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Decision 83 05 047 MAY 18 1983

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

In the Matter of the Application of SAN DIEGO GAS & ELECTRIC COMPANY for approval of Geothermal Sales Contract, Heber Binary Project.	Application 82-08-49 (Filed August 19, 1982; amended November 24, 1982)

Wayne P. Sakarias, Attorney at Law, for applicant.
John W. Witt, City Attorney, by William S. Shaffran, Deputy City Attorney, for the City of San Diego, interested party.
Jeff Thomas, Attorney at Law, for the Commission staff.

I N D E X

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O P I N I O N

San Diego Gas & Electric Company (SDG&E) seeks a finding of this Commission that the terms of the Geothermal Sales Contract (Contract) as amended effective July 19, 1982 and November 2, 1982 between SDG&E and Union Oil Company of California (Union Oil) in connection with the Heber Binary Project (Project) are reasonable. SDG&E further seeks authorization to recover the actual cost of energy paid under the Contract during the period prior to commercial operation in its Energy Cost Adjustment Clause (ECAC) proceedings.

After due notice, six days of public hearing were held on this matter in Los Angeles before Administrative Law Judge N. R. Johnson during the period December 20, 1982 through January 5, 1983, and the matter was submitted subject to concurrent briefs due after one extension of time was granted on February 1, 1983.

Testimony was presented on behalf of SDG&E by its manager of the Project, Robert G. Lacy, by its supervisor, Fuel Planning, James M. Nugent, by its senior engineer on the Project management staff, Tiffany T. Nelson, and by a research associate of Regional Economic Research (RER) acting as a consultant to SDG&E on the Project, Mark A. Thayer. Testimony was presented on behalf of the Commission staff by one of its supervising utilities engineers, Julian Ajello, by one of its senior utilities engineers, Richard Finnstrom, by one of its regulatory analysts I, Mary Wand, by one of its regulatory program specialists I, Meg S. Schachter, and by one of its senior regulatory policy specialists, Ronald L. Knecht. The City of San Diego (San Diego) participated through cross-examination of the various witnesses and submittal of a concurrent brief. Concurrent briefs were also received from SDG&E and the Commission staff.

I - SUMMARY OF DECISION

This decision provides for the continued funding of the Heber binary-cycle geothermal electric generating plant project by permitting SDG&E to recover its participant share of capital costs and heat costs not associated with the generation of electricity through its research, development, and demonstration (RD&D) adjustment clause. SDG&E would recover its ownership share of the heat costs associated with the generation of electricity through its ECAC proceedings. To protect SDG&E's ratepayers from excessive costs, this decision establishes a limit of $89.7 million for total ratepayer funding for this project. This limit places a value of approximately $68 million on the RD&D benefits of this project, over and above the value of the energy actually produced. Such a limit not only places a finite limit on ratepayer involvement in the Project, but creates an incentive to SDG&E to operate the generating plant cost-effectively, while at the same time not being so restrictive as to result in the termination of the Project.

Permitting funding for the Project is consistent with this Commission's policy to encourage development of alternative, nonfossil-fueled, pollution-free sources of electric power generation. The only way that the viability of such a type plant can be determined is by building and operating a commercial size plant. It is on this basis that this Commission endorsed the Project in Decision (D.) 91271 and that other participants to the Project are willing to fund it to the extent of $95.1 million.

The Project will demonstrate whether binary-cycle geothermal generation is a viable technology. Should this type of generating plant prove out as anticipated, it will enable the development of additional geothermal resources in the Imperial Valley and similar areas.

The decision also provides that the RD&D phase of the Project shall end at the beginning of the commercial phase, but not later than four years from first fluid delivery without further

Commission authorization. Recovery of project costs for the commercial phase of the Project shall be limited to the reasonable costs of operating and maintaining the plant. The reasonableness review will take into consideration such factors as the cost data obtained during the demonstration period, as well as the cost of alternative energy sources available to SDG&E at the time.

II - BACKGROUND

Ordering Paragraph 6 of D.88758 dated May 2, 1978, in Order Instituting Investigation (OII) 4, our investigation into SDG&E's resource plan and financial liability, stated:

> "6. SDG&E shall continue to aggressively pursue its geothermal plans. In accordance with this SDG&E shall file semi-annual reports with this Commission commencing June 30, 1978 as to its geothermal development efforts." 83 CPUC 707 at 734.

In accordance with this ordering paragraph, SDG&E became involved in the Project. In July 1979 the U.S. Senate House Conference Committee on the Department of Energy's (DOE) Appropriations Bill directed DOE to choose a site for the development of a 50 MW binary-cycle demonstration plant. On December 3, 1979 SDG&E submitted to DOE a proposal for financial assistance for 50% of the costs of constructing and operating a binary-cycle demonstration plant at Heber. SDG&E's participation was conditioned on Commission endorsement of the Project, approval of special ratemaking treatment for SDG&E's share of the expense, and insulation of SDG&E from potential liability for geothermal reservoir development costs if the Project were abandoned. SDG&E sought and obtained Commission endorsement of the Project. Resolution M-4709 dated November 9, 1979 ordered SDG&E to secure the broadest possible participation of other parties to the Project and authorized the recovery of reasonable project RD&D expenditures through annual rate adjustment filings. San Diego petitioned for a formal hearing on the matter and D.91096 dated November 30, 1979 granted the petition and the matter was

assigned Application (A.) 59280. D.91271 dated January 29, 1980 in A.59280 found that the proposed Project was of benefit to the SDG&E ratepayers, that special ratemaking treatment was in order, and that the Project should be classified as RD&D. D.91271 also:

a. Established a special balancing account for the Project;

b. Provided that SDG&E should be allowed to adjust rates annually either by advice letter or in a general rate increase filing to cover its costs of participating in the Project;

c. Established that the recoverable costs would include the geothermal heat cost through the demonstration phase of the Project and any reasonable liability to the geothermal heat supplier;

d. Required that all contracts with DOE and other participants as well as any geothermal heat supply contracts with the geothermal suppliers be provided to the Commission staff for review of reasonableness; and

e. Provided that approval of the special rate treatment will be withdrawn if the Contract SDG&E negotiates with the geothermal heat supplier appears to impose unreasonable financial risks upon the SDG&E ratepayers.

On April 19, 1982 SDG&E submitted a draft of an advice letter filing under General Order 96-A requesting approval of a proposed geothermal heat contract with Union Oil. After review by the Commission staff it was determined that the Contract indicated the potential for considerable risk to SDG&E ratepayers and that the proper vehicle for complete review of the proposed Contract was a formal filing before the Commission. Consequently on August 19, 1982 this application was filed.

III - THE PROJECT

The Project is a 67.9 MW gross/44.4 MW net binary-cycle geothermal electric generating facility to be constructed on a 20-acre site south of the community of Heber. According to the design

at full rated output 7,700,000 pounds per hour of brine at a temperature of 360 degrees Fahrenheit is pumped from the production wells across the plant boundaries to the heat exchangers. The thermally spent fluid is repressurized by the brine return pump and returned at a temperature of 164 degrees Fahrenheit to the reinjection wells located about 1½ miles from the plant. The heat lost in the heat exchanger is used to vaporize the hydrocarbon working fluid which turns a turbine-generator to produce electricity. The hydrocarbon vapor is condensed back into a liquid after leaving the turbine by a series of hydrocarbon pumps. A cooling water loop removes the heat of condensation from the hydrocarbon.

The term of the RD&D phase of the Project is about seven years and seven months beginning with the execution of the cooperative agreement between DOE and SDG&E and ending four months after a two-year full power demonstration period. At the conclusion of the demonstration period SDG&E will publish a final Project report which will include an assessment of the economic viability of the binary-cycle technology.

If, at that time, it is determined that electric generation by the geothermal binary-cycle method is a viable alternative to conventional methods, the plant will enter into a commercial phase and produce electricity as a base load plant. The contract life is 35 years from the date of the initial synchronization of the plant to the electric grid unless sooner terminated.

The breakdown of the Project costs for the RD&D phase according to the December 1979 proposal (D.91271 figures), and updated information as of December 1982 has been set forth in the Commission staff brief as follows:

TOTAL HEBER PROJECT COST PROPOSALS

Description	(Dollars in Millions) 1979 Proposal	December 1982 Definitive Estimate
1. Environmental Studies & Permits		$ 0.7
2. Plant Engineering & Procurements		72.2
3. Plant Construction		29.5
4. Plant Start-Up		1.1
5. Project Management		5.0
6. Plant	$ 84.2	108.5
7. Operations & Maintenance	10.8	11.9
8. Heat	27.8	67.8
9. Energy Credit	?	(61.7)
10. Power Plant Demonstration	38.6	18.0
11. Data Collection System		0.3
12. Data Acquisition Analysis and Dissemination		0.1
13. Data Acquisition and Dissemination	5.6	0.4
RD&D Project Costs Total of Lines 6 & 10	128.4	126.9
Total plus "energy credit/expense"	128.4	188.6

(Red Figure)

IV - THE BINARY CYCLE

The two major types of plants that can use the liquid-dominated geothermal resources found in Imperial Valley are known as the flash-cycle plant and the binary-cycle plant. In the flash plant hot geothermal fluid flows under pressure to a vessel where it is allowed to boil to produce steam. The steam is separated from the

remaining liquid and use to turn a conventional turbine. This is a proven and commercially used technology.

With the binary cycle, the hot geothermal fluid is pumped to a heat exchanger which transfers the heat to change a working fluid, typically a hydrocarbon, which boils to a vapor at lower temperature than the geothermal fluid. The vapor is used to turn a turbine. The binary-cycle technology has been proven in other applications in the petrochemical industry, but has never been used in connection with a commercial size geothermal power plant. Unlike the flash system, which is applicable for use in high-temperature geothermal reservoirs, the binary cycle is applicable to reservoirs over the entire spectrum of temperatures. Another important aspect of the binary cycle is its flexibility to adapt to changing reservoir conditions by changing the working fluid to optimize performance within different temperature ranges.

The first phase of the Project is considered RD&D because a commercial size geothermal binary-cycle power plant has never been built and further development of some of the necessary equipment is necessary. The major components requiring further development are the hydrocarbon turbine and the down well production pumps. SDG&E estimates that at least 4,300 MW could be produced from moderate-temperature reservoirs with the binary-cycle technology in California should such systems prove commercially feasible.

V - DECISION 91271

As previously stated, D.91271 found the proposed Project of benefit to SDG&E ratepayers and endorsed SDG&E's proposal to construct a 50 MW binary geothermal demonstration plant at Heber. At that time the total costs associated with the construction and demonstration phases of the Project were estimated at $128.4 million over a 6½-year period. Of the total estimated project cost

anticipated, SDG&E would fund $37.6 million, of which $28.2 million was for construction and $9.3 million for demonstration. The $128.4 million figure includes the total fuel costs for the two-year demonstration period estimated to be $27.8 million. At the time the decision was issued SDG&E was negotiating a contract with Chevron Resources Company (Chevron) for the price of the geothermal heat energy. Such a contract was never consummated. SDG&E, however, was successful in negotiating a contract with Union Oil and the reasonableness of this contract is the subject of this proceeding.

It should be emphasized that at the time D.91271 was issued no contracts had been finalized. In this respect we said:

> "Turning to the question of the geothermal brine contract and potential liability to the reservoir developers if the project is abandoned, we are gravely concerned that no contracts have been finalized at this time. However, we recognize that DOE is under tight time constraints for awarding its contract which would support 50 percent of plant expenditures for development of a commerical binary plant. Under normal circumstances, we would not approve any project where expenditures have not been clearly defined. We, therefore, caution SDG&E, first, that we expect the utility to negotiate a contract which minimizes risk and expense to itself and its ratepayers, and, secondly, that project approval will be withdrawn if the contract it negotiates with Chevron appears to impose unreasonable financial risks upon SDG&E and its ratepayers, or in the event that such contract is not negotiated within a reasonable period of time. . . ." 3 CPUC 2d 203 at 226.

