MAKUSHIN GEOTHERMAL PROJECT

REVIEW OF OESI DEVELOPMENT PLAN

ALASKA INDUSTRIAL DEVELOPMENT AND EXPORT AUTHORITY

May 1994

June 13, 1994

R·W·BECK

Mr. Dave Eberle
Alaska Industrial Development & Export Authority
480 West Tudor
Anchorage, Alaska 99503-6690

Dear Dave:

Subject: Makushin Geothermal

Enclosed is the report summarizing the review team's findings regarding OESI's Development Plan of the Makushin Geothermal Project. The report incorporates comments provided through the beginning of May 1994.

We of the review team appreciate the opportunity to assist the Authority in its review of this project. Should you or others have any questions concerning this report, please do not hesitate to contact any member of the review team.

Sincerely,

R. W. BECK, INC.

Michael D. Hubbard
Director of Alaska Operations

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File: WS2156AA2AG

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Makushin Geothermal Project
Review of OESI Development Plan

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I. INTRODUCTION AND PURPOSE OF REPORT

The technical, economic and financial feasibilities of the Unalaska Geothermal Project (the "Project") have been investigated over the past several years by both the Alaska Energy Authority ("AEA") and the Alaska Industrial Development and Export Authority (the "Authority"). These early studies have shown that while there are certain risks associated with the Project, development of this geothermal resource could under certain conditions provide net economic and other benefits over present diesel generation.

As the studies progressed, it became clear that the amount of energy sold from the Project and the security provided by the purchasers would both play important roles in the success of the Project. In order for sufficient energy sales to occur, the local electric utility (owned and operated by the City of Unalaska) and the fish processors that currently produce their own power would all have to participate in the Project. Furthermore, the purchasers must make a commitment to purchase Project power in order for bonds to be sold or for the State not to absorb all of the risk.

The growing peak and total energy requirements of the City and the processors have caused them to operate their diesel generators in amounts that approach or, in some cases, exceed that allowed under their existing air quality operating permits. This, in turn, has given rise to renewed interest in the Project. Consequently in June 1993, a meeting was held in Juneau with the processors and the City of Unalaska to determine their interest in the Project and what type of commitments they might make.

At the meeting, it was determined that:

1. A take-or-pay contract was not acceptable to the processors, although some form of requirements contract was a possibility; and

2. The proposed delivered cost of 12.0 cents/kilowatt-hour (in 1992 dollars) might be acceptable.

After the meeting, the proposed Project developer, OESI Power Corporation ("OESI"), offered to submit a proposal for the development of the Project. The proposal was to be based on a turnkey development where the State does not take ownership of the Project until it is operational. The price of the delivered power was to be 12.0 cents per kilowatt-

hour in 1992 price levels including 1.5 cents per kilowatt-hour for distribution and other costs estimated by the City of Unalaska. OESI submitted its proposed development plan to the Authority on August 18, 1993, although it has since been revised to accommodate Authority concerns, changing events, and other factors.

In February 1994, the City of Unalaska and the three major processors signed a Letter of Intent to negotiate a power sales agreement in substantially the same form as that provided in Appendix A to this report. Negotiations to complete the power sales agreement have not been scheduled at this time.

Given the OESI proposal and the indication of interest by the users, the Authority retained the services of a multi-firm team to review the merits of the OESI's proposal and its subsequent revisions (the "Development Plan"), its impacts on existing and future Authority financings, the risks associated with the contemplated finance plan, legal issues that must be resolved, and other factors. Members of this team and their respective tasks include:

R. W. Beck and Associates - Finance, Project Usability, Air Quality
Public Financial Management - Finance
Birch, Horton, Bittner and Cherot - Legal
Douglas Kemp Mertz - Permitting, Air Quality

This report summarizes the findings of the team's review.

II. OESI DEVELOPMENT PLAN

GENERAL

The Development Plan submitted by OESI to the Authority does not constitute an offer by OESI but was intended to form the basis on which the parties could negotiate agreements necessary to develop the Project. It contains, in general terms, a Project description, estimates of construction, operating, and financing costs, a proposed construction schedule, and a pro forma of power costs. It is anticipated that the final negotiated agreement will include price and performance guarantees.

The general concept included in the Development Plan is first to develop the initial test production and re-injections wells. If the commercial availability of the geothermal fluid is proven, the remainder of the Project would then be constructed. Supporters of the Project are seeking a $10 million State appropriation to fund the initial development. If the full Project is built, it is anticipated that Authority bonds would fund the remaining construction costs.

The Letter of Intent signed by the City and the processors includes provisions for power to be delivered to the City at a rate of 10.5 cents/kilowatt-hour in 1992 dollars. The City in turn would add a certain amount to this rate to cover additional operating and administrative costs. The cost of power delivered to the processors has been estimated to be 12.0 cents/kilowatt-hour (again in 1992 dollars). Delivered power costs would not be shielded from inflation but would increase on an annual basis such that they remain constant in real terms.

PROJECT DESCRIPTION

OESI proposes to construct a geothermal power project near the Makushin Volcano, approximately 12 miles west of the City of Unalaska. Thermal energy from the geothermal fluid located in an underground reservoir near the Project will be used to drive the turbines, which in turn produce electric energy. The fluid will be drawn from the reservoir via wells, piped through a heat exchanger, and then returned into the reservoir through a re-injection well. The Project facilities and wells will be located to allow the fluid to be drawn from a fracture zone located approximately 1,950 feet below the surface and connected to the underground geothermal reservoir. Although well-field development

within the fracture zone allows greater access for drilling than the reservoir does, it also adds greater risk in completing production wells.

The Project will be constructed in modular fashion such that four interconnected generating units will be used to provide an installed nameplate capacity of 18.0 megawatts. Peak capability of the Project will vary depending on the ambient temperature. OESI expects that the Project will be able to deliver an average of 12.2 megawatts on an annual basis after accounting for seasonal variations and transmission losses to the point of interconnection with the City of Unalaska's distribution system.

Integral parts of the Project include:

Power Plant
- Modular binary generating units
- Control and monitoring equipment located in Unalaska
- Electrical systems
- Auxiliary systems for maintenance purposes
- Emergency diesel-fueled generator for on-site purposes
- Fire protections system

Pipelines and Transmission Line
- Geothermal fluid gathering and injection systems
- 13.5-mile 34.5 kV transmission line

Road and Dock
- Road from dock to Power Plant
- Dock located at Nateekin Bay

Well Field Development
- Three production wells
- Two injection wells

Distribution
- City/Processor interconnection equipment
- Dispatch controls

PROJECT SCHEDULE/COST

At this time, the Authority believes that a prudent development plan would be to first confirm the commercial availability of the geothermal fluid before constructing the power plant and transmission line. OESI has indicated that it has therefore submitted all of its applications for the permits required to drill. Allowing time for the agencies to request

additional information and the required review period, permits could potentially be obtained by mid-1994. Since OESI's applications did not include those required for the dock and road, mobilization and support of the drilling equipment will have to be done using helicopters. This would add to the overall cost of the Project but has the advantage of allowing the initial drilling effort to begin as soon as permits and funding are obtained.

Based on a schedule of proving the resource in late 1994/early 1995 and completing the construction in 1995 and 1996, the total development costs are estimated to be $104.4 million. This amount is based on OESI's estimate of development costs included in their original (August 1993) development plan plus an amount to allow for price escalations due to extending the development schedule by one year from that included in the original plan. This cost also includes an additional $2.8 million to allow for the use of helicopters during drilling.

OPERATING COSTS

An estimate of annual operating costs has been prepared by OESI based on their expectations of staffing requirements, labor rates, and miscellaneous other expenses. Total direct operating costs are shown to be $2,400,150 in 1996 dollars. Additional costs assumed to be paid to the operator on an annual basis include $260,000 for general and administrative expenses and $240,000 as a fixed fee. The resulting $2,900,150 total operating and maintenance costs are assumed to increase with inflation.

Other annual cost estimates prepared by OESI include fluid fees, steamfield royalties, well rehabilitation costs, plant rehabilitation costs, administrative, and insurance costs.

All of these estimates are used as the basis to R. W. Beck's analysis, although they have not been reviewed by an independent party. Given the remote location, the difficult terrain, and the local climate, these estimates should be thoroughly reviewed prior to the State making any commitments for final Project development.

III. PROJECTED OPERATING RESULTS

GENERAL

The Development Plan was reviewed under the premise that the State's objective is to develop the Project such that power is ultimately delivered to the processors at a target price of 12.0 cents/kilowatt-hour in 1992 dollars. Cost of power delivered to the City of Unalaska (the "City") would be equal to the target price less an amount for administrative and distribution costs (described in greater detail later in this chapter).

Should actual Project costs be greater than the target price, withdrawals from a rate stabilization fund (assumed to be funded up-front by the State) would be used to lower costs to the target price. It has been assumed that the State would desire some sort of return on its investment in the rate stabilization fund. Therefore, power costs were held constant such that if the cost of power is less than the target price, payments would be made to the rate stabilization fund.

It should be noted that the rate concept used herein differs slightly from that presently contemplated in the draft power sales agreement where the rate is set at 10.5 cents/kilowatt-hour to the City (in 1992 dollars) and leaves the rate to the processors open. If the City's administrative and distribution costs are equal to 1.5 cents/kilowatt-hour and increase with inflation, then the concept used in this report would be the same as that included in the draft power sales agreement. However, should the City's costs be less than the 1.5 cents or increase at a rate less than inflation, then the amount of rate stabilization calculated in this report will be less than that required using the concept included in the power sales agreement.

Three different concepts regarding debt service and the rate stabilization fund can be pursued. These include:

1. Maintaining the traditional levelized debt service and size the rate stabilization fund accordingly.

2. Structuring the debt service to mimic a ramp by using a combination of serial and capital appreciation bonds (a form of zero-coupon bonds). This second

concept would reduce the rate stabilization fund from 1. above but would increase the average interest rate of the bonds by a small amount.

3. Providing enough grant money during construction such that the initial cost of power is low enough and a rate stabilization fund is not required.

The second concept can, in certain cases, leave an amount of principal left to be repaid at the end of the bond life. Therefore, this type of debt structure was not investigated. Due to the nature of the power sales agreement, the amount of rate stabilization required during the life of the Project would change if actual Project generation or costs deviated from that assumed when making the initial deposit into the rate stabilization fund.

PROJECT ENERGY SALES

Of all the assumptions used in determining the economics of the Project, the amount of energy that can be utilized from the Project has the most impact on cost of power and the required rate stabilization fund. Because area load requirements and patterns have changed significantly in the past several years due to changes in fishing seasons and other developments, R. W. Beck has updated its estimate of Project energy sales from that estimated in December 1991.

In large utility systems where a number of resources are used to provide for generating requirements, a resource such as the geothermal Project would be baseloaded and operated at full output all of the time. Generation reductions would occur only during periods of unscheduled outages or scheduled maintenance. For the City and the processors, however, the Project will be the primary source of power and output must be increased or decreased to follow load. Therefore, the amount of energy usable from the Project is a function of three main factors: area energy requirements, the relationship between the peak demand and the capacity of the Project at any given moment, and the amount of time that the Project is inoperational due to maintenance and other factors. Just because total energy requirements may be increasing on the island does not necessarily mean that more energy is usable from the Project. If all of the increase occurs during months when the Project would already be operating a full output, other sources of generation would have to be used to meet the additional load.

Based on conversations with the area processors, the City of Unalaska, SeaLand, and others, R. W. Beck has made estimates of the amount of energy that can be used from the Project. These estimates, shown below in Table 1, are based on present loads, load patterns, and estimates of peak and energy requirements of future additions.

