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BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

TESTIMONY OF J. BRIAN DIETZ

ON BEHALF OF PANDA-KATHLEEN, L.P.

DOCKET NO. 950110-EI

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I. INTRODUCTION AND QUALIFICATION

Q. Please state your name, profession, and business address.

A. My name is J. Brian Dietz. I am the Director of Engineering and Operations of Panda Energy International, Inc. Panda Energy International, Inc. is engaged in the development and operation of cogeneration facilities. Panda-Kathleen, L.P. is engaged in the development, ownership and operation of independent power facilities and a qualified cogeneration facility in Lakeland, Florida pursuant to a contract between Panda-Kathleen, L.P. and Florida Power Corporation. My business address is 4100 Spring Valley, Dallas, Texas 75244.

Q. State briefly your educational and professional background.

A. I earned a Bachelor of Science degree in mechanical engineering from the University of Maryland in 1960 and a Master of Science degree in mechanical engineering from Rensselaer Polytechnic Institute in 1966.

From 1960-61, I was employed by Vitro Laboratories of Silver Spring, Maryland. From 1961-66, I was employed by

United Technologies as a Senior Engineer, leaving in 1966 to join Vought Corporation of Dallas, Texas as a Senior Engineering Specialist. I left Vought in 1977 to become the Director of Engineering and Development for Lone Star Energy Company of Dallas, Texas.

In 1983, I left Lone Star to become the Manager of Business Development for CSW Energy, Inc. of Dallas. In that position, I directed project development activities for cogeneration, small power production and energy management activities for CSW, a then newly-formed subsidiary of Central and Southwest Corporation, a public utility holding company. At CSW, I led a business development team that obtained four letters of intent to develop more than 300 MW of cogeneration projects.

In 1985, I left CSW to become the Director of Project Development for Ford, Bacon & Davis of Monroe, Louisiana. While employed in this position from 1985-87, I marketed and developed cogeneration projects for this engineering and construction firm specializing in pulp and paper projects.

In 1987, I returned to Lone Star Energy as a Vice-President, serving as executive manager for Lone Star, directing engineering, operations and profit-loss performance for five large thermal energy plants representing a $170 million investment.

In 1989, I left Lone Star to become an independent consultant specializing in the development, analysis and operations and maintenance of industrial energy and cogeneration projects. During that time, in addition to my work for other clients, I reviewed the operational readiness of the operations contractor, and performed owners representative overview activities for the commissioning, start-up and testing of a 165 MW combined cycle cogeneration facility for Panda Energy Corporation, the predecessor to Panda Energy International, Inc..

I joined Panda Energy Corporation in September 1992 as its Director of Engineering and Operations.

I am a registered professional engineer in the state of Texas and have held numerous offices in the American Society of Mechanical Engineers.

Q. **On whose behalf are you appearing in this proceeding?**

A. I am appearing on behalf of Panda-Kathleen, L.P.

Q. **Please describe your duties with Panda Energy International, Inc.**

A. As Panda's chief engineer, I have the responsibility for the direction of the design, analyses, selection and specification of all major equipment and systems for the Panda-Kathleen project and the 230 MW Panda Brandywine project. These responsibilities also include, and have included, participation in the negotiation of the turnkey engineering/procurement/construction contracts for these cogeneration plants.

As Panda's chief of plant operations, I have total management responsibility for the operation and maintenance of Panda's existing 175 MW cogeneration facility in North Carolina. The plant consists of one GE Frame 7 and one GE Frame 6 gas turbine in a combined cycle configuration. My responsibilities also include corporate management and the administration of the power purchase contract and thermal sales contract, and responsibility for the financial performance (profit and loss) of the plant.

Q. Have you ever testified before the Florida Public Service Commission?

A. No, I have not.

II. PURPOSE OF TESTIMONY

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to state the facts underlying Panda's attempts to comply with its contractual obligation to ensure that it will be able to supply Florida Power Corporation with wholesale electric power for 30 years at a net 74.9 MW or greater of capacity, under all operating conditions. My testimony will also state the facts regarding the engineering and permitting necessities that Panda attempted to comply with throughout the configuration selection process.