D.91271 set forth a heat cost of $27.8 million for the demonstration period. That is $40 million less than the present estimate of such costs of $67.8 million. In A.59280 SDG&E sought authorization to include the costs of geothermal brine for the Project as an RD&D expense during the entire demonstration phase of the Project. As a result of the substantial increase in the heat costs, SDG&E now requests that it be permitted to recover in ECAC proceedings the entire cost of energy under the Contract prior to

commercial operation. Under SDG&E's cost recovery proposal, total costs to SDG&E ratepayers are projected to be $93 million during the RD&D phase. This represents $55 million more than the $37.6 million total cost limit established in D.91271.

It should be emphasized that D.91271 approved the Project, leaving for determination in this proceeding only the establishment of limits for SDG&E ratepayer participation in the Project costs as related to the possible benefits to be derived by SDG&E and its ratepayers. The following findings of fact set forth on pages 227-231 of 3 CPUC 2d relate to the justification leading to our endorsement of SDG&E's proposal to construct the plant.

> "1. The development of the binary-cycle geothermal technology would further stimulate the utilization of moderate temperature geothermal resources located in Imperial Valley, California, for the production of electric energy.
>
> "2. The binary-cycle geothermal technology is the subject of national interest as evidenced by the congressional directive to the U.S. DOE to proceed without further delay with the development of a 50-MW binary-cycle conversion geothermal demonstration plant."
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> * * *
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> "4. The Heber binary-cycle demonstration plant, as proposed by SDG&E, is supported by the California Energy Conservation and Development Commission as evidenced by a resolution adopted by that Commission on October 10, 1979.
>
> "5. The U.S. electric utility industry, as represented by the EPRI, supports SDG&E's proposed Heber binary project and is currently considering SDG&E's request for a contribution of approximately $8.4 million to the project.
>
> "6. Geothermal power generation could provide a significant new fuel resource option that would diversify the fuel requirements of SDG&E and ease its dependence on fuel oil."
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> * * *
>
> "15. The objectives of the Heber plant are: (1) to demonstrate the potential utility of moderate temperature geothermal reservoirs for

> economic electric power generation; (2) to scale up and evaluate the performance of binary-cycle technology in geothermal power plants; (3) to demonstrate the performance of the plant and reservoir and the environmental acceptability of binary-cycle geothermal power plants; and (4) to resolve uncertainties of reservoir performance, plant reliability, and the economics of plant operation."

* * *

It is obvious from these findings that both A.59280 and this proceeding address the viability of binary-cycle geothermal electric generating plants as an alternative source of power not only for SDG&E but also for both the State and the nation. Were this not so, SDG&E would normally pay 100% of the capital and nongeneration-related heat costs rather than its 33.3% participant share.

VI - THE CONTRACT

The major issue facing the Commission in this decision is whether or not the benefits of this project to SDG&E ratepayers (taking into account the value of energy provided) are commensurate with projected total costs of $93 million.

General

The Contract term is 35 years after the date of initial synchronization of the plant to the electrical transmission line unless sooner terminated. Union Oil is to design and construct at its sole risk and expense all field facilities, including the wells, downhole production pumps, and the production and injection pipelines, necessary to deliver and inject the geothermal fluid. Union Oil's obligations also include delivery of 100% of the heat required for the plant and the collection and furnishing to SDG&E of reservoir operation data including temperatures, pressures, flow rates, power consumption of pumps, chemical analysis of fluid, and the results of any well test performed.

SDG&E's obligations include the purchase of certain quantities of geothermal fluid supplied by Union Oil, the

construction and operation of the 65 MW electric plant including the installation and operation of injection pumps in the plant, and supplying electricity required to operate the field facilities.

Price

The pricing formulas set forth in the Contract are quite complex and for the demonstration period contain one or more of the following component parts: (a) field operating and maintenance expenses, (b) incremental demand charge, (c) demand charge, and (d) commodity charge. Commencing with the date of firm supply obligation and continuing until the termination of the Contract, SDG&E shall pay Union Oil each month the sum of the demand charge and the commodity charge.

The startup period commences on the date of first fluid delivery and ends with SDG&E's request for field facilities capable of producing 7,500,000 pounds of brine per hour. During this startup period there is no payment for heat because the fluid is being flowed through the plant bypass to obtain reservoir operation experience.

The test and inspection period starts with the end of the startup period and ends on the later of nine months after date of initial synchronization of the electric plant to the electrical transmission line, or when the heat supplier has installed the field facilities to deliver 7,500,000 pounds of fluid per hour to the electric plant, and SDG&E has generated a specific number of kilowatt-hours (kWh) within a period of 90 consecutive days. During this period SDG&E will pay a Btu charge equal to the basic heat price of $1.30 per million Btus times the Btus used times an adjustment for the energy used by the field facilities and a price adjustment factor for the first 3,750,000 pounds of brine per hour. For brine delivered in excess of 3,750,000 pounds per hour an incremental demand charge equal to 75% of the product of Union Oil's supply obligation in excess of 3,750,000 pounds of fluid per hour, the difference in enthalpy between the delivered fluid and the fluid at a

temperature of 154 degrees Fahrenheit, the number of hours in the month, the base heat price per Btu, a supply reduction factor, a price adjustment factor, and a field facility electric power requirement factor.

Full operation commences with the conclusion of the test and inspection period. During this period the base price is reduced from $1.30 to $1.15 per million Btus reducing both the Btu charge and incremental demand charge applicable during this period. Following some additional operating time the plant will be shut down for about two months for a major internal inspection. After the inspection is complete and the plant has operated at 70% capacity factor for 48 hours, the incremental demand charge ceases and SDG&E will pay the Btu charge for all fluid used in addition to the field operations and maintenance (O&M) charges.

After the date of firm supply obligation, the date that Union Oil notifies SDG&E in writing that it will deliver its supply obligation on a continuous basis, the cost of geothermal fluid will be based on the sum of the demand and commodity charges. The demand charge is equal to 60% of Union Oil's supply obligation, the difference in enthalpy between the brine delivered and the brine at a temperature of 154 degrees Fahrenheit, the hours in a month, an average supply reduction factor, the base price of brine, a price adjustment factor, and the field facility electric power requirement factor. The demand charge is based on 75% of the price per unit to ratepayers, using an 80% capacity factor.

The commodity charge (replacing the Btu charge) is equal to 25% of the product of the total pounds of geothermal fluid delivered to the plant, the difference in enthalpy between the fluid delivered to SDG&E and the fluid returned to Union Oil, the field facility electric power requirement factor, the base price of brine, and the price adjustment factor.

The various modifying factors included in the computations of the incremental demand charges, demand charges, and commodity charges set forth above are as follows:

1. The base heat price is $1.30 per million Btus until the end of the test and inspection period and $1.15 per million Btus thereafter except the base price is zero if the geothermal fluid is delivered at a temperature less than 325 degrees Fahrenheit.
2. The supply reduction factor is equal to the average delivery rate divided by Union Oil's supply obligation provided SDG&E is demanding more than the average delivery rate but not more than the supply obligation.
3. The price adjustment factor is based 30% on the oil and gas field machinery index, 30% on the oil and gas field workers index, 30% on oil well casing alloy index, and 10% on the Portland Cement index.
4. The field facility electric power requirement factor is equal to one minus the field facility electric requirements divided by actual or calculated electric plant gross generation in the preceding 12 months.

Other Provisions

Union Oil will deliver geothermal fluid at the plant property line at a pressure between 250 pounds per square inch absolute (psia) and 275 psia. SDG&E will return the fluid to Union Oil at the plant property line at any pressure requested by Union Oil up to 565 psia.

Either party may terminate without any further obligation and without obligation to offer its facilities to the other party if (1) the other party cannot perform the obligations for one year due to uncontrollable force, (2) O&M expenses exceed the ceiling of Union Oil's field O&M expenses estimated to be about $9 million per year (plus escalation), or (3) the parties are unable to agree on O&M increment within 90 days of the end of the demonstration period.

If certain reservoir performance criteria are not met, Union Oil may elect not to install additional field facilities to achieve full operation. SDG&E may elect to install such facilities and thereby earn rights in the geothermal facilities in proportion to its investment in the additional field facilities.

VII - POSITION OF SDG&E

Testimony, exhibits, and argument presented on behalf of SDG&E indicate that:

1. Demonstration of the feasibility of binary-cycle technology in geothermal power plants would hasten the development and use of geothermal resources in the Imperial Valley.

2. At least 4,300 MW could be produced from moderate temperature reservoirs with the binary-cycle technology in California, an equivalent of about 58 million barrels of oil each year.

3. If the Heber Binary Plant is placed into commercial service, it will be operated as a base load plant because the busbar costs are lowest when the plant is operated continuously at full load.

4. SDG&E executed the Heat Contract only after it met the following objectives: (a) provide a firm supply of geothermal heat to operate a binary-cycle power plant at Heber; (b) acknowledge the R&D nature of the Project and the requirements of DOE; (c) limit SDG&E ratepayer and stockholder liabilities; (d) be responsive to the Commission's concerns raised during consideration of the SCE/Chevron Heber contract if applicable; and (e) provide for full commercial operation if the Project is successful.

5. The demand charges, the fuel O&M expenses, the price escalation indexes, and the base prices are all reasonable and the termination provisions are of significant benefit to the Project. Consequently, the Contract is reasonable and should be approved.

6. During the period from initial brine delivery to the end of the demonstration period three different sets of heat pricing formula will come into effect.

   a. Initially fuel used for the generation of power will be priced only on the actual amount of heat used.

b. The period of incremental demand charges stems from the time when Union Oil first demonstrates substantial flow rates greater than 3,750,000 Btus an hour to the end of the two-month scheduled shutdown. During this period a Btu charge is applied to the heat used for the first 3,750,000 pounds per hour flow and the incremental demand charge applies to the fuel in excess of 3,750,000 pounds per hour which Union Oil is capable of delivering.

c. Twenty-four months after first fluid delivery Union Oil has the option of implementing commodity and demand charges which provides for 25% of the base prices used in the commodity charge formula and 75% of the base prices used in the demand charge formula.

7. The cost of heat required to generate power to operate the fuel facilities and brine return pumps is deducted from the heat cost charged by Union Oil to SDG&E.

8. During the first six months after synchronization assumed values of 50% for the first two months and 70% for the remaining four months are used as availability factors for the operation of the plant. After scheduled shutdown and through commercial operation a 77.1% availability factor is used.

9. After initial synchronization SDG&E should be allowed to recover in ECAC proceedings its contract costs in proportion to its share of the electricity generated by the plant.

10. In calculating total costs of the Project SDG&E would offset contract costs with an energy credit equal to the actual cost of generating electricity, thus acknowledging the energy credit discussed in D.91271, supra.

11. All Project costs not recovered in ECAC proceedings are properly RD&D expenses.

12. The total heat cost under the Contract will be approximately $67.8 million assuming 77.1%

plant availability and the most likely level of field O&M costs. Of this amount, approximately $3.3 million will be spent prior to initial synchronization of the plant and should be included as an RD&D expense.

13. The nonRD&D share of the total heat costs is $64.5 million. Of this, SDG&E's ownership share (estimated to be 83%) would be approximately $53.3 million over 11 quarters of operation prior to the commercial operation of the plant.