The basis for Case 1 includes a centralized dispatch system where the geothermal Project is utilized to the maximum extent possible and assumes no loss of geothermal generation

due to maintenance and forced outages. This implicitly assumes that planned or unscheduled outages can occur, but only on a unit by unit basis at times when a particular unit is not required to meet load. Therefore, this case represents the upper limit of Project usage given present load levels and shapes. Since outages may occur that affect the entire Project, it is not likely that Case 1 will be realized.

A case was also run without a centralized dispatch system. In this case, it was assumed that the processors would take geothermal power up to an assumed contract demand. Above that amount, it was assumed that each processor would use its own diesel generation. The results of this scenario are shown as Case 2. This case also assumes no loss of generation due to maintenance and forced outages.

During the course of operations, both planned and unscheduled outages will occur. Planned maintenance can at times be accomplished on a unit by unit basis at periods of low loads such that the remaining three units can meet load. However, unscheduled outages due to equipment failures, problems with the wells, or weather-related problems can reduce unit availability or even cause the entire Project to go off-line. Therefore, another scenario was run which assumes a 5 percent outage rate applied on a random basis throughout the year. This scenario is presented in Table 1 as Case 3 and assumes no centralized dispatch system.

Table 1
UNALASKA GEOTHERMAL PROJECT
Project Energy Sales
(Thousands of kilowatt-hours)

	Case 1	Case 2	Case 3
Centralized Dispatch	yes	no	no
Outage Rate	0%	0%	5%
Geothermal Energy	84,023	80,250	78,802
Diesel Energy	5,339	9,112	10,560
Total Load	89,362	89,362	89,362

As seen in Table 1, the inclusion of a five percent outage rate has a noticeable effect on Project usage. However part of these outages might possibly be scheduled for off-peak periods such that Project generation is not affected. Furthermore, the Project usage restrictions indicative of a system without a centralized dispatch (Cases 2 and 3) are not found in the current draft of the power sales agreement. Therefore for purposes of this report, R. W. Beck has performed its analysis using 80 million kilowatt-hours, although higher and lower amounts are examined in the sensitivity analysis.

FUTURE LOAD GROWTH

Long-term projections of area energy requirements are always subject to the difficulties of predicting future events with accuracy. In Unalaska where the economy is predominantly dependent on one industry that is subject to numerous actions from outside the community, this problem is compounded; and even short-term projections are difficult to make. The fishing industry has undergone radical changes in past years, both in the equipment being used and the management of the resource. Therefore, one cannot predict with any degree of accuracy whether loads will increase, decrease, or remain approximately the same in the future. However, the risk that the load could decrease in Unalaska is probably greater than in communities with more diversified economies.

For purposes of the analysis, despite the high degree of uncertainty, we have assumed future Project energy sales will remain approximately the same over the life of the Project.

CITY DISTRIBUTION COSTS

The current concept of the Project includes a transmission line from the Project site to a point of interconnection with the City's distribution system. Project power would then be carried over the City's lines to the various self-generators as well as the City's own customers. In order for the City to transmit power to the various self-generators, certain system betterments must be made. Although these costs are included in the construction cost estimate, the City has indicated that it would also incur some additional annual costs due to the Project.

The City originally provided a preliminary estimate of 1.5 cents/kilowatt-hour for these additional costs. Power delivered to the processors would therefore be 12.0 cents/ kilowatt-hour (10.5 cents/kilowatt-hour delivered to the City plus 1.5 cents/kilowatt-hour). Subsequent discussions with the City, however, has shown that this amount might be high. Therefore in our analysis, we have also included cases using 0.7 cents/kilowatt-hour.

City officials believe that part, if not all, of these increased costs will inflate with time; and therefore this number should be escalated at some rate. For purposes of the analysis, R. W. Beck has assumed that these estimates escalate at one-half of general inflation.

DEBT SERVICE RESERVE FUND

Bond issues by state and local governmental agencies typically include, in addition to the amount raised for the primary purpose of the bonds, an amount to fund a debt service reserve fund. The fund is typically sized at an amount equal to one year's debt service; but for tax-exempt issues, it cannot exceed ten percent of the bond size. The moneys in this

fund can only be used to pay debt service in the event that annual revenues are inadequate to pay the full amount of debt service. Thus, it provides a means to pay bondholders while working through problems that may arise. In large projects such as this Project where the cost of power may exceed the alternative cost during the early years, bondholders would expect to see the debt service reserve fully funded at the time of the bond issue.

PFM believes the bond issue should establish the debt service reserve fund at an amount equal to a full year's debt service. The additional annual cost from this will be partially offset from the additional interest earnings accruing to the Project revenues.

OTHER ASSUMPTIONS

In addition to those assumptions described above, certain other underlying assumptions have been used concerning costs, financing, and other Project parameters. These include the following.

1. General price escalation is assumed to average 4.0 percent per year.
2. The $10 million appropriation currently being sought by the Project supporters is assumed to be in the form of a grant and available in mid-1994.
3. The Authority cannot presently pledge the moral obligation of the state for these bonds. Therefore, two interest rates were assumed: 9.0 percent without the moral obligation and 7.5 percent with the moral obligation. Reinvestment rates of bond proceeds during construction are assumed to average 5 percent.
4. Interest earnings on the debt service reserve fund during Project operations are assumed to be used to offset Project operating costs. The investment rate is assumed to average 6.0 percent.
5. The Project is commercially operable by April 1997, although interest on the bonds is capitalized through June 1997.

BASE CASE

Using the assumptions described above, the required rate stabilization has been determined and is included in Table 2 as the base case. The results show that the rate stabilization fund must be sized at approximately $35.5 million. This assumes that the moneys are deposited into the fund by mid-1995 and that interest earnings accrue to the fund at an assumed reinvestment rate of 6 percent.

As net Project revenues increase with inflation, fewer payments from the rate stabilization fund are required such that in time, Project revenues will support payments back to the State. Over the Project's expected 30-year life, the State could, under the Base Case assumptions, expect a 4.2 percent rate of return on its $35.5 million investment. If the

(EXHIBIT "A")

MEMORANDUM OF AGREEMENT

NET REQUIREMENTS INDUSTRIAL CUSTOMER

THIS AGREEMENT, made and entered into this __day of ____, 1993, by and between the CITY OF UNALASKA, a First Class City organized under the Constitution and laws of the State of Alaska, hereinafter referred to as "UNALASKA," and _____, a United States corporation organized under the laws of the State of_____, hereinafter referred to as "PURCHASER," for the supply and sale, and the use and purchase of electric energy.

WHEREAS, UNALASKA desires to sell and supply electric energy to PURCHASER, and to purchase peaking energy from PURCHASER pursuant to the terms and conditions of this Agreement,

WHEREAS, PURCHASER desires to buy from UNALASKA and use, for industrial purposes, electric energy, and to sell UNALASKA peaking energy pursuant to the terms and conditions of this Agreement, and

WHEREAS, UNALASKA has entered into a certain *Memorandum of Agreement Regarding the Makushin Geothermal Project* with the Alaska Industrial Development and Export Authority ("AIDEA), to purchase electric energy from the Makushin Geothermal Project (hereinafter, the "Project");

NOW, THEREFORE, the parties agree as follows:

Section 1. Purchase and Sale Commitment.

(a) Parties commitments to sell energy. UNALASKA hereby agrees to sell and deliver electric energy to PURCHASER, and PURCHASER hereby agrees to sell and deliver electric energy to UNALASKA, pursuant to the terms and conditions hereinafter provided.

(b) UNALASKA's obligation to supply energy. UNALASKA shall deliver to PURCHASER, PURCHASER'S Net Requirements of electric energy, as hereinafter defined, within the City of Unalaska service area.

(c) PURCHASER's obligation to purchase energy. PURCHASER agrees to purchase PURCHASER's Net Requirements of electric energy as hereinafter defined from UNALASKA under this Agreement.

(d) PURCHASER'S obligation to supply energy. PURCHASER shall deliver to UNALASKA, Peaking Energy , as hereinafter defined.

(e) UNALASKA'S obligation to purchase energy. UNALASKA agrees to purchase and receive Peaking Energy, as hereinafter defined, from PURCHASER.

Section 2. Term of Agreement.

(a) Effectiveness. This Agreement shall become effective on the first date when (i) the Agreement has been executed and delivered by UNALASKA and PURCHASER, and (ii) an agreement in substantially the form of Exhibit "I" to this Agreement has been executed and delivered to UNALASKA by the Alaska Industrial Development and Export Authority ("AIDEA").

(b) Commencement of purchase obligations. The purchase obligations of PURCHASER under this Agreement shall commence on the Date of First Commercial Operation of the Project, as defined in Section 2 of the agreement between UNALASKA and AIDEA, as described in Exhibit "I" hereto.

(c) Term of Final Power Purchase Agreement. The Parties intend to enter into a Final Power Purchase agreement in accordance with section 12 of this Agreement, and expect the term of the Final Power Purchase Agreement be no less than the final maturity of bonds issued by AIDEA to finance the Project. The parties expect that maturity to be approximately 20 years.

Section 3. Exhibits. The following exhibits are incorporated by reference into this Agreement:

(a) Exhibit "I", form of *Memorandum of Agreement regarding the Makushin Geothermal Project* between the Alaska Industrial Development and Export Authority and the City of Unalaska; and,

(b) Exhibit "II", Requirements of Unalaska Net Requirements Industrial Customers.

Section 4. Electric Service To Be Furnished By UNALASKA.

(a) Sale and Purchase. UNALASKA hereby agrees to deliver to PURCHASER one hundred percent (100%) of the PURCHASER'S Net Requirements of electric energy as hereinafter defined, and PURCHASER hereby agrees to purchase PURCHASER's Net Requirements of electric energy.

(b) Net Requirements defined. For the purposes of this Agreement, PURCHASER'S "Net Requirements" of energy shall mean the total load demand for energy to operate PURCHASER'S (name of facility(s) to be served) facility(s) less the energy generated by PURCHASER'S generators and supplied by PURCHASER to UNALASKA at the request of UNALASKA. The minimum load generated by PURCHASER'S generators when operated for these purposes is anticipated to be approximately ___. kilowatts (___.___ kW).

(c) Available Energy. UNALASKA shall at all times, except when prevented by a cause or event not within the control of UNALASKA, make energy available to PURCHASER in an amount equal to the requirements of the PURCHASER'S industrial facilities described in subsection 4 (b) of this Agreement. UNALASKA and PURCHASER understand and agree that UNALASKA's obligation and ability to provide energy is subject to the availability of energy from the Project and to the terms of a future interconnect, dispatch and load shedding agreement (hereinafter "Interconnect Agreement") between UNALASKA and its industrial Net Requirements customers, including PURCHASER.

(d) Specification of Electric Service. All electric energy delivered hereunder by UNALASKA shall be in the form of three-phase alternating current at a frequency of approximately 60 cycles and at approximately __volts. UNALASKA agrees to limit any low voltage condition as a result of starting in rush current to no more than __ percent (__%) leading. UNALASKA further agrees to install suitable capacitors and other equipment necessary to maintain and regulate the power factor at acceptable levels.

(e) Point of Delivery. The point of delivery for the electric energy to be delivered hereunder shall be the __ KV line at the load side terminals at PURCHASER's No. __ line tap. UNALASKA will take such steps and make any arrangements necessary to bring the electric power service hereunder to the Point of Delivery.

Section 5. Electric Service To Be Furnished By PURCHASER.

(a) Sale and Purchase. PURCHASER hereby agrees to deliver to UNALASKA up to ___ kilowatts (__ kW) of Peaking Energy when requested by UNALASKA, and UNALASKA hereby agrees to purchase all electric energy so delivered.

