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COURTHOUSE
EL CENTRO, CALIFORNIA

October 2, 1980

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SUBJECT: Quarterly Topical Report of DOE Cooperative Agreement
#DE-FC03-79EP27196, April 1, 1980 to July 1, 1980

Dear Mr. Crawford:

This quarterly report is submitted as partial fulfillment of Cooperative Agreement DE-FC03-79ET27196. It will address:

- A. Geothermal Administration - status of transfer of Imperial Valley Environmental Project, status of data cataloging and storage, findings of geothermal field inspections, status of cooperative efforts between industry and the County for commercialization, problems in local geothermal commercialization and recommendations for action, and the status of geothermal exploration development and production in the County.
- B. Geothermal Planning - We will discuss the number and types of applications for geothermal energy received, results of hearings on applications, permits issued, and EIR prepared.
- C. Other geothermal activity - The Department of Energy Region 9 meeting in April, the Department of Energy Direct Heat Developers meeting held in El Centro in April, and a new drilling company in the County. These will be followed by the summary of events.

A. Geothermal Administration

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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. It is responsible for the transfer of the IVEP, updating of the

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geothermal resource center, conducting geothermal field inspections, and of both monitoring geothermal development and addressing commercialization problems. Results of progress in these areas is as follows:

- 1) Status of the Imperial Valley Environmental Project (IVEP) Transfer - IVEP Transfer proposed in March 1978 to Imperial Valley indicated cooperation from several other federal agencies. One of the key people in the Proposed Transfer was Lynn Anspaugh of Lawrence Livermore Laboratories. In May there was an all-day working meeting with him to review and update the plans. Some possible solutions to our monitoring needs were discussed and our priorities established. Lynn indicated that he would be talking to Dr. Hudson who is responsible for the IVEP transfer for DOE and would indicate our priorities. He also stated that Dr. Hudson might be able to either fund these monitoring needs or make arrangements with other federal and state agencies to have this monitoring accomplished. We are waiting the results of this meeting.
- 2) Update of the Geothermal Resource Center - An arrangement was made with Lawrence Livermore Labs to insure the completeness of our publications file. Plans were made to send LLL a list of our currently held LLL publications for their review. Any publications currently held by them, but not on the list, would be forwarded. All other publications are being reviewed at this time.
- 3) Results of field inspections - This quarter the first commercial dual flash 10MW power plant came on line, Magma's 10MW binary power plant is not producing, PGE/SCG methane plant may expand, and June Mexican earthquake not effect Cerro Prieto.
 - A. While geothermal development continues throughout the valley, the biggest event for this quarter was on June 17 when Southern California Edison started their 10MW plant in Brawley. This is the first dual flash commercial power plant in Imperial Valley and the United States operating with steam from hydro-geothermal wells. The geothermal field is operated by Union Oil Company of California. It provides 200,000 pound per hour steam to the power plant and was designed with duplication piping and pumps to allow scale removal during operation. The Project Manager at the site, Mr. Sedillo, is over-seeing the testing of the turbine utilizing a start-up crew from WESTEC Corporation. To date they have had no unexpected problems.
 - B. Magma Power's Magma Max Process 10MW binary power plant at East Mesa has produced and sold electricity to San Diego Gas & Electric, but currently are having to rework their gas turbines. They hope to be back on line in July.
 - C. The Pacific Gas & Electric Southern California Gas experimental bio-gas project at North Brawley is completing it's two year study. This experimental methane facility is capable of producing 1.5 million cubic foot/year. They are looking at the possibility of a 2 million cubic foot/day facility using geothermal heat for its drying needs. Pueblo Maciel is the Project Manager.

- D. On June 8th, there was an earthquake in Mexico, approximately 50 miles southeast of Cerro Prieto, called the Victoria Event. Approximately a week after the event, we conducted an informal tour of the area with Mexican representatives. There was no damage to the Cerro Prieto Geothermal power plant or field.
 - E. The other geothermal processors or developers mentioned last quarter are still proceeding, but have not passed any major milestones. For instance, MAPCO is evaluating the data gathered from flow tests at their Westmorland site. Occidental is evaluating the well that it drilled for an ethanol facility east of Brawley. McCulloch Geothermal is deepening their second well at their South Brawley site in preparation for geothermal field exploration.
- 4) Evaluation of the cooperative effort between industry and the County to commercialize geothermal energy in the area. - The effort is typified by listing a few of the transactions that have occurred this quarter:
- A. Meetings with representatives of Chevron to review their proposed micro-seismic monitoring network at Heber and subsequent field trip to the primary and alternate sites being considered.
 - B. Meetings with seismologist, Carl Johnson, of California Institute of Technology, who is monitoring seismic activity of the Valley for U.S.G.S. about the October 15th earthquake report he was preparing.
 - C. Meeting with a developer to discuss possible siting of greenhouses in Imperial Valley.
 - D. Meetings with local graduate student working on a geothermal sociology project.
 - E. Meetings with various developers about an ethanol facility in Imperial Valley.
 - F. Meetings with representatives of Southwest Border Regional Commission to discuss their participation in a possible direct heat project or seminar dealing with direct heat.

In addition, we conducted an Imperial Valley Geothermal Developer's meeting on May 1st. This meeting provided an exchange of information and progress reports on all active projects in Imperial Valley. There were over 100 people at this meeting with all the large developers represented. There was generally a positive mood about the progress that had been made by each individual developer. Some of the comments were:

1. SDG&E expects to have a 45MW binary plant on line by 1984.
2. Southern California Edison expects to have their Heber 45MW dual flash plant on line in 1982 and a 10MW dual flash at the Salton Sea in 1982.
3. The geothermal developers main concern is water availability.
4. The Master EIR for the Salton Sea KGRA will be started this year.
5. Geothermal development has spread to the Westmorland and South Brawley areas.
6. Dr. Robinson, University of California is doing agricultural research using geothermal brine water from East Mesa.
7. IT Corporation is completing plans for a geothermal waste disposal site (class 2-1 site)
8. Representatives from Cerro Prieto indicated that they expect to reach 620MW by 1984. A summary of this meeting is enclosure 1.

5) Problems in geothermal commercialization and Recommendations for action. - During this quarter three major concerns were looked into:

- A. The problem of geothermal direct heat development
- B. Revision of the County Solid Waste Management Plan
- C. Investigation of geothermal drilling muds

A) The County Ethanol Committee decides to seek outside help on the problems of geothermal direct heat applications in the Imperial Valley. The County Ethanol Committee composed of the Public Works Director, Planning Director, County Administrative Officer, and Agricultural Commissioner discussed these problems at length and agreed that the best solution to this problem was an organized review of the various impacts of direct heat applications on County planning, zoning, geothermal element, and social/economic impacts. Because of the limited staff available for such a review, it was felt that a consultant should be hired. It was further recommended that DOE funds be requested.

B) Modification of the Solid Waste Management Plan to incorporate the geothermal waste site is needed. IT Corporation has obtained a suitable location and is in the process of getting the appropriate permits from the County for a geothermal solid waste disposal site. Because of this, the County has put aside plans for its own solid waste disposal site. Since this type of site does not currently exist in Imperial Valley, modification of the County Solid Waste Management Plan is required. Because of limited man power, this duty has been assigned to the Geothermal Coordinator. He has met with representatives of the Solid Waste Management Board and is currently working on this revision.

C) Disposal of geothermal drilling muds at the County waste sites should continue. In the past geothermal drilling muds have been accepted at the Imperial County solid wastes sites, with the proviso that it was only until a class 2-1 site was constructed. This is a safe-guard measure because of the compounds added to the drilling muds during drilling operations. In light of the new restrictions on additives, the County feels that the geothermal drilling muds are not hazardous. During this quarter we have met with representatives of Accurex, who are conducting a study for EPA involving the chemistry of the drilling mud. We toured the solid waste sites that have received geothermal drilling muds. The results of their study will be forwarded to us.

B. Geothermal Planning

Geothermal planning is the task of the geothermal planner based within the Planning Department under the direction of the Planning Director. It is responsible for: Geothermal applications, hearings, permits, preparing draft Environmental Impact Reports, EIR's or statements, and implementing the Geothermal Policy Element to the General Plan.

Progress this quarter was as follows:

1. Planning Commission Actions

A. April 23, 1980, the Planning Commission issued a Geothermal Exploration Permit to Chevron Resources, Inc. to allow 8 exploratory wells southwest of the City of Brawley (Holly Prospect).

