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To Howard Ross, UURI, Earth Sciences Laboratory

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Panel Findings for Proposals Under PRDA No. DE-PR07-87ID12662 - State
Geothermal Research and Development

H. Brent Clark
Source Selection Official

Background

The Geothermal Energy Research, Development, and Demonstration Act of 1974 contained Congressional findings that the Nation is suffering a critical shortage of environmentally acceptable forms of energy and the Nation's energy problems can be solved if a national commitment is made to dedicate the necessary financial resources and enlist the cooperation of the private and public sectors in developing geothermal resources and other nonconventional sources of energy. Toward this end, the FY 1987 Continuing Resolution Bill, PL 99-591, includes funding of \$1,200,000 to continue a minimal effort in the hydrothermal area. Funds for this project will depend on the quantity of grants awarded and the specific grant amounts.

The objective of the project was to select and award up to seven or more grants with state and/or state-designated organizations to cost-share in the resource assessment, resource development or technical assistance and related activities on those aspects of geothermal energy that are not being studied by private industry, but which have the potential for results that will be applicable by industry in the development of geothermal resources.

Chronology of Events

Commerce Business Daily Announcement	March 5, 1987
Federal Register Announcement	March 18, 1987
PRDA Issued	April 1, 1987
Amendment No. 1 Issued	May 4, 1987
Proposal Due Date	June 19, 1987
Competitive Range Determination	September 2, 1987
Revised Proposals Due	November 2, 1987
Selection Statement Issued	December 15, 1987 (est.)

The PRDA was sent to 187 organizations. Prior to the closing date of June 19, 1987, 4:00 p.m., local time, the following twenty-one (21) organizations submitted proposals in response to the solicitation. Two organizations submitted two proposals each for a total of twenty-three (23) proposals.

1. State of Washington Department of Natural Resources
2. Arizona Solar Energy Commission
3. University of Wyoming

H. Brent Clark

4. University of Alaska
5. State University of New York at Buffalo
6. University of Nevada, Las Vegas
7. State of Hawaii
8. New Mexico Research and Development Institute (Rio Grande)
9. New Mexico Research and Development Institute (Tularosa)
10. Colorado Geological Survey
11. Washington State Energy Office
12. Desert Research Institute, *Univ. Nevada System*
13. Idaho Department of Water Resources
14. North Dakota Mining and Mineral Resources Research Institute
15. Oregon Department of Energy
16. Louisiana State University
17. Utah Geological and Mineral Survey
18. California State Lands Commission
19. California Energy Commission (Brockway)
20. Arkansas Mining and Mineral Resources Research Institute
21. American Samoa Government
22. Oregon Department of Geology and Mineral Industries
23. California Energy Commission (Wilbur)

Raden Gas

e.s. being responsible for geothermal resources within the state.

None of the above proposers appeared on the current list of contractors debarred, suspended, or ineligible for Government contracts. There was one amendment issued to the PRDA on May 4, 1987, which responded to the written questions submitted by prospective proposers. A preproposal conference concerning this solicitation was not conducted and all proposals were timely. The Program Research and Development Announcement (PRDA) included ~~four~~ *agency or agency* four minimum requirements: The proposer shall (1) be a state or designated by the state; (2) propose research in the areas of resource assessment, resource development, or technical assistance; (3) propose research related to hydrothermal resources with a significant hydrothermal resource base; and (4) propose work be done in the state or have written approval from the state where proposed work is to be done. Twenty-two of the proposals met the minimum requirements. One proposal did not meet the minimum requirements, but was evaluated and considered not eligible for selection.

Proposers were requested to submit their proposals in two sections distinctly marked as Part I - Technical Proposal, and Part II - Business Proposal. The technical proposals were reviewed by a Technical Evaluation Committee (TEC) comprised of Chairman, Peggy Brookshier and members, Marshall Reed, DOE-HQ; Howard Ross, UURI; Duncan Foley, Pacific Lutheran University; and Ben Lunis, EG&G. The TEC reported its initial findings to the SEP (see Attachment No. 2). Both the technical and the business proposals were reviewed by Elaine Richardson, SEP Chairman; Steve Pulley, Cost/Price Analyst; and Peggy Brookshier, Technical Committee Chairman.

The criteria were listed in descending order of importance. The Technical Criteria were weighted approximately three times greater than the Business Criteria. Technical Criterion A was weighted two times greater than Criterion B. Subcriterion A.1 was weighted approximately one-half the total weight of Criterion A. Subcriterion A.2 was weighted about one and one-half times the weight of Subcriterion A.3. Subcriterion B.1 was weighted about one and one-half times the weight of Subcriterion B.2. Business Criterion C was weighted approximately four times as much as Criterion D.

Part I - Technical and Business Proposal Evaluation - The TEC, ^{reviewed all technical proposals} and Source Evaluation Panel (SEP) voting members reviewed the twenty-three technical and business proposals submitted based on the criteria and subcriteria established prior to the solicitation and set forth in the PRDA. The criteria are as follows:

Criterion A: Statement of Work

1. Usefulness of the proposed research on resource assessment, resource development, or technical assistance and related activities to industry and others in the development of geothermal resources.
2. Technical quality of the proposed work, including consideration of the merit of the proposed approach and probability of achieving positive results.
3. The significance of the hydrothermal resource base.

Criterion B: Qualifications and Capabilities

1. Key personnel will be evaluated as to their capability, knowledge and understanding of the technology involved in the proposed work, as demonstrated by education, publication, and work experience.
2. Proposing organization's and subcontractor's capabilities will be evaluated with regard to availability of the necessary facilities and support. Under this criteria, past technical performance will also be evaluated.

Part II - Business Proposal

Criterion C: Cost-Sharing

The degree of cost-sharing and the ability of the offeror to provide its cost-share commitment will be evaluated.

Criterion D: Project Financial Plan

The project financial plan will be evaluated to determine the realism and reasonableness of the proposed costs, manhours, duration of the total project, and adequacy of cost breakdown by cost element and tasks.

The following is a summary with strengths and weaknesses for each proposal.

State of Washington Department of Natural Resources

Title: Definition and Delineation of the Southern Washington Cascade Range Geothermal Anomaly ✓

Strengths:

The proposed project would add to the Cascade Range information base and provide substantial new thermal gradient heat flow data over a fairly large region of the Southern Cascades.

All personnel proposed in drilling task are experienced and well qualified. Past performance in similar work has been of high quality and timely.

Good financial strength.

Weaknesses:

Proposed depth of ^{some} drill holes may not give meaningful gradients and heat flow data.

Thermal conductivity measurements not specifically spelled out.

~~No identification of specific sites~~ ^{Several (8)} suggested, exact sites to be determined

~~No subcontractor identified.~~ (Competitive bid) t.b.d.

Arizona Solar Energy Commission

Title: Hydrothermal Resource Assessment for Arizona's Basin and Range

Strengths:

Transfer of existing data to computer data base may be useful to a small percentage of potential users. A computerized data base could be easily updated.

Good cost breakdown.

Weaknesses:

No new resource data will be obtained.

A cell size of ^{(625 square} 25 miles ^{too} is large and ^{would} not be meaningful for most resources. ^{or 25 mi on a side}

Some of the proposed research is duplicative of previous DOE funded work.

No rationale of how the computer model will be developed.

There is no ~~known~~^{major} hydrothermal resource of significance in the area proposed.

An estimated cost of exploration for an unknown resource which might occur (?) in a given grid is not meaningful.

The statement of work is poorly defined.

Proposed personnel lack knowledge and understanding to evaluate the accuracy or significance of the geothermal data to be entered.

No financial statements provided.

significant risk to developers in reliance on computer evaluation in lieu of study of detailed resource maps.

University of Wyoming

Title: Improved Computational Schemes for the Numerical ~~Modeling~~ Matching of Hydrothermal Resources in Wyoming

Strengths:

The proposed work may well represent a major advancement in the analysis of complex, convection dominated hydrothermal resources.

The numerical work could greatly enhance the ability of geologists to predict combined fluid-heat flow.

Innovative mathematical approach to a complex problem which could have applicability to a large number of hydrothermal systems.

The work proposed is of high quality. The proposed personnel are well qualified.

Good cost breakdown.

Weaknesses:

Additional data for testing of the modeling may be needed to verify the applicability.

Question if the algorithm development will be successful.

Minimal amount of new resource data will be obtained.

No financial statements.

University of Alaska - Geophysical Institute & Alaska DGG

**

Title: Geothermal Resource Assessment in the Aleutian Islands and Alaska PeninsulaStrengths:

Maps will be beneficial and will be a carry-on from previous DOE-funded work.

Area could use resource assessment and might be applicable to other volcanic areas.

