

**ORDER**

1. The Regulatory Authority of Bermuda (“RA”) issues this order per Regulatory Authority (Service Standards Indicators for Electricity Licensees) General Determination 2019.
2. Annex 1 has effect.
3. This Order’s publication date is also its effective date.
4. So ordered this 14 day of December 2021.



Chairman, Regulatory Authority of Bermuda

# ANNEX 1



# **Service Standards Indicators – Minimum Filing Requirements Administrative Determination**

Matter: 20211214

Date: 14 December 2021

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## Acronyms

AF	Availability Factor
AMI	Advanced metering infrastructure
ASAI	Average Service Availability Index
CAIDI	Customer Average Interruption Duration Index
CAIFI	Customer Average Interruption Frequency Index
CEMS	Continuous Emissions Monitoring System
CO	Carbon Monoxide
CO <sub>2</sub>	Carbon Dioxide
COMS	Continuous Opacity Monitoring Systems
EPS	East Power Station
FOF	Forced Outage Factor
GT	Gas Turbine
GUG	Group Unavailable Generation
GUT	Generator Unit Trips
GW	Gigawatts
GWh	Gigawatt-hours
HR	Heat Rate
HFO	Heavy Fuel Oil
HV	High Voltage
Hz	Hertz
IEEE	Institute of Electrical and Electronics Engineers
kV	Kilovolts
LFO	Light Fuel Oil
MW	Megawatts
MWh	Megawatt-hours
NO <sub>2</sub>	Nitrogen Dioxide
NO <sub>x</sub>	Nitrogen Oxides
NPS	North Power Station
PM <sub>10</sub>	Inhalable Particulate Matter
POF	Planned Outage Factor
RA	Regulatory Authority of Bermuda
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index

SO <sub>2</sub>	Sulphur Dioxide
SO <sub>x</sub>	Sulphur Oxides
TD&R	Transmission, Distribution and Retail
TSP	Total Suspended Particles
UG	Unavailable Generation
VOC	Volatile Organic Compounds
WAF	Capacity-Weighted Availability Factor
WFOF	Capacity-Weighted Forced Outage Factor
WPOF	Capacity-Weighted Planned Outage Factor

# 1 Introduction

## 1.1 Background

This administrative determination (“AD”) has been prepared by the Regulatory Authority of Bermuda (“the RA”) following the publication of the *Service Standards Indicators for Electricity Licensees* (“the Service Standards”) dated 4 April 2019. It is intended to provide further instructions to licensees about the RA’s expectations concerning how the performance indicators are to be measured and reported by BELCO.

The objective of the Service Standards is to measure and incentivise licensees’ performance in the following areas:

- Customer service levels;
- Reliability of electricity supplied to customers;
- Quality of electricity supplied to customers;
- Efficiency of electricity supplied to customers;
- Meeting safety and environmental goals.

This report captures minimum filing requirements in relation to most of the Service Standards across all areas listed above. In due course, minimum filing requirements will encompass all of the Service Standards.

The Service Standards have been produced at a time of significant change within the Bermudian electricity sector, with consequential influence on the setting of targets. Some of these changes are briefly discussed in Table 1.

**Table 1: Summary of changes in the Bermuda electricity sector influencing the setting of performance targets**

Development	Influence on performance targets
Accounting separation of BELCO generation and TD&R activities	Targets will be set, and performance measured, for generation and TD&R activities separately.
Electricity network capital plan upgrades and installation of advanced meters between 2018 and 2022	The significant upgrades to the network should increase the reliability of supply to customers as old existing and decommissioned cables are replaced. The installation of advanced meters (advanced metering infrastructure, “AMI”) should increase the quality of the data that BELCO has on customer outages and the quality of electricity supplied, enabling it to respond to interruptions more quickly and proactively.
Retirement of some existing generation units and commissioning of the North Power Station (“NPS”) in 2020	The older generation units (those installed before 1995) are generally less reliable than the newer units (installed since 1995); therefore, the aggregate performance of the generation fleet should increase from 2020.

## 1.2 Purpose

The primary purpose of this AD is to provide instructions for reporting of indicator performance, and to provide further instructions in relation to their calculation whenever deemed necessary.

- Provide further instructions to licensees about how indicators are to be measured or calculated and categorised; and
- Provide instructions for reporting of indicator performance;

## 1.3 Reporting process

It is important to have having accurate performance data to set reasonable targets. The reporting process is shown in **Table 2** on the next page.

Three categories of deliverables are shown with deadlines listed below (unless otherwise agreed):

1. Annual forecasts for generation reliability and efficiency indicators for the next calendar year using a spreadsheet template to be provided by the RA, to be submitted before the end of November.
2. Quarterly performance reports for customer service, network efficiency and generation efficiency indicators, to be submitted within 3 weeks of the end of each quarter.
3. Annual performance reports for all indicators, to be submitted before the end of February for the previous reporting year.

Those Minimum Filing Requirements become binding in 2021, meaning that in **Table 2**:

- “Year 0” is 2021 (period starting from 01/01/2021 and ending on 31/12/2021);
- Step A will first occur in February 2022; and
- Step B will first occur in April 2022, and so on.

The deadline for submission of reports for the annual customer satisfaction survey will be agreed when the survey design is discussed.

**Table 2: Overview of performance indicator reporting process.**

Step #	Timing	Party Responsible	Customer Service Indictors	Network Reliability Indicators	Network Quality of Supply Indicators	Network Efficiency Indicator	Network Environmental Indicator	Network Safety Indicators	Generation Reliability Indicators	Generation Efficiency Indicator	Generation Safety Indicators	Generation Environmental Indicators	
A	February of reporting year 1	BELCO	Annual report on performance in reporting year 0					-					
B	April of reporting year 1	BELCO	Quarterly perf. report	-	-	Quarterly perf. report	-	-	-	Quarterly perf. report	-	-	
C	July of reporting year 1	BELCO	Quarterly perf. report	-	-	Quarterly perf. report	-	-	-	Quarterly perf. report	-	-	
D	October of reporting year 1	BELCO	Quarterly perf. report	-	-	Quarterly perf. report	-	-	-	Quarterly perf. report	-	-	
E	February of reporting year 2	BELCO	Annual report on performance in reporting year 1										

## 1.4 Allowances made for Force Majeure events

The performance of the TD&R licensee can be expected to reduce during and immediately after Force Majeure events. The definition of Force Majeure events adopted is as follows – in line with that currently used in the TD&R License.