14. SDG&E's share of the "as expected" generation of electricity is 531.4 million kWh which divided into its $53.3 million share of the costs averages approximately 10¢ per kWh during the demonstration period.

15. A study prepared by an independent consultant assessing the external benefits of the Heber Binary Project led to the following conclusions:

    a. The employment benefits over the construction, demonstration, and commercial stages would range from 0.9¢ to 2.0¢ per kWh, predominantly in Imperial County.

    b. The total net public revenues associated with the development and commercial operation of the Project would range from 0.2¢ to 0.8¢ per kWh, predominantly in Imperial County.

    c. Environmental benefits in the order of 1.1¢ to 0.3¢ per kWh could be experienced in Imperial County and of 9.8¢ to 1.4¢ per kWh could be experienced in San Diego County.

    d. The expected learning and experience benefits associated with the construction and operation of the plant and field facilities would amount to several cents per kWh.

16. The Commission staff's recommendations as set forth on pages xi and xii of Exhibit 9, with minor modifications, are generally acceptable

to SDG&E. (SDG&E's acceptance of the staff's recommendations is set forth in Section VIII - Position of Commission Staff of this decision.)

17. The Commission staff's modified recommendations as set forth in Exhibit 11 and sponsored by the testimony of Commission staff witnesses Schachter and Knecht did not recognize the following several important considerations:

    a. SDG&E will receive about 82½% of the net energy generated during the demonstration period and this energy has a very real value.

    b. The concept of energy credit which was presented by SDG&E in the proceeding that led to D.91271.

18. The effect of the adoption of the proposed modified recommendations in staff Exhibit 11, if adopted, would be a project shortfall of approximately $30 million and will probably result in discontinuation of the Project.

19. SDG&E could probably continue the Project if the Commission should adopt staff witness Ajello's alternate ceiling of ratepayer involvement of $68.95 million based on an anticipated 50% capacity factor and energy valued at 7¢ per kWh.

VIII - POSITION OF COMMISSION STAFF

General

Testimony and exhibits were presented on behalf of the Commission staff by members of Revenue Requirements, Utilities, and Policy and Planning (P&P) Divisions. The primary staff exhibit (Exhibit 9) was a staff report which discussed Project costs, comparison of fuel and O&M costs of various geothermal plants, avoided costs of the energy generated, nonquantifiable benefits of the Project, and ratemaking policy considerations of the Project.

Staff Recommendations and SDG&E Response

The original and revised specific recommendations sponsored jointly by the staff witnesses from the Revenue Requirements and P&P Divisions, together with SDG&E's position on these recommendations as testified to by its witness Lacy, are as follows:

> The staff recommends that the Commission should find that:
>
> 1. Given the facts here, cost recovery on an expense basis is reasonable for this project during the RD&D phase, with the limitations noted below, if and only if:
>
> a. Recovery during the commercial period for ratemaking purposes (as defined in item 3 below) is set at long-run avoided costs (the long-term long-run avoided offer to be developed in OIR 2); and
>
> b. The RD&D phase is limited to four years from first fluid delivery (startup).

Recommendation 1.a. is acceptable to SDG&E with the understanding that the mechanism for defining and projecting long-run avoided costs will be established in another proceeding dealing with A.82-04-47, in OIR 2. Recommendation 1.b is acceptable to SDG&E provided that Recommendation 4, which provides for a method of obtaining an extension of time, is also adopted.

> 2. At the end of 3½ years from first fluid delivery, SDG&E must file a report with the Commission summarizing experience to that time, giving project costs and performance, and indicating status and future of the project. In particular, this report should indicate whether and when the Project will enter into its commercial phase. If the schedule is accelerated from that currently projected, SDG&E must file this report six months before the start of commercial operation is anticipated, or as soon as the

accelerated commercial date is determined, if not known at least six months in advance. If the Project goes commercial earlier than expected, this report will give the Commission the necessary notice to advance the date at which long-run avoided cost payments become the basis for cost recovery.

Recommendation 2 is acceptable to SDG&E provided that the final report to DOE would be considered a fulfillment of this recommendation.

3. The commercial period as defined for ratemaking purposes shall begin after the RD&D phase, but no later than four years after first fluid delivery to the plant.

4. If SDG&E anticipates a need to request a delay in entering the commercial period, as defined above, SDG&E must submit a formal application requesting an extension to the Commission for review no later than December 1, 1987. If such notice is not given, the recovery provision of Recommendation 1.a. above will take effect automatically.

Recommendations 3 and 4 are acceptable to SDG&E.

5. The Commission reiterates the requirement in this decision that SDG&E justify "with a strong compelling showing" to the Commission a share greater than $37.6 million in total project costs (see D.91271, Ordering Paragraph 3.)

SDG&E accepted Recommendation 5 as set forth above. However, staff witnesses Schachter of P&P and Knecht of Revenue Requirements Division jointly sponsored Exhibit 11 presenting additional prepared testimony recommending modification to Recommendations 5, 7, and 8. The recommended modifications consist of raising the $37.6 million total project cost figure for SDG&E ratepayers set forth in D.91271 to $63 million and changing the offsets applicable to SDG&E ratepayers to equal the brine

contractor's established prices during the RD&D phase proportional to SDG&E's participant share rather than ownership share. According to SDG&E, adoption by this Commission of these revised recommendations will create a $30 million shortfall in SDG&E's revenues and cause the Project to fail.

6. Brine expenses (except as noted below) should be handled directly through ECAC (thereby eliminating the energy credit double accounting). However, the entire project costs (including brine costs) must be reported in the annual April 15 RD&D report and other RD&D filings in conformance to the definitions/guidelines developed in OII 82-08-01. (See D.82-12-005.)

With respect to Recommendation 6 SDG&E will file reports in accordance with D.82-12-005 to identify those project costs which are treated as RD&D expenses and those costs which are treated as ECAC expenses. However, SDG&E believes that ECAC expenses should be only reviewed in applicable ECAC proceedings and not as a part of its RD&D review under D.82-12-005.

7. Field O&M costs prior to initial synchronization (during RD&D phase) will not be offset in ECAC, but be part of SDG&E's project costs. These costs fall under the $37.6 million limit described above.

As set forth above, Recommendation 7 was acceptable to SDG&E with the understanding that payments to the heat supplier during the two-month plant shutdown would be treated as ECAC expenses. However, replacing the above $37.6 million limit with a $63 million limit, including ECAC offsets, is, as discussed above, unacceptable to SDG&E.

8. ECAC offsets applicable to SDG&E ratepayers will be equal to the brine contract established prices during the RD&D phase proportionate to SDG&E's ownership share. However, ECAC staff will be directed to closely monitor, as part of its reasonableness review, the relationship between current projections, based on SDG&E's

> exhibits on "expected availability" in this application, and actual prices as they develop under the contract. In particular, the staff should evaluate actual field brine flow, O&M expenses, and plant capacity factors. The billings for field O&M and brine expenses should also be detailed enough and backed by appropriate documentation to show that they reflect only the costs allowed under each of these categories.

As set forth above, Recommendation 8 was acceptable to SDG&E with the understanding that expected availability and costs will be reviewed only in ECAC proceedings and not in RD&D review. However, the staff's modification of changing the "ownership" share to "participant" share is unacceptable to SDG&E.

Additional direct testimony was presented by staff witness Ajello in an attempt to describe the Commission's options in dealing with the fact that the ratepayer's share of Heber's cost will exceed the $37.6 million limit set in D.91271. According to this witness, the Commission can take one of three approaches:

1. It can adopt a new higher limit to ratepayer involvement which SDG&E could reasonably be expected to observe without obtaining any additional participants or more funds from existing participants.
2. The Commission could approve the brine contract contingent on SDG&E finding additional participants or persuading existing participants to increase their share so as to limit SDG&E ratepayer participation to the above $37.6 million.
3. The Commission could adopt the recommendation in Exhibit 9 that SDG&E be allowed to recover brine costs proportional to its ownership share through ECAC subject to an annual review of reasonableness.

Utilities Division staff stated that a decision to continue the Project must be based on the nonmonetary benefits, chief of which is the Project's contribution to the binary-cycle geothermal

technology. Such technology is essential for complete development of geothermal resources in the Imperial Valley. If the Project is abandoned the Utilities Division believes that geothermal development in Imperial Valley would suffer a severe setback. This witness further testified that if the Commission decides the Project should continue, he would recommend the third approach above. It is his belief that adoption of the second approach would probably result in termination of the Project. Should the Commission adopt the first alternative by raising the limit of ratepayer involvment, he would recommend that the limit be raised to $68.95 million. This represents a limit on SDG&E ratepayers' cost over and above the avoided cost of energy produced. That figure was derived by adding the capital cost of $39.9 million and the total energy expense of $53.5 million for a total project cost of $93.4 million and deducting from that amount SDG&E's marginal energy cost applied to SDG&E's share of the amount that would be generated at 50% capacity factor. SDG&E ratepayers would pay via ECAC offsets for the energy actually produced (valued at avoided energy costs). SDG&E believes that if the Commission adopts this alternative, the Project would go forward.

Project Costs

In addition to detailing the Project costs and funding arrangements for the RD&D phase of the matter as set forth in Section III - The Project and the details of the heat contract as set forth in Section VI - The Contract, staff testimony on Project costs indicated that:

1. Only for operations at a high availability factor for the years 1986 and 1987 do SDG&E's total heat costs compare favorably with its projected oil cost.
2. Cents per kWh costs obtained from the sum of demand and commodity charges are higher at low capacity factors due to the demand portion of the heat rates.
3. Fuel O&M costs in cents per kWh are higher at 50% availability than they are at 75% availability.

4. The Contract formula with both demand and commodity charges results in higher total heat charges than a rate based on a 100% commodity charge.

Cost Comparisons

The staff presented testimony comparing the fuel O&M costs of five average size geothermal generating plants expected to be in commercial operation in California in 1988. These plants are:

1. The Project.
2. Southern California Edison Company's (SCE) Heber--Geothermal Plant rated at 52 MW gross output and 47 MW net output.
3. California Department of Water Resources (CDWR) direct geothermal steam Bottle Rock plant rated at 62 MW gross output and 56.5 MW net output.
4. The Northern California Power Authorities' (NCPA)--two direct geothermal steam plant rated at 55 MW gross output and 52.8 MW net output.
5. Sacramento Municipal Utility District's (SMUD) SMUD Geo.1 direct geothermal steam plant rated at 72 MW gross output and 65 MW net output.

Staff testimony comparing the operations of these plants is summarized in Table 1.

Avoided Costs

A staff witness presented testimony based on the use of avoided costs to test the reasonableness of the proposed brine contract during the commercial phase. According to the testimony, the avoided costs were based on the revenue requirements related to a generic coal-fired unit because both geothermal and coal-fired plants are usually characterized as base load facilities. In the preparation of the data the staff witness assumed an in-service capital cost of $1,356 per kW of 1981 dollars and an average capacity factor of 62% over the life of the coal-fired plant. The staff witness' analysis indicated that:

1. While it is unlikely that the proposed brine contract will be commercially competitive, the total cost of Heber may under certain circumstances compare favorably with the avoided costs.

