FAIR TRADING COMMISSION

DECISION

The Barbados Light & Power Company Limited Application to Recover the Costs of the 5MW Energy Storage Device through the Fuel Clause Adjustment

Document No.: FTCUR/DECESD/BL&P-2018-02 **Date of Issue: April 13, 2018**

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SECTION 1 EXECUTIVE SUMMARY

On July 11, 2017, the Barbados Light & Power Company Limited (BL&P) applied to the Fair Trading Commission (Commission) under Section 16 of the Utilities Regulation Act, CAP.282 (URA) of the Laws of Barbados for approval of:

(i) Recovery of the costs associated with the commissioning of a 5MW Energy Storage Device (ESD) in proportion to the fuel savings benefits it delivers; and

(ii) The recovery of the cost of the ESD through the Fuel Clause Adjustment (FCA).

The initial Application did not meet legislative requirements and the BL&P duly submitted an amended Application on August 4, 2017; Procedural Directions were issued by the Commission on September 4, 2017. The Commission received submissions from six (6) intervenors within the timelines provided for by the Commission, as detailed in this document. The Commission duly conducted its analysis and held a written hearing as provided for under Section 15(4) of the URA and Rule 37(1) and 37(2) of the Utilities Regulation (Procedural) Rules (URPR), 2003. The Commission also served on the Applicant additional interrogatories with respect to the assignment of heat rate targets in order to assess the efficiency of the BL&P's generation systems; these and the associated responses were also shared with the intervenors. The intervenors had the opportunity to respond; one responded.

In summary, the major issues which were raised and considered by the Commission were:

(i) The prudence of the BL&P being allowed to recover the cost of the ESD;
(ii) The most appropriate mode of recovery of the ESD's cost, whether by FCA or rate base;
(iii) Efficiency as defined by heat rate performance;
(iv) Assessment of the appropriateness of the proposed 95%/5% ratio sharing of savings benefits generated by the ESD between the utility and the customers[1,2]; and

[1] Barbados Chamber of Commerce & Industry (BCCI), Affidavit: *Affidavit of James Reid*, October 13, 2017, 1 (7).
[2] Barbados Renewable Energy Association (BREA), Affidavit: *Affidavit of Aidan Rogers*, October 9, 2017, 5 (19).

(v) Assessment of the appropriateness of the Weighted Average Cost of Capital (WACC).

After a detailed analysis of the BL&P's Application, the submissions of intervenors and the Commission's own research, the Commission has determined the following:

(i) The cost of the ESD is prudently incurred and thus the BL&P shall be allowed to recover said cost;

(ii) The FCA is an acceptable mechanism at this time to recover the cost of the ESD;

(iii) Recovery of the ESD's costs is approved for a period of three (3) years, commencing from September 1, 2018. Six (6) months prior to the expiration date, a review shall be conducted to assess the continued appropriateness and applicability of the recovery mechanism.

The BL&P shall pursue a heat rate maintenance/improvement programme based on the following heat rate targets for each plant type and the individual unit in the case of the gas turbines:

- **Steam Plant - 15,370.20 BTU/kWh**
- **Low Speed Diesel (LSD) 1 - 9,067.28 BTU/kWh**
- **Low Speed Diesel (LSD) 2 - 7,980.52 BTU/kWh**
- **Gas Turbines (GT#)**
  - **GT01 - 17,514.40 BTU/kWh**
  - **GT02 - 15,209.60 BTU/kWh**
  - **GT03 - 14,070.30 BTU/kWh**
  - **GT04 - 13,007.80 BTU/kWh**
  - **GT05 - 12,872.50 BTU/kWh**
  - **GT06 - 12,861.30 BTU/kWh**

The heat rate targets shall be reviewed and amended annually or from time to time, as is warranted. The results of heat rate tests of plant/unit performance shall be signed by senior management of the BL&P or contracting party performing the tests, prior to its submission to the Commission. In the event that the BL&P's operations are impacted by

perceived force majeure conditions, it shall be eligible to apply to the Commission for exemptions. Such submissions shall detail the nature and cause of the event, resolution plan and future mitigation.

(iv) All financial inputs of the FCA related to the recovery of ESD costs shall be audited by a representative of the Commission to ensure its value is correctly determined;

(v) The formula for the determination of the FCA in February shall now be:

$$FCA_{feb} = \frac{\sum_i (Fuel\ Cost_{n-1} . \frac{THR^i_{n-1}}{AHR^i_{n-1}}) + Purchased\ Power_{n-1} + ESD\ Recovery_{yt}}{Energy\ Generation_{n-1} . (1 - Aux_{n-1}) . (1 - losses)} [BD\$/kWh]$$

(vi) The formula for the determination of the FCA for all months excluding February shall now be:

$$FCA_n = \frac{\sum_i (Fuel\ Cost_{n-1} . \frac{THR^i_{n-1}}{AHR^i_{n-1}}) + Purchased\ Power_{n-1}}{Energy\ Generation_{n-1} . (1 - Aux_{n-1}) . (1 - losses)} [BD\$/kWh]$$

(vii) The BL&P's quarterly regulatory reports as submitted to the Commission shall now include, but are not limited to, the monthly performance data of the ESD:

- **a) Cycle life;**
- **b) Energy Charged (kWh);**
- **c) Energy Displaced (kWh);**
- **d) Energy Charged Costs ($/kWh);**
- **e) Energy Displaced Costs ($/kWh);**
- **f) Round Trip Efficiency (%); and**
- **g) Net Fuel Savings ($)**

(viii) Ad-hoc reporting on any emergency events, associated with the ESD, shall be submitted to the Commission within seven (7) working days of occurrence of the event; and

(ix) A WACC of 10% is approved.

SECTION 2 INTRODUCTION

2.0 Background

Economic growth is a major concern for Barbados and the rest of the Caribbean and one of the prerequisites for such growth is an expansion in energy supply. There is a positive relationship between output per capita and both the capital stock per capita and energy consumption per capita. The role of the regulator in the adoption of energy technologies includes protecting the ratepayer, while ensuring that the utility is afforded the opportunity to achieve a reasonable return on its investments. This means that all aspects of the deployment and integration of these technologies, such as energy storage systems, must be considered.

The BL&P has applied to the Commission for approval to recover the costs of a 5MW/20MWh ESD via the FCA. The capital cost of the ESD is BDS $19.5 million and carries an operational warranty of ten (10) years. It is seeking to recover BDS $22,947,770 - the full cost of the ESD, inclusive of a return on capital over its warranty lifetime. This is contingent on the ESD's ability to realise fuel savings subject to forecasted fuel prices – where annual fuel savings exceed the annual estimated recovery cost of the ESD. The BL&P proposes to recover the ESD costs once per year, in February.

