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Decision 83 05 043, May 18, 1983

ORIGINAL

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Application of PACIFIC GAS AND ELECTRIC COMPANY for an Order approving certain provisions of a Power Sales Agreement between AeroTurbine Energy Corporation and Pacific Gas and Electric Company. (Electric)	Application 82-12-22 (Filed December 8, 1982; amended January 20, 1983, May 5, 1983, and May 17, 1983)

O P I N I O N

I. Summary

We approve the power purchase arrangement contained in the Power Purchase Agreement (Agreement) between Pacific Gas and Electric Company (PG&E) and AeroTurbine Energy Corporation (ATE) for Stage I of the proposed wind facility (Facility).

We find that the Agreement's nonstandard pricing provisions for Stage I, which call for initial payments of 11¢ per kilowatthour (/kWh) starting November 1, 1984, are prudent and reasonable for the development of this commercial scale wind turbine project. We also find that the operating incentives and performance standards contained in the Agreement for ATE adequately limit the risk assumed by PG&E's ratepayers in the early years of the project.

PG&E is authorized to recover the contract payments made to ATE for purchases from the Stage I installation through its Energy Cost Adjustment Clause (ECAC), subject only to a review of the reasonableness of PG&E's performance of its obligations and exercise of its rights under the Agreement.

In addition to the 46 megawatts (MW) of wind turbine generators (WTGs) developed in Stage I, the Agreement provides for the later development of Stage II and Stage III, each consisting of 40 MW of WTGs. PG&E retains discretion under the Agreement to authorize development of Stage II and Stage III at a later date, and to decide whether such authorizations shall require specific approval by this Commission of their pricing provisions.

We note that in Decision (D.) 82-01-103 in Order Instituting Rulemaking (OIR) 2, we limited automatic review by this Commission of nonstandard contracts to those filed by January 21, 1984. This limitation still applies, though D.82-01-103 allows extensions of this deadline if deemed necessary. Today's approval of portions of the Agreement does not prejudge whether we would review the Stage II and Stage III pricing provisions after that date.

II. Background

Application (A.) 82-12-22 requests approval of a power purchase agreement between PG&E and ATE. Approval is sought because the Agreement's pricing provisions do not conform with PG&E's presently authorized standard offer for purchases of capacity and energy from alternate energy resources. PG&E asks that the Commission issue an order that approves the nonstandard provisions and authorizes recovery by PG&E through the Energy Cost Adjustment Clause (ECAC) procedure of all payments made to ATE.

A.82-12-22 was served upon all known interested parties. The original filing and three amendments were noticed in the Commission's Daily Calendar. No protests to A.82-12-22 have been received at the Docket Office. A hearing was not required, and A.82-12-22 was processed on an ex parte basis as requested by PG&E.

The Commission staff (staff) reviewed the original filing and the first amendment to A.82-12-22, and submitted its analysis by letter dated February 17, 1983. PG&E responded to the staff analysis by letter dated February 23, 1983. Staff reviewed the second amendment and submitted further comments on May 16, 1983. The third amendment contained additional PG&E testimony, but did not alter the Agreement.

III. PG&E - ATE Agreement

On December 3, 1982, PG&E executed the Agreement with ATE. Under the Agreement, PG&E will purchase all power delivered from ATE's wind generation facilities located in Solano County, California, for a period of 30 years. ATE plans to install up to 126 megawatts (MW) of generation, consisting of 36 3.5 MW Boeing Commercial Mod 2 WTGs, at the site.

PG&E's currently effective Standard Offer No. 1 (Standard Offer) for the purchase of as-delivered capacity and energy from alternate resources over 100 kilowatts (kW) was used as the starting point for negotiations. PG&E and ATE departed from the Standard Offer and negotiated nonstandard pricing provisions which are intended, on the one hand, to promote the development of ATE's project by guaranteeing the price in the early years of operation and, on the other hand, to minimize the ratepayer's exposure and compensate the ratepayer for the risk presented by the Agreement.

There are three phases to the pricing provisions: Phase I (1985 through 1992), Phase II (1993 through 2000), and Phase III (2001 through 2015). The pricing arrangements for the first 46 MW comprising Stage I differ from those for Stage II and Stage III only during the seven years of Phase I.

During Phase I, power delivered from the Stage I development shall be purchased at a price of 11¢/kWh, subject to

adjustment for the average capacity factor achieved by the WTGs. Power delivered from Stage II would be purchased at 10¢/kWh and from Stage III at 9¢/kWh during this phase, subject to the same adjustments as in Stage I. The price adjustment is tied to a contractually established capacity factor for the Facility during each of the seven years of Phase I of the Agreement. These capacity factors start at 35% in the first year and escalate yearly to a maximum of 40% in years five through seven. If the capacity factor achieved during a given year falls below the contractually established capacity factor, the price for the following year will be adjusted downward. After a downward adjustment, if ATE is later able to increase its capacity factor significantly above the established level, it is able to recoup the revenue lost as a result of the earlier price reduction.

During Phase II, which begins January 1, 1993, and ends December 31, 2000, ATE will receive payments of 90% of PG&E's then current Standard Offer prices for as-delivered capacity and energy unless certain conditions exist.

If during a given year ATE has attained a 30% capacity factor, and PG&E's payments to ATE of 90% of then current as-available avoided cost do not equal or exceed ATE's necessary and reasonable cost of operation for such year, and the Performance Account (described below) has a positive value, PG&E shall pay ATE the difference up to a maximum of the per kWh prices set forth in the Agreement, ranging from 14.3¢/kWh in 1993 to 23.9¢/kWh in 2000, multiplied by the number of kWh delivered. The contractually established caps were derived as 90% of PG&E's most recent avoided cost projections.