*“acts of God, war, warlike operations, civil commotion, major strikes or any other significant or protracted industrial action, fire, tempest or any other causes beyond the Licensee's reasonable control”*

The following provides further guidance on the qualification of Force Majeure events and on when Force Majeure events are deemed to start / end.

- A weather event must only be deemed a Force Majeure event when the intensity of the weather event is such that Government officials advise citizens to shelter in their homes or non-essential business are advised to close. In determining the start of such weather force majeure event, the starting point will be the point at which the Government states that sheltering in place ought to begin and/or non-essential businesses ought to be closed, whichever is the earliest. The end point will be the point at which the TD&R Licensee declares that all customers impacted by such an event have had their electricity service restored. Information pertaining to events occurring at any point between the start and the end of Force Majeure events must not impact calculations of Service Standards.
- For other Force Majeure events (whether or not weather-related), the starting point of the Force Majeure event will be the point at which the TD&R Licensee has declared that the first customer is off supply due to an incident directly caused by such event. The end point will be the point at which the TD&R Licensee declares that all customers impacted by such an event have had their electricity service restored. Information pertaining to events occurring at any point between the start and the end of Force Majeure events must not impact calculations of Service Standards.

## 2 Customer Service Indicators

The Service Standards list fifteen indicators for customer service. These are discussed in turn in the sections below.

### 2.1 Reporting of customer service indicators

The customer service indicators must be recorded for each calendar month, and BELCO must submit quarterly summary reports and a formal annual report to the RA in the February following the reporting year.

In the context of customer service indicators, a statement, comment, or query made by a customer must be treated as a “complaint” when the following are **all** verified:

- The statement, comment, or query is made by a customer of BELCO; **and**
- The customer lodging the statement, comment or query has specifically informed BELCO of its intention to lodge a “complaint”; **and**
- The statement, comment, or query has been directed to the Customer Experience team.

### 2.1.1 Percentage of calls answered within 30 seconds, based on total calls received

<b>Indicator description:</b>	Percentage of calls answered within 30 seconds, based on total calls received.
<b>Instructions for measurement and reporting:</b>	<ul style="list-style-type: none"> <li>• This indicator exclusively refers to telephone calls made to the telephone line 299-2800.</li> <li>• Provide a breakdown by month of the total number of calls received, the number of calls answered within 30 seconds (by an automated system or human being) and the resulting percentage.</li> <li>• If there is an Force Majeure event in a given month, then the performance must be reported: <ul style="list-style-type: none"> <li>○ in aggregate for the month;</li> <li>○ during the Force Majeure event;</li> <li>○ excluding the Force Majeure event.</li> </ul> </li> </ul>

### 2.1.2 Average waiting time before a call is answered

<b>Indicator description:</b>	Average waiting time before a call is answered.
<b>Instructions for measurement and reporting:</b>	<ul style="list-style-type: none"> <li>• This indicator exclusively refers to telephone calls made to the telephone line 299-2800.</li> <li>• Calls abandoned must be included in the calculation.</li> <li>• Calculate the average waiting time before a call is answered or abandoned for each month.</li> <li>• For automated systems, the time must be measured from when the caller has selected his/her choice from the menu.</li> <li>• For human operator systems, this is the time from connection to when the operator answers.</li> <li>• If there is an Force Majeure event in a given month, then the performance must be reported: <ul style="list-style-type: none"> <li>○ in aggregate for the month;</li> <li>○ during the Force Majeure event;</li> <li>○ excluding the Force Majeure event.</li> </ul> </li> </ul>

### 2.1.3 Percentage of calls abandoned

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<b>Indicator description:</b>	Percentage of telephone calls abandoned
<b>Instructions for measurement and reporting:</b>	<ul style="list-style-type: none"><li>• This indicator exclusively refers to calls made to the telephone line 299-2800.</li><li>• This indicator refers to calls abandoned by the caller before being answered.</li><li>• Provide a breakdown by month of the total number of calls received, the number of calls abandoned and the resulting percentage.</li><li>• If there is an Force Majeure event in a given month, then the performance must be reported:<ul style="list-style-type: none"><li>○ in aggregate for the month;</li><li>○ during the Force Majeure event;</li><li>○ excluding the Force Majeure event.</li></ul></li></ul>

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### 2.1.4 Number of complaints received and resolved by type

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<b>Indicator description:</b>	Number of complaints received and resolved by type.
<b>Instructions for measurement and reporting:</b>	<ul style="list-style-type: none"><li>• The complaint categories are:<ol style="list-style-type: none"><li>i. Customer property damage caused by BELCO;</li><li>ii. Incomplete work by BELCO personnel;</li><li>iii. Unsatisfactory service team interaction;</li><li>iv. Billing errors;</li><li>v. Customers deeming their electricity bills to be too high; and</li><li>vi. All other customer complaints.</li></ol></li><li>•</li><li>• “Complaints received” must be reported for all categories listed above. “Complaints resolved” (within 48 hours) must be reported for all categories except “Complaints relating to customers deeming their electricity bills to be too high”.</li><li>• Results for residential customers must be reported separately from other customers.</li><li>• Applies to complaints submitted by telephone, mail, email or in person at customer service points.</li></ul>

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### 2.1.5 Resolution time by complaint type

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**Indicator description:** Resolution time (average, minimum and maximum) by complaint type.

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**Instructions for measurement and reporting:**

- Comments made in relation to circumstances where statements, comments, or queries made by customers must be treated as “complaints” in section 2.1.4 are also applicable to this indicator.
  - Provide a breakdown of the average, minimum and maximum time to resolve complaints received in each month for each complaint category (see section 2.1.4), except for “Customers deeming their electricity bills to be too high”.
  - Applies to complaints submitted by telephone, mail, email or in person at customer service points.
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### 2.1.6 First call complaint resolution rate

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**Indicator description:** Percentage of complaints remaining unresolved after the first telephone call.