The Applicant proposes to share a minimum of 5% of the fuel savings with customers each year. Where the actual fuel savings fall short of 105% of the ESD recovery, the BL&P proposes an adjustment of the ESD recovery amount, to ensure customers obtain a minimum of 5% of the net annual fuel savings. If the life of the ESD exceeds the 10-year warranty, fuel savings will be shared between the BL&P and ratepayers at a rate to be determined by the Commission. Where the realised life of the ESD is less than the warranty life, the BL&P will absorb the unrecovered cost of the ESD.

The BL&P suggests the FCA as the appropriate cost recovery mechanism[3] for the ESD and claims that the ESD's ability to deliver fuel saving benefits will relieve ratepayers from price

[3] The BL&P, *Utility Energy Storage Application*, August 4, 2017, p1, paragraph1(b), paragraph(s): 29, 33-34.

or operational risk[4] associated with traditional cost of service recovery mechanisms. The FCA was designed to facilitate recovery of the service provider's full fuel cost and was subsequently amended to include the recovery of costs associated with purchased power. ESDs are considered critical tools for unlocking the benefits of traditional generation and aligning the renewable energy (RE) electricity output to meet current grid requirements[5].

Electricity production is derived from steam, diesel, aviation jet (Av jet) and solar photovoltaics (PV) generator sets. This energy comprises approximately 95% thermal plants and 5% RE contribution. The BL&P asserts that the ESD will allow efficient energy dispatch of base load and peaking plants and the execution of grid management functions – frequency and voltage response, which will result in fuel savings.

[4] Operational risk relates to factors which may impact the ESD's performance. These include but are not limited to fires, explosions, communication failure, under and over charging, failure to operate, etc. Adherence to specific environmental and operational limits will guarantee the safe deployment of ESDs.

[5] Energy Sector Management Assistance Program (ESMAP) and International Finance Corporation (IFC), *Energy Storage Trends and Opportunities in Emerging Markets*, Conference Edition, 2017, accessed October 13, 2017, https://www.ifc.org/wps/wcm/connect/ed6f9f7f-f197-4915-8ab6-56b92d50865d/7151-IFC-EnergyStorage-report.pdf?MOD=AJPERES.

2.1 Legislative Framework

Under Section 4(3) (a) of the Fair Trading Commission Act, CAP. 326B (FTCA) of the Laws of Barbados, the Commission is responsible for establishing principles for arriving at the rates to be charged by service providers. The Commission also has this duty under Section 3(1) of the URA, which states:

> "*The functions of the Commission under this Act are, in relation to service providers, to*
>
> (a) *establish principles for arriving at the rates to be charged*".

In accordance with Section 2 of the FTCA and the URA, "principles" mean the formula, methodology or framework for determining a rate for a utility service.

Additionally, Section 2 of the URA states that "rates" include

> *(a) "every rate, fare, toll, charge, rental or other compensation of a service provider;*
>
> *(b) a rule, practice, measurement, classification or contract of a service provider relating to a rate; and*
>
> *(c) a schedule or tariff respecting a rate;"*

By virtue of Section 16 of the URA, where the Commission has not fixed a period of time in accordance with Section 15(1), the Commission may, on its own initiative or upon an application by a service provider or consumer, review the rates, principles and standards of service for the supply of a utility service. In light of this provision, the BL&P has correctly filed an Application with the Commission for approval to recover the cost associated with the commissioning of a 5MW ESD via the FCA.

On October 11, 2013, the Commission issued its Decision on its own Motion to Review the FCA, pursuant to Section 16 of the URA. The FCA was approved by the Commission as a principle or formula that the BL&P is permitted to use to pass through the cost of fuel used to generate electricity and power purchased to its customers.

By virtue of Section 36 of the FTCA, the Commission may, on application or on its own motion, review and vary or rescind any decision or order made by it, and where under the Act a hearing is required before any decision or order is made, such decision or order shall not be altered, suspended or revoked without a hearing.

SECTION 3 INTERVENORS AND SUBMISSIONS

On September 4, 2017, the Commission published a notice in the media advising the public of the BL&P's Application to Recover Costs associated with the Commissioning of a 5MW ESD via the FCA. The Commission invited written submissions from interested parties. The deadline for the submission of comments was September 11, 2017.

Upon request, the Commission approved an extension, until October 13, 2017, for intervenors to submit their written responses. Intervenor status was granted to the following, who actively participated in the hearing:

- CARITEL;
- Dr. Roland Clarke;
- Mr. Tony E. Gibbs;
- The Barbados Chamber of Commerce & Industry (BCCI);
- The Barbados Renewable Energy Association (BREA); and
- The Division of Energy and Telecommunications (DET).

Pursuant to Rule 4 of the URPR, Procedural Directions were issued to all parties. This guided the parties on the procedural aspects of the hearing and outlined timelines for the process. All intervenors were invited to submit written, sworn affidavits to the Commission and to serve the same and interrogatories for the BL&P on all parties.

The Commission received submissions from the six (6) intervenors. All written submissions, as well as interrogatories, were shared among the intervenors and the Applicant. The Applicant was granted an opportunity to respond to these submissions and the Commission's interrogatories. The Applicant's responses to the Commission's interrogatories were also circulated among the parties. The Commission also submitted additional interrogatories to the Applicant, with respect to heat rate targets; the Applicant was also required to provide answers by February 23, 2018 and the intervenors were required to provide responses to the same by March 1, 2018. One intervenor responded to the interrogatories.

Synopsis of Submissions

CARITEL

CARITEL's concerns are similar to those expressed by another intervenor, such as the fact that the BL&P has been operating a 10MW solar plant without battery storage. It contends that storage is a vital consideration given the increasing penetration of RE generation on the Barbados electricity grid. While CARITEL decries the use of the FCA as a mechanism for the recovery of the cost of the ESD over the long term, considering the critical need for storage at present, it asserts that the application ought to be approved on a temporary or pilot basis. It also suggests that the Commission hold a public hearing to determine the best type of tariff for utility scale and independent battery storage investors, given that there are a number of RE projects either currently in existence or coming on stream in the near future.

Dr. Roland Clarke

Dr. Clarke, in his affidavit to the Commission, articulated his opinion as to why the BL&P should not be allowed to recover the cost of the ESD through the FCA. Dr. Clarke asserts that the BL&P intends to utilise the ESD for the purpose of grid management and as an operational improvement tool, as opposed to purely an energy saving device. The energy saving feature, Dr. Clarke claims, is incidental. He quoted several areas of the BL&P's application which he claims support his view- for example, paragraph seven (7) of said application says that the ESD "is required to smooth out the fluctuating supply of electricity from increasing intermittent renewable energy (RE) sources like wind and solar". Dr. Clarke insists that this is evidence of the fact that the ESD is to be used for operational improvement rather than strictly for fuel savings. Dr. Clarke also contends that the FCA is inappropriate because it is used to facilitate recovery of fuel expenditure and not capital expenditure such as is required for the commissioning of the ESD. Consequently, he concludes that it would be most appropriate for the cost of the ESD to be borne by the BL&P's shareholders.

