# FAIR TRADING COMMISSION

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# DECISION

# on

# Energy Storage Framework and Tariffs

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## LIST OF ABBREVIATIONS

| ACRONYMN | TERMS |
|---|---|
| BESS | Battery Energy Storage Systems |
| BLPC | Barbados Light & Power Company Limited |
| BNEF | BloombergNEF |
| BNEP | Barbados National Energy Policy |
| BCESEP | Barbados Clean Energy Storage and EV Policy |
| CAPEX | Capital expenditure |
| EMS | Energy Management System |
| EPC | Engineering, Procurement and Construction |
| EST | Energy Storage Tariff |
| ELPA | Electric Light and Power Act, 2013-21 |
| FCA | Fuel Clause Adjustment |
| FTCA 2020 | Fair Trading Commission Act, CAP. 326B, as amended |
| GoB | Government of Barbados |
| IPPs | Independent Power Producers |
| IRR | Internal Rate of Return |
| IRRP | Integrated Resource and Resiliency Plan |
| LCOS | Levelised Cost of Storage |
| MEB | Ministry of Energy and Business |
| PCS | Power Control System |
| PPA | Power Purchase Agreement |
| PV | Photovoltaic |
| RE | Renewable Energy |
| RPPA | Renewable Power Purchase Adjustment |
| RTE | Round trip efficiency |
| The Commission | The Fair Trading Commission |
| URA 2020 | Utilities Regulation Act CAP. 282, as amended |
| VRE | Variable renewable energy |
| WACC | Weighted Average Cost of Capital |

## SECTION 1 SUMMARY

The Government of Barbados (GoB) has set the country on a path to transition to an economy powered by 100% RE by 2030. There are indeed challenges to achieving this goal, as it requires the steady integration of RE resources into the electricity grid. So far, the Barbados energy sector has seen the installation of predominantly VRE resources, mainly solar PV. This and other intermittent resources such as wind power tend to introduce stability and sustainability issues into the operation of the grid, leading to the need for mitigation measures to be implemented. As a result, the GoB has identified energy storage as an appropriate means of mitigating the effects of these intermittent resources.

The Commission is empowered by its underpinning legislation to develop and implement reasonable, fair and transparent rates. The GoB's recommendations for energy storage point to the need to maximise a number of benefits inherent in the available technologies, such as enhanced grid resilience, reliability, and reduced greenhouse gas emissions. To effectively implement policy as required, the Commission has developed an EST framework for storage that utilizes a four (4) year pilot project aimed at gathering relevant data on the functioning of storage systems and their ability to provide services on the Barbados electricity grid. The pilot project will focus on the use of BESS of four (4), three (3) and two (2) hour durations, with a total allocated capacity of 50MW.

The Commission held a period of consultation from March 31 2023, to April 21 2023 and as customary, issued a consultation paper that sought comments from stakeholders, interested parties and the public in general on the most appropriate structure and quantum of tariffs for energy storage systems. Responses to the consultation are outlined and addressed in this Decision.

The Commission has determined the following tariffs and associated size categories:

**Table 1: Size Categories and EST Rates for a two (2) hour battery**

| Size Category | LCOS(BBD$/kWh) | LCOS(BBD$/kW-month) |
|---|---|---|
| Up to 25 kW | 0.675 | 56.78 |

**Table 2: Size Categories and EST Rates for a three (3) hour battery**

| Size Category | LCOS(BBD$/kWh) | LCOS(BBD$/kW-month) |
|---|---|---|
| > 25 kW - 1 MW | 0.404 | 33.95 |
| > 1 MW – 10 MW | 0.292 | 24.61 |

**Table 3: Size Categories and EST Rates for a four (4) hour battery**

| Size Category | LCOS(BBD$/kWh) | LCOS(BBD$/kW-month) |
|---|---|---|
| > 25 kW - 1 MW | 0.374 | 41.95 |
| > 1 MW – 10 MW | 0.270 | 30.34 |

Additionally, the Commission has determined that the monitoring and administrative framework for the EST shall comprise the following:

I. The pilot shall be for a duration of four (4) years total. The first two (2) years is expected to see the design, procurement, installation and connection of the BESS equipment. The remaining two (2) years covers the operation of the projects and collection of the relevant data to assess the performance and viability of the projects. Project participants whose applications and/or registrations are verified, shall receive the rate available at the date of verification that is the date at which the MEB communicated to the investor that the application is complete and accepted, upon their connection to the grid

for delivery of storage capacity and any associated services as required. The participants who are licensed during the pilot phase of the storage programme shall be eligible to receive associated tariffs for ten (10) years.

II. In order to receive the EST payment, projects must meet the "used and useful" criteria. This means that the project must be able to provide three (3) or more storage power services and two (2) or more voltage/reactive power services simultaneously or temporally, and actively deliver these services to the grid. These services required are peak shaving with renewables, renewable energy firming & ramping, renewable curtailment reduction, spinning reserve, frequency response, distribution hosting capacity control, voltage control and power factor control.

III. The BESS systems shall participate in the autonomous grid services or utility dispatch signal which on average, should add up to the power capacity of storage to prove to be "used and useful" or demonstrate that 365 cycles per year are utilized. The kWh capacity of the BESS should not fade more than 50% over ten (10) years and more than 5% per year based on 365 cycles per year of use.

IV. One key element of this EST pilot programme is the necessity for the framework to set out provisions via which the regulator may assess the performance and feasibility of the projects. This requires that performance monitoring be facilitated by comprehensive data collection and submission on a defined schedule to assess the efficiency and costs of the BESS during the pilot. Consequently, the Commission determines that participants in the pilot shall submit quarterly reports which summarize the data collected and provide insights into the project's progress, challenges, and outcomes. The aforementioned reports shall include, inter alia, operational data including energy storage capacity, discharge rates, metered kilowatt and kilowatt hours, state of charge, throughput, cycles, and time series data using any metrics as is relevant. Additionally, participants shall be required to complete annual

duration and power tests. This is where a check is done to ensure that the battery is able to perform as expected during the required operating time.

V. Where it is found that a battery's capacity has degraded more than 50% over (the ten (10) year contract, or more than 5% in any one given year), there shall be a true-up mechanism where payments made to projects on the basis of full capacity are refunded in proportion to the level of degradation.

VI. The BLPC and the project owners shall be required to retain all data generated during the pilot project. In addition, the Commission reserves the right to perform random checks on the batteries, as well as perform audits as necessary. The Commission shall prepare a final pilot project report at the end of the pilot, consolidating all the data, findings, and recommendations for stakeholders.

VII. The EST and associated framework shall be reviewed every two (2) years. However, the Commission reserves the right to conduct reviews on a more frequent basis should market conditions deem it prudent.

