



THE JAMAICA PUBLIC SERVICE COMPANY LIMITED

EXTRAORDINARY RATE REVIEW

SUBMISSION FOR 2022

May 10, 2022

Glossary

BOP	-	Balance of Plant
GT10	-	Gas Turbine No 10
HESS	-	Hybrid Energy Storage System
HGPI	-	Hot Gas Path Inspection
JPS/Licensee	-	Jamaica Public Service Company Limited
KVA	-	Kilovolt-Ampere
KWh	-	Kilowatt-hours
Licence	-	The Electricity Licence, 2016
MSET	-	Ministry of Science Energy and Technology
MVA	-	Mega Volt Amperes
MW	-	Megawatt
MWh	-	Megawatt-hours
O&M	-	Operating and Maintenance
OEM	-	Original Equipment Manufacturer
Office/OUR	-	Office of Utilities Regulation
T&D	-	Transmission & Distribution
TL	-	Technical Losses
USD	-	United States Dollar

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1. Request for Extraordinary Rate Review

1.1 Overview

This submission is made pursuant to Paragraph 59 to 61 of Schedule 3 of the Electricity Licence, 2016, which gives JPS the authority to request the OUR to conduct an Extra-ordinary Rate Review under exceptional circumstances which have significant impact on the Licensee and which were not factored in the previous five-year Rate Review.

59. “The Licensee or the Minister may request the Office to conduct an extra-ordinary Rate Review owing to exceptional circumstances that have a significant impact on the electricity sector and/or the Licensee, but were not factors considered or known when the Rate Review was undertaken. The Office is empowered, to review the rates for this purpose outside of the five yearly Rate Review periods. “

60. For the avoidance of doubt, the Extraordinary Rate Review shall not result in a rescheduling of the time period for the next stipulated Rate Review.

61. Where possible, the scope of such extraordinary Rate Review will be limited to the impact of the exceptional circumstances and therefore the review process is expected to be completed within a 60-day period, unless the Office and the Licensee agree otherwise.

In a letter to the OUR dated November 30, 2020 and in a subsequent meeting on December 21, 2020, JPS outlined the need for additional capital projects in 2021 to preserve Corporate Area Power Quality. Based on the OUR’s request and JPS’ commitment, documentation to support the proposal for the Corporate Area Capacitor Bank Project and the Gas Turbine No 10 (GT10) Hot Gas Path Inspection (HGPI) 2021 were submitted. Consequent upon the retirement of the Hunt’s Bay B6 Unit and the anticipated impact on load centres in the Corporate Area, as well as the increased operation of GT10, JPS requested the OUR’s approval of the two aforementioned project solutions for reactive support, and for maintaining grid stability. The cost of the said projects are outlined below:

- The Capacitor Bank project valued at US\$1.3M for 2021 is the most cost effective approach to maintaining energy security in the corporate area given the criteria of: supply and demand requirement; grid stability, voltage stability; production cost; Operation and Maintenance (O&M) and Capital Investment requirements.
- The GT10 HGPI, which involves the rehabilitation and replacement of critical components, is valued at US\$2.43M. The expected benefits of the project include mitigating load shedding in the corporate area; avoiding unserved energy of 20,000 MWh per year; and maintaining voltage quality and grid stability.

On December 22, 2020, JPS submitted to the OUR, a project proposal document entitled, “Corporate Area Bulk Capacitor Bank & Hunts Bay GT10 Hot Gas Path Inspection 2021” requesting the OUR’s approval of required capital investments to implement the abovementioned projects. The project proposal was subsequently reviewed by the OUR and a recommendation made by the Office, that a ‘no objection’ be given to JPS for the implementation of these projects subject to five matters being addressed by the JPS; namely:

1. JPS submitting to the OUR a planned maintenance programme for the existing bulk capacitor banks in the system, and the proposed capacitor banks.
2. JPS providing the OUR a rationale for not considering installing new capacitor banks at Lyssons substation.
3. Submitting Technical Standards to which the equipment and construction will be carried out. The provision of the Technical Standards is required by the Electricity Sector Codes.
4. JPS providing the OUR with the scheduled completion and commissioning date of the proposed old Harbour to Hunts Bay 138 kV transmission line, including latest project status.
5. JPS submitting the condition evaluation of GT 10 under the JPS Asset Health Index (AHI) for generating asset. This is to allow the OUR to ascertain the condition of GT 10 prior to the HGP inspection work on the unit.

