

1 Q. Please provide a list of the major equipment, systems, and facilities expected to have a  
2 primary bearing on the responses to PUB-NLH-048 through PUB-NLH-050 and briefly  
3 describe any conditions or concerns known or reasonably suspected to affect them.

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6 A. The major equipment, systems, and facilities expected to have a primary bearing on  
7 Newfoundland and Labrador Hydro's ("Hydro") responses to PUB-NLH-048 through PUB-  
8 NLH-050 can be separated into the assets that impact the short-term extended operation  
9 (to 2023), as detailed in Hydro's response to PUB-NLH-048 part a, and the assets that  
10 impact medium-term extended operation to 2027, as detailed in PUB-NLH-051, Attachment  
11 1. Standby operation beyond 2021 would be impacted by the same assets. Table 1 and  
12 Table 2 summarize this information. Table 1 identifies the assets and systems that impact  
13 short-term operation. Table 2 identifies the assets and systems that impact medium-term  
14 operation, which are additional to the short-term assets and systems. Attachment 1 lists  
15 estimated cost and timing for all activities listed in Tables 1 and 2.

**Table 1: Assets or Systems that Impact Short-Term Extended Operation**

<b>Asset/System</b>	<b>Comments</b>
Heavy Fuel Oil Storage Tanks	Storage tanks require regular costly internal inspections (approximately \$4 million per inspection). Currently Tank 1 and Tank 2 are certified to the end of December 2021. Tank 3 is certified through June 2023, and Tank 4 is certified through November of 2020. Hydro is currently exploring the possibility of extending the certifications to 2023 or beyond for all 4 tanks with an API contractor and Government.
Steam Turbines	Steam turbines require regular overhauls on the valves and on the entire machine to ensure safe and reliable operation. The frequency for valves is 3 years and the frequency for major inspection of the full machine is 9 years.
Generators	Generators require regular overhauls to ensure safe and reliable operation. The frequency for generator overhauls is 6 years.
Major Pumps	The major pumps include the boiler feed pumps, condensate extraction pumps, condenser cooling water pumps, and vacuum pumps. There are two of each type of pump on each unit for a total of 24 major pumps. Overhaul frequencies are every 6 years for the boiler feed pumps and 12 years for the other major pumps.
Boilers and High Energy Piping	The boilers and high-energy piping consist of pressure retaining components, many of which operate at high temperatures. Regular assessment and upgrade of these components is essential to ensure safe reliable operation. Based on the plan to cease steam generation on March 31, 2021, the final boiler and high energy piping condition assessment project is being executed in 2019. For each extended year of operation, an additional condition assessment project would be required.
Exhaust Stacks	To ensure that the exhaust stacks remain in a safe condition to remain standing, a 3-year inspection and overhaul frequency is being maintained. The previous cycle was completed in 2018 with the next scheduled for 2021. This interval will be required to continue until the stacks are demolished, even if they are taken out of service. An inspection in 2024 would be required unless the stacks are demolished prior to that date.
Land Fill	The current on-site land fill is approximately 90% full, but considered adequate for operation until March 31, 2021. Extended operation beyond this date will require an extension to the existing landfill (vertical), an additional on-site land fill, or another means to process and dispose of waste that includes boiler ash and filter cake from the wastewater treatment plant.

**Table 2: Assets or Systems that Impact Medium-Term (Beyond March 31, 2023) Extended Operation (additional to those listed in Table 1 for Short-Term Extended Operation)**

<b>Asset/System</b>	<b>Comments</b>
Controls Systems	For reliable operation beyond 2023, some controls systems will require upgrade. This includes the Distributed Control System, Turbine Governor Mark V System, and the boiler sootblower controls.
Unit 1 and Unit 2 Generators	For reliable continued operation of Unit 1 and Unit 2, a stator rewind should be completed.
Stack Breeching	For all 3 units to maintain reliable operation, upgrades will be required to the stack breeching system, which is the ducting that carries boiler exhaust gas to the stacks.
Forced Draft Fans	For continued reliable operation, an upgrade of the forced draft fan journal bearings should be considered.
High Pressure Heater Valves	For continued reliable operation, replacement of the inlet, outlet, and bypass valves should be completed.
Fuel Oil Pumping and Heating Sets	For continued reliable operation, upgrade of one fuel oil pump and replacement of 1 fuel oil heater on each unit should be considered.
Condensers and Condenser Cooling Water System	For continued reliable operation, the tubesheets and waterboxes should be upgraded on each unit. The condenser discharge piping should be upgraded on Unit 3. The Unit 3 general service cooling water coolers should be upgraded. The pumphouse discharge piping on Unit 2 and Unit 3 should be upgraded. General service cooling water cooler filtration should be upgraded.
Stage 1 Cooling Water Pumphouse	The Stage 1 pumphouse will require some upgrades to maintain reliable operation.
Boiler Stop Valves	For continued reliable operation of Unit 1, particularly if standby operation is required, replacement of the boiler stop valve should be considered.
Fuel Oil Storage Day Tank	An internal inspection of the day tank would be required in 2023 based on 10-year interval from previous internal inspection in 2013.
Turbine Vibration Monitoring System	For continued operation of the 3 turbines, the vibration monitoring system should be upgraded



