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REMARKS

Marcello, Mike,  
 Copy of CASCADES BACKGROUND LETTERS FROM RON, RO. MARCH 21-22 MEETING OF CASCADES LEASEHOLDERS WITH CLAY NICHOLS IN PORTLAND. TSVI HAS RAISED THIS WITH ME AT LOCAL GRC MEETING.

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FROM: (Name, org. symbol, Agency/Post)

Room No.—Bldg.

SAN/MOLLOY

Phone No.

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LAW OFFICES OF  
C. GIRARD DAVIDSON  
PARK WASHINGTON BUILDING  
519 SOUTHWEST PARK  
PORTLAND, OREGON 97205

(503) 223-3800

HARTY/MULLY  
Ltr From Ron Toms 12/09/83  
cc: MARCELLO/LL  
Norm  
MIKE/JURI

December 8, 1983

Mr. Ron S. H. Thoms, Assoc. Director  
Division of Geothermal Energy  
Resources Application Division  
Room 7104 Federal Building  
1200 Pennsylvania Avenue  
Washington, D.C. 20461

Dear Ron:

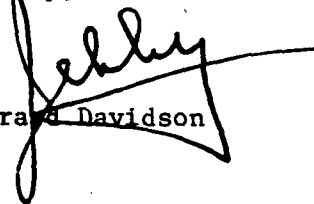
I have been working on the proposed exploration program for the Cascades in Washington and Oregon that we discussed at some length during the Geothermal Resources Council meeting here in Portland.

While at a meeting of the Pacific Northwest Section of the Council in Seattle on Tuesday, I made it a point to discuss the proposed program with representatives of Seattle City Light, and they were extremely interested and gave me the impression that they would be happy to participate in such a program with DOE paying half the cost of such a well. As you know, Tsvi Meidav of Trans-Pacific Geothermal has said that he would participate, and I have discussed it briefly by phone with Ollie Loose of Chevron who asked me to write him a letter on the subject that he could kick upstairs. A copy is enclosed for your information. John Hook and I are going to talk to Reynolds Metals, California Energy and others. Tsvi agreed to talk to Union. I will, of course, keep you advised of developments, but if you have any suggestions, please let me know.

T. L. Sadlier Brown, who represents City Light and also British Columbia Hydro, was at the meeting Tuesday in Seattle. He is recommending that Seattle City Light participate in such a program. It was obvious in the discussion with him that British Columbia Hydro would jump at a chance to get half of a deep well paid for in the Meager Creek area. As you know, this is the one place, other than Newberry Crater, in the Cascades that has produced steam. I told him that I would mention this to you, but I felt sure DOE would not wish to participate in financing any exploration outside of the United States. (Maybe you have some deal with the State Department that I don't know anything about, but I thought I would mention this for what it is worth.)

Sincerely,

C. Girard Davidson



RECEIVED  
RONALD S. H. TOMS

DEC 13 1983

FBI

Enclosure

cc: John Hook  
Tsvi Meidav

LAW OFFICES OF  
C. GIRARD DAVIDSON  
PARK WASHINGTON BUILDING  
510 SOUTHWEST PARK  
PORTLAND, OREGON 97205

(503) 223-3800

December 8, 1983

Mr. Ollie Loose  
District Land Supervisor  
Chevron Resources Co.  
P. O. Box 7147  
San Francisco, CA 94120-7147

Dear Ollie:

This is in further reference to our telephone conversation relating to a proposed geothermal exploration program of the Washington and Oregon Cascades.

While at the Geothermal Resources Council recent meeting in Portland, Ron Thoms of the U. S. Department of Energy, talked to Tsvi Meidav of Trans-Pacific Geothermal, Inc. and me about his desire to see a geothermal exploration program in the Oregon and Washington Cascades. He says that DOE has money for this purpose and felt that his Agency would probably be able to match contributions by private industry if a proper program could be developed. One of the problems that he raised was the difficulty of the government providing funds which would tend to prove the existence of geothermal resources on a particular company's holding. He understands, however, that as a practical matter, non-competitive geothermal lease applications have been filed on practically all of the prime areas of the Cascades where geologists feel the most likely geothermal potential exists, and nothing can be done about this. Obviously, if these areas on which filings exist are the best prospects, they would be the best areas in which to conduct an exploration program.