Mr. Anthony Gibbs

In his submission, Mr. Gibbs outlined the traditional use of the FCA as a tool of cost recovery for fuel expenditure "without reference to heat rates or fuel efficiency performance". He intimates that, not only does it encourage inefficient performance but it also passes a

significant amount of risk onto the consumer and away from the utility. Consequently, Mr. Gibbs is firmly against allowing the BL&P "to impose an additional surcharge on ratepayers via the FCA". He deems that this would be a "significant departure from traditional utility rate setting practice". He asserts that, as the costs of commissioning the ESD are not "volatile, uncontrollable or unpredictable", best practice indicates that they ought to be a part of the rate base and recovered through the revenue requirement. He further asserts that this would therefore necessitate a traditional rate hearing, an undertaking not sought by the BL&P in almost a decade, indicating that perhaps the company is more than capable of meeting its financial obligations, providing a safe and reliable service and ensuring investors receive a fair return. He refers to the current application by the BL&P as "single issue ratemaking" which is used "typically for costs, such as fuel, that were considered largely outside the utility's control". The costs of the ESD, he however asserts, are neither unpredictable nor uncontrollable. Mr. Gibbs also illustrates that island grids which introduce intermittent distributed generation often require investors to meet technical requirements which seek to smooth out ramp rates. These often necessitate battery storage, as is the case in Puerto Rico and Hawaii. In these jurisdictions, the costs of the storage solutions are not passed on to ratepayers via fuel charges.

BCCI

The BCCI fully supports the BL&P's application and commends the company on its "forward thinking nature" and "willingness to invest in the future prosperity and energy security of Barbados". However, it suggests that the 5% allotted to customers as a share of the fuel savings is too low and instead recommends 10% to 15%.

BREA

BREA indicates its long-standing support for the use of storage as a part of the evolution of Barbados' electricity grid, as the country moves toward increasing levels of RE in its energy mix. In principle, BREA agrees with the BL&P's move to implement a storage solution. However, it deemed the FCA to be an inappropriate cost recovery mechanism for the ESD. BREA contends that "the comingling of these non-fuel variables within the existing FCA in the long run would not lend to fairness and transparency". Additionally, a number of other concerns were raised in the affidavit, such as:

- "What services will the Energy Storage Device (ESD) be applied to and how has [sic] those cost [sic] been allocated? For example, generation, transmission, distribution";
- "How was the 95% cost recovery figured [sic] arrived at and can a greater percentage of savings be attributed to the customers?"; and
- "If the current cost of purchased fuels increases would the customer be entitled to a bigger percentage of the fuel savings as the cost of the ESD will be recovered within the ten (10) year period?"

DET

The DET, in addition to making comments on the application, submitted a number of interrogatories which sought to clarify issues such as:

- Potential errors in the modifications made to the FCA Equation; and
- The provision of further details with respect to fuel savings and their redistribution to the consumer.

The affidavit provided a detailed overview of the DET's work in assisting in the development of the Barbados National Energy Policy (BNEP). This highlighted proposed policy measures and "tariff and pricing regimes for the utility that include consideration of the cost of storage technologies", as well as the development of standards for generation, transmission, storage and other components of the electricity sector. The DET's submission states that "Government is prepared from a policy standpoint to support the use of battery storage where it is financially, economically, environmentally and technically viable", subject to the interrogatories which accompany its affidavit. The DET did not articulate a position on its preferred mode of recovery.

SECTION 4 THE COMMISSION'S ANALYSIS

The Commission, in its analysis of this matter, reviewed the BL&P's Application, considered the submissions of the intervenors, the responses to interrogatories submitted and the findings of its own research.

The Need for Energy Storage

The BL&P asserts that an ESD can "enhance grid resilience, reliability and lower fuel cost to customers"[6]; "enable the sustainable achievement of clean energy objectives, smoothing out fluctuating supply"[7] from variable RE effects; "increase efficiency of dispatch"; and meet "some auxiliary services role [sic] of frequency control and reserve capacity"[8] of its thermal plants, thereby creating enhanced fuel saving opportunities and operation of service. The Applicant also contends that further fuel saving cost benefits would be generated from the ESD's energy-shifting capabilities[9]. Based on projections derived by the 2016 GE Consulting Integration Study[10], the BL&P expects to grow base demand by approximately 1% each year, reaching a level of 1113 GWh in 2027. This projected growth in demand is expected to be satisfied by growth in variable RE, which would necessitate increased deployment of ESDs. The ESD project is expected to generate fuel savings of BDS $26.7 million over the warrantied life of the asset, approximately 5% of which the BL&P intends to distribute to the ratepayer over the period. The view that there is a need for storage is supported by the intervenors.

The Commission's Analysis

The Commission acknowledges that energy storage deployment can positively enhance the operational features of both the thermal and variable RE plant and lead to improved grid management capability[11]. It is of the view that, given the existing business model of the

[6] The BL&P, Utility Energy Storage Application, 1 (1).
[7] Ibid, 2 (7).
[8] Ibid, 4 (18).
[9] Ibid, (19).
[10] GE Energy Management Consulting, Barbados Wind and Solar Integration Study Phase 2 Report: *Executive Summary*, October 10, 2016
[11] Seth Mullendore, *Energy Storage and Electricity Markets: The value of storage to the power system and the importance of electricity markets in energy storage economics, August 2015, accessed December 10, 2017, https://www.cleanegroup.org/wp-content/uploads/Energy-Storage-And-Electricity-Markets-August-2015.pdf*.

utility, this necessitates the utilisation of energy storage. The inclusion of electricity from variable RE sources in its energy mix, requires some form of energy storage in order to mitigate the side effects of the intermittent availability of this resource. In doing so, energy storage will also improve the economic viability of electricity from variable RE sources as it will directly and/or indirectly reduce fuel costs; reduce the need for additional conventional plant and improve the quality of electricity service through its grid support and stabilisation capabilities. The Commission recognises the many tangible benefits that are likely to accrue from the utility's use of an ESD.

Prudently Incurred Costs

The bulk of electricity produced is derived from fossil fuel consumption. The BL&P anticipates that ESD deployment should optimise energy flows on the grid from conventional generation and RE sources and translate to incremental cost savings to ratepayers. The integration of an ESD in the existing grid environment is expected to reduce the quantum of peaking plant fuel utilised, hence a reduction in the FCA should be realised. Additionally, its energy shifting functionality should redound to a lower marginal cost of electricity due to a lower spinning reserve requirement. The BL&P claims that the benefits to be realised from the ESD were based on the results of the GE Energy Consulting Phase 2 Study and that of its own modelling analysis; these revealed that the inclusion of the 5MW ESD, as proposed, can result in significant fuel saving benefits[12]. It is anticipated that the utilisation of an ESD will benefit the entire electricity system.

The Commission's Analysis

The following questions arise when determining the prudence of utility investment:

- Will the costs to be incurred meet customers' needs?
- Is the associated cost of the utility asset necessary to provide adequate service to customers?
- Are these costs reasonable?
- Does the utility asset under consideration meet the used and useful criterion?
- How will the utility investment benefit ratepayers?
- Is storage in keeping with the tenets of the BNEP?