HTGS Operation Beyond 2021

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 HTGS Operation Beyond 2021

**HTGS Capital Plan 2019 through 2026**

Option A = End of Steam March 31, 2021

Option B = End of Steam March 31, 2027

Consideration	Description	Estimated Costs															
		2019		2020		2021		2022		2023		2024		2025		2026	
		Option A	Option B	Option A	Option B	Option A	Option B	Option A	Option B	Option A	Option B	Option A	Option B	Option A	Option B	Option A	Option B
Turbine Overhauls	U2 Valves				3,300												3,600
	U1 Major Turbine O/H and Generator Upgrades - Slip Rings, Brush Gear, Bearings, upgrade lube oil & seal oil systems, replace steam inlet nozzles					6,800											
	U3 Valves	3,290	3,290				3,400										
	U2 Major Turbine O/H and Generator Upgrades - Slip Rings, Brush Gear, Bearings, upgrade lube oil & seal oil systems, replace steam inlet nozzles							7,000									
	U1 Valves										3,500						
	U3 Major Turbine O/H													7,200			
Condensers	Upgrade waterboxes, tube sheets all three units					250		250									
	Upgrade discharge piping Stage 2					100											
	Upgrade GSCW Coolers Stage 2							200									
	Upgrade pumphouse discharge piping units 2 and 3					75		75									
Generator Overhauls	U2 (including installing a rotor flux probe)				1,250												1,400
	U3							1,300									
	U1 (including installing a rotor flux probe)											1,350					
Pump Overhauls	U3 BFPW		350													350	
	U3 Vac Pump South																
	U3 BFPE				350												
	U1 BFPE					350											
	U1 CWPW							200									
	U2 CWPW												200				
	U3 CWPE																
	U1 CEPN																
	U2 CEPS																
	U1 Vac Pump North																
	U1 BFPW																
	U2 BFPE																
	U2 BFPW																
Boilers	Replace Unit 1 Boiler Stop Valve																
	Extend condition assessment / remedial upgrades program through 2025	1,842	1,842			3,000		3,000				3,000				3,000	3,000





HTGS Operation Beyond 2021

4/5/2019  
HTGS Operation Beyond 2021

**NOTES**

- 1) The provided capital plan considers what would be required to keep HTGS running with the reliability as recently experienced and fully available through 2026 given the currently information available. This plan contains very rough estimates given the time frame allotted.
- 2) The following was used to develop the plan:
  - an unbiased perspective was maintained in the exercise to develop a fair assessment.
  - the existing 20 year capital plan (end of steam in March 2021) for non-generation, balance of plant equipment was included.
  - the existing 20 year capital for sync condensing assets was considered and projects duplicated for Unit 1 and 2, as appropriate.
  - pre-existing schedules for overhauls were extended on turbines, generators, major pumps, boiler and high energy piping condition assessments.
  - a brainstorming session was held with Plant Manager, Work Execution Manager, Operations Manager, HTGS Electrical and Mechanical Engineers. The asset registry was reviewed as a guide for the discussion.
  - estimates were primarily very high level, order of magnitude costs, based on what is believed to be a reasonable estimate for the work.
  - in some cases, where available - primarily for overhauls, estimates were based on previous completed projects having similar scope.
- 3) Since instating the enhanced boiler ITP in 2010, Hydro has been monitoring the thickness of tubing and the integrity of welded connections and as such, completing repairs and applying for capital investment or purchasing critical spare materials (i.e. boiler tubing). In 2012, the plant engaged AMEC to establish an EPRI Level 2 condition assessment program focusing on boiler internal components such as headers, tubing and welded connections using advanced non-destructive testing methods in addition to the annual ITP. Included in AMEC's Level 2 condition assessment program was the expansion of inspection and monitoring of boiler internal piping, high energy piping (main steam, hot reheat, cold reheat and high pressure feedwater piping) and high energy piping hanger support systems. Since 2012, Hydro has completed all of these ITP activities based on the AMEC and EPRI (Electrical Power Research Institute) guidelines through its sustaining capital program. Through the ITP combined with annual boiler maintenance, the plant has been able to monitor, assess and repair any immediate concerns with boiler related equipment and also establish appropriate inspection intervals to monitor conditions. With continued regular boiler maintenance and the condition assessment capital program Hydro is confident that any issues requiring attention will be identified within a suitable time to apply for capital funding if required. Also, Hydro has increased its inventory of critical spare boiler pressure parts so that any related forced outages can be repaired within a two week (or less) timeframe.
- 4) Option A is the current capital plan for HRD - based on steam generation ending 2021. It is meant for comparison with the Option B to continue generation operations at HRD beyond 2021.
- 5) Operation past 2027 will be dependent on the results of further condition assessments.