REGULATORY AUTHORITY OF BERMUDA

Fairness • Innovation • Integrity

Feed-in Tariff Methodology

Final Report
Final Decision and Order
Date: 19 October 2018

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I. INTRODUCTION

1. The purpose of this Final Report, Final Decision and Order (the "Final Report") is for the Regulatory Authority of Bermuda (the "Authority") to: (i) present the Authority's assessment of the responses to the Consultation Document (the "Consultation Document") and the Preliminary Report, Preliminary Decision and Order (the "Preliminary Report"); and (ii) to issue the General Determination ("GD") setting the updated methodology (the "Methodology") for assessing the level of the Feed-in Tariff ("FIT") for power purchased from distributed generators by the Transmission, Distribution & Retail ("TD&R") licensee.

2. The Authority is responsible for the regulation of the electricity sector in Bermuda, and its overarching responsibilities are to:

    - regulate tariffs and the quality of service provision to end-users;
    - ensure that access to the electricity infrastructure by current and prospective generators in Bermuda is transparent, fair, reasonable, and non-discriminatory;
    - investigate and respond to complaints from end-users regarding the provision of electricity.

3. Section 36 of the Electricity Act 2016 ("EA") provides that the Authority shall determine the FIT in accordance with the methodology set by GD and in accordance with the principles set out in the EA.

4. On 2 March 2018, the Authority issued a GD mandating that the Bermuda Electric Light Company Ltd ("BELCO")[1], in its capacity as the TD&R licensee, should pay a FIT for electricity produced by distributed renewable energy systems in accordance with the net avoided costs of generation, as described in the GD.

5. On 27 April 2018, the Authority issued the Consultation Document, which presented a full methodology for assessing the level of the FIT that the TD&R licensee would pay to distributed generators for the purchased renewable energy.

6. The Authority received six responses to the Consultation Document.

7. On 12 September 2018, the Authority issued the Preliminary Report, which summarised the responses to the Consultation Document and presented a draft GD setting forth the Methodology for assessing the level of the FIT in light of the responses, inter alia, to the Consultation Document.

8. In accordance with the EA, the Preliminary Report applied to all technologies used by distributed generators to produce renewable energy.[2]

9. This Final Report is structured as follows:

    a. section II outlines the background and procedural history;

    b. section III sets out the legislative context that underpins the development of theMethodology;

    c. section IV summarises the responses to the Consultation Document;

[1] That is, the TD&R licensee in Bermuda.
[2] e.g. solar, wind, biomass, landfill gas, municipal solid waste, ocean (including tidal, wave, current, and thermal), geothermal, or hydro resources, see Electricity Act 2016, p. 6.

d. section V summarises the decision;

e. Appendix A sets forth the Final Order;

f. Appendix B sets forth the GD.

II. BACKGROUND AND PROCEDURAL HISTORY

IV.A. Background

10. The Authority initiated this consultation by publishing a Consultation Document on 27 April 2018 that invited responses from members of the public, including electricity sectoral participants and sectoral providers, as well as other interested parties.

11. The purpose of the Authority's initial Consultation Document was to consult on the Methodology.

12. The Consultation Document asked the following questions:

(a) Do you agree that the reduction in fuel costs and other variable operating costs of generation should be considered in estimating the avoided costs of generation?

(b) Do you agree that the reduction in further generation capacity requirement should be considered in estimating the avoided costs of generation?

(c) Do you agree that the reduction in network losses should be considered in estimating the avoided costs of generation?

(d) Do you agree that the estimate of other net economic benefits from distributed generation should be based on the difference between the benefits and costs that distributed generation imposes on the system?

(e) Do you agree that the overall system costs imposed by distributed generation (i.e. increase in (i) network costs, (ii) cost of system balancing and (iii) cost of economic stranding of existing generation or network assets) should be used in estimating the economic costs from distributed generation?

(f) Do you consider that changes in thermal plant efficiency should be considered when deriving the appropriate FIT for distributed generation?

(g) Do you agree that the magnitude of (i) reduction in costs associated with meeting environmental standards and (ii) increased economic activity should be consistent with the relevant government policy?

(h) Do you agree that the FIT should vary for different distributed generation technologies?

(i) Do you think that any additional categories of benefits and costs should be included in the assessment of the FIT?

(j) Do you agree with the approach outlined above for the conversion of avoided costs and wider economic benefits into a FIT?

(k) Do you agree that it would be appropriate to revise the FIT periodically so that all distributed generators are provided with the same level of the FIT, and if so, how frequently should the tariff be revised?

13. Responses to the Consultation Document were solicited from the public electronically through the Authority's website at www.rab.bm.

14. The response period commenced on 27 April 2018 and concluded on 4 June 2018.

15. The Authority received six responses to the Consultation Document.

16. On 12 September 2018 the Authority issued its Preliminary Report. The Authority invited responses from members of the public, including electricity sectoral participants and sectoral providers, as well as other interested parties.

17. Public comments on the Preliminary Report were to be submitted by the extended deadline of 26 September 2018.

18. The Authority received one written response to the Preliminary Report from Bermuda Alternate Energy Limited ("BAE").

IV.B. Final Decision and Order

19. The Authority hereby adopts the Order in Appendix A and make the General Determination set out in Appendix B to this Final Report.

III. LEGISLATIVE CONTEXT

20. The Regulatory Authority Act 2011 ("RAA") established a cross-sectoral independent and accountable regulatory body "to protect the rights of consumers, encourage the deployment of innovative and affordable services, promote sustainable competition, foster investment, promote Bermudian ownership and employment and enhance Bermuda's position in the global market".[3]

21. In June 2015, the Ministry of Economic Development of Bermuda published the National Electricity Sector Policy (the "Policy Document").[4] The Policy Document set out the groundwork for the establishment of the subsequent EA and the desired structure of the electricity sector of Bermuda, and it also outlined four broad policy objectives for the sector. These policy objectives encourage the pursuit of an electricity service that is (i) least cost and high quality, (ii) environmentally sustainable, (iii) secure and (iv) affordable.[5]

22. The EA established an electricity sector regulatory framework within the meaning of the RAA. The EA received Royal Assent on 27 February 2016 and came into operation on 28 October 2016 pursuant to the Electricity Act 2016 Commencement Day Notice 2016 (BR 101/2016). The EA repealed the Energy Act 2009.

