Exhibit No. _____
Issue: Maintenance Costs
Witness: Gary L. Groninger
Type of Exhibit: Direct Testimony
Sponsoring Party: Empire District
Case No.:
Date Prepared: November 2, 2000

Before the Public Service Commission
of the State of Missouri

Direct Testimony

of

Gary L. Groninger

_____ Exhibit No. 9
Date 5/29/01 Case No. ER-2001-299
Reporter KRM

November 2000

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI
DIRECT TESTIMONY OF GARY L. GRONINGER
ON BEHALF OF THE EMPIRE DISTRICT ELECTRIC COMPANY

CASE NO.

I. INTRODUCTION AND PURPOSE

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. Mr. Gary L. Groninger, 11401 Lamar, Overland Park, KS 66211

Q. WHO IS YOUR EMPLOYER AND WHAT POSITION DO YOU HOLD?

A. Black & Veatch is my employer. I hold the title of Project Manager in the Power Sector Advisory Services section of Black & Veatch's Energy Services Group.

Q. PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND.

A. I graduated from Vanderbilt University in 1972 with a Bachelor of Science Degree in Mechanical Engineering. In 1973 with I received a Master of Science degree in Mechanical Engineering from Purdue University.

Q. PLEASE DESCRIBE YOUR PROFESSIONAL EXPERIENCE.

A. I joined General Atomic Company in San Diego immediately after graduation from Purdue University. I worked with Management Analysis Company for over ten years, Energy Factors, Inc. for three years, and Siemens Westinghouse Power Company for over eight years prior to joining Black & Veatch in March 1999. These assignments were all in the power industry in engineering and management roles. Included in these responsibilities were the preparations of operation and maintenance estimates for many different utilities with many different types of power generating equipment.

Q. WHAT TYPE OF SERVICES DOES BLACK & VEATCH'S ENERGY SERVICES

GROUP (ESG) PROVIDE?

A. Black & Veatch currently has about 400 full time equivalent employees working in ESG. These employees provide engineering and consulting services to the power industry. The group provides services in the area of New Generation, Retrofit, Air Quality Control, Power Generation Services, Environmental Advisory, and Power Sector Advisory.

Q. WHAT'S THE PURPOSE OF YOUR TESTIMONY?

A. Empire retained Black & Veatch during the summer of 2000 to develop an operation and maintenance (O&M) cost estimate for the State Line Power Plant. The purpose of my testimony is to present the results of the study as evidence in this case. The report that we developed for Empire is attached as Schedule 1 of my direct testimony. It was prepared by me.

II. O&M DERIVATION METHODOLOGY AND RESULTS

Q. WHAT WAS THE METHODOLOGY USED TO DEVELOP THIS REPORT?

A. Black & Veatch typically develops O&M estimates for new power generation facilities in two components – fixed and variable. We utilized the same methodology in this case. Fixed O&M components are designed to represent components such as labor, staff supplies and materials, rentals, routine plant maintenance, contract services, insurance, property tax, safety, and environmental fees. Variable O&M components generally include major maintenance expenses on combustion turbines, steam turbine, and heat recovery steam generators.

Q. DO FIXED O&M COSTS VARY AMONG LIKE PLANTS?

A. Yes. Fixed O&M costs vary among like power plants due to different philosophies concerning the availability of specialized contract labor, support from other power plants,

and the availability of corporate support for engineering, administrative, and accounting functions. Therefore, fixed O&M cost estimates developed by Black & Veatch may vary based on the owner's specific operating strategy and situation.

Q. WHAT ARE THE MAIN FACTORS THAT CAUSE VARIABLE O&M EXPENSE?

A. For combustion turbine based power plants, variable O&M expenses are normally driven by a combination of unit starts and unit operating hours. The following table presents the maintenance schedule for Westinghouse combustion turbines such as those installed at State Line.

Maintenance Cycle	Simple Cycle Operation	Combined Cycle Operation
Combustor Inspection	Every 400 equivalent starts	Every 8,000 operating hours
Hot Gas Path Maintenance	Every 800 equivalent starts	Every 24,000 operating hours
Major Overall Maintenance	Every 1,600 equivalent starts	Every 48,000 operating hours

Maintenance intervals are usually governed by starts for simple cycle combustion turbines and by hours of operation for combined cycle units. Each step in the maintenance cycle from combustor inspection (CI) to hot gas path (HG) to major maintenance (M) increases in complexity and expense. The costs for combustion turbine major maintenance are the largest single component of the combined cycle estimate.

Q. WHAT DOES BLACK & VEATCH DO TO ASSURE THAT THE COMBUSTION TURBINES MAJOR MAINTENANCE PORTION OF THE O&M ESTIMATE IS ACCURATE?

A. For major combustion turbine maintenance, Black & Veatch estimates the expenses based on our experience and then checks them against long-term service agreement proposals provided by the manufacturer, Siemens Westinghouse Power Corporation (SWPC). This check assures that labor and parts prices are current as of the date of the estimate and double checks the largest part of the estimate.

Q. CAN YOU GIVE ME SOME EXAMPLES OF ITEMS IN THIS ESTIMATE SPECIFIC TO EMPIRE?

A Yes. Our typical O&M estimate includes gaseous ammonia for the selective catalytic reduction (SCR) emission system. In Empire's case they are utilizing aqueous ammonia due to safety issues involved with the use of anhydrous ammonia. Therefore, we modified our initial estimate to reflect aqueous ammonia. Our estimates also normally begin based on new combustion turbines. In the case of State Line 1, it already has a certain number of starts and hours. We modified the timing of future outages to reflect its current operating history. We also made adjustments to generator inspections to reflect items that were specific to Empire.

Q. WHY DID YOU MAKE ADJUSTMENTS FOR GENERATOR INSPECTIONS?

A. Black & Veatch did not originally include generator inspections in its analysis. Upon consultation with Empire we discovered that Empire is required by their property insurance carrier to follow all manufacturer's recommendations. One of Siemens Westinghouse's recommendations is to perform a generator inspection every five years. Since Empire is required to perform the inspection, we included the expense.

Q. YOU SAID EARLIER THAT VARIABLE O&M WAS TYPICALLY DRIVEN BY STARTS FOR SIMPLE CYCLE COMBUSTION TURBINES, AND BY HOURS FOR

COMBINED CYCLES. WHAT ASSUMPTIONS DID YOU MAKE WHEN DEVELOPING THIS O&M ESTIMATE?

A. For the simple cycle unit (State Line 1), we assumed 150 equivalent starts per year. For the combined cycle unit we assumed 6,132 hours per year of operation. These inputs were developed in consultation with Empire. Based on the history of operation on State Line 1, and probable operation of a combined cycle within Southwest Power Pool (SPP), the assumptions appear reasonable.

Q. WHAT IS THE DIFFERENCE BETWEEN AN "EQUIVALENT START" AND A "START"?

A. Because the effect of cyclic thermal stress caused by some starts, trips, and load changes are cumulative, SWPC combines them into one metric stated as "equivalent starts". The net effect is that a combustion turbine always has more equivalent starts than actual starts. For instance, if a unit trips while operating at 76-100% of base load, then the unit accumulates 20 equivalent starts. The SWPC supplied algorithm and procedures for calculating equivalent starts is included in Appendix B of Schedule 1. The net effect of considering the algorithm is to compress the maintenance cycle into a shorter period.

Q. WHAT ARE THE EXPECTED O&M EXPENSES FOR THE STATE LINE PLANT BASED ON THE STUDY THAT BLACK & VEATCH PERFORMED FOR EMPIRE?

A. The results of the analysis in constant 2001 $ is presented in Table 6 of Schedule 1. Based on average 20 year life cycle costs, we would expect annual average O&M expenses to be $14,645,182 in constant 2001 $ for the entire plant site. Empire's share of this average is $9,284,431 per year.

Q. IF YOU LOOKED AT THE PERIOD JUNE 2001 THROUGH DECEMBER 2005, WHAT IS THE RESULTING ANNUAL O&M AVERAGE?

A. Once again, based on Table 6 of Schedule 1, O&M expenses for the total State Line Facility would average $12, 311,163 per year. Empire's share would be approximately $8,201,347.

Q. EMPIRE'S AVERAGE EXPENSES REDUCE ALMOST $1,000,000 WHEN YOU COMPARE THE 20-YEAR AVERAGE AND THE 4.5-YEAR AVERAGE. WHAT CAUSES THIS REDUCTION?

A. As stated earlier in the testimony, each step in the maintenance cycle from combustor inspection (CI) to hot gas path (HG) to major maintenance (M) increases in complexity and expense. When you examine only the first 4.5 years of the study period you ignore the fact that you have created future maintenance liabilities.

