DOE/ET/27196--T6

IMPERIAL COUNTY

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✓ GEOTHERMAL DEVELOPMENT,

QUARTERLY REPORT

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FC03-79ET27196

January 1 to March 31, 1982

MASTER

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IMPERIAL COUNTY
GEOTHERMAL QUARTERLY REPORT
January 1 to March 31, 1982

INTRODUCTION

This Quarterly Report will show the current progress on Cooperative Agreement DE-FC03-79ET27196 and the status of geothermal development in Imperial County. It was prepared by the Director of Public Works and the Geothermal Coordinator in partial fulfillment of this Cooperative Agreement. This report will discuss the highlights of geothermal development activities during January, February and March, 1982. The report is organized into three sections covering Geothermal Administration, Geothermal Planning, and the Direct Heat Study.

Section I, Geothermal Administration, will address the activities of the Geothermal Office during the quarter. Topics include important geothermal events, geothermal waste disposal, grant applications to the California Energy Commission, the planned geothermal development meeting, and the current status of geothermal development in Imperial County.

Section II, Geothermal Planning, will address activities of the Geothermal Planner during the quarter, including processing of applications for geothermal permits, processing of EIR's, and other geothermal planning activities.

Section III, Direct Heat Study, will discuss the progress on the VTN direct heat study.

I. Geothermal Administration:

Geothermal administration is the task of the Geothermal Office based within the Department of Public Works, under the direction of the Director of Public Works. The office is responsible for investigations and activities in Imperial County to stimulate and support the growth of geothermal energy. The Geothermal Coordinator is responsible for monitoring geothermal development in Imperial County, addressing issues as they arise, collecting and developing information, and encouraging direct heat development.

A. Important Geothermal Events

The Imperial County Planning Commission began consideration of the expansion of zoning for geothermal development at the Salton Sea in January. As part of this proceeding, the Commission was to consider the land use issues, take public testimony, consider the environmental review, and develop recommendations for the Board of Supervisors on which of the lands assessed for the proposed rezoning should be included in the "Geothermal Overlay Zone." Geothermal Overlay zoning indicates that the County considers an area appropriate for geothermal development subject to the site specific items that are addressed in Conditional Use Permit proceedings.

The Planning Commission also began consideration of an application for a Conditional Use Permit by Magma Power Company to allow the construction and operation of a 49 megawatt geothermal power plant in the Salton Sea anomaly.

A number of public hearings were held on these items. The public hearings stimulated substantial public response.

The Geothermal Coordinator and the Geothermal Planner prepared responses to information requirements of the Commissioners, and participated in drafting the conditional use permit for the Magma Project. The draft permit was to address the various issues that were raised in hearings and in the EIR.

The Geothermal Coordinator prepared information on benefits to Imperial County of geothermal resource development. This information was collected in response to concerns expressed by the Planning Commission regarding the level of benefits to be received by the County from geothermal development. The information was based on studies conducted by the University of California at Riverside and Lawrence Livermore Laboratories which identified the potential economic impacts of geothermal development. The three major benefits identified in these reports are: increased tax revenues, increased employment opportunities for local residents, and secondary benefits to the local economy through increased demand for goods and services. The Coordinator presented the benefits paper to the Planning Commission on March 31. The paper is attached as Appendix 1.

The Geothermal Coordinator also prepared information on the Imperial County Geothermal Subsidence Detection Network, the results of past surveys of the network, the requirements for monitoring by geothermal developers, the results of monitoring at development sites, and the current plans by the County for continued monitoring. The Coordinator presented this information to the Planning Commission on February 10th. The letter is attached as Appendix 2.

On March 31 the Planning Commission took action on these items. The Salton Sea Environmental Impact Report was certified and the Commission recommended to the Board of Supervisors that all parts of the proposed Geothermal Overlay Zone which are on land be included in the G-Zone, but off-shore portions be excluded from the G-Zone to remove the possibility of off-shore geothermal development in the near future. The Magma Conditional Use Permit was denied by the Planning Commission.

The Imperial County Board of Supervisors will hold public hearings and consider the expansion of the Geothermal Overlay Zone in early May. The decision on the Magma Conditional Use Permit has been appealed to the Supervisors and will be heard at a later date.

B. Geothermal Waste Disposal

The County Planning and Public Works Departments presented a report to the Board of Supervisors in early February on the need for geothermal waste disposal and on alternatives for ownership and operation of a disposal facility. In response to this report the Board of Supervisors directed the Public Works Department to proceed with preliminary testing of certain sites to identify the most appropriate disposal area, and allocated funds for testing.