In the discussion that ensued, it developed that if we can get 6 to 10 different companies or individuals whose geothermal lease applications cover the Washington and Oregon Cascades and who are willing to pay half of the cost of a well on one of its leases, this problem could possibly be solved. Thus the government would not be financing just one entity but several, with the result being a broad exploration program of the Cascades under government sponsorship. For example, a program such as the following may be possible and meet the problem since geothermal exploration wells would be drilled in the Cascades from Northern Washington to Southern Oregon. The following is purely an example of what I have dreamed up, and I have not discussed it with the companies I have taken the liberty to name, with the exception of those mentioned later. I envisage something as follows:

- 1) Seattle City Light might be interested in putting up one-half of the cost of a 2,000 or 3,000 foot well on some of its lease applications or leases on Mt. Baker in Washington.

Mr. Ollie Loose  
Dec. 8, 1983  
Page 2

2) Reynolds Metals might be interested in placing a well on lease applications or leases in the Trout Creek area south of Mt. St. Helens in Washington which Sea-Tac Geothermal controls.

3) Any one of several companies with whom we have talked might be willing to pay one-half the cost of such a well in the Red Hill-McGee Creek-Clear Branch area on the north side of Mt. Hood.

4) Chevron might be interested in paying one-half of the cost of a well on one of its leases in the Clackamas area of Mt. Hood National Forest.

5) Trans-Pacific Geothermal might be interested in such a program in the Blue Lake area of Oregon. (Since Chevron and Trans-Pacific have leases or lease applications in both this area and the Clackamas area, you two might decide which area each of you would like to tackle, or possibly do a joint venture for two wells.)

6) California Energy might be interested in such a program on its lease applications in the vicinity of Crater Lake.

7) Union Oil has a number of land positions throughout the Cascades and might well be interested in paying half the cost to see the results or information derived from a well put down on one of its areas.

There are other companies that have holdings in the Cascades which may wish to participate in such a program. But if a sufficient number will participate, it would accomplish Ron Thoms' objective of getting six or more exploratory wells drilled in the Cascades from Northern Washington to Southern Oregon. Since some of the companies may already have their budgets fixed for 1984, I feel we should consider this as a two-year program for 1984 and 1985. But, of course, it will be preferable if we can get some of the wells drilled during the 1984 season.

We are thinking in terms of each well being approximately 3,000 feet, and it is my understanding the cost would be about \$250,000 per well. Thus if Chevron and any of the other companies are interested in drilling such a well on one of its leases, it would agree to commit up to \$125,000 for this purpose, to be matched by DOE for a similar amount. Obviously there are a great many details which would have to be worked out, but at this point I am trying to ascertain which companies may be interested in pursuing such a program.

As I told you over the phone, Tsvi Meidav of Trans-Pacific Geothermal says that his company is interested in having a well drilled in one of his areas of interest, and will participate in the program. Tuesday at the meeting of the Pacific Northwest Section of the Geothermal Council in Seattle, I discussed this program with representatives of Seattle City Light. Recognizing that certain problems have to be worked out, they felt that City Light would like to participate in the program and have a well drilled on its Mt. Baker applications or leases with City Light paying only one-half of the cost.

Mr. Ollie Loose

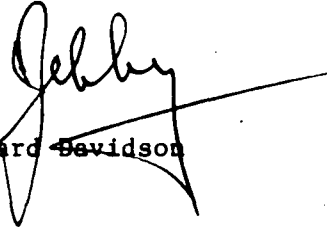
Dec. 8, 1983

Page 3

Obviously I am not suggesting a commitment at this time. I am merely trying to ascertain whether such a program is interesting to you and you wish to explore it further. Please let me have Chevron's reaction.

Should you wish to discuss it further, please give me a ring.

Sincerely,

A handwritten signature in cursive script, appearing to read "Girard Davidson", written over a horizontal line.

C. Girard Davidson

cc: John W. Hook

VURI/WRIGOTT



**Department of Energy**  
San Francisco Operations Office  
1333 Broadway  
Oakland, California 94612

June 12, 1984

Ms. Susan M. Prestwich  
Dr. Clayton R. Nichols  
Energy Technology and Conservation  
US Department of Energy  
550 2nd Street  
Idaho Falls, ID 83401

**Subject: Cascades Solicitation Strategy and Criteria**

Dear Susan and Clay,

In response to your letter of May 24, I am indeed interested in participating in ID's Technical Advisory Committee for cooperative thermal gradient drilling in the Cascades region.

My comments and suggestions are concerned with the overall strategy for DOE's geothermal activities in the Cascades in relation to this specific solicitation. In this respect, I have benefitted from USGS/Pat Muffler's, Union/Dick Dondanville's, and LBL/Norm Goldstein's ideas.

