

**EXH. RJR-19C
DOCKETS UE-22___/UG-22___
2022 PSE GENERAL RATE CASE
WITNESS: RONALD J. ROBERTS**

**BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION**

**WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION,**

Complainant,

v.

PUGET SOUND ENERGY,

Respondent.

**Docket UE-22___
Docket UG-22___**

**EIGHTEENTH EXHIBIT (CONFIDENTIAL) TO THE
PREFILED DIRECT TESTIMONY OF**

RONALD J. ROBERTS

ON BEHALF OF PUGET SOUND ENERGY

REDACTED VERSION

JANUARY 31, 2022

2020 CAPITAL JUSTIFICATION SUMMARY

PROJECT TITLE: *Turbine/Generator Base Overhaul*

DATE: *7/29/2019*

Approved Early. Project number to be assigned

Completed by: *Andrea Garvin*

Description of Project:

The scope of this project is to perform base maintenance on the turbine/generator associated with the overhaul on Unit 4. The work to be performed is consistent with OEM recommendations and includes the mobilization of labor, the high velocity oil flush, bearing work as required, general open and close on the generator, TV pinned seat installation, GV, TV, IV and RHS valve routine rebuilds, contractor overhead (site support staff, project management, contract engineering support, office/clerical help, etc.), scaffolding, insulation, tool use, general steam chest maintenance, NDE testing and maintenance of the bolts and studs on the valves and steam chest and other assigned duties. This base maintenance is performed every overhaul as preventative maintenance to ensure proper operation and reliability of the turbine/generator.

Alternative 1: Inspect/Repair

The budgetary price for the turbine/generator base is: [REDACTED] (see items 1, 5, 6, 12, 13, 14, 15, 25, 26, 28, and 29 in file RNA2019-21766 Colstrip 4 2020 Major Inspection 6.21.19.pdf and RNA2019-21766 Colstrip 4 2020 Major Inspection 6.21.19.pdf). This includes labor for mobilization, valve inspection, valve repair/replacement, throttle valve pinned seat installation, high velocity oil flush, bearing work as required, open/close generator, contractor overhead, lifetime assessment, NDE, and general repair. There is approximately [REDACTED] for required parts and contingency. Given the severe consequences of an overspeed event, we recommend performing the turbine/generator base in 2020.

Alternative 2: Do Nothing

The second option is to do nothing to the main turbine/generator train or associated valves and defer the work until the 2024 overhaul. The risks run by doing nothing is that main turbine valves will experience leaks to the point of either overspeeding the turbine or leading to not being able to stop the turbine when the unit trips. If an overspeed event occurred, it could lead to large amounts of damage in the main turbine train, leading to an extended outage of 1 year or more as repairs are made on an unscheduled outage. A failure such as this could cause a loss of [REDACTED] incremental value) as well as potential collateral damage to other steam turbine generator component. Due to the level of risk and severe consequences of failure, we recommend performing the turbine/generator base maintenance in 2020.

Alternative 3:

Comparison Table

	Alternative 1: Inspect/Repair	Alternative 2: Do Nothing	Alternative 3:
<i>Recommended Alternative</i>	X		
<i>Risk</i>		Medium	
<i>Capital Costs</i>	[REDACTED]		
Incremental Annual Impacts			
<i>Generation w/o impact to O&M - MWh</i>			

Low/Medium/High

REDACTED VERSION

<i>\$ impact</i>			
<i>Generation w/impact to O&M - MWh</i>	Mitigates Risk		
<i>\$-impact</i>	Mitigates Risk	\$	
<i>Heat Rate - btu/kwh</i>			
<i>\$-impact</i>			
<i>O&M savings/(costs)</i>			
Economic Metrics			
<i>Internal Rate of Return (%)</i>			
<i>Net Present Value (\$)</i>			
<i>Estimated Payback Period (Yrs)</i>			
<i>Profitability Index</i>			
Other Considerations			
<i>Leadtime (months)</i>			
<i>Safety</i>			
<i>Environmental</i>			

2020 HURDLE RATE WORKSHEET

PROJECT TITLE:	Turbine/Generator Base Overhaul	W.O.#		Project Closed	N	Y/N
DATE:	7/29/2019	PROJECT #:	10026780	Project Closed As date	-	(DDMMYYYY)
Manager:	E. Petritz	SUB PROJECT #:	900	Engineer Signoff		Full Name
Completed by:	Andrea Garvin	*PROJECT APPROVED EARLY.				
Revision	1	Plant Acct	10711	Filled out by Finance team		
Date of Revision	8/15/2019 (DDMMYYYY)	Bechtel System	4AC			
Environmental (Check Hbb X)	Air:	Activity Code	0000ASTG00			
	Noise:	CRC #	4571			
	Solids:	Budget Category	SUS			
	Water:	Current Budget Year	2020 (YYYY)			
Estimated Useful Life	1 (In Years)	Super Project #	Talen Montana LLC			
Estimated In-Service	Jul-20 (MMYYYY)	Location	Unit 4			
Estimated Final Payment Date	Aug-20 (MMYYYY)	Facility Code	A004 Unit 4			

