in 1980

<u>Energy Source</u>	<u>Money Spent</u>
_____	\$ _____
_____	\$ _____
_____	\$ _____
_____	\$ _____
_____	\$ _____

16. What percentage of your total operating costs are spent on energy?
_____ % spent on energy
(WRITE-IN)

17. What do you see as the future energy needs of your firm?

Why? _____

18. What steps or measures is your firm planning to take in order to meet these future energy needs? (PROBE FOR ANY CHANGES IN ENERGY SOURCES AND PERCENTAGE OF USE).

LOOK BACK TO QU. 12, IF USING GEOTHERMAL ENERGY CONTINUE.
ALL OTHERS SKIP TO QU. 34a, PAGE 7

19a. You mentioned earlier that your firm uses geothermal energy. Does your firm have any plans for changes in or expansion of your use of geothermal energy?

Yes. 1

No 2 → (GO TO QU. 20)

19b. What changes or expansion is planned?

20. How did your firm first become aware of geothermal energy?

21a. Did the availability of geothermal energy influence your decision to locate your firm in Susanville?

Yes. 1

No 2 → (GO TO QU. 22)

21b. How was that?

22. Did you retrofit an existing plant for geothermal, or did you include geothermal when the plant was built?

Retrofit existing plant. . . . 1

Built new plant. 2

23a. Do you lease or own your geothermal wells?

Lease. 1

Own. 2 → (GO TO QU. 24)

23b. Who do you lease your wells from?

24. How many wells does your firm use?

Number of wells
(WRITE-IN)

IF NO WELLS IN QU. 24
SKIP TO QU. 27

25a. (FOR EACH WELL MENTIONED IN QU. 24, ASK:) How old is this well?
(WRITE IN AGE UNDER QU. 25a BELOW)

25b. (FOR EACH WELL MENTIONED IN QU. 24, ASK:) How many feet deep is
this well? (WRITE IN FT. DEEP UNDER QU. 25b BELOW.)

26. (FOR EACH WELL MENTIONED IN QU. 25, ASK:) What is the temperature
of the geothermal fluid in this well? (WRITE-IN TEMPERATURE UNDER
QU. 26 BELOW.)

	Qu. 25a	Qu. 25b	Qu. 26
Well	Age	Depth	Temperature
1st Well	_____ yrs.	_____ ft.	_____ degrees
2nd Well	_____ yrs.	_____ ft.	_____ degrees
3rd Well	_____ yrs.	_____ ft.	_____ degrees
4th Well	_____ yrs.	_____ ft.	_____ degrees

27. What factors did your company consider when deciding whether or
not to use geothermal energy? (LIST BELOW AS MANY FACTORS AS
MENTIONED. BE SURE TO LIST THEM IN ORDER MENTIONED).

1st Factor _____

2nd Factor _____

3rd Factor _____

4th Factor _____

5th Factor _____

6th Factor _____

28a. How important was (READ NAME OF 1st FACTOR FROM QU. 27) when deciding
whether to use geothermal energy. Would you say it was (READ LIST.
REPEAT QU. 28a FOR EVERY FACTOR MENTIONED IN QU. 27)

	1st Factor	2nd Factor	3rd Factor	4th Factor	5th Factor	6th Factor
Very Important.1	1	1	1	1	1	1
Somewhat Important, or.2	2	2	2	2	2	2
Unimportant3	3	3	3	3	3	3

- 28b. (ASK THIS QUESTION BY PAIRING EACH FACTOR MENTIONED IN QU. 27, UP TO A MAXIMUM OF 10 PAIRS. AN EXAMPLE: IF RESPONDENT MENTIONS 4 FACTORS, ASK THIS QUESTION FIRST FOR FACTORS 1 AND 2, THEN FACTORS 1 AND 3, THEN FACTORS 1 AND 4, etc.) Now, I'd like to present some possible situations and get your reaction. Forgetting for a moment all other considerations, suppose you found a geothermal project that was completely satisfactory in terms of (1st CHOICE), but was less than what you wanted in terms of (2nd CHOICE). Would you still consider being involved in that project? (AFTER ASKING QU. 28b IMMEDIATELY ASK QU. 28c, THEN PROCEED TO THE NEXT FACTOR PAIR, CONTINUE UNTIL QUES. 28b AND 28c ARE ASKED FOR ALL FACTORS PAIRS.
- 28c. (FOR EACH YES/NO ANSWER IN QU. 28b., ASK:) Why? (PROBE FOR OTHER REASONS. RECORD BELOW).

