



**MINISTRY OF MINERAL RESOURCES, GREEN TECHNOLOGY AND ENERGY SECURITY**

# **ROOFTOP SOLAR GUIDELINES**

**JUNE 2020**



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# 1.Introduction

The overarching goal of Botswana's National Energy Policy is to provide an affordable, reliable and adequate supply of energy for sustainable development, as well as to improve access to an efficient use of energy resources. The policy states that the Government will support and facilitate initiatives that increase the contribution of solar energy to the energy supply mix in order to attain energy security and a low carbon portfolio. In its submission of its climate action plans to the United Nations Framework Convention on Climate Change (UNFCCC) in 2015, Botswana committed to an overall Greenhouse Gas (GHG) emission reduction of 15 per cent (from 2010 emissions level) by 2030.

Botswana further committed to conducting the necessary legislative review, develop a Climate Change Policy and Institutional Framework supported by relevant strategies to achieve the intended reduction. To that end, the Government of Botswana is implementing the Rooftop Solar Programme to create an environment in which end users can generate their own electricity and sell any excess to Botswana Power Corporation (BPC). The Programme is an alternative suitable mechanism to facilitate private sector participation and increase the uptake of solar energy. It entails the development of Rooftop Solar Guidelines, applicable rules, regulations, standards, tariffs as well as review of processes. These Guidelines define the framework and administrative process for the implementation of small scale grid-tied solar photovoltaic (PV) systems, either roof or ground mounted. The system-wide aggregate capacity of the Programme in the first 12 months is 10 MW.

## 1.1 Goal of the Guidelines

The goal of these Guidelines is to enable BPC electricity consumers to generate electricity for their own use while selling any excess to BPC up to the limit as defined by the Ministry.

## 1.2 Objectives

The objectives of these Guidelines are to provide:

- i. The framework and administrative process for the implementation of small scale grid-tied solar PV systems either roof or ground mounted;
- ii. Guidance that will assist in the development of applicable rules, regulations, tariffs and processes;
- iii. Guidance to consumers on how they may use the RTS Programme in a compliant manner to generate electricity for their own use and sell any excess to BPC; and
- iv. Support for the evaluation of the effectiveness of this type of programme as one part of an overall strategy for enhancing capacity and connectivity in Botswana's Electricity Sector.



## 2. Glossary, Definitions & Abbreviations

**Bi-directional meter:** A device that separately measures electricity flow in both directions (import and export)

**Consumer:** means any person who is supplied with electricity for his/her own use by BPC. Consumers who also generate will be referred to, herein, as “consumers”, although in effect they are “consumer/generators”.

**Consumption:** Kilowatt hours (kWh) used by the consumer for his/her own use and tracked by the BPC meter.

**Export:** Any kWh that is generated by the Rooftop Solar (RTS) system and sent to the BPC grid through its Point of Connection.

**Generating capacity:** The maximum amount of electricity, measured in kilovolt Amperes (kVA), which can flow out of the generation equipment into the consumer’s alternating current wiring system. This is therefore the maximum alternating current power flow which can be generated.

**Grid-tied:** Embedded generation, such as photovoltaic solar, that is connected to the utility electricity grid either directly or through a consumer’s internal wiring is said to be “grid-tied”. The export of energy onto the utility grid is possible when generation exceeds consumption at any point in time. Such consumers would rely on the utility grid to supply them with electricity when their instantaneous generation is insufficient to supply their instantaneous consumption. Also known as “interconnected”.

**Interconnection Agreement (ICA):** A contract between the consumer and BPC that details the terms and conditions of interconnecting an RTS system with the BPC grid. The ICA, signed by both the consumer and BPC, and the Certificate of Completion constitutes the Permit necessary for an RTS system.

**Inverter:** A power device that converts direct current to alternating current at a voltage and frequency which enables the generator to be connected to the utility grid.

