

CI 39623

LIN U&U CW Pump Refurbishment

REDACTED

July 30, 2010

NOVA SCOTIA
POWER
An Emera Company

UARB APPROVAL SHEET

Project Title: **LIN - U&U CW Pump Refurbishment**

CI Number: 39623

☒ Capital Project Authorization

Head Office Use:

☐ ATO

Project Number:

☐ Final Cost

Date: July 30, 2010

Location:			Division:	
Expenditure Profile			Schedule	
YEAR	Budget Estimate	Project Estimate		
2010		381,736	Estimated Start Date	2010-08
			Estimated In-Service Date	2010-08
			Estimated Close Date	2010-09
Total	\$0	\$381,736		

COMMENTS

This item is submitted pursuant to section 35

Submitted on behalf of NOVA SCOTIA POWER INCORPORATED

Approved on behalf of NOVA SCOTIA UTILITY AND REVIEW BOARD

M Savory

July 24/2010

Authorized Signatory

DATE

DATE

Mark Savory

VP Technical and Construction

Project Number

- LIN-U&U-CW Pump Refurbishment

CI Number : 39623

Parent CI Number :

Budget Version - 2010 07/05 Forecast

Cost Centre : 305 - 305-Lingan 3&4 Prod.Unit

Forecast

Start :	08/18/2010
Operational :	08/30/2010
Final Cost :	09/18/2010
2010	\$381,736.22
Total :	\$381,736.22
Original Cost :	\$0.00

The Unit 3A pump failed in March 2010 due to a broken shaft at the coupling taper and was taken out of service. Bearings, running surfaces and clearance fits were also damaged. This work has been completed.

The failed pump was extracted and sent to a qualified repair shop for evaluation. It is believed that the shaft failure was due to running shaft misalignments (whipping) resulting from misalignments between the upper shaft and pump shaft that occurred during service. To reduce the potential for future whipping, the refurbishment project included the installation of an additional bearing on the pump shaft. This bearing will help to maintain alignment and will reduce the movement of the pump shaft if misalignment occurs, protecting related bearings and running surfaces. The evaluation also indicates that normal service wear and corrosion is present due to solid particle and salt water exposure. The CW pumps are routinely inspected for running shaft misalignment / whipping but all developing failures are not always indicated in advance as monitoring of the submerged lower pump shaft is not feasible while the pump is in service.

The refurbishment includes re-surfacing / re-building and coating of worn, corroded and damaged surfaces and components, a new sleeveless, chromed stainless pump shaft, new marine bearings, and verification of all mating fits and alignments.

Summary of Related CI's +/- 2 years
 2009 - 34703 LIN 2B CW Pump Refurbishment
 2011 - TBD LIN 4A CW PUMP Refurbishment

CI Number : 39623 - LIN-U&U-CW Pump Refurbishment Project Number

Parent CI Number : - Approved Date

Cost Centre : 305 - 305-Lingan 3&4 Prod.Unit Budget Version 2010 06/06 Forecast

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal & Hydro Contracts AO		5,195	0	5,195
095		095-Thermal Regular Labour AO		19,473	0	19,473
001	014	001 - THERMAL Regular Labour	014 - SGP - Circ.Water Sys.	73,568	0	73,568
012	014	012 - Materials	014 - SGP - Circ.Water Sys.	272,500	0	272,500
013	014	013 - POWER PRODUCTION Contracts	014 - SGP - Circ.Water Sys.	11,000	0	11,000
Total Cost:				381,736	0	381,736
Original Cost:						

CI Number : 39623	- LIN-U&U-CW Pump Refurbishment	Project Number
Parent CI Number :	-	Approved Date
Cost Centre : 305	- 305-Lingan 3&4 Prod Unit	

Capital Item Justification

Justification Criteria : Thermal
 Sub-Criteria : Maintenance
 Name of Report :
 Document Location :
 Person Responsible :

Why do this project?

In March 2010, the pump in location 3A failed and was removed from service. It is necessary to refurbish this pump and return it to service as soon as possible to reduce the risk of unit de-rating or a forced outage while operating with only one pump.