The Geothermal Coordinator, with the assistance of Public Works Department Staff, developed and issued a "Request For Proposals" for Geo-hydrological testing of the potential geothermal waste disposal sites. The testing program is to identify the most appropriate site or sites for future testing and eventual development for geothermal waste disposal. Testing and analysis is to be conducted with respect to the California Department of Health Services and the Water Quality Control Board criteria.

The Proposals will be reviewed and the contract awarded in May. The Department hopes to have the field work completed by the end of June. The geo-technical report on the sites would then be assessed by the Geothermal Coordinator and Public Works Department Staff, and recommendations made to the Board of Supervisors.

C. Grant Applications to the California Energy Commission

1. Geothermal Subsidence Detection Network Monitoring:

The Imperial County Public Works Department has applied for funding under the California Energy Commission's "Geothermal Grant Program for Local Governments". Grant monies would fund necessary field survey work and related operating costs for a program to monitor portions of the Geothermal Subsidence Detection Network.

The actual potential for geothermally-induced subsidence in Imperial County is unknown at present. The County monitoring program is designed to detect subsidence before serious impacts occur so that mitigations can be imposed. Continued monitoring is essential so that the difference between natural and geothermally-induced subsidence can be detected. Without regular monitoring information, public fears of subsidence impacts could pose a substantial obstacle to geothermal development.

The Geothermal Coordinator was the lead person in the preparation of the Grant application.

2. Methane Production Plant Study

The Imperial County Office of Community Economic Development

submitted an application for study of a methane production plant in Heber. The grant would fund the adaptation of an existing feasibility study to apply to this specific project, support promotional work to attract a developer to perform the project, and provide some program funding.

D. Geothermal Development Meeting

The Geothermal Coordinator has begun planning for the Annual Imperial County Geothermal Development Meeting. The meeting will be held on May 13th and 14th, 1982. The format will consist of short presentations by a variety of organizations. The presentations will focus on activities in the Imperial County in the development of geothermal resources, resolution of technical issues, and regulation of geothermal development.

The meeting will provide a timely forum for discussion of geothermal development accomplishments, current challenges, and future plans. The County believes that this meeting will be valuable for all those involved in some phase of geothermal development in Imperial County.

In connection with this meeting, Union and Southern California Edison will offer a tour of their Brawley 10 megawatt power plant #1 to meeting attendees.

E. Field Inspections and Status of Geothermal Development

Geothermal development activities in Imperial County are continuing to increase. This section will briefly discuss current development activities.

1. Power Plant Projects

- a. Magma Power is continuing the refitting of the East mesa 10 MW Binary Power Plant. The new equipment now being installed will enable the facility to produce 10 megawatts nominal output in the summer and perhaps 13 megawatts in the winter. The refitting is expected to be completed during May and June, and plant operators hope to recommence operations during June.
- b. The Union Geothermal/Southern Cal Edison Power Plant in Brawley is producing about 5.7 megawatts on average. A replacement well has been brought into production, and 2 well work-overs are in progress. An analysis of the subsidence survey field work performed by the site operators has detected no localized subsidence. The plant continues to meet air quality regulations and is continuing experiments on H₂S control and abatement systems.
- c. The Union/Southern Cal Edison/Southern Pacific 10 megawatt power plant, under construction at Salton Sea, is expected to be completed in late May or early

June. The operators hope to begin production during early June. Union has completed experiments with processes and technologies for increasing the reliability of the plant, lowering cost of production, and handling the problems caused by the Salton Sea brines. They are completing testing of the five new wells. They expect to install a subsidence monitoring network soon.

- d. Magma Power's 28 megawatt Power Plant at the Salton Sea anomaly is scheduled to begin construction in 1982. Physical construction of the plant will not begin until Magma completes legal proceedings resulting from the sale of their interest in the Geysers geothermal field.
- e. Chevron/Southern Cal Edison's 49 megawatt Power Plant in the Heber anomaly will begin construction in 1982. Decisions by the Imperial Irrigation District and the Imperial County Board of Supervisors will allow Southern California Edison to use canal water for cooling tower purposes. Well drilling for the project is expected to begin in May 1982.
- f. The Heber Binary Demonstration Project is proceeding on schedule. Appropriation of Federal Funds for 1982 allowed the project to continue and major equipment procurements to proceed. Construction and operation planning is continuing and procurement of major equipment is nearly complete. Construction should begin in 1982.
- g. Republic Geothermal's application to USGS for a 19 megawatt Power Plant at the East Mesa has been approved. Republic is seeking funding for the project.
- h. MCR Geothermal and the California Department of Water Resources are continuing planning for a 45 megawatt power plant in South Brawley. The EIR will be initiated in May 1982 when MCR applies for a production permit from Imperial County.
- i. The application for a Conditional Use Permit for the proposed Magma 49 megawatt facility at Salton Sea will be considered by the Board of Supervisors during the next quarter.