**Licence:** For RTS systems above 100 kW, a licence will be issued by BERA to verify that the system meets the full intent and requirements of the Electricity Supply Act. The Licence term will be for 15 years.

**Licensed Technician or Engineer:** This refers to a Technician or Engineer who is certified by the Engineer’s Registration Board of Botswana.

**Permit:** A permit, comprised of the ICA signed by both the consumer and BPC as well as the Certificate of Completion to verify that an RTS system as met all technical and safety standards for interconnection with the system grid. The Permit term will be for 15 years.

**Photovoltaic Solar System:** A small scale embedded generation system, also known as PV system or solar power system, designed to supply usable solar power by means of photovoltaics. The system is comprised of solar panels to absorb and convert sunlight into electricity, a solar inverter to change the electric current from DC to AC, as well as mounting, cabling, and other electrical accessories to set up a working system.

**Point of Connection:** An electrical node on a distribution system where the consumer's electrical assets are physically connected to the utility's grid (BPC).

**Rooftop Solar:** PV systems owned by consumers at the same location at which they receive a bill for electric service. The generation from these facilities is primarily intended for self-use, with excess generation eligible to be sold back to the grid.

**Rooftop Solar Programme:** A programme for grid-tied roof or ground-mounted solar PV systems (with or without energy storage), owned by consumers at the same location at which they receive their electricity bill. The generation from these facilities is primarily intended for self-use, with excess generation eligible to be sold back to the grid. The facilities may be roof or ground mounted and may include battery storage.

**Utility:** The electricity distribution service provider responsible for the electricity grid infrastructure to which the consumer is connected.

**Utility Network (or Utility Grid):** The interconnected network of wires, transformers and other equipment, covering all voltage ranges, and belonging to the Utility.

## Abbreviations

AMI	Advanced Metering Infrastructure
BERA	Botswana Energy Regulatory Authority
DOE	Botswana Department of Energy, under the Ministry of Mineral Resources, Green Technology and Energy Security
kVA	kilovolt-ampere (unit of electrical power, often similar in magnitude to kW)
kW	kilowatt (unit of electrical power)
kWh	kilowatt-hour
MMGE	Ministry of Mineral Resources, Green Technology and Energy Security
MW	Megawatt
PV	Photovoltaic
RTS	Rooftop Solar



## 3. General Guidelines

### 3.1. General definition of the Rooftop Solar Programme (RTS)

A programme for grid-tied roof or ground-mounted solar photovoltaic (PV) systems (with or without energy storage), owned by consumers at the same location at which they receive their electricity bill. The generation from these facilities is primarily intended for self-use, with excess generation eligible to be sold to BPC.

### 3.2. Operating period

The RTS will align with and operate for the duration of the NDP11 (March 2023); and upon its completion be evaluated for changes.

In the event of the Programme's termination, any RTS-approved projects will be eligible to continue to operate their RTS under the terms and conditions of the Programme for the duration of the term of their permit or licence.

### 3.3. Relevant Legislation

The Guidelines seek to align with the following legislation:

- i. Electricity Supply Act;
- ii. Botswana Energy Regulatory Authority Act;
- iii. Botswana Power Corporation Act and By-Laws;
- iv. Environmental Impact Assessment Act;
- v. Occupational Health and Safety Act;
- vi. Trade Disputes Act; and
- vii. Any applicable law of the Republic of Botswana

### 3.4. General Roles and Responsibilities of Key Stakeholders.

The Department of Energy (DOE), under the Ministry of Mineral Resources, Green Technology and Energy Security (MMGE) shall be responsible for the oversight and policy direction of the Rooftop Solar Programme, providing general guidance through the Rooftop Solar Guidelines.

BERA shall be responsible for developing the necessary regulations, aligned with the Rooftop Solar Guidelines as needed to guide the interconnection process, set tariffs, establish tariff methodologies, and oversee safety concerns. It will also be responsible for issuing permits and/or licenses, as specified in further detail below.

