MASTER

**SUSANVILLE
GEOTHERMAL ENERGY
PROJECT**

**SUMMARY REPORT
AUGUST 27, 1976**

CITY OF SUSANVILLE

PREPARED FOR THE U. S. ENERGY
RESEARCH AND DEVELOPMENT
ADMINISTRATION UNDER CONTRACT

AT (04-3)-1077

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ENERGY PROJECT

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Director of Finance
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PREPARED FOR THE U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
UNDER CONTRACT NO. AT(04-3)-1077

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INTRODUCTION

This Summary Report covers the follow up on the SGEP Workshop which was held in Susanville on July 14-16, 1976. A post-conference survey was conducted and pertinent reports collected. Analysis of the survey and reports have been used to formulate Program Office comment and recommendations for future related energy projects.

Copies of available pertinent letter reports have been included in the Appendix.

In addition, our consulting counsel has recently delivered a proposed preliminary draft of a local ordinance that he structured for the protection of the resource. The proposed ordinance in current form is also included in the Appendix.

On August 11, 1976, the City Council of Susanville adopted a preliminary - City of Susanville Geothermal Policy. A copy of the objectives, guidelines and criteria are included in the Appendix. This policy material is expected to evolve as required in developing the working interfaces between the City, County, private sector and inhabitants. At an appropriate time, a formal policy statement will be formulated.

In accordance with SGEP Quarterly Report format, this report has been prepared for management purposes and contains material addressed to Replicable Communities. All technical information has been included in the SGEP Workshop Proceedings, SAN-1077-4, dated July 13, 1976.

OVERVIEW

- The Project has been extensively complimented on the SGEP Workshop, held in conjunction with the Susanville Geothermal Conference at Lassen College on July 14-16, 1976.
 - ° Over 125 representatives from seven states and the District of Columbia attended
 - ° Local communities, private industry, financial institutions, state and Federal agencies were represented.
- More education and communication with local inhabitants and local government management is required to accelerate the development and use of the hydrothermal resources.
 - ° A national, overt educational/promotional activity should be implemented. It must go beyond newsletters, listing of available reports and news releases.
 - ° A "how to" manual and film and slide shows should be directed at state and local government management, civic and leading social groups and industrial/commercial associations.
- Front-end or start up financing (not a Federal but a local issue) needs developing. Various means are being implemented.
- For the implementation phase, the combination of the ERDA Guaranty Loan Program, the Bu Rec PL94-156 for resource assessment and the non-energy financing through established socio-economic agencies can be synergized by a local government for a major impact on the organized development and use of hydrothermal resources.

- The development and documentation of the procedures for a community to define and qualify a project for the ERDA Guaranty Loan Program is a remaining required piece of work.
- Replication of the SGEP has been initiated by the Eastern Oregon Community Development Council. Data transfer and discussion has been initiated with other local agencies both in and outside of the Utilization Panel membership.
- The assistance of Linda Kennedy, a representative of the news-media in Susanville, is appreciated. Ms Kennedy described, from a lay-person's view, the results of the SGEP and its usefulness to a community. Her contribution, excerpted from SGEP Newsletter No. 4 follows:

DEVELOPING YOUR GEOTHERMAL SYSTEM. . .

Communities can benefit economically from the development of geothermal resources - - - whether they start with geothermal production wells, use hot water exhausting from established power plants or other hot water users.

Planning procedures or "tools" needed by communities to reap the benefits of geothermal development were determined by the Susanville Geothermal Energy Project.

These Planning tools can help communities establish low-cost sources of energy and provide incentives to industry. The use of geothermal resources becomes extremely important when one considers the large extent of resources available in the United States.

It is estimated that it would take two trillion barrels of oil burned

in a boiler to heat the hot water that is in the reserves in over 2,500 communities in the U.S.

Using the SGEP's tools, a community can determine the amount of their resource, how much development will cost, what returns to expect and what benefits will be generated.

The first step is a preliminary assessment of the resource by geologists and/or geophysicists. A more complete appraisal can then be conducted by the U.S. Bureau of Reclamation through Federal funding under new legislation, PL94-156.

The next step includes use of the tools by the Community planning department to define a geothermal utility system, estimate its cost and the cost of the heat and electricity delivered to users. The department can then estimate the projected economic impacts upon the community.

THE SGEP TOOLS. . .

The Engineering Design Guide as a tool is used by the community to map out a utility system, size the hardware and define the performance for the identified resource.

The Economic Model as a tool is used to integrate information and procedure into existing community planning functions. With this tool, an estimate of the cost of a geothermal utility system for the developing of geothermal energy to industrial, commercial and residential users can be determined.

Further, the Model can assist the community in planning with commerce

and industry for the use of this lower cost energy as an encouragement for additional job opportunities in the private sector. Finally, the Model can be used to estimate the projected economic impacts upon the community.

If the resource is adequate, the modeling can estimate the cost of an electric conversion plant that should ideally be a subsystem of the non-electric thermal utility.

The SGEP found Susanville to be "Geothermal Community, USA". The community is small, rural, remote and subject to high-unemployment. It is a good candidate for the economic benefits derived from geothermal development.

Hydrothermal geothermal resources (hot water) have a broad application to agriculture and forest product industries. These resources can best be exploited through a thermal utility system.

THE WORKSHOP PROCEEDINGS. . .

The tools and their use as well as the other related information on the Project are described in the Susanville Geothermal Energy Project Workshop Proceedings, July 13, 1976. Copies may be obtained from ERDA, Technical Information Center, P.O. Box 62, Oak Ridge, Tenn. 37830.

SGEP WORKSHOP FOLLOW UP

Survey

As a follow up, a survey was conducted to determine:

- General reaction to the Workshop
- An assessment of the Engineering Design Guide and Economic Modeling
- Problems of implementation by other communities
- Suggestions for related future efforts that directly support the primary objectives of the Project.

Contacts in the survey included:

- Official representatives of all Utilization Panel member communities that attended the Workshop.
- Representatives of regional and state agencies
- Representatives of ERDA and FEA
- Representatives of private industry
- Project Task Managers
- Koepf and Lange, an engineering consulting firm employed by the Project to independently assess the SGEP tools developed on the Project. Koepf and Lange had not been employed by the Project before the Workshop.

Comments on the Workshop

The comments have been compiled and condensed to eliminate redundancy. The following includes the salient features of all comments received to date. Comments are grouped by category.

Category 1. Overall Workshop and Conference Content, Organization and Mechanics.

We have received unanimously favorable comments regarding

the Workshop and the overall Susanville Geothermal Conference. Comments have ranged from "most meaningful information..." to "most well organized...well run conference" and "such a diversity of material". The success of the organization and operation of the conference is in large part the result of the fine organization and operation of the Lassen College staff and the staff of the City and of the local community organizations. The only critical comments regarded the lack of air conditioning and the tight schedule that restricted time for informal conversation and relaxation. This latter is an important consideration for future conferences.

Category 2. Institutional

Institutional comments centered around the need for education of key citizens, local government management and the local inhabitants. This is a key to a successful implementation phase and to new project starts in other communities. These comments included:

- Inaccurate media reporting caused problems and delays in geothermal developments at the Geysers.
 - 90% of the people are waiting to be led in directions, not necessarily to their benefit, by the 10% minority activists.
 - Need for a "traveling medicine show" to advise the people-at-large and local government management on the pro and con, in a factual manner.
 - Key citizens must be actively sought out and educated.
- Public Hearings won't do it by themselves.

- Translate the technical for the lay person and non-technical local government management.
- "The modeling is one or two steps ahead of (our) community -- if the city fathers could sit through this conference they would be sold on the idea."

In addition to education and communication, the front-end financing for project start-up received some comment:

- The community probably won't move without some source of front-end financing -- possibly a severance tax -- like stumpage fees in lieu of local taxes.

A strong recommendation was made to maintain the operation of the Utilization Panel through the future phases of the Susanville Project. This was made by a government representative not part of the Panel. The reason offered was for the further encouragement of the obvious technology transfer, (to the Panel and from the Panel to the Project), that has gone on during the current Panel operations. The initiation of a project extending the Susanville Project in Union and Baker Counties in Oregon is direct proof of the transfer.