[12] The BL&P, Utility Energy Storage Application, August 4, 2017, 5 (26 - 28).

The Commission notes that where the investment in a utility asset is likely to improve the utility's operational efficiency, the cost associated with that improvement can be reasonably borne by all customers. In such instances, this would allow the utility to recover the investment cost of the asset that provides the service to the entire electricity system. On this basis, the Applicant can justifiably seek and recover all prudently incurred costs, which impact the quality of electricity service delivered. The Commission anticipates that on commissioning of the ESD, benefits will accrue to customers. Additionally, the opportunity to evaluate these benefits will arise. Customers should benefit from incremental fuel cost savings. The utility also agrees to pass on a minimum of 5% of the annual fuel savings and maintains that in some instances, the percentage savings "is anticipated to be in excess of 20%".[13] Additionally, the possibility exists that cost saving benefits may extend beyond the warranty lifetime of the ESD. Where this occurs, mutual agreement will be required on the split of benefits. Further, the BL&P has proposed the absorption of all remaining capital costs, should the warrantied life of the ESD not be realised. This clause in the application significantly mitigates consumers' risk exposure.

The Commission also notes that energy storage is becoming a prominent utility asset in the evolution of clean energy and grid modernisation. Its deployment on a greater scale is anticipated, given the national clean energy vision for Barbados of 75% RE electricity contribution by 2037[14]. Further, the ongoing expansion of the RE sector has contributed to energy imbalances on the grid, which necessitates energy storage deployment to mitigate against this effect. The Commission therefore acknowledges that the utility's investment in an ESD should enhance the reliability of supply, a tangible benefit to the customer base. It is of the view that the costs associated with the ESD are reasonable and its use will facilitate the realisation of Barbados' clean energy vision.

Another view held by the Commission is that the utilisation of an ESD offers environmental benefits to the society. Its operation assists in accelerating decarbonisation of the energy sector, as it does not add to the Greenhouse Gas (GHG) emissions of the utility. Given the benefits to be realised from the integration of an ESD in the existing electricity grid topology, the Commission is of the view that its associated costs are prudently incurred.

[13] The BL&P, Affidavit: *Affidavit of Rohan Seale*, November 10, 2017, 24-25.
[14] Government of Barbados, *Barbados Nation Energy Policy 2017-2037*, 41, 2018.

Appropriate Cost Recovery Mechanism for the ESD

The FCA was conceptualised to recover volatile costs that are outside the control of the utility and not capital expenditure. The Applicant suggests that the FCA is a suitable and efficient cost recovery mechanism for the ESD's associated costs[15,16]. Based on this view, it claims that ratepayers will be protected from the technological and operational risks associated with the ESD, which is borne by its shareholders[17]. It also asserts that under the rate base methodology, the customer would be financially disadvantaged while the FCA provides efficient cost recovery[18]. The BL&P proposes that the Commission has the flexibility to allow recovery of the ESD's costs via the FCA[19].

While some submissions from intervenors supported the case for the deployment of the ESD, consensus on the FCA as the appropriate cost recovery mechanism was not evident. The rationale advanced for recovery via the rate base methodology was that the costs were not variable and are within the utility's control.

The Commission's Analysis

While the Commission acknowledges that the FCA is not traditionally used in this manner, the formula can easily and safely be adjusted to facilitate the desired calculations. In accordance with the FTCA and the URA, the Commission has the power to establish principles for arriving at rates to be charged by service providers and to set the maximum levels of said rates. The Commission may, at its own discretion, decide on the methodology to be used when establishing said principles and determining said rates. Consequently, the Commission has the power to make adjustments to various formulae and/or mechanisms, including the FCA, in discharging its duties. Additionally, the FCA is relatively easily monitored; it is also monitored on an ongoing basis and offers the Commission control of the recovery period and amount. With a traditional rate base approach, where the cost of the ESD would be recovered via the revenue requirement, said cost could continue to be passed on to consumers beyond the ten (10) year project life cycle.

[15] The BL&P, Affidavit, 8 (38), 9 (42).
[16] The BL&P, Utility Energy Storage Application, August 4, 2017, 5(29).
[17] Ibid, 6 (34).
[18] The BL&P, Affidavit: *Affidavit of Rohan Seale*, October 24, 2017, (37-38)
[19] The BL&P, *Utility Energy Storage Application*, 5 (30).

The Commission evaluated the merits of utilising the rate base versus FCA recovery methodology. It notes that, while the rate base approach is a participatory, transparent and accountable process, it remains time and cost intensive. The Commission also notes that, given the timing of the BL&P's Application and the state of the RE industry, an alternative approach to rate base is warranted. It is common for RE projects to be co-located with energy storage and for the project costs to be recovered through the rate base. One question to be answered is whether the application, which focuses on one device, merits the expenditure of time and capital resources associated with a rate base review, the costs of which are borne by ratepayers. Further, under the rate base approach, the ESD's associated costs would continue to be recovered from ratepayers via the applicable tariff, regardless of the equipment's functionality.

In terms of the cost recovery via the FCA methodology, its cost inputs can be audited by the Commission prior to its annual determination and reconciled by the BL&P. This would also ensure that only prudently incurred costs are recovered; this is more easily achieved under the FCA than via the rate base.

Additionally, the FCA offers some flexibility as a cost recovery mechanism. Its determination is subject to the assumptions used in the modelling of the system with and without the ESD. The evaluation of this cost recovery approach provides the Commission the opportunity to determine the appropriate constraints.

The Commission notes that this approach was utilised by the Arizona Corporation Commission, which allowed Tucson Electric Power Company to recover prudently incurred costs associated with its two (2) 10 MW[20] energy storage projects, through its Power Purchase and Fuel Adjustment Clause. Similarly, the opportunity exists to learn from cost recovery of the ESD asset via the FCA in this jurisdiction. The Commission considers that the FCA can be modified to be used as a cost recovery mechanism for the ESD.

[20] Arizona Corporation Commission, Docket No*: E-0199#-15-0239*, accessed October 10, 2017, https://www.tep.com/wp-content/uploads/2017/05/TEP-2016-Rest-Plan-Order.pdf.

Efficient Energy Production

The cost of fossil fuel for power production represents a significant portion of the utility's operating expenditure. This cost is passed through to customers via the FCA and is a dominant cost item on their utility bills. Hence, the conversion of fuel to electricity has direct implications for customers when this process is suboptimal.

One intervenor viewed the FCA as a cost recovery mechanism which is delinked from fuel efficiency or heat rates. This, he suggests, passes considerable risk to customers[21]. The BL&P has indicated that its rationale for a 5MW ESD is to leverage its operational flexibility and its energy efficiency potential attributes, which it hopes will enhance its entire system operations. Additionally, the Applicant, in response to the Commission's final set of interrogatories suggested that it was not opposed to the concept of instituting performance incentive mechanisms. It cautioned that heat rate targets alone, "could encourage the use of lower heat rate/high fuel cost generation units for (sic) higher heat rate/lower fuel cost generation units"[22] to meet the proposed targets. The BL&P also suggested an annual $100,000 cap on under/over recovery[23], should the Commission's proposed heat rate targets be based on the average of the prior five (5) or three (3) years of heat rate performance[24].