Appendix A provides the responses to these matters raised by the OUR.

OUR’s approval of the abovementioned projects was subsequently received via letter dated June 29, 2021, on the basis of the technical scope and costs as set out by JPS in its proposal.

JPS recognizes that the Licence provisions for “exceptional” circumstances, as outlined above, justifies the OUR’s consideration of an Extraordinary Rate Review as these changes, which have a significant impact on JPS both from a revenue and cost perspective were not factored into the 2019 – 2024 Rate Review. As a result, and in keeping with discussions and formal submission to the OUR, the JPS is requesting, as a matter of urgency, the approval of an additional capital investment outlay of US\$3.3M to undertake these two projects. This request stemmed from the retirement of the Hunt’s Bay B6 unit in December 2020 that has resulted in grid security issues and load balance concerns. Further, in accordance with the above-mentioned GT10 HGPI and Capacitor Bank projects, JPS is requesting an adjustment of \$US1.03M to the revenue requirement for 2022 approved by the OUR in the Final Determination. Additionally, JPS is seeking the approval of, and alignment on cost recovery for additional capital expenditure needed to maintain existing generating units (Rockfort unit#1, Rockfort unit #2, Hunts Bay GT5, Bogue GT3, Bogue GT6 and GT11) until the new 171.5MW replacement generation capacity enters service. The accelerated approval of \$US10.96M is being requested to expedite critical maintenance activities needed to extend the life of several units beyond 2023. This includes expenditure of \$US4.66M in 2023 and \$US6.29M in 2024. JPS does not

request an incremental change to the revenue requirement to facilitate the Rockfort and Gas Turbine projects at this time.

Instead, their addition to the revenue requirement will be submitted at the next annual rate review. Details outlined in Section 3 substantiates the rationale for this additional expenditure. The company is also seeking the approval of the North East Coast Voltage Upgrade project, which was submitted in JPS' 2021 Annual Filing.

2. Project Summary

2.1 Capacitor Bank

The Corporate Area of Jamaica (substations east of Duhaney) is the largest load center in Jamaica accounting for approximately 50% of the total real and reactive demand of the country. The weekday day peak typically has the largest corporate area real power import and reactive demand, thus, making this period vulnerable to N-1 violations and voltage instability. These vulnerabilities to voltage violations and voltage instability have been compounded due to the decommissioning of Hunt's Bay B6 (68.5MW) at the end of 2020. Therefore, there is an immediate need for additional VARs in the corporate area to support bus voltages and maintain grid security. To fill this need, JPS commissioned a Grid Study on September 8, 2020 in which a weekday day peak scenario involved Hunt's Bay B6 being off-line. In addition, 2022 and 2023 forecasted day peaks were studied to determine the optimal capacitor bank solution set.

To provide reactive support to the Corporate Area in light of the decommissioning of Hunt's Bay B6 at the end of 2020, a total installed capacity of 40 MVAR of capacitor banks is required by the year 2021. The 40 MVAR capacity will consist of 30 MVAR of new capacitor banks and the restoration of 10 MVAR of existing capacitor banks at the substation medium voltage level.

Siting for New Capacitor Banks

The project will see the installation of 13.8 kV Busbars at Three Miles T1 and Hunt's Bay T3 as well as 24 kV Busbars at the following substations in the Corporate Area:

- Greenwich Road T2
- Hope T1
- Rockfort T1
- Washington Boulevard T1
- Constant Spring T1
- Washington Boulevard T2

The implementation of the 40 MVAR capacitor bank solution will, for all Corporate Area busbars, improve steady state bus voltages, improve voltage stability and remove N-1 voltage violations in accordance with the planning criteria (includes busbars at Good Year and Lyssons). It will also eliminate the need for the VAR dispatch of the Hybrid Energy Storage System (HESS) and reduces the dispatch of Hunt's Bay GTs 5 & 10 for voltage support, thus reducing the cost of fuel and improving the overall efficiency of the generating fleet. In addition, it will reduce overall transmission technical losses by 0.014% after project implementation. Recommended locations for new and existing MVAR solutions are outlined in Table 1.

Table 1: Summary of Recommendations for Corporate Area Capacitor Bank Solution

Category	Total MVAR	Location
New	30	Greenwich Road T2, Hope T1, Hunt’s Bay T3, Rockfort T1, Three Miles T1, Washington Boulevard T2
Existing	10	Constant Spring T1, Washington Boulevard T1
Total	40	

Details pertaining to the planning criteria and assumptions as well as study cases are presented in the Grid Study in Appendix B.