TABLE 1
Comparison of Plant Operations

Plant/Utility	Operating Data: Press PSIA	Temp. F.	Enth: Btu/Lb.	Flow to Plant: Lbs/hr	Cost Data 1988: Heat & O&M Mills/kWh	ESC %
Heber SDG&E	250	359	199	Brine 7,500,000	69 Heat[a] 16 O&M 85 Mills	SDG&E data
Heber SCE b/	150	350 190	163.8	Brine 8,000,000	58 Heat 25 O&M 83 Mills	SCE data
Bottle Rock CDWR	113.7	355	1200	Steam 1,031,000	43 Heat 13 O&M 56 Mills	9% annual
NCPA-2 NCPA	113	348	1190	Steam 983,000	29 Heat 10 O&M 39 Mills	7% annual
SMUD Geo. 1 SMUD	115	348	1196	Steam 983,200	42 Heat 08 O&M 50 Mills	9% annual

Plant/Utility	Plant Performance Data: Gross/Net Output (MW)	Gross/Net Utilization Lbs/hr (MW)	Gross/Net H. Rate Btu/kWh	CF%
Heber SDG&E	67.9 44.4	110,465 169,683	23,417 37,680	75
Heber SCE b/	52 47	153,846 170,212	25,200 27,880	75
Bottle Rock CDWR	62 56.5	16,629 18,248	19,954 21,897	75
NCPA-2 NCPA	55 52.8	17,852 18,617	21,263 22,154	75
SMUD Geo. 1 SMUD	72 65	13,656 15,126	16,332 18,092	75

a/ SDG&E best case assumes zero field O&M component in heat cost.
b/ Project discontinued.

2. The Project will be cost-effective from the standpoint of avoided costs only if reasonable capacity factors are maintained and the O&M increment negotiated at the end of the RD&D phase is not excessive.

Nonquantifiable Benefits

Testimony presented by a staff witness on the indirect and nonmonetary benefits of the Project under consideration indicated that:

1. The benefits from the RD&D stage include research information on the binary technology and other characteristics of the Heber anomaly, potential diversification of resource base, and a fuller utilization of geothermal resources.

2. An evaluation of the potential nonmonetary benefits of the Project's commercial operation indicates the benefits are not unique to the Heber geothermal project.

3. There is a potential for reduced operating costs relative to more intermittent sources of alternative energy. Such cost savings are internalized by the firm and will benefit ratepayers.

4. A binary-cycle geothermal plant would generate greater nonmonetary benefits than a coal plant would. Geothermal power and alternative generation sources, in general, would provide such nonmonetary benefits when compared to traditional fossil fuel-fired generation plant as reduced reliance on oil and gas fuel, reduced air pollution, and diversification of the utilities' power supply. Such nonmonetary benefits, however, are not unique to geothermal plants when compared to other forms of alternative energy.

Ratemaking Policy Considerations - P&P

P&P stated its opinion that the allocation of project costs and risk should, to the extent possible, be commensurate with the allocation of benefits among the parties involved. The staff witness testified that:

1. Indirect and nonmonetary benefits associated with the Heber Project during the RD&D phase are significant and should be taken into consideration in evaluating the merits of this application.

2. The Heber Project does not generate a significant amount of unique indirect and nonmonetary benefits during its commercial phase relative to other forms of alternative energy.

3. A $63 million level of ratepayer RD&D funding generously allows for all direct, indirect, and nonmonetary benefits which ratepayers may receive as a result of this project. SDG&E is proposing that its ratepayers pay at least $93.5 million for a project worth to them at most $63 million. Utilities Division's calculation of an alternative ratepayer funding limit still allows ratepayer's share of total project costs, to reach an inappropriate level of about $90 million.

4. Since the capital costs will be expensed, shareholders will not receive direct monetary benefits from this Project should it prove successful.

5. It is very uncertain how much energy the project will produce during the RD&D period, and distribution of energy is not among the project's purposes set forth in D.91271. Nonetheless, most of the energy costs under the brine contract will remain even if little energy is produced. For these reasons, together with those described in point number 6 below, distribution of energy costs during the RD&D period according to ownership share, as now proposed by SDG&E, is inappropriate.

6. During the RD&D phase the heat contract with Union Oil allocates the majority of the risks and uncertainties surrounding the fuel suppliers' O&M costs to the ratepayers.

7. The risks and costs to ratepayers associated with the commercial phase of the Contract appear unreasonably high particularly since ratepayers already bear the majority of the

costs and risks of the Project. P&P recommends that the Commission approve the Contract for a 35-year period, but only allow ECAC offsets for brine prices up to SDG&E's long-run avoided costs during the commercial period.

8. During the RD&D phase all the project participants will benefit from demonstration of the project whether or not they directly receive energy from it. SDG&E's ratepayers should not pay costs which are the responsibilities of others. Therefore, energy costs should be distributed according to participant shares as was done in D.91271. SDG&E's ratepayer's participant share of total project costs, including energy costs, is $63 million. Distribution of energy costs according to ownership share would cost ratepayers at least $30 million more.

Ratemaking Policy Considerations - Revenue Requirements Division

Testimony presented by a staff Revenue Requirements Division witness indicated that the Heber Project and the Union Oil Contract hold potential benefits for SDG&E, its ratepayers, and society as a whole that may more than offset the total cost and consequently the Contract should not be rejected. This witness further testified that the Contract raises many problems and, therefore, in his opinion, cannot be approved as proposed. It is believed, however, that limited and conditional approval of the Contract can be structured in a way that will allow the Project to go forward to yield the potential net benefits while mitigating the problems. In support of this basic position, the staff witness testified that:

1. Limitations and conditions on a certificate of public convenience and necessity to allocate costs, risks, and returns between stockholders and ratepayers are appropriate in matters such as this where the Commission does not have complete access to all relevant records and materials because some of the parties are not regulated by this Commission.

2. Limiting SDG&E's cost recovery to long-run avoided cost during the commercial phase of the Project will charge the ratepayers the economic cost of service and thereby assure that the ratepayers will pay only market-type risk premium and will not assume individual producers' risks.

3. In order to allow SDG&E's ratepayers the chance to get back energy worth their investment in heat costs and to receive compensation (in the form of indirect and nonmonetary benefits) for taking an enormous risk, ratepayers should not be required to pay more than the long-run avoided cost for energy during the RD&D period. Twelve cents per kWh is within the higher portion of the long-run avoided cost range, and is equivalent to a total project cost of $63 million during the RD&D phase, assuming a 77% capacity factor.

4. Indirect benefits to SDG&E's ratepayers should be considered in setting the appropriate level of Project cost to be paid by the ratepayers. Absent such indirect benefits the appropriate level of costs during the RD&D period would be the short-run avoided cost of 7¢ per kWh.

5. A $63 million limit on ratepayer funding allows for the value of energy which might be produced by the RD&D project as well as indirect benefits through the commercial period.

6. An increase from $37.6 million to $63 million total Project cost is justified because since D.91271 issued the startup, check-out, and demonstration period has been extended from 24 months to 39 months with a large overall increase in heat purchases from Union Oil under the Contract, SDG&E had determined that the plant would be less efficient than expected at the time D.91271 issued, and the escalation in prices from a project delay of 12 months have increased the Project cost significantly.

7. The above-discussed $63 million limit on ratepayers' participation recommended by P&P, Revenue Requirements Division, and Legal

Division would result in a funding shortfall of approximately $30 million and adoption of this recommendation by the Commission would require the participants to raise this amount from a party other than SDG&E or renegotiate the contract.

8. P&P, Revenue Requirements Division, and Legal Division believe that the Commission should not base its decision in this proceeding on whether or not the Project should go forward but should instead concern itself with determining the fair and appropriate level of ratepayers' funding for the Project in light of the benefits which SDG&E's ratepayers can reasonably hope to receive from it.

9. The staff recommends that all Project costs be considered in the RD&D review and that brine expenses associated with the generation of energy be reviewed in the applicable ECAC proceedings as well.

In addition to the above-described staff positions, in its brief the staff made an additional recommendation that SDG&E be required to notify the Commission before giving notice to Union Oil of its intent to terminate the Project and before assigning its rights and obligations under the brine contract to other participants.

IX - POSITION OF THE CITY OF SAN DIEGO

In its brief, San Diego attempted to point out the positions of the various parties to the proceedings and the total costs involved in the Heber Project. San Diego makes no value judgment as to whether the Commission should maintain the total Project cost to SDG&E's ratepayers (including ECAC offsets) at the D.91271 limit of $37.6 million, at the $63 million limit proposed by staff witnesses Schachter and Knecht, or at the $93.4 million limit indirectly proposed by staff witness Ajello and SDG&E.

San Diego notes that the Commission must decide if the cost of this Project to SDG&E's ratepayers for the geothermal brine contract of about $53.5 million as contrasted to the $27.8 million in D.91271 is justified because of the potential benefits to SDG&E's ratepayers and to society as a whole.

San Diego notes that SDG&E is seeking to increase the cost to its ratepayers for the Heber demonstration project from the D.91271 limitation of $37.6 million to $93.4 million, but in its presentation maintains that it is not requesting the limitation in D.91271 be increased. According to San Diego, SDG&E justifies this

position by creating a multimillion dollar "energy credit" based on Finding 26 at 3 CPUC 2d 203, 230.[1] San Diego alleges there is nothing in the main body of the decision that refers to "energy credit" or intimates that the $37.6 million limitation is some "net" figure that is the product of some higher "gross" figure less this "energy credit". Consequently, San Diego maintains the position that since SDG&E has refused to admit it is seeking to exceed the $37.6 million limit, therefore, there has not only been no "strong compelling showing", there has been no showing at all.

San Diego notes that staff witness Schachter has recommended in her modified recommendation that:

1. The $37.6 million limitation be revised to $63 million in total project cost to SDG&E's ratepayers including the cost to ratepayers of the ECAC offsets.
2. The fuel O&M costs prior to initial synchronization should not be offset in the ECAC but be part of a new $63 million limitation.
3. The ECAC offsets applicable to SDG&E's ratepayers be equal to the brine contract established during the RD&D phase proportioned to SDG&E's participant funding share of approximately 33%.

San Diego alleges that witness Schachter's position that SDG&E's ratepayers only pay brine costs proportional to their participant funding share is fully supported by D.91271 because the decision indicates that the total cost associated with the construction and demonstration phases of the Heber Project was estimated to be $128.4 million and this included total fuel cost.

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[1] "26. Any electric power generated by the Heber plant would be allocated to the participant owners in accordance with their respective ownership interests in the plant. Any revenues from sales by SDG&E will be credited back to offset project costs.

San Diego notes that both staff witness Wand and SDG&E witness Thayer conclude that there are nonmonetary or external benefits to society from the demonstration phase of the Heber Binary Process Geothermal Plant and poses the question as to whether or not those benefit are great enough to justify the cost to SDG&E's electric ratepayers who are currently paying electric rates that are among the highest in the United States of America.

San Diego included as Attachment 1 to its brief a copy of a letter dated January 24, 1983 to Joseph E. Bodovitz, Executive Director of the Commission, from C. Richard Swanson, Manager, Regulatory Affairs Department of SDG&E, indicating that SDG&E is pursuing a possible sale of a portion of its ownership in San Onofre Nuclear Generating Station (SONGS) Units 2 and 3. San Diego notes that SONGS Units 2 and 3 are two 1,100 MW nuclear power plant units and SDG&E has a 20% ownership of these units. Should SDG&E sell only 10% of its ownership interest in SONGS Units 2 and 3, it would be selling 44 MW or about the equivalent amount of capacity that the Heber plant will produce. Under these circumstances San Diego raises the question, is the Heber Binary-Cycle Geothermal Project really necessary?