Cascades Geothermal Enigma

Despite the horrendous explosion of Mt. St. Helens on May 18, 1981, and the ample evidence of recent volcanic activity, the Cascades remain a geothermal enigma. There may be extremely large geothermal energy resources beneath the Cascades Range. Such a large energy source will have major economic implications for the Pacific Northwest states and Northern California.

Where are the volcanic hot spots? Are geothermal reservoirs associated with them? Is it possible to locate geothermal drillsites, and to demonstrate practical means of producing useful energy from such reservoirs? Is it possible to get the heat out safely, and with environmentally acceptable processes? And, most importantly, can potential geothermal reservoirs be brought to the point of commercial application, for the generation of electricity and direct heat uses? At this point in time, we apparently don't know the answers to these practical questions.

Background and Rationale

Extended research has been conducted by US Geological Survey (USGS), Oregon's Division of Mines and Mineral Industries (DOGAMI), and others. Yet, we have only a limited understanding of the chain of giant stratovolcanoes which stretch from Lassen Peak and Mt. Shasta in Northern California, through Oregon's 9 major volcanoes, past Washington's 5 major

peaks including Mt. St. Helens, and north into Canada. Despite some continuing exploration efforts, several major geothermal development companies, like Sun and Phillips, have apparently given up.

Therefore, it appears that Federal financial assistance is necessary to encourage the extensive exploration, research and development required to define the commercial geothermal potential of the Cascades. Cooperation of the private and public sectors is needed to solve the scientific and technological problems involved.

For such a multi-institutional effort to successfully reach its goal, DOE needs a comprehensive strategy for Cascades Geothermal R&D.

The DOE strategy must be linked with efforts of the USGS, which has the legislative authority to "conduct regional surveys....which will lead to a national inventory of geothermal resources..." (Public Law 93-410). It must effectively cooperate with major public experts in the region, like DOGAMI; California's Division of Mines and Geology, and Division of Oil and Gas; and Washington State's Department of Natural Resources. Private industry must be the driving force in commercial development and steam sales. Public utilities are potential purchasers of geothermal steam; and the Bonneville Power Administration has the Federal mandate for power marketing in the Pacific Northwest, including Idaho and Montana. The US Forest Service, the US Bureau of Land Management, and State forest services are responsible for leasing and permitting of geothermal activities in the extensive forests that cover the Cascades. Environmental agencies and groups, ranging from EPA to the Sierra Club, are properly concerned, since the Cascades are a major scenic and wildlife area of the nation.

With such institutional complexity, no wonder earlier efforts have foundered!

#### Proposed DOE Cascades Geothermal Strategy

The proposed DOE strategy is aimed at characterizing the geothermal energy potential of the Cascades. This means: location and exploration of specific geothermal reservoirs, if they exist; definition of reservoir energy capacity and longevity; and, technology development for the purpose of resolving all major problems inhibiting the fullest possible commercial utilization of Cascades geothermal resources, in a safe and environmentally acceptable manner.

The proposed steps in the DOE Cascades Geothermal Strategy are those in the classical sequence of locating and evaluating a subsurface natural resource:

1. Regional geological, geophysical, geochemical and hydrological surveys, resulting in an integrated conceptual geologic model of the High Cascades and nearby geothermal areas, such as Newberry Caldera, OR.
2. Identification of potential geothermal prospects, and preparation of definitive three-dimensional models for the targeting of intermediate

depth (1,000-3,000') drillholes at each prospect.

3. Identification of gaps in knowledge which prevent the completion of the drill targeting, step 2. above, and the acquisition of essential geophysical surveys, geochemical sampling, shallow heat flow and temperature test holes, etc., for the targeting of deep slim holes (3,000-6,000') at high priority prospects.
4. Updating and revision of established conceptual geologic models and prospect priorities as a result of information from shallow, intermediate depth, and deep slim holes.
5. Targeting of a few deep (~10,000') drillholes at high priority site(s) of potential high temperature geothermal reservoir(s).

#### USGS/Muffler Cascades Drilling Strategy

USGS/Pat Muffler informally summarized the objectives of a Cascades drilling program as:

- a significant number of stratigraphic test wells;
- which yield an evaluation of the Cascades geothermal resource, despite the hydrologic problems, (the 'rain curtain' which has masked subsurface temperatures on prior 2,000' holes); and,
- which result in significant drillhole data in the public domain.