A Performance Account (PA) will be established at the beginning of Phase II with a balance of 3,250,000 kWh for each MW of installed project capacity, which represents about one year's output at a 40% capacity factor. At the end of each year of

Phase II, the difference between the actual number of kWh delivered and 4,000,000 kWh (which represents approximately a year's output at a 50% capacity factor) for each MW of installed capacity will be added or subtracted from the PA balance, provided that the PA balance can never exceed 3,250,000 kWh times each MW of installed capacity or be less than zero. If there is a positive balance in the PA, and ATE has attained a 30% capacity factor during a given year, PG&E will pay the cost of operation differential but not in excess of the kWh delivered times the contractually established cap.

If at the beginning of a Phase II year the PA is positive but after the year end accounting the PA balance is eliminated, PG&E's cost of operation payment will be prorated appropriately.

If total payments during any Phase II year in which a 30% capacity factor is attained do not cover ATE's cost of operation, the remainder is carried over (without interest) to following years' calculations of operating costs. Under no circumstances would PG&E's payments in a given year of Phase II be greater than the higher of 90% of then current as-available avoided cost or the contractually established per kWh maximum price.

Any operating costs in excess of revenues incurred during a year in which ATE does not attain a 30% capacity factor shall be borne solely by ATE. In addition, any operating costs which are not liquidated by PG&E's final Phase II payment (for power delivered in the year 2000) shall be borne by ATE.

During Phase III, which begins January 1, 2001, and continues until the Agreement expiration date, December 31, 2015, ATE will be paid a price based on the internal rate of return (IRR) the ratepayers have received during the first 15 years of the Agreement (Phases I and II). The IRR is calculated by comparing

the actual payments by the ratepayers with the payments they would have made at the as-available Standard Offer price. If the IRR is 25% or more, PG&E has the right to credit 20% of the project's net revenue (the Standard Offer price reduced by ATE's operating costs) toward the monthly power purchase payments which have been computed using the then current as-available Standard Offer prices. If the IRR is zero, 65% of the net revenues may be credited toward the payments. A sliding scale adjusts this percentage linearly between the minimum and maximum depending on the actual IRR. In no event would ATE receive above Standard Offer prices during Phase III.

PG&E emphasizes that several provisions of the Agreement will minimize the ratepayer's risk.

First, PG&E asserts that the technical and resource risk to the ratepayer is minimized since the price paid in Phase I is tied to machine capacity factors. If the WTGs' capacity factor drops below a specified level, then the price per kWh the ratepayers pay is reduced. PG&E points out that the ratepayer's exposure decreases if the WTGs experience technical difficulties or if the wind availability at the project site is below current projections. If the project fails and no power is delivered, the ratepayer pays nothing.

Second, PG&E claims that the authority which it has obtained to review and approve the financing arrangements for the project ensures that financing costs will be fairly spread over the Phase I and Phase II years of operation.

Third, PG&E states that its right to require refinancing if it will lower project costs is another way for PG&E to control and lower the project's operating costs in Phase II.

Last, PG&E notes that ATE will obtain a warranty from Boeing for the WTGs and also will get insurance for the first five years of installation. In addition, ATE will negotiate an operating and maintenance (O&M) agreement with Boeing for the Phase I and Phase II years. Both the warranty and O&M agreements are subject to approval by PG&E.

There are several other substantial non-standard features of the Agreement. PG&E has the right of first refusal to purchase ATE's interest or ownership right in the project at any time. PG&E further has the one-time option to purchase the project in 1993 for 90% of its market value at that time, if that sum is sufficient, after provision for income taxes, to cover 1.25 times any outstanding debt. ATE agrees to provide PG&E with operating and machine performance data, which PG&E agrees to keep confidential if requested by ATE. Commencing January 1, 1992, PG&E can audit any of ATE's records regarding its performance under the Agreement. ATE has agreed to permit PG&E to make available to the Commission any information obtained by PG&E through such audits.

IV. PG&E's Showing

PG&E attached to A.82-12-22 the prepared testimony of G. Ted Ankrum, President and Chief Executive Officer of ATE; Michael V. Russo, Civil Engineer in PG&E's Generation Planning Department; and John E. Lowe, Director of the Wind Energy Program at Boeing Engineering and Construction Company, a subsidiary of the Boeing Company. Ankrum's testimony explains the structure of ATE, ATE's incentives under the Agreement to operate the project, and the lead time necessary to produce the WTGs and at the same time qualify for federal and state tax credits. Russo's testimony

is amended in the second and third amendments to A.82-12-22, and describes the nonstandard pricing provisions in detail with several projections of contract payments measured against projected as-available avoided costs over the 30-year life of the project. Finally, Lowe's testimony discusses the design and development of Boeing's Mod 2 WTGs.

PG&E predicts that power purchases over the life of the Agreement will be below PG&E's avoided cost. Under the base case analyzed by PG&E, based on its most recent projections of avoided costs, the ratepayers would earn an internal rate of return of about 23% on those payments made in excess of Standard Offer prices. PG&E asserts that the predicted benefits, both economic and societal, from the project are greater for the ratepayer than for its stockholders. Accordingly, PG&E asserts that the ratepayer, not the stockholder, should assume the price risk presented by this project and the Agreement.

V. Staff Review

A.82-12-22 was reviewed by the Utilities Division, Policy and Planning Division, and the Legal Division. The Utilities and Legal Divisions recommend conditional approval. The Policy and Planning Division recommends disapproval of the contract.

Utilities - Legal Position

The Utilities and Legal Divisions representatives, R. Thomas Beach and Brian T. Cragg, conclude that the Agreement strikes a fair balance between the risks and benefits of this project. The contract amendments provide a reasonable limit to the ratepayers' exposure to meeting ATE's Phase II cost of operation, and provide ATE with a strong incentive to minimize this cost.

However, the amendments do not offer sufficient incentives to ATE to install as large a project as possible, in order to reduce average costs.

