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REPORT
OF THE
ENERGY RESEARCH ADVISORY BOARD
GEOPRESSURED RESOURCES SUBPANEL
OF THE
GEOTHERMAL PANEL

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November 1980

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Department of Energy
Washington, D.C. 20585

December 24, 1980

The Honorable Ruth M. Davis
Assistant Secretary for
Resource Applications
US Department of Energy
Washington, D.C. 20585

Dear Dr. Davis:

I am pleased to transmit on behalf of the Energy Research Advisory Board the report on Geopressured Resources prepared by the Geothermal Panel. This report was approved by the Board at its meeting on November 7, 1980.

The Panel's assessment of the Geopressured Resources Program leads it to the conclusion that a shift in program emphasis is warranted. Specific recommendations are contained in the report.

We are pleased that we could be of assistance to you in this area.

Sincerely,

A handwritten signature in dark ink, appearing to read "S. Buchsbaum", is written over the typed name.

Solomon J. Buchsbaum
Chairman
Energy Research Advisory Board

Att.
As Above

Department of Energy
Washington, D.C. 20585

OCT 28 1980

Dr. Solomon J. Buchsbaum
Executive Vice President
Customer Systems
Bell Laboratories
Crawford Corner Road
Holmdel, New Jersey 07733

Dear Dr. Buchsbaum:

I am pleased to transmit to you the Geothermal Panel's report on the Geopressured Resources Program of the Department of Energy. The Geopressured Resources Subpanel's report was reviewed, amended and endorsed at the Geothermal Panel's public meeting on May 23, 1980.

I hope that it will be of value to ERAB and the department.

Sincerely,

Carl Savit

CS/VT

Enclosure

cc: Tom Kuehn
Geothermal Panel

I. Introduction

The Energy Research Advisory Board Geopressured Resources Subpanel was established to evaluate the Department of Energy's Geopressured Resources Program strategy. This report is in response to, and largely composed around six issues put forth in the attached Terms of Reference (Appendix II). The Subpanel's report was reviewed, modified and adopted by the Geothermal Panel.

Below is a summary of findings and a discussion and list of recommendations of the Panel.

II. Summary

1. The main objective of the Geopressured Resources program is to define and assess the potential of the resource and demonstrate its economic viability so private industry will take over development. The Panel recommends that the program continue at about the present pace, but only after a shift in emphasis toward delineating low-salinity prospects for further testing.
2. The objective resource is now methane contained in reservoir water. However, results of limited testing to date have shown reservoir water salinity to be much higher than expected and, consequently, methane content only half that expected. There are some recent industry results on lower salinity waters with methane content two to three times higher which may be more promising.
3. Because of some discouraging test results in high salinities there must be a shift in emphasis to determine if low salinity-high methane prospects can be defined for further testing. Knowledgeable persons or entities should be involved in re-directing the program toward finding lower salinity reservoirs. It is recommended that DOE direct initial requests for help to technical societies and trade groups.
4. Resource definition should continue to be the major objective and support programs such as

environmental, legal and institutional, should remain at a reduced level until the technical and economic issues are favorably resolved.

5. Existing wells (Wells of Opportunity) should be utilized to the maximum extent to define the most favorable prospects upon which to drill fewer Designed Wells.
6. Industry participation is not likely to occur now because of industry's perception that development will not be technically or economically viable.
7. Industry cooperation should be encouraged by educational efforts on a personal appeal basis to appropriate technical and professional societies and industry trade groups.
8. One-time, proof-of-concept pilot plants utilizing the thermal and hydraulic energy should be constructed on a cost-shared basis.
9. Reservoir continuity may turn out to be the most serious technical impediment to the development. Detailed reflection seismic surveys should be considered over prime prospects prior to drilling to determine if structural conditions permitting adequate reservoir volume exist.
10. One major issue has not been addressed. What happens if private industry does not ultimately choose to participate in development of the resource for technical, economic or other reasons? If industry does not elect to participate, DOE will have to decide whether to cancel the program or continue it with Federal funds to develop gas reserves for national interest reasons.