Each operating Unit is equipped with two Circulating Water (CW) pumps, which supply cooling water to each unit's condenser as well as to various smaller heat exchangers serving the Unit. Adequate condenser cooling is necessary to ensure proper condenser vacuum, which is a major contributor to unit efficiency. During the cooler months, one CW pump per operating unit is capable of providing adequate condenser cooling. During warmer months both pumps are required to maintain condenser vacuum. If one of a unit's two pumps is unavailable during the warmer months, the unit's heat rate and/or ability to generate full load will be restricted. The loss of both pumps would lead to an unplanned outage. Therefore, the reliability and availability of these pumps is critical to plant operation. The CW pumps range in age from 18 to 23 years, and over the years have developed normal operating wear and component erosion and corrosion due to solid particle and salt water exposure.

Why do this project now?

The risk of a unit de-rating or outage is increased if the second pump is not available. Having this pump refurbished and re-installed as soon as possible will also mitigate the risk of future emergency repairs and unplanned outages. Not having a second pump available could result in an extended forced outage for the unit if the remaining pump failed.

Repair and balancing facilities are not available on site or locally and refurbishment has been completed at an ISO 9002 pump repair facility.

Why do this project this way?

Refurbishment is the most cost effective and practical option.

Station: LINGAN GENERATING STATION

CI Number: CI 39623

Project: LIN-UU CW PUMP Refurbishment

Item	Description	Rate (\$/hr)	Qty	Cost Est	Totals
1	Regular Plant Labor				
	Engineering	47	64	\$3,008	
	Supervision	42	80	\$3,360	
	Trades	32	2100	\$67,200	
	Sub-Total Plant Resources				\$73,568
2	Material				
	CW Pump rebuild subcontract	1	260,000		
	Piping replacement	1	5,000		
	Consumables	1	2,500		
	Miscellaneous Materials	1	5,000		
	Sub-Total Materials				\$272,500
3	Contracts				
	Machine small parts as required	1	1000	\$1,000	
	Transportation	1	10000	\$10,000	
	Sub-Total Contracts				\$11,000
4	A/O				
	Contract AO	\$5,195		\$24,668	
	Labour AO	\$19,473			
	Sub-Total A/O Charges				\$24,668
	Total Project Estimate				\$381,736

LIN U&U CW Pump Refurbishment
Reference Notes

Budget Year	2010
Division	Power production
Department	Lingan Generating station

Date	May 18th
CI number	39623

Note 1	CW pump Rebuild subcontract	Attached quote from the supplier indicates that a refurbishment of the existing Cooling Water pump will have a cost of \$[REDACTED]. An additional \$[REDACTED] was added to the estimate as contingency to cover the potential unforeseen costs during re-installment.
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LIN-PE-CW PUMP Refurbishment Summary of Alternatives

Budget Year : 2010
 Division : Power Production
 Department : Lingan
 Originator : Ron MacNeil

Date : 30-Jul-10
 CI Number: 39623
 Project No. :

	Alternative	After Tax WACC	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Refurbish Pump	6.55%	14,642,577	1	376.19%	1.3 years
B	Replace Pump	6.55%	14,427,873	2	375.58%	1.4 years
C	Test 3	6.55%	0	3	#NUM!	0.0 years
D	Test 4	6.55%	0	4	#NUM!	0.0 years

Recommendation :

It is recommended based on this EAM to Refurbish the CW pump rather than replace with a new pump. The justification of this is based on a NPV of \$14,642,577 and an IRR of 376.19%.

Notes/Comments :

Refurbish Pump

The assumptions used to analyze this option are as follows: A life of 15 years, a capital cost of \$381,736 in 2010 for a refurbishment and a capital cost of \$720,744 present value in 2016 for replacement of the asset. Justification is based on avoided replacement energy and avoided repair costs associated with an unplanned outage. The avoided costs for 2010 and 2011 are : \$272,824 and \$1,024,575.

Replace Pump

The assumptions used to analyze this option are as follows: A life of 15 years a capital cost of \$640,000 in 2010 for replacement and an additional \$795,760, present value, in 2021 for a second replacement. Justification is based on avoided replacement energy and avoided repair costs associated with an unplanned outage. The avoided cost for 2010 and 2011 are : \$272,824 and \$1,024,575.