BPC shall set design standards and specifications, interpret and implement the provisions of the policy and regulations, thereby allowing Consumers to interconnect their rooftop solar system to the grid. BPC may also propose changes to BERA on matters that are subject to BERA regulatory approval, for BERA's consideration and approval. In the process, it should ensure overall safety, adherence to the overall technical guidelines, and follow good commercial practices.

The Consumer shall ensure compliance with the Guidelines in the event the Consumer decides to sign up for the RTS Programme and meets the eligibility criteria. Such compliance includes the engagement of a licensed Electrician, Technician or Engineer to design the solar system; ensuring that the Consumer obtains all the applicable permits and licenses as provided for in the Guidelines, and ensuring the timely payment of all costs and charges that the Consumer is responsible for as detailed in the Guidelines such as the installation costs.



## 4. Eligibility

### 4.1. Eligibility Criteria

To be eligible for this Programme a consumer shall:

- i. be a BPC consumer;  
have title to the Rooftop Solar System.
- ii. site the system on the same property as the meter that will measure the consumption and export of the electricity;
- iii. adhere to the limitations in capacity and sizing contained herein; specifically, the following capacity limitations apply to this Programme:
  - a. Domestic – up to 35 kW of generating capacity.
  - b. Commercial & Industrial – up to 1 MW of generating capacity.

Additionally, the size of a system may not exceed 110% of the consumer's consumption over the 12-month period immediately preceding the date of application.

Consumers are allowed to apply for multiple permits and/or licenses, as long as the total generating capacity of the RTS systems does not exceed 35 kW for each domestic consumer and 1 MW for each Commercial & Industrial consumer.

Example 1: A domestic consumer owning two properties may apply to the Rooftop Solar Programme for each property to have a solar photovoltaic system, if all criteria are met from Section 4.1, and that the generating capacity equals no more than 35 kW. Therefore, each property could have the following roof or ground-mounted RTS systems:

- i. 5 kW and 10kW, totaling 15 kW; or,
- ii. 15 kW and 20 kW, totaling 35 kW

Example 2: A C&I consumer, meeting the above criteria from Section 4.1, with the generating capacity not exceeding 1MW, each property could have the following RTS systems: 300 kW and 250 kW and 350 kW, totaling 900 kW.