B. May 14, 1980, the Planning Commission issued a Geothermal Exploration Permit to Republic Geothermal, Inc. to allow 12 exploratory wells southwest of the Townsite of Niland.

C. May 14, 1980, the Planning Commission issued a Geothermal Exploration Permit to McCulloch Geothermal, Inc. to allow 4 exploratory wells north of the City of Brawley.

D. May 14, 1980, the Planning Commission issued a Geothermal Exploratory Permit to Imperial Magma to allow 8 exploratory wells in the Salton Sea KGRA.

E. June 11, 1980, the Planning Commission granted an amendment to Geothermal Exploration Permit #96-78 issued to Union Oil Company allowing the relocation of Sinclair Well #14 in the Salton Sea KGRA.

2. Board of Supervisors Actions

A. May 27, 1980, the Board of Supervisors denied an appeal to overturn (thereby approving) the granting of a Geothermal Exploration Permit to Chevron Resources for 8 exploratory well (Holly Prospect) Southwest of the City of Brawley.

B. June 17, 1980, the Board of Supervisors approved and authorized the signing of an agreement with the State Energy Commission to provide a Master Environmental Impact Report for the Salton Sea KGRA.

C. June 24, 1980. The Board of Supervisors denied an appeal to overturn (thereby approving) the granting of a Geothermal Exploratory Permit to Republic Geothermal for 12 exploratory wells southwest of the Township of Niland.

D. June 24, 1980. The Board of Supervisors denied on appeal to overturn (thereby approving) the granting of a Geothermal Exploratory Permit to Imperial Magma for 8 exploratory wells in the Salton Sea KGRA.

3. Permit Processing

A. Republic Geothermal (12 wells southwest of Niland). Incomplete application submitted January 7, 1980. Completed application received February 26, 1980. Mitigated Negative Declaration reviewed (through State Clearinghouse) between March 21 - April 24, 1980, and approved on May 14, 1980.

B. McCulloch Geothermal (4 wells north of Brawley). Incomplete application submitted February 6, 1980. Completed application received March 4, 1980. Mitigated Negative Declaration reviewed (through the State Clearinghouse) between March 21 - April 24, 1980, and approved on May 14, 1980.

C. Imperial Magma (8 wells in Salton Sea KGRA). Incomplete application submitted November 9, 1979. Completed application received March 15, 1980. Mitigated Negative Declaration reviewed (through the State Clearinghouse) between April 2 - May 3, 1980. and approved on May 14, 1980.

D. Imperial Magma submitted an incomplete application on May 15, 1980 for Magma Power Plant #3 in the Salton Sea KGRA (49 net MW and up to 17 initial wells and 24 replacement wells over the life of the project.)

4. Other Geothermal Planning Activities

A. The Planning Department is finalizing a contract between the County and California Energy Commission (CEC) to prepare a Master EIR for the Salton Sea KGRA. This document will address the generic and cumulative impacts of full field and power plant developments resulting from up to 1,400MW of electrical generating capacity. This effort will be jointly funded by CEC and the geothermal lease holders. Preliminary meetings have been held and the RFP (request for proposal) has been sent out to consulting firms.

C. Other Geothermal Activities

Three additional activities occurred this quarter: The DOE Region 9 meeting in April, and the DOE Direct heat Developers meeting held in El Centro on April 15th and 16th, and the formation of a new geothermal drilling company (H & W. Drilling).

- 1) The Region 9 DOE meeting - April 1, 2, 3, 1980 in Carson City Nevada provided an opportunity for DOE to be updated on the progress made in the various cooperative agreements they are funding. This meeting also provided information on the geothermal loan guarantee program, Farmers Home Administration Program, and an opportunity to discuss problems common to geothermal development. (Summary of this meeting is enclosure 2).
- 2) Department of Energy Geothermal Direct Heat Application Program, Semi-Annual Review Meeting.

This meeting held in El Centro on April 15th, 16th and 17th for DOE to review with 22 separate Direct Heat Project Managers their current stages of development. These DOE funded projects included agri-business, district heating systems, industrial processing sites and institutional heating systems. This meeting is held in different locations and covers projects all over the western United States. It provided an opportunity to learn about many applications that might apply in the Imperial Valley, plus an update of the two Valley projects, the Holly Sugar project and the City of El Centro heating and cooling of the Community Center. A program summary of these papers given at the three day of meetings is in the geothermal library. One of the interesting conclusions was that it was more cost effective to contract your own drilling rather than go through a subcontractor.

Increased drilling is expected in the County as Frank Wright, Vice President of Republic quits to form his own drilling company, H & W Drilling. Republic Drilling has one new and one old drilling rig currently but have ordered an additional new rig. H & W Drilling with one brand new drilling rig will start operation in July. Expectations are so positive that he has ordered a second drilling rig. By fall Magma will have begun their own drilling geothermal wells in the Imperial Valley. This amount of activity can only indicate an increase in geothermal production.

D. SUMMARY

This quarterly report was divided into three sections; Geothermal Administration, Geothermal Planning and other Geothermal Activity.

In Geothermal Administration progress is as follows:

Status of IVEP transfer - meeting with LLL updated monitoring need, awaiting DOE approval.

Status of Geothermal Resource Center - final review with LLL for completeness of publications scheduled.

Status of field inspections and current progress - SCE/Union 10MW power plant in Brawley on line. Magma Power 10MW power plant at East Mesa down for turbine. PGE/SCG is funded for feasibility study of commercial size methane plant here.

June 8th earthquake in Mexico did not damage Cerro Prieto.

Chevron's proposed micro-seismic monitoring network for Heber KGRA was approved.

Imperial Valley Geothermal Developers meeting was conducted in May by the County (enclosure 1).

Status of Current Concerns -

County proposes a geothermal direct heat development study - funds requested.

County Solid Waste Management Plan needs revision to include proposed IT Corporation geothermal waste site. Task assigned.

In Geothermal Planning progress is as follows:

32 exploratory wells were permitted

In progress is Magma Powers Power Plant #3 in the Salton Sea KGRA with up to 17 wells initially and 24 replacement wells over the life of the project.

A Master EIR for Salton Sea has been planned to address field development to 1400MW of electrical generating capacity. This will be jointly funded by CEC and lease holders. RFP's have been sent out.

In other Geothermal activities:

1. DOE Region 9 meeting was held in April. It brought together grantees from California, Arizona, Nevada, Hawaii, and Samoa and DOE representatives from San Francisco and Washington D.C. In addition to reporting on the progress of the grants, there was a presentation on the Geothermal Loan Guarantee Program and the technical assistance program. A summary of the meeting is enclosure (2).

2. The DOE Geothermal Direct Heat Application Program semi-annual review meeting was held in El Centro April 18, and 19th. This review of 22 direct heat projects throughout the western United States covered from a geothermally heated prawn farm to heating and air conditioning (the City of El Centro project). The complete detail of this meeting is contained in the presentation of papers volume on file in our library or from Hillary Sullivan the DOE Project Manager.
3. Formation of H & W Drilling now provides two local geothermal drilling companies.

This concludes the Quarterly Topical Report for April 1, 1980 to July 1, 1980. If there are any questions concerning this report, please contact Mr. F. A. Scholz at (714) 352-2851.

Sincerely yours,

DAVID E. PIERSON
Director of Public Works

BY:
F. A. SCHOLZ
Geothermal Coordinator

bb
Enclosures

cc: Procurement Division/SAN
1333 Broadway
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cc: Office of Patent Counsel/SAN
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SUMMARY OF IMPERIAL VALLEY GEOTHERMAL DEVELOPERS
ANNUAL MEETING
THURSDAY, MAY 1, 1980
IMPERIAL COUNTY AIRPORT

Welcome by David E. Pierson, who stated that the purpose of this meeting was to let others know what each firm was doing both in development and research of geothermal in Imperial County.

Chairman- F. A. "Dutch" Scholz introduced each speaker

ROBERT LACY - SAN DIEGO GAS & ELECTRIC

Update on Heber project - first commercial scale binary plant in the world - 45MW net plant with 64MW gross output. Goals: All agreements completed in July, construction starting in mid-1982, plant in service in 1984, two year demonstration period, and a commercial facility in 1986.

Other activities include entering into letter of intent with Magma for two plants located at Niland anomaly - a 28MW and a 50MW plant and program under way to look at generic problems such as waste disposal, water acquisition, and transmission lines.