(b) Peaking Energy defined. For the purposes of this Agreement, "Peaking Energy" ~~of energy~~ shall mean the total load demand for energy of UNALASKA'S system less the energy generated by the Makushin Geothermal Project (the "Project) and UNALASKA'S other generating resources.

(c) Available Energy. PURCHASER shall at all times, except when prevented by a cause or event not within the control of PURCHASER, make energy available to UNALASKA in an amount equal to the amount specified in Section 5 (a) above.

(d) Specification of Electric Service. All electric energy delivered hereunder by PURCHASER shall be in the form of three-phase alternating current at a frequency of approximately 60 cycles and at approximately __volts. PURCHASER agrees to limit any low voltage condition as a result of starting in rush current to no more than ___ percent (___%) leading. PURCHASER further agrees to install suitable capacitors and other equipment necessary to maintain and regulate the power factor at acceptable levels.

(e) Point of Delivery. The point of delivery for the electric energy to be delivered hereunder shall be the ___ KV line at the line side terminals at PURCHASER's No. ___ line tap. PURCHASER will take such steps and make any arrangements necessary to bring the electric power service hereunder to the Point of Delivery.

Section 6. UNALASKA'S Dispatch Services.

(a) UNALASKA'S dispatch services. UNALASKA shall provide complete dispatch services and shall dispatch all Project energy, all energy generated by the UNALASKA system, and, all Peaking Energy generated by UNALASKA'S Net Requirements industrial customers. Such dispatch services shall be provided in accordance with the Interconnect Agreement between UNALASKA and its Net Requirements Industrial customers, said Interconnect Agreement to be negotiated prior to the execution of a Final Power Purchase Agreement for the Project between UNALASKA and AIDEA.

(b) Priority of energy dispatched. UNALASKA shall operate the dispatch service in such a manner that, whenever possible, the full available

energy output of the Project is dispatched prior to dispatch of any other available energy, whether from UNALASKA'S system or from other generation sources.

Section 7. Dispatch Of Peaking Energy.

(a) Full capacity increments. UNALASKA shall use best efforts to dispatch Peaking Energy from PURCHASER in accordance with the Interconnect Agreement.

(b) Proportionate dispatch. UNALASKA shall, to the maximum extent feasible, dispatch Peaking Energy from its Net Requirements customers proportionately to the Net Requirements of each individual such customer, as shown in Exhibit "II" hereto. The Parties understand and agree that (i) priority in dispatch decisions shall be given to the requirement to use best efforts to dispatch in full capacity increments according to Section 7 (a) above, and that (ii) UNALASKA shall use best efforts to achieve dispatch proportionate to the Net Requirements of each individual Net Requirements customer, as listed in Exhibit "II" hereto, over each annual contract period.

Section 8. Electric Power Reserves.

(a) Need for reserves. The parties recognize that (i) energy from the Project may be unavailable periodically because of generation and transmission outages, repairs, maintenance, well re-working or replacement, inspections, testing, and similar events, (ii) available capacity of the Project may be insufficient to serve the entire demand of the UNALASKA system during periods of peak demand, and (iii) UNALASK's responsibility for maintaining (or contracting for the purchase of energy from) generation reserves shall be limited to that responsibility explicitly undertaken in the Interconnect Agreement, as finally agreed by both Parties hereto.

(b) Provision of reserves by UNALASKA. Subject to the Interconnect Agreement, UNALASKA shall provide prudent reserve energy and capacity (either through its own generating capacity or through purchase and dispatch of energy generated by its Net Requirements Purchasers) to serve its system, including its industrial customers, with amounts of energy that may be reasonably projected as required.

(c) Provision of reserves by PURCHASER. PURCHASER shall provide prudent reserve energy and capacity reserves through its own generating capacity to meet its obligation under this Agreement to deliver

Peaking Energy to UNALASKA in amounts that may be reasonably projected as required.

Section 9. Energy Price.

(a) Initial rate paid by PURCHASER. All electric energy delivered by UNALASKA to PURCHASER under this Agreement shall be received and paid for by PURCHASER at an initial rate of ___ cents per kilowatt hour ($0.___/Kwh).

(b) Annual rate adjustment. The rate paid by PURCHASER for each kilowatt-hour of energy shall be adjusted annually on January 1 by the same percentage by which the rate per kilowatt-hour paid by UNALASKA for purchase of Project power is adjusted on the same date.

(c) Rate paid by UNALASKA. The annual rate paid by UNALASKA to PURCHASER for net energy delivered to UNALASKA shall be equal to the concurrent wholesale rate owed by UNALASKA to AIDEA for purchase of Project energy.

Section 10. PURCHASER'S System.

(a) Operation and maintenance of PURCHASER's system. PURCHASER covenants and agrees that it will operate and maintain its system in good repair, working order and condition, and in accordance with Prudent Utility Practice.

Section 11. Limitation On Certain Contracts.

(a) Limitation on certain energy purchases. PURCHASER covenants and agrees not to enter voluntarily into any contract or agreement to take or to take or pay for energy, other than this Agreement, payable on a parity with or superior to the execution of its obligations under this Agreement.

(b) Limitation on certain energy sales. PURCHASER further covenants and agrees not to sell or deliver any energy to any party other than UNALASKA.

Section 12. Negotiation of Other Agreements. The Parties agree to use best efforts to agree upon terms of and execute on or before June 1, 1994 (i) a Final Power Purchase Agreement containing terms and conditions substantially similar to those of this Agreement, and (ii) an interconnect, dispatch and load shedding agreement (the "Interconnect Agreement").

Section 13. Efforts To Obtain Appropriations.

(a) Appropriations sought. UNALASKA and PURCHASER agree to assist AIDEA in investigating potential means to achieve funding for the Project through appropriations from the Alaska Legislature and the United States Congress. Such appropriations may be in the form of direct grants, loans, rate subsidies, or other considerations.

(b) Mutual efforts. UNALASKA and PURCHASER agree to mutually support AIDEA in achieving government funding from the sources identified through the investigation carried out pursuant to Section 10 (a).

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed in their respective names by the proper officers hereunto duly authorized as of the date and year first above written.

CITY OF UNALASKA	PURCHASER
_____	_____
Mark Ernest, City Manager	
_____	_____
Date	Date
ATTEST:	ATTEST:
_____	_____

(EXHIBIT "B")

MEMORANDUM OF AGREEMENT

FULL REQUIREMENTS INDUSTRIAL CUSTOMER

THIS AGREEMENT, made and entered into this _day of _____, 1993, by and between the CITY OF UNALASKA, a First Class City organized under the Constitution and laws of the State of Alaska, hereinafter referred to as "Unalaska," and _____, a United States corporation organized under the laws of the State of _____, hereinafter referred to as "PURCHASER," for the supply, sale and use and purchase of electric energy.

WHEREAS, UNALASKA desires to sell and supply electric energy to PURCHASER pursuant to the terms and conditions of this Agreement, and

WHEREAS, PURCHASER desires to buy from UNALASKA and use, for industrial purposes, electric energy pursuant to the terms and conditions of this Agreement, and

WHEREAS, UNALASKA has entered into a certain *Memorandum of Agreement Regarding the Makushin Geothermal Project* with the Alaska Industrial Development and Export Authority ("AIDEA), to purchase electric energy from the Makushin Geothermal Project (hereinafter, the "Project");

NOW, THEREFORE, the parties agree as follows:

Section 1. Purchase and Sale Commitment.

(a) Parties commitments. UNALASKA hereby agrees to sell and deliver electric energy to PURCHASER, and PURCHASER hereby agrees to purchase and receive electric energy from UNALASKA, pursuant to the terms and conditions hereinafter provided.

(b) UNALASKA's obligation to supply energy. UNALASKA shall deliver to PURCHASER, PURCHASER'S full Requirements of electric energy, as hereinafter defined, within the City of Unalaska service area.

(c) PURCHASER's obligation to purchase energy. PURCHASER agrees to purchase PURCHASER's full Requirements of electric energy from UNALASKA under this Agreement.

Section 2. Term of Agreement.

(a) Effectiveness. This Agreement shall become effective on the first date when (i) the Agreement has been executed and delivered by UNALASKA and PURCHASER, and (ii) an agreement in substantially the form of Exhibit "I" to this Agreement has been executed and delivered to UNALASKA by the Alaska Industrial Development and Export Authority ("AIDEA").

(b) Commencement of purchase obligations. The purchase obligations of PURCHASER under this Agreement shall commence on the Date of First Commercial Operation of the Project, as defined in Section 2 of the agreement between UNALASKA and AIDEA, as described in Exhibit "I" hereto.

(c) Term of Final Power Purchase Agreement. The Parties intend to enter into a Final Power Purchase agreement in accordance with section 12 of this Agreement, and expect the term of the Final Power Purchase Agreement be no less than the final maturity of bonds issued by AIDEA to finance the Project. The parties expect that maturity to be approximately 20 years.

Section 3. Exhibit. The following exhibit is incorporated by reference into this Agreement:

(a) Exhibit "I", form of *Memorandum of Agreement regarding the Makushin Geothermal Project* between the Alaska Industrial Development and Export Authority and the City of Unalaska,

Section 4. Electric Service To Be Furnished.

(a) Sale and Purchase. UNALASKA hereby agrees to deliver to PURCHASER one hundred percent (100%) of the PURCHASER'S electric energy requirements, and PURCHASER hereby agrees to purchase PURCHASER's full Requirements of electric energy.

(b) Available Energy. UNALASKA shall at all times, except when prevented by a cause or event not within the control of UNALASKA, make

energy available to PURCHASER in an amount equal to the amount PURCHASER may require for PURCHASER'S industrial operations.

(c) Specification of Electric Service. All electric energy delivered hereunder by UNALASKA shall be in the form of three-phase alternating current at a frequency of approximately 60 cycles and at approximately __volts. UNALASKA agrees to limit any low voltage condition as a result of starting in rush current to no more than ___ percent (__%) leading. UNALASKA further agrees to install suitable capacitors and other equipment necessary to maintain and regulate the power factor at acceptable levels.

(d) Point of Delivery. The point of delivery for the electric energy to be delivered hereunder shall be the ___ KV line at the load side terminals at PURCHASER's No. ___ line tap. UNALASKA will take such steps and make any arrangements necessary to bring the electric power service hereunder to the Point of Delivery.

Section 5. PURCHASER's facilities. PURCHASER shall provide and maintain all facilities on the load side of the Point of Delivery as necessary for the utilization of said service and in accordance with Prudent Utility Practice.

Section 6. Energy Price.

(a) Initial rate paid by PURCHASER. All electric energy delivered by UNALASKA to PURCHASER under this Agreement shall be received and paid for by PURCHASER at an initial rate of ___ cents per kilowatt hour ($0.___/Kwh).

(b) Annual rate adjustment. The rate paid by PURCHASER for each kilowatt-hour of energy shall be adjusted annually on January 1 by the same percentage by which the rate per kilowatt-hour owed by UNALASKA for purchase of Project power is adjusted on the same date.

Section 7. PURCHASER's Facilities.

(a) Operation and maintenance of PURCHASER's facilities.. PURCHASER covenants and agrees that it will operate and maintain its electrical system in good repair, working order and condition, and in accordance with Prudent Utility Practice.

Section 8. Limitation on certain contracts. PURCHASER covenants and agrees not to enter voluntarily into any contract or agreement to take or to take or pay for energy, other than this Agreement, payable on a parity with or superior to the execution of its obligations under this Agreement.