III. CONCLUSIONS

Q. DO YOU HAVE ANY FINAL REMARKS CONCERNING YOUR ANALYSIS?

A. Yes. Whether the Commission ultimately agrees with Black & Veatch's O&M derivation for State Line, it must recognize the fact that O&M expenditures are unavoidable. The Commission should also recognize that a unit start or operating hour today has an effect on future maintenance requirements.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY AT THIS TIME?

A. Yes, it does.

AFFIDAVIT

STATE OF KANSAS)
) ss
COUNTY OF JOHNSON)

On the 30th day of October, 2000, before me appeared Gary Groninger, to me personally known, who, being by me first duly sworn, states that he is a Project Manager for the Black & Veatch Energy Services Group and acknowledged that he has read the above and foregoing document and believes that the statements therein are true and correct to the best of his information, knowledge and belief.

Gary L. Groninger

Gary L. Groninger

Subscribed and sworn to before me this 30th day of October, 2000.

DEBORAH A. FENDORF
Notary Public - State of Kansas
My Appt. Expires 03/10/01

Deborah A. Fendorf

My commission expires: March 10, 2001

Schedule 1

To

Prepared Direct

Testimony of

Gary L. Groninger

FINAL REPORT

Operation & Maintenance Estimate
for
State Line Power Plant

Western Resources

EMPIRE

Services You Count On

WESTERN RESOURCES, INC.

EMPIRE DISTRICT ELECTRIC COMPANY

August, 2000

B&V Project 98698.0010

the engineering and construction company | BLACK & VEATCH

The Empire District Electric Company / Westar Generating

O&M Analysis

Purpose

The purpose of this report is to provide the partnership of Empire District Electric Co. and Westar Generating Inc. (hereby known as "The Partners") with an operational and maintenance (O&M) estimate for the State Line Power plant. This report will present a Black & Veatch derived estimate of the expected life cycle costs of operating and maintaining Empire's simple cycle 501D5 and the soon to be completed jointly owned 2X1 F class combined cycle generator.

Description of facilities

The State Line plant is located on the Missouri side of the Kansas-Missouri state line just west of Joplin, MO. The plant currently consists of one Westinghouse 501D5 installed in 1995 and one Westinghouse 501F originally installed in 1997. The 501F is currently being expanded with another 501F, two heat recovery steam generators, a steam turbine, a cooling tower, and associated equipment to create a 2X1 F class combined cycle of a nominal 500 MW. The 501D5 (State Line 1) is 100% owned by Empire. The 2X1 F class combined cycle (State Line 2) will be the jointly owned unit. The unit will be owned 60% by Empire and 40% by WRI. There are also common facilities on the site such as offices and maintenance buildings that will be owned 66% by Empire and 34% by WRI. Fuel procurement for the plant is done off-site. Empire plant personnel will do the majority of purchasing, inventory management, contract services administration, and general oversight/operations.

State Line 1

State Line 1 went commercial in approximately June of 1995. As of October 1, 2000, the unit has had about 950 equivalent starts, 8,500 hours of operation, and has generated over 430,000 MWh's of energy. The unit last had a hot path inspection during the fall of 1998. The unit has the dual fuel capability of natural gas or oil. Operated primarily on natural gas, the unit emits 25 PPM_v of NO_x from its dry low NO_x combustion system. When operating on oil, the unit is permitted at 42 PPM_v with water injection. The plant endeavors to maintain a 3-day supply of oil on-site as emergency fuel.

State Line 2

State Line 2 went commercial in approximately June of 1997. As of October 1, 2000, the unit had 925 equivalent starts, 6,800 hours of operation, and has generated about 570,000 MWh's of energy. The unit underwent a complete major overhaul in the spring of 2000.

During this major, the unit was upgraded from the original FC compressor design to the new FD compressor design. The unit was returned to a virtually new condition as a result of the major. As of approximately September 15, 2000 unit 2 will stop operation as a simple cycle and begin upgrade to a combined cycle. The combined cycle Unit 2 will be brought back on line with an expected commercial operation date of July 1, 2001

State Line Combined Cycle

State Line 2 will be combined with a new 501F to form the basis of a new 2X1 F combined cycle. The unit will be rated a nominal 500 MW. Both combustion turbines will be tuned to have NOx emissions of 25 PPM_v. These emissions will be reduced to a level of 4 PPM_v through the use of an SCR. The plant will utilize a cooling tower. The water make-up for the cooling tower will come from a series of deep wells. The plant will be equipped with duct firing designed to bring the unit back to ISO conditions on a 100 F day and to aid in compensating for deterioration during normal operation. The combustion turbines will be equipped with pulse inlet and evaporative coolers.

Methodology

The estimate presented in this report has been customized for the State Line units and incorporates the Partner's current operational plan. Black and Veatch has done many estimates of Operation and Maintenance expenses for power plants throughout the world. Black & Veatch typically develops O&M estimates for Combustion Turbine plants in two components – fixed and variable.

Fixed O&M estimates are designed to represent components such as labor, staff supplies and materials, rentals, routine plant maintenance, contract services, insurance, property tax, safety, and environmental fees. Fixed O&M costs vary among like power plants due to different philosophies concerning the use of contract labor, support from other power plants, and corporate support for administrative and accounting functions. The costs shown in this report are based on B&V experience.

Variable O&M is generally estimated to include major maintenance expenses on the combustion turbines, steam turbine, and heat recovery steam generators. Since the combustion turbine components are such a large component of overall O&M costs, Black & Veatch estimates them based on experience and checks them against long-term service agreement proposals provided by the manufacturer, Siemens Westinghouse Power

Corporation (SWPC). This insures that labor and parts prices are current as of the date of this report. It is expected that the Partners will be conducting operational-type maintenance, but very little major maintenance activities other than contractor oversight.

Major combustion turbine maintenance is included in the variable O&M component. It is classified according to the following table:

Maintenance Cycle	Simple Cycle Operation	Combined Cycle Operation
Combustor Inspection	Every 400 equivalent starts	Every 8,000 operating hrs
Hot Gas Path Maintenance	Every 800 equivalent starts	Every 24,000 operating hrs
Major Overall Maintenance	Every 1,600 equivalent starts	Every 48,000 operating hrs

Maintenance intervals are usually governed by starts for simple cycle units and by hours of operation for combined cycle units. Each step from combustor inspection (CI) to hot gas path (HG) to major maintenance (M) increases in complexity and expense. The general scope of work as defined today for each type of maintenance inspection for a 501D5 and a 501F is shown in Appendix A.

Fixed O&M

The following guidelines and criteria govern this analysis:

- Staffing for both units combined consists of the following personnel:
  - 1 – Plant Manager
  - 1- Maintenance Manager
  - 1 – Operations Manager
  - 1 – Cost / Inventory Manager
  - 1 –Results Manager
  - 1 – Project Manager
  - 1- Administrative Assistant
  - 11 – Operators / technicians
  - 11 – Technicians / Operators
  - 29 – TOTAL PERSONNEL

- The staffing proposed for this plant is within a typical range that is expected within the industry. As a result, the anticipated plant staffing has been included as shown above in the estimate.
- The estimated average staff labor cost was estimated at $38 / man-hour. It includes benefits and overhead charges but does not assume any bonuses. The labor rate used in this analysis is typical and may need to be adjusted based on labor situations unique to the Partners.
- Staff supplies and materials (e.g. office equipment, supplies, etc.) were estimated to average 10% of payroll.
- Rentals were included to cover costs for heavy mobile equipment required for specific maintenance activities.
- Routine maintenance costs were estimated based on B&V experience. They include costs for painting of buildings, maintenance of facilities, etc.
- Contact services includes costs for services not directly related to power production (i.e. HVAC, plumbing, snow removal, pest control, security, etc.)
- Insurance includes liability and property damage coverage, but does not include business interruption coverage.
- Property taxes are assumed to be approximately 0.5 % of total plant value.
- Environmental fee is for air emissions.

Variable O&M - State Line 1 (Simple Cycle)

The following guidelines and criteria govern this analysis:

- Annual capacity factor: 20 percent (1,752 hours per year).
- Unit's last major work was a hot path completed in late 1998.
- Primary fuel is natural gas.
- Annual equivalent starts = 150. (Note: A manufacturer-supplied algorithm which accounts for fired aborts, trips from load, and instantaneous load changes. For full definition, see Appendix B.)
- Combustion turbine major maintenance expense was calculated based on two different scenarios: 1) Empire personnel performs outages, or 2) a long-term service agreement is entered into with SWPC.

- Balance of plant operational and maintenance costs are estimated based on Black & Veatch experience. These include items such as pump and valve maintenance and repair, etc.
- Initial operational spares, combustion spares, and hot gas spares have not been included. This expense will be included in the capital cost.