	QU. 28b		QU. 28c
	<u>Yes</u>	<u>No</u>	<u>Why</u>
1st and 2nd Factors	1	2	
1st and 3rd Factors	1	2	
1st and 4th Factors	1	2	
1st and 5th Factors	1	2	
2nd and 3rd Factors	1	2	
2nd and 4th Factors	1	2	
2nd and 5th Factors	1	2	
3rd and 4th Factors	1	2	
3rd and 5th Factors	1	2	
4th and 5th Factors	1	2	

29. Thinking back to what you know or have been told about your firm's decision to use geothermal energy, please describe the decision process, including what was considered and by whom.

30a. Did any agencies or persons outside of your firm influence the decision to use geothermal energy?

Yes. 1

No 2 → (GO TO QU. 32)

30b. Who? _____

Anybody else? _____

31. What role or effect did local government have on your firm's decision to use geothermal energy? (PROBE: Describe effect.)

32. How satisfied has your firm been with geothermal as an energy source?

Very satisfied. 1

Somewhat satisfied. . . 2

Dissatisfied. 3

33. Why do you say firm is (READ RESPONSE FROM QU. 32) with geothermal on an energy source?

----- GO TO QUESTION 42a -----

34a. As I understand it, your firm does not now use geothermal energy. Do you currently have any plans to use geothermal energy in the future?

Yes. 1

No 2 → (GO TO QU. 37)

34b. What are your plans? (PROBE FOR DETAILED DESCRIPTION AND PRESENT STAGE OF DEVELOPMENT).

35. Who would be responsible for any decisions regarding the future use of geothermal energy?

36a. Has your firm been seeking any information on geothermal energy?

Yes. 1

No 2 → (GO TO QU. 37)

36b. From whom?

What type of information were you seeking?

37. If your firm were considering the use of geothermal energy, what would be the factors that you would take into consideration during the decision making process?

38. What are the actual steps you would follow in this decision process?

39. How knowledgeable would you say your firm is regarding geothermal energy? (READ LIST)

Very knowledgeable. 1

Somewhat knowledgeable. . . . 2

Not knowledgeable 3

40. How satisfied do you think your firm would be if the firm decided to use geothermal energy? (READ LIST)

Very satisfied. 1

Somewhat satisfied. 2

Dissatisfied. 3

41. How likely is it that your firm will use geothermal energy in the future. Do you think it will be . . . (READ LIST).

Very likely. 1

Somewhat likely. 2

Unlikely 3

42a. How interested is your firm in the use of geothermal energy? (READ LIST)

Very interested. 1

Somewhat interested, or. . . 2

Uninterested 3

42b. Why do you say your firm is (READ RESPONSE TO QU. 42a) in geothermal energy?

What other reasons?

43a. How would you describe your firm's attitude toward geothermal energy?
(READ LIST)

Very favorable. 1

Somewhat favorable. . . . 2

Unfavorable 3

43b. Why do you say your firm's attitude is (READ RESPONSE TO QU. 46a)
toward geothermal energy?

What other reasons?

44. Considering the following sources of energy: solar, water, geothermal, petroleum (such as gas and oil), coal, wind, nuclear, and biomass (such as wood), which of these would you most prefer to see your firm use? What would be your second preference? Third? Fourth? Fifth? Sixth? Seventh? Eighth? (SHOW RESPONDENT THE SOURCES LISTED ON THE QUESTIONNAIRE BELOW. NEXT TO EACH SOURCE, WRITE THE ORDER OF PREFERENCE. . . 1st, 2nd, 3rd, etc.)

Solar

Water

Geothermal

Petroleum

Coal

Wind

Nuclear

Biomass

45a. Why do you most prefer (READ 1st CHOICE FROM QU. 44)?

45b. Why do you prefer (READ 2nd CHOICE FROM QU. 44) as your second choice?

46. Why do you least prefer (READ 8th CHOICE FROM QU. 44)?

IF GEOTHERMAL RANKED AS FIRST OR EIGHTH
CHOICE IN QU. 44, SKIP TO QU. 48.