2.1.1 Revenue Requirement

The changes that have occurred in the domestic and international context since the five-year Rate Review make it necessary to develop new investment projects not contemplated in Revenue Requirement outlined in the Final Determination. The description and justification of the projects are outlined in the ensuing sections of this Extraordinary Rate Review, where JPS presents estimation of the economic impact of these investments and the tariff adjustment necessary to ensure revenue recovery of said investments.

The 2022 incremental revenue requirement for the Capacitor Bank project is \$US206 as outlined in the table below:

Table 2: Incremental Revenue Requirement

Project Name	2021	2022
Capacitor Banks		
Depreciation	-	54
Return on Investment	2	118
Tax	1	35
Incremental Revenue requirement	3	206
GT10 Hot Path		
Depreciation		667
Return on Investment	42	122
Tax	12	36
Incremental Revenue requirement	54	825
Totals		
Depreciation	-	720
Return on Investment	44	240
Tax	13	71
Incremental Revenue requirement	57	1,031

2.1.2 Tariff Impact

The OUR's review of the projects' tariff impact did not identify that the overall tariff impacts as determined by JPS is reflective of the operational dispatch benefits outlined in the cost benefit assessments, given the operational costs reduction proposed by JPS. The OUR, however, takes the view that since fuel dispatch cost is a "pass through" to customers any benefits in this regard should be passed on to the customers through the fuel cost adjustment (FCAM).

The OUR concurs with JPS project non-fuel tariff impact assessment of US cents 0.00146 /kWh increase. The OUR has computed based on JPS' dispatch cost savings of US\$749,490 per annum a fuel tariff impact reduction of US cents 0.024 /kWh.

Outlined in Table 3 below is the average tariff impact from the incremental revenue requirement of the Capacitor Bank project for 2022:

Table 3: Average Tariff Impact

Project Name	2021	2022
Energy Sold (GWh)		3,067
Capacitor Banks		
Incremental Revenue requirement	3	206
Average tariff impact (JMD/kWh)		0.0104
GT10 Hot Path		
Incremental Revenue requirement	54	825
Average tariff impact (JMD/kWh)		0.0417
Total		
Incremental Revenue requirement	57	1,031
Average tariff impact (JMD/kWh)		0.0521

2.2 GT10 Hot Gas Path Inspection (HGPI) 2021

The Original Equipment Manufacturer (OEM) guidelines recommend that a HGPI be conducted after 1,200 equivalent fired starts. This recommendation comes against the background that thermal stresses, fatigue and corrosion during operation contributes to the overall degradation of Hot Gas Path and combustion components over time. GT10 has surpassed the number of recommended starts as at the end of October 2020 with 1,287 equivalent starts since the last HGPI completed in 2017. Correspondingly, there were 1543 equivalent Starts as at December 31, 2021.

Arising from the retirement of the Hunt's Bay B6 on December 31, 2020, there is a need to increase the reliability and availability of GT10 for security dispatch and voltage support in the corporate area. At this point, the unit will be at high risk of failure due to material degradation from excessive thermal stress. It is therefore important for JPS to conduct the HGPI at the earliest opportune time in order to ensure its reliability matches its increased demand.

This unit is a part of the existing 171.5MW which was slated for implementation of new generating capacity in 2023 as per the present Minister's retirement schedule. However, the plan to install new generating capacity in 2023 will not be realized as originally planned especially having regard to when the exercise of the right to replace the capacity was confirmed by the Minister. As such, this investment will ensure the capability of the unit to continue providing services beyond its scheduled retirement date.

The goal of this project is to perform HGPI on the 32.5MW Hunt's Bay Gas Turbine No.10 (GT10) peaking unit. This involves the rehabilitation and replacement of critical components, not limited to the following:

- Combustion and Hot Gas Components
- Servicing of the obsolete Mark V Controls system
- Load Gear box and accessory gear box
- Exhaust stack
- Unit Generator
- Balance of Plant (BOP) and auxiliary systems
- Accessory Drive Coupling

The execution of GT10 HGPI will significantly reduce the risk of a forced outage on the unit attributed to failed hot gas components. JPS assures that undertaking this inspection will significantly improve the reliability of the unit, thereby achieving grid security and production goal targets. The operation and maintenance cost is expected to remain relatively constant between 2022 and 2024 at \$161,000 if the HGPI is done.