Section 9. Negotiation of Final Agreement. The Parties agree to use best efforts to agree upon terms of and execute on or before June 1, 1994 a Final Power Purchase Agreement containing terms and conditions substantially similar to those of this Agreement.

Section 10. Efforts To Obtain Appropriations.

(a) Appropriations sought. UNALASKA and PURCHASER agree to assist AIDEA in investigating potential means to achieve funding for the Project through appropriations from the Alaska Legislature and the United States Congress. Such appropriations may be in the form of direct grants, loans, rate subsidies, or other considerations.

(b) Mutual efforts. UNALASKA and PURCHASER agree to mutually support AIDEA in achieving government funding from the sources identified through the investigation carried out pursuant to Section 10 (a).

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed in their respective names by the proper officers hereunto duly authorized as of the date and year first above written.

CITY OF UNALASKA	PURCHASER
_____	_____
Mark Ernest, City Manager	
_____	_____
Date	Date
ATTEST:	ATTEST:
_____	_____

APPENDIX B

Permits

Major State Permits:

Alaska Dept. of Environmental Conservation

Air Quality Control Operating Permit - Although the Project design does not call for venting of primary or secondary fluids during normal operations, ADEC will look at the potential for emissions from upsets and from auxiliary and backup diesels or other fossil fuel components. If the Project owner can convince ADEC that the Project is essentially emissionless in operations, the facility could avoid needing an air quality permit to operate for the operations phase. Since the Project site is outside the area affected by emissions from the Unalaska/Dutch Harbor generators, the new facility would not be subject to the same tight restrictions as the existing resources are as they attempt to expand. If it were truly emissionless, it would not even be necessary to comply with federal "new source standards" for new electric generating facilities. However, at present the ADEC Air Quality staff is skeptical about the ability to avoid operational venting of secondary fluids, which have had human health effects in geothermal projects in other states.

Solid Waste Disposal Permit - The Project design calls for reinjection of thermal fluids. It does not appear that the design calls for underground injection of other substances. OESI believes solid waste during operations will be minimal and limited to normal industrial process wastes such as used oil and solvents. However during drilling, substantial amounts of drilling muds and cuttings will be generated; the current plan is to bury them nearby, presumably in an approved lined disposal pit. A State solid waste permit is necessary, including a plan showing how the disposal method will prevent contamination of aquifers or surface resources by the toxic components of the drilling muds.

Domestic Wastewater Disposal Permit and Plan Review - Required for domestic sewage.

Wastewater Disposal Permit and Certification - The federal government has not delegated to the State of Alaska the authority to issue permits for discharge of pollutants into federal waters, as it has in many other states. Hence, the wastewater disposal permit, or National Pollutant Discharge Elimination System ("NPDES"), must be issued directly by the U. S. Environmental Protection Agency. (See below under federal permits.) The State's role is to certify that the federal permit will result in compliance with state water quality standards. Both the federal permit and the state certification can be appealed by parties who disagree with the decisions.

Large Scale Fuel Storage - OESI believes that the on-site storage of fuels should be limited to very small quantities of diesel fuel for local backup generation. If so, there will be no need for ADEC approval of oil spill contingency plans or financial responsibility demonstrations, which become applicable with storage capacity of 10,000 barrels.

Department of Natural Resources

Geothermal Operations Plan Approval - State statutes require a detailed plan of operations for geothermal activity, in both exploration and production phases. There has been little preliminary work done in this area. The great uncertainty on the scope of this approval arises because such reviews are very rare, and in fact DNR's Division of Oil and Gas, which administers the program, has never reviewed a geothermal plan of operations since it took over the program several years ago. The Division developed a set of standard forms for use in permitting and monitoring geothermal well drilling and production, but again, it has not had occasion to use them. The concerns which the statute requires to be addressed are basically the same as those for petroleum production, namely a.) safety of field operations, b.) conservation of the resources (*i.e.*, prevention of waste), and c.) fairness to competing holders of rights to a common reservoir. If the petroleum model is used for geothermal resources, the Division will require a fairly detailed plan which addresses in some detail the geological structures and the potential for contamination or waste of geothermal fluid through the extraction and reinjection process. Since there is no track record in this area, the largest unknown is the time frame for DNR review and approval.

Water Rights Appropriation - The generation process itself is designed to be entirely air-cooled, so process cooling water will not be necessary. A temporary appropriation for construction will be needed, as well as a permanent appropriation for domestic needs during the operational phase. OESI believes there will be not need for any other large appropriation. This assumption needs to be investigated further. If there is a need for a large quantity of water, the capacity of the area to provide it must be assessed.

Tidelands Lease - The State owns the tidelands upon which the new dock would be built. At this point, OESI prefers the alternative of not building a new dock or pier to support the facility construction and operation. If even temporary use of the tidelands is made for logistical support, a tidelands lease is needed from DNR. Apparently there is some preference by DNR for a permanent dock facility.

Uplands Lease - According to OESI, there is no need for any State lease of uplands because the entire Project site and transmission line right-of-way are owned by private entities. The power plant site is owned by Battle Mountain Gold Company; the road and transmission lines and materials sites are owned by two Native corporations (Ounalashka Corp. owns the surface, and Aleut Corp. owns

the subsurface). However, negotiating the full use of surface, subsurface, geothermal resources, and construction material sites with these entities will itself be far from simple. Note that the owner of subsurface rights can choose to disturb the surface to gain access to subsurface resources, so it may be necessary to negotiate an agreement to guarantee permanent use of the surface areas.

Division of Governmental Coordination (Governor's Office)

Coastal Zone Consistency Determination - The Division of Governmental Coordination will conduct a review of the Project to determine whether it is consistent with standards of the Alaska Coastal Management Program. The standards are designed to protect environmental and public use values associated with coastal areas, including water quality and subsistence opportunities.

Department of Fish and Game

Title 16 Stream Crossing Permits - These permits will be necessary for several crossings by the road of anadromous fish streams.

Alaska Public Utilities Commission

Certificate of Public Convenience - The APUC conducts a proceeding to review the need for new power generation and the effect on consumer rates and issues a certificate of public convenience to the utility. This certificate is necessary whether the project owner sells energy directly to consumers or wholesales it to the City for resale.

Major Federal Permits:

U. S. Environmental Protection Agency

NPDES Permit - EPA issues permits for discharge of pollutants into federal waters under the NPDES (National Pollutant Discharge Elimination System) mandated by the federal Clean Water Act. OESI claims that the Project can be built and operated without a wastewater discharge. For a project this size, avoiding a wastewater discharge seems extremely unlikely, and OESI's conclusion should be reviewed further. Even without use of water for cooling and for direct processing of any kind, construction phase discharges and storm water discharges seem likely. As noted below the need for a NPDES permit will affect the need for NEPA review.

NEPA Compliance - If a federal permit is necessary, the Project must undergo review under the National Environmental Policy Act ("NEPA"). The result could be a cursory environmental assessment ("EA") and finding of no significant impact ("FONSI"), or it could be a full environmental impact statement. OESI's Project

estimates for both time and cost are predicated on the assumption that a full EIS will not be necessary; in fact, OESI believes that it may be possible to avoid *any* NEPA review by avoiding all federal permits. These assumptions -- that a NEPA review can be avoided altogether and that if a review becomes necessary, it can be limited to an EA and a FONSI -- are both questionable. As noted above, it would be unusual for a project his size to avoid an NPDES wastewater discharge permit. It also seems probable that some areas in which fill is necessary would be classified as wetlands under current EPA criteria. Such fill sites might include areas for drilling platforms, plant construction, powerline construction, road construction, and dock facilities. If so, a NEPA review will be necessary. Its scope and results could also differ depending on whether the review is carried out by the Corps of Engineers or the EPA. The agencies themselves will decide which one will take the lead role and actually conduct the review. *The assumption that a lengthy EIS process can be avoided is one of the key weaknesses in OESI's Project proposal.*

RCRA Compliance - OESI believes that the Project would generate few substances classified as hazardous wastes, and that in any case, any solid waste would be exempt from coverage under the Resource Conservation and Recovery Act under the exclusion for wastes "associated with exploration, development, or production of oil..., gas..., or geothermal energy" [42 USC §6921(b)(2), 40 CFR §261.4(b)(ii)(5)]. EPA has ruled, however, that the exclusion does not apply to wastes which are not "uniquely associated" with geothermal production, so ordinary industrial wastes such as used solvents, paints, etc., would be covered by RCRA [53 Fed. Reg. 25,445, 25,454]. OESI needs to make a realistic inventory of wastes likely to be generated in order to assess RCRA applicability and the costs of RCRA compliance.

Oil Spill Prevention Control and Countermeasure Plan - This is required under the Oil Pollution Act of 1990. Unless significant quantities of fuel oil are to be stored on site, there should not be a problem with this requirement. However, it will take an affirmative showing that fossil fuel requirements are minimal.

U.S. Corps of Engineers

404 Permit - A COE permit is necessary to fill wetlands, including privately owned wetlands. OESI claims that drilling will not require fill, at least if the helicopter option for access is used instead of a road. It is unclear how they can support a drilling rig, a helicopter landing area, or a heavy equipment storage area without laying down a pad, however. Moreover, site preparation for the facility itself may require filling wet tundra. They also believe construction can be accomplished without a new road, using only the existing airstrip, no dock facility will be required, and apparently no fill will be required for transmission line construction. If any of these assumptions is wrong, it is likely that a Corps permit will be required. OESI also needs to verify that its definition of wetlands is the same as that used by the COE, where wet tundra, even when subject only to seasonal

inundation, can constitute a wetlands. If a dock facility is needed and requires permanent structures in navigable waters, a separate COE permit would be needed for that purpose as well.

U.S. Fish and Wildlife Service

Section 7 Consultation (Endangered Species Act) - OESI must verify through consultations with the U. S. Fish and Wildlife Service and other experts, that the construction and operation of the Project would not impact the habitat or migratory pathways of endangered or threatened species. If an endangered or threatened species is encountered, Project designs may need to be altered to eliminate adverse impact.

Minor Permits

City building permits, Coast Guard navaid reviews, fuel transfer checks, fire marshal reviews, CPCRA listings (community right-to-know listings of hazardous substances), OSHA safety reviews, and others will be required during the course of Project development.

APPENDIX C

DIESEL EMISSION REDUCTIONS

Emissions Control - Emissions from the existing facilities can be reduced through certain combustion modifications or post-combustion techniques. These include:

Fuel Injecting Timing Retard ("FITR") - This is the most common method of reducing NO_x emissions. The technique delays the injection of fuel, thereby limiting peak temperatures and pressures and the associated NO_x formation. The delay is set based on the crankshaft angle of rotation from top-dead center. Our recent experience indicates that most permits are issued requiring between 2° and 10° retard. Tests have demonstrated from 30 to 40 percent NO_x reduction with 6° to 8° of retard on medium-speed diesels. Disadvantages include 1.) a resulting 5 percent increase in fuel consumption and 2.) additional maintenance costs related to increased engine wear. Engine design must be evaluated to verify FITR is technically feasible for the unit in question.

Water/Fuel Emulsion - With this technique, fine water droplets are dispersed in the fuel oil prior to injection to the cylinder. Water reduces combustion temperatures in the engine and may also influence the chemistry of the conversion of nitrogen and oxygen into NO_x during the combustion process. Engine tests on low-speed diesels have resulted in reductions of NO_x well beyond 15 percent with little degradation in fuel consumption. Drawbacks include 1.) significant engine modifications for more than about 20 percent water in fuel, 2.) instability of emulsion with distillate oil requiring mixing immediately prior to injection or chemical additives which can be corrosive, and 3.) a requirement of good quality potable water. This method can be used in conjunction with FITR.