47. Why did you say geothermal would be your (NUMBER OF GEOTHERMAL
CHOICE IN QU. 44) choice?

What other reasons?

48. What do you see as the advantages of geothermal use?

What else?

49. What do you see as the disadvantages of geothermal use?

What else?

Why?

50a. Are you aware of any of the incentives, such as those that might be available from the government, for the use of geothermal energy?

Yes. 1

No 2 → (GO TO QU. 51)

50b. What are they?

Who are these incentives available from?

51. In your opinion, what could be done to increase industrial use of geothermal energy in Susanville?

52. In your opinion, what do you think the city of Susanville can do to attract potential users of geothermal energy?

53. Now, I'd like to talk a little bit about the environment for further development of geothermal energy. What do you think are the most important influences on the industrial use or non-use of geothermal energy in Susanville?

Why do you say that?

54. What economic conditions, local or otherwise, do you see as impacting the use of geothermal energy by industry?

Why do you say that?

55. What do you see as the future direction of these economic conditions?

Why do you say that?

56. What political, social and institutional conditions and issues do you see influencing the industrial use of geothermal energy?

Why?

57. What effect do you see the local government having on the use of geothermal energy by industry in Susanville?

Why do you say that?

- 58a. Are there any other local groups or agencies that you think influence the industrial use of geothermal energy in Susanville?

Yes.1

No2 → (GO TO QU. 59)

- 58b. Who are they, and how do they influence the industrial use of geothermal energy?

59. In your opinion, what is the influence of the regulatory environment on industrial use of geothermal energy in Susanville?

- 60a. Are there any current regulatory issues that influence or will influence the use of geothermal energy by industry?

Yes.1

No2 → (GO TO QU. 61)

- 60b. What are these?

61. In general, what do you think are the current conditions in Susanville that affect relocation of industry?

Why do you say this?

62. What is your opinion of the city's geothermal project?

Thank you for your time. Do you have any further comments?
(IF YES, RECORD BELOW.)

(RECORD TIME ENDED ON PAGE 1)

APPENDIX I
REGULATORS QUESTIONNAIRE
FOR SUSANVILLE

ENERGY USE STUDY
REGULATORS
QUESTIONNAIRE

INTERVIEWER _____

FIELD SERVICE NAME _____

DATE _____ TIME BEGAN _____ AM/PM TIME ENDED _____ AM/PM

RESPONDENT NAME _____ RESPONDENT COMPANY _____

Thank you for taking the time to talk with me. As you know, I'd like to talk with you about the regulation of geothermal energy.

1. First of all would you please describe the role that you and your agency have in the regulation of the development of geothermal energy.

2. Have you exercised this regulatory role in Susanville, California?

Yes 1

No 2 — (GO TO QU. 4)

3. How have you and your agency been involved in Susanville? _____

4. Please describe the process by which a site is regulated. We are especially interested in the types of decisions that are made at the various stages which lead up to a final regulatory decision.

5a. Are there any legislative constraints which affect your regulatory decisions and/or actions in Susanville?

Yes 1

No 2 — (GO TO QU. 6a)

5b. What are these constraints? _____

What else? _____

6a. Are there any organizational constraints within your regulatory agency which affect your regulatory decisions and/or actions in Susanville?

Yes 1

No 2 — (GO TO QU. 7a)

6b. What are these constraints? _____

What else? _____

7a. Are there any other factors that limit regulatory decisions and/or actions in Susanville?

Yes 1

No 2 — (GO TO QU. 8)

7b. What are they? _____

8. What do you see as the advantages of geothermal use?

9. What do you see as the disadvantages of geothermal use? _____

10. What changes or future trends do you see in the regulation of geothermal energy? _____

11a. Has the local government in Susanville had any impact on your regulation in that area?

Yes 1

No 2 → (GO TO QU. 12)

11b. How? _____

12. What factors are taken into consideration before you or your agency make a regulatory decision? (LIST BELOW AS MANY FACTORS AS MENTIONED.)

1st Factor _____

2nd Factor _____

3rd Factor _____

4th Factor _____

5th Factor _____

6th Factor _____

13. How important is (READ NAME OF 1st FACTOR FROM QU. 12) when making a regulatory decision? Would you say it is (READ LIST)...(REPEAT QU. 13 FOR EVERY FACTOR MENTIONED IN QU. 12).