Generally using established techniques; some geophysical methods would record meaningful anomalies. Work should extend knowledge of Geyser Big resource which appears to have a substantial hydrothermal resource.

(geophysics deleted in revised proposal area)

Good financial strength with reasonable fringe benefit and indirect overhead rates.

I thought these were high.

Weaknesses:

Extent of proposed work may be greater than is reasonable for a second stage study. Past performance has not always provided high quality deliverables.

Too many studies proposed for time and funds available. CSAMT and VLF resistivity may be of little use. S P survey as planned is too limited to be really meaningful.

(S in revised proposal)

Success of project is highly dependent on weather and logistics.

An excellent resource is proposed; however, there exists no likely user due to the remoteness of the resource.

The proposer is highly qualified, but past work performance has not always been timely.

State University of New York at BuffaloTitle: Geothermal Energy From the Theresa Formation, South Central NYS

v Title

Strengths:

The proposed research will help refine our understanding of 9000 foot deep geothermal resources in southern New York state. The heat flow work and the interpretation of geophysical logs will help to determine if Cambrian sandstone has ~~any~~ permeability.

would establish resource temp. evaluation

significant

Potentially large resource in the area of likely users.

Weaknesses:

Low grade resource at great depth. A temperature of 180° at 9,000 feet may ^{depths approaching} not be economically feasible. There is no data to support the economical ^{not be sufficient for an} feasibility. _{development.}

Statement of work is inadequate.

No statement as to capabilities to model and interpret seismic data.

No financial statements provided.

University of Nevada, Las Vegas

Title: Geothermal Fluid Genesis in the Great Basin

Strengths:

Acquisition and integration of new and existing data, and project addressing longevity of geothermal resources is proposed utilizing innovative techniques.

The study would result in new data, especially in ~~the~~ producing areas, which would be beneficial to the public.

Geochemical and isotopic sampling and analysis of geothermal fluids would be a useful addition to the resource assessment in Nevada.

The resource is very large and is of moderate to high temperature.


Key personnel are experienced in field studies for geology and geochemistry.

Good financial strength. Reasonable salary rates.

Weaknesses:

Project to attempt too large an area in addressing entire Great Basin.

Geochemical approach, ^{supported by glacial data} even on ice, and archaeological artifacts, may not be enough to provide ^{answers}. No information is given about the technical quality of isotopic analyses or archaeological determinations. The technical quality is questionable.

~~There is a gap in~~ ^{logic} The explanation of how geochemical data will be interpreted to provide analysis of recharge, flow paths, and especially, prediction of system longevity, ^{is incomplete} 

Success in obtaining good carbon-14 dates is uncertain.

Technical backgrounds appear to be weak in reservoir hydrology and hydrogeochemistry which are important elements in the study.

Manpower ^{cost/time} is high.

State of Hawaii

Title: Hawaii Geothermal Research and Development Project

Strengths:

The trace element and isotope studies are useful activities for resource assessment and the technical quality is high.

silica precip. ✓ rev. resp

Tasks 1 and 2 are both useful and interesting with applications in other areas.

One of the highest temperature sites in the world, with great local importance.

Key personnel have strong backgrounds in geology, geochemistry, and surface facility engineering.

Good financial strength with a significant cost share proposed.

Weaknesses:

The proposer lacks reservoir engineering experience.

✓ rev. propos

Task 3, reservoir optimization is poorly defined and constrained.

Consultants will be required on Task 2, several are suggested but none are identified in detail.

Travel breakdown is incomplete, *and excessive.*

Insufficient detail on consultant, subtasks, and equipment.

New Mexico Research and Development Institute

Title: Evaluation of Time-Integrated Radon Soil-Gas Surveys in the Southern Rio Grande Rift

Strengths:

Proposed radon studies may have some applicability for low-moderate temperature resource exploration. May also relate to new basic observations about radon movement in the natural environment.

The personnel are very qualified and have done a good job in the past.

Good financial strength.

Weaknesses:

The resource is useful for direct heat projects such as greenhouses. However, the greenhouse business is very limited.

May be attempting to complete too many different site studies, and too large (nonspecific) areas.

The final report down-plays development of resource model, which is an important aspect of the final product, especially for applicability in other states.

Past performance indicates problems in timely performance, especially with regard to subcontractors.

Too ~~numerous~~ ^{many} of sites proposed for a test of hypothesis.

Limited hydrological and geochemical background.

Financial statements not provided.

Travel breakdown is incomplete.

New Mexico Research and Development Institute

Title: Geothermal Resource Assessment in the Tularosa Basin

Strengths:

Technical quality of work could be good. Positive results in defining target areas as they relate to subsurface fault locations ~~exists.~~ ^{could be expected.}

Personnel are qualified to do the work.

Financial strength is good for New Mexico portion.

✓ revised

Weaknesses:

The work will benefit almost exclusively DOD. Site access may be a problem. No indication of agreement from the Texas Bureau of Economic Geology for work to be done in Texas. For the work proposed on DOD property there is a question as to whether or not the data will be proprietary.

The proposal did not address extensive, DOE funded studies in the one proposed area (Hueco Tanks); did not ^{fully} justify selection of the six sites, and the study would not provide new types of information broadly applicable to other areas.

Excessive subcontracting of work. Proposer has had difficulty in the past of managing subcontractor work.

Possible weakness in the hydrologic and geophysics expertise of the team.

No documentation on subcontractor's financial stability.

Colorado Geological Survey

Title: Geothermal Resource Assessment of the San Luis Basin

Strengths:

If additional resources are located, an economically depressed area could benefit through direct-use projects.

Moderate possibility of achieving positive results.

Proposes acquisition of new data and interpretation of new and existing data in an integrated effort.

The key personnel are knowledgeable and experienced and have access to much of the data.

Good salary rate breakdown.

Weaknesses:

Emphasis is on geophysics, not hydrology, and this may be a hydrologic ^{more of} problem. ^

Proposal not specific about anticipated results of new studies and is missing stratigrapher and analysis of coupled fluid/heat flow phenomena.

Gravity data should already be compiled by ^{Dr} Homer at CSU.

Proposal does not discuss whether proprietary data exists; what ~~the~~ specific hydrologic questions will be tested; and what methodology will be used to evaluate accessible resource base.

Quality and economic viability of resource is relatively unknown at present.

The Colorado School of Mines personnel have strong background in geothermal, but the Colorado Geological Survey personnel, other than Mr. Galloway lack *significant* experience in geothermal.

Cost breakdown by tasks and financial statements not provided.

Travel breakdown is incomplete.

Washington State Energy Office

Title: Development and Field Testing of Geothermal Optimization Computer Model GEODIM

Strengths:

Addresses an area of significant need in the development of district heating systems.

Program will be tested in cities where the results can have significant impact and will allow adjustments suitable for many areas.

Existing work already performed on this test is available at no charge.

Could reduce risk of investment in planning and decision process regarding development of low to moderate temperature resources.

A ^{one} percent gain in efficiency for any one major district heating system would make the program development well worthwhile.

Proposed project appears to be state-of-the-art in computer application to engineering associated with geothermal development.

Key personnel have significant background and experience to perform the tasks.

Past performance is excellent with good financial strength.

Cost and travel breakdown is good.

Weaknesses:

Completion of the program could require more effort than anticipated.

A more complete understanding of the input, assumptions, and manipulations inherent in GEODIM is required to fully evaluate its applicability.

Foreign travel should not be a DOE cost.
Task breakdown not provided.

Desert Research Institute

Title: Quantitative Evaluation and Numerical Simulation of the Moana Geothermal System

Strengths:

Numerical modeling of geothermal reservoirs is a much needed component of most areas.

Well defined project, manageable in scope and size, and is state-of-the-art. It is very relevant to present development and related problems.

Work proposed, if it can be accomplished, will be of high quality. The reservoir testing will provide important data not available in many systems.

Proposed team is highly qualified for proposed work in hydrogeology.

Good financial strength.

Excellent breakdown of tasks.

Weaknesses:

numerical simulation
Need to recognize that the χ results will only be as good as the input *data.*

No geological staff from past geothermal geological studies are involved and their input could be an important part of the program.

Team may be weak in general/exploration geology of geothermal systems.

Mileage, man-hours, and computer usage is high.

Idaho Department of Water Resources

Title: Geothermal Resource Analyses in Idaho (Boise, Twin Falls, and the Wood River Valley, ID)

Strengths:

three
Two areas of significant concern, Boise and Ketchum, will be studied. *Twin Falls - Bamberg*
Evaluation of reservoir data by quality Reservoir Engineer is important.
The qualification^s of the personnel *are* ~~is~~ ~~very~~ good.
Excellent breakdown by task.

Weaknesses:

Concerned about the lack of independence that the reservoir engineer will have in analyzing and reporting the data.

Past record shows that the proposer has difficulty obtaining timely reports from subcontractors.