The characterizations of the communities surprised many people including the Project staff. The characteristics indicating the small size but political strength in affecting the local way of life is a most important fact affecting the overall development of geothermal energy.

Category 3.- Technical

In the technical area, comments received varied over a considerable spectrum.

- Silica precipitation can occur with heat removal (on a site specific basis - Imperial Valley). This is of concern in

areas of high concentrations of brine.

- The total energy budget should be addressed. This is of interest to ERDA in evaluating the worth of a project. One should assess the total energy required vs the new energy yield in order to assure a net energy gain. It seems that a reasonable resource (1500+GPM/5000'well) yeilding hot water (200+°F) would "cost" about 1000 gal of diesel oil to drill. This should readily be recovered by a reasonable hot water system. A "useful" resource would also have only minimal pumping energy requirements. A site-specific study is required during the preliminary design and evaluation effort. (Energy budget analyses are planned for the next phase of the Susanville Project.)
- A product market analysis and business plan are required for viability of the project. (This effort may not have been explicitly defined in the modeling presentation. Market analysis is one of the many analyses that makes up the "Community and Candidate Industry Characterization" activity -- the center section of the Overall Modeling Concept, see Fig. I-1 and IX-2 in the Proceedings¹).
- Field development concepts were compared. Large diameter bores plus multiple slant-drilled down-hole development (Raft River) vs the more conventional single well per 20

¹Susanville Geothermal Energy Project, Workshop Proceedings, Final Technical Report July 13, 1976, SAN-1077-4. Available through ERDA, Technical Information Center, P.O. Box 62 Oak Ridge, Tenn. 37830

acre development. It was stated that the Raft River concept could not use current down-hole pumps.

- The need to define the energy specifics (energy content) of products and processes was brought up on a number of occasions. The lack of usable data can become a deterrent to the extensive utilization of non-electric applications by industry. No clear resolution of this problem was evident from the discussion.
- In the context of the above, it was recommended that an annual symposium for geothermal energy applications to the food industry should be instigated.
- A question was raised regarding comparison of the example piping systems with other current systems in the World. The Task Manager indicated such comparisons had not been made. It should be noted that the Engineering Design Guide was developed for maximum flexibility of use. The samples run through the Guide were merely simple examples that were credible but selected only as a means of exercising and testing the Guide, the Model and their interface.

In this light, it was interesting to note that the consulting engineer, who had not been exposed to the work prior to the Conference, used the Guide and Model to design a small utility system for Susanville. He used his own design philosophy which called for a different system pressure and a different size of storage facility. However, using the Guide and Model, he costed the system and calculated the pay back and servicing of the financing. This analysis was performed while attending the Workshop.

- The description of the atmospheric freeze drying facility for Brady, Nevada was very pertinent to the conference.
- An inquiry was made regarding the definition of an economic threshold for a minimum size of a cascade system. It was cautioned that such is a very site-specific situation that can only be analyzed using the "community-industry characterization" or center section of the overall Model on a real case. It involves the nature of the product and process as well as the economics of the specific utility, competing energy forms, the market, local labor, etc. The use of the Model assists a community in conducting such analyses.
- The concept or over-simplification of "a Btu is a Btu" was discussed. The product-by-product evaluation of the value of energy and the site-specific competing energy alternatives probably have a greater influence on the pricing of a Btu than some theoretical value of a Btu vs temperature.

Program Office Comments

The most relevant comments fall in the areas of Institutional and Finance. Since this Spring the Program Office has recognized and preliminarily planned for the initiation of an educational effort. However, the initiation of such activity has been held up pending the definition of the future direction and timing of the Project. The acquisition of some geothermal resources in the Project area by "third parties" external to the Project have re-inforced this recognition of need for declaring the city's position. However, it is important to not be premature with the

education program. There already is an indication of impatience on the part of some citizens in Susanville. There is a lack of understanding or unwillingness to accept the time required for government-sponsored R & D. This is aggravated by the irritation associated with high unemployment rates. Hence, the education program must be timed to be coincided with the site-specific resource development and system definition phase.

The above emphasizes the need to complete the development of procedures for a community to go the whole way from resource assessment, and community planning, through project financing, construction and energy system operation.

A more overt, national educational program is needed. Community managements are not aware of the data and information that is and is becoming available, (see Fillmore letter in the Appendix). Further, this data is quite technical in current form. In addition, it must be pulled together in a useful package. This package should be in several forms.

- An all encompassing geothermal "how-to" handbook.

This handbook should be technical only to the extent necessary to be accurate. It should contain an executive overview that is completely non-technical, and each section should have a non-technical overview.

- Appearances on major television networks is required to make up for the obvious weaknesses through the current reduction in effectiveness of communication through the printed media.

- Institutional "road shows" - film and slide shows directed at state and local government management.

- Interesting presentations on call from field offices for civic, fraternal, social and business groups, "town hall" meetings, etc.
- An organized effort to convert or neutralize and/or obtain the assistance of anti-energy development groups.

Of potential value to other communities planning for geothermal development a number of institutional "next steps" are planned for the Susanville Project.

- Set municipal policy regarding the city's direction and objectives for the development of the near at hand resources. This includes definition of desired relationships with property owners, mineral right owners, geothermal developers, current local industry, potential new industry, etc. (This is in preliminary form).
- Develop a policy for joint efforts with Lassen County government.
- Initiate an education program in the area. Seek out, contact and develop clear understandings with representatives of local industry, agriculture and commerce. Seek out, contact and develop clear understandings with representatives of citizens groups, local offices of state and Federal agencies, civic organizations, etc. Hold specific public hearings. Augment our media program.

In parallel we must participate in planning for the Bureau of Reclamation resource assessment program as funded by Congress to the Bureau of Reclamation and ERDA.

- Develop a "licensing" arrangement with the Bureau of

Reclamation for the geophysical research and drilling program. This approach is preferred by the Bu Rec.

- Develop the permitting for access to private property for the geophysical work.
- Complete the Ca. Energy Commission and City of Susanville financed lease option program in the Susanville Anomaly.
- Establish a Commerce and Industry Park through Farmers Home, EDA, Redevelopment and Private financing.
- Form a non-profit corporation in conjunction with the county for the financing of the first segment of the Utility system.
- Establish a program of economic development to (1) strengthen local industry and commerce, and (2) select and obtain commitments from potential new industry.
- Design, evaluate and financially plan for the utility system in support of an application to ERDA for a guaranty of the taxable revenue financing of the first segment of a thermal utility system. This effort is to be conducted in cooperation with a commercial financial institution.
- Implement the various elements of the plan using revenue bond financing.

In the area of financing, the "front-end" financing warrants some comment. The actual project implementation phase financing should be readily available through commercial sources assisted by an ERDA Guaranty -- once the community procedures are developed. However the "front-end" is still unclear and may have to be worked out on a case by case basis.

This front-end effort encompasses:

- Local community planning to define needs and objectives for the project.

- Conduct such surficial, geologic and geophysics surveys as required to select the sites, identify the potential characteristics of the resource(s), and develop a plan for future resource assessment. This effort determines the practicality of initiating action, through Congress, with Bu Rec under PL 94-156.
- Planning for the major financing of the project including:
 - 1) Developing an interface with the commercial/municipal financing institutions
 - 2) Conducting preliminary planning with the ERDA Loan Guaranty personnel
 - 3) Identification and development of candidate equity for the Project.

In this light the Principal Investigator has contacted a number of communities. Each has at least a slightly different approach to the "front-end" financing. The options being considered or being used include:

- 1) Municipal staff time and expense through the general fund plus industrial firm contributions of staff and expense, (Susanville prototype).
- 2) Extension of the Susanville Project through local government leadership and regional economic council effort. Being funded (\$25,000/1 yr,) by a tri-state economic development fund.
- 3) Local private institutional industry plus county officials have initiated planning. Potential of private or public plus private financing.
- 4) Limited funding available through city. Potential of private investment fund for front-end financing.