** This is a maintenance item. Evaluated based on impact in one year of not performing maintenance.

Description of Project

The scope of this project is to perform base maintenance on the turbine/generator associated with the overhaul on Unit 4. The work to be performed is consistent with OEM recommendations and includes the mobilization of labor the high velocity oil flush bearing work as required general open and close on the generator TV pinned seat installation GV TV IV and RHS valve routine rebuilds contractor overhead (site support staff project management contract engineering support office/clerical help etc.) scaffolding insulation tool use general steam chest maintenance NDE testing and maintenance of the bolts and studs on the valves and steam chest and other assigned duties. This base maintenance is performed every overhaul as preventative maintenance to ensure proper operation and reliability of the turbine/generator.

Process

The process is to identify any known issues and develop solutions to those issues. We evaluated two options 1) Inspect/Repair the turbine/generator component and 2) Do Nothing. This worksheet shows the incremental impact of inspection and repair as found issues compared to doing nothing.

ATTRIBUTES	SAVINGS \$/YR
Safety	0
Environmental	0
Plant Capacity	0
Heat Rate	0
O & M	0
Facility/Equipment Reliability	0
TOTAL SAVINGS \$/YR	0
PROFITABILITY INDEX	
INTERNAL RATE OF RETURN (%)	
NET PRESENT VALUE (\$)	
ESTIMATED PAYBACK (yrs)	

SMD	EMD	RMD
Safety	Environmental	Reliability
Must	Must	Must
Do	Do	Do

PROJECT COST

Capital Cost (\$)										
	2020		2021		2022					
	Material	Contract	Material	Contract	Material	Contract				
Jan			\$0	\$0	\$0	\$0				\$0
Feb	\$0	\$0	\$0	\$0	\$0	\$0				\$0
Mar	\$0	\$0	\$0	\$0	\$0	\$0				\$0
Apr	\$0	\$0	\$0	\$0	\$0	\$0				\$0
May			\$0	\$0	\$0	\$0				\$0
Jun			\$0	\$0	\$0	\$0				\$0
Jul	\$0	\$0	\$0	\$0	\$0	\$0				\$0
Aug			\$0	\$0	\$0	\$0				\$0
Sep	\$0	\$0	\$0	\$0	\$0	\$0				\$0
Oct	\$0	\$0	\$0	\$0	\$0	\$0				\$0
Nov	\$0	\$0	\$0	\$0	\$0	\$0				\$0
Dec	\$0	\$0	\$0	\$0	\$0	\$0				\$0
Total Annual Capital Spent			\$0	\$0	\$0	\$0				\$0
Annual O&M Cost	\$0									

INCREMENTAL SAVINGS - RECOMMENDATION vs. CURRENT STATE.

NOTE: 2.0 points (MUST DO) in the Safety, Environmental or Facility/Equipment Reliability attribute passes the hurdle rate regardless of Internal Rate of Return. Safety, Environmental & Facility/Equipment Reliability points can be assigned in tenths. The 0.0, 0.5, 1.0 and 2.0 are general guide lines. One (1) point is equivalent to \$50,000/yr.

SAFETY	\$/YR	COMMENTS
0		
<p>Improvements to alleviate a condition which adversely affects health, safety or security. Improvements to correct a major threat to health safety, security or to meet a firm contractual agreement. Requirements mandated by law, regulation or binding agreement.</p> <p>No Impact 0.0 points Minor Impact 0.5 points Major Impact 1.0 points Regulatory Requirement 2.0 points (MUST DO) NOTE: Safety savings cannot exceed 1/2 the Capital Cost.</p>		
ENVIRONMENTAL		
0		

REDACTED VERSION

Improvements to alleviate a condition which adversely affects the environment. Improvements to correct a major threat to the environment. Requirements mandated by law, regulation or binding agreement.
 No Impact 0.0 points
 Minor Impact 0.5 points
 Major Impact 1.0 points
 Regulatory Requirement 2.0 points (MUST DO)
 NOTE: Environmental savings cannot exceed 1/2 the Capital Cost.

PLANT CAPACITY

mw/yr improvement

Increased generation w/o increased O&M costs

0

mw/yr improvement

Other increased generation (reduced outage time).

Increased efficiency

Units 3 & 4 Based on [REDACTED] btu/kwh/yr NPHR

HEAT RATE

Units 3-4 Btu/kwh/yr

0

0

O & M

0

MATERIAL & CONTRACTS

Est. material & contract \$/yr savings

0

Est. labor man-hours/yr reduced

0

FACILITY/EQUIPMENT RELIABILITY

1.5

No Impact 0.0 points
 Employee Productivity Improvement 0.5 points
 Functional, but obsolete (cannot maintain in future) 1.0 points
 Beyond Repair, failure imminent (MUST DO) 2.0 points
 NOTE: Reliability savings cannot exceed 1/2 the Capital Cost.