	1st Factor	2nd Factor	3rd Factor	4th Factor	5th Factor	6th Factor
Very important	1	1	1	1	1	1
Somewhat important, or	2	2	2	2	2	2
Unimportant	3	3	3	3	3	3

14. For each of the factors you mentioned, I'd like to find out what would be the compensating or corrective factors. Consider (READ NAME OF 1st FACTOR FROM QU. 12). What, if any, would be compensating or corrective factors if a project did not meet regulatory standards in this area? (RECORD BELOW UNDER APPROPRIATE FACTOR).

1st Factor	2nd Factor	3rd Factor
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

4th Factor	5th Factor	6th Factor
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

15. How interested are you in the further development of geothermal energy?

Very interested 1

Somewhat interested 2

Uninterested 3

16. Why do you say you are (READ RESPONSE FROM QU. 15) in the further development of geothermal energy? _____

17. In general, how much would you say you know about geothermal energy? Would you say you are...(READ RESPONSES.)

Very knowledgeable 1

Somewhat knowledgeable, or 2

Not very knowledgeable 3

18. What kinds of cooperative efforts, if any, go on between your agency and other regulatory agencies? That is, how would you work with other regulatory agencies in the regulation of geothermal development in a site such as Susanville?

19. Please describe what you know of the management of geothermal use in Susanville, California?

20. What do you think of this approach to the management of geothermal use?

Thank you for your time. Do you have any further comments? (IF YES, RECORD BELOW).

APPENDIX J
FINANCIERS QUESTIONNAIRE
FOR SUSANVILLE

ENERGY USE STUDY
FINANCIERS
QUESTIONNAIRE

INTERVIEWER _____

FIELD SERVICE NAME _____

DATE _____ TIME BEGAN _____ AM/PM TIME ENDED _____ AM/PM

RESPONDENT NAME _____ RESPONDENT COMPANY _____

Thank you for taking time to talk with me today. As you know, I'd like to talk about the financing of resource development.

1. First, there are many potential sources of energy and electricity. By potential sources, we mean the base source from which energy is generated. Please tell me all energy sources that come to your mind. (DO NOT READ LIST.) CIRCLE ALL THAT ARE MENTIONED. IF RESPONDENT MENTIONS OTHER SOURCES PLEASE DESCRIBE THEM EXACTLY AS STATED).

Solar 1
Water (Hydro-electric) 2
Geothermal 3 ----> (SKIP TO QU. 3)
Petroleum (gas, oil) 4
Wind 5
Nuclear 6
Biomass (wood) 7
Coal 8
Other (PLEASE DESCRIBE): _____

2. One potential source of energy is geothermal energy. Geothermal refers to using the internal heat of the earth which is available to man in the form of heated rocks or heated water. Are you aware of geothermal energy?

Yes 1 No 2 ----> (TERMINATE)

3. How did you first become aware of geothermal energy? _____

4. Approximately how many years ago was it when you first became aware of geothermal energy?

(WRITE-IN) No. of Years

5. In general, when talking about geothermal energy, do you consider yourself to be (READ LIST)?

Very knowledgeable 1
Somewhat knowledgeable 2
Not very knowledgeable 3

6. To the best of your knowledge, how has geothermal energy been used in Susanville? (DO NOT READ LIST, CIRCLE AS MANY AS APPLY).

Space heating 1
Direct process heat 2
Generation of electricity 3
Other (PLEASE DESCRIBE): _____

7. What do you see as the potential uses for geothermal energy in Susanville?

Space heating 1
Direct process heat 2
Generation of electricity 3
Other (PLEASE DESCRIBE): _____

8. How interested are you in seeing the further development and use of geothermal energy in Susanville? Would you say you are (READ LIST) ...

Very interested 1
Somewhat interested, or 2
Uninterested 3

9. Why do you say you are (READ ANSWER FROM QU. 8) in the further development and use of geothermal energy in the Susanville? _____

10. In your opinion, how interested is the city of Susanville in the further development and use of geothermal energy in your area? Would you say Susanville is (READ LIST)...