Variable O&M - State Line 2 (Combined Cycle)

The following guidelines and criteria govern this analysis:

- Annual capacity factor: 70 percent (6,132 hours per year).
- Primary fuel is Natural gas.
- Commercial operation date = 7/1/01
- Combustion turbine major maintenance expense was calculated based on two different scenarios: 1) Empire personnel provides labor for outages, or 2) a long term service agreement is entered into with Siemens Westinghouse.
- Balance of plant operational and maintenance costs are estimated based on Black & Veatch experience. These include items such as chemicals for water treatment, water well maintenance, pump and valve maintenance and repair, etc.
- SCR uses aqueous ammonia and reduces NOx from 25 to 4 ppm @ 15% O2 with 9 ppm ammonia slip. Aqueous ammonia cost = $109.50 / ton.
- Raw and de-mineralized water costs are included. Raw water cost = $0.35 / 1000 gallons. De-mineralized water cost = $1.85 / 1000 gallons.

Financial Analysis

The following guidelines and criteria govern this analysis:

- Cycle life: 20 years
- Annual escalation rate = 3%
- Discount rate = 12%

Results

Due to the increasing complexity and costs of outages in a maintenance cycle, examining only the first year O&M costs understates the average yearly O&M costs that should be

expected. When life cycle O&M costs are analyzed on a constant dollar basis, Black & Veatch estimates the average annual fixed costs to be $5,667,903 and the annual average variable costs to be $9,212,987 for a total of $14,880,890 (see Table 6). If inflation is taken into account, the levelized average annual cost totals approximately $16,128,000 per year (see Table 7). The values developed for this report are in the normal range of costs that Black & Veatch would expect to encounter on plants similar to State Line. It is Black & Veatch's opinion that these are representative of the eventual operation and maintenance expenditures for the State Line facility.

TABLE 1

Table 1 (two pages) outlines the schedule of combustion turbine maintenance for both State Line units. The outages are driven by starts and hours supplied by the Partners. The starts provided by Empire were adjusted to reflect equivalent starts.

TABLE 1

EMPIRE DISTRICT ELECTRIC
STATE LINE POWER STATION
SCHEDULE OF COMBUSTION TURBINE MAINTENANCE

State Line 1 - Simple Cycle [1]	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Annual No. of Starts	75	150	150	150	150	150	150	150	150	150
Cumulative No. of Starts	1,050	1,200	1,350	1,500	1,650	1,800	1,950	2,100	2,250	2,400
Type of Inspection or Maintenance Required		CI		CI	M			CI		CI

State Line - Combined Cycle [2]	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Annual Operating Hours	3,066	6,132	6,132	6,132	6,132	6,132	6,132	6,132	6,132	6,132
Cumulative Operating Hours	3,066	9,198	15,330	21,462	27,594	33,726	39,858	45,990	52,122	58,254
Type of Inspection or Maintenance Required		CI		CI	HG	CI		CI	M	CI

Combustor Inspection	CI
Hot Gas Path Maintenance	HG
Major Overall Maintenance	M

Notes:

[1] It is assumed that maintenance schedule is governed by starts for simple cycle operation (e.g., 400 equivalent starts occurs before 8000 hours of operation).

[2] It is assumed that maintenance schedule is governed by operating hours for combined cycle operation (e.g., 8000 hours of operation occurs sooner than 400 equivalent starts).

TABLE 1

EMPIRE DISTRICT ELECTRIC
STATE LINE POWER STATION
SCHEDULE OF COMBUSTION TURBINE MAINTENANCE

State Line 1 - Simple Cycle [1]	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Annual No. of Starts	150	150	150	150	150	150	150	150	150	150
Cumulative No. of Starts	2,550	2,700	2,850	3,000	3,150	3,300	3,450	3,600	3,750	3,900
Type of Inspection or Maintenance Required		HG		CI		CI		M		CI

State Line - Combined Cycle [2]	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Annual Operating Hours	6,132	6,132	6,132	6,132	6,132	6,132	6,132	6,132	6,132	6,132
Cumulative Operating Hours	64,386	70,518	76,650	82,782	88,914	95,046	101,178	107,310	113,442	119,574
Type of Inspection or Maintenance Required	CI		HG		CI	CI	M	CI	CI	HG

TABLE 2

Table 2 (five pages) outlines the projected Operation and Maintenance costs for both State Line units for the next 20 year period. Values shown are in **constant 2001 dollars**. The staff and others services outlined in the fixed O&M estimate have been combined for both the simple cycle and combined cycle units. Variable costs, however, due to the different operation and configurations of the two units, has been developed separately. This analysis has assumed that the Partners will utilize its own staff for completing outages and major maintenance operations of the combustion turbines.

TABLE 2

Fixed O&M Costs - State Line 1-CC	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Staffing	$1,212,683	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367
Supplies and Materials	$121,268	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537
Rentals	$82,500	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000
Contracted Services	$107,500	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000
Routine Maintenance	$247,500	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000
Safety	$15,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000
Employee Training	$30,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000
Environmental Fees	$17,500	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000
Insurance	$250,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000
Property Taxes	$750,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000
	$2,833,952	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903
Variable O&M Costs - State Line 1										
Combustion Turbine Maintenance	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
- Labor (CI)		$40,100		$40,100				$40,100		$40,100
- Labor (HG)										
- Labor (M)					$255,000					
- Materials (CI)		$574,900		$574,900				$574,900		$574,900
- Materials (HG)										
- Materials (M)					$5,126,700					
- Management Fee										
BOP Maintenance	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800
	$140,800	$755,800	$140,800	$755,800	$5,522,500	$140,800	$140,800	$755,800	$140,800	$755,800
Variable O&M Costs - State Line CC										
Combustion Turbine Maintenance	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
- Initial Spares	$0									
- Labor (CI)		$98,600		$98,600		$98,600		$98,600		$98,600
- Labor (HG)					$268,200					
- Labor (M)									$556,100	
- Materials (CI)		$2,373,600		$2,373,600		$2,373,600		$2,373,600		$2,373,600
- Materials (HG)					$6,791,600					
- Materials (M)									$23,642,000	
- Management Fee	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
HRSG and SCR Maintenance	$658,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000
Steam Turbine Maintenance										
- Labor / Materials (Minor)		$355,500		$355,500		$355,500		$355,500		$355,500
- Labor / Materials (Intermediate)					$1,111,000					
- Labor / Materials (Major)									$4,444,000	
Generator Inspections	$75,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000
BOP Maintenance	$295,350	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700
Water Consumption	$233,500	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000
	$1,261,850	$5,351,400	$2,523,700	$5,351,400	$10,694,500	$5,351,400	$2,523,700	$5,351,400	$31,165,800	$5,351,400

Note: All estimates are based on assumptions set forth on pages 4-6 and assume that CT part lifes meet OEM projections.

State Line 1 based on 150 Equivalent Starts per year.
State Line CC based on 6132 hours per year.

TABLE 2

Fixed O&M Costs - State Line 1-CC	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**TOTAL**
Staffing	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$47,294,650
Supplies and Materials	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$4,729,465
Rentals	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$3,217,500
Contracted Services	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$4,192,500
Routine Maintenance	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$9,652,500
Safety	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$585,000
Employee Training	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$1,170,000
Environmental Fees	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$682,500
Insurance	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$9,750,000
Property Taxes	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$29,250,000
	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$110,524,115

Variable O&M Costs - State Line 1											
Combustion Turbine Maintenance	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**TOTAL**
- Labor (CI)				$40,100		$40,100				$40,100	$280,700
- Labor (HG)		$99,500									$99,500
- Labor (M)								$255,000			$510,000
- Materials (CI)				$574,900		$574,900				$574,900	$4,024,300
- Materials (HG)		$2,383,600									$2,383,600
- Materials (M)								$5,126,700			$10,253,400
- Management Fee											$0
BOP Maintenance	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$2,816,000
	$140,800	$2,623,900	$140,800	$755,800	$140,800	$755,800	$140,800	$5,522,500	$140,800	$755,800	$20,367,500

Variable O&M Costs - State Line CC											
Combustion Turbine Maintenance	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**TOTAL**
- Initial Spares											$0
- Labor (CI)	$98,600				$98,600	$98,600		$98,600	$98,600		$986,000
- Labor (HG)			$268,200							$268,200	$804,600
- Labor (M)							$556,100				$1,112,200
- Materials (CI)	$2,373,600				$2,373,600	$2,373,600		$2,373,600	$2,373,600		$23,736,000
- Materials (HG)			$6,791,600							$6,791,600	$20,374,800
- Materials (M)							$23,642,000				$47,284,000
- Management Fee	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
HRSG and SCR Maintenance	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$25,662,000
Steam Turbine Maintenance											
- Labor / Materials (Minor)	$355,500				$355,500	$355,500		$355,500	$355,500		$3,555,000
- Labor / Materials (Intermediate)			$1,111,000							$1,111,000	$3,333,000
- Labor / Materials (Major)							$4,444,000				$8,888,000
Generator Inspections	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$2,925,000
BOP Maintenance	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$11,518,650
Water Consumption	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$9,106,500
					5,351,400	$5,351,400	$31,165,800	$5,351,400	$5,351,400	$10,694,500	$159,285,750

State Line 1 based on 150 Equivalent Starts per year.
State Line CC based on 6132 hours per year.