Pat's strategy is a subset of, and consistent with, steps 1, 2, 3, and 4, above. He emphasizes obtaining geologic (stratigraphic) and other data, despite the serious 'rain curtain' problem which may wipe out meaningful temperature results.

USGS/Bob Mariner's geothermometry apparently indicates that the hot springs, out on the flanks of the Cascades, may have a "cold" source. The hot springs may only indicate low-temperature leakage, along valley faults far from the heat source. Much of the leasing activity appears to be around these hot springs, in the lowlands between the peaks. If so, drilling the hot spring leases may be a waste of time and money.

#### Union Geothermal's Cascades Drilling Strategy

Union/Dick Dondanville does not support a number of intermediate depth temperature holes, but rather proposes a single deep well. This sounds like step 5, above, and apparently presumes Union's existing knowledge from regional geophysical surveys, geochemical sampling, and temperature holes, (in other words, steps 1 - 4). In speaking with Dick on March 29th, he said that he doesn't know the magic depth required to get below the 'rain curtain', but 1,000' is not enough. He questions the drilling of a number of temperature holes, and wonders how much slim hole you'll get for \$300K, (in view of the many drilling problems).

Dick called the Cascades "a real enigma"; we have yet to determine whether there is a significant high heat flow anomaly in the region. He feels that



eventually, some group will have to drill a 3 km. hole to find out if the Cascades have a high heat flow, or not. Dick makes two arguments. First, a deep hole drilled almost anywhere in the Imperial Valley would detect anomalously high heat flow. If the Cascades contain Geysers-sized geothermal reservoir(s), a deep hole should (get below the 'rain curtain' and) detect anomalously high regional heat flow. Second, he suspects that "all that water pouring out and washing the heat flow away" is just an excuse. Dick observes that it rains as much or more in Java and Sumatra, but flying over those areas you can see the outline of the geothermal systems in the arc of hot springs of the volcanic system.

If Dick could convince Union's management, he'd drill a deep hole. A representative location could be picked by a group of august scientists from a scientific and tectonic point of view; they should not look at a lease map. The purpose is exactly that of DOE's Continental Scientific Drilling Program (for which he is an advisor): to define the roots of the Cascades and the thermal boundary of the plates. In other words, deep volcanic structure and stratigraphy of the High Cascades. If the deep hole finds high temperatures, (in addition to measuring regional heat flow), that would be a bonus.

Dick suspects that the active Cascades volcanoes may have a narrow conduit, without a shallow magma chamber. He feels that a 4,000' hole is not going to discover a geothermal reservoir, but is a step in the right direction. He suggests core drilling to get rid of the lost circulation problems, (the powder packs away in the fractures). Dick isn't particularly receptive to joining a 3,000-4,000' drillhole effort. Union wouldn't get enough out of the effort to be worthwhile; they might as well use the money themselves to drill, and keep the results proprietary.

#### Conclusions with Respect to ID Solicitation

Union's Cascades strategy underlines our major difference with the non-strategy proposed by Davidson - a number of temperature holes until your money runs out. Geothermal exploration should successively reduce drilling risk and project cost through increasing steps in knowledge. This objective is normally accomplished by beginning with regional surveys, and progressively narrowing down prospective areas to a few prospects - for which conceptual drill targeting models are defined.

DOE needs to know if there is enough evidence, such as geology and geophysics, on the geothermal potential at the proposed site(s).

Following the proposed DOE strategy, above, we need to take these actions:

- A. Before reviewing proposals, work with USGS, DOGAMI and UURI to assemble regional and site data into maps outlining favorable areas, with supporting geophysical, geochemical, and hydrologic data (step 1). Within these favorable areas, outline specific prospects, each with a drill targeting model consisting of cross sections and justification for nature, depth, and temperature of the drilling target (steps 1 & 2).

- B. Require the proposers to present the evidence and justification for proposed sites, in terms of conceptual model, geology, geophysics, geochemistry, hydrology, cross sections, existing drill data, logs, etc.
- C. Establish qualification criteria for accepting drilling proposals for evaluation, consisting of the evidence and justification in B, above. Simply offering their "best lease" is a good basis for disqualifying their proposal.
- D. Establish rigorous qualification and selection of driller(s), based on experience in high mountain drilling in hard, fractured volcanic rock; with strict inspection and quality control of equipment, esp. drill pipe.
- E. In the manner of the ID's Industry-Coupled and State-Coupled Programs, establish rigorous procedures for documenting the cost-shared drill-holes, collecting drill data, and analyzing it in cooperation with experts on those areas. Proprietary rights to data for 6 mos. to 1 yr. may be negotiated with participants, to encourage submittal of the best, rather than marginal prospects.
- F. Identify gaps in knowledge of prospects, priorities, targets and technologies, to be addressed by DOE (&USGS) R&D tasks in FY'86-on.