The Utilities and Legal Divisions recommend expeditious approval of the application subject to the following conditions:

1. PG&E's review and approval of the warranty and O&M agreements obtained by ATE should be examined by the Commission.
2. PG&E's review and approval of the project's financing terms should be examined by the Commission.
3. PG&E's payment of ATE's operating costs beyond 90% of avoided costs in Phase II should be reviewed by the Commission. PG&E should justify why this cost was "necessary and reasonable," including the use of cash purchases in lieu of financed transactions for capital improvements.

Essentially, the Utilities and Legal Divisions recommend that PG&E's administration and enforcement of its rights under the Agreement should be reviewed for reasonableness by the Commission at a later date. If PG&E diligently asserts its contract rights on behalf of the ratepayer, then all payments made to ATE should be recovered through ECAC. However, if PG&E somehow fails to exercise its contract rights and does not adequately protect the ratepayer's interest, then full recovery should not be allowed. This staff recommendation is consistent with PG&E's own request for approval of the Agreement "...subject only to a review of PG&E's performance of its obligations and exercise of its rights under the Agreement." (A.82-12-22, page 1.)

Both Beach and Cragg support the project as a unique opportunity for commercial scale development by a large manufacturer of a preferred alternate resource.

Policy and Planning Position

The Policy and Planning Division representative, Ken D'Antonio, asserts that ratepayer risk under the Agreement is excessive compared to potential benefits, though the second amendment has reduced the amount of ratepayer risk. He evaluates risk due to uncertainty about (1) the number of WTGs that will be installed at the site; (2) the operating life of the Mod 2 WTGs; and (3) ATE's cost of operating the WTGs. Because of these three uncertainties, he concludes that the ratepayers face unacceptable technical risks. In his opinion, the proposed project should yield ratepayer returns of at least 7.5% plus inflation, to compensate for the risks associated with it. Under his assumption about avoided cost escalation rates and WTG capacity factors, the project does not produce returns of this magnitude.

In addition, D'Antonio comments that the staff lacks the capability to properly evaluate a multimillion dollar investment of this type. He notes that staff analysis of these applications is dependent on utility data which may be inaccurate or self-serving. He contends that since the utility's interest is not identical to that of the ratepayer, reliance on utility representations creates an additional risk in the Commission's evaluation of nonstandard contracts.

VI. Discussion

After reviewing the Agreement as amended and the parties' analyses of it, we are persuaded that PG&E and ATE have struck a reasonable balance of the risks and benefits created by the non-standard pricing provisions for Stage I. The proposed project presents substantial risks which are spread among PG&E's ratepayers,

ATE, Boeing, and other investors. ATE must finance and build the project. ATE also bears the risk of complete project failure. If no power is ever delivered by ATE, PG&E's ratepayers pay nothing. Although the manufacturer's warranty is not yet available for review, Boeing will guarantee a minimum mechanical availability for its WTGs. If this minimum is not achieved, then Boeing will pay for lost revenues up to an unspecified limit. Boeing also will commit to a 15-year O&M contract with a fixed price for the first five years of operation. Boeing bears much of the performance risk in the early years of the project. PG&E's ratepayers are asked to assume the price risk and some technical risk. However, PG&E's ratepayers would benefit if avoided costs increase as PG&E projects and the machines continue to operate in later years. The risk is limited by operational incentives in the Agreement which encourage ATE to minimize early overpayments.

In Decision 82-01-103, the Commission established a policy for review of nonstandard offers:

> "The guiding principle ...is that the contract terms, taking into account the associated risks, should not be more than expected avoided cost under the standard offer. Ratepayers are expected in most nonstandard offers to accept some technological or market risk, in which ratepayers should be returned compensating benefit. ...In the rare event that the nonstandard offer is above avoided costs, an explanation of how ratepayers otherwise benefit should be presented. In all cases, the burden is on the applicant to demonstrate why the nonstandard offer is in the ratepayers' interest. We must caution all parties that the Commission will review these contracts as a banker reviews a loan application, with scrutiny and skepticism. While we want to encourage QF development, we do not wish to burden ratepayers in the process." (D. 82-01-102, page 103)

We divide our discussion of this project into two sections: Economic Analysis and Implications for the Advancement

of Wind Technology. Based only on an analysis of likely future avoided cost payments and the substantial risks presented to ratepayers by the contract, we cannot conclude that the contract is the economic equivalent of the standard offer. However, the contract has important compensating benefits. Besides the several nonquantifiable benefits associated with most renewable energy technologies, this project, if successful, would commercialize a large-scale wind technology for the first time. This could produce substantial long-term benefits to ratepayers.

We approve the power purchase arrangements only for Stage I of the proposed Facility. Since PG&E has not committed to Stage II and Stage III and has not submitted any analyses of these portions of the Facility, we do not rule on their merits.

PG&E is authorized to recover the contract payments made to ATE for purchases from the Stage I installation through its ECAC, subject only to review of PG&E's performance of its obligations and exercise of its rights under the Agreement. This review will include the extent to which PG&E limits any payments in Phase II and Phase III based on ATE's operating costs to only "necessary and reasonable" costs, as well as PG&E's exercise of its rights and performance of its obligations such as review and approval of the warranty, O&M agreements, and financing terms. We expect PG&E to pay the minimum amount allowed under the Agreement at all times.