It is believed that limited front-end funding can best be obtained through one or more of the following:

1. State energy offices
2. Foundations
3. Private investment funds
4. Local share in-kind

Communities must realize that a successful project of this nature requires the dedication of at least two key individuals

- 1) Project leader in the community
- 2) Project counterpart in the principal sponsoring agency.

Both of these individuals must have knowledgeable persistence.

LOCAL ORDINANCE DEVELOPMENT

As part of the scope of the Institutional and Environmental Plan, Task 2.0, the structuring of local ordinances has been explored. These ordinances are to protect the community's way of life, the environment and the resource. To over simplify, the protection of the community's way of life is to maintain local self determination through land use ordinances and local control through the planning commissions.

As stated in the Workshop Proceedings, (page XIII-9), we have established objectives for these three areas of local legislation. In addition we have received a proposed preliminary draft of an ordinance designed to protect the development of the resource. (Oregon State's Special District Heating Law contributes to this same end). It is believed important that local resource development, especially in relatively congested urban areas, should be incentified to drill and otherwise conduct such development such that a maximum utilization occurs for the development investment. Individual developers should be incentified to plan together to preclude inadvertent damage to the resource. In other words it is better to encourage ten home owners to hook up to one well rather than have each home owner have an individual well that is used at 10% capacity. Unitization for field development and for disposition (reinjection) should be encouraged.

The preliminary proposed ordinance was developed under the SGEP contract and hence is included in the Appendix. It is offered for use by other communities in their own planning. The document is in review in the SGEP Project Office. It has not been reviewed or approved by the City Council of Susanville.

It is recommended that such ordinances be structured to encourage development of the resources and to not hinder that development. However, the ordinances must protect the inhabitants and should protect the resource. The draft ordinance contains many elements pertaining to these two areas of protection.

Comments are offered on the reports included in the Appendix.

FEA (FEO)

The critique of more community education and involvement is accepted in part. The community has been involved through the active participation of the Susanville Geothermal Advisory Committee formed in October 1974. Members participated in special meetings with the Project staff and at all quarterly reviews. We have found, however, that significant action on their part is not required until a site-specific plan and system are defined. On the other hand a local education program is overdue.

The critique regarding extent of the environmental considerations is an interesting one. The Project intentionally restricted the scope to the more near term potential of non-electric and a single module of electric conversion. This was done to reflect the needs of the local community rather than directly approaching national or regional needs.

The "total" resource can be speculated upon, but probably won't be defined for some time. In retrospect it would have been interesting to look at such a scope in terms of its potential impact upon the local environment and the local community's way of life.

The comments on the Utilization panel activities are appreciated. The Project concurs in the value of the Utilization Panel. It has been a very educational experience -- both ways -- and an effective means to assure a broad "fit" for the tools and to

rapidly assure technology transfer. It can even be improved upon through better meeting arrangements and efficient dialogue -- provided the added work load on small, local community management is minimized.

The comments on institutional effort are fully accepted. We originally programed approximately 6% of project funds plus city staff time to the effort. In retrospect we could have programmed at least 20% plus city staff time. However, excess effort in this area before a site-specific development, financing and design are identified could be inefficient. It should be remembered that the Project was precluded from designing a Susanville geothermal system. Only at the end of the Project were we in a position to define potential direction for such system planning.

Regarding the FEA (FEO) final comments, the Project sincerely looks forward to their future participation and appreciates their past support on the Advisory Panel.

City of Fillmore

The Project sincerely appreciates the very thorough, constructive and professional participation of the City of Fillmore on the Utilization Panel. We hope that our results will assist Mayor Wright in his unique dealings with the geothermal developers and utility companies now operating in his area.

The Fillmore letter report contains data that illustrates the need for a better national communication program. Some of the

data sought is critical to geothermal developments in the semi arid conditions in the Sevier Basin, Utah. It is assumed that ERDA will place the Mayor's office on appropriate distribution lists.

Keopf and Lange

A. H. Koepf's report reflects, through a relative new comer's eyes, the dichotomy of the project: namely to conduct a generalized study to fit many communities and still result in an incentive for a specific community as a prototype.

Through Mr. Koepf's eyes and many others in federal, state and local governments it can be seen that it has been difficult to communicate this dichotomy. More direct effect on Susanville has been expected by most that have not understood the ground rules. The Susanville proposal currently before ERDA covers many of the areas recommended in the comments received to date.

The Project Office concurs in Mr. Koepf's recommended approach except for the small scale (1 to 5MW) power plant. It is not obvious that such can compete with current energy costs in the Honey Lake Valley.

A P P E N D I X

- ° FEO (FEA) Report
- ° City of Fillmore Report
- ° Koepf and Lange Report
- ° Preliminary Proposed Ordinance
- ° City of Susanville Geothermal Policy

Federal Energy Administration Report

FEDERAL ENERGY ADMINISTRATION

WASHINGTON, D.C. 20461

August 4, 1976

Dr. David Lombard
Assistant Director
Advanced Energy Systems
Division of Geothermal Energy
Energy Research & Development
Administration
20 Massachusetts Avenue, N.W.
Washington, D.C. 20545

Re: Susanville Geothermal Energy Project (SGEP);
(ERDA Contract AT (04-3)-1077)

Dear Dr. Lombard:

Since the initiation of the subject project in July 1975, the Federal Energy Office (FEO) has served as a member of the Advisory Panel in support of the project. Now that the workshop proceedings are completed and the final technical report has been published, we feel obliged to evaluate the progress and offer our recommendations for future development activities.

FEO representatives, from both the Region IX office and Headquarters, were present at each of the program review meetings and for the recent final report meeting held in Susanville, California July 14-16, 1976. With regard to our joint evaluation of the subject project, we have prepared the following evaluation based on the contractor's Statement of Work (Appendix "A" Contract AT (04-3)-1077).

In general, we believe the primary goal of the study--to evaluate the use of geothermal energy as an economic base for a small community--has been achieved and that, to the degree possible, the results can be applied to replicable communities as a model to follow in developing their respective geothermal resource potential. We recognize, however, several deficiencies in the study that deserve more in-depth analysis. The deficient areas, specified below, are not necessarily the result of omission in their treatment in the study, but because they could not be adequately addressed until the resource assessment is sufficient to prepare a development plan specific to a given community. Our comments follow the Work Statement outline contained in the contract between the sponsor, the Energy Research and Development Administration (ERDA), and the contractor, the City of Susanville, California (Contract AT (04-3)-1077; Appendix "A").

Research Plan

Specifically, with regard to the five (5) tasks under the research plan, we felt that Tasks 1 and 4 were deficient for the efforts devoted to defining the community requirements for building an economic base and for conducting an institutional study, respectively. In both tasks, evidence of community input and involvement in the effort appears to be lacking. This was also evidenced in the absence of community participation at the mid-point and final program reviews. We recognize the tasks under the research plan had to be designed for more than one community and that until a specific site development plan is pursued, the definition of community requirements and institutional structure could not be detailed. However, if the SGEP is to be truly effective as a model, these tasks will need to be addressed in greater depth, particularly in terms of community education and involvement.

A final comment on one element of Task 4 concerns sub-task (c) covering environmental assessment study; the final report reflects what we believe to be a rather subjective and restricted analysis of the potential environmental impact of geothermal development. Susanville, and the other utilization panel communities with undeveloped geothermal resources, would do well to consider environmental impact in light of the experiences the community of Lakeport, California has encountered. We feel that as long as the study was focused on a hypothetical resource base, capable of producing both thermal and electrical energy, it should also have included an environmental assessment in context with maximum resource potential and development. For example, in using Susanville, as the case study, the environmental assessment should have considered the community in view of its potential as an exporter of energy (i.e., electrical) rather than restrict the environmental impact study on the basis of a development that could satisfy the future demand of the community.

