Attachment 6

O&M and Lifecycle Cost Estimate

Hatch Ltd.

MAJOR PROJECTS CONTRACTOR DOCUMENT FRONT COVER SHEET

Contract Number and Description: 2024-97582 DS - RFP for 150 MW Combustion Turbine Plant– Front End Engineering and Design Project	**Project Number:** 12972390
Contractor Name: Hatch Ltd.	**Contractor Address:** 80 Hebron Way, Suite 100 St. John's, NL A1A 0L9
Document Title: O&M and Lifecycle Cost Estimate	**Total Number of Pages incl. Front Sheet:** 8
Contractor Document Number: H373979-0000-620-030-0001	**Contractor Revision Number:** 0
Contractor Signature/Stamp: [redacted]	
NLH Document Number: HRDCT2-HAT-49100-EP-EST-0002-01	**NLH Revision Number:** B0
NLH Document Date (DD-MMM-YYYY): 06-12-2024	
Comments:	**Equipment Tag:**

REVIEW DOES NOT CONSTITUTE APPROVAL OF DESIGN DETAILS, CALCULATIONS, TEST METHODS, OR MATERIAL DEVELOPED AND/OR SELECTED BY THE CONTRACTOR, NOR DOES IT RELIEVE THE CONTRACTOR FROM FULL COMPLIANCE WITH CONTRACTUAL OR OTHER OBLIGATIONS.

- ☐ 01 REVIEWED AND ACCEPTED – NO COMMENTS
- ☐ 02 REVIEWED – INCORPORATE COMMENTS, REVISE AND RESUBMIT
- ☐ 03 REVIEWED – NOT ACCEPTED
- ☐ 04 INFORMATION ONLY
- ☐ 05 NOT REVIEWED

NLH Lead Reviewer	Date (DD-MMM-YYYY)	NLH Project Manager	Date (DD-MMM-YYYY)

General Comments:

Newfoundland and Labrador Hydro

150 MW Combustion Turbine Plant FEED Study

O&M and Lifecycle Cost Estimate

			[redacted]		
2024-12-06	0	Issued for FEED			
Date	**Rev.**	**Status**	**Prepared By**	**Checked By**	**Approved By**
	HATCH				

HATCH

Project Memo

H373979

06/12/2024

To: [redacted] From: [redacted]

Newfoundland and Labrador Hydro
150 MW Combustion Turbine Plant FEED Study

O&M and Lifecycle Cost Estimate

1. Calculation Inputs and Assumptions

The operation and maintenance costs were determined for a 150 MW combustion turbine power plant based on the final design parameters, equipment and deliverables produced during the FEED.

To develop the cost estimate, a budgetary multi-year maintenance plan, was obtained from [redacted] and information in the proposal, including costs and maintenance recommendation, was used. Past project experience was also used to develop costing and was scaled based on the MW output of the plant for components such as labour & resources, salaries, expenses, etc. Costs and maintenance schedules [redacted] were on a per CTG unit basis, therefore for the purpose of analysis values have been multiplied by 3 based on the assumption of the plant configuration.

No escalation was included in the calculations. The prices reflect the costs and rates as they stand on the date the memo was created.

The cost of fuel and fuel delivery (including the jetty and offloading equipment) was not included in the estimate.

1.1 Plant Configuration

The 150 MW combustion turbines will be located on the Holyrood Thermal Generating Station (HTGS) site. The combustion turbines are assumed to be available 100% of the time and operating for 2,000 hours of the year.

A summary of the plant parameters and operating assumptions is outlined in Table 1-1.

Table 1-1: Power Plant Parameters and Operating Assumptions

Parameter	Units	Value
Site Location	-	Holyrood Thermal Generating Station (HTGS)
Fuel Selection	-	Diesel
Configuration	-	[redacted]
Average Net Plant Load Demand	MW	150
Demin Water Usage (NOx Abatement and Power Augmentation)	m^3/hr	[redacted]
Availability %	%	100
Net Heat Rate	kJ/kW-hr	[redacted]

Parameter	Units	Value
Net Efficiency	%	[redacted]
Operating Hours	hr/yr	2,000
Total Net MW-hr	MW-hr/yr	300,000

1.2 Turbine and Generator Maintenance

The gas turbine maintenance costs were estimated based on vendor information provided in the Budgetary Multi Year Maintenance Plan. Maintenance intervals and assumptions are outlined in Table 1-2. Minor inspections and maintenance are expected to take place every 16,000 operating hours, and major maintenance overhauls are set to take place every 50,000 operating hours.

Table 1-2: Maximum Maintenance Intervals

Cost Component	Units	Value
Combustion Turbine Generator (CTG)		
PI/HSE/Combustor	Operating Hours	16,000
Major Overhaul	Operating Hours	50,000
Basis for Major Maintenance Interval	-	Hours Based
Years b/w Major Overhauls	#	15 years for CTG

1.2.1 Turbine Overhaul Costs

Utilizing the generator overhaul costs, the total CTG package overhaul costs were calculated. The turbine overhaul costs also include the borescope inspection, combustor maintenance, and major maintenance costs. Borescope inspections are conducted every 2,000 operating hours, or every year, but are completed when other maintenance work is required. The combustor maintenance is to take place every 16,000 operating hours and the major maintenance every 50,000 operating hours. A summary of the total maintenance costs for all 3 CTGs per year of plant operation are listed in Table 1-3.