Ability to fund cost share is not documented and financial statements were not provided.

Cost for Consultant Engineer is excessive;

North Dakota Mining and Mineral Resources Research Institute

Title: Stratabound Geothermal Resources in North Dakota and South Dakota

Strengths:

Basin wide assessments of total resource base, with evaluation of heat and water flow, will be very useful. Working in two states will allow integrated approach to problem and be applicable to many sedimentary basins.

High quality work builds on earlier studies to resolve critical questions on heat flow and hydrodynamics. The proposal has a sound and systematic technical approach.

Resource is of broad extent at reasonably shallow depths in many areas; hence, probable collocation with potential users.

Key personnel are very experienced and well qualified.

Good breakdown of costs.

Weaknesses:

Relatively low grade resource.

Financial statements not provided.

Oregon Department of Energy

Title: Resource Development Research at McKenzie Bridge, Oregon

Strengths:

The project will provide a subsurface data point in the Oregon Cascades. ^{temperature}

Good task breakdown.

Weaknesses:

Specific data to be gathered are not identified.

Lack justification to do this project. The project is oriented toward direct energy development, yet: (1) the probability of adequate temperature and flow for wellhead power generation is low; (2) the resource is 80 km from a population center which is too far for direct heat use; (3) the main benefit would be to one landowner; and (4) there is limited technical value to others.

There was no discussion of geology, resource type, hydrology, siting plan, or purpose of well. *Proposed drill site may be off known resource geology.*

Geological-geothermal background is relatively weak. Capabilities of the owner to accomplish permitting, drilling monitoring, and well design are not demonstrated.

Close coordination with the Oregon Department of Geology and Mineral Industries is not evident.

Ability to fund cost share is not documented and financial statements were not provided.

Louisiana State University

Title: Two Phase Flow Studies of Gas and Water in the Wellbore

Strengths:

If development of computer program is successful, research could be useful to geopressed resource developers.

Field data should be easy to get.

Personnel appear to be very capable.

Good task and cost breakdown.

Weaknesses:

Research in the proposed two phase flow (gas and water) will not be *directly* applicable to hydrothermal reservoirs which are generally steam-water systems.

Success of proposed work is questionable.

The proposal does not address ^{*reference*} previous work already done on two phase flow in the wellbore *hydrothermal resources.*

Financial statements not provided and ability to fund cost share is not documented.

Supplies, manpower, and travel costs appear high.

Utah Geological and Mineral Survey

Title: Geothermal Resource Assessment at Newcastle, Iron County, Utah

Strengths:

May help expand knowledge of area especially in regards to deep thermal conditions; perhaps applicable to other areas of Utah and Nevada.

The tasks proposed are generally simple, and will help identify possible fault controls and deep thermal conditions at the site.

Study may have some general value in documenting responses of totally blind geothermal resources in basin and range setting.

Past performance has been very good.

Good breakdown of hours, rates, and cost share by task.

Weaknesses:

The justification for selection of 1000 feet as target depth in thermal gradient drilling was not presented. Mercury studies proposed are based on higher temperature areas ~~that~~ *and* may not work here.

Work proposed not ^{very} innovative.

Some data (aeromagnetic) is available at no cost, but cannot be disclosed.

Uncertain of resource utilization.

Personnel identified for gravity and magnetic studies lack expertise in this area. The project manager lacks extensive management experience.

Students @ U of W. adequate say vision: ?

Financial statements not provided.

California State Lands Commission

Title: Studies of Fracture/Fault Characteristic and the Natural Thermodynamic State of the Geysers

Strengths:

The proposed work could provide important information to developers in Geysers.

Tasks 1 and 2 sound like state-of-the-art approach to evaluation of a geothermal resource.

The Geysers are the largest geothermal power producing system in the world.

The LBL staff is well qualified and experienced in the area proposed.

Weaknesses:

Substantial amount of data (geologic, geophysics, geochemical) have already been published for the Geysers.

- most recent data are proprietary

The tasks are ^{not well} poorly defined.

100% pass thru funding to a national lab; cost share is artificial - CSLC staff time only no breakdown

California Energy Commission

Title: Resource Assessment of the Brockway Hot Springs Area

Strengths:

Key personnel are qualified to do the job.

Good financial strength.

Weaknesses:

The only potential users are members of an exclusive resort development. It is unlikely that fluid volume and temperature are adequate to allow economic use at ski areas and casinos several miles away.

Aerial photo interpretation, SP, and VLF surveys may be of little use for a minor, low temperature resource in this complex surface environment.

The discussion of the geophysics does not include mention of possible cultural or physiographic problems (the lake) and how they will be handled.

There is no comparative data provided from either nearby wells or other similar geologic environments around that would suggest that thermal gradient drilling in climatically cold area adjacent to a lake (in fractured rocks) will succeed in defining the resource.

The well drilling is not described in detail and the data to be gathered are not indicated. Justification for subcontractor costs not provided.

Proposed goals are not well defined.

Arkansas Mining and Mineral Resources Research Institute

Title: Geochemical Exploration for Undiscovered Geothermal Resources
Ouachita Mountains, Arkansas

Strengths:

Possible utilization by poultry industry if collocated with resource.

Personnel are qualified in the area of geology and sediments.

Significant cost share.

Weaknesses:

Known thermal springs are adequately studied by the USGS, the National Park Service, and possibly Los Alamos National Lab.

Hot Springs occurrence has been known for more than 150 years. The possible occurrence of other warm springs near populated areas should be known.

No data was presented to suggest hypotheses might work. Minimal chances for development of resources until locations are identified.

Previous studies have not indicated the existence of any major resource base in Arkansas, *(other than Hot Springs National Park)*

No financial statements or documentation to support cost share was provided.

No task breakdown.

American Samoa Government

Title: None

Strengths:

None

Weaknesses:

This proposal did not follow the instructions in the PRDA and did not address the minimum requirements.

Oregon Department of Geology and Mineral Industries

Title: Investigations of the Thermal Regime of the Volcanic Axis of the High Cascades, Oregon

Strengths:

Proposed thermal gradient hole will fill major data gap in cascades. Goals are clearly defined. The data ~~will~~ *could* be useful and ~~will~~ *would* supplement the DOE Cascades program.

~~Proposed hole and data are well conceived, approach is good, and there exists a high probability of positive results.~~

~~Personnel~~ *P.I.* ~~have~~ *has* much experience in this program and ~~are~~ *is* highly capable of accomplishing all tasks.

Good financial strength.

Good cost breakdown by element/task.

Weaknesses:

Total result of the research would be a single thermal gradient/heat flow value along the axis of the high cascades. The data could be of little use if the rain curtain is not penetrated, or if problems prevent reaching the projected depth.

if Intra hole flow is great,

Project is basically drilling of one hole with little new or novel science.

The Principal Investigator may be over-committed and is behind schedule in present DOE grant.

Drilling and geophysics costs appear high and lack detail.

Would have to hire most of staff to complete project.

California Energy Commission

Title: Resource Assessment of the Wilbur Hot Springs Area

Strengths:

Could be a useful comparison of four different power cycles for wellhead power generation.

Evaluation of resource and power generation potential are both of interest.

The key personnel are experienced.

Good financial strength.

Good breakdown of costs by task.

Weaknesses:

The proposal is poorly written.

Link between resource assessment (gradient hole) and power production systems analyses is not made/ *(resource evaluation probably incomplete)*

Relationship of land under study to hot drill holes, hot springs, other resource indicators is uncertain.

Siting plan for Wilbur Hot Springs well does not specifically indicate geologic mapping or geophysics.

Much of the power cycle data already exist in separate reports.

The Wilbur Hot Springs is not developed as a major resource.

Inadequate description of task labor and justification for drilling and contractual costs not provided.