III. CONTRACTUAL CONSIDERATIONS IN CONFIGURATION SELECTION

Q. What considerations went into the choice of configuration for the Panda facility?

A. Panda must select a plant configuration which meets the performance and interconnection requirements set forth in the contract executed by Panda and Florida Power Corporation ("FPC"). These include requirements for the Facility to:

1. Make available to FPC the Committed Capacity of 74.9 MW, at all times, at the Point of Delivery from the Contract In-Service Date throughout the entire term of the power agreement (30 years);

2. Demonstrate, each year, the Commercial In-Service Status of the Facility within 60 days of when FPC demands that demonstration;

3. Maintain an hourly kW output, as metered at the Point of Delivery, equal to or greater than the Committed Capacity for a consecutive twenty-four hour period or during the on-peak hours for two consecutive days;

4. Be in compliance with all applicable permits;

5. Be a Qualifying Facility ("QF") delivering steam during all hours of plant operation (as opposed to the avoided or deferred unit which is a combustion turbine operating as a peaking unit in a simple cycle configuration);

6. Be capable of delivering the Committed Capacity using back-up fuel; and

7. Operate at 74.9 MWH per hour or more for 90% of the on-peak hours and 42% of the total hours in each year of the Contract term to approximate the availability and capacity factor of the utility's avoided unit as required by the Contract.

There are no constraints in the power agreement on the technology, equipment or plant configuration that may be utilized.

Q. Did Panda consider size restrictions in its contract with Florida Power in selecting a configuration for the Panda facility?

A. There are no provisions in the power purchase agreement that restrict the electrical generating capability of the plant. In fact, the contract requires Panda to deliver 74.9 MW of Committed Capacity at the Point of Delivery at all times under all weather conditions and states of maintenance.

IV. <u>ENGINEERING CONSIDERATIONS IN CONFIGURATION SELECTION</u>

Q. Why would Panda need to select a configuration for the facility that would have an ultimate capability exceeding 74.9 MW at the generator?

A. Given the realities of electrical generation, the contract required Panda to construct a facility with an ultimate capability exceeding 74.9 MW at the generator because:

1. The Committed Capacity is determined after parasitic electrical usage (the electricity needed to run auxiliary equipment and systems in the plant that are necessary to generate electricity) is subtracted;

2. The Committed Capacity is determined at, and must be delivered to, the Point of Delivery, after line and transformation losses have occurred;

3. The Committed Capacity must be delivered under all weather conditions and without regard to degradation occurring as a result of normal wear and tear;

4. The Committed Capacity must be deliverable using the back-up fuel; and

5. The Contract requires demonstrating this capability on 60 days notice throughout the term of the Contract, and prudence requires assuming that such notice will take place under worst case conditions.

To satisfy all of these requirements requires the construction of a plant with a maximum total capability greater than the 74.9 MW Committed Capacity.

Q. What design issues went into this configuration selection process?

A. To meet its obligations under its contract with Florida Power, Panda proposed to construct a combustion turbine in a combined cycle configuration for this Facility. Under this configuration, the waste heat from the combustion turbine is captured to make steam, which in turn is used to generate more electricity with great efficiency. The steam is extracted for process uses which is what makes it a cogeneration facility. This is the only viable QF configuration that could be built whereby the capacity and energy payment streams under the Contract will match up with the project's fixed and variable costs and that also will ensure that the facility is in full compliance with the Public Utilities Regulatory Policies Act ("PURPA"). Combined cycle technology has a number of characteristics that require the application of a unit with a maximum total capability greater than the Committed Capacity of 74.9 MW.