23. The Minister responsible for electricity is currently the Minister of Transport and Regulatory Affairs (the "Minister"). The Minster can issue Ministerial declarations that establish policies for the electricity sector[6] and can also issue Ministerial directions to the Authority regarding any matter within his authority with regard to the electricity sector.[7] In formulating Ministerial directions, the Minister shall set priorities and resolve trade-offs or conflicts that arise from the purposes of the EA in a way that he thinks best serves the public interest.[8]

24. The Authority has the powers to supervise, monitor and regulate the electricity sector in Bermuda in accordance with the purposes of the EA. Such purposes, as set forth in section 6 of the EA, are:

    (a) "to ensure the adequacy, safety, sustainability and reliability of electricity supply in Bermuda so that Bermuda continues to be well positioned to compete in the international business and global tourism markets;

    (b) to encourage electricity conservation and the efficient use of electricity;

    (c) to promote the use of cleaner energy sources and technologies, including alternative energy sources and renewable energy sources;

    (d) to provide sectoral participants and end-users with non-discriminatory interconnection to transmission and distribution systems;

    (e) to protect the interests of end-users with respect to prices and affordability, and the adequacy, reliability and quality of electricity service;

    (f) to promote economic efficiency and sustainability in the generation, transmission, distribution and sale of electricity."

25. The principal functions of the Authority set forth in section 12 of the RAA are:

[3] Regulatory Authority Act 2011, p. 5.
[4] Ministry of Economic Development (2015), 'The National Electricity Sector Policy of Bermuda', Bermuda.
[5] Ministry of Economic Development (2015), "The National Electricity Sector Policy of Bermuda", Bermuda, p. 4.
[6] Electricity Act 2016, section 7(2).
[7] Electricity Act 2016, section 8(1).
[8] Electricity Act 2016, section 9.

(a) “to promote and preserve competition;

(b) to promote the interests of the residents and consumers of Bermuda;

(c) to promote the development of the Bermudian economy, Bermudian employment and Bermudian ownership;

(d) to promote innovation;

(e) to fulfil any additional functions specified by sectoral legislation.”

26. To further the purposes of the EA, the EA grants various functions to the Authority. Section 14 of the EA provides that the function of the Authority is generally to monitor and regulate the electricity sector. Section 14 (2) (c) (ii) of the EA states that the functions of the Authority shall include, among other things, the making of administrative determinations[9] to provide for the control and conduct of the provision of electricity services, including transparency measures and notice requirements relating to the rates, charges, and other terms and conditions for the provision of electricity services for the benefit of end-users.

27. The Policy Document[10] provides guidance in relation to the objectives that a FIT should achieve. In particular, the tariff structure should be set such that it:

(a) “Ensures cost recovery by reflecting the Electric Utility’s cost of providing services to distributed generators (energy, demand, and grid access services), and”

(b) “Fairly compensates distributed generators for the value of any energy produced by their distributed generation system. This may be set to reflect financial value (according to avoided generation cost), as well as economic value (accounting for externalities and benefits not captured in avoided cost).”

28. To establish the approved FIT, section 37 of the EA requires the Authority to conduct feed-in tariff reviews in accordance with the methodology set by general determination and in accordance with the principles set in section 36 of the EA. This Final Report issues the GD setting forth the methodology to conduct feed-in tariff reviews.

[9] Defined in the RAA as including a General Determination, order, direction, decision or other written determination by which the Authority establishes the legal rights and obligations of one or more Sectoral Participants but does not include an advisory guideline (or an adjudicative decision and order. General Determination is defined as a statutory instrument made pursuant to Section 62 of the RAA that is applicable to all Sectoral Participants or categories of Sectoral Participants as fall within the scope of the Statutory Instrument.

[10] The National Electricity Sector Policy of Bermuda Section 5.6

IV. SUMMARY AND DISCUSSION OF RESPONSES TO THE INITIAL CONSULTATION DOCUMENT

IV.A. Response Method

29. The Consultation Document allowed the public to submit responses commenting on the methodology to determine the Feed-In Tariff and to respond to the consultation questions. Six written responses to the Consultation Document were received from:

(a) BAE;

(b) Bermuda Solar Energy Association;

(c) Bermuda Electric Light Company Ltd ("BELCO");

(d) the Department of Energy ("DOE");

(e) Mr. Kurt Repose;

(f) Mr. Carl Shechtman.

IV.B. Summary of Responses

30. This section provides an overview of the key themes from the responses to the Consultation Document and the related decisions that the Authority has made, taking into consideration the public responses.

31. Not all respondents chose to answer the questions specified in the Consultation Document. Some preferred to provide their views in more general terms and where possible the Authority has included information from these responses in the appropriate section. In addition, some responses addressed some of the questions but not all.

32. The responses are summarised by consultation question and topic of discussion below. The rest of this section is structured as follows:

(a) Section A discusses the types of costs that should be considered in estimating the avoided cost of generation (consultation questions 1–7 and 9);

(b) Section B considers whether the level of the FIT should vary for different distributed generation technologies (consultation question 8);

(c) Section C discusses the approach for conversion of avoided costs and economic benefits into a FIT (consultation question 10);

(d) Section D provides a discussion on whether FIT should be revised periodically (consultation question 11);

(e) Section E provides additional responses to the queries highlighted by Bermuda Solar Energy Association;

(f) Section F provides additional responses to the queries highlighted by the DOE;

(g) Section G provides a rationale for using a gross metering rather than net metering approach for setting the FIT.

IV.C. Discussion of Responses

A. Which types of costs and benefits should be considered in estimating the feed-in tariff (consultation questions 1–7 and 9)?

33. BAE, BELCO and Mr. Kurt Repose provide their comments on each type of cost and benefits proposed by the Authority for determining the FIT in the Consultation Document. These comments, along with the Authority's responses, are summarised in Table 1.

Table 1 Responses to the Consultation Document—types of costs and benefits to be considered for determining the FIT

Note: ✓—indicates that the cost/benefit should be included in the determination of the FIT; ✓✗ —indicates that it is not clear if the cost/benefit should be included in the determination of the FIT (additional assessment required); ✗—indicates that the cost/benefit should not be included in the determination of the FIT.