X - DISCUSSION

General

As previously stated, SDG&E is seeking a finding that the terms of its geothermal sale contract with Union Oil are reasonable as amended, and authorization to recover the actual costs of energy paid under the Contract prior to the plant's commercial operation in ECAC proceedings. It is obvious from the record that the Project costs envisioned in D.91271 were considerably less than the current projection of such costs. It is equally obvious that under SDG&E's proposal the bulk of the rate adjustments permitting SDG&E to recover reasonable Project costs have been shifted from annual RD&D

adjustments to periodic ECAC adjustments. The resolutions of these two major issues as well as other issues raised at the hearings require that we address the following component items:

1. The Need for the Project
2. D.91271 Limitations
3. The Contract
4. Project Cost Shares
5. Project Costs Recovery
6. Other Items

The Need for the Project

As previously noted, both A.59280 and this proceeding address the viability of binary-cycle geothermal electric generating plant as an alternative energy source rather than the limited matter of certificating one relatively small generating plant. It is only through the installation and operation of a commercial size plant such as this that the knowledge required to accurately evaluate the economic feasibility of binary-cycle geothermal plants can be obtained. In recognition of this fact DOE, EPRI, SCE, State, IID, and CDWR are willing to fund the Project to the extent of $95.1 million. Such funding could be lost if we deny the application or impose restrictions on its grant that are unacceptable to the participants in the Project.

SDG&E did not attempt to justify the Project on the basis of the need for the capacity. The primary purpose of the Project is to obtain information. Should binary-cycle plants prove to be a viable alternative electric power generating source the payoff could be substantial. SDG&E estimates that it would be able to construct more than 400 MW of such plants in Imperial Valley, and that more than 4,300 MW of binary-cycle geothermal electric generating plants could be constructed in California. SDG&E estimates that such capacity would be available only with a binary-cycle geothermal plant.

Staff witness Knecht questioned the present need for the Project in view of the current availability of lower priced fuel oil. While it is true that the rapidly escalating price of fuel oil was one of the motivating forces for this Commission to seek alternative sources of generation, it was not the sole motivating force. Of equal or possibly even greater importance are the external and nonquantifiable benefits to be derived from such plants as compared to fossil fuel-fired plants. Furthermore, commercial operation of this Project would serve as a hedge against the possibility that oil and gas costs will soar again as they did twice during the 1970s.

The benefit of obtaining the information necessary to determine the commercial viability of binary geothermal plants is the primary nonquantifiable benefit unique to this project. There are other external or nonquantifiable benefits associated with Heber, although they are not unique to the binary geothermal technology. These additional benefits include a reduction in air pollution, a reduction in reliance on oil and gas as fuels for generating electricity, and diversification of SDG&E's generation resource base. Furthermore, a geothermal plant, unlike some of the other alternative generation technologies, can operate as a reliable single unit base load plant.

D.91271 Limitations - A.59280
of SDG&E (1980) 3 CPUC 2d 203

Finding of Fact 10 established SDG&E's participant share of the Project cost at approximately 31% or $37.6 million. (Id. p.228.)

Conclusion of Law 2 states:

"2. Inasmuch as the Commission staff did not have an opportunity to review the reasonableness of the construction and demonstration budgets submitted by SDG&E in its proposal to DOE, and inasmuch as the Commission does not have the opportunity to review the SDG&E-Chevron contract at this time, SDG&E's costs designated in SDG&E's proposal to DOE should be considered maximum but not necessarily reasonable ratemaking costs. Accordingly, SDG&E must justify all costs for

> reasonableness regardless of the amounts contained in the DOE proposal, and any amounts which exceed those contained in the DOE proposal must be justified by a strong compelling showing." Id. p.231, 232.

and Ordering Paragraphs 2 and 3 state:

> "2. SDG&E must justify all costs for reasonableness regardless of the amounts contained in its Department of Energy (DOE) proposal.
>
> "3. SDG&E must justify with a strong compelling showing all amounts which exceed the estimates shown in the DOE proposal totaling $37.6 million for its share." Id. p.232, 233.

It is obvious from the above quotes that at the time D.91271 issued we lacked the requisite cost data to establish firm limits on the amount of ratepayer funding that should be permitted SDG&E for the Heber Project. Our acceptance and approval is required of all of SDG&E's participant share of costs up to the DOE proposal amount of $37.6 million. For participant share costs in excess of that amount, we decreed that SDG&E justify such costs by a strong compelling showing. The above ordering paragraphs do not, nor were they intended to, establish a ceiling for SDG&E's participant costs of the Project. They do demonstrate our increasing vigilance to safeguard both SDG&E and its ratepayers.

SDG&E's participant share of the Project costs is $37.6 million. This figure represents the product of the total Project cost prior to commercial operation of $128.4 million, including a total fuel cost of $27.8 million for the demonstration period, and SDG&E's participant share. Id. p.204. The equivalent figure reflecting updated cost estimates and revised participant share percentages would be, as previously stated, $63 million. P&P and Revenue Requirements staff recommend that it be established as SDG&E's Project participation limit including ECAC offsets.

SDG&E argued that the $37.6 million is a net figure reflecting its participant's share of the capital costs and heat costs prior to the initial synchronization of the plant. After initial synchronization, SDG&E would calculate the total costs of the Project by offsetting the heat costs with an energy credit equal to the actual cost of generating electricity. According to SDG&E, the basis for this position is Finding 26, which states:

> "26. Any electric power generated by the Heber plant would be allocated to the participant owners in accordance with their respective ownership interests in the plant. Any revenues from sales by SDG&E will be credited back to offset project costs." Id. p.230.

According to SDG&E, the above finding permits it to offset Project costs with an energy credit as described above. The fallacy of such an interpretation becomes obvious by referral to a portion of the test in the summary of the decision as follows:

> "Construction of the binary plant is expected to commence in 1980 with completion before the end of 1984.
>
> "Two years of initial operation would follow to demonstrate the technology. Should this prove successful, the plant would then be operated commercially and power sales credited back to the participants. However, the plant is conceived as a demonstration project and commercial sales cannot be counted upon." Id. p.206.

It is obvious from the above that the energy credits referred to in Finding 26 were for the commercial period and not for the demonstration period. It is equally obvious that the funding of the Project was not predicated on the assumption that substantial quantities of electric energy would be generated.

Ordering Paragraph 21 of D.91271 states:

> "1. San Diego Gas & Electric Company (SDG&E) is authorized to treat as research, development, and demonstration (RD&D) expense its share of the construction and demonstration costs of the Heber project, including its share of the costs

associated with purchasing brine for the project during the demonstration period."

By this application SDG&E seeks to shift the recovery of heat costs associated with the generation of electricity from an RD&D adjustment to an ECAC proceeding adjustment. This procedural change request was apparently motivated by the increase in the cost of brine for the RD&D period from $27.8 million to $67.8 million.

D.91271 permits special ratemaking treatment permitting recovery of expenditures on a dollar-for-dollar basis as expenditures are made. However, such expense-type ratemaking treatment was limited to a five-year construction and a two-year demonstration period. Such a limitation is not incompatible with the staff's recommendation, acceptable by SDG&E, that the RD&D phase be limited to four years from first fluid delivery.

The Contract

The general provisions of the Contract are summarized in Section VI of this decision. SDG&E stated that if established five objectives to be satisfied before the Contract could be executed by SDG&E as follows:

1. To provide a firm supply of geothermal heat from the Heber geothermal reservoir for the purpose of operating a binary-cycle power plant.
2. To acknowledge the RD&D nature of the Project and the requirements of DOE.
3. In view of the RD&D nature of the Project, to limit both SDG&E ratepayer and stockholder liabilities.
4. To be responsive to concerns raised by the Commission during its consideration of the SCE/Chevron Heber contract, to the extent those concerns might also apply to the SDG&E Contract.
5. To provide for full commercial operation if the Project is successful.

It is SDG&E's belief that these objectives were met. It was noted that other Project participants approved the Contract. Amendments 1 and 2 to the Contract were negotiated primarily to respond to the scheduling concerns raised by DOE during its review of the Contract.

The demand charge becomes effective at Union Oil's election by its notifying SDG&E that it intends to deliver 7,500,000 pounds of brine per hour to the electric plant on a continuous basis provided the notification is not earlier than 24 months after the first fluid delivery by Union Oil and follows the installation and three months' operation of facilities sufficient to deliver 7,500,000 pounds of brine per hour to the plant. Union Oil's election to institute the demand charge makes it liable for paying liquidated damages for failure to deliver the specified amount of brine. The demand charge is subject to a supply obligation reduction if Union Oil is unable to supply the full amount and a reduction in amount if the brine temperature decreases.

The field O&M expenses, as previously noted, are subject to a maximum limit estimated to be $9 million per year plus escalation factor. In addition, the expenses will be subject to audit by DOE and SDG&E. According to the record, the estimated costs at the Contract limit compare favorably with the projections of SDG&E's marginal cost of fuel oil available at the time of the hearings. At the conclusion of the demonstration period, SDG&E and Union Oil will negotiate an increment to be added to the base price to reflect the field O&M costs. SDG&E's witness testified that he believes this increment will either be very small or zero.

The price escalation factor is based on four factors: the average hourly wage of natural gas and natural gas liquids workers, the oil well casing alloy index, the cost of Portland Cement, and the cost of miscellaneous oil and gas field machinery. SDG&E notes that historically the above escalation factor has risen more slowly than

the price of oil and this trend is expected to continue. However, it is anticipated that the price escalation factor in the Contract will escalate more rapidly than the Consumer and Producers Price Indexes.

The Contract termination provisions are, according to SDG&E, unique in that they allow either party to terminate for its convenience at any time, without cause and with no obligation to pay the termination charges.

SDG&E alleges that the terms of the Contract are reasonable. While both the Revenue Requirements, P&P, and Legal divisions of the Commission staff and San Diego took issue with the allocation of the Contract costs among the participating parties, neither party took a position that the terms of the Contract were unreasonable. The uncontradicted evidence of record supports SDG&E's position regarding the reasonableness of the Contract.

Project Cost Shares

Tabulated below are the participant shares of the various parties as shown for the 1979 proposal and for the latest 1982 estimate of record including and excluding SDG&E's proposed energy credit:

Participants	1979 Proposal		1982 Estimated			
			With Energy Credit		Without Energy Credit	
	Funding	Percent	Funding	Percent	Funding	Percent
	(Dollars in Millions)					
DOE	$ 67.1	50.0%[b]	$ 61.0[a]	48.1%	$ 61.0[a]	32.4%
EPRI	8.4	7.0	12.7	10.0[b]	12.7	6.7
SCE	3.6	3.0	2.5[a]	2.0	2.5[a]	1.3
State	-	-	2.0[a]	1.6	4.4	2.3
IID	7.2	6.0	4.9	3.8	10.9	5.8
CDWR	2.0	1.0	1.6	1.2	3.6	1.9
Other	2.5	2.0	-	-	-	-
SDG&E	37.6	31.0	42.2	33.3	93.5	49.6
Total	$128.4	100.0%	$126.9	100.0%	$188.6	100.0%

a/ Fixed Dollar Amount
b/ Fixed Percentage

It will be noted that in the 1979 proposal, DOE's participant share was shown as $67.1 million or 50% as contrasted to the 1982 estimated figures of $61 million or 48.1%. DOE entered into a Cooperative Agreement with SDG&E in September 1980. At that time the proposed estimated project cost was $122 million and DOE agreed to fund 50% or $61.0 million, but established this $61 million as the upper limit for DOE participation.

The ownership shares of the various parties for the 1979 proposal and for the latest 1982 estimates are as follows:

Owners	Percent Ownership 1979	1982
IID	14.6	9.7
CDWR	4.0	3.2
Other	5.1	-
State	-	3.9
SDG&E	76.3	83.2
	100.0%	100.0%

According to the contracts, the electrical energy generated at the Heber plant will be allocated to the parties in accordance with the above ownership shares. Energy credits and costs in any form are to be distributed in accordance with these ownership shares.