An oil/water emulsion system will consit of an ultrasonic homogenizer, demineralizer, controls, modified injectors, and miscellaneous piping, pumps, and valves. Other indirect costs will be incurred such as the engineering, design, and installation costs. Total costs are expected to be less than $75,000 per engine.

Inlet Air Humidification - In this method, water is sprayed into the intake to "humidify" the air charge. The method offers a lower degree of control than FITR and water/fuel emulsion due to the small amount of water that can be carried into the combustion chamber via the combustion air. However similar to water/fuel emulsion, the method can be used in conjunction with FITR.

Exhaust Gas Recirculation ("EGR") - The theory behind EGR is the displacement of oxygen and nitrogen in the intake air by redirecting a portion of exhaust gas back into the inlet ports. This reduces power output and combustion efficiency and can foul or plug flow passages due to build up of solid and condensable particulates. There is little experience with this technique.

Aftercooling - Aftercooling decreases the inlet air temperature after the turbocharger, thus reducing peak temperatures and the associated NO_x formation. The engines in Unalaska are likely already turbocharged and aftercooled.

Selective Catalytic Reduction ("SCR") - A post-combustion technique, SCR is one of the least common of control techniques for diesel engines due to the expense of the systems and the maintenance requirements. It is susceptible to chemical and physical deactivation when firing distillate fuel oil. Further, the catalysts are subject to high physical stress due to mechanical vibration and pulsation of the diesel engine. Other issues include the on-site storage of ammonia and disposal of the catalyst as a hazardous waste. Reductions of NO_x emissions with SCR are typically in excess of 80 percent. For a 2-megawatt diesel engine, the capital expenditure for SCR would be approximately $500 to $600 per kilowatt, and operating and maintenance costs are estimated at $75,000 to $100,000 per year if the diesel is operated at baseload.

Alternative Generation - Another potential way to reduce emissions and alleviate the air quality issue in Unalaska would be to install alternative generation technology. The current permitting trends indicate that agencies favor combustion turbines over diesel engines. When burning either No. 2 fuel oil or gas, combustion turbines emit less NO_x than medium-speed diesel engines, and exhaust temperature and flow of combustion turbines provide better dispersion in a modeling analysis. Many used combustion turbines are expected to be available due to the tightening emission limits in ozone non-attainment areas. One drawback of combustion turbines, however, is that they are generally slightly less efficient than diesels.

Another alternative is the use of gas-fired diesel engines, although the reduction of NO_x is not expected to be significant. The use of gas (such as propane) may make catalytic controls more viable. Non-selective catalytic reduction (NSCR), comparable to a catalytic converter on an automobile, can be used on certain engines burning clean fuel and operating with very little excess air. Issues to consider would include available engine capacity, fuel type, emissions and performance characteristics, and economics of the control technology.

Relocation of Generation Facilities - One solution might be to relocate existing generating units or constructing new units at a different physical location where its emissions would not flow into a problem area. This option, however, would probably require construction of new buildings, distribution lines, and other support facilities.

Centralized Dispatch - Presently, the processors do not exchange power among themselves, but instead rely on their own generation and occasional purchases from the City. A centralized dispatch with exchanges or purchases of power could help reduce the pollution problem by generating in areas that are not as severely limited by emissions.

initial $10 million grant is also included in the calculations, the expected return would be reduced accordingly.

SENSITIVITY RUNS

Actual Project revenues will vary from that estimated depending on actual Project sales, operating costs, inflation rates, and other factors. The State may find itself in the position of having to make additional deposits to the rate stabilization fund in the future should any of these factors vary in such a manner to reduce net revenues. Similarly, the State may have a higher return on investment if the actual outcome of these factors increases net revenues. In order to assist the Authority in assessing the risk of making future deposits, the results of the base case have been tested for their sensitivity to several assumptions. The assumptions modified are described below, and the results are shown in Table 2.

Interest Rate - As will be described in the next chapter, the bonds issued for the Project could be less than investment grade if certain credit enhancements are not included. Since the Authority cannot pledge the moral obligation of the State for its bonds, a relatively high interest rate was assumed for the base case. However, should some sort of credit enhancement be available, such as the general obligation of the Authority or the moral obligation of the State, then the interest rate could be significantly less than that assumed. Therefore, Case 1B was run using 7.5 percent, the approximate rate of an Alaskan revenue bond rated A-.

In the event that interest rates rise between now and the time bonds are issued, another scenario (Case 2) was tested assuming an interest rate of 11.0 percent. In this case, reinvestment rates have been increased by a percent above that assumed for the other cases.

Project Energy Sales - Cases 3 and 4 were run in order to determine the sensitivity of the results to the amount of Project energy sales. Case 3 is based on Project energy sales of 84 million kilowatt-hours instead of the 80 million kilowatt-hours used in the base case. This figure represents the highest amount of Project energy sales given present load levels. Case 4 includes Project energy sales 10 percent lower than the base case.

Debt Amortization Period - The amortization periods of project revenue bonds typically vary between 20 to 30 years depending on the expected life of the project, the expected availability of fuel, how much debt service the project can sustain and still be economic, and other factors. A longer amortization period lowers the annual debt service although total debt payments over the life of the bonds increase. The relationship between required rate stabilization and the amortization

period was examined in Case 5 by increasing the amortization period to 30 years from the 25-year period used in the other cases.

Equity - The base case assumes that all of the Project costs, with the exception of the assumed $10 million grant, are funded with bonds. The resulting debt service causes overall annual Project costs to be greater than the target rate, and rate stabilization is required during the initial years of Project operations. An alternative approach would be to provide equity funding for part of the construction costs such that the resulting debt service is low enough that the initial rate is approximately equal to the target rate. This approach is shown in Cases 6 and 7. The two cases differ from each other by the assumed interest rate on bonds; 7.5 and 9.0 percent.

Construction Costs - Construction and wellfield development costs may vary from that assumed in the base case. Consequently, cases were run to investigate the effects of increasing and decreasing the total costs by 5 percent. These are shown in Cases 8 and 9.

Well Rehabilitation Costs - During the life of the Project, wells will have to be drilled periodically to maintain the required flow of geothermal fluid. OESI has estimated that annual deposits of $300,000 into a well rehabilitation fund will be sufficient for the required drilling. This $300,000 is assumed to increase with inflation. Based on a limited review, the Authority feels that it is prudent to evaluate the Project using a $700,000 annual deposit. This scenario is provided in Case 10.

City Costs - At this time, the City has not developed detailed estimates of the additional costs that they would incur due to the Project. As stated previously, their initial estimate was approximately 1.5 cents/kilowatt-hour, but later discussions revealed that this may be too high. The sensitivity of the rate stabilization fund size was tested to City costs by using the 1.5 cents/kilowatt-hour in lieu of the 0.7 cents/kilowatt-hour included in the previous cases.

Federal Incentives - Certain generating facilities using alternative fuels qualify for a subsidy from the U. S. Department of Energy under the 1992 National Energy Act. At this time, it is unknown whether or not this geothermal Project will qualify for such a subsidy. However in the event that it does, 1.5 cents/kilowatt-hour may be made available for the first ten years of operation. Four cases were run analyzing the effects of gaining this subsidy. Cases 12 and 13 assume bond financing for all amounts above the initial $10 million appropriation. Cases 14 and 15 are similar to Cases 6 and 7 which assume additional equity contributions such that the cost of power in the first year is equal to the target rate.

Table 2
UNALASKA GEOTHERMAL PROJECT
Summary of Results

	Assumptions/Inputs								Results				
											Additional Contribution		
Case	Bond Interest (%)	Bond Amort. (Years)	Energy Sales (MWh)	RSF/ Equity	Construction Cost (Millions)	Wellfield Reserve ($Mil/yr)	City Costs (c/kWh)	Federal Incentive	Initial Contrib. (Millions)	Bond Size (Millions)	Amount (Millions)	Expected Return (%)	Yr Begin to be Repaid
1A	9.0%	25	80,000	RSF	$104.4	$300	0.7	No	$10.0	$134.1	$35.5	4.2%	19
1B	7.5%	25	80,000	RSF	$104.4	$300	0.7	No	$10.0	$125.9	$15.7	8.2%	14
2	11.0%	25	80,000	RSF	$104.4	$300	0.7	No	$10.0	$140.8	$56.4	2.1%	23
3	7.5%	25	84,000	RSF	$104.4	$300	0.7	No	$10.0	$125.9	$11.0	10.8%	12
4	7.5%	25	72,000	RSF	$104.4	$300	0.7	No	$10.0	$125.9	$28.1	4.4%	19
5	7.5%	30	80,000	RSF	$104.4	$300	0.7	No	$10.0	$125.1	$11.0	8.7%	13
6	7.5%	25	80,000	Equity	$104.4	$300	0.7	No	$10.0	$85.0	$28.5	9.1%	1
7	9.0%	25	80,000	Equity	$104.4	$300	0.7	No	$10.0	$75.0	$38.5	7.4%	1
8	7.5%	25	80,000	RSF	+5%	$300	0.7	No	$10.0	$132.8	$20.5	6.9%	16
9	7.5%	25	80,000	RSF	-5%	$300	0.7	No	$10.0	$119.0	$11.5	10.0%	13
10	7.5%	25	80,000	RSF	$104.4	$700	0.7	No	$10.0	$125.9	$19.3	6.8%	16
11	7.5%	25	80,000	RSF	$104.4	$300	1.5	No	$10.0	$125.9	$22.6	6.1%	16
12	7.5%	25	80,000	RSF	$104.4	$300	0.7	Yes	$10.0	$125.9	$8.5	11.2%	14
13	9.0%	25	80,000	RSF	$104.4	$300	0.7	Yes	$10.0	$134.1	$24.6	5.6%	19
14	7.5%	25	80,000	Equity	$104.4	$300	0.7	Yes	$10.0	$100.0	$17.5	11.1%	1
15	9.0%	25	80,000	Equity	$104.4	$300	0.7	Yes	$10.0	$88.0	$29.5	8.1%	1

Input Variable(s) Tested

IV. FINANCING STRUCTURE AND IMPACT ON AUTHORITY CREDIT

GENERAL

As described earlier, the development concept being proposed is to first drill the initial test production and re-injection wells. Once the availability of sufficient geothermal fluid is established, work on the Project facilities and transmission line would begin. It is anticipated that an Authority bond would fund these later activities.

Should the Authority decide to participate in the Project, the bond issue can either be general obligations of the Authority or project revenue bonds. The general obligation bond essentially combines the credit of this Project with other general obligations that the Authority has. If Project revenues are insufficient to pay debt service, then other revenues available to the Authority would be called on to pay any shortfall. A project revenue bond, on the other hand, does not offer the bondholders the added security of additional revenues. Only Project revenues are pledged to the bondholders, and shortfalls must be made up through reserve funds or the rate stabilization fund.

Each type of bond issue offers varying degrees of risk to the Authority, the State, and the bondholders; and therefore certain advantages of one over another may be offset by additional costs. Furthermore, either type of bond could impact the Authority's or the State's bond ratings on future issues. The following is a discussion of the risks associated with the Project, how they will affect the bonds issued for the Project, and how they could affect future Authority financings.

RISKS

Credit risks associated with this Project can be categorized into three main areas: geothermal resource risks, technology and construction risks, and market demand.

Geothermal Resource Risk. Risks associated with the development of the facilities required to use the geothermal fluid include:

- Drilling-related problems with both source and re-injection wells. These problems can include well blowouts, failure to find the resource (dry hole), and "communication" between source and re-injection wells.