Utilization Plan

We feel the deliverables assigned to the tasks under the Utilization Plan were adequate; particularly in view of the fact that the contractor had the additional problem of describing and coordinating the elements in the study with such a diverse assemblage of communities whose geographical distance and circumstances (i.e., municipal government administration, statutes, resource productivity) varied

considerably from the Susanville case. The interest and participation by the Utilization Panel at the Workshop indicated to us that the model developed from the study will undoubtedly be beneficial and that one of the objectives of the study to provide replicable communities with a useful model has been accomplished.

Program Planning

The two tasks related to the program planning effort were more than adequate in their presentation, and in the ensuing proposed work effort will constitute a major source of reference.

Conclusions and Recommendations

We have recognized that certain of the study tasks could not be adequately developed until a specific development plan is initiated. We believe this to be the case in each of the tasks that are considered inadequately presented in the study. We feel that the problem areas, which were commented on will need additional effort. Assuming that ERDA decides to continue sponsoring the project to the point of demonstration of a non-electric utility system, such as has been proposed by the City of Susanville, we feel it would be particularly advantageous to put extra effort into developing the following tasks:

- a community education program
- more in-depth analysis of the institutional problems concerned with development (apart from planning the financing of the project).
- an expanded environmental assessment program.

We feel the SGEP effort does represent an excellent prototype for a demonstration program. Based on the project results to date, we recommend that the Project be continued. as further evidence of our interest in the proposal now being considered by ERDA, FEO hopes to provide support for the Institutional and Environmental Plan Tasks in the proposal, subject to ERDA's authorization to continue the SGEP, and of course, to FEO approval of appropriations.

Please contact Burt Barnes in my office (961-8163) if we can be of any further assistance.

Yours Truly,

Edwin A. Kuhn, Director,
Office of Synfuels, Solar
& Geothermal Energy

City of Fillmore Report

CITY OF FILLMORE

96 South Main Street
Fillmore, Utah 84631

Phone 801 743-5314

August 4, 1976

Mr. Alfred B. Longyear
Principal Investigator
Susanville Geothermal Energy Project
555 Capitol Mall, Suite 445
Sacramento, California 95814

Dear Mr. Longyear:

The purpose of this letter is to give you my reaction as a utilization panel member on the Susanville Geothermal Energy Project, to the project itself, and the conference conducted at Susanville on July 13, 14 and 15, 1976. After attending the workshop and studying the final technical report, it is my sincere opinion that both the quality and the scope of the materials presented was outstanding. Again, may I say that I was genuinely impressed by the vast array of technical and scientific data which had been collected and which should have practical application not only in Susanville, but in other areas with potential for development of geothermal energy.

It is my opinion that in terms of the objective of the Susanville project that there are no significant omissions or gaps which I can point out. I would like, however, to make the following suggestions:

(1) That further study and research be conducted, not necessarily by the Susanville project, in the area of the effectiveness of the recharge of geothermal reservoirs, both by natural flow and by the reinjection of the utilized hot water. I realize that this could be different perhaps for each area involved. If data has already been obtained from Iceland, the Imperial Valley or other areas, the availability of this data for these areas should be valuable.

(2) The second recommendation, also, would be site specific. Further research and study, I feel, would be helpful in determining the original source of the water in the geothermal reservoirs. A field representative for the Phillips Petroleum Company which has drilled eight apparently very successful wells in the Roosevelt Springs, Utah area has advised me that through the procedure of isotopic detection, indications are that the water in these wells has originated in the Colorado Plateau area, some two hundred miles east of the wells.

Mr. Alfred B. Longyear

-2-

August 14, 1976

The University of Utah in Salt Lake City has been awarded a Federal grant for study and research of geothermal energy resources in Roosevelt Springs area. It would appear to me that the data you have collected and the reports you have compiled would be very useful to them. I will assume the responsibility of informing them of the activities of the Susanville Geothermal Energy Project, the reports which are available and where they may be obtained. I will also submit that information to Mr. Clifford Collins, Utah State Energy Coordinator, Salt Lake City.

I would be remiss if I did not express my sincere appreciation to you for the opportunity you afforded me to participate in the Susanville project as a utilization panel member. I will endeavor to make the data of the project available to all of those in the Utah area effected by geothermal energy development and other who may be interested.

Kind personal regards.

Sincerely,

A large, stylized handwritten signature in dark ink, likely belonging to Golden P. Wright, is written over the typed name and title.

Golden P. Wright
Mayor

GPW/ccw

Koepf and Lange Report

KOEPF & LANGE
CONSULTING ENGINEERS
971 DEWING AVENUE
LAFAYETTE, CALIFORNIA 94541
(415) 284-4650

July 27, 1976

Susanville Geothermal Energy Project
City of Susanville
66 North Lassen Street
Susanville, California

Attention: Mr. James C. Jeskey
Program Manager

Subject: Letter Report on Susanville Geothermal,
Energy Project Workshop, Susanville, CA

Dear Mr. Jeskey:

In accordance with our agreement, please find a Letter Report on my observations at the Susanville Geothermal Workshop, July 14-16, 1976.

Generally I felt it was a good Workshop and directed itself to the generalized subject of Geothermal Energy quite well. If there were deficiencies they showed up where they were expected to in assessment of the resources and application to the specific situation at Susanville in utilization.

Thank you for your courtesy during the Workshop.

Very truly yours,

KOEPF & LANGE

A. H. Koepf

AHK:rr

Enclosures

Copy to: Mr. Alfred B. Longyear, CSL, Sacramento, CA

REPORT ON SUSANVILLE GEOTHERMAL
ENERGY PROJECT WORKSHOP,
SUSANVILLE, CALIFORNIA

Koepf & Lange was retained by the City of Susanville to attend the workshop on Geothermal Energy, July 14 - 16, 1976, and to prepare a letter report of observations and conclusions derived from the workshop and proceedings. The detailed charge follows:

"Conduct an independent assessment of the engineering procedures and economic modeling, Tasks 1.3 and 1.4, respectfully, of AT(04-3)-1077. This assessment is to be made by attending the Workshop in Susanville, July 14 - 16, 1976, assessing the papers as presented and participating in the appropriate seminars and interviewing the 1.3 and 1.4 Task paper and related task paper authors. A letter report assessing the engineering procedure and economic modeling is to be prepared by the consultant after the Workshop. The report is to present an assessment of the use of the procedures as a planning procedure for community planning purposes. The report will recommend areas for improvement as deemed appropriate for their intended use."

RESOURCE ESTIMATE

In order to review and assess the proceedings, it is necessary to establish an order of magnitude of the Geothermal Resource(s) of the Susanville area to place the portions of the Systems and Modeling portions of the presentation into the proper context. Review of the papers presented and interviews with the Geological Scientists was conducted. The results cause the Susanville area to be described as several distinct Geothermal Resources which may ultimately be interconnected.

There is a little data available to describe a detailed Scope of the Geothermal Resources at or near Susanville. A limited number of existing wells have been monitored or measured for thermal profiles. Flow rates are generally unknown. The Consulting Geologist for the project has estimated substantial potential in quantity and temperature is a reasonable expectation. The Bureau of Reclamation has in progress a program to drill test borings to define the resources better. Because of the limits of knowledge the extent of the resources is little more than an "educated guess"; however, in order to proceed evaluation will be based upon these limitations. These limitations shown are considered to be "floor" values and it is quite possible that tests and operation will show higher potential for each site. If this occurs the scope of each system will be substantially improved.

SUSANVILLE ANOMALY

Location	South of and adjacent to City of Susanville. This is a relatively small area.
Water Flow	1350 GPM including 350 GPM at the existing North State Growers Well.
Temperature	150°F Maximum.
Well Depth	500 to 1500 Feet. (Existing wells are 5 - 600 feet).

WENDEL & AMEDEE KGRA

Location	Wendel to Amedee Hot Springs approximately 6 miles length by 1 mile width. This is a larger area approximately 25 miles East of Susanville.
Water Flow	7500 GPM total.
Temperature	240°F.
Well Depth	1500 - 5000 Feet.