Scoring:

Consensus scores were determined by the SEP between zero and ten for each criterion and subcriterion. Final scores were calculated by multiplying each consensus score by the weighting factors from the PRDA and normalizing results to ten. Weighting factors for each criterion were taken from the PRDA. Final weighted scores in order of total ranking are as follows:

RANK	PROPOSER	TECH. RANK	BUS. RANK	WEIGHTED TOTAL
1	State of Hawaii	6.00	2.40	8.40
2	University of Wyoming	6.80	1.10	7.90
3	North Dakota Mining and Mineral Resources	6.50	1.10	7.60
4	Desert Research Institute	6.00	1.40	7.40
5	Washington State Energy Office	6.00	1.25	7.25
6	California State Lands Commission	5.45	1.10	6.55
7	Washington Department of Natural Resources	4.80	1.25	6.05
8	University of Alaska	4.05	1.85	5.90
9	Idaho Department of Water Resources	5.10	.50	5.60
10	University of Nevada, Las Vegas	4.05	1.40	5.45
11	California Energy Commission (Wilbur)	3.00	2.40	5.40
12	Oregon Department of Geology and Mineral	3.75	1.40	5.15
13	New Mexico R&D Institute (Rio Grande)	3.75	1.10	4.85
14	Utah Geological and Mineral Survey	3.30	1.10	4.40

The competitive range includes the top 14 rated proposals

15	Oregon Department of Energy	1.80	2.25	4.05
16	State University of New York at Buffalo	2.70	1.10	3.80
17	California Energy Commission (Brockway)	1.75	2.00	3.75
18	Arkansas Mining and Mineral Institute	1.50	2.10	3.60
19	Louisiana State University	1.55	1.85	3.40
20	Colorado Geological Survey	2.70	.50	3.20
21	New Mexico R&D Institute (Tularosa)	1.45	1.10	2.55
22	Arizona Solar Energy Commission	.70	1.10	1.80
23	American Samoa Government	0.00	0.00	0.00

See Attachment 1 for the combined final scores for each proposer in the competitive range along with the proposed DOE share, proposer share, and total cost.

[^]
revised

A detailed breakdown of the strengths and weaknesses of the technical proposals can be found in the Technical Evaluation Report (Attachment No. 2).

A detailed breakdown of the strengths and weaknesses of the business proposals plus a summary of the method of scoring can be found in the Business Evaluation Report (Attachment No. 3).

Louisiana State University
Colorado Geological Survey
New Mexico R&D Institute (Tularosa)
Arizona Solar Energy Commission
American Samoa Government

Changes to Initial Evaluation of Competitive Range Proposals

All proposers in the competitive range were requested to submit written clarification to their proposals. These clarifications were submitted by November 2, 1987. Proposers were allowed to address more than one option when submitting their clarifications and revised proposal. Oregon Department of Geology and Mineral Industries and California State Lands Commission withdrew from consideration. The changes in ratings for the remaining twelve organizations are summarized as follows:

There was no change in rating for State of Washington DNR and University of Alaska. ✓ ?

University of Wyoming proposal was upgraded in the ratings for cost share and financial plan. ✓

University of Nevada, LV was downgraded in their financial plan. ✓

State of Hawaii proposed two options both being downgraded from the original proposal in the areas of technical quality and financial. One option was downgraded in usefulness. ✓

New Mexico (Rio Grande) proposed three options, two with no change in rating and the third was downgraded in usefulness. ✓

Washington State Energy Office and Idaho Department of Water Resources were upgraded in financial plan. ✓

Nevada Desert Research Institute was downgraded in financial plan. ✓

North Dakota Mining and Mineral Resources was upgraded in cost share and financial plan. ✓

Utah Geological and Mineral Survey was upgraded in usefulness, technical quality, key personnel, cost share, and financial plan. ✓

California Energy Commission (Wilbur) proposed two options both being downgraded from the original proposal in the areas of technical quality and financial plan. One option was downgraded in usefulness. ✓

Final Ranking of Proposals

The final ranking of proposals is as follows:

<u>Rank</u>	<u>Proposer</u>	<u>Rating</u>
1	University of Wyoming	8.65
2	North Dakota Mining and Mineral Resources	8.50
3	State of Hawaii*	7.80
4	Washington State Energy Office	7.40
5	Desert Research Institute	7.10
6	Utah Geological and Mineral Survey	6.95
7	Washington Department of Natural Resources	6.05
8	University of Alaska	5.85
9	Idaho Department of Water Resources	5.75
10	University of Nevada, Las Vegas	5.30
11	New Mexico R&D Institute (Rio Grande)*	4.85
12	California Energy Commission (Wilbur)*	4.80

Single
space

← * Highest Scoring Option Selected

Description of Final Revised Proposals in Competitive Range

University of Wyoming

The University of Wyoming has proposed to develop and test improved three-dimensional computational schemes for solving the combined heat conduction and forced convection equations for the purpose of determining subsurface temperatures. Temperature data from existing wells will then be used to determine geothermal ground water parameters and a model will be developed for either the Cody or Thermopolis hydrothermal system in the Bighorn Basin, Wyoming. The work proposed is original and will extend the state-of-the-art in numerical modeling of these types of resources. The computational schemes will have general applicability to a substantial resource base throughout the Rocky Mountains and new observational data will be obtained for one hydrothermal system. The work is very useful and has a

high probability of success. A highly qualified research team has been assembled at the University of Wyoming, and the members of this team have previously completed high quality resource assessment projects for the Department of Energy. This significant work will be completed in a 12 month period at a relatively modest cost to DOE and a favorable cost share.

North Dakota Mining and Mineral Resources Research Institute

The North Dakota MMRI brings together the North Dakota and South Dakota Geological surveys and excellent UND staff to propose a comprehensive assessment of the significant but relatively untapped resources in these two states. New drilling and heat flow measurements will supplement the existing drill holes and data base. The data will be quantitatively interpreted in terms of distinct stratigraphic and hydrologic units and promising geothermal aquifers will be identified. A specific task calls for dissemination of the results of the study at meetings with state agencies and presentations at professional meetings. The Principal Investigator has made major contributions to geothermal resource assessment and leads an excellent team in this two-state cooperative resource assessment. The study is regarded as highly useful, very practical and of excellent quality with a high probability of success. The study should not be compromised by reduced funding.

State of Hawaii (Phases I and II)

The State of Hawaii study seeks to investigate methods of controlling silica deposition from geothermal fluids of the Hawaii East Rift Zone. The study addresses a major problem inherent to this high temperature resource area and has a good probability of success in solving the silica deposition problem and possibly producing high quality silica as a economic byproduct. A Phase II investigation which evaluates the effects of reinjection on an injection well is not essential to the silica study, may duplicate the work of industry and if funded would decrease the cost effectiveness of the overall study. The research team is well qualified to complete the silica deposition study.

State of Hawaii (Phase I and II Plus East Rift Optimization Study)

This proposal has three major tasks: 1) A study to investigate methods of controlling silica deposition from geothermal fluids of the Hawaii East Rift Zone; 2) an evaluation of the effect of injecting spent geothermal fluids on the reinjection well; and 3) financial support for a study to determine optimum vacuum pressure for geothermal power plants in the Hawaiian East Rift. The silica deposition study addresses a major problem and the possibility of recovering high quality silica as a byproduct. The fluid reinjection study and vacuum pressure optimization study may duplicate the work of industry, are less likely to reach specific conclusions, and greatly

reduce the overall cost effectiveness of the proposal. An expert research team is proposed to conduct all aspects of the proposed work.

Washington State Energy Office

The Washington State Energy Office has proposed the development and field testing of the geothermal optimization computer program GEODIM. GEODIM is a partially completed program designed by the University of Lund, in Sweden which supports the design and optimization of wells, pipes, pumps and heat transfer systems. Completion and documentation of the program and its field testing at geothermal operating systems in Yakima and Walla Walla (WA), Boise (ID) and Klamath Falls (OR) are considered highly relevant projects which could result in higher efficiency and improved resource utilization for many direct heating systems. The proposed work will produce a quality, readily usable computer program. The proposing organization has an outstanding record of performance on DOE geothermal projects and has assembled a talented group of professionals to compete this project at only modest cost to DOE.

Desert Research Institute

The Desert Research Institute (DRI), UNLV ^{System} has proposed detailed hydrologic monitoring followed by a quantitative evaluation and numerical simulation of the Moana Geothermal System. Uncoordinated development of this moderate-temperature resource is rapidly expanding and the long term productivity of the Moana system may be threatened. The proposed work includes the appropriate data gathering and interpretation which will provide baseline data and understanding, and a quantitative model of the Moana system. Thus three state regulatory agencies and several developers will have the information and guidance necessary for the effective long term utilization of the resource. The proposer offers a high quality study which addresses an important problem for a heavily used resource. A highly qualified team is available at DRI to participate in this study. A minimal cost share is proposed. ← NEW

Utah Geological and Mineral Survey

The Utah Geological and Mineral Survey (UGMS) has proposed an integrated, multi-method study of the Newcastle geothermal system which could have broad applicability to the discovery and evaluation of other Basin and Range geothermal systems. The study includes an appropriate mix of Quaternary and bedrock geologic mapping, gravity and magnetic studies, soil-mercury investigations, fluid geochemistry and thermal gradient drilling.

A substantial amount of geophysical work will be completed by students of the University of Utah at little or no cost to the project. The proposed study would be completed by a qualified team and would contribute to the exploration methodology for Basin and Range blind hydrothermal systems.