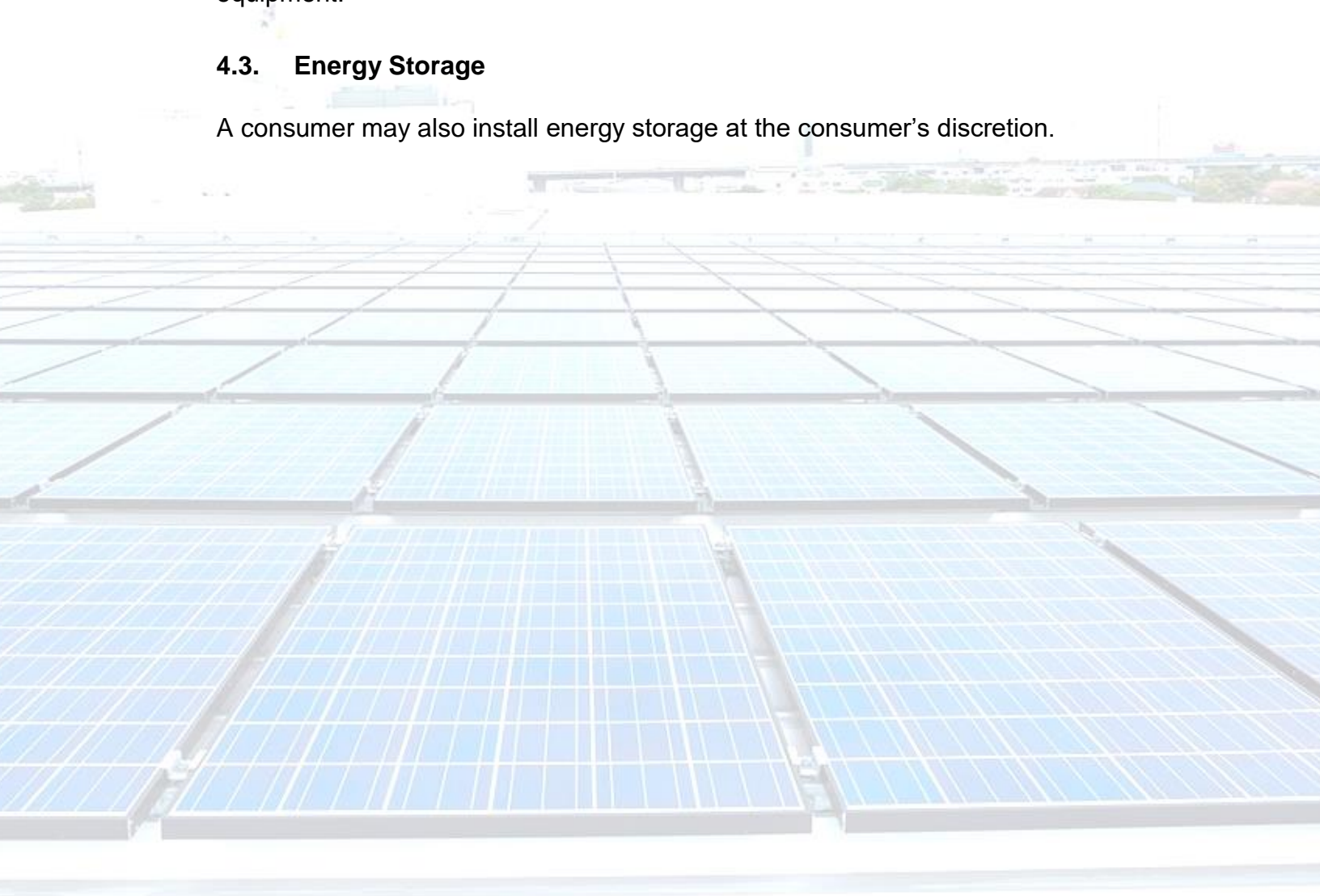
## **4.2. System Design**

It is the responsibility of the consumer to engage a licensed Electrician, Technician or Engineer in designing the solar system. A system can be mounted on a building roof or ground-mounted.

The RTS systems should be designed with Islanding Protection feature to detect loss of grid power and automatically (within two seconds) shuts off the solar inverter irrespective of connected loads to stop feeding power back to the grid. The Consumer may choose the design that allows their system to remain operational in isolation from the grid for own consumption, which may require additional equipment.

## **4.3. Energy Storage**

A consumer may also install energy storage at the consumer's discretion.



## 5. Permitting & Licensing

### 5.1. System-wide aggregate capacity

This nationwide Programme is limited to system-wide aggregate capacity of 10 MW for the first 12 months of the Programme. Twenty percent, or 2 MW, will be reserved for domestic consumers. Thereafter, the Ministry, in consultation with BPC, will determine the system-wide aggregate capacity for the remaining tenure of the Programme.

### 5.2. Definitions of Licence and Permits for RTS systems

For all domestic and C&I projects in this Programme, the RTS consumer must obtain a Permit, to ensure that its project meets all technical and safety standards. The Permit constitutes the Interconnection Agreement and the Certificate of Completion, as described below:

- i. **Interconnection Agreement (ICA)** – A consumer is required to execute an ICA with BPC. The ICA for domestic consumers will be standardized and simplified, requiring minimum terms and conditions relating to safety and technical standards.
- ii. **Certificate of Completion** – After installation and inspection of the RTS system, BPC (or its representative) will certify its completion, deeming the ICA as final and in effect.

For C&I projects sized between 100 kW to 1 MW, the RTS consumer must obtain a Licence (over and above the Permit), according to the BERA Act.