Very interested 1
Somewhat interested, or 2
Uninterested 3

11. Why do you say that? _____

(QUESTION 12 NOT USED IN THIS VERSION)

13. Considering the following sources of energy: solar, water, geothermal, petroleum (such as gas and oil), coal, wind, nuclear, and biomass (such as wood), which of these would you most prefer to see used in the Susanville area? What would be your second preference? Third? Fourth? Fifth? Sixth? Seventh? Eighth? (SHOW RESPONDENT THE SOURCES LISTED ON THE QUESTIONNAIRE BELOW. NEXT TO EACH SOURCE, WRITE THE ORDER OF PREFERENCE... 1st, 2nd, 3rd, etc.)

Solar _____
Water _____
Geothermal _____
Petroleum _____
Coal _____
Wind _____
Nuclear _____
Biomass _____

- 14a. Why do you most prefer (READ 1st CHOICE FROM QU. 13)?

- 14b. Why do you prefer (READ 2nd CHOICE FROM QU. 13) as your 2nd choice?

15. Why do you least prefer (READ 8th CHOICE FROM QU. 13)?

What other reasons? _____

IF GEOTHERMAL RANKED AS FIRST OR EIGHTH
CHOICE IN QU. 13, SKIP TO QU. 17.

16. Why did you say geothermal would be your (NUMBER OF GEOTHERMAL CHOICE IN QU. 13) choice? _____

What other reasons? _____

17. What factors do you consider when making a decision to finance or not to finance any type of project or development? _____

(QUESTIONS 18 - 20 NOT USED IN THIS VERSION)

21. What factors would you take into consideration when deciding whether or not to finance a geothermal project? (LIST BELOW AS MANY FACTORS AS MENTIONED. BE SURE TO LIST THEM IN ORDER MENTIONED).

1st Factor _____
2nd Factor _____
3rd Factor _____
4th Factor _____
5th Factor _____
6th Factor _____

22. How important is (READ NAME OF 1st FACTOR FROM QU. 21) when deciding whether or not to become involved in a geothermal development project? Would you say it is (READ LIST)...(REPEAT QU. 22 FOR EVERY FACTOR MENTIONED IN QU. 21).

	1st Factor	2nd Factor	3rd Factor	4th Factor	5th Factor	6th Factor
Very important	1	1	1	1	1	1
Somewhat important, or	2	2	2	2	2	2
Unimportant	3	3	3	3	3	3

LOOK BACK TO QU. 21, IF RESPONDENT MENTIONS ONLY ONE FACTOR
SKIP TO QU. 24a.

- 23a. (ASK THIS QUESTION BY PAIRING EACH FACTOR MENTIONED IN QU. 21, UP TO A MAXIMUM OF 10 PAIRS. AN EXAMPLE: IF RESPONDENT MENTIONS 4 FACTORS, ASK THIS QUESTION FIRST FOR FACTORS 1 AND 2, THEN FACTORS 1 AND 3, THEN FACTORS 1 AND 4, etc.) Now, I'd like to present some possible situations and get your reaction. Forgetting for a moment all other considerations, suppose you found a geothermal project that was completely satisfactory in terms of (1st CHOICE), but was less than what you wanted in terms of (2nd CHOICE). Would you still consider taking on that project? (AFTER ASKING QU. 23a IMMEDIATELY ASK QU. 23b, THEN PROCEED TO THE NEXT FACTOR PAIR, CONTINUE UNTIL QUES. 23a AND 23b ARE ASKED FOR ALL FACTOR PAIRS.)
- 23b. (FOR EACH YES/NO ANSWER IN QU. 23a, ASK:) Why? (PROBE FOR OTHER REASONS. ASKED FOR ALL FACTOR PAIRS RECORD BELOW).

	QU. 23a		QU. 23b
	Yes	No	Why
1st and 2nd Factors	1	2	
1st and 3rd Factors	1	2	
1st and 4th Factors	1	2	
1st and 5th Factors	1	2	
2nd and 3rd Factors	1	2	
2nd and 4th Factors	1	2	
2nd and 5th Factors	1	2	
3rd and 4th Factors	1	2	
3rd and 5th Factors	1	2	
4th and 5th Factors	1	2	

- 24a. Please describe in detail the process by which you or your firm would make a decision about financing a geothermal resource development project.

- 24b. How are geothermal projects generally financed? (PROBE FOR SPECIFIC PROGRAMS USED).