	Type of cost	Comments	Authority Response
	Avoided costs of generation		
A	Reduction in fuel costs and other variable operating costs of generation	○ **BAE** considers that the definition of avoided costs of generators should include a fixed cost component. ○ **BELCO** does not believe that the benefit of avoided fuel taxes should be passed on to distributed generators.	○ The Authority considers that the feed-in tariffs should be based on the costs that are avoided by the electricity system as a whole. ○ The Authority does not consider that it is appropriate to exclude fuel taxes from the Methodology.
B	Reduction in bulk generation capacity requirements	○ None of the parties provided detailed comments.	○ No detailed justification provided to support this comment.
C	Reduction in the TD&R licensee's network losses	○ **BAE** notes that international precedent on network losses should be considered, highlighting Cayman Utilities Company as a relevant comparator. ○ **BELCO** indicated that it would like to better understand how the reduction in network losses is expected to be calculated on a case-by-case basis.	○ The Authority considers that the approach for calculating network losses would depend on the information received as part of the data-gathering process.
D	Increase in the network costs of the TD&R licensee	○ According to **BAE**, this cost will be negligible until distributed solar capacity reaches at least 30MW. ○ **Mr. Kurt Repose** considers that the fraction of network costs attributable to distributed generation is small, and therefore that the cost should borne by the network.	○ The Authority considers it appropriate to request that BELCO provide additional information about these costs, to assess to what extent these should be included in the FIT.
E	System balancing costs and costs associated with services such as frequency response and operating reserves	○ **BAE** considers that this cost will be negligible until distributed solar capacity reaches at least 30MW. ○ **Mr. Kurt Repose** considers that distributed generators do not cause a significant impact on system balancing costs.	○ The Authority notes that these costs are included in the Methodology under item D: "Increase in the network costs of the TD&R licensee".

Note: ✓—indicates that the cost/benefit should be included in the determination of the FIT; ✓✗ —indicates that it is not clear if the cost/benefit should be included in the determination of the FIT (additional assessment required); ✗—indicates that the cost/benefit should not be included in the determination of the FIT.

	Type of cost	Comments	Authority Response
F	Increase in the cost of economic stranding of existing generation or network assets	○ **BAE** considers that this cost will be negligible until distributed solar capacity reaches at least 30MW. ○ **Mr. Kurt Repose** considers that existing generation assets are unlikely to be stranded, arguing that Bermuda will continue to mainly rely on fossil fuels in the future.	○ The Authority notes that these costs are included in the Methodology under item D: "Increase in the network costs of the TD&R licensee".
G	Changes in thermal plant efficiency	○ **BAE** points out that based on available data, thermal plant efficiency is unlikely to decrease with the wider adoption of distributed generation. ○ **Mr. Kurt Repose** disagrees with inclusion of this cost in the methodology because changes in thermal plant efficiency would not be accurately measurable.	○ The Authority notes that these costs are included in the Methodology under item D: "Increase in the network costs of the TD&R licensee".
	Economic benefits		
H	Reduction in costs associated with meeting environmental standards	○ **BELCO** notes that it is not necessarily the case that an increased deployment of distributed generation (of renewable energy) will reduce costs associated with meeting the environmental standards. **BELCO** argues that the greatest positive environmental impact for Bermuda will be achieved through the introduction of natural gas and not from wider deployment of distributed generation.	○ The Authority will carefully examine the data that would support inclusion of any economic benefits as part of the level of the FIT. This analysis will establish the existence and magnitude of the relevant economic benefits.
I	Increased economic activity	○ **BELCO** questions whether rate payers should shoulder the financial burden of stimulating increased economic activity. It argues that the economy is better stimulated when rate payers pay less for their electricity.	○ The Authority will carefully examine the data that would support inclusion of any economic benefits as part of the level of the FIT. This analysis will establish the existence and magnitude of the relevant economic benefits.

B. Should FIT vary for different distributed generation technologies (consultation question 8)?

Question	Comments	Authority Response
Should FIT vary for different distributed generation technologies (8)	○ **BAE**, **Mr. Kurt Repose**, and **BELCO** agree with the Authority's proposal that the FIT may vary depending on the distributed generation technology.	○ The Authority considers that setting different levels of the FIT for different distributed generation technologies may be appropriate, and it will consider any data that is provided as part of the data-gathering process regarding differentials in avoided cost by different technology.

C. What should be the approach for conversion of avoided costs and economic benefits into a FIT (consultation question 10)?

Question	Comments	Authority Response
What should be the approach for conversion of avoided costs and economic benefits into a FIT (10)	○ **BAE, the Department of Energy** and **BELCO** agree with the general approach for conversion of avoided costs and economic benefits into a FIT ○ **Kurt Repose** disagreed with the proposed approach suggesting a net metering approach as well as investigating a distributed energy market model.	○ The Authority has suggested that the avoided cost of generation and net economic benefits that relate to the electricity produced by distributed renewable energy systems should be divided by the forecasted system total kWh produced by distributed generators. ○ The Authority notes that the net metering approach is inconsistent with the requirements of the EA, and a distributed energy market model is prohibited by Section 20(2) of the EA.

D. Should FIT be revised periodically (consultation question 11)?

34. Four out of six respondents provide their comments with respect to the periodicity of the FIT revision (see Table 2).

Table 2 Responses to the Consultation Document—FIT periodical revision

Respondent	Comments	Authority Response
BAE	The FIT should be revised periodically, for example, every three years. However, once the FIT has been determined for a given applicant, it remains fixed for the remaining lifetime of the asset.	○ The Authority considers that the FIT should be updated for all applicants periodically. The Authority also notes that most of the respondents agree with its position that in order to satisfy the requirements of the EA to ensure cost reflectivity, the FIT should be revised periodically over the lifetime of the asset.
Mr. Kurt Repose	The FIT should be revised at least once a year.	
DoE	Both the FIT and the FIT methodology should be revised every five years or less, as determined by the Authority.	
BELCO	The FIT should be revised annually.	

E. Responses to queries raised by Bermuda Solar Energy Association

35. **Bermuda Solar Energy Association** raised a number of concerns in relation to the determination of the FIT that currently applies to distributed generators of renewable energy, in particular concerns in relation to the data used to determine the fuel costs, generator efficiencies, lubricant cost, transmission losses and changes in the data over time.

36. The Authority would like to highlight that the Authority is required to conduct a FIT review in line with the Methodology to establish the new FIT. Therefore, the concerns raised by Bermuda Solar Energy Association will be addressed as part of the FIT review.