TABLE 3

The analysis in developing Table 3 is identical to Table 2 with the exception that inflation has been included in the expenditures. The inflation rate utilized was 3% per year.

TABLE 3

Fixed O&M Costs - State Line 1-CC	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	
Staffing	$1,212,683	$2,498,128	$2,573,071	$2,650,264	$2,729,772	$2,811,665	$2,896,015	$
Supplies and Materials	$121,268	$249,813	$257,307	$265,026	$272,977	$281,166	$289,601	
Rentals	$82,500	$169,950	$175,049	$180,300	$185,709	$191,280	$197,019	
Contracted Services	$107,500	$221,450	$228,094	$234,936	$241,984	$249,244	$256,721	
Routine Maintenance	$247,500	$509,850	$525,146	$540,900	$557,127	$573,841	$591,056	
Safety	$15,000	$30,900	$31,827	$32,782	$33,765	$34,778	$35,822	
Employee Training	$30,000	$61,800	$63,654	$65,564	$67,531	$69,556	$71,643	
Environmental Fees	$17,500	$36,050	$37,132	$38,245	$39,393	$40,575	$41,792	
Insurance	$250,000	$515,000	$530,450	$546,364	$562,754	$579,637	$597,026	
Property Taxes	$750,000	$1,545,000	$1,591,350	$1,639,091	$1,688,263	$1,738,911	$1,791,078	$
	$2,833,952	$5,837,940	$6,013,079	$6,193,471	$6,379,275	$6,570,653	$6,767,773	$
Variable O&M Costs - State Line 1								
Combustion Turbine Maintenance	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	
- Labor (CI)		$41,303		$43,818				
- Labor (HG)								
- Labor (M)					$287,005			
- Materials (CI)		$592,147		$628,209				
- Materials (HG)								
- Materials (M)					$5,770,146			
- Management Fee								
BOP Maintenance	$140,800	$145,024	$149,375	$153,856	$158,472	$163,226	$168,123	
	$140,800	$778,474	$149,375	$825,883	$6,215,622	$163,226	$168,123	
Variable O&M Costs - State Line 2								
Combustion Turbine Maintenance	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	
- Initial Spares	$0							
- Labor (CI)		$101,558		$107,743		$114,304		
- Labor (HG)					$301,861			
- Labor (M)								
- Materials (CI)		$2,444,808		$2,593,697		$2,751,653		$
- Materials (HG)					$7,644,006			
- Materials (M)								
- Management Fee	$0	$0	$0	$0	$0	$0	$0	
HRSG and SCR Maintenance	$658,000	$1,355,480	$1,396,144	$1,438,029	$1,481,170	$1,525,605	$1,571,373	$
Steam Turbine Maintenance								
- Labor / Materials (Minor)		$366,165		$388,464		$412,122		
- Labor / Materials (Intermediate)					$1,250,440			
- Labor / Materials (Major)								
Generator Inspections	$75,000	$154,500	$159,135	$163,909	$168,826	$173,891	$179,108	
BOP Maintenance	$295,350	$608,421	$626,674	$645,474	$664,838	$684,783	$705,327	
Water Consumption	$233,500	$481,010	$495,440	$510,304	$525,613	$541,381	$557,622	
	$1,261,850	$5,511,942	$2,677,393	$5,847,619	$12,036,754	$6,203,739	$3,013,430	$

Note: All estimates are based on assumptions set forth on pages 4-6 and assume that CT part lifes meet OEM projections.

State Line 1 based on 150 Equivalent Starts per year.
State Line CC based on 6132 hours per year.

TABLE 3

Fixed O&M Costs - State Line 1-2	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**TOTAL**
Staffing	$3,259,490	$3,357,275	$3,457,993	$3,561,733	$3,668,585	$3,778,642	$3,892,002	$4,008,762	$4,129,024	$4,252,895	$63,957,827
Supplies and Materials	$325,949	$335,727	$345,799	$356,173	$366,858	$377,864	$389,200	$400,876	$412,902	$425,290	$6,395,783
Rentals	$221,746	$228,399	$235,251	$242,308	$249,577	$257,065	$264,777	$272,720	$280,901	$289,328	$4,351,112
Contracted Services	$288,942	$297,610	$306,539	$315,735	$325,207	$334,963	$345,012	$355,362	$366,023	$377,004	$5,669,631
Routine Maintenance	$665,239	$685,196	$705,752	$726,924	$748,732	$771,194	$794,330	$818,160	$842,704	$867,985	$13,053,335
Safety	$40,317	$41,527	$42,773	$44,056	$45,378	$46,739	$48,141	$49,585	$51,073	$52,605	$791,111
Employee Training	$80,635	$83,054	$85,546	$88,112	$90,755	$93,478	$96,282	$99,171	$102,146	$105,210	$1,582,222
Environmental Fees	$47,037	$48,448	$49,902	$51,399	$52,941	$54,529	$56,165	$57,850	$59,585	$61,373	$922,963
Insurance	$671,958	$692,117	$712,880	$734,267	$756,295	$778,984	$802,353	$826,424	$851,217	$876,753	$13,185,187
Property Taxes	$2,015,875	$2,076,351	$2,138,641	$2,202,801	$2,268,885	$2,336,951	$2,407,060	$2,479,271	$2,553,650	$2,630,259	$39,555,562
	$7,617,188	$7,845,704	$8,081,075	$8,323,507	$8,573,212	$8,830,409	$9,095,321	$9,368,181	$9,649,226	$9,938,703	$149,464,733

Variable O&M Costs - State Line 1											
Combustion Turbine Maintenance	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**TOTAL**
- Labor (CI)				$58,888		$62,474				$70,316	$378,439
- Labor (HG)		$137,731									$137,731
- Labor (M)								$421,476			$708,481
- Materials (CI)				$844,260		$895,675				$1,008,091	$5,425,550
- Materials (HG)		$3,299,460									$3,299,460
- Materials (M)								$8,473,654			$14,243,800
- Management Fee											$0
BOP Maintenance	$189,223	$194,900	$200,747	$206,770	$212,973	$219,362	$225,943	$232,721	$239,703	$246,894	$3,783,349
	$189,223	$3,632,091	$200,747	$1,109,918	$212,973	$1,177,512	$225,943	$9,127,851	$239,703	$1,325,300	$27,976,810

Variable O&M Costs - State Line 2											
Combustion Turbine Maintenance	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**TOTAL**
- Initial Spares											$0
- Labor (CI)	$132,510				$149,141	$153,616		$162,971	$167,860		$1,339,619
- Labor (HG)			$382,389							$470,290	$1,154,541
- Labor (M)							$892,377				$1,596,828
- Materials (CI)	$3,189,920				$3,590,283	$3,697,991		$3,923,199	$4,040,895		$32,248,685
- Materials (HG)			$9,683,198							$11,909,112	$29,236,315
- Materials (M)							$37,938,470				$67,887,448
- Management Fee	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
HRSG and SCR Maintenance	$1,768,594	$1,821,652	$1,876,301	$1,932,590	$1,990,568	$2,050,285	$2,111,794	$2,175,147	$2,240,402	$2,307,614	$34,703,413
Steam Turbine Maintenance											
- Labor / Materials (Minor)	$477,762				$537,726	$553,857		$587,587	$605,215		$4,829,966
- Labor / Materials (Intermediate)			$1,584,020							$1,948,145	$4,782,606
- Labor / Materials (Major)							$7,131,315				$12,760,842
Generator Inspections	$201,587	$207,635	$213,864	$220,280	$226,888	$233,695	$240,706	$247,927	$255,365	$263,026	$3,955,556
BOP Maintenance	$793,851	$817,667	$842,197	$867,463	$893,487	$920,291	$947,900	$976,337	$1,005,627	$1,035,796	$15,576,980
Water Consumption	$627,609	$646,437	$665,830	$685,805	$706,379	$727,571	$749,398	$771,880	$795,036	$818,887	$12,314,965
				,706,139	$8,094,473	$8,337,307	$50,011,960	$8,845,049	$9,110,400	$18,752,870	$222,387,763

State Line 1 based on 150 Equivalent Starts per year.
State Line CC based on 6132 hours per year.