1. Economic Analysis

The threshold question is whether the costs under the Agreement are greater than expected avoided costs. For purposes of this analysis, PG&E and staff compared the Agreement with the as-available Standard Offer. Table 1 presents representative results of the value of this contract to ratepayers assuming

TABLE 1

PG&E/AEROTURBINE POWER PURCHASE AGREEMENT

Performance Based On
Selected Avoided Cost Escalation Rates and Capacity Factors

Avoided Cost Escalation Rate (%)	Prime, Discount Rate (%)	Capacity Factor (%)	Ratepayer Savings, 1985-2000 Net Present Value ($000)	Ratepayer Savings, 1985-2000 Internal Rate of Return (%)	Ratepayer Savings, 1985-2015 Net Present Value ($000)	Ratepayer Savings, 1985-2015 Internal Rate of Return (%)	Maximum Amount of Overpayments Net Present Value ($000)	Maximum Amount of Overpayments Year	Breakeven Year (Net Present Value of Overpayments = 0)
0,5,5*	7	30	-1,090	1.64	22,228	21.5	3,982	1995	2001
		40	-28,071	-***	12,258	9.2	31,046	1996	2010
		50	-28,696	-	23,571	10.3	30,435	1997	2009
0,5,10*	10	30	1,430	16.1	11,576	26.1	2,101	1986	1992,1998
		40	-19,935	-	33,788	15.9	23,066	1996	2006
		50	-19,853	-	52,191	16.8	24,557	1994	2005
Base Case**	10	30	16,620	78.9	26,996	78.9	1,075	1986	1988
		40	6,370	19.9	28,333	24.7	7,775	1989	1994
		50	5,683	15.9	45,582	23.2	11,540	1989	1996
5	7	30	4,890	91.6	13,646	91.6	704	1985	1987
		40	-17,521	-	25,503	12.4	20,039	1997	2006
		50	-15,275	-	44,614	14.3	17,898	1992	2004
10	10	30	23,934	164.9	42,194	164.9	639	1985	1987
		40	16,043	41.5	42,327	42.4	4,195	1988	1990
		50	17,892	36.2	52,341	37.8	5,414	1988	1991

* Escalation rates for 1984-85; 1986-90; and 1991-2015
** PG&E's November 1982 Base Case: 3.5% for 1984-85; average of 11.2% for 1986-91; and 7.7% for 1992-2015.
*** Less than zero.

ATE's operational cost projections, various avoided cost escalation rates, and three different average capacity factors. PG&E's "Base Case" analysis assumes that avoided cost will be 7.1¢/kWh in 1985, compared with a 6.8¢/kWh level currently, and that it will escalate at an average rate of 11.2% from 1985-90, and at 7.7% from 1991-2015. PG&E estimates that the internal rate of return to ratepayers in its Base Case will be about 24%, depending on the project's capacity factor. In other words, the investment ratepayers make in the project in the early years in the form of payments above avoided cost would earn an average return of 24% per year due to the discounts from avoided cost in the later years, assuming the machines operate successfully for thirty years.

Avoided costs are calculated from three factors: the price of fuel (fundamentally oil or gas), the efficiency at which a utility burns the fuel (the incremental heat rate), and the capacity payment. Each of these components must be examined to assess the reasonableness of PG&E's Base Case forecast.

While fuel price forecasts are cloudy at best, world oil markets have softened and additional sharp increases now appear less likely than only a few months ago. Competing energy suppliers may continue to drive oil prices below the peak levels established by OPEC. Oil prices may increase with general inflation, or slightly above inflation, but we do not view inflation rates nor oil escalation rates near the peak levels of the past decade as the most likely scenario during the years ahead.

Secondly, a high avoided cost (as opposed to fuel price) escalation rate seems less likely when expected system efficiency improvements are taken into account. When the Diablo Canyon nuclear units and the Helms pumped storage facility come

on-line, PG&E will rely less on its less efficient plants. PG&E predicts that its system incremental heat rate will improve by more than 15% within 10 years. This will place a downward pressure on avoided costs, tempering any oil and gas price increases.

Avoided costs also include a capacity component. PG&E assumes in its Base Case forecast that its capacity payments will be at 50% of the cost of a combustion turbine in 1985, increasing to 100% of a combustion turbine in 1990. We note that the current as-available avoided cost payments include 100% of the cost of a gas turbine as the capacity component. (The capacity component of the as-available avoided cost of 6.8¢/kWh used by PG&E in evaluating this contract is weighted by the expected time of delivery of the wind-generated electricity.) If we were to adopt an adjustment to capacity payments to reflect changes in system reliability as PG&E advocates in the OIR 2 proceedings, then there would be a further downward pressure on avoided costs in the 1980's.

As this brief summary of the components of avoided cost indicates, estimates of future avoided costs are difficult to make, at best. However, given current oil markets, we believe that PG&E's Base Case forecast represents the high end of what we would consider reasonable expectations. Avoided costs have declined recently. We believe that continued stablilization with slight escalation throughout the remainder of the 1980's is likely.

Without extensive study, we have no intention of blessing any scenario as an official Commission forecast. Given the great uncertainties that exist regarding avoided cost, we find it useful to examine the sensitivity of the contract performance to a range of avoided cost projections. Table 1 presents the value

of the contract to ratepayers with various avoided cost escalation rates. Based on a 5% avoided cost escalation rate, the ratepayers would earn a return of 12.4% on their investment over a 30-year life of the project if the machines operate at a 40% capacity factor. Under higher avoided cost escalation assumptions, the contract looks much more attractive. If oil prices climb rapidly, then ratepayers would benefit from a relatively low-priced source of energy.

There is, of course, a possibility that avoided costs will escalate at less than 5% yearly. PG&E analyzed what would occur if avoided costs remain flat between now and 1985, and then escalate at a 5% rate. The ratepayers' return is reduced to 9.2% over the life of the contract if the machines operate at a 40% capacity factor.

Thus, depending upon assumptions about avoided cost escalation rates, the ATE contract produces annual returns for ratepayers ranging from 9% to 24%. This range of return appears to be reasonable, if ratepayers could be assured the benefits would be realized through the successful operation of the WTGs over a thirty year period. In other words, the contract does not appear to place unreasonable avoided cost risks on ratepayers. Ratepayers accept fuel market risks whenever the Commission issues a Certificate of Public Convenience and Necessity for a utility project. Ratepayers regularly accept risks that cheaper alternatives (either through operations of existing plants or development of new technologies) will appear.

The ATE contract includes more than market risk, however. It also includes the risk that the machine will not perform as expected. These technological risks must be evaluated separately. Since the MOD-2 wind machines have not been proven commercially,

they carry with them an unknown technological risk. We have looked carefully at the potential losses to which the ATE contract exposes ratepayers in the event that the machines encounter operational problems.