2. Exploration Activities

Geothermal exploration and testing activities in Imperial County are continuing to expand. Testing programs are being conducted throughout the County. As noted above, MCR's work in South Brawley is continuing and should culminate in an application for a production permit soon. Pioneer Livestock

plans to do test drilling in South Brawley. Union, Phillips and Occidental have exploratory programs in East Brawley. Republic plans to do exploratory drilling in the Salton Sea KGRA, near Niland. Bear Creek Mining hopes to do off-shore temperature hole surveys at Salton Sea. Union and Phillips have an exploratory program at Truckhaven. Chevron is drilling a number of exploratory holes throughout the County.

3. Direct Heat Development

- a. City of El Centro: The DOE funded project to heat and cool the El Centro Community Center completed drilling of both injection and production wells. Temperature surveys have been completed, flow testing will be conducted during the second quarter of 1982.
- b. Ultra Systems: Ultra Systems is continuing planning for a direct heat project at the East Mesa. Developers are negotiating for funding for their project. The concept for the project was approved by USGS, but no construction applications have yet been filed.
- c. As discussed above, the County Office of Community Economic Development applied for funding for preliminary development activities for a methane generation plant in Heber KGRA.

II. Geothermal Planning:

Geothermal planning is the task of the Geothermal Planner based within the Planning Department under the direction of the Planning Director. The Geothermal Planner's responsibilities are to receive applications for geothermal projects; to review applications and arrange for hearings on these projects; to draft permits and conditional use permits for geothermal exploration, development, and production operations; to prepare or arrange for the preparation of environmental impact reports; to implement the geothermal element of the County general plan; and to participate in other geothermal activities.

A. Applications for Geothermal Permits:

1. A geothermal exploration permit was issued to Pioneer Livestock for the drilling and testing of four wells in South Brawley.
2. Republic Geothermal has applied for a geothermal exploration permit for the drilling and testing of four wells near Niland.
3. Bear Creek Mining Company has applied for a geothermal exploration permit for exploratory holes within the off shore area of the Salton Sea.
4. Chevron received a permit to drill 25 exploratory holes in various areas of the County.

5. Occidental received approval for 6 exploratory holes at East Brawley.
6. Southern California Edison received approval of an amended Conditional Use Permit that will allow use of canal water for cooling tower purposes for a limited time.
7. Chevron received approval for a time extension on their permit to build a water treatment plant on the New River.

B. Processing of EIR's:

1. As discussed above, the processing of the Salton Sea Master Environmental Impact Report was completed when the Planning Commission certified the MEIR on March 31. The certification of this MEIR required a number of hearings and work shops during which discussions were held regarding various environmental impacts revealed in the report.
2. The Magma EIR for a 49 megawatt power plant was certified in January.

C. Other Geothermal Planning Activities:

1. IT Corporation has applied for a Conditional Use Permit for their geothermal waste disposal site in order to allow the acceptance of other types of waste. An amendment to their EIR will be required; a "Request For Proposals" for this work has been issued.
2. The Bureau of Land Management has issued a "Notice of Sale" for land parcels located in off-shore areas of the Salton Sea. Approximately 5,000 acres will be offered for lease September 21, 1982. The County will continue to review BLM planning and environmental documentation on the proposed sale.
3. As discussed above, extensive hearings were held to consider the Salton Sea Master Environmental Impact Report and the Magma Application for a Conditional Use Permit. The Planning Department will continue to process these items during the second quarter as the items are presented to the Board of Supervisors.

III. Direct Heat Subcontract

The Imperial County Direct Heat Committee met with representatives from VTN Consolidated. The Committee reviewed VTN's submission for Task 3, the socio-economic analysis, and commented on specific areas that will require expansion or revision. In general, the draft was considered acceptable.

The Committee assessed the parameters suggested for the Task 4 Dun and Bradstreet search process. The search will identify potential developers who could be interested in Imperial County. The Committee believes that the search parameters should be expanded to include

additional industries. The Committee will meet to consider additional information and perhaps suggest additional types of industries to be included in the search process.