Suggested Drilling Prospect/Target Criteria

- a. Prospective area includes the Cascade Region (Goldstein lc., letter of June 1 to you.), from Lassen Peak, CA north to the Canadian Border, including Medicine Lake/Glass Mtn., CA and Newberry Caldera, OR (see attached map, gray area).
- b. Geologic evidence of Recent (<200,000 yr. old) volcanism, or current volcanic activity associated with prospect site.
- c. Proposer specifies the drilling target, at depth, and attempts to associate it with a magma chamber and/or geothermal reservoir.
- d. Proposer attempts to locate prospective steam/hot water user within economic distance of the site.
- e. Priority given to high-temperature, electric power generation prospects.

Sorry to run on so long. Trying to get the horse back in front of the cart requires an overall perspective of Cascades geothermal exploration, before narrowing down to the temperature drill holes.

Sincerely,



cc: HQ/Toms, Reed  
USGS/Muffler, Sammel  
~~Union/Dandanville~~  
LBL/Goldstein  
UURI/Wright  
DOGAMI/Priest  
SAN/Adduci, Crawford, Holman

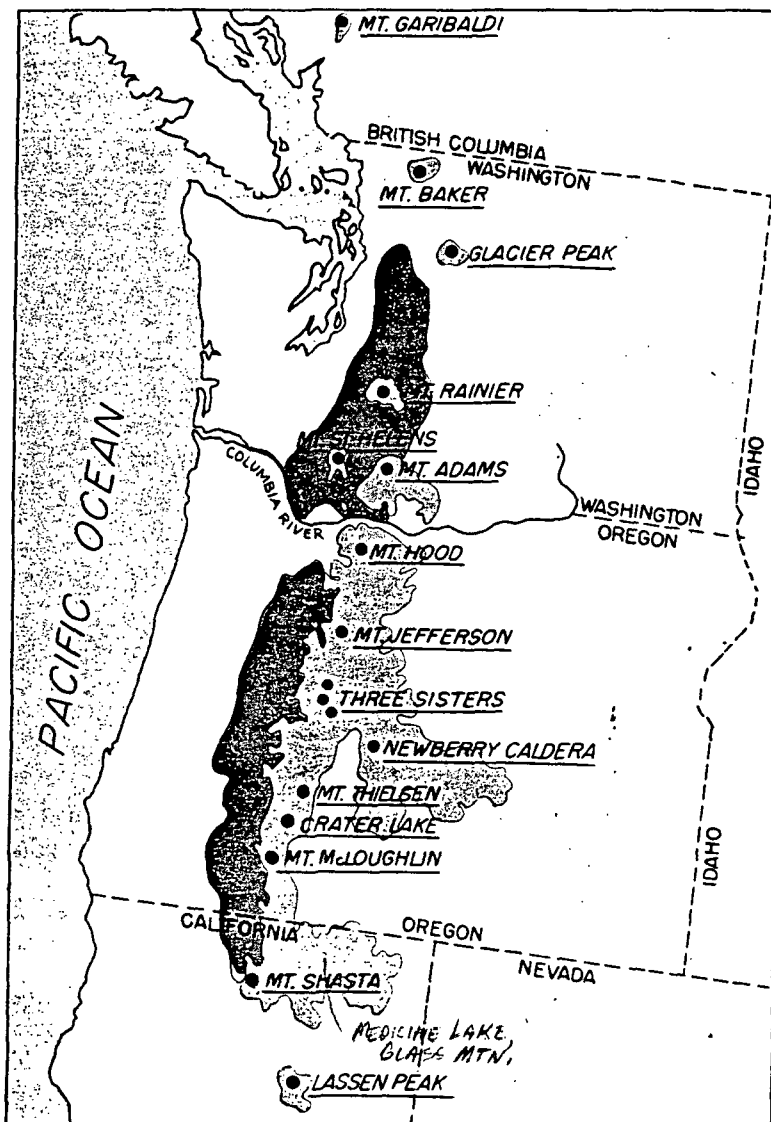
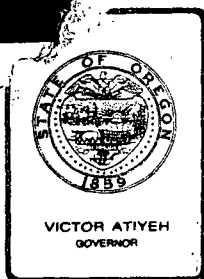


Figure 1-1. Map of the Cascade Range, showing areas covered by the older "Western Cascade" lavas and the High Cascade basalts and andesites of the Pleistocene-Holocene Epochs. Note that the three northern volcanoes are not surrounded by older volcanic material.