Test 3

Test 4

LIN-PE-CW PUMP Refurbishment
Refurbish Pump

Year	Total Revenue	Operating Costs	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	Discount Factor	PV of CF	CNPV
2010	272,842.3	-	(381,736.0)	15,269.4	366,466.6	(108,893.8)	(87,877.1)	(196,770.8)	1.000	(196,770.8)	(196,770.8)
2011	1,024,571.8	-	-	29,317.3	337,149.2	1,024,571.8	(329,628.4)	700,943.4	0.939	657,854.0	461,083.2
2012	1,218,675.0	-	-	26,971.9	310,177.3	1,218,675.0	(369,481.4)	849,193.5	0.881	747,996.9	1,209,080.0
2013	1,419,974.1	-	-	24,814.2	285,363.1	1,419,974.1	(432,459.6)	987,474.5	0.827	816,329.6	2,025,409.6
2014	1,628,678.5	-	-	22,829.0	262,634.1	1,628,678.5	(497,888.6)	1,130,819.9	0.776	877,363.6	2,902,773.2
2015	2,214,004.0	-	-	21,002.7	241,531.3	2,214,004.0	(679,830.4)	1,534,173.6	0.728	1,117,139.0	4,019,912.3
2016	2,821,594.0	-	(720,743.9)	48,152.3	914,123.0	2,100,850.1	(859,766.9)	1,241,083.1	0.683	848,164.6	4,868,076.9
2017	2,876,752.3	-	-	73,129.8	840,993.2	2,876,752.3	(869,122.9)	2,007,629.3	0.641	1,287,684.1	6,155,761.0
2018	2,933,000.9	-	-	67,275.5	773,713.7	2,933,000.9	(888,373.7)	2,044,627.3	0.602	1,230,797.2	7,386,558.3
2019	2,990,361.7	-	-	61,897.1	711,816.6	2,990,361.7	(907,824.0)	2,082,537.7	0.565	1,176,553.8	8,563,112.0
2020	3,048,856.7	-	-	56,945.3	654,871.3	3,048,856.7	(927,452.5)	2,121,384.2	0.530	1,124,813.9	9,687,926.0
2021	3,108,508.5	-	-	52,389.7	602,481.6	3,108,508.5	(947,366.8)	2,161,111.7	0.498	1,075,447.5	10,763,373.5
2022	3,169,340.0	-	-	48,198.5	554,283.1	3,169,340.0	(967,553.9)	2,201,786.2	0.467	1,028,332.8	11,791,706.3
2023	3,231,374.8	-	-	44,342.6	509,940.4	3,231,374.8	(987,960.0)	2,243,394.9	0.438	983,356.1	12,775,062.4
2024	3,294,636.8	-	-	40,795.2	469,145.2	3,294,636.8	(1,008,650.9)	2,285,945.9	0.411	940,410.8	13,715,473.2
2025	3,359,150.4	-	-	37,531.6	431,613.6	3,359,150.4	(1,029,701.8)	2,329,448.6	0.386	899,396.8	14,614,869.9
2026	-	-	-	34,529.1	397,084.5	-	10,704.0	10,704.0	0.362	3,878.7	14,618,748.7