- Potential resource capacity problems including low pressure flow, low temperature fluids, inadequate re-injection capacity, mineral deposits choking off production and re-injection wells, or the existence of foreign matter in wells.

- Inadequate longevity of geothermal field capacity.

The Makushin geothermal field has been explored and analyzed by AEA and its consultants, OESI, and others. GeothermEx, Inc., a geothermal resource consultant, has provided a written report to AEA which summarizes their analysis of the field. The conclusions of their February 19, 1992, report are as follows:

"The following conclusions summarize our current knowledge of the Makushin Geothermal project.

- A high-temperature, permeable geothermal resource exists on the eastern flanks of Makushin Volcano. The available data indicate that a 12 MW (gross) geothermal project can be supported by this resource.

- Most geologic hazards which exist can be avoided or mitigated by appropriate design and location of roads, structures and wellfield equipment. Other hazards may necessitate periodic maintenance and/or repair; as such, they are more nuisances than hazards.

- OESI has a legal right, an appropriate infrastructure, and a reasonable plan to develop the resource."

It should be noted that the gross nameplate capacity of the present Project configuration is 18 megawatts which is in excess of the 12 megawatts cited in the GeothermEx conclusion. Therefore, the development schedule has been revised to develop and test the geothermal field prior to initiating power plant and transmission line development to assure the Project can be supported by the resource.

Should additional wells be required, OESI has verbally stated that the cost of those wells would be deducted from their future fluid fees. Additional wells, however, would require the Authority to invest more in the initial field development.

Technology and Construction Risk. As with the development of the resource itself, the construction and the technology of the generating plant also involve some inherent risks

ranging from short- to long-term. Project sponsors and developers can reduce these risks by:

- Installing proven generating technology.
- Planning, designing, and budgeting for construction consistent with site conditions.

Problems during the initial Project operation are generally covered by warranties provided by the vendors and developer. Mid-term operating problems can be mitigated somewhat by renewal and replacement funds established by the initial bond financing and future deposits. However should operating problems require large amounts of money for corrections, additional bond issues may be required.

For the Project as proposed, there are no known problems with the technology proposed by OESI, which has been used in other applications. Construction risks can also be mitigated with appropriate terms and conditions in the development contract.

Market Demand. The geothermal and the technology/construction risks are probably not greater than what bondholders are willing to accept so long as the risks are dealt with in a prudent manner by the owner or developer. The demand for the Project output, however, may yield a risk for which the bondholders would require an interest rate premium.

Peak demand and energy requirements in Unalaska are largely driven by the needs of the seafood processing industry. The current conditions in Unalaska, and the past performance of the local economy, provide some positive support for the economic base of the Project. These include:

- Worldwide seafood demand has been rising consistently in recent years.
- Unalaska/Dutch Harbor has a proven track record of production capability.
- The major processors have made significant investment in plant and other facilities in the area.
- The processors, residents, and City government have common interests in the development of Unalaska.
- The current reliance on diesel generation may prompt regulatory action in favor of alternative resources. (See Chapter VI - Regulatory/Environmental for further discussion.)

On the other hand, there are many factors which credit analysts would consider to be serious negative indicators. These include:

- Unalaska's economic base is clearly dominated by a single industry - seafood processing. That industry is subject to numerous potentially damaging factors, including:

  - Global market competition
  - Potential resource depletion
  - Weather and environmental risk
  - Regulatory uncertainty
  - Continuing debate in on-shore/off-shore allocations

- The fishing industry historically has moved parts of its operations from one location to another corresponding to resource, market, and regulatory requirements.

- Unalaska's isolated location and relatively hostile environment present significant barriers to diversification of the local economy.

- The inability to acquire take-or-pay contracts may emphasize some of these negative indicators to credit analysts.

- The requirements-type contract would not carry payment obligations similar in duration to debt service on the bonds. (For more discussion on the requirements-type contract, refer to Chapter VII - Contract Provisions.)

On balance, these factors indicate a very high level of uncertainty regarding the initial and on-going levels of demand for the Project output or ability to pay debt service from Project revenues. Even if the issues related to business decisions by major individual customers and the aggregate estimates of demand were resolved, the downside exposure from dependence on the fisheries could present a formidable barrier to credit market acceptance of the Project.

NEED FOR CREDIT ENHANCEMENT

Based on the foregoing discussion and a requirements-type contract, it appears that a pure project revenue bond without any credit enhancement, such as the moral obligation of the State, the general obligation of the Authority, or both, would incur a significant interest rate premium, if such a financing was available at all. Without the credit enhancements, bondholders would perceive the risk to be significant enough such that the bonds would be rated less than investment grade. PFM believes that the interest rate premium would be

approximately 1.75-2.5 percent. For purposes of this analysis and the fact that bonds would not be issued for at least a year, the table below shows the range of bond interest rates that might be incurred.

Table 3
UNALASKA GEOTHERMAL PROJECT
Interest Rates

	Investment Grade Enhanced[1]	Non-Rated Speculative
Interest Rate	7¼-7½%	9-10%

(1) Enhanced with the moral obligation of the State or the general obligation of the Authority.

EFFECT OF BONDS ON STATE

If the State's moral obligation were pledged for the Project, the amount financed would be added to the State's existing indebtedness and would be included in credit analyses of the State's debt. The addition of $115+ million of relatively high risk moral obligation debt would certainly be considered a negative for the State's overall credit.

In order to ensure against a negative rating action, the State would have to demonstrate the importance of the Project to the State, the self-supporting nature of the debt, and the ability to meet the moral obligation without adversely affecting the State's operations or finances.

EFFECT OF BONDS ON FUTURE AUTHORITY FINANCINGS

Prior to the acquisition of the AEA's operating projects, the Authority had a portfolio of approximately $450-500 million of loans and projects, all of which were intended to be self-supporting project financings. A certain portion of that total (approximately $125 million) was financed through general obligation bonds. The Authority's board adopted a strategic financial policy in 1992 which favors the use of project revenue bonds over general obligations and which promotes only the most credit worthy projects for the Authority general obligation financing.

The addition of $115+ million of general obligation debt for such a relatively high risk project would endanger the Authority's credit rating. The reduced credit rating would adversely affect the cost of financing future Authority projects.

It is not possible to quantify the specific impact this financing would have on the Authority's bond rating. However, the risks associated with this financing would likely result in a drop of at least half a grade in the Authority's credit rating. If the Authority's rating was dropped half a grade, its interest costs could increase in the range of 15-30 basis points (.15-.30%). A full-grade drop could mean increased interest costs in the range of 35-60 basis points.

With its credit rating lowered by half a grade, the Authority's annual debt service on a $100 million, 25-year bond issue would increase by $78,488 - $157,869. A full downgrade would result in $184,543 - $319,463 higher annual debt service on the same type of issue. In today's low interest rate environment, the spread of interest rates between different ratings is compressed. However at times of higher interest rates, the spread would widen, and the impact of a drop in the Authority's credit rating would be more costly under those circumstances.

The effect of the Project in future years on the Authority's rating and borrowing costs would be dependent on the success of the Project. Should there be insufficient Project revenues to pay debt service, there could be further rating and market access deterioration. On the other hand if the Project is successful, the Authority could develop an upgrade strategy based on the Project's demonstrated self-sufficiency and creditworthiness.

V. LEGAL ISSUES

GENERAL

Although OESI is proposing to develop the Project, the Authority retaining ownership presents certain legal issues that must first be resolved. The following presents a preliminary discussion of certain matters regarding the financing of the Project. Other legal issues will arise if the Project is developed, and this should not be considered a complete list.

ISSUER OF BONDS

Since the Alaska Energy Authority ("AEA") is now a part of the Authority, the question has arisen as to what entity would issue the bonds for the Project. At this time, the Authority has the requisite statutory authority to own the Project and issue debt while AEA does not.

MORAL OBLIGATION

The Authority does not presently have legislative authorization to pledge the moral obligation of the State as security for debt issued for this Project.

INDUSTRIAL DEVELOPMENT BOND ALLOCATION

In order to obtain the lowest interest costs, tax-exempt bonds should be obtained for Project financing. Since several of the major users are private industry and not local governments, tax-exempt financing would probably have to be obtained through the issuance of industrial development bonds ("IDB's").

Under current law, only a certain amount of IDB's can be issued in any year in any particular state. Allocations can be made to qualified projects by submitting to the Internal Revenue Service a list of projects that are being elected to be financed through IDB's. Once an allocation is made to a specific project, it can be carried forward for a period of time.

The State had previously requested that an $80 million allocation be made to the geothermal Project. This allocation is not a set-aside of funds but only allows for the issuance of tax-exempt IDB's. Based on the bond sizing analysis summarized on Table 2, $40-50 million more may be required. Therefore, an increase in the allocation should be sought if the Project is to be constructed. Additionally, the allocation should be extended to accommodate the anticipated schedule.

LEGISLATIVE APPROVAL

State statute provides that the Authority must obtain legislative approval prior to funding projects which cost $10 million or more. The geothermal Project must, therefore, be approved by the state legislature prior to the issuance of bonds or other financing.

VI. REGULATORY/ENVIRONMENTAL

REQUIRED PROJECT PERMITS

Should the Project be built, a number of permits, certifications, and reviews will be necessary. The length of time required to obtain the permits can vary from project to project, and it is difficult to determine with any degree of accuracy how quickly they can be obtained for the geothermal Project. However, a range between eight and 18 months could be expected. The shorter time period is based on the most optimistic assumptions, while the longer time period is based on an Environmental Impact Statement being required but without legal challenges. Legal challenges could lead to further delays and increased costs.

The list of permits and authorizations required for this Project have been preliminarily identified as follows. (For more detail, refer to Appendix B to this report.) Any of the major permits may be obtained without undue delay if the applicant does a thorough job of marshaling needed information *and* if the Project does not arouse public opposition. Especially with NEPA review, NPDES permits, and Corps of Engineer permits, public opposition can lengthen the regulatory process manyfold. This should be recognized in any project timeline.

MAJOR STATE PERMITS:

Alaska Dept. of Environmental Conservation

Air Quality Control Operating Permit
Solid Waste Disposal Permit
Domestic Wastewater Disposal Permit and Plan Review
Wastewater Disposal
NPDES Certification
Large Scale Fuel Storage

Department of Natural Resources

Geothermal Operations Plan Approval
Water Rights Appropriation
Tidelands Lease
Uplands Lease

Division of Governmental Coordination (Governor's Office)

Coastal Zone Consistency Determination

Department of Fish and Game

Title 16 Stream Crossing Permits

Alaska Public Utilities Commission

Certificate of Public Convenience

MAJOR FEDERAL PERMITS:

U. S. Environmental Protection Agency

NPDES Permit (may not be required)
NEPA Compliance
RCRA Compliance
Oil Spill Prevention Control and Countermeasure Plan

U.S. Corps of Engineers

404 Permit

U.S. Fish and Wildlife Service

Section 7 Consultation (Endangered Species Act)

MINOR PERMITS

City building permits, Coast Guard navaid reviews, fuel transfer checks, fire marshal reviews, CPCRA listings (community right-to-know listings of hazardous substances), OSHA safety reviews, and others will be required during the course of Project development.

AIR QUALITY BENEFITS

The Unalaska/Dutch Harbor area presents unique air pollution problems. Because of its nature as one of the busiest fishing and fish processing ports in the world, it is an industrial area in the middle of the North Pacific Ocean, with few other sources of air pollution within hundreds of miles. The air pollution problem, however, could be significant due to the fact that electric energy is produced through diesel generation. Diesel generation is, compared to other generation methods, "dirty" in its production of nitrogen oxides (NO_x) and particulate matter. For years, the U.S. Environmental Protection Agency and Alaska's Department of Environmental Conservation were less than strict in requiring prompt permitting of new generators and in mandating strict emissions controls. The result is that both agencies are now concerned with possible violations of ambient air quality standards for nitrogen dioxides (NO_2).