2.2.1 Revenue Requirement

See Table 2 for the 2022 incremental revenue requirement for the GT10 HGPI.

2.2.2 Tariff Impact

JPS submitted the cost benefit assessment, which included the operational benefits to be realized under the project. However, the OUR outlined that that these benefits did not account for the tariff impact. The OUR stated further that it was satisfied that the overall non fuel tariff impact, as determined by JPS, is reflective of the investment costs. The expectation is that changes in the dispatch costs will be a pass through to the customers based on the prescribed fuel cost adjustment mechanism (FCAM) in place.

Further, the OUR concurs with JPS' project non-fuel tariff impact assessment of US cents 0.00146 /kWh increase. The OUR has computed based on JPS' dispatch cost savings of US\$749,490 per annum, a fuel tariff impact reduction of US cents 0.024 /kWh.

JPS notes the comments of the OUR in relation to the tariff impact where the Regulator states in the document entitled, 'Evaluation of JPS' Projects Proposal: Corporate Area Bulk Capacitor Bank & Hunts Bay GT10 Hot Gas Path Inspection 2021':

The OUR notes that JPS did not compute the tariff impact of the dispatch savings accruing to the project. The OUR has observed that the overall tariff impact as determined by JPS is not reflective of the operational benefits outlined in their cost benefit assessments, given the operational costs reduction proposed by JPS. The OUR is satisfied that the non-fuel tariff impact increase of US cents 0.032/kWh is the non-fuel tariff based on the investment costs proposed. The OUR expectations are that changes in the dispatch costs will be a pass through to the customers according to the tariff fuel cost adjustment mechanism (FCAM).

Table 3 shows the 2022 Average Tariff Impact from the incremental revenue requirement of the GT10 HGPI project for 2022.

3. ROCKFORT AND GAS TURBINES

3.1 JPS' Request

JPS is seeking the approval of and alignment on cost recovery for additional capital expenditure needed to maintain existing generating units until the new 171.5MW replacement generation capacity enters service. These units form a part of the set to be retired under the 171.5MW as provided for in the Minister's retirement schedule.

1. Approval for **US\$12.98M** in Additional Capex to:
 - a) Carry out those additional maintenance activities (projects) which will be done before July 2024. Considering the long lead times of many components, JPS must start the procurement process long before the project commences. **[US\$10.96M]**
 - i. Expedited approval is being requested for Rockfort unit#1 major overhaul, which is due in January, 2023.
 - b) Procure additional critical capital spares in line with the life extension of the identified units. **[US\$2.02M]**
2. Agreement on Cost Recovery for Additional Capex
 - a) For those projects occurring in 2023, JPS will submit an Extra-Ordinary Rate filing in 2023 to request an adjustment to tariffs to allow the recovery of costs.
 - b) For those projects occurring in 2024 (before July), JPS will include the associated costs in its 5yr Rate filing for 2024 to 2028.

It should be noted that the total amount of US\$12.98M above includes an offset of US\$2.70M obtained from shifting the already approved GT11 maintenance activity for 2023 to 2026. In other words, the total amount required is US\$15.68M, however, US\$2.70M was already approved for GT11. As such, only US\$12.98M additional capex is required.

3.1.1 Context

The 2019 Minister's Schedule mandated that 171.5MW of existing generation be replaced with new capacity by 2023. However, the requisite Letter of Notification (LON) from the Ministry of Science, Energy, and Technology authorizing the commencement of the process was only issued on February 3, 2022.

Based on the date of the issuance of the LON and the requisite schedule for the various stages of the replacement project – permitting, financial close, construction and commissioning – JPS projects commercial operation date (COD) of the new capacity in Q1 2026. To maintain system generation capacity with adequate reserve to serve customer demand reliably, the retirement of the existing generating units must be delayed to match and overlap the projected COD of the replacement capacity. To do otherwise would lead to generation shortage and demand curtailment.

This therefore requires that the existing units operate beyond the current 2023 retirement date of the Minister’s Schedule, to 2026 when the replacement plant/s are projected to be commissioned into service.

3.1.2 Additional Maintenance Activities

Considering the need for the units to operate reliably until the new 171.5MW plant becomes operational in 2026, additional maintenance activities will be needed to extend the lives of several units beyond 2023. The proposed activities are based on experience operating the units, OEM recommendations, and results of inspections.