2027	-	-	-	31,766.8	365,317.7	-	9,847.7	9,847.7	0.340	3,349.1	14,622,087.7
2028	-	-	-	29,225.4	336,092.3	-	9,069.9	9,069.9	0.319	2,891.7	14,624,989.5
2029	-	-	-	26,887.4	309,204.9	-	8,335.1	8,335.1	0.300	2,496.9	14,627,486.3
2030	-	-	-	24,736.4	284,488.5	-	7,663.3	7,663.3	0.281	2,155.9	14,629,642.3
2031	-	-	-	22,757.5	261,711.0	-	7,054.8	7,054.8	0.264	1,861.5	14,631,503.8
2032	-	-	-	20,936.9	240,774.2	-	6,491.4	6,491.4	0.248	1,607.3	14,633,111.1
2033	-	-	-	19,261.9	221,512.2	-	5,971.2	5,971.2	0.232	1,387.8	14,634,498.9
2034	-	-	-	17,721.0	203,791.3	-	5,493.5	5,493.5	0.218	1,198.3	14,635,697.2
2035	-	-	-	16,303.3	187,488.0	-	5,051.0	5,051.0	0.205	1,034.7	14,636,731.8
2036	-	-	-	14,999.0	172,488.9	-	4,643.7	4,643.7	0.192	893.4	14,637,625.2
2037	-	-	-	13,799.1	158,689.8	-	4,277.7	4,277.7	0.180	771.4	14,638,396.6
2038	-	-	-	12,695.2	145,994.6	-	3,935.5	3,935.5	0.169	666.0	14,639,052.6
2039	-	-	-	11,679.6	134,315.0	-	3,620.7	3,620.7	0.159	575.1	14,639,637.7
2040	-	-	-	10,745.2	123,569.8	-	3,331.0	3,331.0	0.149	496.6	14,640,134.3
2041	-	-	-	9,885.6	113,684.3	-	3,061.5	3,061.5	0.140	428.8	14,640,563.1
2042	-	-	-	9,094.7	104,589.5	-	2,819.4	2,819.4	0.131	370.2	14,640,933.3
2043	-	-	-	8,367.2	96,222.4	-	2,593.8	2,593.8	0.123	319.7	14,641,252.9
2044	-	-	-	7,697.8	88,524.6	-	2,386.3	2,386.3	0.116	276.0	14,641,528.9
2045	-	-	-	7,082.0	81,442.6	-	2,195.4	2,195.4	0.109	238.3	14,641,767.2
2046	-	-	-	6,515.4	74,927.2	-	2,019.8	2,019.8	0.102	205.8	14,641,973.0
2047	-	-	-	5,994.2	68,933.0	-	1,851.2	1,851.2	0.096	177.7	14,642,150.7
2048	-	-	-	5,514.6	63,418.4	-	1,709.5	1,709.5	0.090	153.4	14,642,304.1
2049	-	-	-	5,073.5	58,344.9	-	1,572.8	1,572.8	0.084	132.5	14,642,436.5
2050	-	-	-	4,667.6	53,677.3	-	1,400.6	1,400.6	0.079	115.1	14,642,577.2
Total	38,612,321.8	-	(1,102,479.9)	1,048,802.6	12,612,470.3	37,509,841.9	(11,667,586.4)	25,842,255.5	151.1	114,642,577.2	14,642,577.2