### 5.3. Permit and Licence Terms

The term of the Permit (ICA) and/or Licence will be for 15 years, upon which time it will require renewal. In event of Programme termination, an RTS-approved project will be able to continue to operate under the terms and conditions of the Permit or Licence until the expiration date of that Permit or Licence.

### 5.4. Application Process

5.4.1 Potential RTS consumer applies with BPC to install a system of a certain size on its property. Until the aggregate capacity limit is reached, consumers gain access to the Programme on a first come-first served basis.



5.4.2 Documents required are filed with BPC, through an online application system:

5.4.2.1 Application –The Application Form shall provide for an attestation that all environmental requirements have been (or will be) met. BPC will confirm the electricity needs after receipt of the application. The Application Form will be completed online, directly on the BPC website.

For PV systems greater than 100 kW, the application will be automatically forwarded to BERA for review and issuance of a Licence to the consumer. BERA will inform BPC of the issuance of such applicable authorization.

5.4.2.2 Interconnection Agreement – A conditional standard ICA developed by BPC and approved by BERA. The ICA will be signed by the consumer and BPC, prior to installation, agreeing to install the system per the terms and conditions of the Interconnection Agreement.

For PV systems greater than 100 kW, the conditional ICA will be signed by the consumer and BPC, upon approval of the Licence by BERA.

5.4.3. If all documents are in order, BPC puts the consumer and the amount in the queue. The capacity requested is subtracted from the running balance of Programme capacity available. BPC will conduct necessary studies or analyses to confirm availability request at the Point of Connection. BPC will notify the consumer of the outcome of their application.

5.4.4 BPC will maintain a Registry of such systems, providing access to BERA, that will include information provided from the Application and any other relevant data. BPC will regularly monitor for Permits (ICA) expiring, while BERA will monitor for licenses that may be expiring.

5.4.5 The consumer will have a set amount of time as determined by BERA, upon application from BPC, to install and certify the system.

5.4.6 The consumer and its representative Licensed Electrician, Technician or Engineer will commission the system for Certification. BPC, or its representative, may elect to witness this commissioning. Authorized representatives of BPC may be a Licensed Electrician, Technician or Engineer. For systems sized between 100 kW to 1 MW, BERA may also witness the commissioning. The Certification process shall be to ensure that the system meets all the conditions of the Interconnection Agreement. Upon Certification, the BPC representative shall sign the Certificate of Completion on behalf of BPC, deeming the ICA as final and in effect.

5.4.7 The system is eligible to be put into service upon certification.

5.4.8 If the consumer does not receive certification for its system within the time frame allowed, the capacity is added back into the Programme capacity available and the consumer is removed from the Registry. BPC will determine, in consultation with BERA and the Ministry, an appropriate timeframe allowed.

5.4.9 For good cause, if the consumer requests, BPC may grant an extension to the deadline, in consultation with BERA.

5.4.10 If the consumer is removed from the Registry, it then must reapply anew in order to be placed back on the Registry.

## **5.5. Renewal and Expansion of Systems**

5.5.1 Renewal of System – BPC will notify a consumer within 60 days of the expiration of the Permit. If planning to renew, the consumer must submit its intent to do so and complete the Application Process from 6.4.6 above. Upon receipt of Certificate of Completion, BERA will renew the term of Licence for projects above 100 kW.

5.5.2 Expansion of System – If a consumer intends to expand a system with a current Permit or Licence, the consumer must follow the entire Application Process anew.



## 6. Access, Indemnity, Legal Requirements

### 6.1. Right to curtail

In the event of operating conditions that may result in BPC electrical grid parameters not meeting minimum quality of supply, safety standards or non-availability of an off-taker, it may become necessary to curtail Rooftop Solar consumers. It is expected that these limitations would be of a temporary nature, applied only during abnormal system conditions or low load periods.