Washington Department of Natural Resources

The Washington-Department of Natural Resources (WDNR) seeks to refine time-space-volume relationships for Cascade volcanism and to relate improved models to the geothermal potential of the Cascades Range. These topics are addressed through an integrated effort of thermal gradient drilling, new geologic mapping, new K/Ar-age dating, thermal gradient studies and geochemistry. The proposal is considered to have a high degree of usefulness and good probability of success in a large area of moderate-to-high resource potential. The methodology is sound and appropriate and will be performed by competent, experienced personnel. WDNR has an established track record in the conduct, interpretation and reporting of geothermal studies.

University of Alaska

The University and the State jointly proposed a geological and geochemical study of Geyser Bight, the hottest (180-264°C) and most extensive area of thermal springs in Alaska. Although this is a major geothermal resource, Geyser Bight is located on a remote uninhabited Aleutian Island and the net usefulness of the study, and resource potential, have been correspondingly downgraded. Geological and geochemical data on the resource may contribute to our knowledge of volcanic island arc systems in general. A related task will result in the preparation and publication of a four-color, geotechnically-oriented geothermal resource map of the Aleutian Islands and the Alaska Peninsula region and an accompanying descriptive circular. These products will document in new detail the present state of knowledge of geothermal resources for the area, and be a starting point for exploration, resource assessment and development efforts in the future. The work would be completed by competent, experienced geoscientists of these institutions. The total cost to DOE of Task 1 (Geyser Bight) appears excessive and should be reduced.

Idaho Department of Water Resources

The Idaho Department of Water Resources (ID-DWR) has proposed continued monitoring of the Banbury-Twin Falls resource and extended resource assessment activities; a geochemical study of Wood River geothermal systems; and continued monitoring and evaluation of the Boise geothermal system. The proposed work appears very useful as it addresses development problems in two substantial resource areas and appropriate resource assessment studies. It is especially important to continue detailed monitoring of the Boise resource and to evaluate the need for a reservoir test and quantitative model, but this work must be completed at the state-of-the-art and totally free from conflicts of interest. The staff proposed for the other studies is competent to complete the work but is poorly supported by the DWR. The ID-DWR cost share is judged to be minimal and somewhat artificial.

University of Nevada, Las Vegas

The proposed University of Nevada study would integrate fluid geochemistry, stable light isotope data, glacial ice data and archaeological information to study the genesis of geothermal fluids in the Great Basin. Nevada has numerous high and moderate temperature resources, several of which are under development, and the new data and interpretation would be useful in better understanding these important resources. The most useful part of the study would be the detailed sampling, chemical analyses and study of geothermal fluids from the hot springs and geothermal developments. The University of Nevada, Las Vegas personnel are competent and experienced geoscientists who can complete the proposed study with good technical quality. A minimal cost share is proposed. This work should be funded in accordance with proposal rankings, and as the availability of funding permits.

New Mexico Research and Development Institute (Sections 1, 2, and 3)

The New Mexico Research and Development Institute (NMRDI) has proposed three options for a study titled "Evaluation of Time-Integrated Radon Soil-Gas Surveys in the Southern Rio Grande Rift." The three options differ in the survey areas, total area to be surveyed, the total number of radon field measurements to be completed, and the corresponding total cost to DOE. Any option would result in an interesting evaluation of the radon gas technique as a geothermal exploration method in the soils and caliche covered areas of the Southern Rio Grande Rift. The proposals show a good understanding of the radon gas method and an appropriate selection of field test areas for the completion of the study. The study would be completed by competent geoscientists and managed by NMRDI, which has an established record of reporting and project management with DOE geothermal projects.

Option 1 includes an evaluation of soil-depth profiles and caliche effects and surveys in the Tortugas Mountain, Radium Springs and Picacho areas, plus interpretation and reporting at the lowest net cost to DOE. This proposal would provide an adequate test of the method and its applicability to the southern Rio Grande Rift.

Option 2 would include an evaluation of soil-depth profiles and caliche effects and surveys in the Tortugas Mountain, Radium Springs and Rincon areas, plus interpretation and reporting at a modest increase (\$4,000) in cost to DOE above the Option 1 proposal. The perceived higher resource potential and commercialization possibilities of the Rincon area, as compared to the Picacho area, would readily justify the small added cost to DOE as compared to Option 1. Option 2 is therefore the most highly regarded option for funding by DOE on cost-effectiveness considerations.

Option 3 includes an evaluation of soil-depth profiles and caliche effects, somewhat reduced survey efforts in both the Rincon and Picacho survey areas, and surveys at Tortugas Mountains and Radium Springs, plus interpretation

and reporting. Although this option permits a more complete evaluation of the technique, the total cost to DOE is substantially higher and the net cost-effectiveness is judged to be reduced as compared to Options 1 and 2.

The Panel determined the proposed studies to be useful projects offering minor innovations to geothermal resource assessment in areas of moderate resource potential. DOE funding for NMRDI Option 1 or 2 is recommended consistent with final evaluation scores and the availability of funds.

California Energy Commission

Option 1 (Geochemical Study)

California Energy Commission (CEC) in conjunction with the Pacific Gas and Electric Company (PG&E) have proposed a two-fold research project which includes a limited resource assessment of an area near Wilbur Hot Springs and a technical study to determine optimum power cycles for well head binary cycle generation systems as related to resources in northern California. The geologic reconnaissance and geochemical surveys may add to the knowledge of the Wilbur Hot Springs resource, but are directed toward a nearby area of unknown resource potential. It is unclear that the present owners of Wilbur Hot Springs will cooperate with the proposed studies. The geothermal power cycle study and technology characterization for Northern California resource areas would provide some useful information but is not considered a high priority study. The proposal does not indicate specific experience with the radon exploration method or nearby wells which may be available to the study. The proposal should be funded in accordance with the competitive ranking if adequate funds are available.

Option 2 (Drilling Program)

California Energy Commission (CEC) in conjunction with the Pacific Gas and Electric Company (PG&E) have proposed a two-fold research project which includes a limited resource assessment of an area near Wilbur Hot Springs and a technical study to determine optimum power cycles for wellhead binary cycle generation systems as related to this area and other resources in northern California. The resource assessment would include drilling of a small-diameter exploratory well for temperature, water chemistry and flow test observations. Although provision is made for geologic reconnaissance to aid in drill hole siting, the main criteria seems to be availability of land controlled by a major financial institution. Few geologic data are presented to support a drill site selection and the \$100,000 drilling budget is not itemized or supported in detailed breakdowns. The power cycle study and technology characterization for Northern California resource areas would provide some useful information but is not considered a high priority study. The total project usefulness, in terms of cost to DOE, is considered low and the resource potential is moderate at best. The proposal is not recommended for funding by DOE.

Program Policy and Preference Factors

In addition to the technical and business criteria, the following six program policy and preference factors were included in the PRDA which may be considered by the Source Selection Official in making the selection for negotiation and final award.

1. The DOE cost-share will not exceed \$200,000 per award, and the proposer must cost-share a minimum of 10 percent of the gross amount requested.
2. The potential benefit of the proposed project for the amount of DOE dollars spent.
3. The selection of projects which provide the greatest potential for data to enhance the goals of DOE.
4. Selections may be made to encourage geographic and resource diversity in the program.
5. Cost Considerations - The proposed cost is a function of the management approach, the technical approach, the manpower, the facilities, the organization, the uncertainties of the work, the proposer's competitive strategy and the economy. The panel will determine its own estimate of what it will probably cost the Government taking into account relevant data available. All other considerations being equal, total cost to the Government may be used in the final selection.
6. Selections may be made so as to effectively utilize available funding.

Etaine M. Richardson, Chairperson
Source Evaluation Panel

Peggy A. Brookshier, Chairman
Technical Evaluation Committee

.....

Stephen R. Pulley
Cost/Price Analyst

.....

Ralph Throckmorton
Assistant Chief Counsel

.....