## SECTION 2 INTRODUCTION

### Background

1.Guided by the central theme of "Energy security and affordability through diversity and collaboration: establishing and maintaining a sustainable energy sector for Barbados", the Barbados' National Energy Policy ("BNEP") sets a clear trajectory for transforming the country's energy landscape.

2.The BNEP seeks to steer Barbados from a petroleum-dependent economy towards a cleaner and more sustainable future. The ultimate goal is to transition to a renewable energy ("RE") powered economy by 2030. Recognizing the unique challenges faced by a small island nation like Barbados, the policy emphasizes the crucial role of energy storage in mitigating the intermittency issues associated with variable renewable energy ("VRE") resources such as wind and solar power.

3.While the development and accessibility of these VRE resources hold tremendous potential for Barbados, their intermittent nature presents significant grid operation, stability, and sustainability challenges. The deployment of significant VRE resources requires careful planning and the implementation of adequate mitigation measures.

4.Storage emerges as the primary mechanism to address these challenges. By effectively utilizing energy storage, Barbados can ensure its RE sector's continued growth and reduce intermittency impacts. This approach not only enhances energy security but also contributes to the overall sustainability of the energy sector.

5.The Cabinet's approval of the storage policy, known as the Barbados Clean Energy Storage and EV Policy ("BCESEP"), provides the direction for the Fair Trading Commission ("Commission") in establishing fair and transparent rates for storage deployment on the grid.

6. The BCESEP aims to maximise the benefits of energy storage, including long-term cost reductions for ratepayers, enhanced grid resilience, reliability, and reduced greenhouse gas emissions. Grid stability and reliability are crucial to the success of the clean energy transition, and energy storage technologies play a vital role in providing necessary grid stability services. The BCESEP recommended the development of an EST for energy storage grid services utilizing pilot projects to aid in understanding the function of stacked services on the Barbados electricity grid.

7. The Integrated Resource and Resilience Plan ("IRRP") highlights the importance of gathering, monitoring, storing, and analysing high-granularity VRE production data throughout Barbados. By adopting a cautious approach and incorporating reserve dimensioning[1] outcomes, the study contributes to determining the required capacity for Battery Energy Storage Systems (BESS), reducing uncertainty and optimising investment costs and tariffs while ensuring supply security.

8. In accordance with the BNEP, BCESEP, and IRRP, Barbados aims to modernise its grid by deploying high levels of RE supported by adequate storage and other essential infrastructure and frameworks. This integrated approach is crucial to achieving the country's objectives for 2030 and establishing a sustainable energy sector for the future.

9. The consultation process focused on a subset of the BCESEP proposed projects as an initial step in developing the EST. The aim is to gather verifiable information to guide the complete storage rollout. The pilot projects covered in this stage include centralised storage operated by private storage suppliers, distributed storage at the sites of large RE suppliers, and small distributed storage solutions at households and other consumers.

[1] Refers to the accurate sizing of the required reserves for the grid.

10. The determination of the required storage capacity, in consultation with the Ministry of Energy and Business ("MEB") and the Barbados Light & Power Company Limited ("BLPC"), will define the initial phase of the EST programme and is set to run for four years, incorporating the three project types mentioned above.

**Energy Storage Tariff ("EST")**

11. The EST is a rate utilities pay to energy storage providers for capacity and services. It is a valuable policy instrument for advancing RE goals, promoting energy independence, supply security, economic competitiveness, and environmental sustainability.

12. An EST is vital in developing and deploying storage to support RE integration. It can send targeted signals to the market, such as developer incentives, to manage investment. However, if the EST design lacks appropriate considerations, it may be unable to garner developers' and investors' support and thus cause market distortions.

13. The EST can be determined administratively or through competitive procurement, where storage capacity is acquired through auctions. The rate is determined based on financial and operational inputs, allowing for investment recovery and a reasonable rate of return.

14. In the case of the proposed EST, it aims to provide recovery and a reasonable return for the recommended pilots providing grid support. Lessons learned from the pilot programme will inform the design of future programmes.

15. The Commission conducted a customer impact assessment to understand the cost-effectiveness of the tariffs and estimate their likely impact on electricity prices.

16. Implementing an EST is expected to enable Barbados to increase its RE deployment, considering the current and anticipated impacts on the grid from the growing penetration of VRE.

**Considerations for EST**

17. Several key considerations were examined in the design of the EST. These revolved around having an understanding of the costs associated with energy storage, the trends in cost reduction over time, and the implications for payments made to developers and benefits for consumers.

18. Additionally, using an EST calculation tool, the parameters involved in rate determination and the criteria for determining capacity payments played crucial roles in ensuring the fairness and effectiveness of the tariff.

19. By carefully contemplating these considerations, the Commission developed an EST framework that fosters cost-effectiveness, supports the growth of energy storage, and maximises the benefits for all involved parties. These considerations include the following:

    a) EST calculation tool and calculation parameters: The Commission utilises an EST calculation tool to consider project types, connections, and services when determining the rates. The rates are calculated based on the Levelised Cost of Storage ("LCOS"), taking into account various parameters, including storage model components, project components, and financial costs.

    b) Impact of costs on payments: Higher total capital expenditure ("CAPEX") and operational costs for storage lead to a higher LCOS and capacity payment made to the developer. There is a positive relationship between the total CAPEX and operational costs of storage and the expected payment made to the developer, i.e. when costs increase, so does the expected payment to the developer.

c) Cost reduction trends: Historically, the cost of energy storage has been decreasing over the years, with a significant decline in LCOS and Battery Energy Storage System ("BESS") capital expenditure CAPEX costs. These cost reductions suggest a general decrease in LCOS over the long term.

d) Consumer benefit from cost reduction: As the costs decrease, the LCOS and capacity payments also decrease, resulting in benefits for the consumer. The anticipated decrease in BESS CAPEX costs will contribute to a lower payment made to the developer which ultimately results in service provision at a lower cost.

e) Determining capacity payment: The capacity payment will depend on whether the energy storage system is categorised as "used and useful." Systems falling under this category must provide multiple power services and voltage/reactive power services simultaneously or temporally. Only systems meeting these criteria will receive the determined monthly tariff payments. Autonomous BESS services that don't require a utility signal can be deemed "used and useful" without waiting for a software dispatch layer from the utility.