VTN submitted preliminary outlines for Task 5, which will identify planning policies and implementation measures that will facilitate development of direct heat, and Task 6, which will develop a plan for the County to implement in order to attract direct heat developers. The Committee provided comments on the completeness and importance of the items to be addressed by VTN, thus providing guidance on the areas where VTN should focus efforts.

VTN proposed that preparation of information in the format of the direct heat brochure should be coordinated with the County's Office of Community Economic Development. The Direct Heat Committee agreed that the direct heat brochure should be complimentary to the information that is currently being prepared by the Division, but believes that the direct heat brochure should be a complete document which could be submitted independently to potential developers. VTN's work on Task 6 will develop the information regarding the format and contents of the brochure so that the final product will be effective in attracting the attention and interest of potential developers.

The County expects the work on the VTN subcontract to be completed by the end of June 1982. Appendix 3 contains a quarterly progress report submitted by VTN.

SUMMARY

Geothermal activities have been numerous and varied during the quarter. The series of hearings before the Imperial County Planning Commission on the Salton Sea Master Environmental Impact Report and the Magma Conditional Use Permit brought various geothermal issues into the public debate, and served to stimulate public interest and information on the topic of geothermal development. The County Geothermal Staff has been active in collecting and developing information to address the information needs of the Planning Commission and the public. The information prepared in conjunction with these hearings will continue to be useful in addressing other questions that arise.

The County has proceeded with its efforts to identify a geothermal waste disposal site for future development. A request for proposals has been issued for geohydrological testing of potential geothermal waste disposal sites. Following the completion of work under this RFP the Public Works Department will present the data and analysis to the Board of Supervisors.

Imperial County applied for two grants under the California Energy Commission's "Geothermal Grant Program for Local Governments". One application seeks funding for a program to monitor portions of the Geothermal Subsidence Detection Network. The second application seeks funding for a project to develop a methane production plant in the Heber anomaly.

Planning has been begun for the annual Imperial County Geothermal Development Meeting, to be held May 13th and 14th, 1982. The focus of this meeting will be on activities in Imperial County in the development of geothermal resources, resolution of technical issues, and regulation of geothermal development.

Geothermal development activities are continuing to increase. By the end of June, 1982, the County expects to have three 10 megawatt power plants in operation. During 1982, construction is expected to begin on three additional power plants. Three additional projects are still in the preliminary planning stages.

Geothermal exploration and testing activities are continuing to expand, testing programs are being conducted in various areas of the County by a number of geothermal development firms.

The Direct Heat Project for the City of El Centro has completed both injection and production wells and should soon begin flow testing. A geothermal direct heat plant at the East Mesa has been proposed by Ultra Systems, developers are negotiating for funding.

Planning activities have been varied. A number of geothermal exploration permits have been issued in the past quarter. The Salton Sea Master Environmental Impact Report and the Magma Environmental Impact Report were certified in March. IT Corporation has applied for a conditional use permit to allow disposal of other types of waste at their geothermal waste disposal site. The Bureau of Land Management intends to offer 5,000 acres of off-shore Salton Sea land for geothermal leasing in September 1982.

VTN Consolidated completed the draft report for Task 3, the socio-economic analysis. The County Direct Heat Committee is considering the suggested parameters for Task 4, which will identify potential developers in industries of interest to Imperial County. VTN began work on Task 5, which will assist the County to facilitate development of direct heat, and Task 6, which will develop a plan to attract direct heat developers to the County.

APPENDIX 1

BENEFITS TO IMPERIAL COUNTY
OF
GEOTHERMAL RESOURCE DEVELOPMENT

PREPARED BY:

IMPERIAL COUNTY DEPARTMENT OF
PUBLIC WORKS

MARCH 1982

BACKGROUND

The County of Imperial overlies major geothermal resource anomalies, which have the capability of providing substantial electrical energy and other by-products. Imperial County policy concerning development of this resource has focused on planning development of resources in order to maximize benefits and to minimize negative impacts on the environment.