### 6.2. Adapting rules & regulations

In the event of changes to the energy sector or associated relevant rules, regulations, policies, laws and/or standards, Rooftop Solar Programme customers may be required to upgrade these systems to meet new specifications or standards. Existing RTS consumers may be exempted from amendments unless BPC files application, agreed to by BERA, to require remediation to rooftop solar projects. Those PV systems currently connected to BPC grid but not exporting power are eligible to apply for this Programme.

### 6.3. Right to deny access

BPC has the right to deny access to any RTS consumer to interconnect with the system grid. It is mandatory that all consumers wishing to install a Rooftop Solar system, regardless of generation capacity, complete the relevant sections of the application process in full, and that the Conditional ICA is signed by BPC before system installation commences. BPC will ensure that, amongst other considerations, there is availability of capacity to accommodate the Rooftop Solar system. If the consumer is willing to take on the necessary upgrades and its associated costs to interconnect, then BPC may consider the Application. Consumers should not purchase equipment prior to signing the Conditional ICA, as approval is not guaranteed and BPC shall not be held liable for equipment expenses where approval is denied.

### 6.4. Change of Ownership

If a transfer of ownership of a property takes place in which an RTS system is installed, the current owner will need to notify BPC of the change and the new owner will be required to sign a new ICA. For projects above 100 kW, BPC would forward the request for a Change of Ownership to BERA to amend the Licence accordingly. Alternatively, the RTS system should be disconnected and removed from the Programme.

### **6.5. Removal or Decommissioning of System:**

If a consumer decides to remove or cease operation of the RTS system, BPC must be notified, and BPC must verify that the system has been physically disconnected from the grid. For projects above 100 kW, the consumer will also need to notify BERA of the discontinuance of the Licence. Costs to remove wiring which connects the inverters with the grid will be borne by the consumer. BPC will provide a Certificate of Compliance that the system has complied with removal and decommissioning procedures and update the Registry as such.

## **7. Technical Standards**

RTS systems should comply with the necessary standards and regulations in order for the system to be approved and put into operation. In addition to the legislation listed above in Section 3.3, BPC, in consultation with BERA, will provide the minimum applicable technical standards as contemplated in the RTS rules and regulations to the RTS Programme on its website as well as referenced within the ICA's terms and conditions to ensure full compliance, a consumer should engage a licensed Electrician, Technician or Engineer.

## **8. Metering, Billing and Other Related Costs**

### **8.1. Good standing of Accounts**

Consumers should be in good standing with BPC. RTS applicants in arrears will not be considered.

### **8.2. Who pays for what:**

8.2.1 The consumer is responsible for any installation costs from the Point of Interconnection (typically the meter for a domestic consumer).

8.2.2 If the system network is oversubscribed or cannot accommodate the RTS system, the consumer will be responsible for any changes (and the associated costs) required to the utility network upstream of the connection point to proceed with its interconnection.

8.2.3 The consumer is responsible for the cost of any special grid studies or tests that need to be carried out to obtain the required ICA.



### **8.3. Metering**

A bi-directional meter, with four quadrant capability to support independent registers for import (kWh consumed), export (kWh generated) and net measurements regardless the meter mode of operation (prepaid/postpaid) as determined by BPC will be provided and installed by BPC at the consumer's cost. The same meter will be of multiple tariff to support the required time of use (TOU) tariff. The meter will be owned by BPC as a non-utility funded asset.

For the purposes of gathering statistics on renewable energy production, it is recommended that installations below 100 kW should install their own energy meter to record the RTS plant energy production. For installation at or above 100 kW it is mandatory that consumer has the energy meter on their RTS plant.

### **8.4. Billing**

Consumers are billed according to the regular billing cycle for kWh. Excess kWh generated and exported to the grid over the consumer's use are credited towards the next billing cycle. The kWh generated less consumed should be clearly represented on each monthly bill.