A.M. COOPER - CHEVRON RESOURCE COMPANY

Prior to 1978 Chevron had executed fuel sales contract with Southern Cal Edison for a 50MW Flash plant. Some 7,400 acres have been unitized in Heber and we are working on a unit development plan. The Master EIR has been certified and conditional use permit approved for Heber.

We have had problems getting water for cooling purposes. Made application to State Water Resources board to appropriate water rights to use New River water for Heber development. Much lab and research work has been done on using New River water (five months of testing has been completed) and we are satisfied with results. Still looking for alternate water resources.

Two things holding Chevron up - the water appropriation and approval of PUC. If these come about on schedule, expect Heber construction this September and should have two rigs running next year to develop this resource sometime the first half of next year. We are also exploring N.W. of Holly Sugar (The Holly Prospect).

RICHARD MITCHELL - COUNTY PLANNING

Since 1972 over 258 geothermal wells have been authorized. During last fiscal year 111 have been authorized. Magma's 10MW plant on East Mesa is almost complete; Union Southern Cal Edison 10MW plant will be completed in approximately 30 days; Magma has permit to construct 49MW plant in Salton Sea; SCE and SDG&E have received permits to construct 45 to 50MW plants in Heber (Chevron is the resource developer).

We were the first County to develop a geothermal element which has lead to our being the only agency authorized by State law to permit exploratory wells and minor testing. Our permitting process is three phased (1) The exploratory wells (2) Exploratory test fields, and (3) Power plants under 50MW.

In addition, we are expanding the Master EIR concept which was used successfully at Heber. It permits each well site to address only specific site differences. This EIR will also be used to change the "G" Zone to include the entire Salton Sea KGRA. It will be joint funded by CEC and leaseholders.

We are still working on transmission corridor element.

NORM DE HAVEN - SOUTHERN CALIFORNIA EDISON

Active in three anomalies - Heber, Brawley, and Salton Sea Area. (1) Heber, received conditional use permit January 22, 1980, have applied to PUC for certificate of public convenience and necessity - need approval of this plus water appropriation permit before construction can begin. Hoping for approval by September 1980. Preliminary engineering completed; about to start final engineering to get into construction by the end of this year. This 69 million dollar project producing 52MW gross and 41MW net.

(2) Brawley - have 10MW power plant constructed - should be rolling Mitsubishi turbine end of May (3) Salton Sea area - Union is testing wells. Have awarded engineering contract to Fluor Power services of Irvine. Plan on starting construction upon receipt of conditional use permit in early 1981. Hope to be operational by July, 1982.

OLIN WHITESCARVER - UNION

Have active project going on in Salton Sea KGRA - four wells drilled - currently testing wells. After completion, will go to prototype power plant test, to determine kind of facilities needed to provide steam to the power plant.

Other major project at Brawley's 10MW power plant and steam gathering system is 98% complete.

NEIL CROW/PHIL LETNER - LAWRENCE LIVERMORE LABS

The Imperial Valley Environmental Project field work was completed in 1978. The goals were baseline data, impacts, and resource assessments. The first volume of the assessments dealing with environment, health, and social economics are in final draft form at present. Lawrence Livermore Labs developed air quality model based on the development of 3,000MW for the valley. It showed that H₂S would not be a problem if minor treatment were done. The model also indicated cooling power drift for subsidence no model could be developed to predict it, so monitoring is the only answer. Seismicity - Imperial Valley has the highest seismic activity in the nation. Small events are occurring all the time near the Salton Sea area. Since we cannot sense a 2.5 to 3. event, we are not aware of most of them. In Colorado they were able to induce some seismicity using high pressure water. Physical make-up of the Imperial Valley is such that the chances of a similar induced activity here are very low. Land use showed that for the 3,000MW plan under 1% of agriculture land would be affected.

GREGG WOOD - AEROJET

Aerojet currently has a project at the DOE test site, East Mesa. It is a unit that simulates the flash part of a steam flash system and records the results. It can simulate a single, dual, or three flash system. It is a portable tester, using a data logger and can check parts per million

(PPM) carry over, corrosion, chemistry of scale, measure brine and brine scaling. It is being tested at well-head 6-2. The system works well and we will be contacting other operators in the area who might want to use the service. This is a DOE funded project.

CLAUDE HARVEY - SPERRY PROJECT

Demonstration project located in East Mesa - DOE funded - patent rights belong to Sperry. Major subcontractors - Barber Nichols, Mustang Engineering, and Republic Geothermal. It is a novel system which promises 36% better operating efficiency than conventional binary process. Pamphlets were passed out that described the technical system. Most unusual aspect is that the heat exchanger is down the well bore. The well is 30 inch wide to about 800 feet, then 24 inch to 1,600 feet, then standard to about 6,800 feet.

The well is complete - Initial indications are that it is good. Expect to produce 4.2MW electrical net from single 350 degree well. Will use a 1,000 gpm stand alone down-hole Sperry organic drive brine pump with direct reinjection.

DR. FRANK ROBINSON - UNIVERSITY OF CALIFORNIA

I am a water scientist at the extension field station, working with East Mesa water that is 2,000 parts per million. There are some areas where high part per million water is being used for irrigation now. The study we are conducting here consist of looking at three herbs, three types of trees, and three crops, all irrigated by geothermal brine. All of these are still being studied, and they were picked because of their high resistance to salt.

The most spectacular growth to-date were the salt cedars which in 7 months have grown 11 feet. These might prove to be a positive benefit, if they were used for a wind break like on Interstate 10, near Indio. The crops being looked at are sugar beets, asparagus, and alfalfa. The tests are not completed yet but at the Salinity Lab, they use water up to 6,000 parts per million. Any crops considered must have a high salt tolerance and boron tolerance. Boron is approximately $3\frac{1}{2}$ parts per million. The results of the test are favorable.

DOUG STOCKTON - STATE DIVISION OF OIL & GAS

The division supervises the drilling operation, production, abandonment and injection of all geothermal wells. Also, have regulations for subsidence monitoring.

CHRIS LANE - WESTEC

Activities include: operations and maintenance - of the DOE test facility at East Mesa, performing startup functions at the 10MW SCE Brawley plant, some miscellaneous field support activities which include well logging support.

Subcontractor to City of El Centro to provide engineering and environmental work involved in the field demonstration of space cooling, heating and domestic hot water heating for the recreation center. We have just received approval for the site, environmental work completed, getting ready to procure drilling contractor.

FAY ROUND - WESTEC

We have completed many EIR's. The most recent of which is the EIR for the Class 2-1 hazardous waste site for IT Corporation.

BARBARA FILNER - SOUTHWEST BORDER REGIONAL COMMISSION

The Southwest Border Regional Commission is a joint Federal/State agency - charged with economic development in four state border regions of Texas, Arizona, California and New Mexico. My purpose here is to publically re-assert support for geothermal development in Imperial County and to request proposals. We are looking for proposals which address direct heat uses such as agricultural processing, ethanol production, industrial brine, geothermal industrial parks and technician training or on the job training. We are also interested in technology transfer to Mexico. We try to work through local non-profit or community based groups.

HECTOR ALONZO - CERRO PRIETO

In April of 1973, Cerro Prieto started producing electricity with 75MW on line. In April of 1979, we added 75 more MW's. This development was due to the revenues from the 600KW production in middle Mexico, which started in 1955. Our national goal is 4,000 million KW's per hour by the year 2000. A savings of 57 million barrels of oil annually. Development at Cerro Prieto started in 1962 and currently there are 67 wells; 13 exploratory and 54 for electrical power. The first 19 wells provide steam to Number 1 and Number 2 turbines. They are the oldest wells drilled from 1200 to 1500 meters. 11 more wells provide steam to Turbine Number 3 and Number 4, and were drilled 1500 to 2000 meters. There are 4 back-up wells. The later 20 wells have been drilled in anticipation of the additional turbines. Two wells, Number 103 and 366, have temperatures in excess of 350 degree C. Current construction is under way for a 30MW low pressure steam turbine, which would utilize waste steam being discharged from the other wells. This turbine should be on line by 1981. We expect to have 620MW on line by the end of 1983. Currently, geothermal electricity provides 1% to 2% of the power needs of Mexico and we intend by the year 2000 for it to be 8% to 9%. We are in negotiation with San Diego Gas & Electric to sell our excess capacity.

In addition to the electrical generation, there has been investigation of the brine. The pilot plant that was constructed in 1978 separates potassium chloride out of the brine. It separates 40KG per hour. Based on analysis, it is possible to separate 72,000 tons a year or two-thirds of the national demand. Presently Mexico imports 5 million dollars a year for agricultural fertilization. Plans are under-way for construction of a commercial size plant. Other chemicals that are being looked at are lithium, chloride, calcium chloride, Chlorine, and sodium hydroxide.