Historical data on Unit 4 has indicated damage to the turbine valves after a 3-yr run time (See pages 8-12 of file 99114 pgit20160830172779 413813 v1.pdf and pages 10-14 of file 99114 pgit20170719179188 429628 v1.pdf for typical damage and repair to turbine valves). With the extension to a 4 year run time on the turbine valves, it is expected that damages would be greater than typically seen after a 3 year runtime. Inability for the turbine valves to operate properly increases the risks of a catastrophic overspeed event, which could cause serious damage to the entire turbine train and to personnel causing an extended outage of a year or longer. It is critical to perform the basic turbine/generator maintenance on a consistent schedule.

2020 CAPITAL JUSTIFICATION SUMMARY

PROJECT TITLE: *Design/Build Dry Waste Disposal System*
DATE: *8/28/2019*
Completed by: *G. Criswell*

Description of Project:

The Colstrip Wastewater Administrative Order on Consent (AOC) (attached in project folder) requires pond closure and remediation activities to address impacted groundwater at the Units 3&4 Effluent Holding Pond (EHP) area. Litigation on the AOC resulted in a Settlement (attached in project folder) that requires a "non-liquid" disposal system for CCR material generated by Units 3&4 at the EHP no later than July 1, 2022. This project provides for design/build of that "non-liquid" disposal system. This project will cover a two year period to complete construction by December 2021 (█ in 2020 and █ in 2021). Pilot testing is being conducted in 2019 to identify the technology that will provide a cost-effective "non-liquid" disposal system. This project is considered an Environmental Must Do project because of the AOC and AOC Settlement requirements.

Alternative 1:

Implement the design/build of the 3&4 EHP Dry Waste Disposal System to meet the requirements of the Colstrip Wastewater AOC and AOC Settlement.

Alternative 2:

Alternative 3: Do Nothing

The Do Nothing alternative would result in a violation of the Colstrip Wastewater AOC and AOC Settlement, and would result in a Notice of Violation (NOV) and likely litigation and fines/penalties.

Comparison Table

	Alternative 1:	Alternative 2:	Alternative 3: Do Nothing
<i>Recommended Alternative</i>	X		
<i>Risk</i>	mitigates risk		High
<i>Capital Costs</i>	█		
Incremental Annual Impacts			
<i>Generation w/o impact to O&M - MWh</i>			

Low/Medium/High

REDACTED VERSION

<i>\$ impact</i>			
<i>Generation w/impact to O&M - MWh</i>			
<i>\$-impact</i>			
<i>Heat Rate - btu/kwh</i>			
<i>\$-impact</i>			
<i>O&M savings/(costs)</i>			
Economic Metrics			
<i>Internal Rate of Return (%)</i>	Environmental		
<i>Net Present Value (\$)</i>	Must		
<i>Estimated Payback Period (Yrs)</i>	Do		
<i>Profitability Index</i>	EMD		
Other Considerations			
<i>Leadtime (months)</i>			
<i>Safety</i>			
<i>Environmental</i>	regulatory requirement		AOC compliance

2020 HURDLE RATE WORKSHEET

PROJECT TITLE: Design/Build Dry Waste Disposal System	W.O. #:		Project Closed	N	Y/N
DATE: 8/28/2019	PROJECT #:		Project Closed As date	-	(DDMM/YYYY)
Manager: R. Borsheim	SUB PROJECT #:		Engineer Signoff		Full Name
Completed by: G. Criswell					
Revision	0	Plant Acct			Filled out by Finance team
Date of Revision		(DDMM/YYYY)	Bechtel System		
Environmental (Check Hbb X)	Air:		Activity Code		
	Noise:		CRC #		
	Solids:		Budget Category		
	Water:	X	Current Budget Year		(YYYY)
Estimated Useful Life	10	(In Years)	Super Project #		
Estimated In-Service	Dec-21	(MM/YYYY)	Location		
Estimated Final Payment Date	Dec-21	(MM/YYYY)	Facility Code		

Description of Project
The Colstrip Wastewater Administrative Order on Consent (AOC) (attached in project folder) requires pond closure and remediation activities to address impacted groundwater at the Units 3&4 Effluent Holding Pond (EHP) area. Litigation on the AOC resulted in a Settlement (attached in project folder) that requires a "non-liquid" disposal system for CCR material generated by Units 3&4 at the EHP no later than July 1, 2022. This project provides for design/build of that "non-liquid" disposal system. This project will cover a two year period to complete construction by December 2021 in 2020 and in 2021. Pilot testing is being conducted in 2019 to identify the technology that will provide a cost-effective "non-liquid" disposal system. This project is considered an Environmental Must Do project because of the AOC and AOC Settlement requirements.