LITCHFIELD ANOMALY

Location	West of Litchfield, approximately 12 miles East of Susanville.
Water Flow	Unknown.
Temperature	Unknown but probably similar to Susanville.

BALD MOUNTAIN ANOMALY

Location	East of Bald Mountain, approximately 14 miles East South East of Susanville.
Water Flow	Unknown.
Temperature	Unknown.

When the project was set up it is understood that it be considered as a Research Study to build an economic base. Accordingly to focus the project the investigators were directed to assume a reasonable resource condition and conduct the work against that assumption. The data noted above is more conservative than the assumption levels.

A cursory comparison of the temperatures above with the papers on Electrical Power Generation shows that technology described on steam or Binary Cycle Power Generation is very difficult to economically develop. Thus that portion of the proceedings may not be applicable to Susanville at this time. Accordingly, the Workshop proceedings should be reviewed as a dual presentation comprising a Generalized Geothermal System based on assumed Geothermal Resources and specific applications which might be applied for Susanville based on lesser assumed Geothermal Resources.

REVIEW OF SECTION 1.3, SYSTEMS

PAPER VI - AN INTRODUCTION TO HOT WATER UTILITY SYSTEMS, D. A. EDSON

This paper was a preamble to presentation of a systems method of consideration for geothermal energy. The advantages of cascading were pointed out, i.e., services that would take water at one temperature and return it at a lower temperature and be accountable for the gross heat removed from the system. The paper contemplated an electric utility use first, followed by industrial, agricultural, and district heating.

PAPER VII - THERMAL ENERGY UTILITY SYSTEMS, B. B. BASSE

The paper describes the components of a geothermal system and a method of selecting and sizing of the components. This is a simplistic approach which is generally satisfactory for preliminary design for a system. The paper starts with general comments on each component such as the supply system (wells and gathering), distribution system (pipelines, pumping, operation, maintenance, and materials), and utilization (peaking and cascading).

Some specific notes from this part of the paper include:

1. Wells must be spaced to prevent interaction, estimated as a spacing of one per 20 acres, approximately 1000 feet spacing.
2. Gathering lines are sized for 7 feet per second (FPS) water velocity.
3. Consider possible salt corrosion or scaling.
4. Pipe materials selected may be asbestos cement (to 210°F maximum) or steel. The thermal effects of insulation were noted.
5. It is possible to transmit hot water over substantial distances with low thermal loss. This is based upon the fact that heat loss for buried lines is low and substantially constant when compared to the high residual thermal mass of hot water flowing at 7 FPS compared to ambient. It presumes continued high flow. Theoretical temperature losses of 0.1°F per mile at 200°F to 0.6°F per mile at 300°F for a 30 inch pipeline flowing at 5 FPS were noted. These figures require a flow of 11,000 gallons per minute (GPM) to conform.

6. Pumping energy was noted as a ratio of pumping energy to thermal energy. Taking the conditions given the ordinate should read percent of ratio (a factor of 1/100), i.e., it costs 1 percent of residual thermal mass value of water to pump 100 miles.
7. Utilization consideration is based on the input-output method of calculation. It is noted that an average annual utilization factor of 25 percent of peak design should be considered for heating. A brief cascade was shown to demonstrate the concept.

A design procedure was presented next. This procedure represents a method to select the component sizes that make up a system. The design procedure consists principally of a heat transfer application data sheet, a pipeline sizing data sheet, and guides for pump power, storage tanks, and pipeline materials. The procedure represents normal Engineering practices for selecting components and tabulating the required performance.

Two examples are considered in the paper; See attached Figures VII-9b, VII-11.

Problem No. 1

A City of Susanville System for a small hot water utility to serve a 10-acre greenhouse located in the south section of the city, 10 commercial and municipal buildings located near Main Street and the Conservation Center located East of the City. A table of customer requirements was prepared.

Research and development of the well field are complete but no production wells are drilled. It has been determined that production wells in the field will cost \$400,000 each and will produce 1,000,000 lb. per hour (2000 GPM) of hot water at 200°F. To achieve this flow each well will be equipped with a pump which discharges at the surface at 80 feet of head absolute pressure. (Note this deviates significantly from Estimates of Resource)

The geothermal water is assumed to have a pH of 8.0, contains 1100 ppm of dissolved solids and is compatible with both asbestos cement and carbon steel piping materials. In the areas of concern the water table is below six feet. The ground has a thermal conductivity $K=14\text{BTU/HR-Ft}^2\text{°F-in.}$ and the soil is mildly alkaline.

Because of the remoteness of the Conservation Center, reinjection wells are selected near Susanville and at the Center. All applications are weather dependent and will peak simultaneously in winter.

Problem No. 2

An industrial park is to be located in the Honey Lake Area. The park is to be immediately adjacent to a well field and contains a binary cycle electrical power plant and several industrial and agricultural customers for geothermal water.

The power plant supplies the base load to a local utility, operates all year round (85% on line) at 30 MW load and has a thermal utilization which varies between 5.1 and 5.5 watts per lb. of brine throughout the year.

An onion dehydration plant works 24 hours a day over a 150 day season, May through September, and is shutdown the rest of the year.

Research and development of the well field are complete but no production wells have been drilled. It has been determined that 15 production wells will cost \$500,000 each and will produce 500,000 lbs. per hour (1000 GPM) each of hot water at 350°F. To achieve this flow each well is equipped with a pump which discharges at 440 feet of head absolute pressure. The lift required by the pumps is 100 feet. (Note this deviates significantly from Estimates of Resource)

The geothermal water is assumed to have a pH of 8.0, contains 1100 ppm of dissolved solids and is compatible with asbestos cement and carbon steel piping materials. Ground thermal conductivity in the area is 12BTU/HR-Ft²-°F-in.

Each problem solution assumes well distribution, gathering line piping, distribution piping, reinjection, pumping power, and utilization. Within the limits posed by assumed geothermal availability and type and size of utilization elements the system layout method may be considered valid from an Engineering view point.

PROBLEM No. 1

LEGEND

- DISTRIBUTION PIPE
- REINJECTION PIPE
- SUPPLY PIPE

SCALE 1"=1 MILE

FIGURE VII-9a

LEGEND

- DISTRIBUTION PIPE
- REINJECTION PIPE
- SUPPLY PIPE

FIGURE VII-9b

PROBLEM No. 2

FIGURE VII-11

**PAPER VIII - HYDROTHERMAL ELECTRIC POWER CONVERSION SYSTEMS, G. K. OLSON,
B. BREINDEL, C. S. MAH, R. L. HARRIS**

The paper describes the types of generating plants which may be considered for Geothermal Power development. The discussion directs itself to both flash steam and binary plant types. The paper reviews in detail such matters as fluids, equipment components, non-condensibles, corrosion and scaling, condensers, regeneration. The paper represents significant background research on the subject.

Comparing the resources available at either Susanville Anomaly or Wendel Amedee KGRA Anomaly with the paper, the depth of the discussion shows limited promise for the Susanville project. Power generation is not presently possible at Susanville, and it has a restricted future at Wendel Amedee. For example, 7500 GPM water at 240°F, with a system performance of 1.5 watts per lb. per hour of water brine offers a potential for up to 5MW power. Special care will be required in design at such low temperatures to produce a plant that can produce power competitively, even with the assist from the downstream users envisioned.

Should future investigation show significantly higher temperatures and flow available the plant size and economics improve markedly.

REVIEW OF SECTION 1.4, MODELING

PAPER IX - AN INTRODUCTION TO ENGINEERING MODELING, D. A. EDSON

This paper noted the objectives of Modeling.

PAPER X - THE THERMAL SYSTEMS MODEL, B. B. BASSE

This paper picks up from previous paper VII through additions of cost data. The purpose here is to provide a basis for determination of system construction or capital costs and operating costs. Cost figures shown are based upon Contractor installed systems. The individual cost items are as accurate as current estimating will permit. Cost data apply to wells, piping, tanks, but do not cover electrical power generation or utilization or customer costs.

Problems 1 and 2 are costed and give representative values expected for those systems described.