DAVID E. PIERSON - COUNTY PRESENTATION

Spoke of what is going on in County - principally interested in early detection of subsidence. The earthquake in October of last year damaged the survey net. Repairs are under way, with resurveying in the fall.

Transfer of data baseline program from Lawrence Livermore Labs and very reduced continuation of monitoring on baseline environmental program is being developed. This will be carried on for the foreseeable future.

Dutch Scholz will be developing a data resource center for all EIR's, LLL studies, socio-economic studies, and development publications on the Valley.

We are working on a solid waste site for geothermal wastes. It is in the EIR stage for the future. I would like to see developed a permanent committee of geothermal developers, to look at Valley wide needs.

JAY SEIDMAN - TRW - HOLLY PLANT

Have contract with Holly Sugar and DOE - for Direct Heat Application.

Phase 1. Resource assessment completed

Phase 2. Completed permits and engineering of conversion of dryers and possibly electrical production, now ready to start.

Phase 3. Drill wells, etc; money is tight, causing a slow down.

We will have 7 month of geothermal available for giveaway.

RAY CHANTLER - McCULLOCH - Geothermal

Drilled two wells to date - one producer and one injector - East of Holly Sugar. A rig will be moving in within the next few weeks to deepen number 2 well to 13,000 feet. Will run preliminary 30 day test and will probably then drill another producer south of Brawley. We have been permitted four wells at this site.

TOM GREEN - STATE DEPARTMENT OF WATER RESOURCES

Partners with McCulloch - using 5.8 billion KW hours annually - expect to grow to 10 billion KW hours. Contracts with various suppliers terminating in 1983, so we need to develop sources of energy. We have some interest in Heber. The policy of the department is to get into other alternate sources such as wind, solar, geothermal.

RALPH DiCORI - IT CORPORATION

Purchased 640 acres west of Westmorland to develop a class II-1 site to handle geothermal industry wastes. Hope to be in operation by end of this year. Will be bringing in 120 bbl vacuum trucks for transportation to the disposal site. Projected life of disposal site is 40 to 50 years.

NEIL MOYER - CALIFORNIA ENERGY COMMISSION

In the Commission there is a development division to enhance development prospects of alternate technology. The Division focuses on solar, bio-mass, synthetic fuels, wind energy, geothermal, and co-generation projects. We try to provide assistance to local governments, such as helping to underwrite funding of WESTEC transmission corridor study which Imperial County used for its transmission corridor element work.

We will be a major funding participant in Niland master environmental Impact Report (MEIR) that will be done for the Salton Sea KGRA. We hope to provide some seed money for the engineering studies of geothermal conversion of alfalfa dehydration process for Handler, Inc.

Finalizing quarter million dollar feasibility of engineering design study for a 20 million gallon per year geothermal ethanol facility in Imperial Valley. In the legislation there is the Energy Development Authority which if passed will provide \$200,000,000 for loans, provision of leases, etc., and for moving ahead on implementation of alternative energy technology. Tentatively \$200,000,000 of this could be available for geothermal prospects. Energy Commission and Development Division will be providing technical support.

JOE EDNY - BUREAU OF LAND MANAGEMENT

I am from the El Centro office of BLM and Project Manager for Environmental Assessments (EA's) in the area. Currently, we are working on the completing YUHA basin EA, half done with the EA for East Mesa, and are doing research on the Glamis and Dunes KGRA's.

Next year we will be starting on the San Felipe Creek area, and then will be looking at operations considerations of power plants on BLM land. Currently there is a California Desert Conservation Plan, which has completed public hearings. BLM is a multi-land use agency concerned with preserving and using the resources of the area.

TOM HINRICHS - MAGMA POWER

The East Mesa 10MW power plant construction was completed last summer. This is a Magma Max power process plant. It has two power fluids in the binary system - one is isobutane and the other a propane system. The 10MW isobutane system is in operation. The 2 1/2 MW propane one is not. Total output of plant will be 13MW, with internal usages, the net output will be 10MW.

DEBBY DEMONIA - BATELLE NORTHWEST

Division of Batelle Memorial Institute which is largest non-profit research organization in the world. We have been in Imperial Valley for five years. In the process of monitoring startup and first two years of Magma power plant operation. Looking at corrosion rate, scaling rate, brine chemistry, cooling water chemistry, and putting all of this data into data loggers at plant and onto phone line transmissions to computers in State of Washington. We can call from the lab and in 30 seconds get readout at 60 different locations on the plant.

There will be some conductivity probes to look at salinity and gas breakout. Will be looking at corrosion probes for continuous readout of corrosion. We are just beginning a two month scaling experiment where we will sample the beginning, middle and end of heat exchanger.

TERRY THOMAS - REPUBLIC GEOTHERMAL

We have completed the wells needed at East Mesa for a power plant and hope to start construction process soon.

OBSERVER'S COMMENTS

Don Lande - Division of Oil & Gas - thanked County Representatives in taking

lead in developing rules and regulations of geothermal resources in the valley. Stated meetings such as this are a good idea and should be continued on an annual basis. Thanked DOE and LLL for Scientific work in area. Need was expressed in the permitting process, particularly with State agencies.

TOM HINRICHS - MAGMA POWER

Gave summary of ongoing projects in valley - two 10MW plants on the line, two more in 1982, and three or four 50MW around 1984-85. At that time there may be a little stabilization: people may want to get some operating history before going off into the next phase. Master EIR's will aid growth. Need waste site.

- Big issue is transmission lines for getting power out of valley.
- Water issue needs to be worked on.
- Need joint efforts on keeping dikes together in Niland area.
- Prime focus of those in developing phase is economics of geothermal
- Gave thanks to Hector Alonzo of Cerro Prieto. Mexico will be getting contract on short-term basis from SDG&E for additional 240MW of electricity.

JEFF WIEGAND AEI

Stated meeting was very valuable exchange of ideas.

One of the most dramatic changes is that there are five geothermal powered ethanol plants that are in some stage of planning. Some of the people are already buying land for those plants and this is a major direct use contribution - thought this should deserve more attention.

ATTENDEES
IMPERIAL VALLEY GEOTHERMAL DEVELOPERS MEETING
May 1, 1980

<u>REPRESENTING</u>	<u>NAME</u>	<u>ADDRESS & PHONE NUMBER</u>
AEI	Jeff Wiegand	Box 961, Rancho Santa Fe, CA 92067 714-756-2733
AEROJET	Greg Wood Project Manager	P. O. Box 13222, Sacramento, CA 95813 916-355-3870
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Arizona Western College	Fred W. Croxen III Geologist	Box 929, Yuma, AZ 85364 602-726-1000 Ext. 286, 351
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Bechtel Corporation	Leon Awerbuch Principal Engineer	50 Beale Street, San Francisco, CA 415-768-1842
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	Ernest Y. Lam Pwr. Tech. Grp. Mangr.	P. O. Box 3965, San Francisco, CA 94119 415-768-7027
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	Neil A. Moyer Manager	1111 Howe Ave., Sacramento, CA 95825 916-920-7361
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Chevron Resource Company	A. M. Cooper Manager	P. O. Box 3722, San Francisco, CA 94119 415-894-3825
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City of Calipatria	W. H. Sorensen Planner	101 N. Lake St., Calipatria, CA 92233 714-348-2246
Comision Federal de Electricidad Coordinadora Ejecutiva De Cerro Prieto	Ing. Hector Alonzo	P. O. Box 248, Calexico, CA 92231 714-357-6728
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Hawke Engineers	Robert Malfanto Principal	78 First St., San Francisco, CA 94101 415-981-8607
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	Carlos Villalon Air Poll. Eng. I	Courthouse, El Centro, CA. 92243 714-352-3610 Ext. 240
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IMPERIAL COUNTY
INTER-OFFICE MEMO

DATE April 14, 1980

TO: Distribution List

FROM: Geothermal Coordinator

SUBJECT: Geothermal Resource Development and Commercialization Meeting of April 1, 2, & 3, Carson City, Nevada.

This DOE meeting was for all grantees and Region 9 to give an oral presentation of development in their area. Region 9 includes California, Nevada, Arizona, Hawaii, and Samoa.