*Department of Geology and Mineral Industries*  
ADMINISTRATIVE OFFICE

1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

June 14, 1984

Dr. Marty Molloy  
Department of Energy  
San Francisco Operations Office  
1333 Broadway  
Oakland, California 94612

Dear Marty:

Thank you for the copy of your June 12, 1984 letter to Susan Prestwitch. I am in agreement with much of the general strategy you laid out. The letter is an admirable effort to put the whole process in perspective. I also agree with Dick Dondanville about the need for a 3 Km hole in the Cascades (I assume he means the High Cascades). A well of this kind would, however, require much more than the \$1 million in the current solicitation (probably over \$4 million).

It is my feeling that one must drill to at least 3,000' to obtain reliable temperature gradient data in the High Cascade Range. Drilling to at least 4,000' is probably required for significant hydrologic testing. Also, wells designed to test fluids will be more expensive than temperature gradient holes. One strategy worthy of consideration would be targeting a series of 3,000' holes on areas which have promising surface geologic, geochemical and geophysical characteristics. Once a thermal anomaly has been defined, then a deeper well aimed at reservoir fluids should be drilled.

With the current level of funding (\$1 million from USDOE and \$1 million from industry) it is doubtful that more than one area could be adequately explored, unless industry has already progressed with the 3,000' drilling program. Thermal anomalies could, however, be outlined for a few areas if only 3,000' wells are utilized. At about \$150,000 to \$300,000 each, about 7 to 20 of these 3,000' wells could be drilled, assuming a 50% cost share. If about 4 to 6 slim holes are required to define a thermal anomaly, about 2 to 5 anomalies could be defined. Presumably, industry would continue into the deeper reservoir confirmation phase, given positive results.

The choice for the technical advisory group is clear. Do we wish to consider proposals for significant hydrologic testing aimed at drilling to at least 4,000', or will we limit proposals to delineation of thermal anomalies via drilling of 3,000' wells in the High Cascades? We cannot do both in

Mr. Marty Molloy  
Page 2  
June 15, 1984

undrilled areas, if we also want to spread the money out to more than one group.

My feeling is that delineation of thermal anomalies should be given priority unless a company has partially or completely finished this initial phase. In any case, the USDOE cost share should not be more than 50% or more than \$500,000 for any one proposal. This would leave open the possibility of a company cost sharing a 4,000' well costing about \$700,000 to \$1.4 million, if they do the required preliminary work themselves. It would also assure that at least 2 projects could be funded.

Listed below are some points made in your letter which need further consideration:

1. (Part A, "actions" section, P. 4) I do not see the need for a new government group to "assemble regional and site data...."

This type of extended data compilation will inhibit implementation of the solicitation. In any case, this type of summary is already being done by DOGAMI and other groups under contract to BPA. Certain large segments of the High Cascades with high potential and significant data gaps should be given priority, but these areas can be delineated relatively easily by the technical advisory committee in a single face-to-face meeting.

2. (Part D, "actions" section, p.5) "Establish rigorous qualification and selection of driller(s)"

Let's let industry pick their own drillers. This seems like over regulation. They know better than we what the drilling conditions are like.

3. (Part E. "actions" section, p.5) "Proprietary rights to data for 6 months to 1 year"

Let's allow proprietary periods up to 2 years from the start of drilling.

4. (Part a, "criteria" section, p.5) "Prospective area includes the Cascades Region....including Medicine Lake/Glass Mountain, CA and Newberry Caldera, OR"

The industry already has a very high level of interest and activity at Newberry and Medicine Lake. Do they really need this solicitation to encourage them in those areas? I would say no. The High Cascade Range in Washington, Oregon, and California is where the solicitation should be aimed.

5. (Part d, "criteria" section, p.5) ".....locate prospective steam/hot water user within economic distance to the site."

The technical advisory group should leave economic issues to industry and not use them as selection criteria.

Sincerely,



George R. Priest  
Geothermal Specialist

GRP:bj

cc: Susan Prestwitch  
Pat Muffler  
Ed Sammel  
Norm Goldstein  
*Mike* ~~Bob~~ Wright  
Dave Blackwell