PAPER XI - THE ELECTRIC CONVERSION ECONOMICS, G. K. OLSON, B. BREINDEL

The cost elements of possible electrical generation facilities are reviewed. The plants described are calculated to operate with Geothermal fluids of 250°F to 400°F and capacity of 10MW or more. The data given appears to be valid and reasonable for the conditions given. The situation at Wendell Amedee poses a more difficult set of conditions, 240°F maximum and 5MW potential. Application of the paper for this condition is difficult due to the stated conditions being beyond the paper ranges shown. They do indicate, however, a probable power cost problem against current electrical costs. Costs of the order of 60 mils per KWH are indicated.

Should future investigation show significantly higher temperatures and flow available the plant size and economics improve markedly.

PAPER XII - THE SOCIO-ECONOMIC MODEL, R. J. GARDNER, W. H. WHITNEY

This paper provides a model for projecting the effects on the community of additions to that community of a geothermal program. Given a set of input expressed in capital investment and new jobs it projects the net gain to the community in dollar terms. It appears to be a very thorough analysis.

The two problems were run through to show the effects of jobs, tax base, revenues.

CONCLUSION

The Workshop and its papers presented a good picture of Geothermal Energy Systems. The bulk of the work presented relates to application of geothermal energy on a generalized basis, thus permitting it to be applied to multiple areas where geothermal resources of the designated size can be obtained.

The situation for the Susanville project appears to be significantly different, thus requiring special study before the Workshop conclusions can be fully projected. The resource sizes of the Susanville area are low by comparison with the scope of some of the papers.

A program needs to be planned for the entire Honey Valley Anomaly System with the purpose of developing first a pilot stage at Susanville and orderly expansion to include Litchfield, Wendel, Amedee, et al as the resources and economics of the project increments permit.

Three areas require additional effort before clear pictures of geothermal potential can be developed:

1. The scope of the Resources at Susanville and other areas must be established. It is understood the Bureau of Reclamation has this work planned.
2. Guidelines need to be developed for the utilization portion to give reasonable indication of potential total financial return possibilities for both the operator and the utility for selected candidate energy consuming operations. In other words, a total Profit and Loss analysis for each candidate customer. This would lend additional credence to the possibility of hot water system payback. Examples would be for space heating (per unit of building area), a greenhouse system, a drying system, or other applications. While in theory energy expressed as BTU's is constant, the true value is limited as temperatures drop.
3. Study and recommendations are needed for a possible generating plant operating at 240°F and producing 1 to 5MW power. It may not be reasonable to apply the usual systems as they cannot compete at this time.

It is possible to economically develop the resources at Susanville, and this should be done. It is recommended that the project be handled on an incremental basis to limit the involvement to permit several key factors to be demonstrated. Our future energy situation virtually dictates that work proceed. What is marginal or a small loss today will be a good investment at the midpoint of the financing payback. Bluntly, what won't figure using \$.50 per gallon fuel oil will look good when fuel costs over \$1.00 per gallon and will probably be allocated.

We propose the following approach:

1. Develop a small pilot system at Susanville to include wells, piping, greenhouses, district heating, and space for applied research. This system would be designed for expansion and tie-in to future additional systems coming from the Wendel area. The system should include standby heat for peaking and some backup.
2. Develop additional increments to include an ultimate Honey Valley Development.
3. We feel there is reasonable possibilities for these programs to become financially self sustaining during the payback period.

- PRELIMINARY PROPOSED ORDINANCE -

Providing Procedure For Establishment of Geothermal Drilling
Sites And Establishing Limitations, Safeguards And Controls
For Geothermal Drilling and Production

NOTE: This draft is in preliminary form, currently under review by the SGEP Project Office. It has not been presented or reviewed or approved by the City Council of Susanville. The material was produced under contract AT (04-3) -1077 and is thereby offered for use in constructing local ordinances by other communities.

PRELIMINARY
ORDINANCE NO.

PROVIDING PROCEDURE FOR ESTABLISHMENT OF GEOTHERMAL DRILLING
SITES AND ESTABLISHING LIMITATIONS, SAFEGUARDS AND CONTROLS
FOR GEOTHERMAL DRILLING AND PRODUCTION.

THE CITY COUNCIL OF THE CITY OF SUSANVILLE DOES ORDAIN
AS FOLLOWS:

Section 1. Findings, Purpose and Intent.

There is reasonably believed to be a substantial geothermal resource in the City of Susanville and in the area surrounding the City. Development of such resource has heretofore been very limited, but it is anticipated that extensive new development thereof may soon occur. The purpose of this ordinance is to establish reasonable and uniform limitations, safeguards and controls for the present operations and future drilling for and production of geothermal steam, geothermal fluids and by-products thereof (hereinafter "geothermal products"). Such limitations, safeguards and controls are found to be necessary in order to protect the citizens, their property rights and the general public of the City and to put into effect practices which will provide a plan for the orderly drilling for, and production of geothermal products. Such orderly development is necessary and will protect the surface uses and the value and character of residential, commercial and other real property in the City as such uses are set forth in and regulated by the zoning ordinance of the City. The Council recognizes that many of its citizens and property owners have made substantial investments in real property. Therefore, in order to protect such citizens and their property rights, to protect the owners of mineral rights and to provide for the orderly exploration, development and production of geothermal products, it is necessary to regulate the drilling for and production of geothermal products in the manner set forth in this ordinance. The Council hereby finds and determines that the uncontrolled drilling on the surface or in the subsurface for geothermal products and the uncontrolled production thereof in the City would be detrimental to the general welfare of the citizens and residents of the City, and detrimental to the general public peace, health, safety, comfort, convenience and prosperity. Surface drilling and production operations should therefore be limited to a minimum number of controlled drilling sites, so located, spaced and regulated as to cause the least possible detriment to the community and the general welfare.

Section 2. Drilling Sites.

The number, location and size of sites for drilling for and production of geothermal products shall be as established by the City Council by ordinance or resolution after public hearing held in the time and manner hereinafter specified. Drilling sites shall be spaced in such manner that no drilling site shall be within _____ feet of any other drilling site. In the exercise of its sound discretion, the City Council may from time to time relocate established drilling sites upon

which drilling for or production of geothermal products has not occurred and is not likely to occur, but only after public hearing in the time and manner specified in Section 3.

Section 3. Public Hearing.

The City Council shall adopt a Resolution of Intention to establish geothermal drilling sites and shall set a date for public hearing thereon not less than ____ days nor more than ____ days after the adoption of such Resolution of Intention. Notice of such public hearing shall be given at least ____ days prior to such hearing by (mailing, posting, publication (whatever method or methods are customarily used in Susanville)). All persons shall be given an opportunity to be heard at such public hearing and the hearing may be continued from time to time. Within ____ days after the close of the public hearing the City Council shall establish geothermal drilling sites in such number and at such locations as will comply with the findings and carry out the purpose and intent of this ordinance as set forth in Section 1 hereof, subject to the limitations set forth in Section 2 hereof. The determination of the City Council shall be final and conclusive.

Section 4. Prohibited Drilling.

Except as otherwise hereinafter provided in Section 6, no person shall drill for or produce geothermal products from any surface location within the City, whether the subsurface operation from such well is within or outside the City, except at a drilling site established by the City Council and in accordance with the regulations herein set forth. No person shall drill for or produce geothermal products from the subsurface of the City from drilling sites located either within or outside the City except as permitted by this ordinance. No person shall drill or redrill or deepen below its present bottom any well for the production of or exploration for geothermal products where any portion of the surface operation or the subsurface operation of said well is located within the City except as is authorized by this ordinance.

Section 5. Unlawful Activities and Public Nuisance.

Except as otherwise hereinafter provided in Section 6, the Council hereby finds and determines that it is, and it is hereby declared to be, unlawful and a public nuisance for any person hereafter to erect any derrick or drilling equipment and hereafter to drill a geothermal well or to produce geothermal products from surface drilling sites or locations within the City except at a Council established drilling site and in accordance with the regulations herein set forth. The Council hereby finds and determines that it is, and it is hereby declared to be unlawful and a public nuisance for any person hereafter to erect any derrick or drilling equipment and hereafter to drill a geothermal well or to produce geothermal products by directional or slant drilling methods from surface locations or sites outside the City which said wells pass through or bottom in the subsurface of any property located within the City except in accordance with the regulations herein set forth.