The introduction was given by Noel Clark, Director, Nevada State Department of Energy. Noel made the comment that there seem to be lots of dollars for contractor's waste, but DOE had trouble coming up with travel funds for meetings like the current meeting. John Crawford from Region 9, the person monitoring our contract, stated that he wanted to have two other DOE representatives present, but due to travel fund restrictions they were not able to attend.

Next were DOE program notes. First speaker Bill Rice, who replaced Burt Barnes, commented that DOE reorganization was not finished yet and that there would be a tight budget this year, but he hoped that most of the budget cuts would come in programs that were now winding down. His personal opinion was that there would be little change to the current geothermal program. He also stated that the combination of the geothermal research Division and Commercialization Division was helping him solve some problems that they had earlier. He also stated that Benney DeBono is now taking the lead and that Rudy Black had been moved up. He stated that if we had a research question and contact him, he could get the right person's name and telephone number for contacting.

Duncan Foley from Region 8, DOE, said that IRS has stated that below 60 degrees centigrade geothermal waters would be eliminated from tax incentives. There is currently a proposed EPA regulation that is being considered that for one production well and one injection well would require 3 monitoring wells around the injection well. He also stated that the nuclear power plant's problems were not only effecting future contracts, but past "Let" contracts. Eleven were canceled last year and six were canceled this year. Therefore, more emphasis must be placed in geothermal development.

The afternoon meeting talked about special commercialization projects. The first one was Honey Lake, California, which is a geothermal-Woodchip Hybrid power plant, not really applicable to the Valley. I have details on this project and the Caliente Nevada District heating project.

The geothermal-Alcohol Development at Winnemucca, Nevada is an alcohol facility utilizing culled potatoes. They have a chart that shows that biomass has not increased cost like oil or coal has. Winnemucca, Nevada is irrigated land similar to Imperial Valley. With 17,000 acres farmed, getting about 320 bushels per acre, they could get 20% culls and make 1 million gallons of ethanol. In addition, they have the Carnation Potato Company there, who presently deadhead their trucks back from the company and could carry culls to the ethanol facility. They need at least 240 degrees fahrenheit geothermal fluid to save 70,000 BTU or have an 83% reduction in fossil fuel needs for ethanol.

The second session of the afternoon dealt with the impact of environmental and land use issues and geothermal development. At the Geysers in Sonoma County where development started, a sparsely settled area, they didn't have a lot of problems with people, but it is a hilly area, so where ever they put a power plant it would tend to show up more than a flat area; like Imperial County. When they started expanding over to Lake County, they got into the problems of more people geothermal land use problems, air quality, and even emotional problems of the pro-development and anti-development groups arguing. They also had to deal with water quality to the fisheries, which fish and game are constantly checking and the Peragin Falcon. Part of their land use problem not only is the site, but access roads that must be cut through the woods to the various sites. Imperial County Impact is Attachment 1, which is the talk that I gave.

For Hawaii, Gene Grabbe could not be there, so Don Thomas spoke on the impact there. There is no new information. The problems there are the problems of different Hawaiian group families coming up with reasons not to develop, both religious and emotional. Also, once you deal with one group and you go to a different island it is a different group to deal with.

Wednesday morning dealt with State and Local Government progress reports. It started with California Resource Assessment by Roger Martin. His statement of work says in part, Direct Heat Implementation Task and advanced planning/Local Government assistance. Sub Section A - , definitize each County potential status of developer ability to respond. (B) Determine a County data, policy, and personal needs fee. (C) Priorize needs for each County. (D) Schedule assistance based on potential. (E) Provide technical and financial assistance. Item number three was federal-state land use coordination under which they are expected to comment on BLM's Desert Conservation Plan Draft. The California Commercialization Planning was addressed by California Energy Commission, Syd Willard. She explained that they were working on direct heat uses for geothermal, transmission line corridor and geothermal resource assessment. She stated that phase 1 had been for work shops which they had conducted and phase 2 was the State-Geothermal resources project which is being funded by California and DOE. Neil Moyer, who replaced Nancy Deller of the California Energy Commission, said that there are two new pieces of legislature that effected geothermal. One was an alternate energy legislation which will establish an alternate energy development authority with ability to sell bonds for State Loan Funds, and the second, dispersal of revenue from BLM geothermal leases (AB1905). This dispersal of rents, royalties, and bonuses will be 40% to local governments on a pro-rated basis. 30% to California Energy Commission to assist local non-developed Counties and 30% for a renewable resource program. He also stated that CEC had regulatory authority for power plant sitings over 50 MW's and this appeared to be the reason that most developers chose power plants less than 50 MW's. Next, State of Arizona spoke to geothermal resources and indicated that they had Southland Royalty and the University of Arizona working together on state leases and were looking at the area around Tucson and to the west of Phoenix. Also, that just north of them, Union had leased large parcel of land. They presently

have 1.2 million dollars from Fleishmann Foundation to pursue Aquaculture. One of the direct users being Williams Air Force Base.

Mr. Don White who is Dean of Arizona Institute of Technology spoke on Arizona resources. There has been no drilling to insure the geothermal fluids are where they are predicted to be. Nevada spoke and went over the state development there. They are involved with Oregon Institute of Technology, and provide workshops for state water people, and have looked for power plant potential geothermal resources, but have not been able to find any to date. They have a couple of direct uses that they are working on right now.

State of Hawaii talked about commercialization of Hawaii and that paper is Attachment 2. Samoa was not present. Imperial County Development was the second paper that I gave, which is Attachment 3.

Thursday, April 3rd, the first talk was on venture capital by Paul Rodzianko. He stated that venture capital was investment capital that would have tax advantages and/or return to the investor. The venture capital evaluated risk assessment, taking logical risk, management experience, and the cost of venture. He stated that geothermal was not a glamour industry, so venture capital is not rushing into the project and they used the DOE loan guarantee application form for their guide in preparing investor presentation. He mentioned that timing of the investment was important because of tax year; etc., and that currently there was a 25% ITC, (Income tax credit.)

The Department of Energy Technical Assistance program was mentioned, which provides 100 hours of service per project. It provides use of Technical Library, in-house experts, and can send out pertinent data. They can arrange informal seminars. Oregon Institute of Technology has 50 projects averaging about 50 man hours and EG&G about 70 projects, averaging about 40 man hours.

Next, Ken Bromberg, with the Loan Guarantee Program, stated that they had 50 million dollars for a direct use project, 100 million dollars for an electric use projects and that if the developers had more than one project going on, the total to one developer would not exceed 200 million. DOE guarantees 75% of the loan with the borrower guaranteeing the other 25%, but DOE is very liberal about what they will take as the 25%, even to the extent of taking drilled cold wells prior to the loan as a part of the 25%. Maximum payback period is 30 years, but the normal is about 18 years. The cost of this service is 1% per year, which is put into a pool to handle any defaults. Attachment 4 shows some of the Valley loans and procedure for getting a geothermal loan guarantee.

Mr. John Woods, with the Bank of Montreal, stated they are heavily into loaning money for geothermal development, but not for first well drilling. They use the same criterion as the loan program, but didn't loan under 3 million dollars. Lastly, Claire Seeley, Farmers Home Administration, stated that he had been in business for 31 years and that the current

president's initiative was 100 million dollars for ethanol. They loan up to 90% and that he would talk to any developer about the loans. Normally, there was no minimum or maximum on a particular loan. The meeting was well received. There was a lot of interchange which should help further development of geothermal.

^{morning}
Good Afternoon - my name is Dutch Scholz. I am the Geothermal Coordinator for Imperial County, and my topic is Environmental and Land Use Issue impacts on Geothermal development.

First, a little background for any new people who do not know the history of Imperial Valley. Imperial County has moved toward Geothermal Development since 1957 when the oil prospect well of Sinclair #1 showed no petroleum but produced hot brine and steam. We have moved in an orderly manner.

In May of 1971 the County adopted regulations titled "Terms, Conditions, Standards and Application Procedures for Geothermal Exploration in Imperial County". They were intended to encourage planned development and are still used today.

In June 1977 under National Science Foundation grant a Geothermal Element to the County General Plan was completed. It addressed the environmental and land use issues important to Imperial County.

They are:

Subsidence

Seismic Activity

Preservation of Agricultural Lands

Transmission Lines

Use & Conservation of Water

EIR's

Imperial County has the potential for over 4500 MW of Electrical generation from the liquid dominated Geothermal Resource, so the concerns had to be

addressed. LLL received a grant to conduct an environmental study which would address all environmental aspects of Geothermal Exploration and Development. This valuable data gives a standard to measure from and inputs into required EIR's or EIS's.