20. The consultation investigated the setting of EST for technology-neutral metered energy storage, independent of the size and location of the storage. It was considered prudent to investigate the following features:
    1) The minimisation of investor and financing risks to allow for low-risk debt financing and low-risk returns on investment;
    2) A degression schedule to reflect the declining cost of production over time and to incentivise innovation;
    3) Inflation adjustments;
    4) A time of delivery differentiator;
    5) Bonus payments for community ownership;
    6) Guaranteed ten (10) year ESTs; and

7) The broadest possible eligibility of all appropriate RE technologies of all sizes and of all domestic investors to encourage democratisation of the energy landscape.

## SECTION 3 LEGISLATIVE FRAMEWORK

**The Commission's authority to set rates and the EST**

21. The Commission is authorized, pursuant to the Fair Trading Commission Act (FTCA) and the Utilities Regulation Act (URA), to set the rates to be charged by service providers and renewable energy producers. By virtue of the definition of "renewable energy producer" contained in the FTCA and the URA (more particularly outlined below), the Commission's rate-setting authority extends to RE producers who, in addition to producing RE-generated electricity, also store such electricity.

Rates

22. Section 2 of both the FTCA and the URA define "rates" as follows:

*"" rates" include:*

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

Renewable energy producer

23. The FTCA and the URA define "renewable energy producer" to include RE producers who also store RE-generated electricity. Section 2 of the FTCA and Section 24A of the URA both state that:

*""renewable energy producer" includes a generator, distributor or person who* stores *and supplies electricity generated from a renewable energy resource for sale to the public grid"*

**Authority to set rates for renewable energy producers**

24. The Commission's authority to set rates extends to the setting of rates to be charged by RE producers who store RE-generated electricity. More specifically, Section 4 of the FTCA empowers the Commission to set and monitor rates to be charged by RE producers and states, inter alia, that:

*"(1) The functions of the Commission are to enforce the Utilities Regulation Act…*

*(2) The Commission shall carry out its functions in such a manner as to*

*(a) promote efficiency and competitiveness amongst; and*

*(b) improve the standards of service and quality of goods and services supplied by service providers, renewable energy producers and business enterprises over which it has jurisdiction*

*(3) The Commission shall, in the performance of its functions and in pursuance of the objectives set out in subsections (1) and (2),*

- ***a) establish principles for arriving at the rates to be charged by service providers and renewable energy producers;***
- ***b) set the maximum rates to be charged by service providers and renewable energy producers;***
- ***c) monitor the rates charged by service providers and renewable energy producers; ...***
- *d) …."*

**The Commission's energy storage functions**

25. Section 24B of the URA expands upon the Commission's specific functions with respect to energy storage. Section 24B (4) states as follows:

*"(4) The functions of the Commission, in relation to a renewable energy producer storing energy that is produced by its plant, are to:*

*a) set the maximum rates to be charged; and*

*b) establish guidelines for interconnection."*

*26.* Section 24B (5) of the URA states:

*"(5) In performing its functions under subsections (1) and (4), the Commission shall request a renewable energy producer to provide the Commission with information relating to its operations, finances or such other information as the Commission may consider necessary to perform its functions."*

**The Electric Light and Power Act CAP 278 (ELPA) – Storage licences**

27. Pursuant to Section 3(1) of the ELPA, RE producers may only store energy to be supplied to the public grid upon obtaining approval for a storage licence.

28. Section 2 of the ELPA states that "*store*", in relation to electricity, means "*to operate a storage system*" while "*storage system*" is defined to mean "*a system, mechanism or device for the conversion of electricity into a form of energy which can be kept in reserve, the keeping of that energy and the subsequent reconversion of that energy into electrical energy in a controllable manner*".

29. The approval of storage licences, however, is not a function of the Commission and RE producers will be required to apply for approval from the Minister to whom responsibility for energy is assigned for a storage licence. The ELPA outlines the requirements for making an application for such a licence.

30. Ultimately, the Commission considers that, by virtue of the provisions of the FTCA and the URA, the Commission is empowered to set the EST and carry out the necessary ancillary functions relative to the setting of such a rate, in accordance with the legislation.

## SECTION 4 SUBMISSIONS FROM RESPONDENTS

31. During the consultation process, gathering stakeholder feedback proved invaluable in informing the development of storage rates and its enabling framework. Stakeholder involvement ensured that the decision-making process remained inclusive, transparent, and accountable.

32. The Commission received eleven (11) submissions, of which ten (10) were substantial. This section will summarise the submissions by the various question groupings provided in the consultation paper. The following is the list of stakeholders who submitted responses to the consultation:

(a) Arcalis Energy
(b) Barbados Renewable Energy Association
(c) Blue Circle Energy
(d) Emera Caribbean Renewables Limited
(e) Green Charge Capital Inc.
(f) HDF Energy
(g) Iken Renewables Group Inc.
(h) North Beach Management Inc.
(i) Solar Genesis
(j) Soleco Energy
(k) Williams Caribbean Capital

**Suitability of Proposed Considerations**

33. Stakeholders universally supported and endorsed the proposed EST considerations, recognizing their solid and sound nature. They opined that the considerations are generally appropriate, comprehensive, and suitable for developing an effective and fair EST framework. These considerations reflect the stakeholders' consensus on the importance of considering costs, trends, and calculation methodologies to support the growth of energy storage in Barbados.

34. Some stakeholders expressed concerns about the applicability of the LCOS data referenced in the consultation paper, suggesting that it may not accurately represent the market conditions in Barbados over the next twelve (12) to twenty-four (24) months, given the inherent uncertainties.

35. Stakeholders emphasized that the LCOS for Barbados is significantly higher (4 to 5 times) than the average figures cited in the Bloomberg report. They highlighted factors such as scale, market experience, strategic value of the Caribbean market, retail electricity costs, and equipment duties and taxes that impact the LCOS for the region.

36. Stakeholders stressed the need for a clear and well-defined definition of "used and useful" when determining the EST, emphasizing the importance of clarity and consistency in applying this criteria.

37. While stakeholders found the considerations mentioned to be reasonable, they pointed out that the paper emphasizes technology neutrality while acknowledging that different technology types impact the parameters involved in the EST calculation. They suggested that further attention should be given to this aspect.

38. Some stakeholders recommended a limited selection of mature technologies for the pilot projects, ensuring economic viability and the ability to meet the "used and useful" criteria. They also advocated for significant input from the utility on performance criteria to ensure the selection of appropriate technologies.

39. Stakeholders supported the EST calculation tool and parameters, considering them reasonable and practical. They highlighted the importance of the specific pilot projects in refining the methodology for determining the EST across different storage technologies.

40. The collective feedback from stakeholders indicated general agreement and support for the proposed considerations, with some suggestions for further

clarification and adjustments to ensure accuracy and effectiveness in determining the EST for various storage technologies in the sector.