Q. Was ambient temperature degradation an issue in configuration selection?

A. Yes. The output of a combined cycle plant varies significantly with changes in ambient temperature and relative humidity. The Contract does not set the ambient conditions for the plant design nor does it set any upper limit for temperature under which the 74.9 MW Committed Capacity performance requirements must be met. Since a combined cycle facility is subject to substantial performance degradation under conditions of high ambient temperature, the plant had to be sized to meet the Committed Capacity under the maximum expected ambient temperature. Florida Power had expressly requested facility performance numbers for temperatures as high as 110° F and temperatures of 100° F are commonly experienced in Lakeland in at least three different calendar months of the year. The maximum recorded temperature is 102° F. During the 30-year term of the Contract, a 102° F temperature must be anticipated.

At a temperature of 102° F, the performance of a combined cycle plant degrades from approximately 15% to 19% of rated capacity (depending on the exact equipment selected) compared with the performance of the unit at 59° F at sea level. Plant rated performance is typically quoted at 59° F at sea level.

Q. What other performance degradation issues were considered in the configuration selection process?

A. A combined cycle facility also is subject to substantial, performance degradation, both non-recoverable and maintenance-recoverable, due to operational wear and tear on the plant. Maintenance-recoverable degradation is experienced between the major overhauls of the combustion turbine, steam turbine, and other plant auxiliary equipment. Published figures by major turbine suppliers show that non-recoverable and maintenance-recoverable degradation can be up to 6%.

In addition, a combined cycle facility experiences operationally-recoverable degradation. This degradation includes that due to combustion turbine compressor and air cleaner fouling. This can amount to 2% of rated capacity. This degradation can be recovered by thorough, off-line "washing" of the compressor and/or cleaning of the air filter. This "washing" can be accomplished when the combustion turbine is off-line.

Q. How must the design capability account for parasitic loads?

A. The facility will consume approximately 2% of its total output for internal purposes, including operating pumps, fans, controls, and other auxiliary equipment. The design must account for these parasitic loads.

Q. How did Panda account for projected transformation and transmission line losses?

A. These losses have been estimated at 1/2% to 1-1/2% and will continue over the thirty year period of the agreement.

Q. Based on the analysis you've just described, what did Panda consider to be the total effects of degradation, parasitic loads and transformation and line losses?

A. For the combined cycle facility to meet the Committed Capacity of <u>74.9 MW at the Point of Delivery at all times</u> during the 30-year term of the power purchase agreement, the plant must be designed to include the cumulative effects of temperature degradation, nonrecoverable degradation, recoverable degradation, and transformation and line losses to the Point of Delivery. These degradations in output do not include reduced plant output or degradation due to random auxiliary equipment failure over the 30 year term of the power agreement. These random equipment failures include such things as loss of a cooling tower fan, heat recovery steam generator tube failures, malfunctioning of combustion or steam turbine controls, valve failures, etc. Prudent engineering practice would include an extra margin of several percent above design rated plant output of the plant. Panda considered 2% to be a conservative margin. In the aggregate, all of these factors, conservatively, can total 27% to 31% of the Facility's initial generation capability rated under standard conditions. As a result the plant must be designed conservatively with a minimum rated output of 100 MW at 59° F net of parasitic loads. This is the minimum size that the Facility must be capable of producing to be able to meet its contractual commitments for the entire 30-year term of the Contract.

IV. ENVIRONMENTAL CONSIDERATIONS IN CONFIGURATION SELECTION

Q. How did environmental regulations play a part in the configuration selection process?

A. When Panda signed the contract with Florida Power, the State of Florida limited nitrogen oxide ("NO_x") emissions to the atmosphere from a generating facility to 25 parts per million ("PPM") at 15% excess oxygen. However, when

Panda began the facility permitting process in late 1992, the State of Florida had limited those emissions to the atmosphere to 15 PPM at 15% excess oxygen. This regulatory change had a significant effect on the technology selection and configuration selection process.