Since we want to insure geothermal development, we have worked with the developers to iron out the potential problems up front. They know "going-in" exactly what is required so they can plan for it.

- A. Subsidence monitoring by the developer requires him tying in to our subsidence monitoring lines.
- B. A seismic monitoring network is required. Union established one to cover the entire north Brawley KGRA. Chevron is developing one for the Heber KGRA.
- C. Preservation of agricultural land is accomplished by island drilling or drilling on non-irrigatable lands. Island drilling uses slant drilling to get the resource without disturbing the land.
- D. Transmission lines has no easy answer, but has been addressed by a County-wide plan.
- E. Use and conservation of water is a very big problem that is still being worked on. Currently IID will provide fresh water to experimental power plants to a maximum of 75 Megawatts net electric in each anomaly for the initial five years of operation. This does two things: encourages developer to be first to build a power plant and encourages research into other water sources, etc.

Salton Sea, agricultural waste water, condensation waters and desalinized brines. Hopefully, technology will solve the problem or show that 100% reinjection is not necessary.

F. Land use also addresses government property. East Mesa has one power plant and looking at another, both on BLM land. BLM just finished an environmental assessment for proposed geothermal leasing in the YUHA Basin (West Mesa) south of Plaster City which could lead to two more power plants. Yet, BLM has drafted the California Desert Conservation Area Plan which could limit development and construction of power plants. There are three alternative plans plus no plan. The "Protection" alternative would severely limit exploration and power plant sittings; i.e., no power plants in West Mesa or new ones in East Mesa; the "Balanced" alternative limits; and the "Use" alternative is the least limiting.

Lastly, one of the technical difficulties of working with geothermal fluid is brine treatment. Scaling has been a major problem in the north end of the valley. There is one technique used by Magma Power that appears to solve the problem - I will cover it ^{this afternoon} tomorrow. The other problem with brine, not reinjected, is disposal. At this time, there is no class II-I site in Imperial County. IT Corporation and the County are both developing plans, so the problem will be corrected. Presently, brine must be shipped to San Diego (OTAY waste site).

In conclusion, our major environmental concerns are subsidence, use of agriculture land, and limited water. Many people are working on these solvable problems so the growth is coming. Valley people want the development and the country needs the alternate energy.

COMMERCIALIZING GEOTHERMAL
ENERGY IN HAWAII

Prepared for

Region IX - Geothermal Resource Development and
Commercialization Meeting, April 1,2,3, 1980
Carson City, Nevada

James L. Woodruff
Project Manager
Center for Science Policy and Technology Assessment
Department of Planning and Economic Development
State of Hawaii

Commercializing Geothermal Energy in Hawaii

Several studies and activities are being conducted to stimulate and prepare for the development of geothermal energy in Hawaii:

- A. Commercializing Geothermal Energy in Hawaii is the title of a DPED project funded by the U.S. Department of Energy to accelerate the technically, economically and environmentally sound utilization of geothermal energy in the State of Hawaii, and consequently to reduce the dependence of the Island community on imported oil.

Plans are being formulated by the project leaders for a comprehensive study of the potential markets in all of the regions identified as possible sources of geothermal energy. Industry consultants will be utilized. Cost-effectiveness of possible applications will be studied. Statements from industry leaders will be solicited on policies regarding geothermal energy. New energy intensive industries such as aluminum processing and extraction of nickle, copper and cobalt from manganese nodules will be considered.

- B. A focus of interest in geothermal activity in Hawaii is the successful well named HGP-A in the southeast part (Puna District) of the Island of Hawaii, usually called "The Big Island." Engineering data collected during flow tests in January indicate that the well characteristics are adequate to drive an environmentally clean 3-megawatt generator scheduled for installation in October of 1980. The devices utilized for abatement of undesirable noise and odor were highly successful, yielding better results than required by OSHA and EPA standards.

Site preparation is under way for construction and installation of the turbine generator, hydrogen sulfide abatement equipment and cooling towers. An approximately six months' delay in start-up was caused by the re-cementing of a faulty well casing before flow tests could be made. Start-up of the generator is scheduled for early in 1981.

The system will be operated for approximately a year to gather environmental and reservoir data and assess the economic feasibility of a small electric generator.

- C. Additional drilling is proposed to begin within 90 days three miles away at Opihikao under a two-year, \$5 million program announced in February by Governor George R. Ariyoshi. The Geothermal Exploration and Development Corporation (GEDCO), in affiliation with Barnwell Industries, Incorporated, will perform the drilling. GEDCO drilled the first successful well, HGP-A. The wells drilled will be potential new energy sources and will yield important information on the amount of geothermal energy available in the Puna District.

Several other geothermal developers are investigating drill sites on the Big Island and some have had negotiations with the Department of Energy for Geothermal Loan Guarantees to drill production wells for geothermal electric generating plants.

- D. A recent significant event was the completion of phase one of a cooperative Federal-State resource assessment program by the Hawaii Institute of Geophysics (HIG) entitled, Potential Geothermal Resources in Hawaii: A Preliminary Regional Survey. The results of this report will be used as a guide for future geothermal surveys and exploratory drilling and as a geographic aid in the study of commercialization of geothermal energy. \$150,000 CIP funds recently released by the State will provide required State match for continued Federal funding.

- E. A one-year social impact study is being conducted by the Puna Hui Ohana on the potential effects of the possible development of geothermal resources on the native Hawaiian population of the Puna area. The Puna Hui Ohana, made up of native Hawaiian groups, is performing the study with the assistance and guidance of the State of Hawaii DPED. Funding is from the U.S. Dept. of Energy and native Hawaiian organizations.

- F. Besides electrical generation, the steam and hot water from geothermal wells may have valuable commercial use. The Dillingham Corporation is conducting a USDOE supported investigation, Engineering and Economic Studies for Direct Applications of Geothermal Energy in an Industrial Park at Pahoa, Hawaii. Several industries to make direct use of geothermal heat have been proposed, including an ethanol plant, an aquaculture system, a fruit processing center, a feed mill, a swine facility, a greenhouse operation, a wallboard factory, a lumber seasoning plant, and a research center.
- G. Another study sponsored by the USDOE called Engineering and Economic Analysis for the Utilization of Geothermal Fluids in a Cane Sugar Processing Plant was completed by the Puna Sugar Company and indicates direct use of geothermal steam will decrease dependency on fuel oil. Transporting steam 15 miles from well to factory appears technically feasible but not cost effective.
- H. The technical and economic feasibility of inter-island undersea cables is being thoroughly investigated for OTEC and geothermal electricity transmission.
- I. At this writing there are five bills related to geothermal energy being considered by the Hawaii State Legislature. Basically, the intent of these bills is: (1) to offer loans to developers of alternate sources such as geothermal energy, (2) to appropriate funds for socio-economic research in communities impacted by geothermal energy development, (3) exemption of certain taxes and forgiveness of royalties as incentives to development of geothermal resources, and (4) to allow energy production facilities in agriculture districts.

Good afternoon. My name is Dutch Scholz. I am the Geothermal Coordinator for Imperial County and my topic is geothermal development in Imperial Valley.

As mentioned yesterday, our County development did not get growing until 1972. We have prepared for this geothermal development in an orderly manner. The terms, conditions, standards and application procedure helped geothermal exploration by delineating what had to be done. The geothermal element of the County General Plan listed the concerns of the County and future development.

We are now stepping into the production phase of geothermal development. Production has not been as soon as expected because of technical problems that I will cover lightly, but exploration beyond our earlier expectations reflects the fact that more development is coming.

In Imperial Valley each known geothermal resource area is unique, so I will cover each one individually. East Mesa, as I mentioned yesterday, is beyond the agricultural area on BLM land.

Bureau of Reclamation had a site which is now a DOE test facility available to geothermal equipment developers. Presently, they have two large projects with a third to start soon. The first is a spring Descaler developed by Aerojet Energy Conversion Company. It uses the theory that as the spring inside the pipe develops scale deposits, it will expand along the pipe to a higher pressure area that will knock the scaling off. The second is a 500 KW Direct Contact Heat Exchanger Pilot Plant that Barber-Nichols Engineering is testing. Here is a copy of their brochure. This size plant, if tests are successful, will lead to production size

plants. The economic factor will be how much isobutane is carried off by the brine. If they lose above 40-50 ppm, it is not economical.

The latest project is a continuation of LBL's "Power System Equipment Module Test" which they started at Magma, but had trouble with results and brine availability, so moved to the DOE site. They simply are testing a binary system using a heat exchanger the opposite of Magma's. The isobutane is circulated around tubes that contain the brine. This should help decrease scaling.