Project Cost Recovery

We have before us for consideration three different project costs to SDG&E ratepayers as follows: (1) the D.91271 limit of $37.6 million; (2) the $63 million limit proposed by the Commission staff's Revenue Requirements and P&P divisions; and (3) the $93.4 million limit indirectly proposed by Utilities Division and SDG&E. These numbers do not include the effect of energy generated by the project. SDG&E's share of energy would displace other sources of power with a value estimated to be between $22 million and $33.5 million.

The only proposal of record which would maintain the D.91271 limit of $37.6 million computed as set forth in the decision was made as one of three alternatives by the staff's Utilities Division witness. He testified that he did not believe that SDG&E could obtain the additional participant support necessary to stay within that limit and, therefore, the Project would probably be terminated.

The $63 million limit, including the ECAC offset, is recommended by the P&P, Legal, and Revenue Requirements divisions. The P&P witness testified that to be consistent with the dictates of D.91271, SDG&E's total share of the Project costs should be computed in accordance with its participant share of approximately 33.3% Applying this percentage to the total Project costs of $188.6 million results in the above participation limit without a strong compelling showing justifying a higher limit. According to this witness, the increase from $37.6 million to $63 million is justified on the basis that consideration should be given to: (1) the three years' inflation since the Project costs were originally estimated and (2) the required turbine design changes which account for a lot of the plant cost increase from $100 to $127 million. She further testified that the recommended limit recognizes that there are nonquantifiable benefits associated with the Project. If there were not, P&P would look at the costs in cents per kWh as compared with the costs of commercial energy available at the time.

Revenue Requirements Division's witness supported the $63 million limit on the basis that at the anticipated capacity factor it approximated the long-run avoided cost. According to his testimony, energy produced by an RD&D project is worth short-run avoided costs. If the Project becomes and remains commercial, then energy during the RD&D period will, in retrospect, have been worth long-run avoided costs as it will have displaced SDG&E's need for a certain amount of additional capacity. On this basis, this witness supports the $63 million limit.

The Commission staff argues that if there were no indirect benefits, the appropriate level of costs during the RD&D period would simply be the short-run avoided cost of 7¢ per kWh, but since there are indirect benefits, the Commission should set a higher funding level. According to the Commission staff, an allowance of 5¢ per kWh more than covers the indirect benefits which ratepayers might receive

from the Project and exceeds SDG&E's estimates of indirect benefits of 2.70¢ per kWh during the RD&D period plus 2.17¢ per kWh during the commercial period, a total of 4.87¢ per kWh. This total includes benefits which ratepayers may receive if SDG&E builds another plant in 1992. At SDG&E's anticipated generation level the 7¢ per kWh short-run avoided cost and 5¢ per kWh indirect benefits, a total of 12¢ per kWh, results in a total Project cost to ratepayers of about $63 million. The staff further argues that the 12¢ per kWh cost is based on an unrealistic capacity factor of 77.1% and that if the Project only achieves 50% availability during the RD&D phase the energy cost (assuming $63 million total cost) will approximate 18¢ per kWh, which they believe includes an extremely generous allowance for indirect benefits.

In its brief the Commission staff states that the Revenue Requirements, P&P, and Legal divisions believe that the Commission should not base its decision in this proceeding on whether or not the Project will go forward, but should instead concern itself with determining the fair and appropriate level of ratepayers' funding for the Project in light of the benefits which SDG&E's ratepayers can reasonably hope to receive from it.

Having determined that, the Commission should, according to the staff, leave the decision of whether the Project continues or terminates to SDG&E and other participants. We agree that the benefits the SDG&E ratepayer could derive from the Project are determinative as to whether or not the Project should go forward. The Project was endorsed to permit the exploration of an economically feasible viable alternative source of electric power generation. Should such a binary-cycle geothermal electric generating plant prove itself, the benefits to electric ratepayers in SDG&E's service territory, the State of California, and any area possessing geothermal resource will be substantial. Although we have difficulty quantifying the indirect benefits derived from the Project, these

benefits are real and must be considered in our decision to approve continuation of the Project. We are, and have been, actively pursuing alternative sources of generation that will decrease dependence on declining and/or imported fossil fuel, will increase utilities' resource bases, and will have a beneficial effect on the environment. A binary-cycle geothermal plant, should it prove to be a viable alternative electric generating source, meets these criteria. The viability of such a plant can only be determined by building and operating a commercial size demonstration plant such as this Heber Project. Under these circumstances, we believe the Project should go forward provided, of course, that the cost to SDG&E's ratepayers is not excessive.

As proposed by SDG&E and proposed by the Utilities Division engineer, the Project costs to SDG&E ratepayers are estimated to be $93.5 million consisting of, according to Commission staff estimates, $42.2 million RD&D costs and $51.3 million energy exenses. The $42.2 million RD&D costs are those costs incurred prior to initial synchronization and the $51.3 million energy expenses are heat contract costs after initial synchronization. SDG&E asks that it be allowed to recover its heat costs in ECAC proceedings in proportion to its share of the electricity generated by the plant. This would, in effect, define the value of energy generated by the Project as equal to the Contract costs. We have previously discussed the fallacy of such an interpretation of the provisions of D.91271. In accordance with the Utilities Division engineer's proposal, the costs incurred after synchronization and prior to commercial operation would not be counted as RD&D costs and SDG&E would be allowed to recover such costs in ECAC proceedings in accordance with its ownership share. The apparent costs to SDG&E ratepayers would be the same in either case.

SDG&E argues that the above $93.5 million limit is reasonable in that the anticipated unit cost of energy generated lies

within the range of forecast marginal energy cost and reflects numerous nonquantifiable benefits to SDG&E ratepayers through the demonstration period, and that the forecast availability factors are reasonable. The justification of the reasonableness of the costs discussed above is completely dependent on the accuracy of the estimates underlying the conclusions. It appears essential that some reasonable limit of ratepayer participation be imposed to adequately protect SDG&E ratepayers without terminating the Project.

As previously stated, the Utilities Division engineer articulated three possible Commission approaches to deal with the fact that the ratepayers' share of Heber costs will exceed the $37.6 million limit set in D.91271. One of these approaches would be to adopt a new higher limit to ratepayer involvement which SDG&E could reasonably be expected to observe without obtaining additional participants or more funds from existing participants. He proposes that should the Commission adopt this approach, the new higher limit be computed by adding SDG&E's currently forecast capital expenditures and costs under the heat contract to generate the total gross expenditures and deducting the value of the electricity generated at 50% plant availability and forecasted short-run avoided energy cost. In determining whether contract costs, other operating costs, and capital costs combined have exceeded the limit thus established the value of electricity actually generated at avoided cost at that time would be subtracted from the total capital and operating accounts. The witness further testified that he would expect SDG&E to trend those costs and if anything occurred which would indicate SDG&E might exceed the limit sometime in the future, it would immediately notify the Commission and that he would not expect SDG&E to wait until it had actually exceeded the limit before such notification.

Both the incremental demand charge and the demand charge set forth in the heat contract represent a major portion of the heat cost billings and are relatively unaffected by the amount of electric

energy generated. Consequently, the heat cost per kWh is substantially greater at lower capacity factors than at higher capacity factors. In our opinion, the higher unit costs caused by operating the plant at a low capacity factor are an unreasonable burden for SDG&E's ratepayers. Consequently, a limit of ratepayer involvement based on the maintenance of a relatively high capacity factor, such as proposed by witness Ajello, appears both reasonable and desirable. However, as indicated the record, the $93.4 million total Project and heat costs are based on a capacity factor of 77.1% and are not compatible with the 349.35 M^2 kWh used in witness Ajello's example. The correct heat cost at 50% capacity factor is $49.8 million which added to $39.9 million Project costs equals $89.7 million. This equals about 25¢/kWh. Furthermore, according to witness Ajello's testimony, the energy should be valued at SDG&E's avoided energy cost, which SDG&E estimated to be about 6.3¢ per kWh. Using these two figures to compute the limit of ratepayer participation above avoided costs yields a figure of $67.7 million. This limit will cost ratepayers a total of about $90 million in RD&D costs as long as 50% capacity is maintained.

Witness Ajello's recommendation that SDG&E be required to notify the Commission as soon as it appears that the limit might be exceeded is a good one and will be implemented. We shall also require SDG&E to obtain prior Commission approval for anticipated costs which exceed 5% of the cost limit found reasonable by this decision.

As indicated above, Ajello's funding limit translates into a total project cost to SDG&E ratepayers of approximately $27 million more than the staff proposal. Put another way, Ajello's proposal places a value of approxiamtely $68 million on the indirect benefits to this project. The staff proposal establishes this value at approximately $40 million. We will approve an $89.7 million ratepayer funding limit. We are willing to allow the higher funding limit because we believe that the plausible range of associated indirect benefits extends to this level. Further, the project is much more likely to go forward with this higher ratepayer contribution.

The funding procedure outlined by Ajello places a limit on ratepayers costs over and above avoided energy costs, whereas the Commission staff proposal places a limit on total project costs, including energy expenses. The two types of funding procedures have identical effects if all our projections are correct. However, there are significant differences if one or more of our assumptions are incorrect:

1. If actual project costs are higher than expected (either due to cost overruns, or to increased electricity output), a funding limit on costs "above avoided energy costs" could automatically increase ratepayer funding for this project up to the limit.

   A ceiling on total project costs, on the other hand, would require SDG&E to approach the Commission if any part of the increase were due to cost overruns. Depending on the actual ceiling level, SDG&E may also need to request additional funding for higher than expected performance.

2. If avoided costs are lower than projected, and a limit is placed upon ratepayer RD&D funding above avoided energy costs, SDG&E will experience a significant shortfall in funding, even if plant performance and project costs meet projected levels.

   With a ceiling on total project costs, on the other hand, ratepayers would cover all project costs up to that limit, regardless of the variation in short-run avoided costs. As part of its decision in this case, the Commission must consider which funding limit mechanism, given the differences summarized above, makes the most sense for this RD&D project. We believe that a limit on total project costs offers the best solution. The Commission will have greater scrutiny of the capital and contract costs, which are highly uncertain. Furthermore, we do not feel that project funding for RD&D, particularly as it relates to a long-term resource option, should be directly tied to variability in short-run avoided costs.

We note that the limit of $89.7 million is based on the assumption that the plant will operate at a 50% capacity factor. If the plant produces at a higher level, SDG&E may enter associated energy costs into its ECAC account. At higher capacity factors, ratepayers pay less for each unit of power received. Cost increases due to factors other than higher output will not be put into rates without a compelling showing.

Other Items

Included under this heading are the full review of total Project costs, consideration of Commission staff recommendations acceptable to SDG&E, and an additional recommendation that SDG&E notify the Commission before giving notice to Union Oil of its intent to terminate the Project.

As previously noted, staff Recommendation 6 would require that the entire Project costs (including brine costs) must be reported in the annual April 15 RD&D report and other RD&D filings in conformance with the definitions/guidelines developed in OII 82-08-01 and set forth in D.82-12-005. SDG&E intends to fully comply with the requirements of D.82-12-005, but expresses concern with respect to overlapping jurisdiction of the review of the reasonableness of heat contract costs. SDG&E believes the ECAC proceeding should render a determination of the reasonableness of the contract costs which have already been incurred, whereas the review of the RD&D projects should look prospectively at the desirability of continuing a particular RD&D project. The staff position is that all Project costs should be presented together in the RD&D report so that the staff and the Commission can make a comprehensive review to determine whether the Project continues to meet the Commission's criteria for RD&D projects and whether the Project is proceeding in accordance with its goals.

These positions are not mutually exclusive. The ratepayer participation limit established for the Project is based on the current heat and marginal energy costs which are properly reviewed in connection with ECAC proceedings. This information is used in the RD&D review as a vital component part of the prospective review of the Project's operations. On this basis there is no overlapping jurisdiction in the RD&D and ECAC reviews.