Process

ATTRIBUTES	SAVINGS \$/YR		
Safety	0		
Environmental	0		
Plant Capacity	0		
Heat Rate	0		
O & M	0		
Facility/Equipment Reliability	0		
TOTAL SAVINGS \$/YR	0		
PROFITABILITY INDEX	EMD	SMD	EMD
INTERNAL RATE OF RETURN (%)	Environmental	Safety	Environmental
NET PRESENT VALUE (\$)	Must	Must	Must
ESTIMATED PAYBACK (yrs)	Do	Do	Do

PROJECT COST						
Capital Cost (\$)	2020	2021	2022	2023	2024	2025
	Material	Contract	Material	Contract	Material	Contract
Jan						
Feb						
Mar						
Apr						
May						
Jun						
Jul						
Aug						
Sep						
Oct						
Nov						
Dec						
Total Annual Capital Spent	\$0	\$0	\$0	\$0	\$0	\$0
Annual O&M Cost	0					

INCREMENTAL SAVINGS - RECOMMENDATION vs. CURRENT STATE

NOTE: 2.0 points (MUST DO) in the Safety, Environmental or Facility/Equipment Reliability attribute passes the hurdle rate regardless of Internal Rate of Return. Safety, Environmental & Facility/Equipment Reliability points can be assigned in tenths. The 0.0, 0.5, 1.0 and 2.0 are general guide lines to to low. One (1) point is equivalent to \$1,000,000/yr.

SAFETY	\$/YR	COMMENTS
0	0	
Improvements to alleviate a condition which adversely affects health, safety or security. Improvements to correct a major threat to health safety, security or to meet a firm contractual agreement. Requirements mandated by law, regulation or binding agreement.		
No Impact 0.0 points Minor Impact 0.5 points Major Impact 1.0 points Regulatory Requirement 2.0 points (MUST DO) NOTE: Safety savings cannot exceed 1/2 the Capital Cost.		

ENVIRONMENTAL	\$/YR	COMMENTS
2	0	The Colstrip Wastewater Administrative Order on Consent (AOC) (attached in project folder) requires pond closure

REDACTED VERSION

Improvements to alleviate a condition which adversely affects the environment. Improvements to correct a major threat to the environment. Requirements mandated by law, regulation or binding agreement.
 No Impact 0.0 points
 Minor Impact 0.5 points
 Major Impact 1.0 points
 Regulatory Requirement 2.0 points (MUST DO)
 NOTE: Environmental savings cannot exceed 1/2 the Capital Cost.

and remediation activities to address impacted groundwater at the Units 3&4 Effluent Holding Pond (EHP) area. Litigation on the AOC resulted in a Settlement (attached in project folder) that requires a "non-liquid" disposal system for CCR material generated by Units 3&4 at the EHP no later than July 1, 2022. This project provides for design/build of that "non-liquid" disposal system. This project will cover a two year period to complete construction by December 2021 in 2020 and in 2021. Pilot testing is being conducted in 2019 to identify the technology that will provide a cost-effective "non-liquid" disposal system.

	PLANT CAPACITY		0
	mw/hr/yr improvement		
Increased generation w/o increased O&M costs		0	0
	mw/hr/yr improvement		
Other increased generation (reduced outage time).			0
	HEAT RATE		0
Increased efficiency	Units 3-4 Btu/kwh/yr		
Units 3 & 4 Based on \$9,8915/btu/kwh/yr NPHR			0
	O & M		0
MATERIAL & CONTRACTS	Est. material & contract \$/yr savings		0
	Est. labor man-hours/yr reduced		0
	FACILITY/EQUIPMENT RELIABILITY		0
No Impact 0.0 points Employee Productivity Improvement 0.5 points Functional, but obsolete (cannot maintain in future) 1.0 points Beyond Repair, failure imminent (MUST DO) 2.0 points NOTE: Reliability savings cannot exceed 1/2 the Capital Cost.			

2020 CAPITAL JUSTIFICATION SUMMARY

PROJECT TITLE: *Cooling Tower Fill Replacement (Rev 1)*

DATE: 11/5/2019

Completed by: Jen Petritz

Description of Project:

The Unit 4 Cooling Tower Fill will be over 11 years old in 2020 (it was last replaced in 2009). Cooling Tower fill is typically replaced every 10 years, per the manufacturer's recommendations. The fill is becoming brittle, as expected with age, and has been subjected to additional breakage due to structural failures in the tower. When the fill breaks the cooling tower efficiency is reduced and the pieces of broken fill migrate to the screens which can cause an increase in condenser backpressure. The project will replace 90% of the fill (10% was replaced in 2016) and 50% of the piping and nozzles, in conjunction with the structural maintenance during the 2020 overhaul. There is also significant damage to the cooling tower structural members and beams that will be addressed by this project. Additional information regarding the structural condition and risk is contained in the attachments. Alternative 1 is the recommended option and provides the least overall cost and risk. At a minimum, Alternative 2 should be done.