The Commission's Analysis

The Commission notes that the FCA is a dominant cost component of customers' electricity bills, accounting for more than 50% of the total cost. It acknowledges that the FCA currently does not incentivise the BL&P to optimally use fuel. The BL&P's regulatory reporting includes heat rate and fuel efficiency statistics for its plant. The Commission routinely assessed these metrics and considered the realised results for the period 2013 – 2017, to determine the energy efficiency performance of each electricity plant. The assessment revealed that there is merit in assigning heat rate targets to the BL&P's thermal fleet, whose fuel mix consists of heavy fuel oil (HFO), diesel and Av jet. Diesel and Av jet are primarily used for peaking plants, while HFO is consumed in steam and diesel plants to supply base load. Diesel plants include waste heat recovery systems which improve energy efficiency

[21] Anthony Gibbs, Affidavit: *Affidavit of Anthony Gibbs*, October 17, 2017, 3 (12).
[22] The BL&P, Affidavit: Affidavit of Rohan Seale, February 28, 2018, 5 (3).
[23] Ibid, 6 (6 e,f).
[24] Ibid, 6 (5 c).

and these units are generally of the same type. The steam plant units consume HFO and diesel and have identical power conversion characteristics. However, the peaking plant fleet consists of gas turbines with varying combustion systems.

The Commission therefore considered, that the diesel plants and the steam plants should have two (2) distinct, cumulative heat rate targets, while the gas turbine units would be best suited with individual heat rate targets, due to their individual, peculiar characteristics.

Heat rate targets were computed based on the statistical evaluation of the BL&P's plant fuel consumption and generation data for the prior five (5) years. The heat rate targets were computed from trend line analysis which provided a baseline performance of the BL&P's plants/units and presents a fair reflection of the heat rate performance. Trend line and regression analyses were conducted to determine the appropriate heat rate target values. These values were derived from the gradients of the trend line analyses and compared to the inverse slopes of the regression model to validate the heat rate targets deduced from the trend line analysis. The final heat rate target values include a 1% tolerance which takes into account the unavoidable system degradation over time.

The following heat rate targets shall be assigned to the BL&P's steam and diesel plants and gas turbines, respectively:

- Steam plant - 15,370.20 BTU/kWh
- LSD1 - 9,067.28 BTU/kWh
- LSD2 - 7,980.52 BTU/kWh
- Gas Turbines
  - GT01 - 17,514.40 BTU/kWh
  - GT02 - 15,209.60 BTU/kWh
  - GT03 - 14,070.30 BTU/kWh
  - GT04 - 13,007.80 BTU/kWh
  - GT05 - 12,872.50 BTU/kWh
  - GT06 - 12,861.30 BTU/kWh

The objective of heat rate assignment is to minimise the amount of fuel consumed by each plant in its production of a unit of electricity by active heat rate monitoring and

management. Only fuel costs associated with the identified heat rate would be allowed to be passed on to customers, while the utility would be allowed to benefit from any efficiency gains made. The Commission notes that research suggests that this strategy – heat rate monitoring and management - can facilitate incremental fuel cost savings to the utility; a 1% heat rate improvement equates to a 1% reduction in carbon emissions [25,26] and this translates to significant annual fuel cost savings which are transferred to customers.

The Commission also examined the fuel saving potential of the BL&P's thermal fleet based on the referenced forecasted fuel prices and plant operational characteristics; the results suggest that a 1% heat rate reduction would yield a significant reduction in fuel expenditure. The LSD plants, for example, revealed fuel cost savings in excess of $10 million over a ten (10) year period based on the World Bank forecasted fuel prices. The Commission is of the view, that the BL&P's proposed cap of $100,000 would nullify the intended efficiency incentives facilitated by the setting of heat rate targets.

The Commission recognises the significant role an ESD is expected to play in realising improved reliability of the national grid. However, it notes that an ESD consumes and dispenses electricity and its operation can impact the quantity of fuel consumed for energy production. To this end, further consideration was given to the validation of the BL&P's plants' heat rates. A number of factors impact the heat rate performance of generating plant. These include equipment degradation, controllable losses and system dispatch, fuel quality, unit and system design, load profile, maintenance, weather, system conditions and economic conditions. The Commission opines that heat rate monitoring and management are crucial activities which contribute to an efficient energy conversion environment. The periodic review of heat rates and making this a priority to achieve near optimal heat rate performance should be the prerequisite for extending the efficiency portfolio of the energy product. Satisfactory heat rates are symbolic of an effective maintenance programme; this improves the reliability of power generation and availability of plants for dispatch. Best practice in power generation dictates that the economic dispatch of plant should effectively meet energy demand.

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[25] Electric Power Research Institute, Range of Applicability of Heat Rate Improvements: *Technical Update, April 2014,* accessed October 17, 2017, https://www.eenews.net.

[26] Emerson Process Management, White Paper: *Using Automation to Improve Plant Heat Rate,* accessed October 12, 2017, http://www.emerson.com/documents/automation/white-paper-using-automation-to-improve-plant-heat-rate-en-178352.pdf.

The Commission holds the view that it is incumbent on the BL&P to pursue best endeavour approaches in guaranteeing near optimal power generation on a consistent basis. The Commission also notes that it has a regulatory responsibility by virtue of Sections 3(2) and 3(3)(a) of the URA.

Section 3(2) states that:

"*In establishing the principles referred to in subsection 1(a) the Commission shall have regard to*

(a) the promotion of efficiency on the part of service providers;

(b) ensuring that an efficient service provider will be able to finance its functions by earning a reasonable return on capital; and

(c) such other matters as the Commission may consider."

Section 3(3)(a) states that:

"*The Commission shall*

(a) protect the interest of consumers by ensuring that service providers supply to the public service that is safe, adequate, efficient and reasonable;"

Consequently, the Commission considers that heat rate tests should form part of the regular monitoring regime of the BL&P's thermal fleet. This test represents a blueprint of the operational performance of the thermal plants, and is a standard input in guiding decision making for the thermo-economic dispatch of plant. Heat rate tests should be conducted every six (6) months for each plant/unit and certified by the service provider's senior management or party contracted who performed such tests, prior to submission to the Commission. The conditions under which heat rate testing is conducted should be consistent with international performance standards and guidelines. This information would guide the Commission in its review of heat rates and targets. The Commission considers that the pursuance of a heat rate management strategy by the service provider should represent a genuine effort for realistic fuel cost containment in electricity production.

The Commission also considered how the ESD will be integrated into the existing grid. The ESD is to be co-located with the 10MW utility scale solar plant but not directly coupled with it. This configuration is anticipated to positively impact the destabilising effects of variable RE resources, thereby increasing the efficiency of the system. As a result, the consumption of the more expensive fuel should decline. Ratepayers can therefore benefit, as unnecessary

pass-through fuel cost is avoided or minimised. This suggests that as energy storage increases, the need for peaking plant to counter RE variability should decline.