While Bogue GT11 is not a part of the 171.5MW ROFR tranche, JPS is proposing to shift the already approved 2023 maintenance activity to 2026. This shift will minimize the tariff impact of the proposed additional maintenance activities needed to secure the system.

Table 4: Additional Maintenance Activities to Extend Asset Lives

Maintenance Activities	2023	2024	2025	2026
Rockfort MOH - RF1	MOH		MOH	
Rockfort MOH - RF2		MOH		
Hunts Bay GT5		HGPI		
Hunts Bay GT10				
Bogue GT3	HGPI			
Bogue GT6	GGOH			
Bogue GT7				
Bogue GT9				
Bogue GT11	HSI-CCR*			HSI-CCR
Key				
MOH - Major Overhaul				
HGPI - Hot Gas Path Inspection				
GGOG - Gas Generator Overhaul				
HSI-CCR - Hot Section Inspection and Combustion Components Rehabilitation				
* Bogue GT11 HSI-CCR in 2023 is already approved. The proposal is for this activity to be delayed to 2026 as the running hours of the unit is behind expectation.				

Details behind timing and need for each maintenance activity is provided below:

- **Rockfort units** – OEM specified a 12 month MOH interval, however, JPS has been able to successfully extend the interval to 24 months for several years now.
- **Hunts Bay GT5** – The HGPI interval on this unit is 1,200 equivalent fired starts. At the end of 2022, this unit is expected to reach 1,370 starts since the last Hot Gas Path Inspection done in 2017.

- **Bogue GT3** – The last HGPI was done in September 2015. Currently, the unit is less than 100 starts to the recommended HGPI interval of 1200 starts. Considering that the projected number of starts for 2022 is 150, a HGPI will be due in 2023. Additionally, cracks were observed on the trailing edge of 3rd stage buckets during the last borescope inspection in November, 2021.
- **Bogue GT6** – The gas generator (GG) is presently operating with an internal lube oil leak. Consequently, 1) the unit has been derated from 14 MW to 10MW and 2) the unit is the last on, first off for dispatch. The GG was last replaced in June 2015. At 1650 fired hours the engine is not close to the recommended maintenance interval of 4000 fired hours, however, the leak is expected to worsen and render the unit unavailable.
- **Bogue GT11** - The Turbine Hot Section Inspection and Combustion components rehabilitation maintenance interval (as per OEM recommendation) is 25,000 to 30,000 fired hours. The unit is currently at 14,000 fired hours. Considering an expected capacity factor of less than 5% annually, the unit will not reach the recommended maintenance interval in 2023 as originally expected.

3.1.3 Capital Expenditure for Additional Maintenance Activities

The proposed maintenance activities needed to extend the life of the units identified will require additional capex. Some of the activities will occur before the next 5-year rate review tariffs are implemented in July 2024. Those activities taking place after July 2024 will be included in JPS' 2024-28 rate filing and are not included in the table below.

The additional capex being requested for maintenance activities is US\$4.66M in 2023 and US\$6.30M in 2024. The two activities in 2024 (RF2 MOH and GT5 HGPI) will both occur before July 2024 and will require some spend in 2023.

Table 5: Additional Capex for Maintenance Activities

Additional Capex for Maintenance Activities (USD'000)				
Maintenance Activities	2023	2024	2025	2026 Total
Rockfort MOH - RF1	3,363			3,363
Rockfort MOH - RF2	150	4,028		4,178
Hunts Bay GT5	300	2,270		2,570
Hunts Bay GT10	-			-
Bogue GT3	2,050			2,050
Bogue GT6	1,500			1,500
Bogue GT7				-
Bogue GT9				-
Bogue GT11	(2,700)			(2,700)
Total	4,663	6,298	-	10,962

NB: This table only includes amounts for those activities that will take place before July, 2024.

3.1.4 Capital Expenditure for Additional Critical Capital Spares

In addition to capex to carry out the proposed maintenance activities, funds will be needed to procure critical capital spares. The amounts stated were derived from historical levels for different parts, anticipated needs, and recent pricing and inflation information. The additional capex being requested for critical capital spares is US\$1.02M in 2023 and US\$0.99M in 2024.

Table 6: Additional Capex for Critical Capital Spares

Additional Capex for Critical Capital Spares (USD'000)					
Maintenance Activities	2023	2024	2025	2026	Total
Rockfort MOH - RF1	367	261			628
Rockfort MOH - RF2	239	351			590
Hunts Bay GT5	106	46			152
Hunts Bay GT10	310	45			355
Bogue GT3		50			50
Bogue GT6		80			80
Bogue GT7		80			80
Bogue GT9		80			80
Bogue GT11		-			-
Total	1,022	993	-	-	2,015

NB: This table only includes additional amounts for spares that need to be procured before July 2024.