The staff recommends that recovery during the commercial period for ratemaking purposes be limited to a maximum amount equal to long-run avoided cost and that the RD&D phase be limited to four years from first fluid delivery. SDG&E finds these recommendations acceptable because: (a) it intends to operate the plant competitively with other sources of generation during the commercial operation, and (b) because it believes the length of the RD&D phase will be determined by the requirements of the Project and cannot foresee any extension of the RD&D phase beyond the presently contemplated conclusion at the end of 1987. It notes that Project financing will not support an extension of the period, there are no benefits to the other Project sponsors who must approve such an extension, the negotiations to decrease the field O&M cannot take place until the demonstration period ends, and there will be no revenue sharing until the start of the commercial period. Notwithstanding this reasoning, SDG&E conditions its acceptance of this recommendation on the adoption of Recommendation 4 which provides for the filing of a formal application for an extension of the demonstration period prior to December 1, 1987. Both of these recommendations appear to be reasonable and will be adopted.

The staff's second recommendation is that at the end of 3½ years from first fluid delivery, SDG&E must file a report with the Commission summarizing experience at that time, giving Project costs and performance, and indicating status and future of the project. SDG&E acknowledges the desirability of such a report, but notes that it has an obligation to DOE to prepare a Final Report containing this

information for submittal three months after the demonstration period concludes. SDG&E proposed at the hearing that the report to DOE be used in lieu of a separate report. SDG&E believes that the report to DOE would supply much more information than sought by the Commission and has no objection to providing the report plus any supplementary information necessary to the Commission. SDG&E also believes the timing of the DOE report, i.e. three months after the conclusion of the demonstration period, is more appropriate than the staff's recommendation that the report be filed prior to the conclusion of the demonstration period. We agree and will adopt SDG&E's proposal in this respect. It is noted that much of the information required will be filed annually in connection with the RD&D reviews.

The staff's third recommendation is that the commercial period as defined for ratemaking purposes shall begin after the RD&D phase, but no later than four years after first fluid delivery to the plant. This recommendation appears reasonable, is acceptable to SDG&E, and will be adopted.

Staff also recommended that SDG&E be paid long-run avoided cost for power produced during the commercial phase of the Project. SDG&E agreed with that proposal. We do not agree, however, that long-run avoided cost is an appropriate level of payment to SDG&E in this case. Since ratepayers will bear all Project risks and costs of construction and operation during the RD&D phase, SDG&E should not have the opportunity to realize a return on the plant during the commercial phase. Rather ratepayers should have the opportunity to recoup some of their costs.

Ratepayers should only pay for the reasonable costs of operating and maintaining the plant during the commercial phase. At that time, SDG&E may recover its expenses for project operation and

maintenance. We will not consider as reasonable continued ratepayer energy purchases which exceed SDG&E's long-run avoided costs during the commercial phase of the Project.

In its brief, the Commission staff states:

> "The brine contract, Appendix A of SDG&E's amended application, sets forth termination provisions at pages 47 through 52. Either SDG&E or Union has the right to terminate the contract without cause by giving notice to the other party in the manner set forth in the contract. If SDG&E wishes to terminate without cause it must offer its rights and obligations under the contract to the other participants in the project. If SDG&E cannot make this assignment, SDG&E must offer its ownership interest in the plant to Union. Termination by Union is subject to similar provisions regarding its field facilities. Because of the risk to ratepayers' funds from a termination without cause, the Commission order in this proceeding should require SDG&E to give the Commission 30 days prior notice before giving notice of its intent to terminate the project or of its intent to assign rights under the brine contract." (Page 45.)

This position is well taken and the recommendation will be adopted.

XI - FINDINGS AND CONCLUSIONS

Findings of Fact

1. It is only through the installation and operation of a commercial size plant such as the proposed Heber Project that the knowledge required to evaluate the economic feasibility of binary-cycle geothermal plants can be obtained.

2. Should the Heber Project prove out as anticipated, it will provide the information required to demonstrate whether binary-cycle geothermal generation is a viable technology, and thus enable the development of additional geothermal resources in Imperial County and other areas.

3. The primary nonquantifiable benefit unique to the Project is the information it will provide which is necessary to determine the commercial viability of binary geothermal plants.

4. Other external or nonquantifiable benefits of the Project under consideration include a reduction in air pollution, a reduction in reliance on oil and gas as fuel for generating electricity, and a diversification of SDG&E's resource base.

5. Ordering Paragraph 3 of D.91271 stating:

> "SDG&E must justify with a strong compelling showing all amounts which exceed the estimates shown in the DOE proposal totaling $37.6 million for its share." (3 CPUC 2d at 232, 233.)

does not establish a maximum ceiling for SDG&E's participant costs of the Project, but demonstrates our increasing vigilance to safeguard both SDG&E and its ratepayers.

6. Finding 26 of D.91271, which states:

> "26. Any electric power generated by the Heber plant would be allocated to the participant owners in accordance with their respective ownership interests in the plant. Any revenues from sales by SDG&E will be credited back to offset project costs." Id. p.230

relates to the commercial and not the demonstration period of the Project, and does not provide for the $37.6 million participant share of the Project costs for the demonstration period as a net figure.

7. The funding of the Project set forth in D.91271 was not predicated on the assumption that substantial quantities of electric energy would be generated.

8. The terms and conditions of the heat contract between Union Oil and SDG&E during the RD&D phase of the Project are reasonable.

9. During the commercial phase of the project energy purchases which exceed SDG&E's long-run avoided cost are not reasonable.

10. Energy credits and costs are to be distributed to the participants in accordance with the ownership share as established by contract.

11. D.91271 established SDG&E's participant share of the Project costs at $37.6 million including heat costs during the demonstration period. Computing its participant share of the costs

in the same manner and reflecting current estimates would result in a participant share of $62.8 million including heat costs during the demonstration period.

12. The cost/benefit ratio of this one plant should not be the only guideline for judging whether the Project should go forward.

13. The Project was endorsed in D.91271 to permit the exploration of an economically viable alternative source of electric power generation.

14. The Project costs to SDG&E ratepayers are currently estimated to be $93.5 million consisting of $42.2 million RD&D costs and $51.3 million energy expense. These costs assume a 77% capacity factor for the Project.

15. The accuracy of the projected costs described above depends on the accuracy of the estimates underlying the forecasts. Consequently, a finite limit on ratepayer involvement should be established.

16. The incremental demand charge and the demand charge set forth in the heat contract represent a major portion of the heat cost billings and are relatively unaffected by the amount of electric energy generated. Consequently, the heat cost per KWh is substantially greater at lower capacity factors than at higher capacity factors.

17. The higher unit costs caused by operating the plant at a low capacity factor may impose an unreasonable burden on SDG&E's ratepayers.

18. The current estimate of total costs for the demonstration period, based on a 50% capacity factor, is $89.7 million.

19. The ECAC review of brine expenses associated with the generation of electric energy should be a retrospective audit of such expenses.

20. The brine expenses verified as described above should be included in total Project costs considered in the RD&D review to prospectively determine whether the Project is proceeding in accordance with its goals.

21. Because ratepayers will assume all risks and costs of project construction during the RD&D phase, SDG&E should only receive reasonable operating and maintenance expenses during the commercial phase which are not to exceed long-run avoided costs. The reasonableness review of these costs will take into consideration such factors as the cost data obtained during the demonstration period.

22. The RD&D phase of the Project should be limited to four years from first fluid delivery.

Conclusions of Law

1. The Project should be permitted to go forward provided the cost to SDG&E's ratepayers is not excessive.

2. It is essential to establish a reasonable limit of ratepayer participation to properly protect SDG&E's ratepayers.

3. The limit of ratepayer involvement in the Project should be based on total current gross expenditures.

4. A limit of ratepayer involvement in the proposed Project of $89.7 million without a compelling showing justifying a higher amount is reasonable.

5. SDG&E should be required to notify Commission if projected total Project costs, including brine costs, exceed the limit of $89.7 million. SDG&E should seek prior Commission approval of anticipated costs which exceed by 5% the limit of $89.7 million.

6. All Project costs (including brine costs) should be reported in the annual April 15 RD&D report in conformance to the definitions/guidelines set forth in D.82-12-005 in OII 82-08-01.

7. Should SDG&E anticipate a need to request a delay in entering the commercial phase, it should submit a formal application requesting an extension prior to December 1, 1987.

8. SDG&E should furnish the Commission a copy of its final report to DOE no later than three months after the conclusion of the demonstration phase.

9. SDG&E should be required to give this Commission 30 days prior notice before giving notice of its intent to terminate the Project or its intent to assign rights under the brine contract.

O R D E R

IT IS ORDERED that:

1. During the research, development, and demonstration (RD&D) phase, San Diego Gas & Electric Company (SDG&E) is authorized to recover its participant share of reasonable capital costs and operations and maintenance (O&M) expenses for the Heber Project through its RD&D balancing account authorized in Decision (D.) 91271. SDG&E's participant share of heat costs incurred prior to initial synchronization shall also be recovered through the RD&D balancing account.

2. After initial synchronization, SDG&E is authorized to recover its ownership share of payments under the heat sales agreement through its Energy Cost Adjustment Clause (ECAC) balancing account subject to a review of reasonableness.

3. SDG&E shall furnish semiannual reports to the Commission staff which detail and justify actual and estimated expenditures, and describe progress made.

4. In compliance with D.82-12-005 in Order Instituting Investigation 82-08-01, SDG&E shall report the entire project costs (including brine costs) in the annual April 15 RD&D report.

5. The limit of ratepayer participation is established at $89.7 million. SDG&E shall immediately notify this Commission if projected costs indicate this limit will be exceeded. SDG&E shall seek prior Commission approval of anticipated costs which exceed by 5% the limit of $89.7 million. This limit includes all capital, operating and maintenance, and brine contract costs.

6. The contract costs, other operating costs, and brine costs shall be reviewed for reasonableness in connection with SDG&E's ECAC proceedings.

7. The contract costs, other operating costs, and brine costs, as set forth in Ordering Paragraph 6 above, shall be included in the annual RD&D filing to permit the Commission and its staff to determine whether the Project is proceeding in accordance with its goals.

8. The RD&D phase of the project shall end at the beginning of the commercial phase, but not later than four years from first fluid delivery unless this time is extended by further Commission decision.

9. Recovery of costs during the commercial phase of the project shall be limited to reasonable operating and maintenance expenses. These costs shall be accounted for and reviewed in SDG&E's ECAC account. In reviewing the reasonableness of these costs, Commission staff will include in their considerations the cost data developed during the demonstration phase of the project and the avoided energy costs of other long-run alternatives available to SDG&E.

10. SDG&E shall furnish the Commission a copy of its final report to DOE no later than three months after the conclusion of the demonstration phase of the project.

11. SDG&E shall notify this Commission 30 days prior to giving notice of its intent to terminate the project or assign rights under the brine contract.

This order becomes effective 30 days from today.

Dated May 18, 1983, at San Francisco, California.

LEONARD M. GRIMES, JR.
President
VICTOR CALVO
PRISCILLA C. GREW
DONALD VIAL
Commissioners

I will file a concurring opinion.
/s/ LEONARD M. GRIMES, JR.
Commissioner

I will file a concurring opinion.
/s/ DONALD VIAL
Commissioner

I CERTIFY THAT THIS DECISION WAS APPROVED BY THE ABOVE COMMISSIONERS TODAY.