The inclusion of an ESD, as proposed, is expected to allow the existing thermal fleet to acquire optimum heat rate performances, thus realising higher energy yield from fuel. The Commission emphasises that the assignment of heat rate targets, monitoring and management and routine heat rate testing will further supplement the efficiency gains to be afforded by the ESD. With respect to the assigned heat rate target, the BL&P shall be allowed to apply for exemptions under force majeure conditions. Force majeure conditions generally pertain to conditions that are reasonably outside the control of the utility.

For the foreseeable future, fossil fuels will remain central to base load generation. The Commission notes that energy storage utilisation should extend the energy efficiency gains from heat rate improvement across the entire system. The interoperable capabilities of energy storage, will also facilitate the transition from fossil fuel energy conversion to emissions-free electricity, resulting in significant reduction in foreign exchange spending on fuel.

Modification of FCA

The BL&P suggests that the Commission has the flexibility to allow recovery via the FCA. It has proposed an amended formula for annual recovery of the ESD's cost via the FCA[27]. Its intention to use the FCA as a recovery tool for the ESD's associated costs requires verification of fuel cost inputs. The BL&P asserts that the computation of the annual fuel savings will be similar to the production cost analysis outlined in its Application[28]. One intervenor opined that the Commission should make certain that the formula is scrutinised to ensure that the expected benefits reach its customers[29].

The Commission's Analysis

The Commission acknowledges that there are varied approaches for the cost recovery of nascent technology assets, such as an ESD and notes that approaches will differ depending

[27] The BL&P, *Utility Energy Storage Application*, 9 (47).
[28] Ibid, 11-17.
[29] CARITEL, Affidavit: *Affidavit of Hallam Hope*, 6 (1).

on specific objectives, circumstances and the applicable operating environments. It maintains that the nature of regulation is not static or rigid and that an organisation/regulator must be allowed the flexibility to utilise cost recovery strategies that best address the issues and attendant circumstances before it.

As with the FCA, all formulae are designed with a specific objective in mind. In a dynamic environment such as regulation, objectives change from time to time, occasioning amendment of said formulae. As it pertains to the Application, the proposal is seeking an amendment of the FCA formula from that of the current Equation (1) to the proposed Equation (2). The adaptation of Equation (2) serves the purpose of also recovering the cost of the ESD over a stated and finite period. Although the use of the FCA to recover fixed costs is not the convention, the Commission is satisfied that the current formula, Equation (1), can be adapted to Equation (3) to achieve the desired objectives without causing any ill effect to the ratepayer. The Commission's revised equation, Equation (3), includes the assignment of a heat rate target for the various plants in the determination of the fuel cost inputs. It is also noted that, where the existing plant conditions are modelled without the ESD, the model shall also take into account the heat rate targets assigned to each plant or unit, in the determination of the final fuel costs. This should ensure that there is consistency in the determination of fuel cost savings. Additionally, the heat rate targets shall also apply in the monthly determination of the FCA as indicated by Equation (4).

The adaptation of the FCA also mitigates the need for an overall rate review. Such reviews are costly in terms of time, human resources and capital and said cost would ultimately be borne by the customer. Additionally, the Commission considers that, to use this Application to trigger a full rate hearing would not be prudent, given the current dynamics of the sector and the expected changes in the near to medium term.

Existing equation:

$$\mathrm{FCA_n} = \frac{\text{Fuel Cost}_{\,n-1} + \text{Purchased Power}_{n-1}}{\text{Energy Generation}_{n-1} \,.\, (1 - \mathrm{Aux}_{n-1}).\, (1 - \text{losses})} \,[\mathrm{BD\$/kWh}] \qquad \text{(Equation 1)}$$

The BL&P's proposed FCA for February:

$$FCA_{feb} = \frac{Fuel\ Cost\ _{n-1} + Purchased\ Power_{n-1} + ESD\ Recovery\ _{yt}}{Energy\ Generation_{n-1}\ .(1 - Aux_{n-1}).(1 - losses)}\ [BD\$/kWh] \quad \text{(Equation 2)}$$

Where:

ESD Recovery$_{yt}$ = %*Net Fuel Savings$_{yt-1}$

And where:

FCA$_{feb}$ =	FCA for the month of February of the given year
Energy Generation$_{n-1}$ =	Energy generated in the previous month
Aux$_{n-1}$ =	Auxiliary consumption as a % of total generation in the previous month
Losses =	System losses as a % of total generation calculated based on a 12-month running average
Fuel cost$_{n-1}$ =	Fuel cost in previous month including cumulative under/over recovery
Purchased Power$_{n-1}$ =	Purchased power from renewable sources in the previous month
ESD Recovery$_{yt}$ =	Storage cost recovery for the previous year including any costs under recovery accumulated from previous year
Net Fuel Savings$_{yt-1}$ =	The difference between the fuel costs with and without the ESD

The Commission's revised FCA for February would therefore be:

$$FCA_{feb} = \frac{\sum_i (Fuel\ Cost_{n-1}.\frac{THR^i_{n-1}}{AHR^i_{n-1}}) + Purchased\ Power_{n-1} + ESD\ Recovery_{yt}}{Energy\ Generation_{n-1}\ .(1 - Aux_{n-1}).(1 - losses)}\ [BD\$/kWh] \quad \text{(Equation 3)}$$

The determination of the FCA for each month other than February would therefore be:

$$FCA_n = \frac{\sum_i (Fuel\ Cost_{n-1}.\frac{THR^i_{n-1}}{AHR^i_{n-1}}) + Purchased\ Power_{n-1}}{Energy\ Generation_{n-1}\ .(1 - Aux_{n-1}).(1 - losses)}\ [BD\$/kWh] \quad \text{(Equation 4)}$$

Where:

ESD Recovery$_{yt}$ = %*Net Fuel Savings$_{yt-1}$

And where:

FCA_n =	FCA for each month other than February
Energy $Generation_{n-1}$ =	Energy generated in the previous month
Aux_{n-1} =	Auxiliary consumption as a % of total generation in the previous month
Losses =	System losses as a % of total generation calculated based on a 12-month running average
Fuel $cost_{n-1}$ =	Fuel cost in previous month including cumulative under/over recovery
Purchase $Power_{n-1}$ =	Purchase power from renewable sources in the previous month
ESD $Recovery_{yt}$ =	Storage cost recovery for the previous year including any cost under recovery accumulated from previous year
Net Fuel $Savings_{yt-1}$ =	The difference between the fuel costs with and without the ESD
i =	refers to the generation plant/unit
AHR_{n-1}^{i} =	Actual Heat Rate for generation plant/unit i, for month n-1
HRT_{n-1}^{i} =	Heat Rate Target for generation plant/unit i for month n-1
BD$/kWh =	Barbados dollars per kilowatt hour

Financial Analysis of the ESD Project

None of the intervenors directly commented on the financial analysis of the Application. The financial implications, both for the utility and the customer, are integral to the determination of this Application. The Commission therefore undertook an assessment.

