

Schedule 2: Generation Services Performance Indicators

S.2.1 Interpretation

S.2.1.1 Where information in this schedule is set out in brackets (namely '[' and ']'), and preceded by the expression 'Example' or 'Note', the information:

- (a) is provided to assist readers; and
- (b) may be used in interpreting this **Code**.

S.2.2 Application of schedule 2

S.2.2.1 This schedule defines the **performance indicators** for **generation entities**.

S.2.2.2 In particular, this schedule specifies the way in which **data** must be used to calculate those **performance indicators**.

S.2.2.3 This schedule is separated into sections: **generation service performance indicators**; **generating unit availability performance indicators**; and **generation services reliability performance indicators**.

S.2.2.4 A **generation entity** must calculate the **performance indicators**:

- (a) identified in Table 1 of this schedule; and
- (b) in accordance with the formulas set out in this schedule or the Definitions and Interpretation schedule.

S.2.2.5 The **data** used to calculate each **performance indicator** must correspond with the **reporting period** for that **performance indicator**.

S.2.3 Generation services performance indicators

S.2.3.1 Table 1:

- (a) lists the **generation services performance indicators** for the purpose of clause **Error! Reference source not found.** of this **Code**; and
- (b) specifies the way in which these **performance indicators** must be segmented for reporting under this **Code**; and
- (c) specifies the **performance indicators** that will be treated as confidential.

S.2.3.2 Where a **performance indicator** is confidential, the **Commission** will seek to use the information in aggregated form (that is, combined with other **generator entity data**).

S.2.3.3 Where there is only one **generator entity** supplying to the **power system**, or there is sufficient reason, then individual **generator entity data** may be reported by the **Commission**.

TABLE 1 – GENERATION SERVICES PERFORMANCE INDICATORS

Performance Indicator	Report	Confidential	Segmentation
Availability Factor (AF)	Yes	Yes	Power station
Unplanned Availability Factor (UAF)	Yes	Yes	Power station
Equivalent Availability Factor (EAF)	Yes	Yes	Power station
Forced Outage Factor (FOF)	Yes	Yes	Power station
Equivalent Forced Outage Factor (EFOF)	Yes	Yes	Power station
System average interruption duration index (SAIDI) relating to generation interruption	Yes	No	Power system and region
System average interruption frequency index (SAIFI) relating to generation interruption*	Yes	No	Power system and region

Note: To avoid doubt, clause **Error! Reference source not found. of this **Code** does not apply to **generation services reliability performance indicators**. However, any **generation event** that affects **supply to customers** and is caused by assets or equipment that are outside **plant management control** in accordance with the IEEE Standard 762-2006 must be excluded for the purpose of calculating **generation services reliability performance indicators**.*

S.2.4 Generating unit availability performance indicators

S.2.4.1 The **generating unit availability performance indicators** in this clause S.2.4 of this schedule are based on the group performance indices in the US Institute of Electrical and Electronics Engineers (IEEE) Standard 762-2006.

S.2.4.2 When calculating the **generating unit availability performance indicators** for each **power station**, only **generation outages** that are caused by a **generation event** that relates to **generating units** that form part of the same **power station** must be included.

*[Note: Each value that is used to calculate the **generating unit availability performance indicator** must be weighted by multiplying the value with the **generating unit's gross maximum capacity**. All those products are then summed over all of the **generating units** which make up the relevant **power station**. Where necessary, this is reflected in the formula. To avoid doubt, each value is weighted while calculating the **performance indicator** and not after.]*

S.2.4.3 Each **electricity entity** must provide the following information in relation to its **generating units** and **power stations** to the **Commission** in the report submitted to the **Commission** pursuant to clause **Error! Reference source not found.** of this **Code**:

- (a) the **gross maximum capacity** of each **generating unit**;

- (b) any **unit derating** for each **generating unit** (permanent or otherwise); and
- (c) information that explains any changes in **gross maximum capacity** or **unit derating** from the previous **reporting period**.

[Note: The **Commission** intends to compare this information with the report submitted for the previous **reporting period** to assess any changes in **gross maximum capacity** and **unit derating** and to ensure that the **generating unit** availability performance indicators are calculated correctly and accurately to reflect the true availability of **generating units** in the **reporting period**.]

S.2.4.4 In circumstances where it is necessary to calculate the '**equivalent partial outage hours**' that a **generating unit** is unavailable due to a **generation outage** that results in a **unit derating**, the following formula will be used:

[Note: This formula is used to calculate the number of **equivalent partial outage hours (EH)** that a **generating unit** is unavailable due to **partial planned outages**, **partial unplanned outages** or **partial forced outages**. The EH due to **partial planned outages** and **partial unplanned outages** are used as an input to calculate the Equivalent Availability Factor (clause S.2.4.7 of this schedule) whereas the EH due to **partial forced outages** are used as an input to calculate the Equivalent **Forced Outage** Factor (clause S.2.4.9 of this schedule).]

$$\text{Equivalent Partial Outage Hours (EH)} = H \times \left(\frac{\text{UD}}{\text{GMC}} \right)$$

Where:

- (a) H is the total number of **hours** that a **generating unit** is unavailable due to a **generation outage** that results in a **unit derating**.
- (b) UD (or 'unit derating') is the **unit derating value**.
- (c) GMC is the **gross maximum capacity**.