Joseph E. Bodovitz, Executive Director

COMMISSIONER LEONARD M. GRIMES, JR., Concurring:

I join in the Commission's endorsement today of two utility contracts with nonutility companies for the purpose of producing electricity from two novel alternative energy technologies, large-scale wind turbines and binary-cycle geothermal energy.[1/] In both decisions, we recognize that the cost to ratepayers of electricity generated by the projects may exceed the avoided cost of conventional generation over their lives; both certainly are more expensive in the short term.

In both cases, these added exposures are reasonable, as means to attempt to demonstrate the commercial viability of the new technologies. Today's decisions reaffirm Commission policy recognizing that reasonable demonstration projects are in the ratepayers' best interests. Such projects are necessary if California is to develop a sustainable, diversified energy resource mix.

Two years ago tomorrow, in D.93035 (in A.59512, dated May 19, 1981) I presented the following list of values which may justify projects with costs exceeding the avoided cost benchmark:[2/]

1. A likelihood that energy from the project will cost less than the avoided cost for a significant part of the life of the project.
2. Promotion of a demonstrated and promising technology in which early investments entail a high risk to the utility.
3. Promotion of a demonstrated and promising technology which has not achieved economies of scale from mass production and appears likely to produce energy below avoided costs when such economies are achieved.
4. Reduced air or water pollution as measured by the value of trade-offs that would be necessary to generate comparable energy with oil.

1/ D.83-05-043, in A.82-12-22 by PG&E, and D.83-05-047 in A.82-08-49 by SDG&E, respectively. The same concurring language appears in both decisions.

2/ In a concurring opinion joined by then - Commissioner Richard D. Gravelle

5. Reliability or security of the fuel supply being greater than that for oil or, at a minimum, being domestically controlled.
6. Demonstrable benefit to the ratepayers caused by recycling of energy expenditures in the California economic.
7. More rapid return on investment of the utility due to shorter construction lead times.
8. Reduced or avoided capital requirements for the utility.
9. Greater diversity of energy resources.
10. Broader dispersion of generating stations.

The PG&E - Aeroturbines Power Sales Agreement and the SDG&E - Union Geothermal Sales Contract present a number of these values. Both projects bear a likelihood of costing less than avoided cost for a significant part of plant life. Both tap dispersed domestic renewable resources with environmental benefits over conventional energy sources.

Most important, however, is the demonstration value of these two projects. If large-scale wind turbines and binary-cycle processes for moderate temperature geothermal resource prove commercially viable, California's electricity consumers stand to gain hundreds of megawatts of new electricity generating capacity. This would represent a significant diversification of the state's energy mix, reducing further reliance on unpredictable conventional resources.

In both decisions, the Commission expresses its concern that important economic, financial and operational data remain under the control of nonutility corporations. We thereby lose a certain amount of the operational understanding usually available through review of the utilities' own records. This loss of control may be inevitable if we are to attract new actors into the electricity market. Our avoided cost benchmark provides an important market-based test of the value of these actors' participation.

If the demonstrations approved today succeed, the Commission will certainly apply our avoided cost benchmark to subsequent

large-scale wind or binary-cycle geothermal plants. Once the technologies are proven commercially viable, they will be evaluated in competition with other viable alternatives. The purpose of today's actions are to make such competition possible.

LEONARD M. GRIMES, JR., COMMISSIONER

San Francisco, California
May 18, 1983

DONALD VIAL, Commissioner, Concurring:

I join with my fellow Commissioners in the approval of this geothermal RD and D project. The innovative binary geothermal technology that will be demonstrated at the Heber site holds great promise for utility ratepayers. If the binary technology proves to be a workable, reliable method of utilizing geothermal heat, it will allow many new geothermal reservoirs to be used for electric generation and will lessen our current dependence on oil and gas. For this reason, I believe the project should go forward.

While I concur with the approval of the project, I am troubled by the cost of the facility and, in particular, by the allocation of project costs among the participants. It is clear that the primary benefit of this RD and D project is the information that is gained about the viability of the binary technology. This benefit is national in scope: it will be useful in all areas of potential geothermal development and will contribute to the nation's ability to reduce its dependence on imported oil and gas. Accordingly, the funding for the RD and D should primarily be national in scope and the Department of Energy should be the primary participant. It would be unfair for the ratepayers of a single utility to bear the bulk of project costs when the benefits flow equally to the nation as a whole.

It is precisely this inequity that we are faced with as we pass judgment on the Heber project. Since the Commission first considered the project in 1979, DOE funding for the project has declined even as the costs of the project have substantially increased. In order to allow the project to go forward, San Diego ratepayers have had to "take up the slack" and become the primary funding source for the facility.

This inequity associated with the Heber project is an example of a larger problem that the Commission now faces. Because the present administration in Washington is pursuing short-sighted policies aimed at slashing federal RD and D funding, particularly for renewable energy technologies, the Commission is left with a regrettable choice. We are forced to choose between allowing our renewable energy options to be foreclosed or to "take up the slack" left by federal inaction and require California ratepayers to bear the primary burden of RD and D costs.

In the case of Heber we have resolved this dilemma in favor of substantial ratepayer funding. The technology is important enough to warrant this outcome. In the future, we will have to make judicious use of ratepayer RD and D funding as we try to fill the vacuum left by the federal retrenchment and inaction. We will need to carefully target funding to those technologies that have a broad potential and are in a critical stage of development. I hope that future utility applications to the Commission will reflect this need.

DONALD VIAL, Commissioner

May 18, 1983
San Francisco, California

These positions are not mutually exclusive. The ratepayer participation limit established for the Project is based on the current heat and marginal energy costs which are properly reviewed in connection with ECAC proceedings. This information is used in the RD&D review as a vital component part of the prospective review of the Project's operations. On this basis there is no overlapping jurisdiction in the RD&D and ECAC reviews.

The staff recommends that recovery during the commercial period for ratemaking purposes be limited to a maximum amount equal to long-run avoided cost and that the RD&D phase be limited to four years from first fluid delivery. SDG&E finds these recommendations acceptable because: (a) it intends to operate the plant competitively with other sources of generation during the commercial operation, and (b) because it believes the length of the RD&D phase will be determined by the requirements of the Project and cannot foresee any extension of the RD&D phase beyond the presently contemplated conclusion at the end of 1987. It notes that Project financing will not support an extension of the period, there are no benefits to the other Project sponsors who must approve such an extension, the negotiations to decrease the field O&M cannot take place until the demonstration period ends, and there will be no revenue sharing until the start of the commercial period. Notwithstanding this reasoning, SDG&E conditions its acceptance of this recommendation on the adoption of Recommendation 4 which provides for the filing of a formal application for an extension of the demonstration period prior to December 1, 1987. Both of these recommendations appear to be reasonable and will be adopted.

The staff's second recommendation is that at the end of 3½ years from first fluid delivery, SDG&E must file a report with the Commission summarizing experience at that time, giving Project costs and performance, and indicating status and future of the project. SDG&E acknowledges the desirability of such a report, but notes that it has an obligation to DOE to prepare a Final Report containing this

information for submittal three months after the demonstration period concludes. SDG&E proposed at the hearing that the report to DOE be used in lieu of a separate report. SDG&E believes that the report to DOE would supply much more information than sought by the Commission and has no objection to providing the report plus any supplementary information necessary to the Commission. SDG&E also believes the timing of the DOE report, i.e. three months after the conclusion of the demonstration period, is more appropriate than the staff's recommendation that the report be filed prior to the conclusion of the demonstration period. We agree and will adopt SDG&E's proposal in this respect. It is noted that much of the information required will be filed annually in connection with the RD&D reviews.

The staff's third recommendation is that the commercial period as defined for ratemaking purposes shall begin after the RD&D phase, but no later than four years after first fluid delivery to the plant. This recommendation appears reasonable, is acceptable to SDG&E, and will be adopted.

Staff also recommended that SDG&E be paid long-run avoided cost for power produced during the commercial phase of the Project. SDG&E agreed with that proposal. We do not agree, however, that long-run avoided cost is an appropriate level of payment to SDG&E in this case. Since ratepayers will bear all Project risks and costs of construction and operation during the RD&D phase, SDG&E should not have the opportunity to realize a return on the plant during the commercial phase. Rather ratepayers should have the opportunity to recoup some of their costs.

Ratepayers should only pay for the reasonable costs of operating and maintaining the plant during the commercial phase. At that time, SDG&E may recover its expenses for proejct operation and

in the same manner and reflecting current estimates would result in a participant share of $62.8 million including heat costs during the demonstration period.

12. The cost/benefit ratio of this one plant should not be the only guideline for judging whether the Project should go forward.

13. The Project was endorsed in D.91271 to permit the exploration of an economically viable alternative source of electric power generation.

14. The Project costs to SDG&E ratepayers are currently estimated to be $93.5 million consisting of $42.2 million RD&D costs and $51.3 million energy expense. These costs assume a 77% capacity factor for the Project.

15. The accuracy of the projected costs ~~in Finding 13~~ described above, depends on the accuracy of the estimates underlying the forecasts. Consequently, a finite limit on ratepayer involvement should be established.

16. The incremental demand charge and the demand charge set forth in the heat contract represent a major portion of the heat cost billings and are relatively unaffected by the amount of electric energy generated. Consequently, the heat cost per kWh is substantially greater at lower capacity factors than at higher capacity factors.

17. The higher unit costs caused by operating the plant at a low capacity factor may impose an unreasonable burden on SDG&E's ratepayers.

18. The current estimate of total costs for the demonstration period, based on a 50% capacity factor, is $89.7 million.

19. The ECAC review of brine expenses associated with the generation of electric energy should be a retrospective, technical audit of such expenses.

20. The brine expenses verified as described ~~in Finding 22~~ above should be included in total Project costs considered in the RD&D review to prospectively determine whether the Project is proceeding in accordance with its goals.

21. Because ratepayers will assume all risks and costs of project construction during the RD&D phase, SDG&E should only receive reasonable operating and maintenance expenses during the commercial phase. The reasonableness review of these costs will take into consideration such factors as the cost data obtained during the demonstration period, ~~as well as the long-run avoided cost of alternative energy sources available to SDG&E at the time.~~

22. The RD&D phase of the Project should be limited to four years from first fluid delivery.

Conclusions of Law

1. The Project should be permitted to go forward provided the cost to SDG&E's ratepayers is not excessive.

2. It is essential to establish a reasonable limit of ratepayer participation to properly protect SDG&E's ratepayers.

3. The limit of ratepayer involvement in the Project should be based on total current gross expenditures.

4. A limit of ratepayer involvement in the proposed Project of $89.7 million without a compelling showing justifying a higher amount is reasonable.

5. SDG&E should be required to notify Commission if projected total Project costs, including brine costs, exceed the limit of $89.7 million. SDG&E should seek prior Commission approval of anticipated costs which exceed by 5% the limit of $89.7 million.

6. All Project costs (including brine costs) should be reported in the annual April 15 RD&D report in conformance to the definitions/guidelines set forth in D.82-12-005 in OII 82-08-01.

7. Should SDG&E anticipate a need to request a delay in entering the commercial phase, it should submit a formal application requesting an extension prior to December 1, 1987.

8. SDG&E should furnish the Commission a copy of its final report to DOE no later than three months after the conclusion of the demonstration phase.

11. SDG&E shall notify this Commission 30 days prior to giving notice of its intent to terminate the project or assign rights under the brine contract.

This order becomes effective 30 days from today.

Dated MAY 18 1983, at San Francisco, California.

I will file a concurring opinion.
/s/ Leonard M. Grimes, Jr.
Commissioner

I will file a concurring opinion.
/s/ Donald Vial
Commissioner

LEONARD M. GRIMES, JR.
President
VICTOR CALVO
PRISCILLA C. GREW
DONALD VIAL
Commissioners