F. Responses to additional queries raised by the Department of Energy

37. The **Department of Energy** raised a number of queries in relation to the proposed Methodology. The Authority summarises the queries and provides the responses in Table 3.

Table 3 Responses to the Consultation Document—Department of Energy

Comment	Authority Response
The Consultation Document stated that a system-wide modelling approach would ideally be used to calculate overall net avoided cost of generation and net economic benefits. Please explain what this model would like and how it would benefit the overall net avoided cost of generation? [sic]	The Authority considers that the identified categories of costs and benefits should be analysed as part of an overall assessment in order to prevent double-counting. The precise methodology would depend on the information gathered as part of the FIT review. The proposed approach for establishing the FIT is described in Section H of the Preliminary Report.
The Consultation Document stated that in the absence of any explicit environmental performance targets or incentive schemes, environmental benefits may be approximated using metrics such as traded carbon prices to value the reduction in carbon emissions. What is being used as the 'Proxy Value' in this statement?	The precise valuation of the environmental benefits will be established as part of the FIT review. The proposed approach for establishing the FIT is described in Section H of the Preliminary Report.
How will the RA's recent decision to approve BELCO's purchase of 10 MW of battery storage be considered when determining the FIT?	The Authority will consider the impact of 10 MW of battery storage on the FIT as part of overall net avoided cost of generation. For example, the battery storage may decrease the costs associated with system balancing or the costs associated with a potential reduction in thermal plant efficiency.
How will the RA's recent decision to approve BELCO's purchase and installation of 56MW of new generation be considered when determining the FIT?	The Authority will consider the impact of 56MW of new generation on the FIT as part of estimating the overall net avoided cost of generation. For example, the new generation may decrease the avoided fuel costs, assuming that the new generation units would displace less efficient existing generation units.
The Authority stated that network reinforcement costs are unlikely to arise at low levels of distributed generation (e.g. solar photovoltaic "PV") penetration. However, higher levels of distributed generation penetration would be more likely to involve costs of integrating the distributed generation into the existing grid. Please provide a definition of low levels and higher levels of distributed generation and what data/examples the assumption stated above is based on?	The Authority will evaluate the impact of the renewable generation technologies on the network reinforcement costs as part of the tariff review. The proposed approach for establishing the FIT is described in Section H of the Preliminary Report.

G. Gross vs net metering

38. **Mr. Kurt Repose** and **Mr. Carl Schectman** have queried the rationale for using a gross metering approach for the FIT. In this section, the Authority outlines the rationale for gross metering.

39. The FIT is paid by the TD&R licensee to distributed generators—small-scale producers of renewable energy—that are connected to Bermuda's electricity network. The primary purpose of a FIT is to compensate distributed generators for the electricity that they supply.

40. There are two potential approaches for compensating distributed generators of renewable energy for the supply of electricity.

(a) Net metering—a charging system based on net imports and exports of electricity, where:

$$Net\ electricity\ (kWh) = imported\ electricity\ (kWh) - exported\ electricity\ (kWh)$$

With this charging arrangement, the price the customer is charged for importing electricity from the grid is effectively identical to the price the customer is paid for exporting electricity to the grid, because the amount of electricity exported to the grid is directly deducted from the imported electricity; and

(b) Gross metering—a charging system based on gross imports and exports of electricity, i.e. electricity import and export volumes are measured separately, with different electricity prices potentially applied to the electricity imported from the grid to that exported to the grid.

41. According to the EA, the FIT should reflect two components—(i) avoided cost of generation for the TD&R licensee arising from purchasing electricity from distributed generators, and (ii) other economic benefits provided by distributed generators. As a result, the use of a net metering approach would contravene the EA. Therefore, the FIT should be set on the basis of a gross metering approach.

42. The Authority also notes that the focus on avoided costs of generation is consistent with the principle of cost reflectivity, which is one of the objectives for the FIT outlined in the Policy Document. In particular, the cost of consuming the electricity (i.e. the TD&R licensee's average production costs) is likely to be different to the benefits of generation (i.e. the TD&R licensee's avoided costs) at customers' premises. In particular, the TD&R licensee's fixed costs are largely unavoidable. These fixed costs relate to the TD&R licensee's fixed generation costs, its network infrastructure, as well as some of its retailing activities (e.g. maintaining customer records, metering, and billing). As these fixed TD&R costs are not avoided if more distributed generation capacity is installed, the FIT should be set primarily with reference to the TD&R licensee's avoided costs. This will also ensure that an increase in distributed generation capacity would not increase the overall cost of electricity for customers who have not installed their own distribution generation capacity.

V. SUMMARY AND DISCUSSION OF RESPONSES TO PRELIMINARY REPORT, PRELIMINARY DECISION AND ORDER

IV.A. Response Method

43. The Preliminary Report allowed the public to submit responses commenting on it. One party, BAE, submitted comments in response to the Preliminary Report.

IV.B. Summary of Responses

44. This section provides an overview of the key themes from BAE's response to the Preliminary Report and the Authority's analysis of BAE's response.

45. The following issues raised in BAE's response to the Preliminary Report are discussed in turn:

(a) The use of distributed solar to substantially reduce the use of inefficient and fuel costly gas turbines by BELCO's Bulk Generation Licensee;

(b) The cost of stranded assets;

(c) The cost of generator efficiency losses due to wider solar adoption.

46. The Authority also notes that BAE's response includes an inaccurate interpretation of the Integrated Resource Plan ("IRP") Proposal, stating that additional gas turbines are proposed by BELCO. There is no reference in the IRP Proposal to the commissioning of additional gas turbines.

IV.C. Discussion of Responses

47. Central to the Authority's views on the Renewable Energy Metering Scheme are the requirements set out in section 36 of the EA,which states that the feed-in tariff can only allow compensation for, at most, the cost of generation that BELCO (as the TD&R Licensee) avoids by purchasing power from distributed generators and any economic benefit derived.

48. This is consistent with the National Electricity Sector Policy, which states that the reformed electricity sector in Bermuda will introduce competition between existing generation facilities, prospective third-party bulk generators (i.e., IPPs), distributed generators (DGs), and other demand-side resources. In order to ensure that the benefits of such competition are realised, it is necessary that all electricity resources have access to the electricity network on fair, reasonable and non-discriminatory terms. In turn, this requires that the feed-in tariff for renewable energy systems reflect the system-wide costs and benefits of this technology—in this case, principally BELCO's avoided costs and avoided network losses.