[Example: If a **generating unit** with a **gross maximum capacity** of 10.1 MW had its output reduced to 6.06 MW (**unit derating value of 4.04 MW**) for a period of 30 days the **Equivalent Partial Outage Hours** will be:

$$30 \text{ (days)} \times 24 \text{ (hours)} \times (4.04 / 10.1) = 288 \text{ hours}]$$

S.2.4.5 Availability factor (AF)

$$\text{AF} = \left(1 - \frac{\sum_{i=1}^n (\text{UH}_i \times \text{GMC}_i)}{\sum_{i=1}^n (\text{H}_i \times \text{GMC}_i)} \right) \times 100$$

Where:

- (a) i is each **generating unit**.

- (b) UH (or 'unavailable **hours**') is the total number of **hours** that a **generating unit** is unavailable due to **planned outages** and **unplanned outages**. This excludes the number of **equivalent partial outage hours** due to **partial planned outages** and **partial unplanned outages**.
- (c) H is the total number of **hours**. However, if a **generating unit** is commissioned during the relevant **reporting period**, H will be the total number of **hours** from the date the **generating unit** is commissioned up until the end of that **reporting period**.

[Example: *If a **generating unit** is commissioned at 12:00 p.m on 1 December of the **reporting period**, H will be the total number of **hours** from 12:00 p.m on 1 December up until the end of the **reporting period**.]*

- (d) GMC is the **gross maximum capacity** (applicable to weighted multiple **generating units** that are part of the same **power station**).
- (e) The AF is expressed as a percentage.

[Example: *Assuming a **power station** has two **generating units**, A and B, with a **gross maximum capacity** of 10 and 20 MW respectively – if **generating unit A** is shut down for a total of exactly 30 days and **generating unit B** is shut down for a total of exactly 20 days for **planned outages** or **unplanned outages** in a **reporting period** of one year, it would have been unavailable for 1,200 **hours** (720 **hours** for **generating unit A** and 480 **hours** for **generating unit B**).*

*The AF for the **power station** is calculated as follows:*

$$AF = (1 - ((720 \times 10) + (480 \times 20)) / ((8760 \times 10) + (8760 \times 20))) \times 100$$

$$AF = 93.61\%$$

S.2.4.6 Unplanned Availability Factor (UAF)

$$UAF = \left(1 - \frac{\left(\sum_{i=1}^n (UOH_i \times GMC_i) \right)}{\left(\sum_{i=1}^n (H_i \times GMC_i) \right)} \right) \times 100$$

Where:

- (a) i is each **generating unit**.
- (b) UOH (or '**unplanned outage hours**') is the total number of **hours** that a **generating unit** is unavailable due to **unplanned outages**. This excludes the number of **equivalent partial outage hours** due to **partial unplanned outages**.
- (c) H is the total number of **hours**. However, if a **generating unit** is commissioned during the **reporting period**, H will be the total number of **hours** from the date the **generating unit** is commissioned up until the end of the **reporting period**.

- (d) GMC is the **gross maximum capacity** (applicable to the weighted multiple **generating units** that are part of the same **power station**).
- (e) The UAF is expressed as a percentage.

[Example: Assuming a **power station** has two **generating units**, A and B, with a **gross maximum capacity** of 10 MW and 20 MW respectively – if **generating unit A** is shut down for 12 days and **generating unit B** is shut down for 15 days for **unplanned outages**, both **generating units** would have been unavailable for 288 **hours** and 360 **hours**, respectively.

The UAF for the **power station** is calculated as follows:

$$UAF = (1 - ((288 \times 10) + (360 \times 20)) / ((8760 \times 10) + (8760 \times 20))) \times 100$$

$$UAF = 96.16\%$$

S.2.4.7 Equivalent Availability Factor (EAF)

$$EAF = \left(1 - \frac{\sum_{i=1}^n ((UH_i + EUH_i) \times GMC_i)}{\sum_{i=1}^n (H_i \times GMC_i)} \right) \times 100$$

Where:

- (a) i is each **generating unit**.
- (b) UH (or 'unavailable hours') is the total number of **hours** that a **generating unit** is unavailable due to **planned outages** and **unplanned outages**. This excludes the number of **equivalent partial outage hours** due to **partial planned outage** and **partial unplanned outages**.
- (c) EUH (or 'equivalent unavailable hours') is the total **equivalent partial outage hours** due to **partial planned outages** and **partial unplanned outages**.
- (d) H is the total number of **hours**. However, if a **generating unit** is commissioned during the **reporting period**, H will be the total number of **hours** from the date the **generating unit** is commissioned up until the end of the **reporting period**.
- (e) GMC is the **gross maximum capacity** (applicable to weighted multiple **generating units** that are part of the same **power station**).
- (f) The EAF is expressed as a percentage.