TABLE 4

The analysis for the development of Table 4 (five pages) is identical to that for Table 2 with the exception that it assumes that a long-term service agreement with Siemens Westinghouse has been entered into for outages and major maintenance services.

TABLE 4

Fixed O&M Costs - State Line 1-CC	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Staffing	$1,212,683	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367
Supplies and Materials	$121,268	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537
Rentals	$82,500	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000
Contracted Services	$107,500	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000
Routine Maintenance	$247,500	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000
Safety	$15,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000
Employee Training	$30,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000
Environmental Fees	$17,500	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000
Insurance	$250,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000
Property Taxes	$750,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000
	$2,833,952	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903

Variable O&M Costs - State Line 1	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Combustion Turbine Maintenance										
- Labor (CI)		$141,184		$141,184				$141,184		$141,184
- Labor (HG)					$852,032					
- Labor (M)										
- Materials (CI)		$395,610		$395,610				$395,610		$395,610
- Materials (HG)					$6,234,773					
- Materials (M)										
- Management Fee	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000
BOP Maintenance	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800
	$200,800	$737,594	$200,800	$737,594	$7,287,605	$200,800	$200,800	$737,594	$200,800	$737,594

Variable O&M Costs - State Line CC	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Combustion Turbine Maintenance										
- Initial Spares	$0									
- Labor (CI)		$302,176		$302,176		$302,176		$302,176		$302,176
- Labor (HG)					$648,176					
- Labor (M)									$2,443,436	
- Materials (CI)		$1,118,700		$1,118,700		$1,118,700		$1,118,700		$1,118,700
- Materials (HG)					$10,271,700					
- Materials (M)									$15,814,540	
- Management Fee	$60,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000
HRSG and SCR Maintenance	$658,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000
Steam Turbine Maintenance										
- Labor / Materials (Minor)		$355,500		$355,500		$355,500		$355,500		$355,500
- Labor / Materials (Intermediate)					$1,111,000					
- Labor / Materials (Major)									$4,444,000	
Generator Inspections	$75,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000
BOP Maintenance	$295,350	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700
Water Consumption	$233,500	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000
	$1,321,850	$4,420,076	$2,643,700	$4,420,076	$14,674,576	$4,420,076	$2,643,700	$4,420,076	$25,345,676	$4,420,076

Note: All estimates are based on assumptions set forth on pages 4-6 and assume that CT part lifes meet OEM projections

State Line 1 based on 150 Equivalent Starts per year.
State Line CC based on 6132 hours per year.

TABLE 4

Fixed O&M Costs - State Line 1-CC	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
Staffing	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$2,425,367	$47,294,650
Supplies and Materials	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$242,537	$4,729,465
Rentals	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$165,000	$3,217,500
Contracted Services	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$4,192,500
Routine Maintenance	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$495,000	$9,652,500
Safety	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$585,000
Employee Training	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$1,170,000
Environmental Fees	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$682,500
Insurance	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$9,750,000
Property Taxes	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$29,250,000
	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$5,667,903	$110,524,115

Variable O&M Costs - State Line 1											
Combustion Turbine Maintenance	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
- Labor (CI)				$141,184		$141,184				$141,184	$988,288
- Labor (HG)		$296,320									$296,320
- Labor (M)								$852,032			$1,704,064
- Materials (CI)				$395,610		$395,610				$395,610	$2,769,270
- Materials (HG)		$2,000,963									$2,000,963
- Materials (M)								$6,234,773			$12,469,546
- Management Fee	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$1,200,000
BOP Maintenance	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$140,800	$2,816,000
	$200,800	$2,498,083	$200,800	$737,594	$200,800	$737,594	$200,800	$7,287,605	$200,800	$737,594	$24,244,451

Variable O&M Costs - State Line CC											
Combustion Turbine Maintenance	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
- Initial Spares											$0
- Labor (CI)	$302,176				$302,176	$302,176		$302,176	$302,176		$3,021,760
- Labor (HG)			$648,176							$648,176	$1,944,528
- Labor (M)							$2,443,436				$4,886,872
- Materials (CI)	$1,118,700				$1,118,700	$1,118,700		$1,118,700	$1,118,700		$11,187,000
- Materials (HG)			$10,271,700							$10,271,700	$30,815,100
- Materials (M)							$15,814,540				$31,629,080
- Management Fee	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$2,340,000
HRSG and SCR Maintenance	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$1,316,000	$25,862,000
Steam Turbine Maintenance											
- Labor / Materials (Minor)	$355,500				$355,500	$355,500		$355,500	$355,500		$3,555,000
- Labor / Materials (Intermediate)			$1,111,000							$1,111,000	$3,333,000
- Labor / Materials (Major)							$4,444,000				$8,888,000
Generator Inspections	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$2,925,000
BOP Maintenance	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$590,700	$11,518,650
Water Consumption	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$467,000	$9,106,500
				,643,700	$4,420,076	$4,420,076	$25,345,676	$4,420,076	$4,420,076	$14,674,576	$150,812,490

State Line 1 based on 150 Equivalent Starts per year.
State Line CC based on 6132 hours per year.

TABLE 5

The analysis in developing Table 5 (five pages) is identical to Table 4 with the exception that inflation has been included in the expenditures. The inflation rate utilized was 3% per year.

TABLE 5

Fixed O&M Costs - State Line 1-2	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Staffing	$1,212,683	$2,498,128	$2,573,071	$2,650,264	$2,729,772	$2,811,665	$2,896,015	$2,982,895	$3,072,382	$3,164,553
Supplies and Materials	$121,268	$249,813	$257,307	$265,026	$272,977	$281,166	$289,601	$298,290	$307,238	$316,455
Rentals	$82,500	$169,950	$175,049	$180,300	$185,709	$191,280	$197,019	$202,929	$209,017	$215,288
Contracted Services	$107,500	$221,450	$228,094	$234,936	$241,984	$249,244	$256,721	$264,423	$272,356	$280,526
Routine Maintenance	$247,500	$509,850	$525,146	$540,900	$557,127	$573,841	$591,056	$608,788	$627,051	$645,863
Safety	$15,000	$30,900	$31,827	$32,782	$33,765	$34,778	$35,822	$36,896	$38,003	$39,143
Employee Training	$30,000	$61,800	$63,654	$65,564	$67,531	$69,556	$71,643	$73,792	$76,006	$78,286
Environmental Fees	$17,500	$36,050	$37,132	$38,245	$39,393	$40,575	$41,792	$43,046	$44,337	$45,667
Insurance	$250,000	$515,000	$530,450	$546,364	$562,754	$579,637	$597,026	$614,937	$633,385	$652,387
Property Taxes	$750,000	$1,545,000	$1,591,350	$1,639,091	$1,688,263	$1,738,911	$1,791,078	$1,844,811	$1,900,155	$1,957,160
	$2,833,952	$5,837,940	$6,013,079	$6,193,471	$6,379,275	$6,570,653	$6,767,773	$6,970,806	$7,179,930	$7,395,328

Variable O&M Costs - State Line 1										
Combustion Turbine Maintenance	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
- Labor (CI)		$145,420		$154,276				$173,639		$184,213
- Labor (HG)										
- Labor (M)					$958,970					
- Materials (CI)		$407,478		$432,294				$486,550		$516,181
- Materials (HG)										
- Materials (M)					$7,017,292					
- Management Fee	$60,000	$61,800	$63,654	$65,564	$67,531	$69,556	$71,643	$73,792	$76,006	$78,286
BOP Maintenance	$140,800	$145,024	$149,375	$153,856	$158,472	$163,226	$168,123	$173,166	$178,361	$183,712
	$200,800	$759,722	$213,029	$805,989	$8,202,264	$232,782	$239,766	$907,148	$254,367	$962,393

Variable O&M Costs - State Line 2										
Combustion Turbine Maintenance	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
- Initial Spares	$0									
- Labor (CI)		$311,241		$330,196		$350,305		$371,638		$394,271
- Labor (HG)					$729,528					
- Labor (M)									$3,095,272	
- Materials (CI)		$1,152,261		$1,222,434		$1,296,880		$1,375,860		$1,459,650
- Materials (HG)					$11,560,889					
- Materials (M)									$20,033,386	
- Management Fee	$60,000	$123,600	$127,308	$131,127	$135,061	$139,113	$143,286	$147,585	$152,012	$156,573
HRSG and SCR Maintenance	$658,000	$1,355,480	$1,396,144	$1,438,029	$1,481,170	$1,525,605	$1,571,373	$1,618,514	$1,667,069	$1,717,082
Steam Turbine Maintenance										
- Labor / Materials (Minor)		$366,165		$388,464		$412,122		$437,220		$463,847
- Labor / Materials (Intermediate)					$1,250,440					
- Labor / Materials (Major)									$5,629,526	
Generator Inspections	$75,000	$154,500	$159,135	$163,909	$168,826	$173,891	$179,108	$184,481	$190,016	$195,716
BOP Maintenance	$295,350	$608,421	$626,674	$645,474	$664,838	$684,783	$705,327	$726,486	$748,281	$770,730
Water Consumption	$233,500	$481,010	$495,440	$510,304	$525,613	$541,381	$557,622	$574,351	$591,582	$609,329
	$1,321,850	$4,552,678	$2,804,701	$4,829,936	$16,516,365	$5,124,080	$3,156,716	$5,436,136	$32,107,144	$5,767,197

Note: All estimates are based on assumptions set forth on pages 4-6 and assume that CT part lifes meet OEM projections.