A. Reduction of Inefficient and Costly Fuel Gas Turbines Use by Distributed Solar

49. In the first section of its response, BAE assesses generation technologies that BELCO is likely to use in 2020. BAE argues that solar PV is the best renewable resource currently available to meet peak demand because the pattern of the peak solar PV output coincides with the peak demand. Based on this assertion, BAE argues that the use of distributed generation can substantially reduce the use of gas turbines, which are typically used to meet the peak demand.

50. BAE also notes that with the present levels of solar and waste generation capacity in the system, gas turbines will be used 11 months per year. BAE implies that this should be reflected in the avoided fuel cost component of the future FIT.

Authority's response

51. The Authority considers that this type of analysis may be useful at the tariff review stage, however, it is not of direct relevance to the proposed methodology. Specifically, the Authority will request BELCO to provide the relevant cost data on a marginal plant basis, i.e. the cost data that is associated with the generation resources that would be displaced by distributed generation of renewable energy. The Authority intends to determine the FIT based on the marginal avoided cost of generation. The Authority will do this if relevant data is available and the required analysis is proportional.

52. BAE asks whether the Authority intends to determine a one-year FIT or a three-year FIT. The Authority notes that although the Preliminary Report and the proposed methodology specify that the FIT review periods will be aligned with the periodicity of the retail tariff review, in the interests of ease of implementation and predictability of the regulatory environment the Authority has determined that the FIT will be assessed every three years.

53. BAE also asks whether the current or future generation mix will be used as a reference for the FIT estimation. The Authority will use the avoided cost of generation forecast for the period for which FIT is applied, i.e. the future generation mix, to the extent that this is practical.

B. Cost of Stranded Assets

54. In this section, BAE suggests that the cost of stranded assets should not be deducted from the FIT. According to BAE, there will be no cost of economic stranding of existing generation or network assets for the following reasons:

(a) The gas turbine assets will not be stranded for many years;

(b) The fuel cost component is the largest component of the gas turbines' levelised cost of electricity;

(c) The gas turbine assets could be sold abroad if they are no longer required;

(d) If solar and storage capacity grow fast enough, one or more of the gas turbines may no longer need to be purchased; and

(e) Further generator retirements are scheduled for 2025.

55. However, BAE does not argue against the principle of including the cost in the proposed methodology.

56. BAE's opinion on the issue is consistent with its response to the Consultation Document, in which it argued that the increase in the cost of economic stranding will be negligible until distributed solar capacity reaches at least 30MW.

Authority's response

57. Since there was at least one response supporting the need for these costs to be quantified, and no respondents argued against the principle of including the cost in the proposed methodology, the Authority's opinion in relation to the issue remains unchanged. In particular, the Authority considers it appropriate to investigate the magnitude of the cost of economic stranding at the tariff review stage.

58. In relation to the possibility of any generation assets to be sold when they are no longer required, without prejudice to Authority's views on the probability of this event occurring, the Authority considers it would be appropriate to take the sale residual value of the assets into account when estimating the avoided cost of the generation component of the FIT.

59. Since the remainder of the arguments presented by BAE relate not to the proposed methodology itself (i.e. the choice of avoided cost categories), but rather to its implementation (i.e. the quantification of an avoided cost to be included in the FIT estimate), these arguments may be resubmitted at the tariff review stage.

C. Generator Efficiency Losses Due to Wider Solar Adoption

60. In this section, BAE emphasizes that the cost savings from the reduced use of the gas turbines outweigh any efficiency losses that will occur until 60MW of solar PV and additional storage is installed. Then, BAE presents estimates of generator efficiency changes.

Authority's response

61. The Authority highlights that it has not expressed a view on whether the cost savings from the reduced use of the gas turbines would outweigh any efficiency losses. The Authority will undertake the relevant assessment at the tariff review stage. Therefore, without prejudice to the Authority's views on the estimates demonstrated by BAE in its response, the Authority encourages BAE to share, at the tariff review stage, the details of its analysis and the underlying data used.

IV.D. Next steps for establishing the FIT, including the data-gathering process

62. This section describes the process for establishing the FIT by outlining (i) the procedural steps for establishing the Methodology and (ii) the approach for gathering the relevant data for determining the FIT.

63. Specifically, the determination of the FIT would follow the process outlined below.

(a) **General Determination.** Pursuant to this Final Report, the Authority shall issue the General Determination to set the Methodology.

(b) **Tariff review**. Once the Methodology is established, the Authority will initiate the tariff review for FIT. As part of the tariff review, the Authority would assess the existence and magnitude of the economic benefits as well as the avoided costs of generation.

VI. CONCLUSION

64. In furtherance of the proposals set forth above, the Authority hereby adopts the Order contained in Appendix A to this Final Report and makes the General Determination contained in Appendix B.

APPENDIX A: ORDER

BERMUDA REGULATORY AUTHORITY

Order:

Feed-in Tariff Methodology

Order
Date: 19 October 2018

1.1 The Regulatory Authority, pursuant to Sections 12, 13 and 62 of the Regulatory Authority Act 2011 and Sections 6, 14, 17 and 36 of the Electricity Act 2016, hereby:

(a) Adopts the General Determination attached hereto, setting forth the methodology for calculating the feed-in tariff for the Transmission Distribution and Retail licensee's purchase of power from distributed generators;

(b) Directs the Chief Executive of the Regulatory Authority to forward the General Determination to the Cabinet Secretary; and

(c) Authorises the General Determination to be effected on the date of its publication in the Royal Gazette.

1.2 So Ordered this 19 day of October 2018

APPENDIX B: GENERAL DETERMINATION

BERMUDA

Regulatory Authority (Feed-in Tariff Methodology) General Determination

BR/2018

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The Regulatory Authority of Bermuda, in the exercise of the power conferred by section 62 of the Regulatory Authority Act 2011, as read with sections 12 and 13 of that Act and sections 6, 14, 17 and 36 of the Electricity Act 2016, makes the following General Determination:

Citation

1 This General Determination may be cited as the Regulatory Authority (Feed-In Tariff Methodology) General Determination.

Interpretation

2 In this General Determination, unless the context otherwise requires, terms shall have the meaning given in the Regulatory Authority Act 2011, the Electricity Act 2016, and the Schedule to this General Determination.

General Purpose

3 This General Determination establishes the methodology for calculating the feed-in tariff for the Transmission Distribution and Retail licensee's purchase of power from distributed generators.