Based on current technology, the electric generation potential of known geothermal resources is estimated to be 6700 megawatts for at least 30 years. The Niland, Brawley, East Mesa and Heber anomalies have the potential of producing 4500 megawatts of electricity by the year 2020. This level of development would utilize an estimated 15 to 20 percent of the available resource, the remaining resources could be used for non-electric development. (1)

GEOHERMAL DEVELOPMENT POTENTIAL

Assessment of the Imperial Valley Geothermal Resource has been proceeding for many years, but important issues have yet to be resolved. For example, we do not know if recharge of the reservoirs occurs, and, if so, the degree of recharge. The resources are estimated to have production possibilities for about 50 to 100 years, but innovations in technology could increase the life span substantially. In addition, electrical generation may become feasible with lower temperature brines. As other energy supplies become increasingly expensive, the possibilities of lower heat electric generation from geothermal may become more attractive. The different depths of the geothermal resource may also extend development potentials. Finally, it appears that the whole area of the Imperial Valley, from the Laguna Mountains on

the west to the Chocolate Mountains on the east, is underlain by geothermal resources. Total geothermal potential estimates may, therefore, be revised as resource assessment identifies increased development opportunities.

BENEFITS OF GEOTHERMAL RESOURCE DEVELOPMENT

The University of California at Riverside (UCR) and Lawrence Livermore Laboratories (LLL) have conducted extensive studies of the potential socio-economic impacts of geothermal development in the Imperial Valley. The impacts identified have shown that substantial benefits to Imperial County will occur as a result of geothermal development. The three major benefits will be 1) increased tax revenues, 2) increased employment opportunities for local residents, and 3) secondary benefits to the local economy through increased demand for goods and services. This paper summarizes the extent of benefits, as estimated by the researchers of UCR and LLL.

TAX REVENUES

UCR states that geothermal installations could represent over 1/3 of the total property value in Imperial County by the year 2020, and would indirectly stimulate another 1/3 increase in total property value. This represents an increase of over 200% above the baseline property value. Since local expenditures would only increase about 40% by 2020, geothermal development presents a fiscal boon to the County. (2)

Direct tax revenues from geothermal development will approximate \$20,000 per megawatt per year. This figure is based on an estimated capital cost of approximately 2 million dollars per megawatt, or 100 million

dollars for a 50 megawatt power plant. At a tax rate of 1%, this represents 1 million dollars per year in tax revenue from each 50 megawatt facility.

Additional revenues are received as a result of federal lease sales. Under California Assembly Bill 1905, Imperial County receives twenty percent of the total lease money paid for geothermal lease parcels in the County. A recent offering of Bureau of Land Management parcels resulted in successful bids totaling nearly \$2 million. Of these payments, the County will receive about \$400 thousand. (3)

Rental fees and royalties will be paid for lands leased for geothermal development. The County will receive a portion of these funds.

Monies received under AB 1905 may only be expended on programs and services related to geothermal development. (4)

EMPLOYMENT

UCR projects that geothermal development "will increase the total personal income by 700 million dollars (in 1972 dollars) above the level of income that may prevail without the development of geothermal resources." (5) The magnitude of this increase in current dollars would be approximately 1 1/2 times the current level of personal income. (Note that this estimate was based on a 4,000 megawatt development potential, whereas current development estimates show a potential of 6700 megawatts.)

Employment studies by UCR, LLL, and WESTEC Services indicate that most jobs at geothermal power plants will be held by current Valley residents and that most other permanent personnel will relocate permanently to Imperial Valley.

The proportion of jobs to be filled locally will increase as prospective employees gain training and experience.

Personnel requirements for a 50 megawatt facility are predicted to range from 25 to 50 persons (1/2 to 1 person per megawatt) for resource production alone. Power plant operations will require additional personnel. (6) Current facilities, however, use substantially more personnel per megawatt for resource production. Due to testing, trouble shooting, experimentation, studies, new equipment design and installation, etc., current employment appears to be more than 4 persons per megawatt. (7) Economies of scale and resolution of technological issues will serve to reduce the numbers of persons required per megawatt, to the 1/2 to 1 person per megawatt estimate.

Construction of a power plant requires an average of 70 workers over a 30 month period, according to WESTEC Services. Approximately 70 percent of the construction work force would be hired locally; percent of local workers is expected to rise to about 90 percent by 1989 as local workers gain training and experience. (6)

Direct heat development can provide substantial additional employment opportunities for Valley residents. A study of direct heat applications that would be appropriate for Imperial County, such as crop cooling and packing, green house operations, alfalfa dehydration, etc. has estimated that employment per company would range from 6 to 75 persons. Most employees for direct heat industries would be hired locally. (8)

SECONDARY BENEFITS

Additional benefits to the local economy would result due to increased

demands for goods and services. Geothermal service industries could be established in the Imperial Valley; some relocations and company formation has already occurred in the area of waste hauling, and consulting services. Geothermal development will also increase the demand for motel, and restaurant, and similar services. And, of course, geothermal employees will spend their income on housing, food, entertainment, etc., just as other Valley residents do. (2, 5)

The current agricultural economy subjects the County to wide fluctuations in employment and income. Since geothermal energy production is not seasonal, development of geothermal resources will help to stabilize the County economy. (2)

Geothermal employment opportunities could provide Imperial Valley future for some Valley residents. Imperial County statistics indicate that young adults tend to leave Imperial Valley shortly after completing high school. (9) This out-migration may well reflect the lack of employment opportunities. Geothermal development will offer a spectrum of jobs from semi-skilled to skilled, and non-technical to technical to young adults who wish to remain in the County.