Uncontrolled, most combustion turbine models emit well over 150 PPM NO_x at 15% excess oxygen. There are currently two methods to achieve compliance with NO_x emission standards for a combined cycle plant: (i) through the use of dry low NO_x combustors ("DLN") in the combustion turbine; or (ii) through the injection of water or steam in the combustion turbine combustors in conjunction with injection of ammonia and catalytic reduction in Selective Catalytic Reduction equipment ("SCR") located in the heat recovery steam generator.

Q. **Would the use of Selective Catalytic Reduction equipment ("SCR") enable Panda to comply with these Florida environmental regulations?**

A. No. While both the DLN and, to some extent, SCR technologies are sufficiently developed to be accepted by the engineering, regulatory, and financial communities, the SCR technology has particular problems associated with it that would make it difficult, if not impossible, to meet the 15 PPM requirement over the 30 year contract term.

Application of SCR to combustion turbines has been primarily limited to natural gas fueled units. In California, the state with the most significant experience with SCR, only 11 of 41 permitted SCR facilities have been permitted to fire oil as a backup fuel, as is required for the facility. This is due to the fact that the SCR catalyst promotes the oxidation of flue gas SO_2 to SO_3, which in turn reacts with un-reacted ammonia to form compounds that foul equipment downstream, including the SCR catalyst, rendering it ineffective. Only one of these facilities has ever been fired on oil (resulting in catalyst failure) and it no longer operates with liquid fuels. This factor alone virtually disqualifies SCR technology, and any turbines that cannot meet environmental standards without it, for use by Panda-Kathleen.

In addition, there are certain inherent safety and environmental risks associated with the use of SCR technology. The safety risks include leaks in an urban environment during the transportation, storage, and handling of the ammonia required for the SCR. Ammonia is designated as an "Extraordinarily Hazardous Substance" under Federal Superfund Regulations. The environmental risks include malfunctioning of the SCR and its control system, ammonia slip (i.e., the mismatch between the ammonia injected and the ammonia needed for NO_x reduction during operation), and the disposal at the end of its useful life of spent SCR catalyst, which contains substantial amounts of heavy metals and metal oxides that are classified as hazardous (e.g., titanium, vanadium, platinum, and rhodium). These safety and environmental risks translate into financial risks for operator, owner, and lenders. In addition, a facility using SCR technology will have a higher capital cost and substantially higher operating and maintenance costs than one using DLN technology.

In addition to the advantages of DLN over SCR technology for safety, environmental protection, and cost, DLN technology also offers operability advantages. These include smoothness and reliability during combustor mode changes, gas turbine load changes, and system transients. In addition, unlike SCR equipment, the DLN system operation is transparent to the plant operator.

The use of SCR technology is not preferred by either engineers or regulators in several areas of the country for the aforementioned reasons. Many consider the use of SCR to control NO_x emissions as "extraordinary means" or "heroic technology." The Panda-Kathleen project considered using SCR technology only as a last resort in the event that plant configurations using DLN could not be employed.

V. FINANCING CONSIDERATIONS IN CONFIGURATION SELECTION

Q. How did all of the factors you've described affect plant financeability?

A. Potential lending and equity participants in the Panda-Kathleen project will look not only at its financial strength but also at the plant design and selection of equipment. To be financeable, the plant must incorporate previously applied technology that has been thoroughly proven in other applications and must incorporate that equipment to produce a plant with high reliability over the term of the power contract. The only viable plant option that would meet all these requirements and could be built and operated as a QF with the capacity and energy payment streams provided under the Contract is a combined cycle facility.