3.1.5 System Generation Capacity and Reserve Margin Projection

The figure below shows the existing and projected total firm generation capacity of the system if the additional capex is not approved and the units become unavailable due to failure and lack of critical spare parts. The unavailability of 171.5MW of existing JPS generation will lower the system reserve margin to only 3% in 2024, much below the minimum of 20% (as per 2018 IRP).

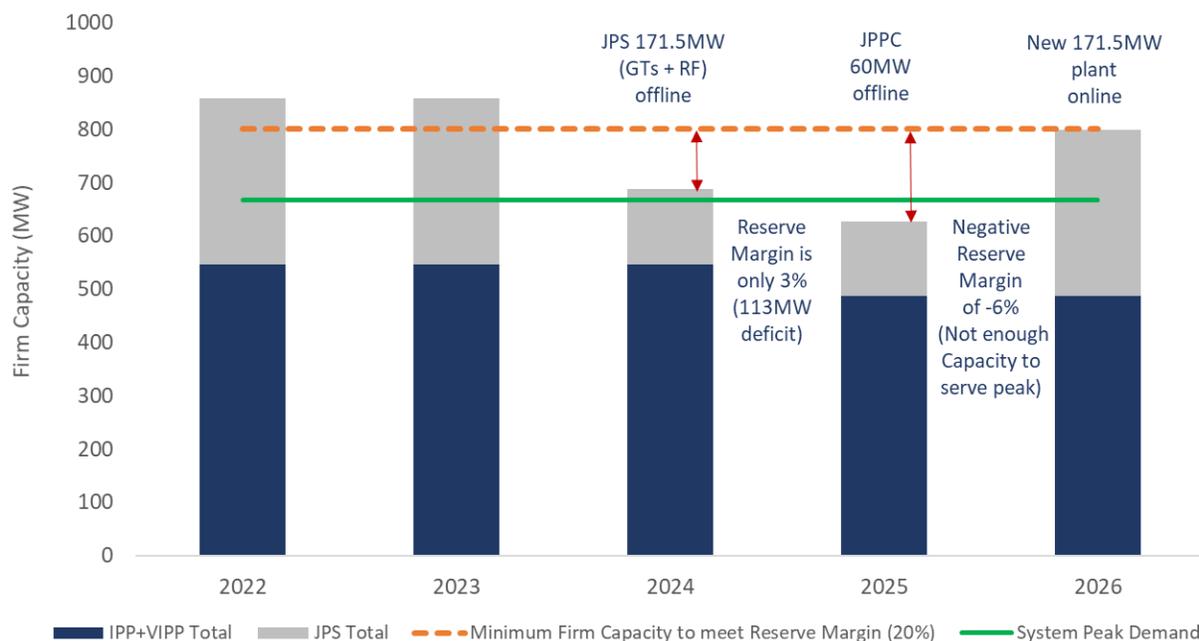
At the start of 2025, the problem will be worsened by the termination of the Jamaica Private Power Company Limited power purchase agreement at the end of 2024. The system reserve margin will then move from 3% to -6%. The negative reserve margin means the installed firm capacity will not be enough to serve the peak demand. The peak demand used in the assessment is 667MW, however, the peak demand over the period can increase which would exacerbate the issue.

A violation of the minimum reserve margin would significantly limit the approval and execution of maintenance outages on all generation plants. This can ultimately lead to the critical failure of plant equipment and subsequent reduction of the individual generating plant asset health indices; an increase in forced outages, and a potential increase in load shedding activities and customer reliability indices. Additionally, a lack of availability of some generating units, based on their

location on the grid, could lead to significant changes in transmission flows and create congestion issues along with contingency violations.

The projection and the consequences mentioned above underscore the need to have the 171.5MW of existing generating capacity in a reliable state until they are replaced. As an island, Jamaica does not have the option of importing power from neighbours to resolve generation capacity shortfalls.

Figure 1: Additional Capex for Critical Capital Spares



NB: The peak demand in each year is kept constant at 667MW. It is possible that the peak demand will increase which would exacerbate the issue (minimum reserve capacity violation).

The Business Cases in Appendix C provides the justification and scope of these projects.

4. Appendices

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