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DEPARTMENT OF PUBLIC WORKS
COURTHOUSE
EL CENTRO, CALIFORNIA

February 10, 1982

Imperial County Planning Commission
Courthouse
El Centro, CA 92243

SUBJECT: Geothermal Subsidence Detection Network

Gentlemen:

In the discussion before the Planning Commission on January 27, 1982, concerns about subsidence were raised in the course of comments on the Salton Sea Master Environmental Impact Report. This letter is submitted to clarify the County policy and activities regarding subsidence detection by presenting the facts about the development of the Imperial County Geothermal Subsidence Detection Network, the results of past surveys of the Network, the requirements for monitoring by geothermal developers, the results of this monitoring, and the current plans by the County for continued subsidence monitoring.

Subsidence detection and prevention have been an emphasis in County Geothermal Policy since the early 70's when substantial interest in geothermal development here first arose. Through the combined interest of the State Division of Oil and Gas, Imperial County and other public agencies, and geothermal developers, a Geothermal Subsidence Detection Committee was formed. Through this committee, decisions on level line location, financing, and other issues were made. Over 400 miles of benchmarks, showing elevations throughout the county, have been established and monitored on a periodic basis since 1971. The subsidence network has been releveled in winter 1973, winter 1975, and last, in winter 1980, following the disruptive 1979 earthquake.

Funding for this type of project has always been a major concern. From the beginning, the geothermal industry has been a large contributor in the funding of the projects. Industry has contributed 40-50% of the cost, with such agencies as the National Science Foundation, Lawrence Livermore Labs, and more recently Lawrence Berkeley Laboratory contributing substantial amounts to the project. In addition local and state public agencies have contributed monies for all the leveling projects.

The first leveling in 1971 showed some interesting results. Many of the cities showed a rise or fall when compared to the levels of the 1941 National Geodetic leveling. The following 1973 and 1975 levelings, when compared to 1971, showed a progressively deepening slope down towards the east and towards the north. This slope has been termed a regional tilt. Between 1971 and 1975 a 200 millimeter (about 8 inches) drop occurred at the north end of the Valley.

The results of the last leveling, which was done during winter 1980, are not complete at this time, but the tentative results show some dramatic earthquake caused changes. First, an open rupture occurred as a result of the 1979 earthquake, beginning near the Mexican border and extending northwest over 20 miles. Leveling differences of up to one-half foot were noted where level lines crossed the Imperial Fault. At the north end of the fault near Brawley the ground dropped about three-fourths of a foot, then gradually rose out of that depression for the next eight miles north. The Mesquite Lake area dropped from three inches to one foot. We have also detected a drop of several inches in the Obsidian Buttes area which runs south for six miles towards Westmorland. In late April of 1981 a 5.5 magnitude earthquake occurred in the Obsidian Buttes area. We checked leveled areas we thought might be affected by the quake but found no significant change. We expect to have precise differences from the 1980 releveing within two months.

These surveys have provided substantial baseline information on natural ground movement in the Imperial Valley. Past surveys have shown a progressively deepening slope to the north and east. Imperial Valley has been naturally subsiding approximately two inches per year over the whole area. However, earthquakes can cause changes in this pattern.

County Geothermal Policy has been designed to assure early detection of geothermally induced subsidence. All geothermal developers are required to participate in the geothermal subsidence detection and prevention program. Developers must prepare a plan for the location of monuments at the development site. Benchmarks are set at well sites and at specific intervals to tie into the Geothermal Subsidence Network. The monumentation plan is submitted for approval to the County. The quality of benchmarks, field work, and computations must conform to National Geodetic Survey standards. Surveys must be run semi-annually at the expense of the operator. The data from all surveys, plus an analysis of the data, is submitted to the County. If subsidence is detected, the County will require corrective action, such as increased injection, deeper injection wells, and/or curtailed production operations.