III. Discussion and Recommendations

The following is a summary of the comments and recommendations offered in context of the Terms of Reference of the review.

1. Are the program objectives clear and reasonable?

It was agreed that the major objectives are clear.

The main objective is to obtain representative data to define and assess the potential of geopressured geothermal resources. The program is structured to yield data that are representative of large regions or trends. All other parts of the program are secondary to the primary objective of resource definition.

Economic analyses, based on these data, will then demonstrate the viability, or lack thereof, of geopressured resources being developed by private industry.

The major questions at the moment are methane content (dependent of salinity) and reservoir continuity (and thereby, longevity).

Although the Panel felt that the original objectives were clear, the consensus was that some shifts in direction are now necessary to keep the objectives reasonable.

It was generally agreed that the program has been scientifically good to this point, but that data acquired dictate changes in objectives to reflect what has been learned.

The original concept was based on moderate salinities in the geopressured aquifers (about that of seawater) and methane content around 40 standard cubic feet per barrel of water (SCFPB). There have only been limited tests conducted to date. Testing at the time of the briefings was showing salinities generally 3 to 6 times that expected, and methane content of only 20 to 25 SCFPB. Private industry (particularly oil and gas companies) generally believes that economics of geopressured resources would be marginal with methane content of 40 SCFPB. A trend to one-half the expected methane content would be rather devastating to the economics of development. Recent industry tests on low salinity waters, however, are reportedly showing methane levels of up to 60 SCFPB. If these results are substantiated, the outlook for this program would be more promising.

Thus, it does not seem reasonable to continue the program as originally envisioned. New directions must be emphasized to determine if prospects, trends, regions, etc., can be delineated in which salinity can reasonably be expected to be low (and methane high).

The main objective now must be to define low salinity prospects. It was suggested that Wells of Opportunity programs involving existing wells may be more suitable in pursuit of this objective. It was also deemed important to involve knowledgeable persons or entities in this regard, for example, logging experts to help determine salinities from logs in the geopressured environment. Study groups within industry or trade organizations (API, AAPG, etc.) could help resolve the problem of estimating salinity.

In summary, the Panel recommends that:

- (a) DOE make definition of low salinity prospects the major objective of the Geopressured Resources Program.
- (b) Knowledgeable persons or entities should be involved in redirecting the program toward finding lower salinity reservoirs.
- (c) Initial requests for aid in this regard should be directed to technical societies and trade groups so these contacts will in turn encourage appropriate industry support.

2. Is the pace of the program reasonable?

It appears that the pace is reasonable in view of the budget.

The program pace has been revised downward from 5 Wells of Opportunity (WOO) and 5 Designed Wells (DW) per year to 3 of each per year. This revision downward was due to high costs of drilling and testing wells compared to the program budget.

The actual pace of the revised program has been slowed further by logistical problems (securing

tubing, casing, etc.) and slower than anticipated results from research programs being conducted in universities. Thus, the program has been criticized for going too slow (particularly within DOE).

The Panel recommends that the program continue at about the present pace, but only after a shift in emphasis toward delineating low-salinity prospects for further testing.

3. Is there a good balance between the Wells of Opportunity, Designed Wells and supporting parts of the program?

The Panel concluded that there is a reasonable balance between resource definition activities (90%) and support programs in legal environmental and institutional areas (10%). The support programs should be increased only after development has been shown to be technically and economically viable.

Within resources definition, it was believed that the program would progress faster by emphasizing WOO. Optimum use of existing wells would yield more results per dollar spent. Results from WOO should also yield data upon which to pinpoint better prospects on which to drill DW.

DOE pointed out that obtaining the right WOO in the right areas is a severe problem due to operator's reluctance to cooperate with DOE, or any other government agency for that matter. The independent nature of operators on the Gulf Coast is a thorny problem and one for which the Panel can offer no fast or easy solution. Operators must be educated so they see that cooperation with DOE is not as distasteful as they perceive.