Table 1-3: Combustion Turbine Overhaul Costs

Year	CTGs			Generator		Total Yearly Costs
	Borescope/ Package Inspection /Remote Monitoring & Diagnostics	Package Inspection /Hot Section Exchange/ Combustor	Major/ Remote Monitoring & Diagnostics	Minor Cost	Major Cost	
1	[redacted]					
2						
3						
4						
5						
6						
7						
8						
9						

Year	CTGs			Generator		Total Yearly Costs
	Borescope/ Package Inspection /Remote Monitoring & Diagnostics	Package Inspection /Hot Section Exchange/ Combustor	Major/ Remote Monitoring & Diagnostics	Minor Cost	Major Cost	
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
Total	**6,495,390**	**16,220,370**	**20,575,275**	**1,560,000**	**1,860,000**	**$ 46,711,245**

1.3 Fixed Operational Costs & Maintenance

The fixed operational costs include costs for the facility, insurance, labour, and materials. A summary of the fixed operation costs is outlined in Table 1-4.

Table 1-4: Fixed Operational Expenses

Fixed Cost Component	Units	Value
Administrative and General	$/year	$ 850,000
Building and Structures	$/year	$ 200,000
Insurance Cost	$/year	$ 1,382,750
Labour Cost	$/year	$ 1,433,750

1.3.1 Administrative Costs

The administrative and general costs can further be defined by the costs of office and facility maintenance, training sessions, conferences, and additional items listed in Table 1-5.

Table 1-5: Administrative Cost Summary

Administrative Cost Component	Cost
Administration Stationary	$ 10,000.00 /year
Head Office Expenses	$ 50,000.00 /year
Road and Facility Maintenance	$ 40,000.00 /year
Consultants	$ 50,000.00 /year
Training and Conferences	$ 50,000.00 /year
HSE Audit	$ 20,000.00 /year
IT	$ 50,000.00 /year
Janitorial Services	$ 30,000.00 /year
Office Costs	$ 200,000.00 /year
Fleet Vehicles	$ 150,000.00 /year
Total	**$ 850,000.00** /year

1.3.2 Plant Operation Personnel Costs

For each plant employee, the quantity of people required for the position and the individual salary per year was used to calculate a total yearly salary. The personnel costs are detailed in Table 1-6.

Table 1-6: Plant Operation Personnel Cost Summary

Labour Type	Salary per Year	Number of Personnel	Total Salary
Plant Operators	[redacted]	[redacted]	[redacted]
Admin Assistance			
Electrician			
Millwright			
I&C Technician			
Gas Turbine Manager			
Production Supervisor			
Gas Turbine Asset Specialist			
Gas Turbine Engineering - Mechanical			
Gas Turbine Engineering - Electrical			
HSE			
Total			$ 1,433,750

1.4 Variable Operational Costs

The balance of plant (BOP), chemical costs and demin water system replacement costs were estimated from past projects and scaled based on the MW output of the plant. The dollar value per MWh is displayed in Table 1-7.

Table 1-7: Variable Operational Expenses

Variable Cost Component	Units	Value
Chemicals and Consumables	$/MWh	0.3
BOP Variable O&M factor	$/MWh	0.5

2. Operating Cost Estimate

Using the inputs and assumptions defined in Section 1, the operation and maintenance costs were calculated for the first 25 years of plant operation. The plant operational and maintenance costs for each year of plant operation are presented in Table 2-1.

Table 2-1: Annual Operations and Maintenance Costs

Annual Operation and Maintenance Costs for Power Plant																										
Year		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
1. Performance Assumptions																										
# of CTs Running	#	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Net Plant Output	MW	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0
Net Plant Heat Rate	kJ/kWh	[redacted]																								
Annual Power Generation, Total	MWh	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
2. Fixed O&M																										
Labour	$/year	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750	1,433,750
Administrative and General	$/year	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000
Buildings and Structures	$/year	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
Insurance	$/year	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750	1,382,750
Total Fixed	$/year	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750	3,300,750
3. Variable O&M																										
3.1. CTGs																										
Total Maintenance	$/year	[redacted]																								
Intake Filter Replacement	$/year								1,800,000							1,800,000								1,800,000		
Discovery During Inspection	$/year	50192	50192	50192	50192	50192	50192	50192	503777	553969	553969	50192	50192	50192	50192	1271332	1321524	1321524	50192	50192	50192	50192	50192	503777	553969	553969
3.2. Balance of Plant																										
BOP	$/year	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
3.4. Demin Water																										
RO Membrane Replacement	$/year			80,000.00			80,000.00			80,000.00			80,000.00			80,000.00			80,000.00			80,000.00			80,000.00	
EDI Replacement	$/year					200,000.00					200,000.00					200,000.00					200,000.00					200,000.00
Sand Filter Replacement	$/year					30,000.00					30,000.00					30,000.00					30,000.00					30,000.00
Carbon Filter Replacement	$/year	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00	90,000.00
3.4. Consumables																										
Water Treatment / Chemicals	$/year	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
Total Variable O&M	$/year	735,437	735,437	815,437	735,437	965,437	815,437	735,437	5,657,172	4,282,609	4,432,609	735,437	815,437	735,437	735,437	11,249,757	9,485,194	9,485,194	815,437	735,437	965,437	815,437	735,437	5,657,172	4,282,609	4,432,609
4. Total O&M																										
Total O&M (excluding fuel costs)	$/year	$4,631,937	$4,631,937	$4,711,937	$4,631,937	$4,861,937	$4,711,937	$4,631,937	$9,553,672	$8,179,109	$8,329,109	$4,631,937	$4,711,937	$4,631,937	$4,631,937	$15,146,257	$13,381,694	13,381,694	$4,711,937	$4,631,937	$4,861,937	$4,711,937	$4,631,937	$9,553,672	$8,179,109	$8,329,109

LB:JVR