25. What role would government regulations play in your decision to be involved in a geothermal project?

- 26a. Has local government had any influence on your involvement in geothermal development?

Yes 1

No 2 —→ (SKIP TO QU. 27)

- 26b. How?

27. What kind of payback period would you like to have for a geothermal venture?

Why?

28. What kind of payback period would you like to have for other ventures?

Why? (PROBE FOR REASONS BEHIND DIFFERENCES, IF ANY, BETWEEN ANSWERS TO QU.

27 and QU. 28)

29. In your opinion, what stage of development in areas such as engineering and resource knowledge do you think geothermal energy is in at this time?

Why?

30. How does this opinion influence your willingness to invest in or finance geothermal resource development?

31. What information would you require on a geothermal resource before considering whether to finance its development?

32a. Does the availability of insurance influence your willingness to finance geothermal development?

Yes 1

No 2 → (GO TO QU. 33)

32b. How? _____

33. What would you require as security on geothermal financing? _____

Anything else? _____

34a. Is there a difference between what you would require as security on geothermal projects and what would be required on other types of ventures?

Yes 1

No 2 → (GO TO QU. 35)

34b. What is the difference? _____

Why? _____

35. In a decision to finance a geothermal project, to what extent would intangible drilling costs influence your willingness to invest? _____

Why? _____

36a. Are you familiar with the Geothermal Loan Guarantee Program?

Yes 1

No 2 → (GO TO QU. 37a)

36b. To what extent does the Geothermal Loan Guarantee Program influence your willingness to invest in geothermal development? _____

Why? _____

36b. What is your opinion of the Geothermal Loan Guarantee Program?

37a. Have you heard of the Geothermal Investment Tax Credit on geothermal development?

Yes 1

No 2 → (GO TO QU. 38a)

37b. To what extent does the Geothermal Investment Tax Credit influence your willingness to invest in geothermal development? _____

Why? _____

37c. What is your opinion of the Geothermal Investment Tax Credit? _____

Why? _____

38a. Have you heard of the Geothermal Depletion Allowance?

Yes 1

No 2 → (GO TO QU. 39a)

38b. To what extent does the Geothermal Depletion Allowance influence your willingness to invest in geothermal development? _____

Why? _____

38c. What is your opinion of the Geothermal Depletion Allowance? _____

39a. Have you heard of the additional energy credit when using geothermal energy?

Yes 1

No 2 → (GO TO QU. 40)

39b. To what extent does the additional energy credit influence your willingness to invest in geothermal development? _____

Why? _____

39c. What is your opinion of the additional energy credit? _____

40. To what extent do government regulations at a site influence your willingness to invest in geothermal development? _____

How else do they influence you? _____

41. What do you see as the advantages of geothermal use? _____

What else? _____

Why? _____

42. What do you see as the disadvantages of geothermal use? _____

What else? _____

Why? _____

- 43a. Are you familiar with the way in which the use of geothermal is managed in Susanville?

Yes 1

No 2

- 43b. Are you familiar with the way in which the use of geothermal is managed in Klamath Falls, Oregon?

Yes 1

No 2

- 43c. What is your opinion of the way geothermal use is managed in (these/that) area(s)? (NOTE TO INTERVIEWER): In Susanville use is centralized around and controlled by the city, and in Klamath Falls there are a lot of individual wells, unlike in Susanville. If possible Probe for a comparison of the two management structures.)

Thank you for your time. Do you have any further comments? (IF YES, RECORD BELOW).

(RECORD TIME ENDED ON PAGE 1)

APPENDIX K
PROMOTERS/DEVELOPERS QUESTIONNAIRE
FOR SUSANVILLE

ENERGY USE STUDY
PROMOTERS/DEVELOPERS
QUESTIONNAIRE

INTERVIEWER _____

FIELD SERVICE NAME _____

DATE _____ TIME BEGAN _____ AM/PM TIME ENDED _____ AM/PM

RESPONDENT NAME _____ RESPONDENT COMPANY _____

1. First, there are many potential sources of energy and electricity. By potential sources, we mean the base source from which energy is generated. Please tell me all the energy sources that come to your mind. (DO NOT READ LIST. CIRCLE ALL THAT ARE MENTIONED. IF RESPONDENT MENTIONS OTHER SOURCES PLEASE DESCRIBE THEM EXACTLY AS STATED).