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**Instructions for measurement and reporting:**

- Comments made in relation to circumstances where statements, comments, or queries made by customers must be treated as “complaints” in section 2.1.4 are also applicable to this indicator.
  - Provide a breakdown by month of the total number of complaints that remained unresolved after the first call to raise the complaint, the total number of complaints received by telephone in the month and the resulting percentage.
  - Complaints falling into the category “Complaints relating to customers deeming their electricity bills to be too high” identified in section 2.1.4 are to be excluded from the calculations.
  - Only applies for complaints raised by telephone.
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### 2.1.7 Number of billing and metering queries

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**Indicator description:** Number of billing and metering queries

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**Instructions for measurement and reporting:**

- In this context, a “query” is defined as a request for information made by one of BELCO’s customers to the Customer Experience team and is not a “complaint” as defined in section 2.1.4.
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- Provide a breakdown by month of the total number of queries into the following categories and sub-categories:
    1. Billing
      - i. Account balance;
      - ii. Explain my bill; and
      - iii. Account maintenance.
    2. Service team interaction;
      - i. Meter service;
      - ii. Meter audits; and
      - iii. AMI.
  - This indicator relates to queries raised by customers about billing and metering and does not include complaints, which are tallied separately (see section 2.1.4).

Applies to queries submitted by telephone, mail, email or in person at customer service points.

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### 2.1.8 Number and percent of meters not read in accordance with the Service Rules

<b>Indicator description:</b>	Number and percent of meters not read in accordance with the Service Rules.
<b>Instructions for measurement and reporting:</b>	<ul style="list-style-type: none"> <li>• Applies to non-AMI meters only.</li> <li>• Report the number of readings (and percentage of the total) where the time since the last reading exceeded 34 days.</li> </ul>

### 2.1.9 Time to provide new connections

<b>Indicator description:</b>	<b>Average lead time to provide new connections.</b>
<b>Instructions for measurement and reporting:</b>	Excluded from this version of the Minimum Filing Requirements.

### 2.1.10 Time to reconnect customers

<b>Indicator description:</b>	Average lead time to reconnect customers following a disconnection for non-payment.
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**Instructions for measurement and reporting:**

Excluded from this version of the Minimum Filing Requirements.

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### 2.1.11 Average lead time to investigate or replace meters following a complaint

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**Indicator description:**

Average lead time to investigate or replace meters following a complaint.

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**Instructions for measurement and reporting:**

- For complaints (in line with definitions provided in 2.1.4) that require a technician to visit the customer’s premises or take other action to investigate and/or replace, calculate the average time (in number of business days) between receipt of the complaint and the visit/action taking place.
  - Whether or not a technician visit is required is to be determined by BELCO on a case by case basis.
  - The time must be reported separately for AMI and non-AMI metered customers.
  - The average must be calculated for all visits in a month.
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### 2.1.12 Number of disconnections due to non-payment

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**Indicator description:**

The number of customer disconnections due to non-payment.

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**Instructions for measurement and reporting:**

- “Non-payment” specifically refers to non-payment of electricity bills.
  - Provide a breakdown by month of the number of times customers were disconnected due to non-payment of bills.
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### 2.1.13 Response time to voltage complaints

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**Indicator description:**

Response time to respond to voltage complaints.

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**Instructions for measurement and reporting:**

- For complaints involving voltage level calculate the average time (in hours) to respond to the initial complaint.
  - Values are to be reported for each month.
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### 2.1.14 Response time to emergency calls

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**Indicator description:**

Time to respond to emergency calls.

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**Instructions for measurement and reporting:**

- Provide a list of all emergency calls, category of emergency (if applicable) and associated response times.
- For all emergency calls, calculate the average time (in hours) to respond, starting from receipt of the call until resolution.
- Values are to be reported for each month.
- The values reported must be the average for all emergency calls in a month.
- Data must be reported separately for performance outside of Force Majeure events; as well as during Force Majeure events and the 24-hour period immediately thereafter.

### 2.1.15 Number of appointments cancelled or rescheduled by the licensee

**Indicator description:**

Number of appointments cancelled or rescheduled by the licensee.

**Instructions for measurement and reporting:**

- For all pre-arranged appointments that require a representative from BELCO to meet with a customer at his/her premises, sum up the total number that were cancelled or rescheduled by BELCO.
- Instances where appointments are cancelled or rescheduled upon request from the client or due to Force Majeure events must be excluded from the calculations.
- The total must be calculated for each month.

## 2.2 Summary of data to submit for Customer Service Indicators

This section summarises the information related to customer service indicators BELCO must provide, as listed in Table 3. This section is to be read in conjunction with reporting provisions from section 1.3 and reporting instructions provided throughout section 2.1.

**Table 3: Summary of data required for customer service indicators.**

Type of data	Recorded	Required
Data on all telephone calls received	Monthly	A. Total number of telephone calls B. Calls answered within 30 seconds (2.1.1) i. Total number; and ii. Percentage of all calls C. Average waiting time (before call answered or abandoned) (2.1.2) D. Number and percentage of abandoned calls (2.1.3)

Type of data	Recorded	Required
		<p>E. Total number of complaints received by telephone (2.1.4)</p> <p>F. Total number of complaints unresolved after the first call to raise the complaint, and percentage of total (2.1.4)</p> <p>In the event of a Force Majeure event occurring, figures reported (applies to 2.1.1; 2.1.2; 2.1.3):</p> <ul style="list-style-type: none"> <li>– in aggregate for the month;</li> <li>– during the Force Majeure event;</li> <li>– excluding the period of the Force Majeure event.</li> </ul>
<p>Data on all complaints (phone, mail, email, in person)</p>	<p>Monthly</p>	<p>G. Total number of complaints received – in different categories specified below (and separated by residential / other customers) (2.1.4)</p> <ul style="list-style-type: none"> <li>i. Connections to and disconnections from the grid;</li> <li>ii. Metering and billing;</li> <li>iii. Quality of supply (e.g. interruptions, voltage, frequency);</li> <li>iv. Customer service and communication; and</li> <li>v. Other complaints.</li> </ul> <p>H. Number (total and by category) resolved within 48 hours (2.1.4)</p> <p>I. Average, minimum, and maximum time to resolve complaints received in each month for each complaint category (2.1.5)</p> <p>J. See E and F above (2.1.4)</p>
<p>Billing and Metering (phone, mail, email, in person) (monthly)</p>	<p>Monthly</p>	<p>K. Total number of queries related to billing and metering (separate to complaints) (2.1.7)</p> <p>L. For non-AMI meters only: Total number of readings, and percentage of total where the time since last reading exceeds Service Rules (i.e. currently 34 days) (2.1.8)</p>