Alternative 1: Recommended Option

The Unit 4 Cooling Tower Fill will be over 11 years old in 2020. Cooling Tower fill is typically replaced every 10 years, per the manufacturer's recommendations. The fill is becoming brittle, as expected with age, and has been subjected to additional breakage due to structural failures in the tower. The project will replace 90% of the fill (10% was replaced in 2016) and 50% of the piping and nozzles, in conjunction with the structural maintenance during the 2020 overhaul. It will also replace all the structural fill beams that are degrading. In addition, repairs will be made to all degrading structure corbels. It is recommended to complete this work in 2020, as it will reduce overall project cost. There is a high risk of breaking the existing fill while doing the beam replacement due to age. The budget to perform this option is [REDACTED] in 2020.

Alternative 2:

Split the project over two outages: We can split the fill replacement project over two outages and only replace fill directly over the new beams. The beams were inspected during the 2016 outage and many of the remaining beams have structural damage. The beams will be inspected again during the 2020 outage and prioritized. This alternative would replace the high priority beams and the fill over the top of them in 2020 (approximately 50% of the beams/fill). The remaining beams and fill will then be replaced in 2024. This option reduces the budget in 2020 from [REDACTED] to \$[REDACTED] but it adds an additional [REDACTED] project in 2024 for a total project cost of [REDACTED] [REDACTED] more expensive overall). The extra cost is primarily due to mobilizing contractors and equipment for two outages instead of one outage as proposed in Alternative 1. In addition to being more expensive overall, there is additional risk associated with this alternative. The cooling tower has been in-service for an additional four years since the last inspection and we expect more structural damage to the beams has occurred. Beams and structural corbels with structural defects will be left in service with this alternative and will not be repaired until 2024. Also, approximately 50% of the old fill will remain in-service for another four years degrading even more.

Alternative 3: Do Nothing

If we do not replace the fill, we will likely have failures in the cooling tower, resulting in unplanned outages. As the brittle cooling tower breaks away, it collects in the circulating water channels, ultimately ending up against the screens. This pluggage and throughout the system. This results in very high condenser back pressure, and can lead to unit outages. Additionally, this option creates a safety hazard for plant personnel performing standard operations and maintenance tasks on and around the tower.

Comparison Table

REDACTED VERSION

	Alternative 1: Recommended Option	Alternative 2:	Alternative 3: Do Nothing	
<i>Recommended Alternative</i>	X			
<i>Risk</i>	mitigates risk		Medium	Low/Medium/High
<i>Capital Costs</i>				
Incremental Annual Impacts				
<i>Generation w/o impact to O&M - MWh</i>				
<i>\$ impact</i>				
<i>Generation w/impact to O&M - MWh</i>				
<i>\$-impact</i>				
<i>Heat Rate - btu/kwh</i>				
<i>\$-impact</i>				
<i>O&M savings/(costs)</i>				
Economic Metrics				
<i>Internal Rate of Return (%)</i>	Reliability			
<i>Net Present Value (\$)</i>	Must			
<i>Estimated Payback Period (Yrs)</i>	Do			
<i>Profitability Index</i>	RMD			
Other Considerations				
<i>Leadtime (months)</i>				
<i>Safety</i>				
<i>Environmental</i>				

2020 HURDLE RATE WORKSHEET

PROJECT TITLE:	Cooling Tower Fill Replacement (Rev 1)	W.O. #:		Project Closed	N	Y/N
DATE:	11/5/2019	PROJECT #:		Project Closed As date	-	(DDMMYYYY)
Manager:	E. Petritz	SUB PROJECT #:		Engineer Signoff		Full Name
Completed by:	Jen Petritz					
Revision	0	Plant Acct		Filled out by Finance team		
Date of Revision	8/1/2019 (DDMMYYYY)	Bechtel System	4DA			
Environmental (Check Wb's X)	Air:	Activity Code	0000AWCT00			
	Noise:	CRC #	4572			
	Solids:	Budget Category	SUS			
	Water:	Current Budget Year	2020			(YYYY)
Estimated Useful Life	10 (In Years)	Super Project #				
Estimated In-Service	7/1/2020 (MMYYYY)	Location	Unit 4			
Estimated Final Payment Date	7/1/2020 (MMYYYY)	Facility Code	A004 Unit 4			

Description of Project
The Unit 4 Cooling Tower Fill will be over 11 years old in 2020 (it was last replaced in 2009). Cooling Tower fill is typically replaced every 30 years per the manufacturer's recommendations. The fill is becoming brittle as expected with age and has been subjected to additional breakage due to structural failures in the tower. When the fill breaks the cooling tower efficiency is reduced and the pieces of broken fill migrate to the screens which can cause an increase in condenser backpressure. The project will replace 90% of the fill (10% was replaced in 2018) and 50% of the piping and nozzles in conjunction with the structural maintenance during the 2020 overhaul.
There is also significant damage to the cooling tower structural members and beams that will be addressed by this project. Additional information regarding the structural condition and risk is contained in the attachments.
Alternative 1 is the recommended option and provides the least overall cost and risk. At a minimum Alternative 2 should be done.