Solar 1
 Water (Hydro-electric) 2
 Geothermal 3 → (SKIP TO QU. 3)
 Petroleum (gas, oil) 4
 Wind 5
 Nuclear 6
 Biomass (wood) 7
 Coal 8
 Other (PLEASE DESCRIBE): _____

2. One potential source of energy is geothermal energy. Geothermal refers to using the internal heat of the earth which is available to man in the form of heated rocks or heated water. Are you aware of geothermal energy?

Yes 1 No 2 → (TERMINATE)

3. How did you first become aware of geothermal energy? _____

4. Approximately how many years ago was it when you first became aware of geothermal energy?

_____ No. of Years
 (WRITE-IN)

5. In general, when talking about geothermal energy, do you consider yourself to be (READ LIST)?

Very knowledgeable 1
 Somewhat knowledgeable 2
 Not very knowledgeable 3

6. To the best of your knowledge, how has geothermal energy been used in Susanville? (DO NOT READ LIST, CIRCLE AS MANY AS APPLY).

Space heating 1
Direct process heat 2
Generation of electricity 3
Other (PLEASE DESCRIBE): _____

7. What do you see as the potential uses for geothermal energy in Susanville?

Space heating 1
Direct process heat 2
Generation of electricity 3
Other (PLEASE DESCRIBE): _____

8. How interested are you in seeing the further development and use of geothermal energy in Susanville? Would you say you are (READ LIST) ...

Very interested 1
Somewhat interested, or 2
Uninterested 3

9. Why do you say you are (READ ANSWER FROM Q. 8) in the further development and use of geothermal energy in Susanville? _____

10. In your opinion, how interested is the city of Susanville in the further development and use of geothermal energy in your area? Would you say Susanville is (READ LIST)...

Very interested 1
Somewhat interested, or 2
Uninterested 3

11. To the best of your knowledge, what types of things is the city of Susanville doing to promote the further development and use of geothermal energy?

12. Considering the following sources of energy: solar, water, geothermal, petroleum (such as gas and oil), coal, wind, nuclear, and biomass (such as wood), which of these would you most prefer to see used in Susanville? What would be your second preference? Third? Fourth? Fifth? Sixth? Seventh? Eighth? (SHOW RESPONDENT THE SOURCES LISTED ON THE QUESTIONNAIRE BELOW. NEXT TO EACH SOURCE, WRITE THE ORDER OF PREFERENCE...1st, 2nd, 3rd, etc.)

Solar	_____
Water	_____
Geothermal	_____
Petroleum	_____
Coal	_____
Wind	_____
Nuclear	_____
Biomass	_____

13. Why do you most prefer (READ 1st CHOICE FROM QU. 12)?

14. Why do you prefer (READ 2nd CHOICE FROM QU. 12) as your 2nd choice? _____

15. Why do you least prefer (READ 8th CHOICE FROM QU. 12)?

What other reasons? _____

IF GEOTHERMAL RANKED AS FIRST OR EIGHTH
CHOICE IN QU. 12, SKIP TO QU. 17.

16. Why did you say geothermal would be your (NUMBER OF GEOTHERMAL CHOICE IN QU. 12) choice? _____

What other reasons? _____

- 17a. Now, I'd like to find out a little more about you or your company's involvement in geothermal energy development. First of all what has been your involvement in the development of geothermal resources? (PROBE FOR NUMBER AND TYPES OF PROJECTS AND ROLE PLAYED IN EACH PROJECT). _____

- 17b. Why are you (involved/not involved) in the development of geothermal resources? _____

18a. What would you hope to gain from an involvement in geothermal development?

What other types of benefits can you see from an involvement in geothermal development? _____

18b. What, if anything, has been your involvement in geothermal development in Susanville?

19. What kind of profit margin or return on investment would you be looking for when involved in a geothermal project? _____

Why? _____

20a. What kind of profit margin or return on investment would you be looking for when involved in other types of projects? _____

Why? _____

20b. How is this profit margin on other projects similar to or different from the profit margin you would be looking for on a geothermal project? (INTERVIEWER WRITE-IN WHETHER RESPONSE IS IN REFERENCE TO SIMILAR OR DIFFERENT).