Type of data	Recorded	Required
Time taken to investigate and/or replace meters (2.1.11)	Monthly	<p>M. For complaints that require a technician to visit the customer’s premises or take other action to investigate and/or replace, the average time (in business days) between receipt of the complaint and the visit/action taking place, across all visits / actions required in the month</p> <p>N. Reported separately for AMI and non-AMI metered customers</p>
Number of disconnections for non-payment (2.1.12)	Monthly	O. Disconnections in the month for non-payment
Response time for voltage level complaints (2.1.13)	Monthly	P. The average time (in hours) taken to resolve the complaint, measured from receipt of the complaint (across all voltage complaints in the month)
Response time to emergency calls (2.1.14)	Monthly	<p>Q. List all emergency calls, category of emergency (if applicable) and associated response times (from receipt of call until resolution)</p> <p>R. Average time (in hours) to respond calculated across all such calls in the month (derogations for Force Majeure events).</p>
Number of appointments cancelled or rescheduled (2.1.15)	Monthly	S. Total number of pre-arranged appointments (requiring a BELCO representative to meet with a customer at his/her premises) which were cancelled or rescheduled by BELCO

### 3 Customer Satisfaction Survey

BELCO must appoint an expert company to conduct surveys annually, at the same time of the year to eliminate seasonal effects (except when a Force Majeure event prevents this). The methodology and survey questions must be reviewed and agreed by the RA before the surveys are conducted.

It is important for surveys to be well designed to provide meaningful results. For the results to be meaningful, the questions must be as objective as possible and taken from a representative cross-section of the population to make them comparable from year to year.

### 4 Transmission and Distribution Network Performance Indicators

Transmission and Distribution network reliability, quality of supply and efficiency performance indicators will be reported annually as described in section 1.3. The network efficiency performance indicator (losses) will also be reported on a quarterly basis.

#### 4.1 Network Reliability (Availability) Measures

As described in the Service Standards, the performance indicators and definitions are derived from *IEEE Standard 1366-2012: IEEE Guide for Electric Power Distribution Reliability Indices*.

Network reliability measures must only take into account “sustained interruptions”, as defined in IEEE 1366. A “sustained interruption” lasts more than five minutes, whereas the maximum duration of a “momentary interruption event” is less than or equal to five minutes.

Where indicated, the filtering of data from the outage management system will need to be extended to separately report on indicators both excluding and during Force Majeure events.

##### 4.1.1 System Average Interruption Frequency Index (“SAIFI”)

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<b>Indicator description:</b>	<b>System Average Interruption Frequency Index.</b>
<b>Instructions for measurement and reporting:</b>	<ul style="list-style-type: none"><li>SAIFI measures the average number of interruptions that a customer experiences in a year. It is a ratio of the number of customer-interruptions in a year to the total number of customers. Customer-interruptions are determined from estimates of the number of customers affected by each interruption.</li><li></li></ul>

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- Calculation must only consider “sustained interruptions”, as defined in IEEE 1366. A “sustained interruption” lasts more than five minutes, whereas the maximum duration of a “momentary interruption event” is less than or equal to five minutes.
- Force Majeure events must be excluded from the calculations

#### 4.1.2 Customer Average Interruption Frequency Index (“CAIFI”)

**Indicator description:** Customer Average Interruption Frequency Index

**Instructions for measurement and reporting:**

- CAIFI measures the average number of interruptions per customer interrupted per year.
  -
- Calculation must only consider “sustained interruptions”, as defined in IEEE 1366. A “sustained interruption” lasts more than five minutes, whereas the maximum duration of a “momentary interruption event” is less than or equal to five minutes.
- Force Majeure events must be excluded from the calculations

#### 4.1.3 System Average Interruption Duration Index (“SAIDI”)

**Indicator description:** System Average Interruption Duration Index

**Instructions for measurement and reporting:**

- SAIDI measures the average duration of interruptions, as the sum of the durations of the customer interruptions used for SAIFI, divided by the total number of customers.
  -
- Calculation must only consider “sustained interruptions”, as defined in IEEE 1366. A “sustained interruption” lasts more than five minutes, whereas the maximum duration of a “momentary interruption event” is less than or equal to five minutes.
- Force Majeure events must be excluded from the calculations

#### 4.1.4 Customer Average Interruption Duration Index (“CAIDI”)

**Indicator description:** Customer Average Interruption Duration Index

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**Instructions for measurement and reporting:**

- CAIDI measures the average amount of time in a year that a customer’s power service is interrupted, as the sum of the customer-interruption durations as in SAIDI, divided by the number of customer-interruptions as in SAIFI.
  - Calculation must only consider “sustained interruptions”, as defined in IEEE 1366. A “sustained interruption” lasts more than five minutes, whereas the maximum duration of a “momentary interruption event” is less than or equal to five minutes.
  - Force Majeure events must be excluded from the calculations
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#### 4.1.5 Average Service Availability Index (“ASAI”)

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**Indicator description:** Average Service Availability Index

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**Instructions for measurement and reporting:**

- ASAI measures the average amount of time that electricity service is available to customers. It is the ratio of the total customer minutes that service was available to the total customer minutes demanded in a period.
  - Calculation must only consider “sustained interruptions”, as defined in IEEE 1366. A “sustained interruption” lasts more than five minutes, whereas the maximum duration of a “momentary interruption event” is less than or equal to five minutes.
  - Force Majeure events must be excluded from the calculations
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#### 4.1.6 Quantity of Worst-Served Customers

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**Indicator description:** **This is the number of customers who have experienced a certain number of interruptions in the previous three-year period.**

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**Instructions for measurement and reporting:**

- Measured to be based on the number of customers that meet the defined requirements of a worst-served customer (i.e. number of customers that experienced more than a certain number of interruptions in the previous three years).
  - BELCO must report on the number of customers that experienced more than 12 sustained interruptions (longer than 5 minutes,
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excluding interruptions during Force Majeure events) in the previous three-year period.