Trudy A. Thorne
Executive Secretary

ATTACHMENT 1

		<u>Tech. Ranking</u>	<u>Bus. Ranking</u>	<u>Total Ranking</u>	<u>DOE Share</u>	<u>%</u>	<u>Proposer Share</u>	<u>%</u>	<u>Total</u>
1	Univ. of Wyoming	6.80	1.85	8.65	\$ 45,611 [✓]	72	\$17,597 [✓]	28 [✓]	\$ 63,208 [✓]
2	North Dakota	6.50	2.00	8.50	194,818 ^{8/8}	75 ⁸²	44,195 [✓]	25 ¹⁸	239,013 [✓]
3	State of Hawaii*	5.55	2.25	7.80	27,800 I+II = 119,950	48 61	33,175 [✓]	54 ³⁹	60,975 [✓]
4	Wash. State Energy Office	6.00	1.40	7.40	51,222 [✓]	79 [✓]	13,372 [✓]	21 [✓]	65,094 [✓]
5	Desert Research Institute	6.00	1.10	7.10	146,607 [✓]	80 [✓]	16,300 [✓]	10 [✓]	162,987 [✓]
6	Utah Geological Survey	4.95	2.00	6.95	60,000 [✓]	70 [✓]	15,341 [✓]	20 [✓]	78,488 [✓]
7	Wash. Dept. Natural Res.	4.80	1.25	6.05	165,189 [✓]	70 [✓]	49,589 [✓]	28 [✓]	214,751 [✓]
8	Univ. of Alaska	4.05	1.80	5.85	127,599 [✓]	80 [✓]	57,049 [✓]	45 [✓]	184,642 [✓]
9	Idaho Dept Water Resources	5.10	.65	5.75	196,992 [✓]	90 [✓]	21,150 [✓]	10 [✓]	218,142 [✓]
10	Univ. of Nevada LV	4.05	1.25	5.30	162,099 [✓]	89 [✓]	20,653 [✓]	13 [✓]	182,712 [✓]
11	New Mexico R&D (Rio Grande)*								
	Option 1	3.75	1.10	4.85	124,960 [✓]	82 [✓]	20,000 [✓]	16 [✓]	152,000 [✓]
	Option 2	3.75	1.10	4.85	129,550 [✓]	82 [✓]	28,000 [✓]	22 [✓]	157,307 [✓]
12	California Energy Comm. (Wilbur)*	2.55	2.25	4.80	55,721 [✓]	61 [✓]	35,142 [✓]	39 [✓]	90,863 [✓]

Highest scoring option selected.

PMW -

Please send
Via Electronic Mail
to: ✓ Dec. 2, '87

M E M O R A N D U M

DATE: December 1, 1987

TO: Peggy Brookshier, DOE/ID
Marshall Reed, DOE/DGT

FROM: Howard P. Ross

RE: SCP PRDA: Proposals - Not Ranked In Final Evaluation

Proposal No. 2 Arizona Solar Energy Commission

The Arizona Solar Energy Commission has proposed a project which would create a comprehensive computer database of geologic, geophysical, hydrologic and geochemical data which would be used to produce a geothermal data disk. This disk would be available for copying by the general public. The database would cover the Mojave, Sonoran Desert and Mexican Highland sections of the Basin and Range Province in Arizona. The project is judged to have no significant usefulness to geothermal exploration, development or utilization. The proposed work offers little technical quality for an area of low resource potential. The emphasis of the proposal is on data base preparation and manipulation rather than geothermal energy. The proposed "cell" size of 625 square miles is much too large to be useful in delineating geothermal resources. Although the key personnel have substantial familiarity with the computational aspects of the study, these personnel and the proposing organization have no significant experience in the field of geothermal energy. This proposal should not be funded.

Proposal No. 5 State University of New York at Buffalo

The State University of New York at Buffalo has proposed a resource assessment of the geothermal potential of the Theresa Formation in south central New York State. The study would include the analysis of bottom hole temperature data, geologic data from wells, the acquisition and interpretation of reflection seismic data and related studies associated with siting a well near Hornell, NY. Although the quality of the study could be good the resource potential is judged to be low and the net usefulness of the study is also considered low. The evaluation of BHT data and thermal conductivity to determine regional heat flow would be worthwhile but the reflection seismic study is premature without a preliminary evaluation of what reservoir temperatures, well depths and flow rates would be economic in

light of drilling and production costs. The principal beneficiary of the study might be a single Hornell company. The key personnel and proposing organization are competent to complete and support the study. The Technical Review Committee would support a study of Tasks 1, 2, 4 and a preliminary economic evaluation, consistent with a ranking of proposal scores and the available funding.

Proposal No. 9 New Mexico Research and Development Institute
Tularosa Basin

New Mexico Research and Development Institute (NMRDI) has proposed a geothermal resource assessment in the Tularosa Basin using thermal data mapping, soil mercury studies, detailed gravity and magnetic studies, and drilling for heat flow determinations. More than two-thirds of the Basin is under military control and the White Sands Missile Range is envisioned to be the potential user for any resources which may be identified and later developed. Moderate temperature brines have been intersected at depth in oil and gas well tests but extrapolations to higher temperatures and the presence of a significant geothermal resource are speculative. The usefulness of the proposed study and the significance of the resource are judged to be low. There is no indication that the state designated geothermal agency for Texas supports this study for the Hueco Tanks area. Some parameters of the proposed surveys may not be appropriate. The key personnel proposed for the study would be competent to complete the study, but funding is not recommended.

Proposal No. 10 Colorado Geological Survey

The Colorado Geological Survey (CGS) and the Department of Geophysics, Colorado School of Mines (CSM) jointly propose a geothermal resource assessment study of the San Luis Valley of south-central Colorado. These organizations propose a compilation and evaluation of existing geoscience data followed by new geological, geochemical, geophysical and hydrologic studies. The technical quality of the proposed study would be good but a substantial database already exists. The resource temperatures would be low thereby limiting the range of uses and downgrading the significance of the resource and usefulness of the proposed work. The remote sensing study, gravity and magnetic surveys and deep electrical resistivity investigations may contribute relatively little to the geothermal resource evaluation. The proposed cost share is the minimum amount and would be difficult to verify. Funding for a substantially revised program may be appropriate if adequate funds are available.

Proposal No. 15 Oregon Department of Energy

The Oregon Department of Energy proposed resource development research at McKenzie Bridge, Oregon in the Belknap-Foley KGRA. The study would include drilling of a test well, hydrologic testing and evaluation of temperature and fluid chemistry data. The proposed drill site is approximately one mile northwest of Belknap Springs (and possibly across controlling structures) and perhaps three miles from Foley Springs. The highest estimated reservoir temperatures for these springs are near the lower limit for binary power generation and the Eugene-Springfield metropolitan area, 80 km away, is probably too far away to permit economic direct utilization of these fluids. The proposed drill hole is sited on private land without significant geologic or geophysical encouragement. The program for well design, drilling, monitoring, and testing are left to the landowner and driller, and are considered weak. The Technical Review Committee considers the usefulness, technical quality, significance of the resource and key personnel all to be weak. In view of these considerations DOE funding is not recommended.

Proposal No. 16 Louisiana State University Department of
Petroleum Engineering

The Louisiana State University, Department of Petroleum Engineering, proposed a study of two phase flow (gas and water) in the wellbore. This proposal addresses geopressured-geothermal wells rather than hydrothermal resources and as such is considered non-responsive to the current PRDA. Evaluated in terms of criteria for hydrothermal resource proposals this proposal has little or no usefulness and resource significance, and would be of low technical quality. The key personnel and proposing organization are recognized to be competent in the study area proposed. Funding under the current PRDA is not recommended.

Proposal No. 18 California State Lands Commission

The California State Lands Commission has submitted a proposal titled "Studies of Fracture/Fault Characteristics and the Natural Thermodynamic State of the Geysers Geothermal Field". The proposed study would be of high technical quality in the country's most important geothermal resource. The study may not include more recent drilling, production, and test results, and much of the data would be proprietary and subject to restrictions. Even with these qualifications the study would be of considerable value. All of the DOE funding requested would be transferred to the Earth Sciences Division, Lawrence Berkeley

Laboratory through an intra-State agency agreement and LBL would complete the software development, model studies, and database management for the study. The California State Lands Commission would provide a cost-share in staff time. The technical Review Committee interprets the arrangement as a 100% pass through to a National Laboratory rather than a resource assessment or research activity which is cost shared with a state agency or state approved team. Therefore the proposal is considered non-responsive to the PRDA. The cost share is judged to be unrealistic and weak. The technical study does not meet the intent and criteria of this PRDA, and should be funded by other means.

Proposals No. 19 California Energy Commission - Brockway
Hot Springs

This proposal by the California Energy Commission requests funding for a resource assessment study of the Brockway Hot Springs area on the north shore of Lake Tahoe. The proposed study would include a geologic field reconnaissance, geophysical surveys, well and spring evaluation and temperature-gradient well drilling. There is considerable doubt that the geophysical (SP and VLF) surveys proposed will contribute significantly to a three-dimensional picture of the structure surrounding the Brockway Hot Springs because of grounded structures associated with local development. The resource appears to be relatively low temperature and direct use development would probably benefit relatively few individuals in this area of exclusive resort development. The key personnel and proposing organization are competent to complete the work but the significance of the resource, the technical quality, and the net usefulness of the proposed study are ranked low. Funding of the proposal is not recommended.