Contract performance is compared in Table 1 for average machine capacity factors of 30%, 40%, and 50%. Ratepayer risk due to the machines operating consistently at a low-capacity factor is minimal. If the machines do not operate, ratepayers pay nothing. There would be discounts from the 11¢/kWh price in Phase I due to failure to reach the capacity factor requirements contained in the contract. Further, in Phase II, the Performance Account would be depleted rapidly so that ATE would not qualify for payments beyond 90% of avoided cost after two or three years. Maximum ratepayer exposure if the machines operate at 30% capacity factor is $4.0 million.

Table 1 shows that ratepayer losses could be much larger if the machines operate successfully for some time, but then fail before ratepayer overpayments are returned in later years. Under the 5% avoided cost escalation case, the maximum exposure to ratepayers, calculated as the net present value of the cumulative total of payments above avoided cost, was estimated to be $20.0 million and would occur in 1997, the thirteenth year of project operation. If the project failed at that time, ratepayers would lose the $20.0 million. The machines would have to operate successfully for twenty years before the ratepayers receive, with interest, their earlier overpayments.

We are uncertain whether the WTGs will operate for twenty years, let alone whether they will provide the substantial benefits envisioned during the last ten years of the thirty-year contract. PG&E presented a report on the technical viability of

the project prepared by Arthur D. Little, Inc., a consulting firm. However, this report was prepared for a five-year insurance policy and does not address potential longer-term reliability problems.

In Phase II the ratepayers face the additional risk that the machines will perform well but at high cost to ATE relative to avoided cost. If this occurs, PG&E may be required to pay ATE its cost of debt, taxes, operation and maintenance, royalties, and management fees up to a contractually established cap. While PG&E may audit ATE books should this situation occur and we would have access to these audit records as well, this need for retroactive review concerns us. A mere verification that the expenditures occurred does not establish their reasonableness. Since ATE cannot make a profit in years in which a cost of operation differential payment is made, it has a strong incentive to keep costs low, which should act to minimize the risk of performance at high capacity factor and high cost in Phase II.

The level of technological risk borne by ratepayers in Phase II has been reduced substantially in the recent contract amendment. We are also reassured by the fact that the project sponsors are themselves at considerable risk for WTG performance, since payments at the maximum prices are made only if the machines perform well, and no payments are made if they do not operate at all. However, significant risks still exist. A possible annual return ranging from 9.4% to 24% is outweighed by the risk of the machines not operating properly. The Arthur D. Little report on machine performance gives us some reassurance, but the technology is too young to estimate its life expectancy or operation and maintenance costs. Based only on our expectations regarding future avoided costs and our evaluation of project risks described

in this section, we cannot conclude that the ATE contract would be less than or equal to expected avoided cost payments under a standard offer. However, as discussed in the next section, there are other important factors which compensate for these technological risks.

2. Implications for the Advancement of Wind Technology

PG&E, the Legal Division, and the Utilities Division argue that this project is a critical step in development of large scale wind machines for electric generation. While contracts for projects employing relatively small wind machines have been signed, this would be the first commercial development of large, multi-megawatt machines. The Utilities Division argues that the optimal size of wind energy technology has not yet been established and that further information on the cost and reliability of larger wind turbines is needed. Larger turbines could yield economies of scale that would allow more extensive and economical exploitation of California wind resources. It is important that this possibility be explored.

PG&E and staff also point out that given the possible expiration of tax credits at the end of 1985, this may be the only opportunity to commence the development of the large wind turbine technology in the near future. If the technology is developed now, there is the prospect that additional machines can be built at a lower cost as production and operation techniques improve. Such a development could provide ratepayers with the benefits of a renewable resource to displace oil-fired capacity in the latter half of this decade and consequently reduce susceptibility to oil embargos and sudden price increases.

We find PG&E and staff reasoning to be persuasive. This is the most advanced commercial project employing large WTGs proposed at this time. The sponsors of the project have agreed to sell energy from two additional 40 MW installations for 10¢ and 9¢ after Phase I, which is a hopeful sign that further economies can be realized. We would also note that excellent wind sites are available both in northern and southern California. If the larger wind turbine technology does prove to be economical, it will allow wind resources in California to be more fully utilized, contributing to our current efforts to diversify fuel sources and reduce our reliance on imported oil.

Were we to look upon this project in isolation, we might not approve this contract. While the project would benefit ratepayers when compared with simply burning oil or gas in existing powerplants if it operated over a thirty year life, we are too unsure about its life expectancy and performance characteristics to approve it solely for those benefits. While there is a fair chance that the project will prove to be cost effective, there is also a fair chance ratepayers would be better off economically just by relying on utility oil operations.

The project cannot be viewed in isolation, however. If it does perform well, it is possible that large scale turbines will be deployed widely in the future. For a potential exposure of about $20-30 million, ratepayers have the opportunity to gain enormously when the possiblility of widespread development of the technology is considered. At worst, ratepayers could lose $20-30 million if the project fails midway and large wind machines prove to be unworkable. At best, ratepayers could earn favorable returns on the project itself and benefit from further diversification into wind. We conclude that the potential benefits outweigh the risks.

This contract should not be viewed as a precedent for other contracts between utilities and small power producers. The price being paid to ATE in Phase I is high, as is the ratepayer's exposure to technological risk. For technologies not in such a critical state of development, or which are without such vast potential, we would not necessarily find these contract provisions to be reasonable. However, we still encourage utilities to continue to negotiate nonstandard contracts when requested to do so.

Findings of Fact

1. PG&E and ATE have negotiated an Agreement with nonstandard pricing provisions calling for initial payments of 11¢/kWh for Stage I of the Facility, with adjustments possible depending on the capacity factor achieved.

2. The pricing level during Phase II of operation is established at 90 percent of the then-current as-available energy and capacity Standard Offer prices, with larger payments possible if ATE costs exceed this payment level.