Process

ATTRIBUTES	SAVINGS \$/YR			
Safety	0			
Environmental	0			
Plant Capacity	0			
Heat Rate	0			
O & M	0			
Facility/Equipment Reliability				
TOTAL SAVINGS \$/YR				
PROFITABILITY INDEX	RMD	SMD	EMD	RMD
INTERNAL RATE OF RETURN (%)	Reliability	Safety	Environmental	Reliability
NET PRESENT VALUE (\$)	Must	Must	Must	Must
ESTIMATED PAYBACK (yrs)	Do	Do	Do	Do

Capital Cost (\$)	PROJECT COST					
	2020		2021		2022	
	Material	Contract	Material	Contract	Material	Contract
Jan						
Feb						
Mar						
Apr						
May						
Jun						
Jul						
Aug						
Sep						
Oct						
Nov						
Dec						
Total Annual Capital Spent	\$5,240,000	\$0	\$0	\$0	\$0	\$0
Annual O&M Cost	0					

INCREMENTAL SAVINGS - RECOMMENDATION vs. CURRENT STATE.

NOTE: 2.0 points (MUST DO) in the Safety, Environmental or Facility/Equipment Reliability attribute passes the hurdle rate regardless of Internal Rate of Return. Safety, Environmental & Facility/Equipment Reliability points can be assigned in tenths. The 0.0, 0.5, 1.0 and 2.0 are general guidelines to follow. One (1) point is equivalent to \$/yr.

SAFETY	\$/YR	COMMENTS
0	0	
Improvements to alleviate a condition which adversely affects health, safety or security. Improvements to correct a major threat to health, safety, security or to meet a firm contractual agreement. Requirements mandated by law, regulation or binding agreement. No Impact 0.0 points Minor Impact 0.5 points Major Impact 1.0 points Regulatory Requirement 2.0 points (MUST DO)		

ENVIRONMENTAL	\$/YR	COMMENTS
0	0	
Improvements to alleviate a condition which adversely affects the environment. Improvements to correct a major threat to the environment. Requirements mandated by law, regulation or binding agreement. No Impact 0.0 points Minor Impact 0.5 points Major Impact 1.0 points Regulatory Requirement 2.0 points (MUST DO) NOTE: Environmental savings cannot exceed 1/2 the Capital Cost.		

REDACTED VERSION

	PLANT CAPACITY	<input type="text" value="0"/>	
	mw/yr improvement	<input type="text" value="0"/>	
Increased generation w/o increased O&M costs		<input type="text" value="0"/>	
	mw/yr improvement	<input type="text" value="0"/>	
Other increased generation (reduced outage time)		<input type="text" value="0"/>	
	HEAT RATE	<input type="text" value="0"/>	
Increased efficiency	Units 3-4 Btu/kwh/yr	<input type="text" value="0"/>	
Units 3 & 4 Based on \$9,8915btu/kwh/yr NPHR		<input type="text" value="0"/>	
	O & M	<input type="text" value="0"/>	
MATERIAL & CONTRACTS	Est. material & contract \$/yr savings	<input type="text" value="0"/>	
	Est. labor man-hours/yr reducec	<input type="text" value="0"/>	
	FACILITY/EQUIPMENT RELIABILITY	<input type="text" value="2"/>	
No Impact 0.0 points Employee Productivity Improvement 0.5 points Functional, but obsolete (cannot maintain in future) 1.0 points Beyond Repair, failure imminent (MUST DO) 2.0 points NOTE: Reliability savings cannot exceed 1/2 the Capital Cost.		<input type="text" value="2"/>	The fill will be over its recommended life span in 2020. Additionally, we will need to remove the fill to replace the structural beams. This will cause further degradation and breakage, resulting in reliability issues.