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#### 4.1.7 Maximum Duration of Planned Interruptions

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**Indicator description:** Maximum duration of planned interruptions

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**Instructions for measurement and reporting:**

- This indicator represents the number of planned interruptions<sup>1</sup> that exceeded the stated maximum duration in each period.
  - In alignment with IEEE 1366, a “planned interruption” is defined as “a loss of electric power that results when a component is deliberately taken out of service at a selected time, usually for the purposes of construction, preventative maintenance, or repair”.
  - BELCO must report for each month, the number of planned interruptions that exceeded the following durations:
    - 8 hours;
    - 24 hours; and
    - 32 hours.
- 

#### 4.1.8 Maximum Duration of Unplanned Interruptions

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**Indicator description:** Maximum duration of unplanned interruptions

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**Instructions for measurement and reporting:**

- This indicator represents the number of unplanned interruptions that exceeded the stated maximum duration in each period.
  - An “unplanned interruption” is defined as an interruption which cannot be treated as “planned”, under the definition given in 4.1.7.
  - BELCO must report for each month, the number of unplanned interruptions that exceeded the following durations:
    - 8 hours;
    - 24 hours; and
    - 32 hours.
- 

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<sup>1</sup> According to IEEE 1366, a planned interruption is defined as “a loss of electric power that results when a component is deliberately taken out of service at a selected time, usually for the purposes of construction, preventative maintenance, or repair”.

## 4.2 Network Quality of Supply Indicators

### 4.2.1 Frequency Excursions

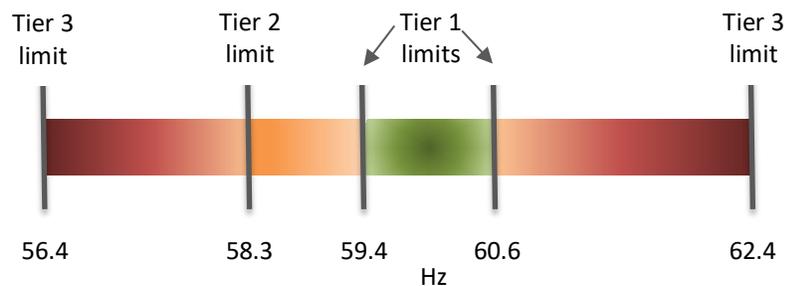
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**Indicator description:** Frequency variation is the deviation of frequency beyond a certain range from the nominal supply frequency.

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**Instructions for measurement and reporting:**

- Frequency is calculated as the mean over 10 seconds
- Number of excursions beyond the limits defined for each tier below (as shown below):
  - Tier 1: Below 59.4 Hz and above 60.6 Hz (based on the mean over a 10 second period)
  - Tier 2: Below 58.3 Hz (over a period length of 6 cycles)
  - Tier 3: Below 56.4 Hz and above 62.4 Hz (for any number of cycles)



- Events where frequency excursions result from actions exclusively attributable to independent power producers connected to BELCO's network must be clearly identified but must be excluded from calculations pertaining to this specific indicator.
-

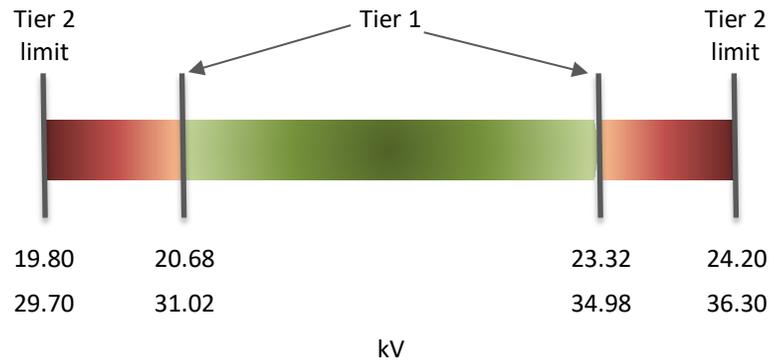
## 4.2.2 Voltage level

**Indicator description:** Based on international standards, the voltage of all transmission substations must be maintained within  $\pm 6\%$  of the nominal declared. This indicator refers to the number, magnitude and duration of occasions of deviations from these limits.

**Instructions for measurement and reporting:**

- Voltage levels must be measured at all 22 kV and 33 kV substations that have measurement devices fitted and the number of excursions reported for each tier below:

	22 kV undervoltage	22 kV overvoltage	33 kV undervoltage	33 kV overvoltage
Tier 1	20.68	23.32	31.02	34.98
Tier 2	19.80	24.20	29.70	36.30



- Instances of voltage deviations under from contingency conditions must be reported separately from other instances.
- The measurements must be taken in accordance with the following standards:
  - IEEE 1453-2004 - IEEE Recommended Practice for Measurement and Limits of Voltage Fluctuations and Associated Light Flicker on AC Power Systems
  - IEEE 120-1989 - IEEE Master Test Guide for Electrical Measurements in Power Circuits
- Events where voltage deviations result from actions exclusively attributable to independent power producers connected to BELCO's network must be clearly identified

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but must be excluded from calculations pertaining to this specific indicator.

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### 4.3 Network Efficiency of Supply Indicator – Losses

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<b>Indicator description:</b>	<p><b>Network losses are calculated as the ratio between the total electrical energy received from the generating plants and the total energy billed to all customers, expressed as a percentage value. The losses are measured over a defined period.</b></p> <p>Some of these losses are technical, including the energy lost as heat from cables and transformers, while other losses are due to non-technical reasons such as theft (illegal connections to the network that are not billed through a meter) or administrative failures. Technical and non-technical losses decrease the efficiency of the network and ultimately result in higher rates for customers, either because more electricity must be generated to compensate for the losses, or the costs of energy not billed for must be recovered.</p>
<b>Instructions for measurement and reporting:</b>	<p>Losses must be measured and reported on an annual basis for:</p> <ul style="list-style-type: none"><li>• Technical losses (Transmission and Distribution)</li><li>• Non-technical losses</li><li>• Total losses</li></ul>

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### 4.4 Network Environmental Impact Indicator – Spill incidents

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<b>Indicator description:</b>	<p>Total number of chemical spills (including fuel oil and lubricating oil) exceeding 1 US gallon in a year, regardless of location or containment measures.</p>
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## 4.5 Network Safety Indicators

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**Indicator description:**      **The Occupational Safety and Health Act 1982 and Occupational Safety and Health Regulations of Bermuda set industry standards for safety. Therefore, the TD&R Licensee will be required to report on the number of accidents, dangerous occurrences and minor injuries involving employees and contractors of the TD&R Licensee, as well as other persons, that occur in a given year.**

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**Instructions for measurement and reporting:**

- The definitions for “accidents”, “dangerous occurrences”, and “minor injuries” are as set out in the Occupational Safety and Health Regulations of Bermuda, where “employer” refers to *the TD&R Licensee* when involving employees of the TD&R Licensee, and *the contractor of the TD&R Licensee* when involving contractors of the TD&R Licensee.
  - Values must be reported separately for accidents, dangerous occurrences and minor injuries involving employees of the TD&R Licensee, and for accidents, dangerous occurrences and minor injuries involving contractors of the TD&R Licensee.
  - Values must be reported separately for each of the following categories:
    - i. at the TD&R Licensee’s place of employment and other premises;
    - ii. in the course of employment of the TD&R Licensee’s employees; or
    - iii. in the course of work performed under a contract between the TD&R Licensee and an individual or company.
-

## 5 Bulk Generation Performance Indicators

### 5.1 Generation Reliability of Supply Indicators

Performance in generation reliability of supply indicators will be reported annually using a spreadsheet template to be provided by the RA, in line with provisions described in section 1.3.