The Geothermal Unit of the California Division of Oil and Gas is the State Agency with responsibility for subsidence detection and abatement in the geothermal areas of California. CDOG regulations are very similar to County requirements. Subsidence benchmarks must be established at well

sites prior to extensive production testing of the wells. All survey work must be coordinated with the County Surveyor and performed under the direct supervision of a registered Civil Engineer or a licensed Land Surveyor. Quality of benchmarks, field work, and computations must conform with National Geodetic Survey Standards. Surveys must be run annually at the expense of the operator while wells are being produced. The data from all surveys is submitted to the Division within two months of the field work. In addition, the Division monitors down hole pressures, because pressure changes are a second indicator of changes in the geothermal reservoir. Well operators supply monthly recordings of production, injection, temperature, and pressure to the Division. If changes in surface land levels or down hole pressure are detected, the Division can order a geothermal developer to change operations. Depending on the circumstances, the Division would order mitigation measures, such as increased injection rates, deeper injection wells, and/or curtailed production operations.

The North Brawley 10 megawatt power plant is the major production facility in the irrigated area of Imperial Valley at this time. The production permit issued by the County requires two surveys per year, as does the CDOG permit. Four precise level surveys have been run in the North Brawley area since the major survey in 1979. The first survey was run between June and August of 1980, the second survey was run between November 1980 and January 1981, the third was in August of 1981, and the fourth in December 1981 to January 1982. These resurveys correspond to initial start-up of the facility, six months after start of commercial operations, then following one year and one and one-half years of operation. The surveying field work is performed by a consultant, the data analysis by Union Geothermal. Both raw data and data analysis are submitted to the County (Public Works) and the CDOG. The data from the latest survey is currently being analyzed. Analysis of the first three surveys identifies some regional subsidence trends, but no localized subsidence has been detected.

In the winter of 1982-83 the County Public Works Department hopes to update leveling data for areas which experienced the most movement following the 1979 earthquake and the areas where a geothermal development project is operating or coming on-line in the immediate future. Survey monitoring would be performed by County survey personnel, with field supervision and preliminary data adjustment performed by the County staff and personnel. The County is seeking to obtain funding for this proposed resurvey at this time.

In summary, the County has been aware of the damage that localized subsidence induced by geothermal development could cause in the Imperial Valley. An extensive subsidence detection network has been established, monitored regularly, and will continue to be monitored during the course of geothermal exploration and development. No geothermally induced subsidence has been detected to date and developers are continuing to monitor production facilities regularly.

February 10, 1982

The actual potential for geothermally induced subsidence is unknown at the present time. County and CDOG monitoring programs are designed to detect subsidence before serious impacts occur so that mitigation measures can be imposed or production can be decreased or halted.

Sincerely yours,

DAVID E. PIERSON
Director of Public Works

BY:

MARGARET J. RANDS
Geothermal Coordinator

so

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Telex: 683492 (VTN CORP IRIN)

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MAY 03 1982

IMPERIAL COUNTY
DEPT. OF PUBLIC WORKS

April 30, 1982

County of Imperial
Department of Public Works
Courthouse
El Centro, California 92243

Attention: Ms. Margaret Rands, Geothermal Coordinator

Subject: Geothermal Direct Use Study, Imperial County,
Quarterly Report, Period Ending March 31, 1982

Dear Margaret:

Work accomplished during the quarter ending March 31, 1982, involved three major efforts, completion of Task 3 analysis, recommendations for work on Task 4, and initiation of work on Tasks 5 and 6.

Task 3

This task, Socioeconomic Impact Analysis, was completed during the March 31 quarter. As previously discussed and documented in a letter to you on January 6, 1982, the analysis indicated that direct use industries which might locate in Imperial County had relatively small employment requirements. Thus, socioeconomic impacts relative to incoming population would likely be minor. Based on this analysis, additional work on Task 3 has been deleted. The comments based on the review of the preliminary submittal will be incorporated into the final report.

Task 4

In addition to the completed Task 3 effort, recommendations were made relative to Task 4, Identification of Direct Heat Developers. This information identified potential industries which might locate in the Imperial Valley, and was based on work completed in Tasks 1 and 2. The five major areas identified were agriculture, aquaculture, food processing, ethanol production, and nurseries. This information was provided in a transmittal to you dated January 6, 1982. As we have discussed, other criteria including location and size of business, will require additional clarification. Once all criteria have been determined, the information will be provided to Dun & Bradstreet, Inc. to conduct the record search.