***The Commission's Position***

41. The Commission recognises the general support of the proposed considerations. This suggests that the sector is of the opinion that the Commission has considered adequate factors in determining a storage rate and framework for Barbados in an effort to meet the BNEP goals.

42. Explicitly addressing the concern about the applicability of the referenced LCOS data in the consultation paper, the Commission's analysis of the referenced data and BESS cost estimates provided by respondents to a call for storage cost data in the sector has shown a close comparison. Based on BloombergNEF ("BNEF")'s 2022 Energy Storage Cost Survey published in December 2022, the cost of turnkey energy storage systems increased by 27% in 2023, with prices ranging from BBD $428.2/kWh to BBD $1,1161.5/kWh. If CAPEX is increased by 20%, (estimated to represent 5% import duty and 17.5% VAT of duties + cost), then the BNEF values are close to the cost estimates provided by the local sector. However, RE and energy efficiency systems are exempt from import duties and VAT pursuant to the Customs Tariff (Amendment) (No. 9) Order 2009 [2]. The Commission notes that the cost estimates provided by local investors were only higher due to their inclusion of the 20% duties. As such, the Commission considers its assumptions to be generally in alignment with local cost estimates.

43. The Commission also recognises the recommendation to limit the selection of options to mature technologies for the pilot project to ensure economic viability and the ability to meet the "used and useful" criteria. Despite the storage policy stipulating that storage should be technology agnostic, the Commission has considered that for the pilot projects, a limitation must be made to ensure simplicity as the Commission and the sector gather greater experience and

[2] Customs Tariff (Amendment) (No. 9) Order 2009

knowledge about storage. This is also supported by the fact that all of the data used in the determination is for BESSs.

44. The Commission therefore determines that the pilot projects will be limited to BESSs in this first instance.

**Mitigation Measures to Manage Risks**

45. Stakeholders provided various suggestions for mitigation measures to manage risks associated with the EST programme in Barbados. These are as follows:

(a) Regular review of the EST is recommended to ensure its effectiveness and alignment with evolving market conditions and technological advancements.

(b) The establishment of a centralised and distributed battery storage option to enhance system flexibility and resilience.

(c) The setting of a maximum energy bill for many Barbados consumers, providing cost stability and affordability.

(d) Co-locating BESSs with RE projects and connecting them behind the meter. This would enable IPPs to avoid purchasing energy from the utility at retail prices to charge their batteries, reducing costs.

(e) Validating the financial viability of the EST programme with the banking sector at regular intervals to ensure ongoing support and investment.

(f) Providing advance notice of any changes to the EST framework would allow stakeholders to anticipate and adjust accordingly.

(g) Addressing issues with the utility to ensure the smooth integration and operation of energy storage systems within the grid infrastructure.

(h) Agility in the EST programme. A flexible and adaptable approach is necessary to meet the diverse needs of Barbados.

(i) Prioritising mature technologies for deployment to mitigate risks associated with emerging or unproven technologies.

(j) Adopting minimum international standards for managing BESSs to ensure battery cells' performance, reliability, and safety.

(k) Utility owning and managing the energy storage systems and allowing IPPs to focus solely on RE generation while leveraging the utility's grid management expertise.

(l) The EST should not be overly generous to de-risk investments, as risk is inherent, and investors should not expect an excessively generous return on investment.

(m) Establishing a central operating and maintenance facility to mitigate operational risks associated with constant oversight and maintenance of energy storage systems.

(n) Limiting the cycle frequency, managing the depth of discharge, and paying a premium for operating the systems outside defined limits to help cover increased maintenance costs.

***The Commission's Position***

46. In considering the suggestions, the Commission notes that some would be better suited for a later full rollout and can be excluded from the initial EST offering in the pilot programme as there is a requirement for further information gathered through the pilot programme to determine their appropriate applicability in the EST framework.

47. The purpose of the pilot is to aid in reviewing and assessing the framework and rates to ensure their effectiveness and inform the process for further storage development.

48. The Commission determines that having a well-defined framework that includes clarity of terms such as "used and useful" is critical. It should also include the standards that are required to operate the energy storage systems. For this reason, the Commission requires the adoption of minimum international standards for managing BESSs to ensure performance, reliability and safety, as this will allow for the acquisition of relevant data from the pilot.

**Community-based Energy Storage Initiatives**

49. When it comes to the question of whether community-based energy storage initiatives should be considered and at what rate, stakeholders provided different perspectives. Some stakeholders supported including such initiatives, suggesting a 10% premium rate similar to the FIT programme. However, they emphasized the need for a clear and proper definition of community-based energy storage.

50. Another stakeholder raised practical concerns, stating that community-based storage may not be suitable due to the increased sophistication, hands-on involvement, and accountability required from owners compared to solar PV projects. According to them, Barbados' storage needs would be better served by incentivizing larger and strategically located storage projects that can provide grid services.

***The Commission's Position***

51. The Commission determines that since the pilot programme is meant to allow for data collection and assessing the feasibility, efficiency, effectiveness and viability of the system, it would not be prudent to include a community-based component at this stage. The community-based component of the Commission's Feed-in-Tariff (FIT) programme still has a number of logistical and

administrative challenges and the Commission is of the view that introducing similar complications into this pilot programme would be imprudent. Such an initiative would be more appropriately included within the full rollout of the programme, particularly after the aforementioned challenges have been addressed.

**Pilot Project Roll-out**

52. To maximise the benefits of the pilot projects, stakeholders emphasised the importance of monitoring, measurement, and transparent reporting to assess project performance accurately. Additionally, implementing a fully functional energy management system is seen as essential, allowing the projects to be built in tandem with developing a 100% RE grid architecture. This approach would enable a better understanding of how stacked services can operate within a modern energy system.

53. Expanding the pilot programme to include a communication sub-pilot for utility-connected SCADA systems was recommended to facilitate effective performance and control. By fast-tracking mature projects and integrating them with new and existing RE generators, stakeholders aim to enhance communication capabilities and optimise system performance.

54. To ensure widespread distribution, stakeholders proposed a limited capacity allocation per feeder for each category of distributed resources. This approach would enable the pilot projects to be spread across different locations, promoting a more comprehensive assessment of their benefits and impacts.

55. Collaboration with the utility is highlighted as essential for effective project design and management. By involving the utility, stakeholders opined that there would be a better understanding of how communication, control, and management systems can be utilised to optimise project outcomes. Leveraging existing data from the utility's 5MW BESS is seen as a valuable starting point for data collection and analysis.

56. Overall, stakeholders emphasised the integration of energy storage with existing RE systems as a priority rather than establishing standalone storage. This integrated approach is considered more efficient and beneficial to the grid, ensuring a cohesive and optimised energy infrastructure.