3. The pricing provisions during Phase III of operation depend on a comparison of earlier payments to avoided costs, as contained in PG&E's as-available Standard Offer.

4. The risks assumed by PG&E's ratepayers are limited by operating incentives and performance standards contained in the Agreement.

5. PG&E, the ratepayer, and the wind industry will gain valuable experience and knowledge from ATE's project.

6. This order should take effect on the date of issuance due to the lead time for manufacture of the WTGs and the expiration of federal and state tax credits in 1985.

Conclusions of Law

1. The power purchase arrangements contained in the Agreement between PG&E and ATE are reasonable for Stage I of the project although the pricing provisions and other provisions differ from PG&E's presently authorized standard offer for as-delivered capacity and energy from privately owned energy resources.

2. PG&E should recover the contract payments to ATE for power delivered from Stage I of the project through ECAC, subject to a review for reasonableness of PG&E's performance of its obligations and exercise of its rights under the Agreement.

O R D E R

IT IS ORDERED that:

1. The provisions of the Power Purchase Agreement (Agreement) contained in Appendix A of A.82-12-22 relating to Stage I of the proposed Facility are reasonable.

2. Pacific Gas and Electric Company (PG&E) shall recover through its Energy Cost Adjustment Clause (ECAC) all payments made under the above-mentioned provisions, subject to review of the reasonableness of its performance of its obligations and exercise of its rights under the Agreement. This review shall include the reasonableness of the warranty and maintenance agreements obtained by AeroTurbine Energy Corporation (ATE) from Boeing, the

project financing terms, and 11 payments by PG&E of ATE's operating costs during Phase II and Phase III.

This order is effective today.

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

I will file a written concurrence.

/s/ Leonard M. Grimes, Jr.
Commissioner

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

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

Joseph E. Bodovitz, Executive Director

COMMISSIONER LEONARD M. GRIMES, JR., Concurring:

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

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

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

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

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

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

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

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

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

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

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

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

LEONARD M. GRIMES, JR., COMMISSIONER

San Francisco, California
May 18, 1983

ALJ/js

Decision 83 05 043 MAY 18 1983

ORIGINAL

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Application of PACIFIC GAS AND ELECTRIC COMPANY for an Order approving certain provisions of a Power Sales Agreement between AeroTurbine Energy Corporation and Pacific Gas and Electric Company. (Electric)	Application 82-12-22 (Filed December 8, 1982; amended January 20, 1983 and May 5, and May 17, 1983)

O P I N I O N

I. Summary

We approve the power purchase arrangement contained in the Power Purchase Agreement (Agreement) between Pacific Gas and Electric Company (PG&E) and AeroTurbine Energy Corporation (ATE) for Stage I of the proposed wind facility (Facility).

We find that the Agreement's nonstandard pricing provisions for Stage I, which call for initial payments of 11¢ per kilowatthour (/kWh) starting November 1, 1984, are prudent and reasonable for the development of this commercial scale wind turbine project. We also find that the operating incentives and performance standards contained in the Agreement for ATE adequately limit the risk assumed by PG&E's ratepayers in the early years of the project.

PG&E is authorized to recover the contract payments made to ATE for purchases from the Stage I installation through its Energy Cost Adjustment Clause (ECAC), subject only to a review of the reasonableness of PG&E's performance of its obligations and exercise of its rights under the Agreement.

In addition to the 46 megawatts (MW) of wind turbine generators (WTGs) developed in Stage I, the Agreement provides for the later development of Stage II and Stage III, each consisting of 40 MW of WTGs. PG&E retains discretion under the Agreement to authorize development of Stage II and Stage III at a later date, and to decide whether such authorizations shall require specific approval by this Commission of their pricing provisions.

We note that in Decision (D.) 82-01-103 in Order Instituting Rulemaking (OIR) 2, we limited automatic review by this Commission of nonstandard contracts to those filed by January 21, 1984. This limitation still applies, though D.82-01-103 allows extensions of this deadline if deemed necessary. Today's approval of portions of the Agreement does not prejudge whether we would review the Stage II and Stage III pricing provisions after that date.

II. Background

Application (A.) 82-12-22 requests approval of a power purchase agreement between PG&E and ATE. Approval is sought because the Agreement's pricing provisions do not conform with PG&E's presently authorized standard offer for purchases of capacity and energy from alternate energy resources. PG&E asks that the Commission issue an order that approves the nonstandard provisions and authorizes recovery by PG&E through the Energy Cost Adjustment Clause (ECAC) procedure of all payments made to ATE.

A.82-12-22 was served upon all known interested parties. The original filing and two amendments were noticed in the Commission's Daily Calendar. No protests to A.82-12-22 have been received at the Docket Office. A hearing was not required, and A.82-12-22 was processed on an ex parte basis as requested by PG&E.

The Commission staff (staff) reviewed the original filing and the first amendment to A.82-12-22, and submitted its analysis by letter dated February 17, 1983. PG&E responded to the staff analysis by letter dated February 23, 1983. Staff reviewed the second amendment and submitted further comments on May 16, 1983.

III. PG&E - ATE Agreement

On December 3, 1982, PG&E executed the Agreement with ATE. Under the Agreement, PG&E will purchase all power delivered from ATE's wind generation facilities located in Solano County, California, for a period of 30 years. ATE plans to install up to 126 megawatts (MW) of generation, consisting of 36 3.5 MW Boeing Commercial Mod 2 WTGs, at the site.

PG&E's currently effective Standard Offer No. 1 for the purchase of as-delivered capacity and energy from alternate resources over 100 kilowatts (kW) was used as the starting point for negotiations. PG&E and ATE departed from the standard offer and negotiated nonstandard pricing provisions which are intended, on the one hand, to promote the development of ATE's project by guaranteeing the price in the early years of operation and, on the other hand, to minimize the ratepayer's exposure and compensate the ratepayer for the risk presented by the Agreement.