2020 CAPITAL JUSTIFICATION SUMMARY

PROJECT TITLE:	<i>U4 IP Turbine Overhaul</i>
DATE:	<i>7/29/2019</i>
Completed by:	<i>Andrea Garvin</i>

Description of Project:

This project has been previously approved by the owners. This is year 3 of a 3-year project. Blade rows 1-3 and blade rings on both sides of the IP Turbine have moderate to severe trailing edge erosion and some blunt leading edges. The inlet flow guide is out of round due to thermal distortion and the inner cylinder bolting hardware is starting to bottom out. The initial rows of the turbine have had shroud repairs to mitigate shroud lifting. This project will entail disassembling the IP Turbine and replacing the rotor, stationary blades (blade rings), and the inner cylinder. The current outer cylinder will be re-used. This project will help reduce future maintenance costs and help prevent potential outages related to the existing turbine. This preventative capital maintenance project will ensure reliable, efficient operation of the IP Turbine. Please see file T-COLSTRIP.U4.IP.003.Install_Delay Storage.2018.10.11.pdf for project invoicing schedule per the signed contract with Siemens. See pages 65-59 of file 99114_pg1t20130610102913_311180_v1.pdf for description and pictures of indications on the IP rotor. See page 5 of file 99114_pg1t20130809104436_316015_v1.pdf for Siemens recommendations for the Unit 4 IP rotor and pages 9-12 for as found condition of the Unit 4 IP parts during the last IP inspection during POU413.

Alternative 1: Replace the IP Turbine

Remaining capital cost to replacement of the IP rotor is [REDACTED] which includes [REDACTED] for remaining storage cost, [REDACTED] for labor to install and complete performance testing, and ~10% contingency. This is year 3 of a 3-year project. During calendar years 2018 and 2019, a replacement IP turbine was built for Unit 4 as opposed to ordering replacement rings and blades to repair previously observed thermal and foreign object damage to the IP turbine. This replacement rotor is in storage at a climate controlled Siemens facility in Charlotte, NC. Replacing the IP has the additional benefits of restoring the efficiency of the IP, speeding up the cold starts, extending the overhaul timeframe beyond the current 6 year cycle, and eliminating bore inspections. Given the sunk cost of [REDACTED] and the impact of an IP failure, we recommend replacing the Unit 4 IP in 2020.

Alternative 2: Do Nothing

The second alternative is to do nothing to the IP turbine during the 2020 outage. If an IP turbine failure occurred, it would come with the risk of needing a forced outage of [REDACTED] weeks or longer, lost generation, and potential safety risks to plant personnel. The damage and safety risk is not factored into the financial analysis. A failure could cause a loss of [REDACTED] (incremental value) as well as potential collateral damage to other steam turbine generator components. Due to the severe consequences of failure, we recommend replacing the IP turbine during the 2020 outage and not deferring work to the 2024 outage.

Alternative 3:

[REDACTED]

Comparison Table

	Alternative 1: Replace the IP Turbine	Alternative 2: Do Nothing	Alternative 3:
<i>Recommended Alternative</i>	X		
<i>Risk</i>		Medium	
<i>Capital Costs</i>	[REDACTED]		
Incremental Annual Impacts			

Low/Medium/High

<i>Generation w/o impact to O&M - MWh</i>			
<i>\$ impact</i>			
<i>Generation w/impact to O&M - MWh</i>	Mitigates Risk		
<i>\$-impact</i>	Mitigates Risk		
<i>Heat Rate - btu/kwh</i>			
<i>\$-impact</i>			
<i>O&M savings/(costs)</i>			
Economic Metrics			
<i>Internal Rate of Return (%)</i>			
<i>Net Present Value (\$)</i>			
<i>Estimated Payback Period (Yrs)</i>			
<i>Profitability Index</i>			
Other Considerations			
<i>Leadtime (months)</i>			
<i>Safety</i>			
<i>Environmental</i>			

2020 HURDLE RATE WORKSHEET

PROJECT TITLE:	U4 IP Turbine Overhaul	W.O.#		Project Closed	N	Y/N
DATE:	7/29/2019	PROJECT #:	10025711	Project Closed As date	-	(DDMMYYYY)
Manager:	E. Petritz	SUB PROJECT #:	900	Engineer Signoff		Full Name
Completed by:	Andrea Garvin					
Revision	1	Plant Acct		Filed out by Finance team		
Date of Revision	8/14/2019 (DDMMYYYY)	Bechtel System	4AC			
Environmental (Check H/W)	Air:	Activity Code	0000ASTG00			
	Noise:	CRC #	4571			
	Solids:	Budget Category	SUS			
	Water:	Current Budget Year	2020 (YYYY)			
Estimated Useful Life	20 (In Years)	Super Project #				
Estimated In-Service	Jul-20 (MMYYYY)	Location	Unit 4			
Estimated Final Payment Date	Aug-20 (MMYYYY)	Facility Code	A004 Unit 4			

Description of Project
This project has been previously approved by the owners. This is year 3 of a 3-year project. Blade rows 1-3 and blade rings on both sides of the IP Turbine have moderate to severe trailing edge erosion and some blunt leading edges. The inlet flow guide is out of round due to thermal distortion and the inner cylinder bolting hardware is starting to bottom out. The initial rows of the turbine have had shroud repairs to mitigate shroud lifting. This project will entail disassembling the IP Turbine and replacing the rotor stationary blades (blade rings) and the inner cylinder. The current outer cylinder will be re-used. This project will help reduce future maintenance costs and help prevent potential outages related to the existing turbine. This preventative capital maintenance project will ensure reliable efficient operation of the IP Turbine. Please see file T-COLSTRIP.U4.IP.003.Install_Delay-Storage.2018.10.11.pdf for project invoicing schedule per the signed contract with Siemens. See pages 65-59 of file 99114_pg120130610102913_311180_v1.pdf for description and pictures of indications on the IP rotor. See page 5 of file 99114_pg120130809104436_316015_v1.pdf for Siemens recommendations for the Unit 4 IP rotor and pages 9-12 for as found condition of the Unit 4 IP parts during the last IP inspection during POU413.