***The Commission's Position***

57. The Commission contends that a communication pilot for the utility-connected SCADA systems would enhance the utility's function and operation while managing the grid and optimising its performance. It is noted that this also is critical for the utility and the Commission as experience in how the stacked services function on the grid is gained, as that is the primary reason for the EST pilot programme. However, the Commission opines that even though critical, such a project can be dealt with outside of the EST framework. The Commission does not consider the time needed to design such a pilot within this one will benefit the process enough to warrant a further delay. The communication pilot can be developed following the issuance of the Commission's decision on the EST and can be rolled out by the time storage is on the ground and operational.

58. The Commission determines that a communication pilot shall not be included at this stage for the aforementioned reasons. Such a project can be designed subsequently to support the storage development.

59. The Commission notes that integrating storage with RE generation, compared to a standalone option, would allow the storage to utilise clean energy first. However, to better understand the use of storage, the Commission must also observe the standalone options stipulated by the storage policy to create a robust future EST.

**Appropriateness of Overall Capacity Payments for Stacked Services**

60. The appropriateness of an overall capacity payment as part of the EST framework has garnered support from stakeholders. They highlighted that

capacity payments provide a more straightforward and manageable approach to storage tariffs, allowing for clear payments based on capacity provision, dispatchability, duration, and reliability. This approach combines various factors to determine the total $/kWh per project for the EST.

61. While some stakeholders acknowledged that determining payments for individual services might seem complex, especially at higher volumes, using an energy exchange could simplify the process. The consensus is that capacity payments are a suitable and practical approach for managing storage tariffs.

62. Designing an encompassing capacity-payment-based EST is acknowledged as challenging. However, stakeholders proposed allowing independent power producers (IPPs) to determine the services they wish to stack and then develop the energy storage system (BESS) and project economics accordingly. This flexible approach addresses investor uncertainty and enables the customisation of services based on specific project requirements.

63. The importance of accumulating verifiable data through pilot studies is emphasised, as it will guide the future development of rates. Stakeholders agreed that paying for overall capacity, with mechanisms to address availability and risk allocation, is the most appropriate way to remunerate BESS investors, simplifying the utility's tasks and providing a more straightforward framework for investment.

64. While stakeholders suggested that residential-scale projects may require a simplified list of services compared to commercial or utility-scale projects, there is general agreement that an overall capacity payment aligns with the current stage of the EST programme. Considering the uncertainty surrounding cycle frequency and the potential impact on pricing, an overall payment based on capacity is viewed as a prudent choice.

*The Commission's Position*

65. The Commission notes that an energy exchange proposed by one of the stakeholders may have several benefits, including reflecting changes in market conditions at a higher frequency and allowing layers of data gathering and analysis. However, the Commission contends that an energy exchange would suit a more modern grid and should be considered later as the utility modernises the grid.

66. The Commission also notes the suggestion to have the IPPs determine the services they wish to stack. The Commission determines that this should also be a consideration for the full rollout of the EST after the Commission and the utility have understood the benefits and impacts of stacked services and how they function within the Barbados energy sector. This also adds additional complexity in that there is no certainty that IPPs will stick to the services they identified. The Commission determines that this suggestion shall not be included in the pilot programme.

67. The Commission determines that an overall capacity payment is the best option at this stage and shall be utilised for the pilot.

**Expected Rate of Return**

68. The general view of the stakeholders was that investors will expect a rate of return in the high teens up to about 20%, given the new market with developing supply chains, higher (than PV) operating risks and risks associated with emerging technologies.

69. Stakeholder responses regarding whether the rate of return should vary based on the risks involved with different technology types were varied. While some stakeholders supported considering different rates of return to reflect varying risk profiles, others had different perspectives.

70. A few stakeholders advocated for allowing varying rates of return, recognizing that different technologies may entail different levels of risk. They suggested that if technical diversity is desired, the EST should be open to accommodating differing risk profiles and corresponding rates of return.

71. On the other hand, some stakeholders argued against incentivizing specific technologies unless a critical benefit is associated with a particular technology. They emphasised that the EST's objective is to minimize risks for the advancement of storage, and selecting mature technologies coupled with minimum international standards can help achieve this goal without introducing varying degrees of risk.

72. While there are differing opinions, some stakeholders expressed the view that varying rates of return should be considered to align with the different degrees of risks involved with varying types of technology. However, there was also an opinion that the EST should prioritize lower-risk and cost-effective technologies that provide significant value to the grid compared to alternatives.

***The Commission's Position***

73. The Commission notes the submissions regarding the expected rate ranging from the high teens up to approximately 20% owing to perceived higher risks but believes that these risks can be addressed and managed, as highlighted by suggestions made by respondents. The Commission contends that the rate of return should reflect the energy sector in Barbados, where the form of storage tariff currently being contemplated is analogous to the existing FIT programme. This is characterized by stable, predictable, long term payments to investors and thus a lower quantum of risk. The Commission therefore determines that the rate shall be structured to consider this as well as what is applicable in the regional and international markets for storage systems.

**Contract Period of EST and Timeframe to Recover Investment**

74. Stakeholder responses regarding the EST contract period varied. Some stakeholders advocated for considering the varied lifespans of energy storage technologies, suggesting that the EST should have a minimum duration of ten (10) years to provide stability and support long-term investments. On the other hand, some agreed with the technology-agnostic approach, advocating for standardised contract durations regardless of the type of energy storage technology. In contrast, one stakeholder stated that the EST should not be technology agnostic, which supports why the contract period should vary.

75. Another perspective suggested that the contract period should not directly vary based on technology type but rather consider the type of service being delivered and the scale of the system. This approach aims to future-proof the EST, allowing storage IPPs to innovate and adapt to emerging technologies.

76. Stakeholders suggested that the recovery time on investment will depend on how the energy storage is used. However, generally they agreed that investors should expect to recover between five (5) to seven (7) years.

***The Commission's Position***

77. Generally, the policy recommends that the choice of technology be agnostic. However as previously mentioned, the Commission considers it prudent for this pilot project to focus on a mature technology which is widely used and understood. This ensures simplicity as the sector gains in knowledge and experience with this process. Consequently the Commission determines that the pilot project shall utilize BESS and contract durations shall be standardised for this technology. The Commission understands that as other technology options (with far longer lifespans) become commercially viable, this matter can be reassessed in a subsequent review.

**EST Guarantee Period**

78. Stakeholder responses regarding whether the EST should be guaranteed for the full lifetime of the energy storage asset differed. One viewpoint asserted that providing a guarantee for the full lifetime of the asset is crucial for investor confidence and project certainty. It was argued that longer-term agreements would reduce risks, ensure the feasibility of projects, and make the EST rates more acceptable.