State Line 1 based on 150 Equivalent Starts per year.
State Line CC based on 6132 hours per year.

TABLE 5

Fixed O&M Costs - State Line 1-2	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
Staffing	$3,259,490	$3,357,275	$3,457,993	$3,561,733	$3,668,585	$3,778,642	$3,892,002	$4,008,762	$4,129,024	$4,252,895	$63,957,827
Supplies and Materials	$325,949	$335,727	$345,799	$356,173	$366,858	$377,864	$389,200	$400,876	$412,902	$425,290	$6,395,783
Rentals	$221,746	$228,399	$235,251	$242,308	$249,577	$257,065	$264,777	$272,720	$280,901	$289,328	$4,351,112
Contracted Services	$288,942	$297,610	$306,539	$315,735	$325,207	$334,963	$345,012	$355,362	$366,023	$377,004	$5,669,631
Routine Maintenance	$665,239	$685,196	$705,752	$726,924	$748,732	$771,194	$794,330	$818,160	$842,704	$867,985	$13,053,335
Safety	$40,317	$41,527	$42,773	$44,056	$45,378	$46,739	$48,141	$49,585	$51,073	$52,605	$791,111
Employee Training	$80,635	$83,054	$85,546	$88,112	$90,755	$93,478	$96,282	$99,171	$102,146	$105,210	$1,582,222
Environmental Fees	$47,037	$48,448	$49,902	$51,399	$52,941	$54,529	$56,165	$57,850	$59,585	$61,373	$922,963
Insurance	$671,958	$692,117	$712,880	$734,267	$756,295	$778,984	$802,353	$826,424	$851,217	$876,753	$13,185,187
Property Taxes	$2,015,875	$2,076,351	$2,138,641	$2,202,801	$2,268,885	$2,336,951	$2,407,060	$2,479,271	$2,553,650	$2,630,259	$39,555,562
	$7,617,188	$7,845,704	$8,081,075	$8,323,507	$8,573,212	$8,830,409	$9,095,321	$9,368,181	$9,649,226	$9,938,703	$149,464,733

Variable O&M Costs - State Line 1											
Combustion Turbine Maintenance	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
- Labor (CI)				$207,333		$219,960				$247,567	$1,332,407
- Labor (HG)		$410,176									$410,176
- Labor (M)								$1,408,279			$2,367,249
- Materials (CI)				$580,967		$616,347				$693,705	$3,733,522
- Materials (HG)		$2,769,801									$2,769,801
- Materials (M)								$10,305,130			$17,322,422
- Management Fee	$80,635	$83,054	$85,546	$88,112	$90,755	$93,478	$96,282	$99,171	$102,146	$105,210	$1,612,222
BOP Maintenance	$189,223	$194,900	$200,747	$206,770	$212,973	$219,362	$225,943	$232,721	$239,703	$246,894	$3,783,349
	$269,858	$3,457,931	$286,293	$1,083,182	$303,728	$1,149,147	$322,225	$12,045,301	$341,849	$1,293,376	$33,331,148

Variable O&M Costs - State Line 2											
Combustion Turbine Maintenance	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
- Initial Spares											$0
- Labor (CI)	$406,099				$457,068	$470,780		$499,451	$514,434		$4,105,485
- Labor (HG)			$924,144							$1,136,581	$2,790,252
- Labor (M)							$3,920,997				$7,016,269
- Materials (CI)	$1,503,439				$1,692,134	$1,742,898		$1,849,041	$1,904,512		$15,199,108
- Materials (HG)			$14,644,988							$18,011,488	$44,217,365
- Materials (M)							$25,377,694				$45,411,080
- Management Fee	$161,270	$166,108	$171,091	$176,224	$181,511	$186,956	$192,565	$198,342	$204,292	$210,421	$3,164,445
HRSG and SCR Maintenance	$1,768,594	$1,821,652	$1,876,301	$1,932,590	$1,990,568	$2,050,285	$2,111,794	$2,175,147	$2,240,402	$2,307,614	$34,703,413
Steam Turbine Maintenance											
- Labor / Materials (Minor)	$477,762				$537,726	$553,857		$587,587	$605,215		$4,829,966
- Labor / Materials (Intermediate)			$1,584,020							$1,948,145	$4,782,606
- Labor / Materials (Major)							$7,131,315				$12,760,842
Generator Inspections	$201,587	$207,635	$213,864	$220,280	$226,888	$233,695	$240,706	$247,927	$255,365	$263,026	$3,955,556
BOP Maintenance	$793,851	$817,667	$842,197	$867,463	$893,487	$920,291	$947,900	$976,337	$1,005,627	$1,035,796	$15,576,980
Water Consumption	$627,609	$646,437	$665,830	$685,805	$706,379	$727,571	$749,398	$771,880	$795,036	$818,887	$12,314,965
	$5,940,213	$3,659,499	$20,922,436	$3,882,363	$6,685,762	$6,886,334	$40,672,369	$7,305,712	$7,524,884	$25,731,958	$210,828,332

State Line 1 based on 150 Equivalent Starts per year.
State Line CC based on 6132 hours per year.

TABLE 6

Table 6 shows the summary of the results on a **constant dollar basis** as presented in Tables 2 and 4, including the annual levelized amount of total O&M costs. This levelized amount was derived using the financial criteria described in the report

TABLE 6
SUMMARY OF O&M COSTS (2001$)

	OUTAGES DONE IN-HOUSE				OUTAGES DONE WITH SERVICE AGREEMENT			
	Fixed O&M Both Units	Var O&M Unit 1	Var O&M Unit CC	TOTAL O&M	Fixed O&M Both Units	Var O&M Unit 1	Var O&M Unit CC	TOTAL O&M
2001	$2,833,952	$140,800	$1,261,850	$4,236,602	$2,833,952	$200,800	$1,321,850	$4,356,602
2002	$5,667,903	$755,800	$5,351,400	$11,775,103	$5,667,903	$737,594	$4,420,076	$10,825,573
2003	$5,667,903	$140,800	$2,523,700	$8,332,403	$5,667,903	$200,800	$2,643,700	$8,512,403
2004	$5,667,903	$755,800	$5,351,400	$11,775,103	$5,667,903	$737,594	$4,420,076	$10,825,573
2005	$5,667,903	$5,522,500	$10,694,500	$21,884,903	$5,667,903	$7,287,605	$14,674,576	$27,630,084
2006	$5,667,903	$140,800	$5,351,400	$11,160,103	$5,667,903	$200,800	$4,420,076	$10,288,779
2007	$5,667,903	$140,800	$2,523,700	$8,332,403	$5,667,903	$200,800	$2,643,700	$8,512,403
2008	$5,667,903	$755,800	$5,351,400	$11,775,103	$5,667,903	$737,594	$4,420,076	$10,825,573
2009	$5,667,903	$140,800	$31,165,800	$36,974,503	$5,667,903	$200,800	$25,345,676	$31,214,379
2010	$5,667,903	$755,800	$5,351,400	$11,775,103	$5,667,903	$737,594	$4,420,076	$10,825,573
2011	$5,667,903	$140,800	$5,351,400	$11,160,103	$5,667,903	$200,800	$4,420,076	$10,288,779
2012	$5,667,903	$2,623,900	$2,523,700	$10,815,503	$5,667,903	$2,498,083	$2,643,700	$10,809,686
2013	$5,667,903	$140,800	$10,694,500	$16,503,203	$5,667,903	$200,800	$14,674,576	$20,543,279
2014	$5,667,903	$755,800	$2,523,700	$8,947,403	$5,667,903	$737,594	$2,643,700	$9,049,197
2015	$5,667,903	$140,800	$5,351,400	$11,160,103	$5,667,903	$200,800	$4,420,076	$10,288,779
2016	$5,667,903	$755,800	$5,351,400	$11,775,103	$5,667,903	$737,594	$4,420,076	$10,825,573
2017	$5,667,903	$140,800	$31,165,800	$36,974,503	$5,667,903	$200,800	$25,345,676	$31,214,379
2018	$5,667,903	$5,522,500	$5,351,400	$16,541,803	$5,667,903	$7,287,605	$4,420,076	$17,375,584
2019	$5,667,903	$140,800	$5,351,400	$11,160,103	$5,667,903	$200,800	$4,420,076	$10,288,779
2020	$5,667,903	$755,800	$10,694,500	$17,118,203	$5,667,903	$737,594	$14,674,576	$21,080,073
TOTAL	$110,524,115	$20,367,500	$159,285,750	$290,177,365	$110,524,115	$24,244,451	$150,812,490	$285,581,056
AVG/YR	$5,667,903	$1,044,487	$8,168,500	$14,880,891	$5,667,903	$1,243,305	$7,733,974	$14,645,182

State Line 1 based on 150 Equivalent Starts per year.
State Line CC based on 6132 hours per year.