County of Imperial
April 30, 1982
Page Two

Progress Meeting

A meeting was held on March 19 to discuss progress on the study and provide the county with the opportunity to comment on the work initiated for Tasks 5 and 6. As indicated during the meeting, Tasks 5 and 6 need further direction from the Ethanol Committee. The information attached provides our preliminary work on Tasks 5 and 6.

Tasks To Be Completed

In the next quarter, Tasks 5 and 6 will be finalized. In addition, we intend to initiate and complete further analysis Task 7, the final report, and on the information booklet.

I look forward to seeing you during the Geothermal Meeting of May 13 and 14 and to the opportunity to make a presentation at the meeting. If you have any further questions about our report, please call me or Carolyn Trindle.

Sincerely,

VTN CONSOLIDATED, INC.

John L. Sakaguchi
Project Manager

JLS/sla

Enc.

Task 5--Planning Policies and Implementation Measures to Facilitate Development of Direct Heat Uses

Introduction

VTN has conducted an initial review of various plans, policies, and procedures which affect or could affect direct use geothermal development in Imperial County (see References). Further review will proceed upon receipt of additional materials relative to direct use development elsewhere in the U.S. Initial considerations indicate that consideration of separate policies for direct use development both within and outside designated KGRAs could be cumbersome. Therefore, it is initially recommended that the Geothermal Element to the Imperial County General Plan be amended with language which would allow direct use to occur wherever it would be technologically feasible. This would be subject to certain "Terms, Conditions, and Standards," as amended to apply to direct use development.

Further suggestions to be considered and revised, as appropriate, include:

1. Conduct comprehensive archaeological/historical review of geothermal areas to provide at-a-glance idea of likelihood of archaeological/historical impact. Proposed sites could be adjusted accordingly.
2. Establish criteria for district heating system, modeled after Klamath Falls, Oregon--public and/or private.
3. Revise G-Overlay Zoning-
G-Overlay/KGRA-electrical use
D-G-Overlay-direct use-no KGRA requirement
4. Establish "permit package" i.e.,
Sample permits
Timing schedules re: other permits, stage of development, time for issuance (see attachment)
Agency contact person, phone # (perhaps with economic development office or County Geothermal Coordinator)
5. Complete a fault/earthquake hazards map for the County to aid in locating new geothermal sites.
6. Pre-arrange for geothermal resource to be supplied to a potential user by the developer (Chevron, Union, etc.)
cost/quantity
make-up of resource

7. Re-establish County injection criteria specific to direct use:
No geothermal fluid to be discharged to the surface as a result of normal operations.
This would assure that all fluid utilized would be reinjected, but eliminates the requirement for make-up water for a direct use development.
8. Adapt County's Terms, Conditions and Standards to be specific to direct use development.
9. To expedite processing, label new plants as demonstration or experimental to the extent practical (p. 64-65 Geothermal Element).
10. CUP - specify environmental issues format so they can be addressed quantitatively to reduce number of processing steps - also time.

Environmental issues for electric generation:

- subsidence
- induced seismicity
- water quality
- blowouts
- air pollution
- excessive noise
- aesthetic concerns
- land re-allocation (less than 2% for full-scale electric generation development)
- biological concerns

No socioeconomic - not potentially adverse
No archaeological/cultural, either

11. Address lack of M-1 & M-2 zoning (per OEDP).

Task 6--Develop a Plan for Encouraging Direct Heat Agricultural
Industry Development

1. Identification of areas of interest and concern to potential direct use developers.

a. Literature review

1. Financial assistance for potential users from CEC, other sources.

*May depend upon status of funding to the County as a redevelopment area, given current Reaganomics.

2. Establish some acceptable locations to:

- utilize in information booklet
- show to prospective users
- show to prospective developers

3. Assist in acquisition of housing for managers, who would likely be imported into the area.

4. Stress reliability and cost of geothermal as energy source.

5. Provide information on technological aspects of geothermal use for processing.

6. For greenhouses, factors which affect plant location decisions (in order of importance):

- energy supply
- proximity of market
- water supply
- labor supply
- climate
- reliability of energy supply also of extreme importance

7. Information needed in order to make decision whether to use geothermal energy:

- location of resource
- character of resource
- technical feasibility for use in greenhouse operations

b. Survey of sample companies to determine their stated needs

2. Questionnaire developed with County input and administered by telephone.

3. Evaluation and presentation of questionnaire results.

Developer	County
Needs	Response
1.	1.
2.	2.
3.	3.

4. Recommendations

5. Implementation Plan

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