79. Another perspective suggested that utilising an energy exchange can offer a more lucrative and expedited return on investment, potentially negating the need for a long-term EST guarantee. This viewpoint emphasises the potential benefits of leveraging an energy exchange platform for storage asset monetisation.

80. However, stakeholders also had uncertainty regarding the need for a long-term EST guarantee. This perspective acknowledges that energy storage technologies are still relatively immature compared to RE technologies. Therefore, the pilot programme's outcomes can provide valuable insights into the viability and performance of energy storage systems.

***The Commission's Position***

81. In noting the submissions and given the stage of development of the EST (pilot), the Commission determines that EST be fixed and guaranteed over the standardised contract period. The Commission considers that an energy exchange would not be optimal at this stage and should be explored in the future as the grid modernises.

**EST Review**

82. Stakeholder responses regarding the frequency of any review of the EST were generally consistent. Stakeholders largely agreed that a review every two (2) years would be beneficial and appropriate. One stakeholder indicated that the

review should begin at the end of eighteen (18) months to allow time for the Commission's analysis and issuance of the new EST, giving an allowance for a three (3) month notice of any change, prior to the effective date of the new rates.

***The Commission's Position***

83. The Commission agrees with the need for frequent review of the EST to ensure the rates reflect current market conditions and storage costs. Therefore, the Commission determines that the EST shall be reviewed every two (2) years with the option to review more frequently should market conditions or other circumstances deem it prudent to do so.

**Degression Schedule**

84. Stakeholder responses regarding including a degression schedule in the EST were generally consistent. Stakeholders all agreed that a degression schedule should be excluded because, once installed, the owner of the BESS has little control over the major factors that influence their costs.

***The Commission's Position***

85. The Commission determines that a degression schedule is unnecessary as most of the costs are known and considered at inception. However, consideration shall be given to reductions in capacity payments to projects in proportion to the level of degradation in their batteries, if any.

**Capacity Bands**

86. Stakeholder responses regarding the consideration for the use of capacity bands for the EST were generally consistent. Stakeholders largely agreed that the capacity bands used for RE generation are generally appropriate and sufficiently granular for an EST. They also stated that given economies of scale and the associated benefits, the use of bands around 20 MW and 50 MW should be considered. In contrast, one stakeholder stated that the 'band' approach

should be removed and replaced with a continuum formula or other approach instead.

87. One stakeholder recommended bands specifically for the residential level, namely; up to 10 kWh, 11 – 50 kWh, and 51 – 100 kWh.

***The Commission's Position***

88. The Commission notes the bands recommended for the residential level and agrees with utilising bands for storage capacities similar to those used for the FIT, where practical. Therefore, the Commission determines that the appropriate capacity bands for BESSs shall be as follows:
    (a) Up to 25 kW (residential)
    (b) > 25 kW – 1 MW
    (c) > 1 – 10 MW

**EST Levy**

89. Stakeholder responses regarding how often any EST levy charged to customers should be amended and how it should be assessed were generally consistent. Stakeholders largely agreed that an EST levy should not be considered as the Renewable Power Purchase Adjustment (RPPA) and the Clean Energy Transition Rider (CETR) should capture the costs. A customer levy for energy storage is not wise, justified or necessary.

***The Commission's Position***

90. The Commission determines that it would be appropriate to account for costs associated with the BESS in the FCA or any mechanism that facilitates direct recovery of fuel or RE costs.

**Responsibility for Dispatch**

91. Stakeholders had varied opinions regarding the responsibility for dispatching services in the EST context. Some stakeholders believed that if the decision-

making process is transparent, equitable, and fair, it does not matter who takes on this responsibility.

92. They argued that the utility should be limited to managing and upgrading the grid, avoiding conflicts of interest as a generator and grid operator. Others proposed that a third party, separate from the utility, should be responsible for the energy management function. One stakeholder posited that the third party should also control the energy exchange (which they recommended should be implemented).

93. However, stakeholders also advocated for the utility to be the sole operator of energy storage and responsible for grid operation and management. They emphasised the utility's access to crucial information about the grid and its capability to dispatch services effectively.

***The Commission's Position***

94. Given the relatively small size of the Barbados electricity grid, the Commission opines that using a third party for dispatch will incur additional costs. The Commission will be guided by the dispatch policy.

**Metered Storage**

95. Stakeholders had different views on the proposal's appropriateness to have storage metered separately or if an alternative option would be more suitable. Some stakeholders supported the proposal, acknowledging that it would require incorporating new technologies such as smart meters, demand management, peak shaving technologies, and dispatch control into the grid.

96. However, one stakeholder expressed concern about the administrative and operational complexities arising from separately metering energy storage systems, particularly when co-located with RE generation. They argued for metering and monitoring storage and RE together for a holistic evaluation of their "used and useful" qualification.

97. Some stakeholders recommended using a bidirectional meter to meter the BESS, suggesting this as a more practical approach.

98. Concerns were raised about the impact on residents with existing RE systems, as they would need to accommodate an additional meter, bringing it to three meters, if storage is separately metered.

99. In addition to the metering question, one stakeholder expressed challenges with the capacity payment model proposed for the EST included throughout their responses.

***The Commission's Position***

100. The Commission acknowledges the submissions from the respondents. However, given that the main objective of the pilot project is to gather data to assess the viability of energy storage within the real world context of Barbados' energy sector, the Commission determines that BESS projects shall be metered separately to allow for effective collection of specific data in order to fulfil the stated objective.

**Tariff Methodology**

101. Some stakeholders argued that the same methodology should be applied to all pilots, emphasizing consistency and fairness across projects. They opined that using a frequently updated FIT methodology may be the most suitable approach. They highlighted the importance of speed in project execution.

102. On the other hand, some stakeholders expressed concerns about competitive procurement, suggesting that it could slow down project development. However, others noted that competitive procurement may offer benefits, particularly at larger scales.

103. Two stakeholders advocated for the utility to own and operate the storage systems, stating that this approach would maximize efficiency, minimize costs, and ensure a reliable grid outcome.

104. Additionally, one stakeholder explicitly stated that a FIT methodology is the most appropriate for the residential pilot, further supporting the use of this approach.

***The Commission's Position***

105. The Commission opines that the use of an administratively determined tariff in the vein of the FIT offers greater control and will allow ease of management of storage rollout. The EST is designed in alignment with a FIT methodology. The Commission considers in appropriate for this pilot project as it is easier to administer and offer greater control. These are desirable characteristics given that the storage market is currently in its infancy. Consequently, the Commission determines that the FIT methodology shall be used for the pilot programme.