Proposal No. 20 Arkansas Mining and Mineral Resources Research
Institute (AMMRRRI)

The Arkansas MMRRI has submitted a proposal titled "Geochemical Exploration for Undiscovered Resources, Ouachita Mountains, Arkansas". The potential for thermal fluids in deep synclinal aquifers of the Ouachita Mountains would be evaluated through geochemical analyses of cold water springs and wells, and any warm waters should they be discovered. The poultry industry is suggested as a potential user of low temperature geothermal fluids. The occurrence of two warm spring systems 55 km apart is not a significant indicator of a vast (undiscovered) low temperature resource, and without some additional encouragement such a warm well waters, the resource potential and project

usefulness are judged to be low. The preliminary study of fluid samples from the Hot Springs area would duplicate earlier work and some aspects of a current solicitation by the National Park Service. The key personnel do not appear to have any experience in geothermal studies. Funding of this proposal is not recommended.

Proposal No. 21 American Samoa Government, Territorial Energy Office

The American Samoa Government submitted a response to the PRDA which included a brief proposal dated December 1986 by KRTA, Limited to Dr. John W. Shupe, Pacific Site Office, U. S. DOE; and portions of a March 1980 report titled "Geothermal Energy for American Samoa". The materials submitted did not conform to the format and information requirements of the PRDA and did not address cost share, project management, key personnel and a financial plan. The 'proposal' is considered non-responsive to the PRDA. An evaluation of the materials submitted indicates the existence of a geothermal resource is only weakly supported and the significance of the resource and usefulness of the work are judged to be low. The work proposed in the KRTA proposal is incompletely described and not supported by discussion or exploration rationale. Funding is not recommended for this submittal.

Proposal No. 22 Oregon Department of Geology and Mineral Industries

The Oregon Department of Geology and Mineral Industries (DOGAMI) submitted a proposal titled "Investigation of the Thermal Regime of the Volcanic Axis of the High Cascades, Oregon". The proposed work includes a minor effort in site selection, core drilling to about 650 m and temperature and geophysical logging. The High Cascades is recognized as an area of high geothermal potential but is a difficult and costly exploration province. There is a substantial risk that the hole would be subject to shallow hydrologic disturbance or intrahole water flows, and that a satisfactory determination of the "conductive" geothermal gradient may not be achieved. If this were the case the primary objective of this costly project would not be achieved. The principal investigator and DOGAMI itself are competent to manage the project but would have to hire a senior geologist and drill site geologist and subcontract for geophysical studies and drilling in order to compete this project. The Technical Review Committee recommends funding for Task 1, the site selection study, but not for the 650m on drill hole.

SCP PRDA: Proposals - Not Ranked in Final Evaluation
Page 6

Note: This proposal was withdrawn from consideration prior to final ranking of all competitive range proposals.

M E M O R A N D U M

DATE: December 17, 1987

TO: Peggy Brookshier, DOE/ID
Marshall Reed, DOE/DGT

FROM: Howard P. Ross

RE: SCP PRDA Proposals (Brief Narrative Summaries)

Proposal No. 3 University of Wyoming

The University of Wyoming has proposed to develop and test improved three-dimensional computational schemes for solving the combined heat conduction and forced convection equations for the purpose of determining subsurface temperatures. Temperature data from existing wells will then be used to determine geothermal ground water parameters and a model will be developed for either the Cody or Thermopolis hydrothermal system in the Bighorn Basin, Wyoming. The work proposed is original and will extend the state-of-the-art in numerical modeling of these types of resources. The computational schemes will have general applicability to a substantial resource base throughout the Rocky Mountains and may be applicable to the evaluation of a large number of other mixed convective - conductive geothermal resources. New observational data will be obtained for one hydrothermal system. The work is very useful and has a high probability of success. A highly qualified research team has been assembled at the University of Wyoming, and the members of this team have previously completed high quality resource assessment projects for the Department of Energy. This significant work will be completed in a 12 month period at a relatively modest cost to DOE and a favorable cost share. This proposal received the highest technical ranking and the highest total ranking.

Proposal No. 14 North Dakota Mining and Mineral Resources
Research Institute

The North Dakota MMRI brings together the North Dakota and South Dakota Geological surveys and excellent UND staff to propose a comprehensive assessment of the significant but

relatively untapped resources in these two states. New drilling and heat flow measurements will supplement the existing drill holes and data base. The data will be quantitatively interpreted in terms of distinct stratigraphic and hydrologic units and promising geothermal aquifers will be identified. A specific task calls for dissemination of the results of the study at meetings with state research and development agencies to encourage commercial development. The accessible resource base is large enough to have a significant impact on the economies of these two states. The Principal Investigator has made major contributions to geothermal resource assessment and leads an excellent team in this two-state cooperate resource assessment. The study is regarded as highly useful, very practical and of excellent quality with a high probability of success. The study will extend and refine recent results which demonstrated a large increase in the accessible resource base of South Dakota. A favorable cost share is proposed. This proposal placed second in both technical and total rankings.

Proposal No. 7 (Phases I and II) Hawaii Department of Business and Economic Development

The State of Hawaii study seeks to investigate methods of controlling silica deposition from geothermal fluids of the Hawaii East Rift Zone. The study addresses a major problem inherent to this high temperature resource area and has a good probability of success in solving the silica deposition problem and possibly producing high quality silica as an economic byproduct. The proposed work is judged to be highly useful. The technical approach is described in considerable detail and has a good probability of achieving positive results. The East Rift Zone is known to be one of the highest temperature geothermal resources in the world and three very productive wells have been drilled. A Phase II investigation which evaluates the effects of reinjection on an injection well is not essential to the silica study, may duplicate the work of industry and if funded would decrease the cost effectiveness of the overall study. The research team is well qualified to complete the silica deposition study. The cost share proposed is the highest offered and is highly beneficial to the DOE.

Proposal No. 7 (Phase I and II plus East Rift Optimization Study) Hawaii Department of Business and Economic Development

The¹⁵ State of Hawaii proposal has three major tasks: 1) A study to investigate methods of controlling silica deposition from geothermal fluids of the Hawaii East Rift Zone; 2) an evaluation of the effect of injecting spent geothermal fluids on the reinjection well; and 3) financial support for a study to determine optimum vacuum pressure for geothermal power plants in the Hawaiian East Rift. The silica deposition study addresses a major problem, and the possibility of recovering high quality silica as a byproduct. The fluid reinjection study and vacuum

pressure optimization study may duplicate the work of industry, are less likely to reach specific conclusions, and greatly increase the total cost to DOE and reduce the overall cost effectiveness and usefulness of the proposal. An expert research team is proposed to conduct all aspects of the proposed work.

Proposal No. 11 Washington State Energy Office

The Washington State Energy Office has proposed the development and field testing of the geothermal optimization computer program GEODIM. GEODIM is a partially completed program designed by the University of Lund, Sweden which supports the design and optimization of wells, pipes, pumps and heat transfer systems. Completion and documentation of the program and its field testing at geothermal operating systems in Yakima and Walla (WA), Boise (ID) and Klamath Falls (OR) are considered highly relevant projects which could result in higher efficiency and improved resource utilization for many direct heating systems. The proposed work will produce a high quality, readily usable computer program. It is quite likely that the use of GEODIM can increase the efficiency of several operating systems by 1-10% thereby delivering more usable energy without added depletion of the resource. The proposing organization has an outstanding record of performance on DOE geothermal projects and has assembled a talented group of professionals to complete this project at only modest cost to DOE. The Washington State Energy Office proposes a high cost share that is advantageous to the DOE.

Proposal No. 12 Desert Research Institute, University of Nevada

The Desert Research Institute (DRI), UN has proposed detailed hydrologic monitoring followed by a quantitative evaluation and numerical simulation of the Moana Geothermal System. Uncoordinated development of this moderate-temperature resource is rapidly expanding and the long term productivity of the Moana system may be threatened. The proposed work includes the appropriate data gathering and interpretation which will provide baseline data and understanding, and a quantitative model of the Moana system. Thus three state regulatory agencies and several developers will have the information and guidance necessary for the effective long term utilization of the resource. This is a useful project which should help extend the lifetime of the resource. The proposer offers a high quality study which addresses an important problem for a heavily used resource. A highly qualified team is available at DRI to participate in this study. A minimal cost share is proposed.

Proposal No. 17 Utah Geological and Mineral Survey

The Utah Geological and Mineral Survey (UGMS) has proposed an integrated, multi-method study of the Newcastle geothermal system which could have broad applicability to the discovery and evaluation of other blind Basin and Range geothermal systems.

Thus the project is ranked highly useful. The study includes an appropriate mix of Quaternary and bedrock geologic mapping, gravity and magnetic studies, soil-mercury investigations, fluid geochemistry and thermal gradient drilling. These are appropriate methods for a detailed study of this resource and other blind resources, and indicate a high quality study which is likely to yield positive results. The UGMS proposes a modest total cost to DOE, and a high state cost share. In addition, a substantial amount of geophysical work will be completed by students of the University of Utah at little or no cost to the project. The proposed study would be completed by a qualified team and would contribute to the exploration methodology for Basin and Range blind hydrothermal systems.