Determination

4 (1) This General Determination is made pursuant to the Consultation entitled "Feed-in Tariff Methodology for Electricity Sector" dated 27 April 2018 and the Regulatory Authority's Decision on it.

(2) Taking into account the responses received to the Consultation and for the reasons given in the Decision, the Regulatory Authority determines that the feed-in tariff methodology set forth in the Schedule is consistent with the purposes of the Electricity Act 2016, including to seek to: (a) ensure the adequacy, safety, sustainability and reliability of electricity supply in Bermuda; (b) encourage electricity conservation and the efficient use of electricity; (c) promote the use of cleaner energy solutions and technologies; (d) provide sectoral participants and end-users with non-discriminatory interconnection to transmission and distribution systems; (e) protect the interests of end-users with respect to prices

and affordability, and the adequacy, reliability and quality of electricity service; and (f) promote economic efficiency and sustainability in the generation, transmission, distribution and sale of electricity.

Terms and conditions of General Determination

5 (1) The Schedule to this General Determination has effect.

(2) The Schedule is also published on the Regulatory Authority's website (www.rab.bm), and is also available for inspection at the offices of the Regulatory Authority (1st Floor, Craig Appin House, 8 Wesley Street, Hamilton HM 11) during ordinary business hours.

Effective Date of General Determination

6 This General Determination shall become effective on the day it is published in the Official Gazette.

REGULATORY AUTHORITY

Bermuda

Schedule to [Regulatory Authority (Feed-in Tariff Methodology) General Determination 2018

General Determination
Date: 19 October 2018

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This General Determination is made by the Regulatory Authority of Bermuda pursuant to Section 62(1) of the Regulatory Authority Act 2011 ("**RAA**") and in accordance with Sections 6, 14, 17 and 36 of the Electricity Act 2016 ("**EA**") and establishes the methodology for calculating the Feed-In Tariff for the electricity sector.

1 Definitions

The "Authority" means the Regulatory Authority of Bermuda established under the Regulatory Authority Act 2011.

"Avoided cost of generation" means a component of a feed-in tariff defined in the Electricity Act 2016 as the cost of generation that the TD&R Licensee avoids by purchasing power from distributed generation.

"Bulk generation licence" means a licence granted under section 25 of the Electricity Act 2016.

"Bulk generation" means generation using a system with an installed capacity at or above the licence threshold (as defined in section 2(i) of the Electricity Act 2016).

"Carbon price" means the monetary value associated with offsetting one unit of CO_2 emissions.

"Connection assets" means assets required to connect an additional generating unit, including distributed generating units, to the network.

"Conventional generation" means electricity generated by fossil fuels.

"Conversion efficiency" means the portion of input energy that can be converted into usable electricity.

"Cost of economic stranding" refers to the cost associated with an investment that cannot be recovered because the assets, in which the investment was made, are under-utilised or no longer used.

"Demand-side management" means all activities or programs undertaken by any person to influence the amount of electricity or timing of electricity they use.

"Demand-side resources" means the reduced demand for electricity resulting from demand side management (as defined in section 2(i) of the Electricity Act 2016).

"Dispatchable generation capacity" means the total generation capacity available in the system for dispatch on demand.

"Distributed generator" means a person that has a Standard Contract 2016 (as defined in section 2(i) of the Electricity Act 2016).

"Distributed generation" means generation using a system with an installed capacity below the licence threshold (as defined in section 2(i) of the Electricity Act 2016).

"Distributed generation penetration" refers to the amount of distributed generation in the system as a ratio of distributed generation to total generation.

"Distribution" means conveying electric power below 22 kilovolts (kV) (as defined in section 2(i) of the Electricity Act 2016).

“EA” means the Electricity Act 2016.

“Economic benefits” refers to the quantifiable benefits less quantifiable costs associated with distributed generation that apply to the general public and other stakeholders, and that are not included in a feed-in tariff as avoided cost of generation.

“Electricity sector” means the regulated industry sector involving the supply, transmission, distribution and consumption of electricity (as defined in section 2(i) of the Electricity Act 2016).

“FIT” means a Feed-in Tariff. This is the pre-determined rate at which renewable energy is purchased by the TD&R Licensee from a distributed generator, for a pre-determined period, and under pre-determined conditions (as defined in section 2(i) of the Electricity Act 2016).

“Frequency response” means a continuous service provided in order to ensure that the electricity output is changing in line with continuous changes in demand.

“Generation” means the process of producing electric power. This includes generation of renewable energy.

“IPP” means an independent power producer. This is an entity that provides energy, capacity, and ancillary services for commercial purposes at a bulk scale to the electric utility under long-term contracts.

“IRP” means integrated resource plan, an energy plan for the supply of electricity in Bermuda approved by the Authority (as defined in section 2(i) of the Electricity Act 2016).

“Licence” means a valid licence granted by the Authority under the Electricity Act 2016 (as defined in section 2(i) of the Electricity Act 2016).

“Licence threshold” means the installed capacity prescribed by regulation from which a licence is required for generation (as defined in section 2(i) of the Electricity Act 2016).

“Licensee” means a person that holds a valid licence in accordance with the Electricity Act 2016 (as defined in section 2(i) in of the Electricity Act 2016).

“Load-following plant” means a power plant that can change its power output to meet fluctuating electricity demand.

“Network costs” means the costs associated with providing the necessary connection assets, network reinforcements etc.

“Network loss” means a loss of energy as it is transferred through the transmission and distribution system mainly in the form of heat.

“Network reinforcement costs” refer to network expenditures associated with accommodating changes in the amount and pattern of electricity demand and supply while ensuring that the network delivers a safe and reliable supply of electricity.

“Operating reserves” means the additional generating capacity available to continue to meet demand, e.g. in the event of a disruption to supply due to the failure of a generating unit.

“Particulate pollution” means pollution caused by small particles and liquid droplets that are suspended in the air.

“Peak” means a time period when the electric system experiences relatively high demand. These periods often occur in daily, weekly and seasonal patterns.

“Renewable energy” means energy that is obtained from naturally occurring sources that are replenished. This includes, but is not limited to, solar, wind, ocean wave, ocean thermal, geothermal, hydropower, and tidal energy (as defined in section 2(i) of the Electricity Act 2016).

“Required capacity margin” means a measure of available capacity over and above the capacity required to meet expected demand.