Just outside the main gate is another new project under construction. It will be the new Sperry down-hole pump and then a vertical down-hole-heat exchanger. Hugh Mathews discussed it at the last Geothermal Resource Council meeting.

Magma has a 10 MW plant that was operational for a short time. Presently, they are rebuilding the turbine which was scarred by a metal screen deteriorating. They have rebuilt everything at the plant with the exception of four pumps so far. The binary plant has turned the turbine and all, so the problems are only power plant which will be fixed soon. They were the first plant to produce 10 MW in the Valley.

East Mesa also has Republic Geothermal with 10 wells looking at starting a power plant. Future development there will depend on BLM and the

"California Desert Conservation Area Plan". At the Heber KGRA, SDG&E has permission for a 45 MW binary plant and SCE a 45 MW dual flash plant.

Chevron will be the reservoir manager. All development here has just passed the permitting phase.

At the Brawley KGRA Union is about 85% completed with the assembly of hardware to supply 200,000 #/hr steam to the 10 MW SCE power plant which is 90% complete. Union is still awaiting two vessels that are coming from Boston in the next few days. They expect first steam the 8th of April, and to turn the turbine May 1, 1980.

The Salton Sea KGRA is where the most recent development is Magma has developed and tested a flash crystallizer that removes the silica which caused the scaling. The design change will be used in the 49MW power plant which Magma has just gotten the cup to build at the old SPG&G Loop site. Magma has also been contacted by SPG&G to build a 27 MW plant near the 49 MW. Also, right on the edge of the Salton Sea is the Salton Sea Geothermal Power Plant Project which is in the EIR stage. This will be a 10 MW SCE Power Plant with Union drilling up to 28 wells.

This development is being spurred by the cost of petroleum and tax incentives as expected. The unexpected is the development outside the KGRA's. South of the Salton Sea KGRA MAPCO has drilled two wells that they are now testing. South of Brawley, McCulloch Geothermal is drilling four (4) new wells because of positive results obtained at 13,000 feet. Also south of the Brawley KGRA Chevron is drilling eight exploratory wells. East of the Salton Sea, KGRA Republic & McCulloch are going to drill.

North of the Heber KGRA, the City of El Centro will be having two wells drilled.

So, it appears that with all the interest outside the KGRA's, more production will be forthcoming.

In anticipation, we have worked at streamlining the permitting process and reducing paper work. The major step in this direction was development of master EIR's for each KGRA. This eliminates the need for an individual EIR for each well or power plant. Only sight specific items need to be addressed if variations are needed. This should save developers money and time in the permitting process.

I now have a Geothermal Planner to concentrate on handling the ever increasing requests for permits. Here is what has happened in the last three months:

1. January 9, 1980, the Planning Commission certified that the EIR was properly prepared and considered, and issued Magma Power Company a conditional use permit to construct a 49 M.W. Geothermal Power Plant in the Salton Sea KGRA.
2. January 23, 1980, the Planning Commission certified a Mitigated Negative Declaration, was properly prepared and considered, and issued a Geothermal Exploratory Permit to Phillips Petroleum to allow six exploratory wells East of Brawley.
3. February 27, 1980, the Planning Commission certified that the EIR was properly prepared and considered, and granted an amendment to Geothermal Production Permit #94-78 issued to Chevron resources to operate Production and Injection Wells in Heber KGRA.
4. March 12, 1980, the Planning Commission certified an EIR was properly prepared and considered, and issued a Geothermal Exploration Permit to McCulloch Geothermal to allow 4 exploratory wells in the South Brawley area.
5. March 12, 1980, the Planning Commission granted an amendment to Geothermal Exploratory Permit #70-76 issued to Union Oil allowing the relocation of the Tow #2 well in the Brawley KGRA.
6. March 12, 1980, the Planning Commission certified that an EIR was properly prepared and considered, and issued a Geothermal Exploration Permit to Union Oil Company allowing 3 exploratory wells in the Brawley KGRA.
7. March 26, 1980, the Planning Commission certified that a Mitigated Negative Declaration was properly prepared and considered, and issued a Geothermal Exploration Permit to Occidental Geothermal to allow one exploratory well Northeast of the City of Brawley.

In addition, the following geothermal applications were initiated since January 1, 1980 and are currently in process:

1. Salton Sea Geothermal Power Plant Project. This project would include a 10 M.W. Power Plant to be constructed by Southern California Edison in conjunction with Union Oil including up to 28 geothermal wells. The notice of preparation was mailed out on 1-25-80. Completion of the draft EIR is anticipated in May, 1980.
2. Niland Exploratory Wells Project. Republic Geothermal proposes to drill up to 12 deep exploratory wells Southeast of Niland. A draft Mitigated Negative Declaration was prepared and is being circulated until April 28, 1980.

3. KSMG Venture. McCulloch Geothermal proposes to drill up to 4 deep exploratory wells North of Brawley. A draft Mitigated Negative Declaration was prepared and is being circulated until April 28, 1980.
4. Salton Sea Geothermal Exploratory wells. At the request of the applicant, Union Oil, 18 of the deep exploratory wells previously proposed for use in the Salton Sea Geothermal Power Plant Project (10 M.W) are now being processed under a separate application. A draft EIR is currently being prepared.
5. Elmore Unit Exploratory Well Program. Imperial Magma proposes to drill up to 10 exploratory wells near the Salton Sea. The Imperial County Environmental Evaluation Committee has authorized the preparation of a Mitigated Negative Declaration for this project. A Draft of this document should be ready for circulation by April 4, 1980.

Mr. Pierson and the County have laid a great foundation for Geothermal development in the Valley that I hope to build on so people will see that we still have the technical knowhow to develop answers to difficult problems.

Imperial Valley is not at the development stage of the geysers, but we are presently working toward ways of solving environmental monitoring problems, so there will be no surprises later on.

CHARACTERISTICS OF THE
GEOTHERMAL LOAN GUARANTY PROGRAM

- Project Maximum: \$100 million (Electric)
\$ 50 million (Direct Use)
- Borrower Maximum: \$200 million
- Guaranty Maximum: 75% of total project costs
- Interest Rate: Reasonable (Taxables)
Interest Differential (Tax Exempts)
- Maximum Term: 30 years
- User Charge: 1% (Maximum)
- Collateral: Project Assets Only

Geothermal Loan Guaranty Program
Region IX Projects

Region IX Projects			mil (\$000)	
<u>Project</u>	<u>Location</u>	<u>Type</u>	<u>Total Cost</u>	<u>Guarant Amount</u>
I. <u>Approved</u>				
East Mesa	CA (Imp. Val.)	Field Dev.	17.9	9.0
Geothermal Food Processors	NV (Brady H.S)	Veg. Dehy.	4.5	3.5
CU I	CA (So. Brawley)	Expl.	3.9	1.8
Westmorland	CA (Imp. Val.)	Field Dev.	<u>41.0</u>	<u>29.1</u>
			67.3	43.4
II. <u>In-Process</u>				
CU I	CA (So. Brawley)	Field Dev.	78.8	49.4
NCPA-2	CA (Geysers)	Power Plant	57.0	44.0
Rorabaugh	CA (Geysers)	Field Dev.	38.3	28.6
Modesto Irrigation Dist.	CA (Geysers)	Field & Plant	<u>76.0</u>	<u>57.0</u>
			250.1	179.0
III. <u>Potential</u> (no application yet)				
China Lake	CA (Coso H.S.)	Field Dev.	20.0	15.0
East Mesa	CA (Imp. Val.)	Field Dev.	139.0	100.0
East Mesa	CA (Imp. Val.)	Power Plant	70.0	52.0
So. Cal. Ed.	CA (Heber)	Power Plant	66.0	50.0
So. Cal. Ed.	CA (Salton Sea)	Power Plant	20.0	15.0
Seagrams	CA (Brawley)	Ethanol	72.0	54.0
HELCO	HI (Puna)	Field & Plant	75.0	50.0
Oglevee	NV (Brady H.S.)	Greenhouse	5.0	3.5
NCPA-I	CA (Geysers)	Field & Plant	<u>75.0</u>	<u>50.0</u>
North Cal. Power Agency			542.0	389.5

IV. Other

Mushroom Plant	- Vale, OR
Ethanol	- Cove Fort, UT
Sulphur Processing	- Cove Fort, UT
Ethanol	- Animas Valley, NM
Space Heating	- Pierre, SD
Space Heating	- Bismark, ND

GLGP PROJECT REVIEW

THE GEOTHERMAL LOAN GUARANTY PROGRAM

Development of our nation's Geothermal Energy Potential is an important goal. Fast, efficient geothermal commercialization will help lessen the impact of rapidly rising petroleum prices and will aid in the effort to decrease our dependence on external energy supplies. Development of the resource and resource utilization technologies will also add to the economic base of those regions where the resources are located by attracting new industries.