VI. EQUIPMENT SELECTION TO COMPLY WITH THE PANDA-FPC CONTRACT

Q. What brands of equipment and models did Panda consider in the configuration selection process?

A. Based on the Contract performance requirements and design issues, Panda performed a detailed evaluation of six combustion turbine alternatives for the combined cycle plant. Several other configurations were evaluated on a preliminary basis. The number of alternative combustion turbines is limited by equipment availability since, unlike conventional steam plants that custom-tailor the steam turbine performance, combustion turbines come only in standard sizes predetermined by the manufacturers. The six configurations evaluated cover a wide range of performance. These were the ABB 8C, Siemens V64.3, GE LM2500, GE LM6000, GE Frame 7EA, and the ABB 11N1 combustion turbines.

The ABB 8C combined cycle facility was unable to produce the necessary minimum rated output of 100 MW at 59° F net of parasitic loads (to overcome expected degradation and line losses) without extensive supplemental firing of the heat recovery steam generator (HRSG) and the use of SCR technology for NOx control to 15 PPM. Supplemental firing of the HRSG is not the most efficient use of fuel for the QF concept. The disadvantages of SCR technology have already been discussed. This configuration was rejected for these reasons.

Similarly, the Siemens V64.3 combined cycle facility also was unable to produce the necessary minimum rated output of 100 MW at 59° F net of parasitic loads without supplemental firing of the HRSG. Further, NO_x emissions cannot be controlled to 15 PPM without the use of SCR. For these reasons, this configuration was rejected.

As with facilities using the ABB 8C or Siemens V64.3 units, a combined cycle facility using three combined GE aero derivative LM2500 combustion turbines was unable to produce the necessary minimum rated output of 100 MW at 59° F net of parasitic loads without supplemental firing of the HRSG. NO_x emissions cannot be controlled to 15 PPM without the use of SCR. For these reasons, this configuration was rejected.

The GE LM6000 aero derivative combined cycle facility using two combustion turbines was determined to produce 109 MW net of parasitic loads at 59° F. This is 9 MW more than the necessary minimum rated output. However, the use of SCRs to control the NO_x emissions to 15 PPM is required. In addition, the capital and O&M costs for this configuration were greater than the costs associated with more acceptable configurations. This configuration was rejected for these reasons.

When new, the GE Frame 7EA combined cycle facility was rated to produce 118 MW net of parasitic loads at 59° F. Control of NO_x emissions to less than 15 PPM can be obtained using DLN technology. Thus, this unit was deemed to be acceptable.

When new, the ABB11N1 combined cycle facility was rated to produce 116 MW net of parasitic loads at 59° F. Control of NO_x emissions to 15 PPM can be obtained using DLN technology. Therefore this unit also was deemed to be acceptable.

VII. PLANT CONFIGURATIONS SELECTED

Q. What brands of equipment and models did Panda ultimately select based on this analysis?

A. Based on the foregoing analysis, Panda determined that the GE Frame 7EA and ABB11N1 combustion turbines are the only reasonable plant configurations that could reliably provide the Committed Capacity of 74.9 MW at the Point of Delivery at all times over the 30-term of the Contract under all weather conditions with the expected degradation, parasitic loads, and losses. These configurations are the lowest capacity units that meet these criteria. The analysis indicated that both were equally capable from a technical and economic standpoint. Both combustion turbine manufacturers were willing to guarantee DLN technology to meet 15 PPM. While Panda submitted both configurations for permitting, ultimately only ABB was able to guarantee timely delivery of its combustion and steam turbines in accordance with the schedule set forth in Panda's EPC contract to assure the plant would achieve Commercial In-Service Status in accordance with the power purchase contract.

Q. Does this conclude your testimony?

A. Yes, it does.

J. Brian Dietz

STATE OF TEXAS)
) SS: 467-54-5763
COUNTY OF Dallas)

The foregoing instrument was acknowledged before me this 4th day of January, 1995 by J. Brian Dietz. He is personally known me, and did take an oath.

[NOTARIAL SEAL]

Notary: Theresia M. Bone
Print Name: THERESIA M. BONE
Notary Public, State of Texas
My commission expires: 6-23-97

THERESIA M. BONE
NOTARY PUBLIC
State of Texas
Comm. Exp 06-23-97