[Example: Assuming a **power station** has two **generating units**, A and B, with a **gross maximum capacity** of 10 MW and 20 MW, respectively – if **generating unit A** is shut down due to **planned outages** and **unplanned outages** for 30 days and **generating unit B** had its output reduced by a **partial outage** to 60% of its total generation output (**unit derating value of 8 MW**) for a further period of 30 days, its **equivalent partial outage hours** will be 30 (days) x 24 (hours) x 0.4 = 288 **hours**.

The EAF for the **power station** is calculated as follows:

$$EAF = (1 - ((720 \times 10) + (288 \times 20)) / ((8760 \times 10) + (8760 \times 20))) \times 100$$

$$EAF = 95.07\%$$

S.2.4.8 **Forced outage** factor (FOF)

$$FOF = \left(\frac{\sum_{i=1}^n (FOH_i \times GMC_i)}{\sum_{i=1}^n (H_i \times GMC_i)} \right) \times 100$$

Where:

- i each **generating unit**.
- FOH (or '**forced outage hours**') is the total number of **hours** that a **generating unit** is unavailable due to **forced outages**. This excludes **equivalent partial outages hours** due to **partial forced outages**.
- H is the total number of **hours**. However, if a **generating unit** is commissioned during the **reporting period**, H will be the total number of **hours** from the date the **generating unit** is commissioned up until the end of the **reporting period**.
- GMC is the **gross maximum capacity** (applicable to weighted multiple **generating units** that are part of the same **power station**).
- FOF is expressed as a percentage.

[Example:

Assuming a **power station** has two **generating units**, A and B, with a **gross maximum capacity** of 10 MW and 20 MW respectively, if **generating unit A** is forced out of service on two occasions for periods of 5 days and 3 days in the **reporting period**, its total **forced outage** time is 192 **hours**. If **generating unit B** is forced out of service for a period of 2 days, its total **forced outage** time is 48 **hours**.

The FOF for the **power station** is calculated as follows:

$$FOF = ((192 \times 10) + (48 \times 20)) / ((8760 \times 10) + (8760 \times 20)) \times 100$$

$$FOF = 1.10\%$$

S.2.4.9 Equivalent **forced outage** factor (EFOF)

$$EFOF = \left(\frac{\sum_{i=1}^n ((FOH_i + EFOH_i) \times GMC_i)}{\sum_{i=1}^n (H_i \times GMC_i)} \right) \times 100$$

Where:

- i is each **generating unit**
- FOH (or '**forced outage hours**') is the total number of **hours** that a **generating unit** is unavailable due to **forced outages**.

- (c) EFOH (or 'equivalent **forced outage hours**') is the **equivalent partial outage hours** due to **partial forced outages**.
- (d) H is the total number of **hours**. However, if a **generating unit** is commissioned during the **reporting period**, H will be the total number of **hours** from the date the **generating unit** is commissioned up until the end of the **reporting period**.
- (e) GMC is the **gross maximum capacity** (applicable to weighted multiple **generating units** that are part of the same **power station**).
- (f) EFOF is expressed as a percentage.

[Example:

Assuming a **power station** has two **generating units**, A and B, with a **gross maximum capacity** of 10 MW and 20 MW respectively – During the **reporting period** **generating unit** A was forced out of service for 8 days and was also restricted to 50% of its total generation output for 80 hours because of a **partial forced outage**. **Generating Unit B** was restricted to 30% of its total generation output (**unit derating value of 14 MW**) for 48 hours.

The **power station's EFOF** would be calculated as

$$EFOF = (((192 + (80 \times 0.5)) \times 10) + ((48 \times 0.7) \times 20)) / ((8760 \times 10) + (8760 \times 20)) \times 100$$

$$EFOF = 1.14\%$$

S.2.5 Generation services reliability performance indicators

S.2.5.1 When calculating **generation services** reliability **performance indicators**:

- (a) for each **power system**:
 - i. only include those **generation interruptions** that are caused by **generation events** that are related to **generating units/facilities** that form part of the same **power system** and affect **supply** to **customers** located within the same **power system**; and
 - ii. only include those **customers** who are supplied by the same **power system**; and
- (b) for each **region**:
 - i. only include those **generation interruptions** caused by **generation events** related to **generating units/facilities** that form part of the same **power system** and affect **supply** to **customers** located within the boundaries of the same **region**; and
 - ii. only include those **customers** who receive **supply** from within the boundaries of the same **region**.