“Retail” means the sale of electric power at the designated tariff rate by the TD&R Licensee to the end-user (as defined in section 2(i) of the Electricity Act 2016).

“Solar photovoltaic (PV) technology” means a renewable energy technology that converts solar radiation into direct current electrical energy.

“Standard Contract” means a contract between the TD&R licensee and a distributed generator for distributed generation, as referred to in section 49 of the Electricity Act 2016.

“System balancing” refers to services associated with ensuring that electricity supply is sufficient to meet electricity demand.

“TD&R” means transmission, distribution and retail.

“TD&R Licence” means a licence granted under section 25 of the Electricity Act 2016.

“Thermal plant” means a power plant that uses heat energy to generate electric power.

“Transmission” means conveying power at or above 22 kilovolts (kV) (as defined in section 2(i) of the Electricity Act 2016).

“Variable operating costs of generation” means costs to the generator that vary as the amount of electricity generated changes.

2 Interpretation

(1) For purposes of interpreting this General Determination:

- (a) unless the context otherwise requires, words or expressions shall have the meaning assigned to them by the RAA and the EA;
- (b) where there is any conflict between the provisions of this General Determination and the EA or RAA, the provisions of the EA or RAA, as the case may be (and subject to sections 3(2) and 3(3) of the EA), shall prevail;
- (c) terms defined herein and in the EA and RAA have been capitalised;
- (d) headings and titles used herein are for reference only and shall not affect the interpretation or construction of this General Determination;
- (e) references to any law or statutory instrument include any modification, re-enactment or legislative provisions substituted for the same;
- (f) a document referred to herein shall be incorporated into and form part of this General Determination and a reference to such document is to the document as modified from time to time;
- (g) expressions cognate with those used herein shall be construed accordingly;
- (h) use of the word "include" or "including" is to be construed as being without limitation; and

(i) words importing the singular shall include the plural and vice versa, and words importing the whole shall be treated as including a reference to any part unless explicitly limited.

3 Legislative and Procedural Background

(1) This General Determination has been undertaken in accordance with section 62 of the RAA and the exercise by the Authority of its powers under sections 6, 14, 17 and 36 of the EA.

(2) The Authority initiated a consultation by publishing a Consultation Document on 27 April 2018 that invited responses from members of the public, including electricity sectoral participants and sectoral providers, as well as other interested parties. The purpose of the Authority's Consultation Document was to consult on the proposed Feed-In Tariff Methodology.

(3) The Consultation Document invited respondents to comment on the proposed methodology for assessing the Feed-In Tariff for distributed generation.

(4) Responses to the Consultation Document were solicited from the public electronically through the Authority's website at www.rab.bm.

(5) The response period commenced on 27 April 2018 and concluded on 4 June 2018.

(6) The Authority received six responses from the public to the Consultation Document.

(7) The Authority issued a Preliminary Report, Preliminary Decision and Order on 12 September 2018 that invited responses from members of the public, including electricity sectoral participants and sectoral providers, as well as other interested parties.

(8) The Authority received one response from the public for the Preliminary Report, Preliminary Decision and Order.

4 Final Determination

(1) Pursuant to section 62 of the RAA and in accordance with sections 6, 14, 17 and 36 of the EA using the general powers granted to the Authority under section 13 of the RAA and in accordance with the procedures established for this purpose in section 62 of the RAA, the Authority hereby determines that:

(2) The adoption and implementation of the Feed-in Tariff Methodology as set forth in Annex 1 of this Schedule below is consistent with the purposes of the Electricity Act 2016, including to seek to: (a) ensure the adequacy, safety, sustainability and reliability of electricity supply in Bermuda; (b) encourage electricity conservation and the efficient use of electricity; (c) promote the use of cleaner energy solutions and technologies; (d) provide sectoral participants and end-users with non-discriminatory interconnection to transmission and distribution systems; (e) protect the interests of end-users with respect to prices and affordability, and the adequacy, reliability and quality of electricity service; and (f) promote economic efficiency and sustainability in the generation, transmission, distribution and sale of electricity.

ANNEX 1 – FEED-IN TARIFF METHODOLOGY

I. METHODOLOGY

1. This methodology focuses on the determination of the Feed-in-Tariff ("FIT") level, in relation to the overall system costs and benefits that arise from higher levels of distributed generation penetration. In line with the Electricity Act 2016 ("EA"), this General Determination applies to all forms of renewable energy generation technologies.

2. Currently, the EA requires that the FIT will, at most, allow only compensation arising from the following sources.[11]

   (a) **Avoided cost of generation**. This is the cost of generation that the Transmission, Distribution & Retail ("TD&R") Licensee avoids by purchasing power from distributed generation.

   (b) **Economic benefits**. Economic benefits associated with distributed generation.

3. This requirement is consistent with the National Electricity Sector Policy, which states that the reformed electricity sector in Bermuda will introduce competition between existing generation facilities, prospective third-party bulk generators (independent power producers ("IPPs")), distributed generators, and other demand-side resources.[12] In order to ensure that the benefits of such competition are realised, it is necessary for all electricity resources to have access to the electricity network on fair, reasonable, and non-discriminatory terms. In turn, this requires that the FIT for distributed generation systems reflects the system-wide costs and benefits of this technology.

1.1 Costs and benefits affecting FIT

4. The FIT will be based on the avoided cost of generation and economic benefits and such other benefits that may from time to time be established by the EA and/or the relevant guidance from the government.

1.1.1 Avoided cost of generation

5. Firstly, the following categories are directly relevant in estimating the net avoided cost of generation which would constitute a benefit from the deployment of distributed generation of renewable energy (section 36(a)(i) of the EA).

   (a) **Reduction in fuel costs and other variable operating costs of generation**. Distributed generation of renewable energy may permit the avoidance of some variable operating costs of overall system generation that would otherwise be incurred. For example, since distributed generators supply renewable energy to the network, the TD&R Licensee can then purchase less energy from a conventional bulk generation licensee. Consequently, the conventional Bulk Generation licensee reduces its fuel and lubricating oil costs and other variable operating costs.[13] The reduction in fuel and lubricating oil costs and other variable costs does not have to be estimated based on the costs of conventional bulk generators currently connected to the network. For example, where data is available, it would be

[11] Electricity Act 2016, section 36.
[12] Ministry of Economic Development (2015), 'The National Electricity Sector Policy of Bermuda', Bermuda.
[13] Where distributed generation capacity is not large enough to make any discrete units of planned bulk generation capacity redundant, it is unlikely that a bulk generation licensee will avoid its fixed operating costs. The bulk generation licensee will also not avoid the capital costs that have already been incurred. However, even if a part of the bulk generation capacity becomes redundant due to the distributed generation, the extent to which the fixed operating costs and capital cost of the bulk generation licensee are avoided would depend on the agreement between the TD&R and the bulk generation licensees.

appropriate to consider the reduction in costs that would arise in a projected least-cost scenario within an integrated resource planning ("IRP") process.