LIN-PE-CW PUMP ReTurbishment
Replace Pump

Year	Total Revenue	Operating Costs	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	Discount Factor	PV of CF	NPV
2010	272,842.3	-	(640,000.0)	25,600.0	614,400.0	(367,157.8)	(84,563.2)	(451,727.0)	1.000	(451,727.0)	(451,727.0)
2011	1,024,571.8	-	-	49,152.0	565,248.0	1,024,571.8	(317,237.6)	707,274.2	0.939	663,795.6	212,068.6
2012	1,218,675.0	-	-	45,219.8	520,028.2	1,218,675.0	(363,861.8)	854,814.2	0.881	752,947.7	965,016.3
2013	1,419,974.1	-	-	41,602.3	478,425.9	1,419,974.1	(427,293.3)	992,678.8	0.827	820,631.9	1,785,648.2
2014	1,628,678.5	-	-	38,274.1	440,151.8	1,628,678.5	(493,101.3)	1,135,577.2	0.776	881,054.7	2,666,702.9
2015	2,214,004.0	-	-	35,212.1	404,939.7	2,214,004.0	(675,423.5)	1,538,578.5	0.728	1,120,346.6	3,787,049.4
2016	2,821,594.0	-	-	32,395.2	372,544.5	2,821,594.0	(864,651.6)	1,956,942.4	0.683	1,337,387.7	5,124,437.1
2017	2,876,752.3	-	-	29,803.6	342,741.0	2,876,752.3	(882,551.1)	1,994,198.2	0.641	1,279,089.5	6,403,506.6
2018	2,737,467.5	-	-	27,419.3	315,321.7	2,737,467.5	(840,111.0)	1,897,352.6	0.602	1,142,142.8	7,545,649.4
2019	2,990,361.7	-	-	25,225.7	290,095.9	2,990,361.7	(919,191.2)	2,071,169.5	0.565	1,170,131.2	8,715,780.6
2020	3,048,856.7	-	-	23,207.7	266,888.3	3,048,856.7	(937,951.2)	2,110,905.5	0.530	1,119,268.4	9,835,049.0
2021	3,108,508.5	-	-	53,181.4	1,009,466.4	2,312,748.9	(947,151.4)	1,365,597.5	0.498	679,570.8	10,514,619.9
2022	3,169,340.0	-	(795,759.6)	80,757.3	928,709.1	3,169,340.0	(957,461.6)	2,211,879.4	0.467	1,033,046.8	11,547,666.7
2023	3,231,374.8	-	-	74,296.7	854,412.3	3,231,374.8	(978,691.2)	2,252,683.6	0.438	987,426.4	12,535,093.0
2024	3,294,636.8	-	-	68,353.0	786,059.4	3,294,636.8	(1,000,141.0)	2,294,488.8	0.411	943,925.2	13,479,018.3
2025	3,359,150.4	-	-	62,864.7	723,174.6	3,359,150.4	(1,021,841.4)	2,337,308.0	0.386	902,431.3	14,381,449.5
2026	-	-	-	57,854.0	665,320.5	-	17,931.7	17,931.7	0.362	6,498.9	14,387,948.4
2027	-	-	-	53,225.7	612,095.0	-	16,501.0	16,500.0	0.340	5,611.4	14,393,559.9
2028	-	-	-	48,967.6	563,127.4	-	15,181.0	15,180.0	0.319	4,845.2	14,398,405.0
2029	-	-	-	45,050.2	518,077.2	-	13,961.6	13,965.6	0.300	4,183.5	14,402,588.6
2030	-	-	-	41,446.2	476,631.0	-	12,841.3	12,848.3	0.281	3,612.2	14,406,200.8
2031	-	-	-	38,130.5	438,500.5	-	11,821.4	11,820.4	0.264	3,119.0	14,409,319.8
2032	-	-	-	35,080.0	403,420.5	-	10,871.8	10,874.8	0.248	2,693.1	14,412,012.8
2033	-	-	-	32,273.6	371,146.9	-	10,001.8	10,004.8	0.232	2,325.3	14,414,338.1
2034	-	-	-	29,691.7	341,455.1	-	9,201.4	9,204.4	0.218	2,007.8	14,416,345.9
2035	-	-	-	27,316.4	314,138.7	-	8,461.1	8,468.1	0.205	1,733.6	14,418,079.5
2036	-	-	-	25,131.1	289,007.6	-	7,791.6	7,790.6	0.192	1,496.9	14,419,576.4
2037	-	-	-	23,120.8	265,887.0	-	7,167.4	7,167.4	0.180	1,292.5	14,420,868.8
2038	-	-	-	21,271.0	244,616.0	-	6,594.0	6,594.0	0.169	1,115.0	14,421,984.8
2039	-	-	-	19,569.3	225,046.8	-	6,061.5	6,066.5	0.159	963.6	14,422,948.4
2040	-	-	-	18,003.7	207,043.0	-	5,581.2	5,581.2	0.149	832.0	14,423,780.4
2041	-	-	-	16,563.4	190,479.6	-	5,134.7	5,134.7	0.140	718.4	14,424,498.8
2042	-	-	-	15,238.4	175,241.2	-	4,723.9	4,723.9	0.131	620.3	14,425,119.1
2043	-	-	-	14,019.3	161,221.9	-	4,346.0	4,346.0	0.123	535.6	14,425,654.6
2044	-	-	-	12,897.8	148,324.2	-	3,998.3	3,998.3	0.116	462.4	14,426,117.1
2045	-	-	-	11,865.9	136,458.2	-	3,676.4	3,676.4	0.109	399.3	14,426,516.4
2046	-	-	-	10,916.7	125,541.6	-	3,384.2	3,384.2	0.102	344.8	14,426,861.1
2047	-	-	-	10,043.3	115,498.2	-	3,113.4	3,113.4	0.096	297.7	14,427,158.8
2048	-	-	-	9,239.9	106,258.4	-	2,864.4	2,864.4	0.090	257.0	14,427,415.9
2049	-	-	-	8,500.7	97,757.7	-	2,635.2	2,635.2	0.084	221.9	14,427,637.8
2050	-	-	-	7,820.6	89,837.1	-	2,381.2	2,381.2	0.079	235.6	14,427,873.4
Total	38,116,788.4	-	(1,435,759.6)	1,345,822.5	16,194,838.1	36,981,028.9	(11,514,449.9)	25,466,579.0	0.079	(14,427,873.4)	469,479,839.4