The Division of Environmental Quality now limits the amount of air pollutants emitted by local sources through a cap on the amount of electricity generated. Both the City and the processors have applied for permission to generate greater amounts and are in the process of trying to demonstrate to the agency through the use of computer modeling that the additional generation will not produce pollutants in excess of the ceiling on additional pollutants imposed under federal law by Prevention of Significant Deterioration ("PSD") standards. Three-hour, 24-hour, and annual limitations are established; and if the computer models show higher emissions than allowed for any particular geographic location, then generation will be limited from the source or sources contributing to the problem area.

The problem facing the City and the processors is that their current emissions very nearly exceed PSD limitations, especially for NO_2. Unless they find some way to reduce their emissions, the PSD cap on NO_2 will result in a prohibition on additional electric generation in specific areas.

A number of alternatives to constructing the Project exist which could also reduce emissions or assist in alleviating the problem. A brief description of each of these options and the approximate cost of implementing it is provided below. For a more detailed discussion of each option, refer to Appendix C to this report.

Emissions Control - Emissions from the existing facilities can be reduced through certain combustion modifications or post-combustion techniques. These include:

Fuel Injecting Timing Retard
Water/Fuel Emulsion
Exhaust Gas Recirculation
Aftercooling

Alternative Generation - Another potential way to reduce emissions and alleviate the air quality issue in Unalaska would be to install different types of generators. When burning either No. 2 fuel oil or natural gas, combustion turbines emit less NO_x than medium-speed diesel engines, and exhaust temperature and flow of combustion turbines provide better dispersion in a modeling analysis. Combustion turbines cost approximately $800 per kilowatt for a new unit.

Another alternative is the use of gas-fired diesel engines, although the reduction of NO_x is not expected to be significant. The use of gas (such as propane) may make catalytic controls more viable. Non-selective catalytic reduction (NSCR), comparable to a catalytic converter on an automobile, can be used on certain engines burning clean fuel and operating with very little excess air. Up-front costs of using gas as a fuel essentially include the cost of storage tanks, piping, and controls. Operating costs, as compared to diesel fuel, would include the price differential of the delivered costs of fuels.

The City is currently investigating the economics of a hydroelectric project in the event that the geothermal Project is not built. This alternative and others exist which do not have as many air emissions as combustion turbines. The economic feasibility of such resources have not been investigated at this time.

Relocation of Generation Facilities - One solution might be to relocate existing generating units or constructing new units at a different physical location where emissions would not flow into a problem area. This option, however, would probably require construction of new buildings, distribution lines, and other support facilities. The costs of implementing this option have not been estimated, but it is expected to be significantly less than construction of the geothermal Project.

Currently, the City has most of its generating facilities located in the Dutch Harbor area, but one generator is located in Unalaska. Since the Unalaska generator does not have the same restrictions as the other facilities, it has been used when the City is facing certain generating restrictions.

Centralized Dispatch - Presently, the processors do not exchange power among themselves, but instead rely on their own generation and occasional purchases from the City. The City relies on its own generation with some purchases on a periodic basis from one of the processors. A centralized dispatch with exchanges or purchases of power could help reduce the pollution problem by generating in areas that are not as severely limited by emissions. Capital expenditures would include equipment for a central dispatch system and upgrading the distribution system so unlimited transfers could occur.

In summary, several technological alternatives can be considered to alleviate air quality problems in Unalaska, and the costs for implementing these alternatives appear to be an order of magnitude less than the geothermal Project.

VII. AGREEMENTS

GENERAL

Should the Authority decide to pursue the development of the Project, certain contracts must be negotiated. The following discussion provides the major aspects of a development contract that would be used in constructing the Project and the power sales agreement used during Project operation. Other agreements, such as an operating and maintenance agreement, a contract to drill and test the wells, and others, will be required also.

DEVELOPMENT CONTRACT

The terms of a development contract will vary depending on the amount of risk the Authority is willing to accept prior to the Project becoming commercially operable. In its final form, the contract should clearly show each party's responsibilities and remedies in the event of non-compliance. Responsibilities detailed in the contract will include such things as:

- Design
- Engineering
- Licensing and permits
- Construction financing
- Construction/construction management
- Resource/fuel contracts which meet pre-determined standards
- Transmission/transportation contracts which meet pre-determined standards
- Demonstrating that the completed facility performs to specified standards
- Assuring that moneys are available to acquire the project when complete and has demonstrated performance
- Start-up

As part of the development process, the Authority's due diligence efforts should also include, among other things, a review of the geothermal lease agreement and potential liabilities that could be passed on to the Authority.

POWER SALES AGREEMENT

Based on past discussions with the City and processors, it appears that a requirements-type contract is the only power sales agreement they would find acceptable. This type of contract differs from the "take-or-pay" type of contract in that the obligation of the power purchaser is limited to acquiring project output to the extent it is available and to the extent it is required. There is no implied or actual pledge of customer financial resources to the energy supplier.

The City and the processors have recently agreed to negotiate a power sales agreements substantially in the same form as that attached as Appendix A to this report. The primary agreement would be between the Authority and the City under which the City would purchase all of the energy produced by the Project. The City, in turn, would then sell power to the processors. Major aspects of these requirements contracts are as follows.

Contract 1 (Authority/City)

Term: Commercial Operation through the final maturity of the bonds

Price: 10.5 cents/kWh (1992 dollars) escalated at inflation or 3 percent, whichever is greater. (Note: This is slightly different than that modeled in this analysis.)

Construction: It is the Authority's responsibility to design, construct, own and operate the Project.

Project Usage: The City agrees to use the output of the Project first in providing for area-wide energy requirements.

Contract 2 (City/Net Requirements Industrial Customers)

Term: Same as Contract 1

Price: The price of energy delivered by the City to the Purchaser is at a yet-to-be specified rate that escalates at the same rate as in Contract 1. (Note: The analysis assumes a rate of 12.0 cents/kWh.)

Energy Sales: The City agrees to sell to the Purchaser all of the Purchaser's Net Requirements. Net Requirements is defined as the Purchaser's total energy requirements less that amount generated by the Purchaser at the request of the City.

Contract 3 (City/Full Requirements Industrial Customers)

Term: Same as Contract 1

Price: The price of energy delivered by the City to the Purchaser is at a yet-to-be specified rate that escalates at the same rate as in Contract 1 (assumed in the analysis to be 12.0 cents/kWh).

Energy Sales: The City agrees to sell to the Purchaser all of the Purchaser's energy requirements.

VIII. SUMMARY

Based on the foregoing analysis and discussions, certain observations can be made regarding the Unalaska Geothermal Project. These include the following.

PROJECT BENEFITS

1. The Project will eliminate many electric generating restrictions (air quality regulations) currently facing the City and some of the processors and provide for more efficient generation and dispatch of power.
2. The Project will significantly reduce the City's and processors' dependence on fossil fuels and provide a more predictable power cost independent of oil price fluctuations.
3. The Project as initially constructed would have surplus capacity during off-peak periods and can accommodate some growth in energy requirements during such periods without additional capital expenditures.
4. Assuming the geothermal resource is adequate, the Project can easily be expanded in discrete increments to accommodate future load growth.

REQUIRED STATE/AUTHORITY INVESTMENT

5. The target price of 12.0 cents/kilowatt-hour in 1992 dollars can be attained with the State's investment in the Project. This investment includes:
    a. An initial grant of $10 million.
    b. An additional amount ranging from approximately $8.5 million to over $56 million depending on the assumptions used.
6. Less State investment is required using rate stabilization instead of equity to maintain rates at the target rate. However, the equity concept significantly reduces the size of the bond issue and provides the opportunity to obtain a higher rate of return on the State investment.

7. The use of the moral obligation of the State would provide the Project access to capital at lower interest costs. However the pledge of the moral obligation could adversely affect the State's credit rating.

PROJECT RISKS

8. The amount of State investment required is highly sensitive to the input variables used in the analysis including the interest rate on the bonds, expected load levels, construction costs, City costs, federal subsidies, and others.

9. Additional amounts of State investment could be required through the life of the bonds should energy requirements, Project availability, or operating costs differ from that assumed.

10. Inclusion of the Project bonds with the Authority's general obligation debt would endanger the Authority's credit rating and adversely affect the cost of financing future Authority projects.

OTHER

11. The cost of power from the Project, as presently structured, would escalate at an annual rate equal to the greater of 3 percent or general inflation. Although the Project would provide more predictability in prices than with diesel generation, the potential benefits from any future price decreases of diesel would be foregone.

12. The amount of bonds required to fund the Project will probably exceed the present $80 million Industrial Development Bond allocation. Therefore, an additional allocation should be sought as well as extending the present allocation to a time commensurate with the Project schedule.

13. There are other possible methods of alleviating Unalaska's current air emission/generation restrictions which have not been thoroughly explored at this time and may want to be considered.

APPENDIX A

Draft Power Sales Agreements

MEMORANDUM OF AGREEMENT
regarding the
Makushin Geothermal Project

THIS AGREEMENT, is made and entered into this ___ day of _____, 1993, by and between the ALASKA INDUSTRIAL DEVELOPMENT AND EXPORT AUTHORITY, an independent agency of the State of Alaska, hereinafter referred to as "AIDEA," and THE CITY OF UNALASKA, a First Class City organized under the Constitution and laws of the State of Alaska, hereinafter referred to as "Unalaska," for the supply, sale and use and purchase of wholesale electric energy, which includes substantially the terms below.

WHEREAS, AIDEA desires to construct the Makushin Geothermal Project (the "Project"), and to sell and supply electric energy from the Project to Unalaska pursuant to the terms and conditions of this Agreement, and

WHEREAS, Unalaska desires to buy, use, distribute and resell electric energy from AIDEA pursuant to the terms and conditions of this Agreement;

NOW, THEREFORE, the parties agree as follows:

Section 1. Purchase and Sale Commitment.

(a) Parties commitments. AIDEA hereby agrees to sell and deliver electric energy to Unalaska, and Unalaska hereby agrees to purchase and receive electric energy from AIDEA, pursuant to the terms and conditions hereinafter provided.

(b) AIDEA's obligation to supply energy. AIDEA shall deliver to Unalaska one hundred percent (100%) of the net electric energy output of the Project at the Point of Delivery.

(c) Unalaska's obligation to purchase energy. Subject to subsection 1 (d) of this Agreement, Unalaska agrees to purchase Unalaska's full requirements of electric energy from AIDEA under this Agreement, to the extent such energy is available from the Project. Unalaska acknowledges that in periods of maximum or peak demand, the Project may not provide sufficient energy to meet the full load requirements of Unalaska's system, including its industrial customers. Unalaska agrees that during such periods Unalaska shall serve the loads of its system, including its industrial customers, by utilizing self-generated

electric energy and by purchasing and reselling electric energy generated by its net requirements industrial customers ("Net Requirements Purchasers").

(d) System reliability and spinning reserve. AIDEA acknowledges that Unalaska may from time to time generate or purchase additional electric energy from sources other than the Project for the purposes of maintaining system reliability and spinning reserve as required by Prudent Utility Practices. Such reasonable enectric energy purchases shall be excluded from Unalaska's obligation to purchase full energy requirements according to subsection 1 (c) of this Agreement.

Section 2. Term of Agreement.