TABLE 7

Table 7 shows the summary of the results on an as spent dollar basis as presented in Tables 3 and 5, including the annual levelized amount of total O&M costs. This levelized amount was derived using the financial criteria described in the report

TABLE 7
SUMMARY OF O&M COSTS (Nominal $)

	OUTAGES DONE IN-HOUSE				OUTAGES DONE WITH SERVICE AGREEMENT			
	Fixed O&M Both Units	Var O&M Unit 1	Var O&M Unit CC	TOTAL O&M	Fixed O&M Both Units	Var O&M Unit 1	Var O&M Unit CC	TOTAL O&M
2001	$2,833,952	$140,800	$1,261,850	$4,236,602	$2,833,952	$200,800	$1,321,850	$4,356,602
2002	$5,837,940	$778,474	$5,511,942	$12,128,356	$5,837,940	$759,722	$4,552,678	$11,150,341
2003	$6,013,079	$149,375	$2,677,393	$8,839,847	$6,013,079	$213,029	$2,804,701	$9,030,809
2004	$6,193,471	$825,883	$5,847,619	$12,866,973	$6,193,471	$805,989	$4,829,936	$11,829,396
2005	$6,379,275	$6,215,622	$12,036,754	$24,631,652	$6,379,275	$8,202,264	$16,516,365	$31,097,903
2006	$6,570,653	$163,226	$6,203,739	$12,937,618	$6,570,653	$232,782	$5,124,080	$11,927,515
2007	$6,767,773	$168,123	$3,013,430	$9,949,325	$6,767,773	$239,766	$3,156,716	$10,164,255
2008	$6,970,806	$929,539	$6,581,547	$14,481,892	$6,970,806	$907,148	$5,436,136	$13,314,090
2009	$7,179,930	$178,361	$39,479,903	$46,838,195	$7,179,930	$254,367	$32,107,144	$39,541,442
2010	$7,395,328	$986,148	$6,982,363	$15,363,839	$7,395,328	$962,393	$5,767,197	$14,124,918
2011	$7,617,188	$189,223	$7,191,834	$14,998,246	$7,617,188	$269,858	$5,940,213	$13,827,259
2012	$7,845,704	$3,632,091	$3,493,391	$14,971,186	$7,845,704	$3,457,931	$3,659,499	$14,963,134
2013	$8,081,075	$200,747	$15,247,800	$23,529,622	$8,081,075	$286,293	$20,922,436	$29,289,804
2014	$8,323,507	$1,109,918	$3,706,139	$13,139,563	$8,323,507	$1,083,182	$3,882,363	$13,289,051
2015	$8,573,212	$212,973	$8,094,473	$16,880,658	$8,573,212	$303,728	$6,685,762	$15,562,702
2016	$8,830,409	$1,177,512	$8,337,307	$18,345,227	$8,830,409	$1,149,147	$6,886,334	$16,865,891
2017	$9,095,321	$225,943	$50,011,960	$59,333,224	$9,095,321	$322,225	$40,672,369	$50,089,916
2018	$9,368,181	$9,127,851	$8,845,049	$27,341,080	$9,368,181	$12,045,301	$7,305,712	$28,719,193
2019	$9,649,226	$239,703	$9,110,400	$18,999,329	$9,649,226	$341,849	$7,524,884	$17,515,958
2020	$9,938,703	$1,325,300	$18,752,870	$30,016,873	$9,938,703	$1,293,376	$25,731,958	$36,964,036
TOTAL	$149,464,733	$27,976,810	$222,387,763	$399,829,307	$149,464,733	$33,331,148	$210,828,332	$393,624,214
		LEVELIZED AMOUNT @12% =		**$16,127,710**		LEVELIZED AMOUNT @12% =		**$15,922,550**

State Line 1 based on 150 Equivalent Starts per year.
State Line CC based on 6132 hours per year.

APPENDIX A

SCOPE OF WORK FOR MAJOR MAINTENANCE ACTIVITIES

501D5 or 501F

501D5 or 501F
Combustor Inspection

The following parts will be replaced:

- Combustor baskets
- Transitions
- Fuel nozzles and mini-manifolds
- Cross-flame tubes
- Combustion Transition Cylinders with V-band clamps
- Row #1 vane segments

INLET SECTION

Disassembly
- Remove access cover on inlet manifold.

Inspection
- Visually inspect compressor inlet for damage and oil leaks.
- Visually inspect the inlet guide vanes and row #1 compressor blades.
- Measure the row #1 compressor blade radial clearances.

Assembly
- Install the inlet manifold access cover.

COMBUSTOR SECTION

Disassembly
- Remove the combustor access manway covers.
- Remove the combustor components.
- Remove the row 1 vane segments.

Inspection
- Visually inspect the combustor components for damage.
- Perform visual inspection of the rotor cooling air pipes in place.
- Perform visual inspection of the row #1 turbine blades.

Assembly
- Install the replacement row 1 vane segments.
- Install and align replacement transitions per the applicable Service Bulletin and measure clearances.
- Measure and record transition outlet mouth clearances.
- Install replacement combustor baskets and check alignment to the transitions.
- Install replacement cross-flame tubes.
- Install replacement combustor transition cylinders and v-band clamps.
- Install replacement fuel nozzles and mini-manifolds.
- Install fuel nozzle piping.

EXHAUST SECTION

Inspection

- Perform visual inspection of the turbine exhaust including the strut shields.
- Visually inspect the row #4 turbine blades and measure the radial clearances.

501D5 or 501F
Hot Gas Path Inspection

The following parts will be replaced:

- Combustor baskets
- Transitions
- Fuel nozzles and mini-manifolds
- Cross-flame tubes
- Combustion Transition Cylinders with V-band clamps
- Row 1 & 2 vane segments
- Row 1 & 2 Turbine Blades

INLET SECTION

Disassembly
- Remove access cover on inlet manifold.

Inspection
- Visually inspect compressor inlet for damage and oil leaks.
- Visually inspect the inlet guide vanes and row #1 compressor blades.
- Measure the row #1 compressor blade radial clearances.

Assembly
- Install the inlet manifold access cover.

COMBUSTOR SECTION

Disassembly
- Remove the combustor components.

Inspection
- Visually inspect the combustor components for damage.
- Perform visual inspection of the rotor cooling air pipes in place.

Assembly
- Install and align replacement transitions per the applicable Service Bulletin and measure clearances.
- Measure and record transition outlet mouth clearances.
- Install replacement combustor baskets and check alignment to the transitions.
- Install replacement cross-flame tubes.
- Install replacement combustor transition cylinders and v-band clamps.
- Install replacement fuel nozzles and mini-manifolds.
- Install fuel nozzle piping.

TURBINE SECTION

Disassembly

- Remove the turbine cooling air piping and cylinder cover.
- Unbolt and remove the upper half rows 2, 3, and 4 blade rings and interstage seals.
- Measure the turbine axial and radial clearances.
- Remove the lower half rows 2, 3, and 4 blade rings.
- Remove the row 1, 2, 3, & 4 vane segments.
- Remove the turbine blades.

Inspection

- Clean and NDE the turbine discs per the applicable Service Bulletin.
- Clean and inspect the row 1 & 2 turbine ring segments per the applicable Service Bulletin.
- Clean and inspect the row 3 & 4 turbine vane and ring segments per the applicable Service Bulletin.
- Clean and visually inspect the turbine cylinder and piping.

Assembly

- Install replacement row 1 & 2 vane segments.
- Assemble the row 2, 3, & 4 blade rings
- Install replacement turbine blades.
- Install the lower half blade rings and measure the axial and radial clearances.
- Install and bolt the upper interstage seals.
- Install and bolt the upper half blade rings.
- Align the blade rings to the rotor.
- Install and bolt the turbine cylinder cover and piping.