The meter will register the energy imported from BPC and the excess energy exported to BPC. These two, energy imported from and exported to BPC will be reconciled on monthly basis to also reflect the Net energy. For every kWh the consumer exports to the grid, they will receive a credit of 1kWh. The credit received shall not be in monetary terms but in kWh. Any excess energy exported by the consumer will be rolled over to the next billing cycle. Only the charges relating to the kWh units, energy part, of the consumer bill are affected, the fixed charge part, non-energy part of the consumer's bill will not be credited for excess energy exported to BPC. If, over any particular month, the customer is a net importer (their net export is negative), the customer will be billed for the energy supplied during that month as per the approved BPC tariff schedule.

For applicable consumers accruing demand charges, aggregate demand will be adjusted over each billing cycle for the first 12 months of the RTS system's operation.

### **8.5. Banking of kWh credits**

Credits will be carried forward for a duration of 12 months, known as "banking". Upon which time, BPC will reconcile the consumer "bank" and pay the consumer for the remaining credits. Any banked kWh should be clearly represented on each monthly bill.

BPC will pay the consumer for any banked credits at the avoided cost rate. The avoided cost rate, or wholesale cost of power and its distribution, will be determined by BPC on an annual basis, as approved by BERA and advised to consumers.

The cost will be informed by the applicable tariff at the time of use. For example, the meter will be configured based of the pre-determined TOU tariff such that any excess power exported to BPC during off-peak hours will be of standard tariff and any export at peak hours will be registered at a non-standard tariff which will be a little more expensive.

### **8.6. Arrearages**

If a consumer becomes in arrears with an operational RTS solar system, routine disconnection and reconnection procedures will apply.

## **9. Dispute Resolution**

Any disputes between BPC and the RTS consumer may be resolved promptly through mutual consultations. Further grievance shall have recourse under the relevant regulations under BERA's jurisdiction.

## **10. Auditing of RTS systems**

BPC will periodically audit a sample of RTS systems, as per the procedures approved by BERA, conducting an inspection of such systems to ensure all technical and safety standards are met. Thereafter, BPC will submit in its audit findings to BERA. All documentation and information pertaining to the auditing and site visits will be retained by BPC for BERA and the Ministry to review upon request.

## **11. Non-compliance**

If at any time an RTS system is not complying with the Guidelines, Rules or associated regulations for this Programme (e.g., technical, safety, environmental), BPC may disconnect the consumer's system immediately and without notice, and notify BERA of the system's non-compliance. BERA has the authority to impose sanctions for non-compliance with Guidelines and Rules.



## 12. Evaluation & Reporting

BPC will report on a quarterly basis the performance of the Rooftop Solar Programme. The report should include the following data and analyses:

- i. any technical and/or financial issues;
- ii. aggregate kWh generated and exported, as well as other relevant data;
- iii. number of active and decommissioned RTS systems, including geographical (city, zone, feeder, etc.) and demographic information captured from the net metered participant register; and
- iv. audit findings.

At the end of the first 12-month term of the Programme, the Ministry will announce its determination of aggregate maximum capacity within the system grid.

## 13. Amendments

The Minister reserves the right, at his discretion, to change or modify these Guidelines at any time. If the minister makes a change to the Guidelines, any application that has been filed will be processed under the (old) Guidelines in effect at the time the application was filed.

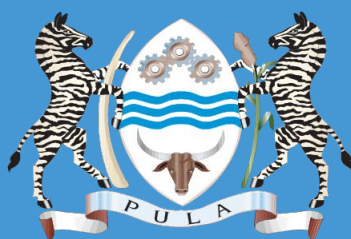
## 14. Implementation of the RTS Programme

Implementation of the RTS Programme will be subject to all applicable policies and relevant laws of the Republic of Botswana.



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Lefoko Maxwell Moagi  
**MINISTER OF MINERAL RESOURCES, GREEN TECHNOLOGY  
AND ENERGY SECURITY**

Date: 26/06/2020



**Republic of Botswana**