Proposal No. 1 Washington-Department of Natural Resources

The Washington-Department of Natural Resources (WDNR) seeks to refine time-space-volume relationships for Cascade volcanism and to relate improved models to the geothermal potential of the Cascades Range. These topics are addressed through an integrated effort of thermal gradient drilling, new geologic mapping, new K/Ar-age dating, thermal gradient studies and geochemistry. The proposal is considered to have a high degree of usefulness and good probability of success in a large area of moderate-to-high resource potential. The methodology is sound and appropriate and will be performed by competent, experienced personnel. WDNR has an established track record in the conduct, interpretation and reporting of geothermal studies. The financial plan is realistic and shows a detailed cost breakdown. The proposed state cost share at 23% is high and is advantageous to the DOE.

Proposal No. 4 University of Alaska Geophysical Institute and Alaska-Division of Geological and Geophysical Surveys

The University of Alaska Geophysical Institute and Alaska-Division of Geological and Geophysical Surveys jointly propose a geological and geochemical study of Geyser Bight, the hottest (180-264°C) and most extensive area of thermal springs in Alaska. Although this is a major geothermal resource, Geyser Bight is located on a remote uninhabited Aleutian island and the net usefulness of the study, and resource potential, have been correspondingly downgraded. Geological and geochemical data on the resource may contribute to our knowledge of volcanic island arc systems in general. A related task will result in the preparation and publication of a four-color, geotechnically-oriented geothermal resource map of the Aleutian Islands and the Alaska Peninsula region and an accompanying descriptive circular. These products will document in new detail the present state of knowledge of geothermal resources for the area, and be a starting point for exploration, resource assessment and development efforts in the future. The work would be completed by competent, experienced geoscientists of these institutions. The total cost to DOE of Task 1 (Geyser Bight) appears excessive and should be reduced. Several items in the University of Alaska-Division of

Geological and Geophysical Surveys budget such as staff salary, travel, and steno and graphics services are too high, as is the 40% indirect charge. These items somewhat offset the zero overhead charge of DGGs and the apparent high cost share by the proposer.

Proposal No. 13 Idaho-Department of Water Resources

The Idaho Department of Water Resources (ID-DWR) has proposed continued monitoring of the Banbury-Twin Falls resource and extended resource assessment activities; a geochemical study of Wood River geothermal systems; and continued monitoring and evaluation of the Boise geothermal system. The proposed work appears very useful as it addresses development problems in two substantial resource areas and appropriate resource assessment studies. It is especially important to continue detailed monitoring of the Boise resource and to evaluate the need for a reservoir test and quantitative model, but this work must be completed at the state-of-the-art and totally free from conflicts of interest. The methodologies proposed for Tasks 1 and 3 are appropriate and should result in quality studies with a good possibility of achieving positive results. The cost of consultant services for Task 2 is very excessive and should be greatly reduced. The staff proposed for these studies is competent to complete the work but is poorly supported by the DWR. The ID-DWR cost share is judged to be minimal and artificial.

Proposal No. 6 University of Nevada, Las Vegas - Division of Earth Sciences

← The proposed University of Nevada, Las Vegas - Division of Earth Sciences study would integrate fluid geochemistry, stable light isotope data, glacial ice data and archaeological information to study the genesis of geothermal fluids in the Great Basin. Nevada has numerous high and moderate temperature resources, several of which are under development, and the new data and interpretation would be useful in better understanding these important resources. The most useful part of the study would be the detailed sampling, chemical analyses and study of geothermal fluids from the hot springs and geothermal developments. Other aspects of the project such as archaeological studies, isotopic analyses and paleoclimatic studies are interesting but more likely to be inaccurate or subject to multiple interpretations. Thus the probability of achieving positive results and the net usefulness of the project are downgraded. Task 1 addresses the gathering of existing data and Task 2 would format these data. Although essential to the project proposed, these are not innovative Tasks and no new data are generated. The University of Nevada, Las Vegas - Division of Earth Sciences personnel are competent and experienced geoscientists who can complete the proposed study with good technical quality. Several items in the

← revised project financial plan are not consistent with the schedule and revisions from the original proposal, especially computer time and vehicle mileage. The computer costs, vehicle mileage, and mileage rate at \$0.30/mi. are high. The proposer cost share is one of the three lowest proposed. This work should be funded in accordance with proposal rankings and the availability of funds.

Proposal No. 8 (Options 1, 2, and 3) New Mexico Research and Development Institute

The New Mexico Research and Development Institute (NMRDI) has proposed three options for a study titled "Evaluation of Time-Integrated Radon Soil-Gas Surveys in the Southern Rio Grande Rift". The three options differ in the survey areas, total area to be surveyed, the total number of radon field measurements to be completed, and the corresponding total cost to DOE. Any option would result in an interesting evaluation of the radon gas technique as a geothermal exploration method in the soils and caliche covered areas of the Southern Rio Grande Rift. The proposals show a good understanding of the radon gas method and an appropriate selection of field test areas for the completion of the study. The study would be completed by competent geoscientists and managed by NMRDI, which has an established record of reporting and project management with DOE geothermal projects.

Option 1 includes an evaluation of soil-depth profiles and caliche effects, and surveys in the Tortugas Mountain, Radium Springs and Pichacho areas, plus interpretation and reporting at the lowest net cost to DOE. This proposal would provide an adequate test of the method and its applicability to the southern Rio Grand Rift.

Option 2 would include an evaluation of soil-depth profiles and caliche effects and surveys in the Tortugas Mountain, Radium Springs and Rincon areas, plus interpretation and reporting at a modest increase (\$4,000) in cost to DOE above the Option 1 proposal. The perceived higher resource potential and commercialization possibilities of the Rincon area, as compared to the Picacho area, would readily justify the small added cost to DOE as compared to Option 1. Option 2 is therefore the most highly regarded option for funding by DOE on cost-effectiveness considerations.

Option 3 includes an evaluation of soil-depth profiles and caliche effects, somewhat reduced survey efforts in both the Rincon and Picacho survey areas, and surveys at Tortugas Mountains and Radium Springs, plus interpretation and reporting. Although this option permits a more complete evaluation of the technique the total cost to DOE is substantially higher and the net cost-effectiveness is judged to be reduced as compared to Options 1 and 2.

The Panel determined the proposed studies to be useful projects offering only minor innovations to geothermal resource assessment. The usefulness of the radon surveys in this environment has not been established and positive results for the delineation of low-to-moderate temperature resources are not guaranteed. This is basically an extended field test for a single exploration method. The significance of the resource base is low as compared to most of the proposed project areas. The proposed cost share is reasonable. DOE funding for NMRDI Option 2 is recommended consistent with final evaluation scores and the availability of funds.

Proposal No. 23 Option A (Geochemical Study) California Energy Commission

California Energy Commission (CEC) in conjunction with the Pacific Gas and Electric Company (PG&E) have proposed a two-fold research project which includes a limited resource assessment of an area near Wilbur Hot Springs and a technical study to determine optimum power cycles for well head binary cycle generation systems as related to resources in northern California. The geologic reconnaissance and geochemical surveys may add to the knowledge of the Wilbur Hot Springs resource, but are directed toward an area of unknown resource potential 1.5 Km away. It is unclear that the present owners of Wilbur Hot Springs will cooperate with the proposed studies. No interpretation is presented for the gravity low that seems to be important for the area of proposed geochemical studies, and no information is presented as to the grid for radon surveys. The geology of the proposed survey area is not described in any significant detail. The geothermal power cycle study and technology characterization for Northern California resource areas would provide some useful information but is not considered a high priority study. The proposal does not indicate specific experience with the radon exploration method or nearby wells which may be available to the study. The usefulness of the proposed study is judged to be low and the quality of the proposed work, as judged by the proposal would be marginal. The significance of the resource is ranked low-to-moderate.

Proposal No. 23 Option B (Drilling Program) California Energy Commission

California Energy Commission (CEC) in conjunction with the Pacific Gas and Electric Company (PG&E) have proposed a two-fold research project which includes a limited resource assessment of an area near Wilbur Hot Springs and a technical study to determine optimum power cycles for wellhead binary cycle generation systems as related to this area and other resources in northern California. The resource assessment would include drilling of a small-diameter exploratory well for temperature, water chemistry and flow test observations. Although provision is made for geologic reconnaissance to aid in drill hole siting,

the main criteria seems to be availability of land controlled by a major financial institution. Few geologic data are presented to support a drill site selection and the \$100,000 drilling budget is not itemized or supported in detailed breakdowns. The power cycle study and technology characterization for Northern California resource areas would provide some useful information but are not considered a high priority study. The total project usefulness, in terms of cost to DOE, is considered low and the resource potential is moderate at best. The proposal is not recommended for funding by DOE.