The Commission's Analysis

Using the PLEXOS software, production cost analysis undertaken by the BL&P will be used to model the amount of fuel that would have been consumed without the benefit of an ESD. The net fuel savings is derived as the difference between the fuel costs, with and without the ESD.

Based on the business model that has been presented to the Commission, it is not expected that the customers of the BL&P will be negatively impacted by the purchase of the ESD, all other things remaining constant. That is to say, the costs that will be borne by the customer will not result in an FCA that is higher than if the utility had not purchased the storage device.

The theoretical difference between the cost of the fuel used with an ESD and the cost of fuel used without the ESD is determined as the savings. This level of savings is then split between the BL&P and the consumer in a 95:5 ratio, respectively. The percentage ratio of the split is projected to vary over the duration of the recovery period, with 5% being the minimum allocated to customers, depending on the cost of fuel during this period. This ratio is designed to allow for full recovery of the project cost over the warranty life of the ESD. This is confirmed by the analysis. Thereafter, the savings which accrue from the residual useful life of the ESD will be split amongst the parties as determined by the Commission.

The BL&P has provided projections of the average annual FCA for the years 2018 to 2028 for four scenarios of oil price projections, comparing the FCA without the use of storage with an FCA that utilises storage. Based on these estimates, Figure 1 charts the difference between the average annual projected FCA without storage when compared with the average annual projected FCA with the inclusion of the ESD, for the four scenarios. Based on these figures, there is estimated to be very little difference in these two numbers under all scenarios. The highest variance is less than 1.2% under the EIA High Price scenario, equating to a difference

of 0.6 cents/kWh in 2027. Based on the data provided, the average annual FCA with the ESD is expected to be lower than the average annual FCA without the ESD, under all scenarios. One can expect to see an increase in the FCA during the month of February each year, as the associated cost recovery is reflected on the customer's bill in this month.

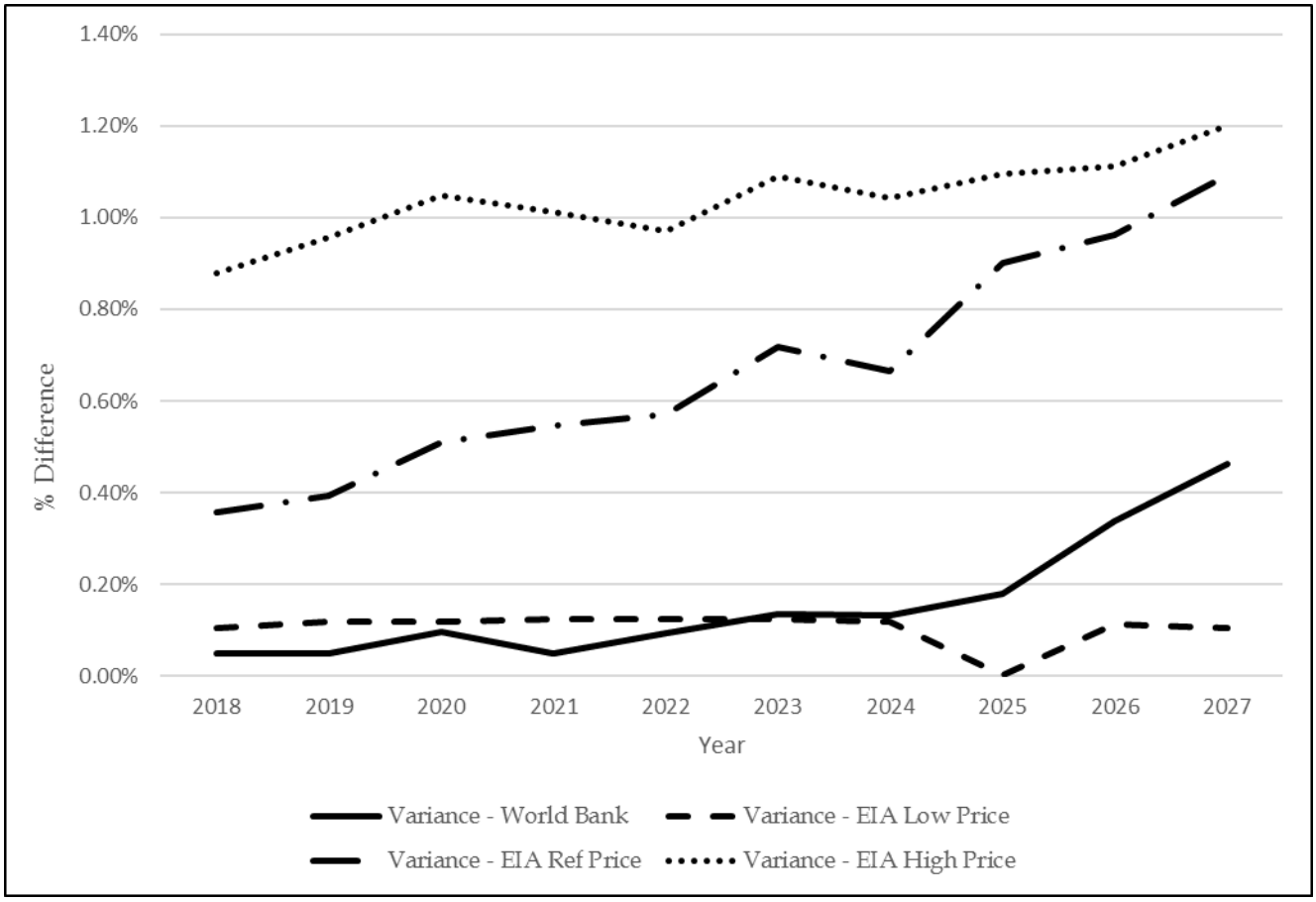

Figure 1: Projected Variance of the FCA with and without Storage by Scenario

In the assessment of the application, the Commission considered the assumptions that are used in the model, specifically, the weighted average cost of capital (WACC). The BL&P has stated in its application that it has determined that an appropriate WACC for this project would be the same 10% that was approved at the last rate review in 2009.

A determination of whether it is appropriate to use the value which was based on the Decision made over eight (8) years ago was required. This question is important given that the economic circumstances have changed since the last rate review. These changes include a general reduction in the cost of debt which is now closer to 5% compared to 5.25% in 2009, and a reduction in deposit rate, now closer to 0% compared to 6% in 2009. The estimated

cost of equity has increased from the 12.75% approved in 2009. This revised estimate was derived using the dividend capitalisation model[30] and adjusted to allow for country risk, which has increased over the past eight (8) years. The increased country risk has been driven by the significant number of downgrades that the island has been given by international rating agencies over the aforementioned period. Barbados' long term debt has been downgraded to CCC, with a negative outlook as of September 27, 2017, by international rating agency Standard and Poors[31], while Moody's rated Barbados at Caa3[32]. The 2009 grades were BBB[33] and Baa3[34], respectively. Professor Damodaran of Stern School of Business of New York University estimates Barbados' equity risk premium at 16.6% and its country risk at 11.52%[35].