All generation reliability of supply indicators, with the exception of Generator Unit Trips, will be calculated and reported separately for two seasons:

- Peak season – June to September.
- Off-peak season – October to May.

#### 5.1.1 Availability Factor

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<b>Indicator description:</b>	For individual units – IEEE 762 defines the availability factor (“AF”) as “the fraction of a given operating period in which a generating unit is available without any outages.”  For groups of units - The capacity-weighted availability factor (“WAF”) is the sum of the availability of individual units in the group, weighted by unit capacity.
<b>Instructions for measurement and reporting:</b>	Reported for separately for the peak and off-peak seasons

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#### 5.1.2 Forced Outage Factor

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<b>Indicator description:</b>	For individual units – IEEE 762 defines the forced outage factor (“FOF”) as “the fraction of a given operating period in which a generating unit is not available due to forced outages.”  For groups of units – this indicator refers to the capacity-weighted forced outage factor (“WFOF”), as defined in IEEE 762.
<b>Instructions for measurement and reporting:</b>	<ul style="list-style-type: none"><li>• Reported separately for the peak and off-peak seasons</li><li>• As defined in IEEE 762, a “forced outage” is an outage that “cannot be deferred beyond the end of the next weekend.”</li></ul>

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### 5.1.3 Planned Outage Factor

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**Indicator description:** For individual units – IEEE 762 defines the planned outage factor (“POF”) as “the fraction of a given operating period in which a generating unit is not available due to planned outages.”  
For groups of units – this indicator refers to the capacity-weighted planned outage factor (“WPOF”) as defined in IEEE 762.

---

**Instructions for measurement and reporting:**

- Reported separately for the peak and off-peak seasons
  - As defined in IEEE 762, a “planned outage” is an outage “where a unit is unavailable due to inspection, testing...or overhaul. A planned outage is scheduled well in advance.”
  - POF and WPOF must include both “Planned Outages” and “Extension of Planned Outage” hours.
  - A schedule of actual planned outages in a calendar year must be submitted together with the report of outturn performance data for that year by the end of February in the following year.
  - BELCO must advise the RA in writing at least 30 days in advance of the start of a planned outage for it to be categorised as a planned outage. Planned outages for the next quarter must be notified in fuel adjustment rate applications. The following information must be provided in a planned outage notification:
    - Unique notification reference number (numbering convention to be determined by BELCO)<sup>2</sup>
    - Generation unit name
    - Planned start date of outage
    - Planned end date of outage
- 

### 5.1.4 Unavailable Generation

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**Indicator description:** For individual units – IEEE 762 defines unavailable generation (“UG”) as “the energy that could not be generated by a unit due to planned and unplanned outages and unit deratings.”  
For groups of units – The UG for a group of units is calculated with the formula provided in the Service Standards.

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<sup>2</sup> The “unique notification reference number” is aimed to simplify communication and avoid any misunderstanding between BELCO and the RA when discussing a specific outage.

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**Instructions for measurement and reporting:**

Reported separately for the peak and off-peak seasons

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### 5.1.5 Generator Unit Trips

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**Indicator description:** This indicator measures the number of generator unit trips within a specified period. A generator trip occurs if a generator experiences an unplanned outage from an in-service state that required it to be removed from service immediately. This is termed by IEEE 762 as a “Class 1 unplanned outage”.

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**Instructions for measurement and reporting:**

Reported for the previous calendar year

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## 5.2 Generation Efficiency of Supply Indicators

### 5.2.1 Heat rate

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**Indicator description:** Heat rate, expressed in kJ/kWh, is a measure of the efficiency of conversion of fuel to electricity. It is calculated in line with the formula provided in the Service Standards.

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**Instructions for measurement and reporting:**

- Heat rates can typically be reported for individual power units or for multiple units – in which case the metric is generally referred to as an “aggregate” heat rate.
  - Heat Rate must be calculated for each month for:
    - Each individual unit in service
    - Each group of units (“aggregate unit group heat rate”)
    - All units (“aggregate system heat rate”)
  - **This Service Standard Indicator refers to the aggregate system heat rate**, other metrics listed above are to be reported to provide contextual historical information only.
  - The aggregate system heat rate is impacted by several factors including but not limited to the efficiency of individual power units, the dispatch and maintenance schedules, and the calorific value of fuels purchased by BELCO.
  - Heat rate will be reported annually and quarterly as follows:
    - Reported in February for each unit for the previous calendar year.
-

- 
- Reported in the quarterly Fuel Adjustment Rate applications for each unit for each month in the previous quarter.
  - Periods of engine test runs must be excluded from the calculation, but BELCO must provide all data necessary to remove test run periods from the data.
  - Periods of unplanned outage(s) attributed to Force Majeure events must be excluded from the calculation.
  - Whenever possible, the calculation must rely on physical measurements realised by BELCO on individual units. When this is not practical, approximations may be done by BELCO when computing the results (e.g. in relation to calorific values), provided that all assumptions are thoroughly justified by BELCO along with the submission of performance results.
  - In the quarterly reports, BELCO must provide the following data for each unit in each month:
    - Higher heating value of heavy fuel oil (“HFO”), in GJ/kg;
    - Higher heating value of light fuel oil (“LFO”), in GJ/kg;
    - Mass of HFO consumed by the unit, in millions of kg;
    - Mass of LFO consumed by the unit, in millions of kg;
    - Mass of HFO consumed by the unit during test runs, in millions of kg;
    - Mass of LFO consumed by the unit during test runs, in millions of kg;
    - Total active power delivered to the grid, in GWh; and
    - Total active power delivered to the grid during test runs, in GWh.
- 

### 5.3 Generation Environmental Impact Indicators

Performance in generation environmental impact will be reported annually in line with provisions described in section 1.3. A report document must be provided with a summary of the results to allow comparison with targets set, and a spreadsheet must be provided with the detailed data and calculations.