## SECTION 5 EST FRAMEWORK DESIGN AND ASSUMPTIONS

106. The Commission determines that the EST shall be a fixed rate tariff with a ten (10) year duration. The Commission considers that a fixed rate with a ten (10) year duration is the optimal way to attract long-term financing at the least possible cost, resulting in the quick uptake of energy storage allocation, and in turn facilitating further RE deployment. The EST shall also be differentiated by size to reflect economies of scale, but not differentiated by technology, as BESS will be used in the pilot. The FIT methodology will provide predictability to the emerging market.

**Table 4: Key EST Framework Design**

| EST Policy Element | BESS Storage up to and including 10 MW |
|---|---|
| Proposed Effective Date | X/X/202X |
| Rate: Fixed, Tiered or Variable Options | Fixed |
| Rate: Differentiated by Technology | No |
| Rate: Differentiated by Size | Yes |
| Tariff Duration | 10 years |
| Administratively-Determined or Competitively-Bid | Administratively-Determined |
| Presumed Off-taker | BLPC |
| Quantity Covered by EST | 100% of capacity |
| Periodic Review of Rates and MW Allocation | Biennial |

107. The costs and input assumptions for BESS projects up to and including 10 MW were utilised in the determination of the EST. All values are expressed in Barbados dollars unless expressly stated otherwise.

## Installed Cost, Operating Cost, Input Assumptions & Rates

108. Tables 5, 6 and 7, below, set out the assumptions of capital costs used in the model from which the rates were derived. For the four (4) hour grid scale battery, i.e. 1MW and above, CAPEX of USD $336/kWh is considered and is based on 2024-year cost from the latest 2023 BloombergNEF Energy Storage Outlook. For residential, i.e., up to 25kW, CAPEX considered is USD $851.85/kWh based on the latest Tesla Powerwall costs. This is 153.5% over BNEF 2024 costs. A two (2) hour duration battery is considered for residential. For above 25kW and up to and including 1MW, for four (4) hour batteries, CAPEX considered is USD $469/kWh based on the latest Lazard's Report (LCOS V8.0). This is 63.8% over BNEF 2024 cost. A fixed OPEX of USD $6/kW per year is assumed for all the EST calculations. Data obtained from local project owners was also considered to ensure that any cost differences attributable to Barbados' island location were accounted for. It also excludes import duties and VAT due to an exemption of these fees implemented by the GoB for inputs into RE and energy efficient systems, including "Solar photovoltaic systems (solar electric systems including inverters, charge controllers and batteries), solar lights, solar radios[3]". Additionally, the recommended rates based on the LCOS are included for each size category.

**Table 5: Assumptions of Input Costs and EST Rates for a two (2) hour battery**

| Size Category | CAPEX(BBD$/kWh) | LCOS(BBD$/kWh) | LCOS(BBD$/kW-month) |
|---|---|---|---|
| Up to 25 kW | 1,720.7 | 0.675 | 56.78 |

[3] Division of Energy and Telecommunications Prime Minister's Office Government of Barbados, *Renewable Energy and Energy Efficiency Fiscal Incentives Booklet for Individuals and Companies,* Division of Energy and Telecommunications, 2017

**Table 6: Assumptions of Inputs Costs and EST Rates for a three (3) hour battery**

| Size Category | CAPEX(BBD$/kWh) | LCOS(BBD$/kWh) | LCOS(BBD$/kW-month) |
|---|---|---|---|
| >25 kW – 1 MW | 1,016.5 | 0.404 | 33.95 |
| > 1 MW – 10 MW | 728.2 | 0.292 | 24.61 |

**Table 7: Assumptions of Inputs Costs and EST Rates for a four (4) hour battery**

| Size Category | CAPEX(BBD$/kWh) | LCOS(BBD$/kWh) | LCOS(BBD$/kW-month) |
|---|---|---|---|
| >25 kW - 1 MW | 947.4 | 0.374 | 41.95 |
| > 1 MW – 10 MW | 678.7 | 0.270 | 30.34 |

ESTs are evaluated considering lithium-ion BESS with round trip efficiency of 85% and operation of 365 cycles per year. The BESS is expected to do 365 cycles per year as this aligns with typical warranty conditions and long-term contracts offered by BESS manufacturers.

## 4.2: Capacity Allocation

109. The Commission notes that the intent of the BCESEP is to establish a pilot programme, the objective of which is to assess the feasibility of energy storage within the Barbados energy sector. As such the capacity allocated to the pilot was determined based on the prevailing policy. The BLPC recognises the impact of RE deployment thus far on the grid and posits that the installation of adequate battery storage capacity of 4-hr duration would provide appropriate mitigation, especially in the case of peak hour production. The BLPC also recognises the capacity limits as set out in the IRRP as a constraint. The IRRP sets out the maximum capacity for four (4) hour battery storage for 2022 to 2024 as 90 MW, and 50 MW for three (3) hour storage for the same period. Given the aforementioned policy direction, the Commission determines that capacity allocation for this pilot is 50MW with any combination of two (2), three (3) and

four (4) hour battery durations. The Commission notes that industry trends indicate that residential battery storage is predominantly of a two (2) hour duration as opposed to three (3) or (4) hour duration. This is because it has been found that batteries with greater than two (2) hours duration tend to be cost prohibitive for residential customers.

**Eligibility**

110. The Commission asserts that to align with the goal of democratising the sector, the programme needs to be available as widely as possible. In order to be eligible for the pilot programme, investors must submit the relevant license application to the Ministry responsible for energy. This applies to storage at all capacities.

**EST Duration and Pricing Structure**

111. The Commission determines a duration of ten (10) years for the EST. The structure would see investors receiving payments based on the installed capacity of their storage systems.

**Storage Model Details including Financing and Other Assumptions**

112.

**Table 8: Financial and other general input assumptions**

| Inputs/Assumptions | Value |
|---|---|
| Project | |
| Pilot Project Start Year (COD) | 2024 |
| Analysis Duration (Years) | 4 |
| Contract Duration (Years) | 10 |
| Financial | |
| Target IRR | 8% |
| Lending Rate | 5% |
| Storage power services | Peak Shaving with Renewables, Renewable Energy Firming & Ramping, Renewable Curtailment Reduction, Spinning Reserve, Frequency Response, Distribution Hosting Capacity Control |
| Voltage/reactive power services | Voltage Control, Power Factor Control |
| Payment Basis | Only Capacity |

The target IRR of 8% is based on the characteristics of the Barbados market and its inherent differences from a market such as the United States of America, which could be classified as a merchant market. In such a market, investors would expect double digit IRRs due to the inherent risk levels. In the Barbados market, the structure contemplates the offer of secure tariffs to investors over the long term, which are then passed on to ratepayers. As such, the structure and risk profile are more akin to those of a generation asset or a utility company. Thus, the Commission determines that the applicable rate of return for projects in the pilot shall be 8%. As it relates to the lending rate, the Commission determines that 5% is appropriate based on its investigation of currently available business and corporate lending rates from local commercial banks.