21. What factors would you take into consideration when deciding whether or not to be involved in a geothermal project? (LIST BELOW AS MANY FACTORS AS MENTIONED. BE SURE TO LIST THEM IN ORDER MENTIONED).

1st Factor _____

2nd Factor _____

3rd Factor _____

4th Factor _____

5th Factor _____

6th Factor _____

22. How important is (READ NAME OF 1st FACTOR FROM QU. 21) when deciding whether or not to become involved in a geothermal development project? Would you say it is (READ LIST)...(REPEAT QU. 22 FOR EVERY FACTOR MENTIONED IN QU. 21).

	1st Factor	2nd Factor	3rd Factor	4th Factor	5th Factor	6th Factor
Very important	1	1	1	1	1	1
Somewhat important, or	2	2	2	2	2	2
Unimportant	3	3	3	3	3	3

LOOK BACK TO QU. 21, IF RESPONDENT MENTIONS ONLY ONE FACTOR
SKIP TO QU. 24.

- 23a. (ASK THIS QUESTION BY PAIRING EACH FACTOR MENTIONED IN QU. 21, UP TO A MAXIMUM OF 10 PAIRS. AN EXAMPLE: IF RESPONDENT MENTIONS 4 FACTORS, ASK THIS QUESTION FIRST FOR FACTORS 1 AND 2, THEN FACTORS 1 AND 3, THEN FACTORS 1 AND 4, etc.)
Now, I'd like to present some possible situations and get your reaction. Forgetting for a moment all other considerations, suppose you found a geothermal project that was completely satisfactory in terms of (1st CHOICE), but was less than what you wanted in terms of (2nd CHOICE). Would you still consider taking on that project? (AFTER ASKING QU. 23a IMMEDIATELY ASK QU. 23b, THEN PROCEED TO THE FACTOR PAIR, CONTINUE UNTIL QUES. 23a AND 23b ARE ASKED FOR ALL FACTOR PAIRS.)
- 23b. (FOR EACH YES/NO ANSWER IN QU. 23a, ASK:) Why? (PROBE FOR OTHER REASONS. ASKED FOR ALL FACTOR PAIRS RECORD BELOW).

	QU. 23a		QU. 23b
	Yes	No	Why
1st and 2nd Factors	1	2	
1st and 3rd Factors	1	2	
1st and 4th Factors	1	2	
1st and 5th Factors	1	2	
2nd and 3rd Factors	1	2	
2nd and 4th Factors	1	2	
2nd and 5th Factors	1	2	
3rd and 4th Factors	1	2	
3rd and 5th Factors	1	2	
4th and 5th Factors	1	2	

24. Please describe in detail the process by which you or your firm would make a decision on involvement in a geothermal resource development project.

25. What role would government regulations play in your decision to be involved in a geothermal project?

- 26a. Has local government had any influence on your involvement in geothermal development?

Yes 1

No 2 —▶ (SKIP TO QU. 27)

- 26b. How?

27. What is your opinion of geothermal as an energy source?

Why do you think this?

28. What do you see as the advantages of geothermal use?

What else?

29. What do you see as the disadvantages of geothermal use?

What else?

30. What type of resources such as manpower and transportation do you feel will be needed for the development of geothermal energy?

31. How would you evaluate Susanville in terms of these resources?

32. What factors or conditions do you see as influencing industry's use of geothermal energy?

33. What factors or conditions do you see as influencing industry's use of geothermal energy regarding plant retrofit or expansion?

34. What factors or conditions do you see as influencing plant relocation and the ultimate use of geothermal energy?

35. Are you familiar with the way in which the use of geothermal is managed in Susanville?

Yes 1

No 2

36. Are you familiar with the way in which the use of geothermal is managed in Klamath Falls, Oregon?

Yes 1

No 2

IF NO TO BOTH QU. 35 AND 36 GO TO QU. 38

37. What is your opinion of the way geothermal use is managed in (these/that) area(s). (NOTE TO INTERVIEWER): In Susanville use is centralized around and controlled by the city, and in Klamath Falls there are a lot of individual wells, unlike in Susanville. If possible probe for comparison of the two management structures.)

38. Thank you for your time. Do you have any further comments? (IF YES, RECORD BELOW).