Section 6. Existing Wells.

The right to maintain and operate geothermal wells lawfully drilled in or into the surface or the subsurface of the

City, prior to the enactment of this ordinance, and which wells are still being drilled or are producing geothermal products at the time this ordinance becomes effective, shall not be prohibited; provided, however, that any such wells shall be maintained and operated in accordance with law and the regulations herein set forth. Any such well shall hereafter be referred to as an "existing well." No existing well shall be drilled or redrilled, or deepened below its present bottom without first complying with all the terms, conditions and provisions of this ordinance including, but not limited to, the payment of the application fee and permit fee and the securing from the Council of a permit as required by Sections 7, 9, and 13; provided, however, that no existing well, drilled from a surface site within the City at a site other than a Council established drilling site shall be drilled or redrilled or deepened below its present bottom.

Section 7. City Council Permit.

Except as otherwise hereinbefore provided in Section 6, it shall be unlawful and a nuisance for any person hereafter to conduct any drilling operations for a geothermal well or hereafter to drill and produce any geothermal products in the surface or subsurface of the City from any drilling site without first having applied for and obtained from the City Council a permit so to do.

Section 8. Application for Permit.

Each application for a permit shall be made in writing to the City Clerk and shall include:

- (a) The legal description of the proposed drilling site;
- (b) If the site is within the City a statement that it is a Council established drilling site;
- (c) The legal description of all properties, both within and outside the City of Susanville through which such well is proposed to pass;
- (d) A statement that the applicant has the right by reason of ownership or the permission of the owner, to pass through and enter all property through which said well is proposed to pass;
- (e) The proposed location, type, kind, size, amount of equipment and method of operation of the proposed well;
- (f) The proposed method of handling and using any product proposed to be developed; and

At the time such application for a permit is made, the application fee hereinafter required shall be paid to the _____ of the City.

Each application shall be accompanied by a detailed written report of a geologist or other person experienced in the field of subsidence as a result of geothermal extraction, indicating the nature and extent of the subsidence, if any, that can reasonably be expected to occur as a result of the proposed drilling and production or drilling or production, as the

case may be, and indicating the nature and extent of the damage to property, if any, that could reasonably be expected to occur as a result of the drilling and production or drilling or production, as the case may be, and setting forth the qualifications and experience of the person making the report in the field of land subsidence as a result of geothermal extraction.

Section 9. Application Fee.

The filing of any application referred to in Section 8 of this ordinance shall be accompanied by an application fee of _____ Dollars. The application fee is to defray the cost to the City of study and investigation by the City concerning the proposal set forth in the application.

Section 10. Investigation; Action by Council.

Upon receipt of any such application, it shall be referred to _____ of the City for study and investigation. The _____ shall, not later than 30 days after the filing of the application, file a report upon his study and investigation with the City Council. The Council may, at the request of the _____ or on its own motion, retain engineers or other persons to assist the _____ in his investigation of the application. The application shall be acted upon by the Council within _____ months of the filing thereof. In its action upon the application, if the Council finds that the terms and conditions of this ordinance have been complied with and that persons and property within the City will not be adversely affected by the granting of the application, and that there is no reasonable probability or danger of damage to any real or personal property or injury to any person within the City by reason of subsidence of the surface of the earth or other reason due to the extraction of geothermal products, and, if, in a case where the proposed drilling site is located within the City, the City Council shall find that there is no reasonable probability of danger or damage to any real or personal property or injury to any person by reason of the production and extraction of geothermal products, they shall grant the application and the permit upon such terms and conditions as the Council may set and fix in granting such permit in order to protect persons and property within the City from injury or damage or hazard of injury or damage and when the drilling site is in the City such further conditions as the Council may impose in order to eliminate or minimize the adverse effect of such drilling site on persons and property in the vicinity. In all other cases the Council shall deny the application.

Section 11. Standard Permit Conditions.

No permit shall be granted by the City Council without the following standard conditions being required and made a part and condition of such permit:

(a) Drilling operations for any well shall commence within ninety (90) days from the effective date of the permit and thereafter be prosecuted diligently to completion and if a producing well is not secured within one year from the effective date of the permit, the well shall be abandoned. The Council, for good cause, may allow additional time for the commencement of the well.

(b) Permittee shall comply with all ordinances, rules and regulations of the City and of any other city through which the well or any part thereof is located or to be drilled and permittee shall comply with all ordinances of Lassen County when the well or any part thereof is located or is to be drilled partly within the unincorporated territory of Lassen County.

(c) A copy of the complete record of any such well furnished to the Resources Agency of the State of California shall be concurrently filed by the Permittee with the Clerk Clerk. Permittee shall, within thirty (30) days after any geothermal well is placed on production, file with the City Clerk a plat showing the location of the producing interval and the route of the well hole between the producing interval and the drilling site. All records submitted pursuant to this paragraph shall be confidential and privileged.

(d) All well holes and geothermal wells passing through or bottomed in or under any real property in the City, which wells are drilled from drilling sites outside the City, shall be below a depth of five hundred feet (500') upon entering any real property within the City.

(e) Officers, employees and authorized agents and representatives of the City shall be permitted at all reasonable times to review and inspect the drilling site and any operations or methods used in the drilling for and producing of geothermal products.

(f) The permittee shall hold the City and its officers and employees harmless from any claims by third parties arising out of or resulting from the permittee's operation under any permit from the City Council. The permittee must at all times during the existence of such permit be insured for not less than Dollars against liability in tort arising from the drilling or production activities or operations incident to the drilling and production of a geothermal well pursuant to such permit, and such policy shall name as additional insureds, the City of Susanville, its Mayor, Members of its City Council, members of its boards and commissions and its officers, agents and employees, while acting as such, for liability arising out of the permittee's operation pursuant to such permit. Such policy of insurance shall be subject to the approval of the City Attorney. A certificate of such insurance shall be filed with the City Clerk before drilling is commenced. Drilling and production shall be suspended at any time when the required insurance is not in full force and effect.

(g) The permit from the City Council shall become null and void unless it is accepted by the applicant in its entirety in writing, filed with the City Clerk within thirty (30) days from the effective date thereof, together with the payment of the permit fee required by Section 13 and no work on said drilling site shall be commenced until such permit is accepted and issued.

(h) The operation of any geothermal well and production therefrom drilled pursuant to a permit from the City Council shall be in accordance with the rules and regulations of the California Resources Agency or any successor agency or body thereof.

(i) The geothermal well drilled pursuant to the permit from the City Council shall be drilled only within the properties which permittee set forth in its application as the properties through which such well was proposed to pass unless permittee secures approval of the Council to cause said well to pass through other properties.

No permittee shall drill, operate or maintain any geothermal well except in conformity with the terms and conditions of the permit pursuant to which said well is being drilled. After a permit has been granted by the City Council, the Council may alter, amend or add to the conditions of said permit in order to protect the citizens and property rights within the City of Susanville. Such new, amended, or added conditions shall be made only after ten days' notice to the applicant or permittee and after hearing before the Council.

Any permit granted by the City Council may be suspended or revoked by the Council for any material violation of the conditions of the permit by the permittee or for persistent violation of any law by the permittee in the operation of any such well. The City Council shall not revoke any such permit, without first giving the permittee ten days' written notice of the nature of the violations and the City Council's intention to revoke said permit. If, within such ten-day period, the permittee requests a hearing before the Council, the City Council shall grant such a hearing within 15 days of the date of such request. At such hearing, evidence shall be presented to establish to the satisfaction of the Council the extent and nature of the violation which constitutes grounds for the revocation, and the permittee shall be given an opportunity to cross examine all witnesses testifying at such hearing. The permittee shall thereafter be permitted at that hearing, or at a continued hearing (if a continuance is requested by the permittee) to present evidence to disprove or explain such alleged violations. The City Council shall thereupon, after hearing all of the evidence, determine whether or not the permit should be revoked, and the City Council determination thereon shall be final. If the City Council determines that the permit should be revoked, they shall order the revocation and the permittee shall thereafter abandon the well in strict conformity with the requirements of law.