**Customer Impact**

The Commission has estimated the impact of the procurement of battery systems on the customers using following assumptions:

These assumptions are as follows:

1) The cost of the various storage solutions are paid up front and amortized over a ten (10) year period at 8%.
2) The cost of the battery is being used as a proxy for the value of the EST paid on a monthly basis.
3) Cost of fuel in the international market is consistent with March 2023 levels.
4) For simplicity, the FCA is not disaggregated in these scenarios.
5) It is assumed that the total investment includes the cost of 2 hour batteries at residential level.

Using these assumptions, an estimated monthly EST and draw down from the battery is applied to the FCA for the months of January 2023 to May 2023 (actual data) to determine what the FCA would be using the assumptions listed.

Using 4 hour batteries, the average increase in FCA is estimated at 1.96% over the five months. Using 3 hour batteries, there is an average 1.5% increase in FCA using the five month period.

**Table 9 - 4 hour Storage**

| FCA | Jan-23 $/kwh | Feb-23 $/kwh | Mar-23 $/kwh | Apr-23 $/kwh | May-23 $/kwh |
|---|---|---|---|---|---|
| **Before Storage** | 0.44979 | 0.45675 | 0.47586 | 0.40478 | 0.42689 |
| **After Storage** | 0.45740 | 0.46410 | 0.48242 | 0.41612 | 0.43686 |
| **% Difference** | 1.69% | 1.61% | 1.38% | 2.80% | 2.33% |

**Table 10 – 3 hour Storage**

| FCA | Jan-23 $/kwh | Feb-23 $/kwh | Mar-23 $/kwh | Apr-23 $/kwh | May-23 $/kwh |
|---|---|---|---|---|---|
| **Before Storage** | 0.44979 | 0.45675 | 0.47586 | 0.40478 | 0.42689 |
| **After Storage** | 0.45561 | 0.46237 | 0.48089 | 0.41344 | 0.43452 |
| **% Difference** | 1.29% | 1.23% | 1.06% | 2.14% | 1.79% |

Utilising the results above, the Commission has estimated the impact of the overall investment in storage on customer bills. For an average residential customer within BLPC's domestic class who uses approximately 150 kWh, their likely bill before VAT would be $98.47. With the investment in 4-hour batteries their bill is estimated to increase by 1.16% to $99.61 before VAT.

## SECTION 6 DETERMINATION

The Commission has determined the following tariffs and associated size categories:

**Table 11: Size Categories and EST Rates for a two (2) hour battery**

| Size Category | LCOS(BBD$/kWh) | LCOS(BBD$/kW-month) |
|---|---|---|
| Up to 25 kW | 0.675 | 56.78 |

**Table 12: Size Categories and EST Rates for a three (3) hour battery**

| Size Category | LCOS(BBD$/kWh) | LCOS(BBD$/kW-month) |
|---|---|---|
| > 25 kW - 1 MW | 0.404 | 33.95 |
| > 1 MW – 10 MW | 0.292 | 24.61 |

**Table 13: Size Categories and EST Rates for a four (4) hour battery**

| Size Category | LCOS(BBD$/kWh) | LCOS(BBD$/kW-month) |
|---|---|---|
| > 25 kW - 1 MW | 0.374 | 41.95 |
| > 1 MW – 10 MW | 0.270 | 30.34 |

Additionally, the Commission has determined that monitoring and administrative framework for the EST shall comprise the following:

I. The pilot shall be for a duration of four (4) years total. The first two (2) years will see the design, procurement, installation and connection of the BESS equipment. The remaining two (2) years will see the operation of the projects and collection of the relevant data to assess the performance and viability of the projects. Project participants whose applications and/or registrations are verified, shall receive the rate available at the date of verification (the date at which the MEB communicated to the investor that the application is complete and accepted) upon their connection to the grid for delivery of storage capacity

and any associated services as required. The participants who are licensed during the pilot phase of the storage programme shall be eligible to receive associated tariffs for ten (10) years.

II. In order to receive the EST, projects must meet the "used and useful" criteria. In this instance, this means that the project must be able to provide three (3) or more storage power services and two (2) or more voltage/reactive power services simultaneously or temporally, and actively deliver these services to the grid. These services required are peak shaving with renewables, renewable energy firming & ramping, renewable curtailment reduction, spinning reserve, frequency response, distribution hosting capacity control, voltage control and power factor control.

III. The BESS systems shall participate in the autonomous grid services or utility dispatch signal which on average, should add up to the power capacity of storage to prove to be "used and useful" or demonstrate that 365 cycles per year are utilised. The kWh capacity of the BESS should not fade more than 50% over 10 years and less than 5% per year based on 365 cycles per year of use.

IV. One key element of this proposed EST pilot programme is the necessity for the framework to set out provisions via which the regulator may assess the performance and feasibility of the projects. This requires that there be a comprehensive provision of data with the aim of monitoring the performance, the efficiency and costs of the BESS during the pilot. Consequently, the Commission determines that participants in the pilot shall submit quarterly reports which summarize the data collected and provide insights into the project's progress, challenges, and outcomes. The aforementioned reports shall include, inter alia, operational data including energy storage capacity, discharge rates, metered kilowatt and kilowatt hours, state of charge, throughput, cycles, and time series data using any metrics as is relevant. Additionally, participants shall be required to complete annual duration and

power tests. This is where a check is done to ensure that the battery is able to perform as expected during the required operating time.

V. Where it is found that a battery's capacity has degraded more than 50% over (the ten (10) year contract, or more than 5% in any one given year), there shall be a true-up mechanism where payments made to projects on the basis of full capacity are refunded in proportion to the level of degradation.

VI. The BLPC and the project owners shall be required to retain all data generated during the pilot project. In addition, the Commission reserves the right to perform random checks on the batteries, as well as perform audits as necessary. The Commission shall prepare a final pilot project report at the end of the pilot, consolidating all the data, findings, and recommendations for stakeholders.

VII. The EST and associated framework shall be reviewed every two (2) years. However, the Commission reserves the right to conduct reviews on a more frequent basis should market conditions deem it prudent.

Dated this 28th day of June, 2023

*Original signed by*
……..
Tammy Bryan
Chairman

*Original signed by*
……..
John Griffith
Commissioner

*Original signed by*
…….
Ankie Scott-Joseph
Commissioner

*Original signed by*
……..
Samuel Wallerson
Commissioner