Process
The process is to identify the issue and develop solutions to the known issue. We evaluated two options Alternative 1) Replace the IP Turbine 2) Do nothing. This worksheet shows the incremental impact of Alternative 1 compared to Alternative 2.

ATTRIBUTES	SAVINGS \$/YR			
Safety	0			
Environmental	0			
Plant Capacity				
Heat Rate	0			
O & M	0			
Facility/Equipment Reliability	0			
TOTAL SAVINGS \$/YR				
PROFITABILITY INDEX			SMD	EMD
INTERNAL RATE OF RETURN (%)			Safety	Environmental
NET PRESENT VALUE (\$)			Must	Must
ESTIMATED PAYBACK (yrs)			Do	Do
				RMD
				Reliability
				Must
				Do

PROJECT COST									
Capital Cost (\$)	\$2,719,000								
	2020		2021		2022				
	Material	Contract	Material	Contract	Material	Contract	Material	Contract	
Jan	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Feb	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Mar	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Apr	\$0		\$0	\$0	\$0	\$0	\$0	\$0	\$0
May	\$0		\$0	\$0	\$0	\$0	\$0	\$0	\$0
Jun	\$0		\$0	\$0	\$0	\$0	\$0	\$0	\$0
Jul	\$0		\$0	\$0	\$0	\$0	\$0	\$0	\$0
Aug	\$0		\$0	\$0	\$0	\$0	\$0	\$0	\$0
Sep	\$0		\$0	\$0	\$0	\$0	\$0	\$0	\$0
Oct	\$0		\$0	\$0	\$0	\$0	\$0	\$0	\$0
Nov	\$0		\$0	\$0	\$0	\$0	\$0	\$0	\$0
Dec	\$0		\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Annual Capital Spent	\$0		\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual O&M Cost	\$0								

INCREMENTAL SAVINGS - RECOMMENDATION vs. CURRENT STATE

NOTE: 2.0 points (MUST DO) in the Safety, Environmental or Facility/Equipment Reliability attribute passes the hurdle rate regardless of Internal Rate of Return. Safety, Environmental & Facility/Equipment Reliability points can be assigned in tenths. The 0.0, 0.5, 1.0 and 2.0 are general guide lines. To low. One (1) point is equivalent to \$1,000,000/yr.

SAFETY	\$/YR	COMMENTS
0	0	
Improvements to alleviate a condition which adversely affects health, safety or security. Improvements to correct a major threat to health safety, security or to meet a firm contractual agreement. Requirements mandated by law, regulation or binding agreement. No Impact 0.0 points Minor Impact 0.5 points Major Impact 1.0 points Regulatory Requirement 2.0 points (MUST DO) NOTE Safety savings cannot exceed 1/2 the Capital Cost.		

ENVIRONMENTAL	\$/YR
0	0

REDACTED VERSION

Improvements to alleviate a condition which adversely affects the environment. Improvements to correct a major threat to the environment. Requirements mandated by law, regulation or binding agreement.
 No Impact 0.0 points
 Minor Impact 0.5 points
 Major Impact 1.0 points
 Regulatory Requirement 2.0 points (MUST DO)
 NOTE: Environmental savings cannot exceed 1/2 the Capital Cost.

PLANT CAPACITY

Increased generation w/o increased O&M costs **mw/hr/yr improvement** 0

An IP Turbine failure would come with serious consequences in the way of extended outage of at least [REDACTED] weeks to remove the old IP and replace with the previously built turbine ([REDACTED] capacity factor) in lost generation.

Other increased generation (reduced outage time). **mw/hr/yr improvement** 634 032

Increased efficiency

Units 3 & 4 Based on \$3,8915btu/kwh/yr NPHR

HEAT RATE

Units 3-4 Btu/kwh/yr 0

O & M

MATERIAL & CONTRACTS

Est. material & contract \$/yr savings 0

Est. labor man-hours/yr reduced 0

FACILITY/EQUIPMENT RELIABILITY

No Impact 0.0 points
 Employee Productivity Improvement 0.5 points
 Functional, but obsolete (cannot maintain in future) 1.0 points
 Beyond Repair, failure imminent (MUST DO) 2.0 points
 NOTE: Reliability savings cannot exceed 1/2 the Capital Cost.