When combined, these changes would result in an increase in the WACC from the 10% approved in 2009 to 14.87%. Utilising a WACC based on more current information would result in the BL&P being able to recover a higher ESD cost from the consumer over the ten (10) years.

This process does not involve a full rate review, as this would consider the WACC applied to all of the regulatory assets of the utility and not just the ESD alone. Even though economic conditions suggest the application of an upwardly revised WACC, the Commission considers that the existing WACC remains appropriate, given that a full rate review is not being pursued at this time. Furthermore, an upwardly revised WACC would result in the consumer paying more for the asset, resulting in a higher projected FCA. As previously explained in this document, the ESD is expected to operate in tandem with the existing assets of the utility and as such, it can be argued that the same WACC should be applied to this asset.

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[30] This model states that investors will expect a return that is the risk free return plus the company's sensitivity to market risk times the market risk premium.
[31] http://www.loopnewsbarbados.com/content/sp-downgrades-barbados-credit-rating-ccc accessed January 19, 2018.
[32] Moody's downgraded Barbados' government bond and issuer ratings to Caa3 and maintained a stable outlook, https://www.moodys.com/page/search.aspx?cy=global&kw=Barbados&searchfrom=GS&spk=qs&tb=1 accessed January 25, 2018.
[33] Barbados Credit Rating https://tradingeconomics.com/barbados/rating accessed January 25, 2018
[34] Moody's downgrades Barbados' ratings https://www.moodys.com/research/Moodys-downgrades-Barbados-ratings--PR_188504 accessed January 25, 2018.
[35] Country Default Spreads and Risk Premiums http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html accessed January 26, 2018

SECTION 5 THE DETERMINATION

The Commission acknowledges that energy storage deployment will become a central focus for the BL&P in transitioning its existing grid infrastructure to better cater to the issues of efficient energy dispatch, grid resilience, reliability and management. The Commission recognises the commitment of the Applicant to the national clean energy vision.

Given the myriad benefits to be derived from the inclusion of an ESD in the grid generation matrix, it is anticipated, that all stakeholders – customers, the utility and the environment (reduced emissions) - stand to benefit from its utilisation. Therefore, the Commission considers that the investment is justified. The main issue posed, is whether the proposed FCA is an appropriate mechanism for the recovery of the ESD's cost. The Commission, having reviewed the submissions from intervenors, the current status of RE penetration, along with its projections and expected impact on the grid, the BNEP, energy storage and its own research, now makes its determination.

Decision

(i) The decision of the BL&P to invest in Energy Storage is prudent and is therefore recoverable.

(ii) The BL&P can recover the cost of the ESD through the FCA.

(iii) The BL&P shall pursue a heat rate monitoring and management programme. Under this programme, each generation plant shall be assigned a heat rate target based on the trend line analysis of the prior five (5) years heat rate performance. These heat rate targets were verified by regression analyses. The waste heat energy contribution associated with the relevant plants, shall be included in the computation of the heat rate targets. Heat rate targets shall be reviewed annually, or from time to time, by the Commission and the determination of the revised values shall consider existing plant conditions. The BL&P shall also submit to the Commission the results of a standard heat rate test of plant/unit performance every six (6) months. Such tests shall be conducted in accordance with international performance standards and guidelines. This document must be signed by BL&P senior management or contracting party performing the heat rate tests.

In the event the BL&P's operations are impacted by force majeure conditions, it shall be eligible to apply to the Commission for exemptions. Such requests shall detail the nature of the event, the cause, resolution plan and future mitigation.

The heat rate targets shall be as follows:

- Steam plant - 15,370.20 BTU/kWh
- LSD1 - 9,067.28 BTU/kWh
- LSD2 - 7,980.52 BTU/kWh
- Gas Turbines
  - ❖ GT01 - 17,514.40 BTU/kWh
  - ❖ GT02 - 15,209.60 BTU/kWh
  - ❖ GT03 - 14,070.30 BTU/kWh
  - ❖ GT04 - 13,007.80 BTU/kWh
  - ❖ GT05 - 12,872.50 BTU/kWh
  - ❖ GT06 - 12,861.30 BTU/kWh

Where the BL&P's actual heat rate for a plant is the same or lower than the ascribed heat rate target, the BL&P shall be permitted to retain the resulting efficiency gains and recover the full fuel costs. However, where actual heat rates exceed the ascribed heat rate targets, fuel cost recovery shall be limited to that associated with the ascribed heat rate targets. Heat rate targets shall also apply to the modelling of existing plant conditions without the ESD. Additionally, the heat rate targets shall apply to the monthly determination of the fuel inputs into the FCA. The adjustment in the FCA shall continue to be computed on a monthly basis.

Recovery of the ESD's costs is approved for a period of three (3) years, commencing from September 1, 2018. Six (6) months prior to the expiration date, a review shall be conducted to assess the continued appropriateness and applicability of the recovery mechanism.

(iv) All financial inputs of the FCA related to the recovery of ESD costs shall be audited by a representative of the Commission to ensure its value is correctly determined.

(v) The formula for the determination of the FCA in February shall now be:

$$FCA_{feb} = \frac{\sum_i (Fuel\ Cost_{n-1} . \frac{THR^i_{n-1}}{AHR^i_{n-1}}) + Purchased\ Power_{n-1} + ESD\ Recovery_{yt}}{Energy\ Generation_{n-1} . (1 - Aux_{n-1}) . (1 - losses)} [BD\$/kWh]$$

(vi) The formula for the determination of the FCA for all months excluding February shall now be:

$$FCA_n = \frac{\sum_i (Fuel\ Cost_{n-1} . \frac{THR^i_{n-1}}{AHR^i_{n-1}}) + Purchased\ Power_{n-1}}{Energy\ Generation_{n-1} . (1 - Aux_{n-1}) . (1 - losses)} [BD\$/kWh]$$

(vii) The BL&P shall include in its quarterly regulatory reporting, monthly information on the following metrics:

a) **Cycle life;**
b) **Energy Charged (kWh);**
c) **Energy Displaced (kWh);**
d) **Energy Charged Costs ($/kWh);**
e) **Energy Displaced Costs ($/kWh);**
f) **Round Trip Efficiency (%); and**
g) **Net Fuel Savings ($)**

(viii) Ad-hoc reporting on any emergency events associated with the ESD, shall be submitted to the Commission within seven (7) working days of occurrence of the event; and

(ix) A WACC of 10% is approved.

Dated this 13th of April, 2018

Original signed by
…….
Jefferson Cumberbatch
Chairman

Original signed by
……..…….
Philmore Alleyne
Commissioner

Original signed by
…….
Dawood Pandor
Commissioner

Original signed by
……
Andrew Willoughby
Commissioner