### 5.3.1 Opacity Exceedances

---

**Indicator description:** This indicator measures the number of occasions in a calendar year that the gaseous emissions have exceeded an average opacity of 20 percent over a test period of six minutes, when measured according to the requirements of licenses granted under the Clean Air Act 1991.

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**Instructions for measurement and reporting:**

- “Permitted exceedances” refers to the total number of opacity exceedances that are permitted under the Operating Licence, and “Non-permitted exceedances” refers to the total number of opacity exceedances that are not permitted under the Operating Licence.
  - “Permitted exceedances” must be reported separately from “non-permitted exceedances”.
  - With respect to both “permitted exceedances” and “non-permitted exceedances”:
    - Values are to be reported for each exhaust stack individually;
    - The total number of opacity exceedances for each stack fitted with a COMS (units E7, E8 and the North Power Station units) must be reported individually on an annual basis.
    - Number of opacity exceedances observed for units E5 and E6 must be reported on an annual basis.
    - The methodology must be as per the requirements of the Operation Licence.
- 

### 5.3.2 Gaseous Sulphur Dioxide (“SO<sub>2</sub>”) Exceedances

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**Indicator description:** Number of occasions in a calendar year that the concentration of SO<sub>2</sub> in the ambient air has exceeded the following values:

- 450 µg/m<sup>3</sup> average over a 1-hour period;
- 150 µg/m<sup>3</sup> average over 24-hour period;
- 30 µg/m<sup>3</sup> average over a 1-year period.

---

**Instructions for measurement and reporting:**

- The total number of exceedances must be reported annually.
  - The total number of exceedances must be reported separately for the three-time categories listed (1-hour, 24-hour and 1-year periods).
  - The methodology must be as per the requirements of the Operation Licence.
-

### 5.3.3 Gaseous Nitrogen Dioxide (“NO<sub>2</sub>”) Exceedances

---

**Indicator description:** Number of occasions in a calendar year that the concentration of NO<sub>2</sub> in the ambient air has exceeded the following values:

- 400 µg/m<sup>3</sup> average over a 1-hour period;
- 200 µg/m<sup>3</sup> average over 24-hour period;
- 60 µg/m<sup>3</sup> average over a 1-year period.

---

**Instructions for measurement and reporting:**

- The total number of exceedances must be reported annually.
- The total number of exceedances must be reported separately for the three-time categories listed (1-hour, 24-hour and 1-year periods).
- The methodology must be as per the requirements of the Operation Licence.

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### 5.3.4 Total Suspended Particles Exceedances

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**Indicator description:** Number of occasions in a calendar year that the total suspended particles (“TSP”) in the ambient air have exceeded the following values:

- 100 µg/m<sup>3</sup> average over 24-hour period;
- 60 µg/m<sup>3</sup> average over a 1-year period.

---

**Instructions for measurement and reporting:**

- The total number of exceedances must be reported annually.
- The total number of exceedances must be reported separately for the two-time categories listed (24-hour and 1-year periods).
- The methodology must be as per the requirements of the Operation Licence.

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### 5.3.5 Inhalable Particulate Matter (PM<sub>10</sub>) Exceedances

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**Indicator description:** Number of occasions in a calendar year that the inhalable particulate matter (PM<sub>10</sub>) in the ambient air have exceeded the following values:

- 50 µg/m<sup>3</sup> average over 24-hour period;
- 30 µg/m<sup>3</sup> average over a 1-year period.

---

**Instructions for measurement and reporting:**

- The total number of exceedances must be reported annually.
- The total number of exceedances must be reported separately for the two-time categories listed (24-hour and 1-year periods).
- The methodology must be as per the requirements of the Operation Licence.

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### 5.3.6 Carbon Monoxide and Carbon Dioxide Volumes

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**Indicator description:** Average volumes of carbon monoxide (“CO”) and carbon dioxide (“CO<sub>2</sub>”) produced (converted to a mass basis) per unit of electricity produced each month, measured in kg/MWh.

---

**Instructions for measurement and reporting:**

- This indicator requires continuous monitoring of the volume of CO and CO<sub>2</sub> produced for each unit (where each unit has its own stack) or for groups of units (where multiple units share a stack).
  - A breakdown must be provided in the annual report for each stack by month of:
    - the total volume and mass of CO produced (in Nm<sup>3</sup> and kg);
    - the total volume and mass of CO<sub>2</sub> produced (in Nm<sup>3</sup> and kg);
    - the total gross generation output (i.e. measured at the generator terminals) for each unit exhausting into the stack (in MWh);
    - result of the calculation of the mass of CO produced divided by the aggregate generation output for units exhausting into the stack (in kg/MWh);
    - result of the calculation of the mass of CO<sub>2</sub> produced divided by the aggregate generation output for units exhausting into the stack (in kg/MWh).
  - This indicator must be reported for units E5 to E8 and the units in the North Power Station.
- 

### 5.3.7 Concentration of Sulphur Oxides (“SO<sub>x</sub>”) in gaseous emissions

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**Indicator description:** The average concentration of SO<sub>x</sub> in gaseous emissions for each month, measured in µg/Nm<sup>3</sup>.

---

**Instructions for measurement and reporting:**

- This indicator requires continuous monitoring of the volume of SO<sub>x</sub> produced for each unit (where each unit has its own stack) or for groups of units (where multiple units share a stack).
  - A breakdown must be provided in the annual report for each stack by month of:
    - half-hourly SO<sub>x</sub> emissions in µg/Nm<sup>3</sup>;
-

- half-hourly average gross generation output (i.e. measured at the generator terminals) for each unit exhausting into the stack (in MW);
- Average SOX emissions in  $\mu\text{g}/\text{Nm}^3$  calculated for all half-hour periods in the month when there were exhaust gases passing through the stack;
- This indicator must be reported for units E5 to E8 and the units in the North Power Station.
- Values must be reported for each stack individually.

### 5.3.8 Concentration of Nitrogen Oxides (“NO<sub>x</sub>”) in gaseous emissions

**Indicator description:** The average concentration of NO<sub>x</sub> in gaseous emissions for each month, measured in  $\mu\text{g}/\text{Nm}^3$ .