Section 12. Additional Permit Conditions When Drilling Site is Within City.

No permit shall be issued by the City Council where all or any part of the proposed drilling site is located within the City without the following additional conditions being required and made a part and condition of such permit:

(a) All drilling shall be done by means of a steel derrick enclosed with fire-proofed and sound-proofed material and operations shall be carried on diligently from the commencement of the drilling until the completion of the well or until such well is abandoned.

(b) All drilling and production equipment shall be operated by either electric or muffled internal combustion engines. All engines shall be equipped with Maxim Silencers or such other types of mufflers as may be satisfactory to the Council.

(c) No sump holes shall be permitted and rotary mud, drill cuttings and other waste material from drilling operations shall be discharged into a steel tank. Such tank, drill cuttings, rotary mud and waste material shall be removed from the controlled drill site upon completion of drilling operations.

(d) During all drilling or production operations, except in the case of emergency, all equipment or supplies to be delivered to the drilling site shall be transported, trucked or conveyed to the drilling site and unloaded only on Monday through Saturday between the hours of 8:00 o'clock a.m. and 6:00 o'clock p.m. As soon as commercial production has been established in any new well, acquisition of a right of way or the construction of a pipeline shall be started within ten (10) days and work thereon diligently prosecuted until such pipeline is completed. Except in cases of emergency, all geothermal products shall be shipped and transported through pipelines when completed. All pipelines outside of said drilling site shall be laid to a depth of at least three (3) feet below the surface of the ground.

(e) Private roads for ingress and egress to and from the drilling site shall be surfaced with gravel, oiled and maintained in good condition at all times during drilling and production operations. No signs shall be erected on the drilling site except those required by law or permitted by ordinance of the City of Susanville.

(f) Within ninety (90) days after the completion of drilling operations or abandonment of further drilling, the derrick and all drilling equipment, including temporary tanks, shall be removed from the drilling site. Well abandonment shall be in accordance with requirements of the California Resources Agency. Upon such well abandonment, permittee shall restore the property as nearly as possible to its original condition and shall remove all concrete foundations and debris; all holes or depressions shall be filled to the natural surface.

(g) When required by the Council, the permittee shall designate a competent representative who shall be responsible for the supervision of drilling operations and the carrying out of the conditions of any permit. Such representative shall be available at all times during drilling operations and shall be the responsible contact agent of the permittee whom the Council may require to carry out the provisions of the permit.

(h) Within thirty (30) days after commercial production has been established, there shall be commenced and prosecuted diligently to completion on each controlled drilling site adequate landscaping and screening either with shrubbery, masonry or concrete wall or their equal so that the same shall not be unsightly nor hazardous.

(i) All drilling and production equipment installed or operated upon any drilling site shall be so constructed, operated and maintained that no noise, vibration, odor or other harmful or annoying substances or effect therefrom which can be eliminated or diminished by the use of modern and approved types of equipment silencers or greater care shall ever be permitted to result from operations on any drilling site to the injury or annoyance of persons in the vicinity of such drilling site. Proven technological and mechanical improvements in methods of drilling and production and in the type of equipment used therefor shall be adopted from time to time as the same become avail-

able, if the use of such equipment, improvements and methods will reduce noise, vibration, odors, or the harmful effects of annoying substances. The use of equipment in any drilling site which causes noise or vibration shall at all times be subject to the approval of the Council and the Council may amend any permit and require the permittee to abate any noise or vibration which constitutes a nuisance and is detrimental to persons or property in the vicinity where such equipment is being operated.

(j) All of the operations at the drilling site shall be conducted in a careful and orderly manner, and the premises shall at all times be maintained in a neat, clean and orderly manner.

(k) All fire fighting equipment as required and approved by the Fire Chief of the City shall be installed and maintained on the controlled drilling site at all times during the drilling and production operations.

(l) The Council may restrict the use of certain streets, alleys or roadways in connection with the permittee's operations which shall be named in any permit granted. In the event any street, alley or roadway is damaged by permittee's operations, then such damage shall be paid for by the permittee upon demand by the City and the failure to pay such damage, being the reasonable cost of the repair of any such damaged portions, shall be grounds for the revocation of the permit and the collection of such damage at law by the City.

(m) No permanent derrick shall be installed or maintained on any drilling site or used for the drilling or production of any geothermal product.

(n) After a geothermal well is placed on production, all equipment with moving parts in use at such well shall be securely enclosed in a building or by an adequate type of fence or approved wire screen or housing, sufficient to prevent the entry of unauthorized persons to such moving parts. Such protections shall be subject to the approval of the _____ of the City. Any gates thereto shall be securely fastened at all times, except when authorized personnel are in attendance at such well.

Section 13. Permit Fee.

When the Council has granted a permit it shall be of no virtue, force or effect until it is issued by the _____ of the City. The _____ shall issue the permit granted by the Council, in the form contemplated by this ordinance, upon receipt of written acceptance of the permit by the permittee and payment to the City of a permit fee for each well or well hole in the sum of _____ Dollars.

Said permit fee shall be in addition to the application fee required by Section 9. Said permit fee is to defray the costs to the City of assuring that permittee complies with the requirements of this ordinance and his permit and to defray the expense of enforcing the provisions of this ordinance. The permit, when issued by the _____, shall show the effective date as the date upon which the Council granted the permit and the date of issue as the date when the permit was actually issued by the _____.

Section 14. Abandonment of Wells.

Any well which has not produced, or has not been used for subsurface injection into the earth for a period of one year, shall be permanently and finally abandoned in strict compliance with the rules and regulations of the Resources Agency of the State of California, or any regulatory authority having jurisdiction thereof.

Section 15. Subsidence.

The City Engineer shall, from time to time, as he deems appropriate, make such tests and observations as he deems appropriate to determine if any adverse effect upon the surface of the City is occasioned or is in danger of being occasioned by reason of the removal of geothermal products from the subsurface of the City pursuant to a well regulated by this ordinance or pursuant to a well, no part of which is located within the City but which drains a subterranean geothermal resource, part of which is in the City. In the event the City Engineer observes any such adverse effect or danger, he may order the immediate suspension of further production from such well or wells as may be located entirely or partly within the City and in the case of such an order, production on such well shall be suspended by the permittee or other operator immediately upon receiving notice of such order. The permittee or other person lawfully producing geothermal products from any such well may appeal to the Council. The Council may, upon good cause being shown by the permittee or such other person, vacate or modify the order of the City Engineer or if no part of the well is in the City, the Council may direct the City Attorney to immediately commence such actions or proceedings as may be necessary for the abatement, removal and enjoining of further drilling operations which adversely affect property within the City in the manner provided by law and to take such other action and to apply to any court having jurisdiction to grant such relief as will restrain or enjoin any person from drilling or producing from any such well.

Section 16. Enforcement.

Any well drilled or produced and any building or structure erected, operated or maintained or any use of property contrary to the provisions of this ordinance shall be and the same hereby is declared to be unlawful and a public nuisance and the City Attorney shall, upon order of the City Council, immediately commence action and proceedings for the abatement, removal and enjoinder thereof in the manner provided by law; and shall take such other action, and shall apply to any court having jurisdiction to grant such relief as will restrain and enjoin any person from drilling or producing any such well or from erecting, operating, or maintaining such building or structure, or using any property contrary to the provisions of this ordinance.

- PRELIMINARY -
CITY OF SUSANVILLE
GEOTHERMAL POLICY
August 11, 1976

Aug. '76

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 ON 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 the 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 POPULATION, THE DEVELOPMENT AND USE OF THE RESOURCES IS BEST ACCOMPLISHED THROUGH A JOINT EFFORT BETWEEN THE CITY, THE COUNTY AND THE PRIVATE SECTOR.