There are three phases to the pricing provisions: Phase I (1985 through 1992), Phase II (1993 through 2000), and Phase III (2001 through 2015). The pricing arrangements for the first 46 MW comprising Stage I differ from those for Stage II and Stage III only during the seven years of Phase I.

During Phase I, power delivered from the Stage I development shall be purchased at a price of 11¢/kWh, subject to

adjustment for the average capacity factor achieved by the WTGs. Power delivered from Stage II would be purchased at 10¢/kWh and from Stage III at 9¢/kWh during this phase, subject to the same adjustments as in Stage I. The price adjustment is tied to a contractually established capacity factor for the Facility during each of the seven years of Phase I of the Agreement. These capacity factors start at 35% in the first year and escalate yearly to a maximum of 40% in years five through seven. If the capacity factor achieved during a given year falls below the contractually established capacity factor, the price for the following year will be adjusted downward. After a downward adjustment, if ATE is later able to increase its capacity factor significantly above the established level, it is able to recoup the revenue lost as a result of the earlier price reduction.

During Phase II, which begins January 1, 1993, and ends December 31, 2000, ATE will receive payments of 90% of PG&E's then current Standard Offer prices for as-delivered capacity and energy unless certain conditions exist.

If during a given year ATE has attained a 30% capacity factor, and PG&E's payments to ATE of 90% of then current as-available avoided cost do not equal or exceed ATE's necessary and reasonable cost of operation for such year, and the Performance Account (described below) has a positive value, PG&E shall pay ATE the difference up to a maximum of the per kWh prices set forth in the Agreement, ranging from 14.3¢/kWh in 1993 to 23.9¢/kWh in 2000, multiplied the number of kWh delivered.

A Performance Account (PA) will be established at the beginning of Phase II with a balance of 3,250,000 kWh for each MW of installed project capacity, which represents about one year's output at a 40% capacity factor. At the end of each year of

Phase II, the difference between the actual number of kWh delivered and 4,000,000 kWh (which represents approximately a year's ouptput at a 50% capacity factor) for each MW of installed capacity will be added or subtracted from the PA balance, provided that the PA balance can never exceed 3,250,000 kWh times each MW of installed capacity or be less than zero. If there is a positive balance in the PA, and ATE has attained a 30% capacity factor during a given year, PG&E will pay the cost of operation differential but not in excess of the kWh delivered times the contractually established cap.

If at the beginning of a Phase II year the PA is positive but after the year end accounting the PA balance is eliminated, PG&E's cost of operation payment will be prorated appropriately.

If total payments during any Phase II year in which a 30% capacity factor is attained do not cover ATE's cost of operation, the remainder is carried over (without interest) to following years' calculation of operating costs. Under no circumstances would PG&E's payments in a given year of Phase II be greater than the higher of 90% of then current as-available avoided cost or the contractually established per kWh maximum price.

Any operating costs in excess of revenues incurred during a year in which ATE does not attain a 30% capacity factor shall be borne solely by ATE. In addition, any operating costs which are not liquidated by PG&E's final Phase II payment (for power delivered in the year 2000) shall be borne by ATE.

During Phase III, which begins January 1, 2001, and continues until the Agreement expiration date, December 31, 2015, ATE will be paid a price based on the internal rate of return (IRR) the ratepayers have received during the first 15 years of the Agreement (Phases I and II). The IRR is calculated by comparing

the actual payments by the ratepayers with the payments they would have made at the as-available Standard Offer price. If the IRR is 25% or more, PG&E has the right to credit 20% of the project's net revenue (the Standard Offer Prices reduced by ATE's operating costs) toward the monthly power purchase payments which have been computed using the then current as-available Standard Offer prices. If the IRR is zero, 65% of the net revenues may be credited toward the payments. A sliding scale adjusts this percentage linearly between the minimum and maximum depending on the actual IRR. In no event would ATE receive above Standard Offer prices during Phase III.

PG&E emphasizes that several provisions of the Agreement will minimize the ratepayer's risk.

First, PG&E asserts that the technical and resource risk to the ratepayer is minimized since the price paid in Phase I is tied to machine capacity factors. If the WTGs' capacity factor drops below a specified level, then the price the ratepayers pay is reduced. PG&E points out that the ratepayer's exposure decreases if the WTGs experience technical difficulties or if the wind availability at the project site is below current projections. If the project fails and no power is delivered, the ratepayer pays nothing.

Second, PG&E claims that the authority which it has obtained to review and approve the financing arrangements for the project ensures that financing costs will be fairly spread over the Phase I and Phase II years of operation.

Third, PG&E states that its right to require refinancing if it will lower project costs is another way for PG&E to control and lower the project's operating costs in Phase II.

is amended in the second amendment to A.82-12-22, and describes the nonstandard pricing provisions in detail with several projections of contract payments measured against projected as-available avoided costs over the 30-year life of the project. Finally, Lowe's testimony discusses the design and development of Boeing's Mod 2 MTGs.

PG&E predicts that power purchases over the life of the Agreement will be below PG&E's avoided cost. Under the base case analyzed by PG&E, based on its most recent projections of avoided costs, the ratepayers would earn an internal rate of return of about 23% on those payments made in excess of Standard Offer prices. PG&E asserts that the predicted benefits, both economic and societal, from the project are greater for the ratepayer than for its stockholders. Accordingly, PG&E asserts that the ratepayer, not the stockholder, should assume the price risk presented by this project and the Agreement.

V. Staff Review

A.82-12-22 was reviewed by the Utilities Division, Policy and Planning Division, and the Legal Division. The Utilities and Legal Divisions recommend conditional approval. The Policy and Planning Division recommends disapproval of the contract.