**Instructions for measurement and reporting:**

- This indicator requires continuous monitoring of the volume of SOX produced for each unit (where each unit has its own stack) or for groups of units (where multiple units share a stack).
- A breakdown must be provided in the annual report for each stack by month of:
  - half-hourly NO<sub>x</sub> emissions in  $\mu\text{g}/\text{Nm}^3$ ;
  - half-hourly average gross generation output (i.e. measured at the generator terminals) for each unit exhausting into the stack (in MW);
  - Average NO<sub>x</sub> emissions in  $\mu\text{g}/\text{Nm}^3$  calculated for all half-hour periods in the month when there were exhaust gases passing through the stack;
- This indicator must be reported for units E5 to E8 and the units in the North Power Station.
- Values must be reported for each stack individually.

### 5.3.9 Concentration of Total Suspended Solids (“TSP” ) in gaseous emissions

**Indicator description:** The average concentration of TSP in gaseous emissions for each month, measured in  $\mu\text{g}/\text{Nm}^3$ .

**Instructions for measurement and reporting:**

- This indicator requires continuous monitoring of the volume of TSP produced for each unit (where each unit has its own stack) or for groups of units (where multiple units share a stack).

- 
- A breakdown must be provided in the annual report for each stack by month of:
    - half-hourly TSP emissions in  $\mu\text{g}/\text{Nm}^3$ ;
    - half-hourly average gross generation output (i.e. measured at the generator terminals) for each unit exhausting into the stack (in MW);
    - average TSP emissions in  $\mu\text{g}/\text{Nm}^3$  calculated for all half-hour periods in the month when there were exhaust gases passing through the stack;
  - This indicator must be reported for units E5 to E8 and the units in the North Power Station.
  - Values must be reported for each stack individually.
- 

### 5.3.10 Concentration of inhalable particulate matter in gaseous emissions

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**Indicator description:** The average concentration of  $\text{PM}_{10}$  in gaseous emissions for each month, measured in  $\mu\text{g}/\text{Nm}^3$ .

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**Instructions for measurement and reporting:**

- This indicator requires continuous monitoring of the volume of  $\text{PM}_{10}$  produced for each unit (where each unit has its own stack) or for groups of units (where multiple units share a stack).
  - A breakdown must be provided in the annual report for each stack by month of:
    - half-hourly  $\text{PM}_{10}$  emissions in  $\mu\text{g}/\text{m}^3$ ;
    - half-hourly average gross generation output (i.e. measured at the generator terminals) for each unit exhausting into the stack (in MW);
    - Average  $\text{PM}_{10}$  emissions in  $\mu\text{g}/\text{m}^3$  calculated for all half-hour periods in the month when there were exhaust gases passing through the stack;
  - This indicator must be reported for units E5 to E8 and the units in the North Power Station.
  - Values must be reported for each stack individually.
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### 5.3.11 Concentration of mercury in gaseous emissions

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**Indicator description:** The average concentration of mercury in gaseous emissions for each month, measured in  $\mu\text{g}/\text{Nm}^3$ .

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**Instructions for measurement and reporting:**

- This indicator requires continuous monitoring of the volume of mercury produced for each unit (where each unit has its own stack) or for groups of units (where multiple units share a stack).
  - A breakdown must be provided in the annual report for each stack by month of:
    - half-hourly mercury emissions in  $\mu\text{g}/\text{m}^3$ ;
    - half-hourly average gross generation output (i.e. measured at the generator terminals) for each unit exhausting into the stack (in MW);
    - Average mercury emissions in  $\mu\text{g}/\text{m}^3$  calculated for all half-hour periods in the month when there were exhaust gases passing through the stack;
  - This indicator must be reported for units E5 to E8 and the units in the North Power Station.
  - Values must be reported for each stack individually.
- 

### 5.3.12 Concentration of volatile organic compounds (“VOC”) in gaseous emissions

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**Indicator description:** The average concentration of VOC in gaseous emissions for each month, measured in  $\mu\text{g}/\text{Nm}^3$ .

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**Instructions for measurement and reporting:**

- This indicator requires continuous monitoring of the volume of VOC produced for each unit (where each unit has its own stack) or for groups of units (where multiple units share a stack).
  - A breakdown must be provided in the annual report for each stack by month of:
    - half-hourly VOC emissions in  $\mu\text{g}/\text{m}^3$ ;
    - half-hourly average gross generation output (i.e. measured at the generator terminals) for each unit exhausting into the stack (in MW);
    - Average VOC emissions in  $\mu\text{g}/\text{m}^3$  calculated for all half-hour periods in the month when there were exhaust gases passing through the stack;
  - This indicator must be reported for units E5 to E8 and the units in the North Power Station.
  - Values must be reported for each stack individually.
-

### 5.3.13 Number of Chemical Spill Incidents

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**Indicator description:** Total number of chemical spills (including fuel oil and lubricating oil) exceeding 1 US gallon in a year, regardless of location or containment measures.

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## 5.4 Generation Safety Indicators

Performance in generation safety indicators will be reported annually in line with provisions described in section 1.3.

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<b>Indicator description:</b>	<b>The Occupational Safety and Health Act 1982 and Occupational Safety and Health Regulations of Bermuda set industry standards for safety. Therefore, the licensee will be required to report on the number of accidents, dangerous occurrences and minor injuries involving employees and contractors of the licensee, as well as other persons, that occur in a given year.</b>
<b>Instructions for measurement and reporting:</b>	<ul style="list-style-type: none"><li>• The definitions for “accidents”, “dangerous occurrences”, and “minor injuries” are as set out in the Occupational Safety and Health Regulations of Bermuda, where “employer” refers to <i>the BG Licensee</i> when involving employees of the TD&amp;R Licensee, and <i>the contractor of the BG Licensee</i> when involving contractors of the BG Licensee.</li><li>• Values must be reported separately for accidents, dangerous occurrences and minor injuries involving employees of the BG Licensee, and for accidents, dangerous occurrences and minor injuries involving contractors of the BG Licensee.</li><li>• Values must be reported separately for each of the following categories:<ol style="list-style-type: none"><li>i. at the licensee’s place of employment and other premises;</li><li>ii. in the course of employment of the licensee’s employees; or</li><li>iii. in the course of work performed under a contract between the licensee and an individual or company.</li></ol></li></ul>

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