The key to these benefits is the early and rapid development of the resource and its uses. As with any new industry, accelerated development is accompanied initially by high financial risks to investment capital. In an effort to promote geothermal development during the high risk period, the Department of Energy (DOE) has been granted the authority to undertake loan risks that exceed levels acceptable in the private marketplace. For geothermal energy development the vehicle by which the DOE accepts these risks is the Geothermal Loan Guaranty Program (GLGP).

The purpose of the GLGP is to stimulate the commercialization of geothermal energy by minimizing the financial risk incurred by development capital lenders. Under the program the United States government pledges its full faith and credit to the lender to guarantee the repayment of principal and interest on geothermal development loans. The GLGP objective is to provide financial incentives for the early and rapid development of the geothermal alternative while helping to establish the resources and technologies necessary for a self-sustaining industry. As the industry develops, normal financial relationships between borrowers and lenders will also develop, eliminating the need for the GLGP. In addition, the opportunities afforded by the GLGP should help to stimulate new entrants into the field helping to foster competition in the industry.

The range of projects for which the GLGP is applicable is very broad. Any project that falls into one or more of the following categories is eligible for a loan guaranty.

- Determination and evaluation of the commercial potential of geothermal resources
- Research and development in geothermal extraction and utilization technologies
- Obtaining rights to geothermal resources
- Development, construction, and operation of equipment or facilities for the commercial production of electrical energy from geothermal resources
- Development, construction, and operation of equipment or facilities for nonelectric application of geothermal resources.

Any organization, public or private, can be granted a geothermal loan guaranty. According to the GLGP regulations, preferential consideration is given to those projects that are to be carried out by small independently owned and operated businesses and small utilities. In addition priority consideration is given to projects that show promise of quickly resulting in geothermal applications, projects that use new technological advances, and projects that exploit the development of new geothermal resource areas.

Loan guaranties of up to 75% of the estimated cost of a project may be granted for up to 30 years. At least 25% of the project cost must be in borrower's equity. The maximum loan guaranty for a single project is set at \$50,000,000 with allowances for larger amounts for projects considered to be in the national interest. The maximum loan guaranty amount that any single borrower may have outstanding is \$200,000,000. The granting of a geothermal loan guaranty does not prohibit the borrower from qualifying for or obtaining other federal financial assistance.

Application for a geothermal loan guaranty is made to the DOE San Francisco (SAN) Office, which has national responsibility for administration of the program. The SAN Office evaluates GLGP applications and monitors ongoing GLGP projects.

The SAN Office works closely with the GLGP applicant to ensure that the application is complete and contains all information necessary for evaluation. The primary objective in evaluating an application is determining that a reasonable assurance of revenue exists for the payment of principal and interest on the loan. The GLGP applicant supplies project information in seven key areas: geothermal resource, engineering feasibility, product marketability, project financial projections, project management, environmental aspects, and legal requirements. The application evaluation process reviews the potential of the geothermal resource, the technical feasibility of the project, and the evidence of a market or potential market for the project's product or results. The evaluation determines whether sufficient financing has been arranged to carry out the project (including contingencies), whether projected cash flows are sufficient to repay the loan, and whether the borrower has a plan of operations for the timely and efficient completion of the project using environmentally acceptable processes. Finally a review is made to determine that all federal, state, and local legal requirements are met for both the project and the guaranteed loan.

At present DOE Headquarters in Washington has approval authority based on the recommendations of the SAN Office.

As the Geothermal Loan Guaranty Program progresses, experience has been gained and the program has been modified to make it more attractive and viable for the potential applicant. Through policy and procedural changes, the supporting information for the GLGP application has been shortened and simplified. More flexibility has been added to the requirements for the borrowers' 25% equity. Further, it is not necessary for the borrower to have an established lender prior to submitting his application.

Expedient evaluation and approval procedures have been established to facilitate review and approval of the application. Normal evaluation and approval time have been established at approximately 4 months in the SAN Office and 2 months in the Washington-DOE Headquarters.

Recent legislative changes have increased the upper limit for loan guarantees from \$25,000,000 to \$100,000,000--the loan limit is currently set at \$50,000,000 until community impact assistance regulations are issued. Principal and interest assistance can be made available for certain projects, and special interest differential assistance is now allowed for those public projects that are partially financed through tax-exempt bonds. Additional changes have also been made to

facilitate the marketability of guaranteed securities. Other regulatory changes now make it possible for the Department of Energy to borrow funds from the treasury if default payment is demanded and the geothermal resource development fund balance is depleted. These and other changes are currently being documented. Revised regulations and procedural documents will be made available in the near future.

For additional information on the GLGP and the application requirements and processes, contact the Manager of the DOE San Francisco Operations Office, at the address below:

Geothermal Loan Guaranty Office
San Francisco Operations Office - DOE
1333 Broadway
Oakland, California 94612

Area Code (415) 273-7151

STATUS OF THE GEOTHERMAL LOAN GUARANTY PROGRAM

To date, DOE has approved four guarantees under the Geothermal Loan Guaranty Program with total project costs of approximately \$43,000,000. Follow-on commitments to these projects total another \$102,000,000. Four additional applications are under review with guarantee requests totaling another \$88,000,000. In total, the Geothermal Loan Guaranty Program has approved, committed, or has under review, projects valued at \$233,000,000.

Examples of Geothermal Loan Guaranty Projects/Applications

Vegetable Dehydration Plant

Geothermal Food Processors of Fernley, Nevada, has constructed a vegetable dehydration plant at Brady Hot Springs, Nevada, using geothermal energy as a heat source. This plant is capable of processing 18,000,000 pounds of raw onions per year as well as other vegetables such as carrots, celery, bell peppers, chilli peppers, and potatoes. Geothermal fluids are used as process water and heat for the plant operations. It is estimated that the company will save \$1.8 million in fuel costs over the next 15 years.

Delayed completion of the plant resulted in the Company experiencing some financial difficulties. However, additional equity capital has been acquired and DOE has increased the loan guaranty to provide the additional financing to complete the plant and start operations.

East Mesa Field Exploration Project

Republic Geothermal Incorporated of Santa Fe Springs, California, has a loan guaranty to demonstrate the economic feasibility of producing electricity from the hot water underlining the East Mesa area. The first phase of the project provides for drilling eight production wells, seven of which have now been completed. Two supplementary applications are expected in the near future: one to build a 64 gross megawatt, double-flash power plant at East Mesa and the other for an expanded field to support the plant.

At the present time it appears that the East Mesa project will result in the first hydrothermal power plant in the country over 10 megawatts. This project will be a significant demonstration of the feasibility of a moderate temperature hot water resource for producing electricity since the East Mesa temperature and flow rates are both at the low end of the commercial range.

The Bank of America, Los Angeles, California, is providing the financing for this project.

Geysers Power Plant

The Northern California Power Agency of Santa Clara, California, has proposed the building of an electrical generating plant in the geysers in California. The proposed project provides for 110 megawatt plant to be located in the Castle Rock Springs area of the geysers. The Bank of Montreal- (California) will provide the financing. The estimated costs are approximately \$60,000,000, of which \$45,000,000 will be guaranteed. DOE has signed a memorandum of understanding with the State of California and other federal agencies to conduct a joint environmental review. This joint review approach is a first, and hopefully will set precedence for more effective and efficient environmental reviews.

Exploratory Drilling Project

Geothermal Kenetics Incorporated and the McCulloch Geothermal Corporation of Los Angeles have completed a drilling project at South Brawley, in the Imperial Valley of California. The project is financed by the Bank of Montreal. After completing the first well, a collapsed casing cut the well tests short. DOE agreed to increase its risk by allowing the borrowers to draw upon the balance of the guaranteed dollars to clean out the well and complete the well tests. The well tests were completed, and the well was tested at 75,000 pounds of steam per hour. From draw-down tests, the borrower believes that the well may be capable of delivering at or above 200,000 pounds of steam per hour. Well head temperatures were measured at 422°F. The borrower has submitted an application for full development of the resource for a 55 megawatt power plant.