Utilities - Legal Position

The Utilities and Legal Divisions representatives, R. Thomas Beach and Brian T. Cragg, conclude that the Agreement strikes a fair balance between the risks and benefits of this project. The contract amendments provide a reasonable limit to the ratepayers' exposure to meeting ATE's Phase II cost of operation, and provide ATE with a strong incentive to minimize this cost.

of Wind Technology. Based only on an analysis of likely future avoided cost payments and the substantial risks presented to ratepayers by the contract, we cannot conclude that the contract is the economic equivalent of the standard offer. However, the contract has important compensating benefits. Besides the several nonquantifiable benefits associated with most renewable energy technologies, this project, if successful, would commercialize a large-scale wind technology for the first time. This could produce substantial long-term benefits to ratepayers.

We approve the power purchase arrangements only for Stage I of the proposed Facility. Since PG&E has not committed to Stage II and Stage III and has not submitted any analyses of these portions of the Facility, we do not rule on their merits.

PG&E is authorized to recover the contract payments made to ATE for purchases from the Stage I installation through its ECAC, subject only to review of PG&E's performance of its obligations and exercise of its rights under the Agreement. This review will include the extent to which PG&E limits any payments in Phase II and Phase III based on ATE's operating costs to only "necessary and reasonable" costs, as well as PG&E's exercise of its rights and obligations such as review and approval of the warranty, O&M agreements, and financing terms. We expect PG&E to pay the minimum amount allowed under the Agreement at all times.

1. Economic Analysis

The threshold question is whether the costs under the Agreement are greater than expected avoided costs. For purposes of this analysis, PG&E and staff compared the Agreement with the as-available Standard Offer. Table 1 presents representative results of the value of this contract to ratepayers assuming

TABLE 1

PG&E/AEROTURBINE POWER PURCHASE AGREEMENT

Performance Based On
Selected Avoided Cost Escalation Rates and Capacity Factors

Avoided Cost Escalation Rate (%)	Prime, Discount Rate (%)	Capacity Factor (%)	Ratepayer Savings, 1985-2000 Net Present Value ($000)	Ratepayer Savings, 1985-2000 Internal Rate of Return (%)	Ratepayer Savings, 1985-2015 Net Present Value ($000)	Ratepayer Savings, 1985-2015 Internal Rate of Return (%)	Maximum Amount of Overpayments Net Present Value ($000)	Maximum Amount of Overpayments Year	Breakeven Year (Net Present Value of Overpayments = 0)
0,5,5*	7	30	-1,090	1.64	22,228	21.5	3,982	1995	2001
		40	-28,071	-***	12,258	9.2	31,046	1996	2010
		50	-28,696	-	23,571	10.3	30,435	1997	2009
0,5,10*	10	30	1,430	16.1	11,576	26.1	2,101	1986	1992,1998
		40	-19,935	-	33,788	15.9	23,066	1996	2006
		50	-19,853	-	52,191	16.8	24,557	1994	2005
Base Case**	10	30	16,620	78.9	26,996	78.9	1,075	1986	1988
		40	6,370	19.9	28,333	24.7	7,775	1989	1994
		50	5,683	15.9	45,582	23.2	11,540	1989	1996
5	7	30	4,890	91.6	13,646	91.6	704	1985	1987
		40	-17,521	-	25,503	12.4	20,039	1997	2006
		50	-15,275	-	44,614	14.3	17,898	1992	2004
10	10	30	23,934	164.9	42,194	164.9	639	1985	1987
		40	16,043	41.5	42,327	42.4	4,195	1988	1990
		50	17,892	36.2	52,341	37.8	5,414	1988	1991

* Escalation rates for 1984-85; 1986-90; and 1991-2015

** PG&E's November 1982 Base Case: 3.5% for 1984-85; average of 11.2% for 1986-91; and 7.7% for 1992-2015.

*** Less than zero.

This contract should not be viewed as a precedent for other contracts between utilities and small power producers. The price being paid to ATE in Phase I is high, as is the ratepayer's exposure to technological risk. For technologies not in such a critical state of development, or which are without such vast potential, we would not necessarily find these contract provisions to be reasonable. We encourage utilities to continue to negotiate contracts which provide greater pricing certainty than the currently available standard offers.

Findings of Fact

1. PG&E and ATE have negotiated an Agreement with nonstandard pricing provisions calling for initial payments of 11¢/kWh for Stage I of the Facility, with adjustments possible depending on the capacity factor achieved.

2. The pricing level during Phase II of operation is established at 90 percent of the then-current as-available energy and capacity Standard Offer prices, with larger payments possible if ATE costs exceed this payment level.

3. The pricing provisions during Phase III of operation depend on a comparison of earlier payments to avoided costs, as contained in PG&E's as-available Standard Offer.

4. The risks assumed by PG&E's ratepayers are limited by operating incentives and performance standards contained in the Agreement.

5. PG&E, the ratepayer, and the wind industry will gain valuable experience and knowledge from ATE's project.

6. This order should take effect on the date of issuance due to the lead time for manufacture of the WTGs and the expiration of federal and state tax credits in 1985.

Conclusions of Law

1. The power purchase arrangements contained in the Agreement between PG&E and ATE are reasonable for Stage I of the project although the pricing provisions and other provisions differ from PG&E's presently authorized standard offer for as-delivered capacity and energy from privately owned energy resources.

2. PG&E should recover the contract payments to ATE for power delivered from STage I fo the project through ECAC, subject to a review for reasonableness of PG&E's performance of its obligations and exercise of its rights under the Agreement.

O R D E R

IT IS ORDERED that:

1. The provisions of the Power Purchase Agreement (Agreement) contained in Appendix A of A.82-12-22 relating to Stage I of the proposed Facility are reasonable.

2. Pacific Gas and Electric Company (PG&E) shall recover through its Energy Cost Adjustment Clause (ECAC) all payments made under the above-mentioned provisions, subject to review of the reasonableness of its performance of its obligations and exercise of its rights under the Agreement. This review shall include the reasonableness of the warranty and maintenance agreements obtained by ATE from Boeing, the project financing terms, and all