EXHAUST SECTION

Inspection

- Perform visual inspection of the turbine exhaust including the strut shields.

501D5 or 501F
Major C.T. Inspection

The following parts will be replaced:

- Combustor baskets
- Transitions
- Fuel nozzles and mini-manifolds
- Cross-flame tubes
- Combustion Transition Cylinders with V-band clamps
- Rows 1, 2, 3, & 4 vane segments
- Rows 1, 2, 3, & 4 Turbine Blades
- Compressor diaphragms (all rows)
- Inlet Guide Vanes
- Journal Bearings (if required)
- Thrust Bearing (if required)
- Air and Oil Seals (if required)

INLET SECTION

Disassembly
- Remove upper half inlet manifold and inlet casing.
- Measure the inlet end journal bearing clearances and remove the bearing.
- Measure thrust bearing axial clearance and disassemble bearing.
- Measure air and oil seal clearances and remove seals.

Inspection
- Clean and visually inspect inlet manifold, inlet casing, and inlet guide vanes.
- Perform ultrasonic inspection of journal bearing babbitt.
- Perform ultrasonic inspection of thrust bearing babbitt.
- Perform visual and dimensional inspection of the oil and air seals.

Assembly
- Install air and oil seals and measure clearances.
- Install journal bearing and measure clearances.
- Assemble thrust bearing and measure clearance.
- Install and bolt upper half inlet casing and inlet manifold.

COMPRESSOR SECTION

Disassembly
- Remove upper half compressor covers.
- Measure compressor axial and radial clearances.
- Remove compressor diaphragms.

Inspection
- Clean and visually inspect compressor cylinders.

Assembly

- Install replacement compressor diaphragms.
- Measure compressor axial and radial clearances.
- Install and bolt compressor cylinder covers.

COMBUSTOR SECTION

Disassembly

- Remove the combustor components.
- Remove Compressor Combustor cover.

Inspection

- Visually inspect the combustor components for damage.
- Visually inspect the rotor cooling air pipes.

Assembly

- Install the rotor cooling air pipes.
- Install and align replacement transitions per the applicable Service Bulletin and measure clearances.
- Measure and record transition outlet mouth clearances.
- Install replacement combustor baskets and check alignment to the transitions.
- Install replacement cross-flame tubes.
- Install replacement combustor transition cylinders and v-band clamps.
- Install replacement fuel nozzles and mini-manifolds.
- Install fuel nozzle piping.

TORQUE TUBE SEAL HOUSING

Disassembly

- Remove the upper half torque tube seal housing.
- Measure the torque tube seal clearances.
- Remove the torque tube seals.

Inspection

- Clean and visually inspect the torque tube seals.
- Visually inspect the static seal segments.
- Clean and visually inspect the torque tube seal housing.

Assembly

- Install the torque tube seals and measure clearances.
- Install and bolt the upper half torque tube seal housing.

TURBINE SECTION

Disassembly

- Remove the turbine cooling air piping and cylinder cover.
- Unbolt and remove the upper half blade rings and interstage seals.
- Measure the turbine axial and radial clearances.
- Remove the lower half rows 2, 3, and 4 blade rings.
- Remove the row 1, 2, 3, & 4 vane segments.

Inspection

- Clean and inspect the turbine ring segments per the applicable Service Bulletin.
- Clean and visually inspect the turbine cylinder and piping.

Assembly

- Install replacement row 1, 2, 3, & 4 turbine vane segments.
- Assemble and install the lower half rows 2, 3, and 4 blade rings and measure the axial and radial clearances.
- Install and bolt the upper half interstage seals and blade rings
- Align the blade rings to the rotor.
- Install and bolt the turbine cylinder cover and piping.

EXHAUST SECTION

Disassembly

- Remove the exhaust cylinder cover.
- Measure the exhaust end journal bearing clearances and remove the bearing.
- Measure the air and oil seal clearances and remove the seals.

Inspection

- Clean and visually inspect the exhaust cylinder including the struts and strut shields.
- Perform ultrasonic inspection of journal bearing babbitt.
- Perform visual and dimensional inspection of the oil and air seals.

Assembly

- Install air and oil seals and measure clearances.
- Install the journal bearing and measure the clearances.
- Install and bolt the exhaust cylinder cover.

ROTOR

Disassembly

- Unbolt turbine/generator coupling and measure alignment.
- Rig and remove the rotor.
- Remove the turbine blades.

Inspection

- Clean and inspect the turbine discs per the applicable Service Bulletin.
- Clean and inspect the compressor blades in place per the applicable Service Bulletin.
- Clean and dimensionally inspect the bearing journals and thrust collar.
- Clean and inspect the coupling.

Assembly

- Install replacement rows 1, 2, 3, & 4 turbine blades.
- Rig and install rotor.
- Measure coupling alignment and bolt coupling.

APPENDIX B

How to Calculate the Equivalent Number of Starts (ES)

Because the effects of cyclic thermal stress caused by some starts, trips, and load changes are cumulative, they are combined into one parameter: equivalent starts.

1. **To calculate the Equivalent Number of Starts (ES), count only Successful Starts, Fired Aborts, Trips from Load, and Instantaneous Load Changes.**

   - **Successful Start** occurs when a unit reaches synchronization. Successful starts are further classified, depending on the total time to accelerate and reach base load:

     Normal start occurs if a unit reaches base load in 20 minutes or longer.

     Intermediate start occurs whenever a unit reaches base load in less than 20 minutes, but more than 10 minutes.

     Fast start occurs whenever a unit reaches base load in 10 minutes or less.

   - **Fired Abort** - Occurs if the unit enters the ignition sequence, but shuts down before reaching base load.

     An **unfired abort** occurs if the unit shuts down before ignition. Unfired aborts are to be disregarded in calculating equivalent starts.

   - **Trip From Load** - Occurs after the unit reaches base load. This is an abrupt shutdown that does not follow the normal shutdown sequence.

   - **Instantaneous Load Change** - Occurs when a unit abruptly increases or decreases load at a rate greater than the specified ramp rate (in response to a change in grid demand, a control system impetus, etc.).

     - Include the trips from load and instantaneous load changes that have occurred ONLY since the last hot path inspection.
     - For any trips or instantaneous load changes that have occurred during operation above base load, consult Westinghouse for additional guidelines and recommendations.

For definitions of Fuel, Trip, & Load Change Factors, refer to Figure 4-1, page 4-7

2. Calculate the Equivalent Number of Starts (ES).

Use Equation 3 for single-fuel operation:

Equation 3

ES_f = Total number of (Successful Starts x Start Factor) +
Total number of fired aborts +
Total number of (Trips from Load x Trip Factor) +
Total number of (Instantaneous Load Changes x Load Change Factor)

Apply this value to the ES column that corresponds to the fuel used, on the inspection interval table recommended for your unit.

Use equation 4 for multiple-fuel operation:

Equation 4

ES_T = Total number of (Successful Starts x Start Factor x Fuel Factor)+
Total number of (Fired aborts x Fuel Factor) +
Total number of (Trips from Load x Trip Factor x Fuel Factor) +
Total number of (Instantaneous Load Changes x Load Change Factor x Fuel Factor)

Apply this value to the ES column labeled "Natural Gas/Propane," on the inspection interval table recommended for your unit.

3. You have completed calculation of ES.

Return to INSTRUCTIONS, on page 3, and continue to Step 6.

Figure B-1. Fuel Factors, Trip Factors, and Load Change Factors

Use these factors in Equations 3 or 4, on page 16, to calculate ES.

Start Factors

Total Time to Accelerate and Reach Base Load	Start Factor
Normal Start (20 minutes or longer)	1.0
Intermediate Start (less than 20 minutes, but more than 10 minutes)	10.0
Fast Start (10 minutes or less)	20.0

Fuel Factors

Fuel Used	Fuel Factor
Natural Gas	1.0
Distillate Oil	1.3
Crude / Residual (starting on Natural Gas, Distillate Oil)	1.8

Trip Factors

Percentage of Base Load at Time of Trip*	Trip Factor
Greater Than Base Load	Consult Westinghouse
76 - 100%	20.0
51 - 75%	14.0
26 - 50%	7.0
Up to 25%	4.0

*Should be counted as a full load trip if the trip occurs on a combined cycle unit that is operating on external control (IGVs modulated at reduced load to maintain exhaust temperature at upper limit).

Load Change Factors

Percentage of Base Load at Time of Instantaneous Load Change	Load Change Factor
Greater Than Base Load	Consult Westinghouse
76 - 100%	6.0
51 - 75%	4.0
26 - 50%	2.0
Up to 25%	1.0

END OF BULLETIN