(b) **Reduction in further generation capacity requirements**. Distributed generation may mitigate the need for further investment in conventional bulk generation capacity. For example, if, according to the IRP, the existing bulk generation licensees' capacity is not sufficient to meet total demand, or is not able to maintain the required level of system reliability, a significant amount of distributed generation capacity could allow the avoidance of some additional fixed costs of installing further conventional bulk generation capacity.[14]

(c) **Reduction in the TD&R Licensee's network losses**. Where there is a high correlation between a customer's demand and on-site generation, the energy losses associated with transmission and distribution may decrease with connecting distributed generators to the network.

6. In addition, the following categories are indirectly relevant in estimating the net avoided cost of generation, resultant from the deployment of distributed generation of renewable energy (section 36(a)(i) of the EA).

(a) **Increase in the network costs of the TD&R Licensee (cost to the system)**. Integration of distributed generation facilities to the existing grid may increase the TD&R licensee's network costs associated with providing the necessary connection assets, network reinforcements and metering services.[15]

(b) **Increase in the cost of system balancing (cost to the system)** and associated services such as frequency response and operating reserves, especially arising from intermittent distributed generation such as solar *photovoltaic* ("solar PV") generation. Introducing distributed generation to an electricity system may be expected to increase the amount of dispatchable generation capacity that must be held in reserve, to cope with short-term fluctuations in electricity output resulting from variable solar or wind conditions.

(c) **Increase in the cost of economic stranding of existing generation or network assets (cost to the system)**. Significant distributed generation capacity may displace some capacity of bulk generation licensee(s) or lead to under-utilisation of network assets. This could imply a system cost in the form of economic stranding of existing generation and network assets.

(d) **Changes in thermal plant efficiency (cost to the system)**.[16] Adding variable distributed generation to a grid may result in a reduction in the conversion efficiency of thermal plants, due to (among other things) more frequent changes in the output of load-following plant assets, greater use of more flexible but potentially less efficient plants, and more frequent plant 'start-up' and 'shutdown' measures.

1.1.2 Economic benefits

7. There are a number of economic benefits and costs that could deliver wider government policy objectives (section 36(a)(ii) of the EA). The magnitude of such benefits would depend on the relevant guidance from the government and may include the following:

[14] System reliability refers to the ability of the electricity system as a whole to meet all connected load requirements.
[15] Network reinforcement costs are unlikely to arise at low levels of distributed generation (e.g. solar PV) penetration. However, higher levels of distributed generation penetration would be more likely to involve costs of integrating the distributed generation into the existing grid.
[16] Costs such as this could conceivably be taken into account when quantifying the FIT if the availability of data permits robust estimation in the electricity sector of Bermuda.

(a) **Reduction in costs associated with meeting environmental standards (economic benefit)**. Distributed generation of renewable energy is likely to provide environmental benefits relative to existing and planned conventional generation. A higher degree of distributed generation of renewable energy would therefore help in achieving the environmental objectives of the government of Bermuda. If the TD&R Licensee is subject to, or will be subject to, explicit environmental performance targets, the environmental benefits of distributed generation can be measured as the reduction in the cost to the TD&R Licensee of meeting its environmental performance targets. In the absence of any explicit environmental performance targets or incentive schemes, environmental benefits may be approximated using metrics such as traded carbon prices to value the reduction in carbon emissions. The inclusion of such benefits in the determination of the level of the FIT should be guided by government policy.

(b) **Increased economic activity (economic benefit)**. The distribution of the benefits from increased economic activity (such as gross value added from direct employment or taxes generated from economic activity in relation to the installation of solar PV in Bermuda) should also be subject to guidance from the government. Based on government policy, the value impact of the increase in distributed generation on wider economic activity may be reflected in the FIT. Including the benefit from increased economic activity in the calculation of the FIT would shift the incidence value of these benefits from the wider economy to the distributed generators.

8. The estimation of the level of the FIT may vary for different distributed generation technologies. The methodology outlined above would reflect the idiosyncrasies of the different technologies for which the FIT is proposed (e.g. solar PV and wind). The net system costs and benefits associated with increased penetration of different distributed generation technologies are likely to differ. Also depending on the maturity and existing penetration of the different technologies, there may be differences in the degree to which government chooses to subsidise further deployment of particular technologies.

9. Therefore, the Authority considers that setting different levels of the FIT for different distributed generation technologies is appropriate, and it will consider any data that is provided as part of the data-gathering process regarding differentials in avoided cost by different technology. The Authority will consider whether there is sufficient penetration of each technology type to make it proportionate that a differentiated FIT level is determined by technology.

1.2 Calculation of the FIT based on avoided costs and economic benefits

10. The FIT shall be calculated as the sum of the avoided cost of generation and any net economic and/or other benefits, divided by forecast system total kWh produced by distributed generators.[17] It will be important to consider avoided cost of generation, net economic benefits and production over the same period (the "Period"), e.g. on an annual basis. As a formula, the FIT is calculated as follows:

$$\text{FIT(\$/KWh)} = \frac{\text{avoided cost of generation (\$/Period)} + \text{economic and/or other benefits (\$/Period)}}{\text{forecast system production by distributed generators (kWh/Period)}}$$

11. It should be noted that there are general limitations to the calculation of individual components of net avoided cost of generation and net economic benefits. In particular, cost categories are likely to overlap. For example, an increased system reserve requirement for short-term balancing may

[17] The Authority notes that this may also include any other benefits that may from time to time be included pursuant to legislative amendment and/or the relevant guidance from the government.

interact with the required capacity margin needed to meet peak demand. Therefore, it is important to ensure that the avoided system costs and other net economic benefits are not double counted.

12. Finally, the Authority takes the view that the FIT cannot be fixed for the duration of the investment and shall be updated with the periodicity of three years.