The Panel agreed with DOE that DW will ultimately be required to evaluate side effects of high flow rates in large diameter wells (scale, etc.) Designed Wells will also be required to test the best prospects in optimum locations if WOO do not exist or are not available for use.

In summary, the Panel recommends that the current balance between resource definition and support programs remain the same until technical and economic viability is shown and that more WOO be used to define the most favorable prospects upon which to drill fewer DW.

4. How could the participation by industry be increased?

One solution would be more DOE dollars. However, more DOE dollars may not be the answer since industry in general feels that private development of geopressured resources will never be technically or economically viable. Cooperation is probably an educational problem best solved by gentle persuasion, through personal contacts, congressional contacts and technical and professional societies.

In summary, it does not appear likely that private industry will participate strongly in development. However, cooperation of private industry should be attainable and, to this end, the Panel recommends that the effort to achieve better cooperation begin with personal appeal to appropriate technical and professional societies and industry trade groups (American Petroleum Institute, American Association of Petroleum Geologists, Society of Petroleum Engineers, etc.).

5. Would it be appropriate to perform pilot-scale projects on present or upcoming wells for utilization of thermal and hydraulic energy?

One-time, proof-of-concept pilot plants for thermal and hydraulic utilization would be beneficial. If this mode of utilization proves feasible, it might enable developers to salvage a situation where methane content proves too low to be economical. Production of alcohol comes to mind as one possibility for combined utilization. Pilot plants of this nature would also facilitate longer-term reservoir assessment. It was felt that these proof-of-concept projects should be cost shared.

The Panel, therefore, recommends that the Geopressured Resources Program make provision for one-time, proof-of-concept pilot plants utilizing thermal and hydraulic energy on a cost-shared basis and that other direct uses be considered in developing the geopressured program.

6. Have critical issues been overlooked?

It appears most of the issues critical to the objectives of the current program have been considered.

However, reservoir continuity may be the most serious problem of all - the complexly-faulted nature of the geopressured regime as revealed by detailed reflection seismic surveys may preclude having enough reservoir volume in each discrete fault-block. Detailed reflection seismic surveys over prime prospects may be a way to reasonably predict if the objective fault-block is large enough to support sufficient reservoir volume.

Economic analyses of geopressured resources development have been marginal, at best, and the most recent analyses are discouraging. Recent economic analyses for other programs have been using the developers' perspective. Since the case for geopressured resources will have to be made in the context of developers' assessment methods before private industry can be attracted, it would seem reasonable to perform such an assessment for this program.

DOE noted that in the program as it exists, no geopressured basins outside the Gulf Coast have been studied. The Panel is of the opinion that the program should make the case for geopressured resources development on the Gulf Coast before going to other areas.

Another issue of interest that has not been addressed in the field is discharge of spent geopressured fluids into the ocean. If reinjection of spent brine is not required for reservoir maintenance, discharge to the ocean could

have a substantial impact on economics in that costly injection wells would not be needed and pumping requirements would be greatly reduced. A WOO in the near-offshore environment could be utilized to determine if discharge to the ocean is feasible. DOE should work closely with EPA in this regard.

Environmental, legal and institutional issues were addressed early in the program and not much more can be done in this area until additional technical and economic data are acquired. Therefore, these issues should be re-emphasized at such time as technical and economic results indicate the program should proceed.

The one critical issue that the Panel feels has been overlooked is that industry may not ultimately choose to participate for technical, economic or other reasons. Since some results to date have not been encouraging, the Panel recommends that DOE should begin considering this issue.

Appendix I
GEOHERMAL PANEL
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Appendix II

Geopressured Resources Subpanel

Terms of Reference

Evaluate the Geopressured Resources Program strategy by addressing the following issues:

1. Are the program objectives clear and reasonable?
2. Is the pace of the program reasonable?
3. Is there a good balance between the Wells of Opportunity, Designed Wells, and supporting parts of the program?
4. How could the participation by industry be increased?
5. Would it be appropriate to perform pilot-scale projects on present or upcoming wells for utilization of thermal and hydraulic energy?
6. Have critical issues been overlooked?