(a) Effectiveness. This Agreement shall become effective on the first date when (i) the Agreement has been executed and delivered by AIDEA and Unalaska, and (ii) Agreements in substantially the form of Exhibit "A" and Exhibit "B" to this Agreement have been executed and delivered to Unalaska by industrial customers comprising in the aggregate an annual estimated net energy demand of Seventy Five Thousand megawatt-hours (75,000 MWH).

(b) Commencement of purchase obligations. The purchase obligations of Unalaska under the Final Power Purchase Agreement shall commence on the date of First Commercial Operation of the Project.

(c) First Commercial Operation defined. The date of First Commercial Operation is expected by both parties to be approximately _____ _____, 19__. The respective obligations to deliver and purchase energy shall in no case become effective before _____, 19__. The obligations to deliver and purchase Project energy shall become effective upon the reasonable declaration by AIDEA that the Project is fully available to be operated at not less than ten megawatts (10 MW), and that its output can be scheduled on a commercial basis.

(d) Expiration. This Agreement shall expire on the earliest of (i) the date when the final Power Purchase Agreement is duly executed by both Parties, or (ii) the date when either party validly terminates this Agreement in accordance with Section 14 hereof.

(e) Term of Power Purchase Agreement. The Parties intend that the term of the Power Purchase Agreement be no less than the final maturity of bonds issued by AIDEA to finance the Project. The parties expect that maturity to be approximately 20 years.

Section 3. Exhibits. The following exhibits are incorporated by reference into this Agreement:

(a) Exhibit "A", form of Net Requirements Memorandum of Agreement between the City of Unalaska and industrial purchasers,

(b) Exhibit "B", form of Full Requirements Memorandum of Agreement between the City of Unalaska and industrial purchasers,

(c) Exhibit "C", Description of the Project, and

(d) Exhibit "D", Estimated Project Costs.

Section 4. Electric Service To Be Furnished.

(a) Available Energy. AIDEA shall at all times, except when prevented by a cause or event not within the control of AIDEA, make energy available to Unalaska in an amount equal to the amount Unalaska may schedule from the Project, within the limitations imposed by available Project capability, available geothermal fluids, available transmission capacity, and the scheduling procedures adopted by the parties.

(b) Specification of Electric Service. All electric energy delivered hereunder by AIDEA shall be in the form of three-phase alternating current at a frequency of approximately 60 cycles and at approximately ___ volts. Buyer agrees to limit any low voltage condition as a result of starting in rush current to no more than _____ percent (___%) leading.

(c) Point of Delivery. The point of delivery for the electric energy to be delivered hereunder shall be the ___ KV line at the load side terminals at Unalaska's No. _____ line tap. AIDEA will take such steps and make any arrangements necessary to bring the electric power service hereunder to the Point of Delivery.

Section 5. Obligations To Construct Project; Operation and Maintenance.

(a) Makushin geothermal project. AIDEA shall design, construct, own and operate the Project, an approximately 13 MW capacity electric generation facility, described more particularly in Exhibit "C" to this Agreement, which shall produce the electric energy to be provided hereunder.

(b) Transmission and other facilities. AIDEA shall provide, own and operate all transmission, metering and protective facilities required to deliver electric energy to the Point of Delivery.

(c) Operation and maintenance. AIDEA shall be responsible for the proper operation and maintenance of all said facilities up to and including the Point of Delivery. AIDEA agrees to provide sixty (60) days written notice of all scheduled maintenance periods. AIDEA agrees to provide at least_____ (___) days written notice prior to making any major modifications to its facilities or major changes in operating conditions.

(d) Unalaska facilities. Unalaska shall provide and maintain all facilities on the load side of the Point of Delivery as necessary for the utilization of said service and in accordance with Prudent Utility Practice.

(e) Cooperation by Unalaska. Unalaska agrees to use its best efforts to cooperate with AIDEA throughout the period of design, construction and operation of the Project in such a manner that best assures that the Project is designed, constructed, operated and maintained to provide the most efficient and most beneficial service, at the lowest reasonable cost, to the Unalaska system and Unalaska's industrial customers.

Section 6. Obligations To Finance Project; Completion of Project.

(a) Project funding. AIDEA shall issue bonds, or otherwise obtain funds (including from appropriations by the Alaska State Legislature or loans from State of Alaska agencies), sufficient to pay or reimburse the cost of acquisition and construction of the Project.

(b) Rate stabilization fund. AIDEA shall establish a rate stabilization fund if such fund is required to provide energy at the price contracted for in this Agreement.

(c) Project completion and operation. AIDEA agrees to use its best efforts to complete the Project expeditiously and in accordance with sound engineering practice. AIDEA shall also use its best efforts consistent with Prudent Utility Practice to construct and complete, and to operate and maintain the Project (or to arrange for such operation and maintenance) to provide energy at the lowest reasonable cost to Unalaska in a manner that is compatible with this Agreement.

(d) Best efforts by Unalaska. To the extent that the retail cost of Project energy is or may be affected by actions of Unalaska, Unalaska agrees to

use its best efforts consistent with Prudent Utility Practice to assist in assuring that the Project provides energy to ratepayers at the lowest reasonable cost and in a manner that is compatible with Unalaska's system and consistent with this Agreement.

Section 7. Energy Price.

(a) Initial rate. During the first calendar year of Project operation, all electric energy delivered under this Agreement shall be received and paid for by Unalaska at an initial rate of 10.500 cents per kilowatt hour ($0.10500/Kwh), adjusted for that calendar year by multiplying 10.500 cents by one plus the percent change in the Anchorage Consumer Price Index (hereinafter "ACPI") between 134.6, which the parties hereby acknowledge to be the average ACPI for calendar year 1992, and the most recent ACPI published before the Date of Commercial Operation.

(b) Annual rate adjustment. The rate charged and paid for energy shall be adjusted each January 1 thereafter by either: (i) applying the percent change in the ACPI during the previous year; or, (ii) multiplying the immediate prior annual rate by 103%, whichever is greater.

(c) Factors affecting ultimate rates. AIDEA and Unalaska understand and agree that, in the final Power Purchase Agreement, the parties may agree to a higher or lower Initial Rate or to a higher or lower minimum annual adjustment factor, depending upon one or more factors. Such factors include, but are not necessarily limited to, (i) grants or subsidies received for the Project from any source, (ii) Project cost, and (iii) interest rates of any bonds or other financing of the Project. Nothing in this Agreement requires either Party to agree to a price other than that specified in subsections 7 (a) and 7 (b) of this Agreement.

Section 8. Unalaska's System.

(a) Unalaska's rate covenants. In order to afford, permit, and make timely payments as specified in this Agreement, Unalaska agrees that it will establish, charge and collect rates, fees, and charges with respect to Unalaska's system in accordance with applicable law to provide revenues sufficient to meet its obligations under this Agreement.

(b) Operation and maintenance of Unalaska's system. Unalaska covenants and agrees that it will operate and maintain its system in

good repair, working order and condition, and in accordance with Prudent Utility Practice.

(c) Limitation on certain contracts. Unalaska covenants and agrees not to enter voluntarily into any contract or agreement to take or to take or pay for energy, other than this Agreement, payable from the revenues of Unalaska's system on a parity with or superior to the execution of its obligations under this Agreement.

(d) Limitation on certain energy sales. Unalaska further covenants and agrees not to sell or deliver any energy, whether generated by Unalaska or another party other than AIDEA, unless the Project cannot deliver that energy upon demand.

Section 9. Dispatch.

(a) Unalaska's dispatch services. Unalaska shall provide complete dispatch services and shall dispatch all Project energy, all energy generated by the Unalaska system, and to the maximum extent possible, all other energy generated or used within the Unalaska service area.

(b) Priority of energy dispatched. Unalaska shall operate the dispatch service in such a manner that, whenever possible, the full available energy output of the Project is dispatched prior to dispatch of any other available energy, whether from Unalaska's system or from other generation sources.

Section 10. Regulatory Jurisdiction And Authorization.

(a) Alaska Public Utilities Commission. To the extent that Alaska Public Utilities Commission ("APUC") jurisdiction is applicable to transactions between the Parties, AIDEA and Unalaska agree to seek any required permits and authorizations from the Alaska Public Utilities Commission authorizing them to enter into the Final Power Purchase Agreement contemplated herein in Section 13, or to execute their respective responsibilities under that Agreement. The Final Power Purchase Agreement shall be subject to the condition that said required authorization and approval, if any, will be granted.

(b) Licenses and permits. Service under the Final Power Purchase Agreement shall also be subject to the provision that there shall be obtained from the appropriate departments of the Federal, State and local governments, the necessary licenses or permits to construct and operate the Project and such other facilities as may be required for the proper implementation of this Agreement.

Section 11. Conditions Subsequent.

(a) Legislative authorization. Any rights or obligations of AIDEA or Unalaska arising under the Final Power Purchase Agreement are contingent upon legislative authorization for AIDEA to finance the Project.

(b) AIDEA Board of Directors approval. Any rights or obligations of AIDEA or Unalaska arising under this Agreement are contingent upon approval of the Project by the AIDEA Board of Directors as a Development Project pursuant to AS 44.88.177. Unalaska hereby acknowledges that execution of this Agreement by the Executive Director of AIDEA does not limit nor burden the AIDEA Board of Directors in their action to approve or disapprove the Project as a Development Project.

Section 12. Efforts To Obtain Appropriations.

(a) Appropriations sought. AIDEA agrees to investigate all appropriate means to achieve funding for the Project through appropriations from the Alaska Legislature and other sources. Such appropriations may be in the form of direct grants, loans, rate subsidies, or other considerations.

(b) Mutual efforts. AIDEA and Unalaska agree to mutually support and use best efforts to achieve government funding from the sources identified by AIDEA through the investigation carried out pursuant to Section 12 (a). Nothing in this Agreement obligates Unalaska to seek government funding for the Project in such a manner as endangers government funding for other Unalaska public works projects which are mandated by federal law.

Section 13. Negotiation Of Other Agreements. AIDEA and Unalaska understand and agree that this Agreement must be memorialized in more detail as a Final Power Purchase Agreement between the Parties before AIDEA can proceed with financing the Project. AIDEA and Unalaska agree to negotiate in

good faith to reach agreement on a final Power Purchase Agreement and other agreements necessary to finance and construct the Project. AIDEA and Unalaska shall make best efforts to complete all necessary final agreements no later than July 1, 1994.

Section 14. Termination By Either Party.

(a) Assumptions. AIDEA and Unalaska understand and acknowledge that this Agreement is entered in good faith on the basis of certain assumptions regarding, among others, (i) the availability of all required licenses and permits for the Project, (ii) approval of the Project by the Alaska State Legislature and the Board of Directors of AIDEA, (iii) final Project cost, (iv) the availability of financing at certain interest rates, (v) the productivity of the Makushin geothermal field, (vi) the initial rate for Project energy, and (vii) sufficient net energy commitments from industrial customers in accordance with subsection 2 (a) of this Agreement. The Parties further agree and acknowledge that construction of the Project and sale of energy at acceptable rates may become imprudent if these or other factors change before Project construction begins.

(b) Termination by either Party. Either Party may terminate this Memorandum of Agreement prior to execution of a Final Power Purchase Agreement, with or without cause, upon thirty (30) days written notice duly delivered to the other Party.

IN WITNESS WHEREOF, the Parties hereto have caused this Agreement to be executed in their respective names by the proper officers hereunto duly authorized as of the date and year first above written.

ALASKA INDUSTRIAL DEVELOPMENT AND EXPORT AUTHORITY	CITY OF UNALASKA
_____	_____
William R. Snell, Executive Director	Mark Ernest, City Manager
_____	_____
Date	Date
ATTEST:	ATTEST:
_____	_____