Publication Handbook for Flow-based Outage Impact Calculations in NUCS

Version 0.1

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SVENSKA KRAFTNÄT FINGRID ENERGINET Statnett NORDIC RCC

Abbreviations:

API	Application Programming Interface
BZ	Bidding Zone
CCC	Coordinated Capacity Calculation
CCR	Capacity Calculation Region
CNE	Critical Network Element
CNEC	Critical Network Element with Contingency
EIC	Energy Identification Codes
FB	Flow-Based
FBMC	Flow-Based Market Coupling
GUI	Graphical User Interface
HVDC	High Voltage Direct Current
LT	Long-term
LTCC	Long-term Capacity Calculation
M-1	Month-ahead
NP	Net Position
NTC	Net Transfer Capacity
NUCS	Nordic Unavailability Collection System
PTDF	Power Transfer Distribution Factor
RAM	Remaining Available Margin
TSO	Transmission System Operator
UMM	Urgent Market Message
VBZ	Virtual Bidding Zone
Y-1	Year-Ahead

Version Control			
0.1	30.10.2025	LTCC Project	First Version

Contents

1. Introduction

In October 2024, the Nordic Capacity Calculation Region (CCR) went live with Flow-Based Market Coupling (FBMC), marking a shift in how available transfer capacity is calculated and allocated. Previously, capacity was calculated using the Net Transfer Capacity (NTC) method. This transition enhances transparency and efficiency, enabling more effective utilization of the Nordic transmission grid. However, Urgent Market Messages (UMMs) are still being published under the NTC framework which no longer accurately represent actual capacity reductions in the flow-based world.

To address this gap, the Nordic Unavailability Collection System (NUCS) Business Process has been introduced. NUCS refers both to the platform where outage-related UMMs are published, and to the business process for calculating capacity impacts in a flow-based context. The NUCS Business Process aims to improve the quality and relevance of UMMs by publishing capacity reductions using flow-based parameters, replacing outdated NTC values.

This handbook introduces the technical foundations for calculating the flow-based impact of outages (chapter 3), provides a detailed walkthrough on the new FB publication format on the web GUI (sections 4.1-4.4), includes a description of new endpoints for querying the FB publications via the NUCS API (section 4.5). The publication frequency is detailed in section 4.6, and a sample outage calculation of the NUCS process is presented in section 4.7. Finally, the Appendix provides a detailed breakdown of the XML formats of the new FB publications as received from the NUCS API. Please note that the new FB publication format capabilities summarised in this handbook are expected to roll out gradually in the first half of 2026. It is expected that there will be improvements to the process and the publications over the course of 2026.

2. Legal basis

The publication of capacity-related information, including outage impacts, is primarily governed by two European regulations that safeguard transparency and integrity in the electricity market:

- **Transparency Regulation (EU Regulation 543/2013)** – requires TSOs to publish information on planned and unplanned outages of transmission infrastructure when these affect cross-zonal capacity by 100 MW or more. Articles 10(1), 10(2), and 10(4) specify that details such as the cause, location, and expected impact of outages must be published, ensuring that market participants have timely and accurate data to support trading and system operations.
- **REMIT 2.0 (EU Regulation 2024/1106)** – reinforces the obligation to disclose inside information that could affect wholesale energy prices. Under Article 4, market participants must publish both planned and unplanned transmission unavailability promptly, accurately, and through recognized platforms (e.g., ENTSO-E, NUCS). REMIT 2.0 also strengthens requirements for timeliness, correctness, and accessibility of information.

The **Nordic Unavailability Collection System (NUCS)** is a free service for collecting and publishing data on unavailable production, transmission, and consumption capacity in the Nordic power system. Data submitted to NUCS is published both on the ENTSO-E Transparency Platform and directly on the NUCS website, giving market participants a consolidated overview of Nordic unavailability.

3. Technical description

This chapter introduces the technical foundations for calculating the flow-based impact of outages. First, the calculation process is elaborated in section 3.1, which is followed by the scope of the NUCS FB publications in section 3.2. The chapter concludes with explaining the difference between NTC values and the net positions published for the FB impacts in section 3.3.

3.1 NUCS process overview

Figure 1 presents the high-level overview of the NUCS Business Process carried out by Nordic RCC in collaboration with the TSOs, delivering the flow-based impacts of Transmission Unavailability. As illustrated in the figure, the NUCS process calculates the impacts of an outage on the long-term grid models (CGMs) and flow-based domains delivered in the Y-1 and M-1 LTCC processes. This is achieved by (re-)executing the FB capacity calculation process after a contingency (outage) was applied to the grid model. This is referred to as *the Grid availability calculation process*. This step is followed by the *Grid unavailability calculation process* where the resulting contingency-adjusted FB domain is compared to the 'intact' LTCC M-1 and Y-1 FB domains via their associated minimum and maximum available net positions (per bidding zones). The reduction (or, in some cases, increase) of the bidding zone-level minimum and maximum net positions compared to the reference LTCC case quantifies the grid unavailability. After the TSOs validated the results, the FB outage impacts are published on the NUCS Platform.

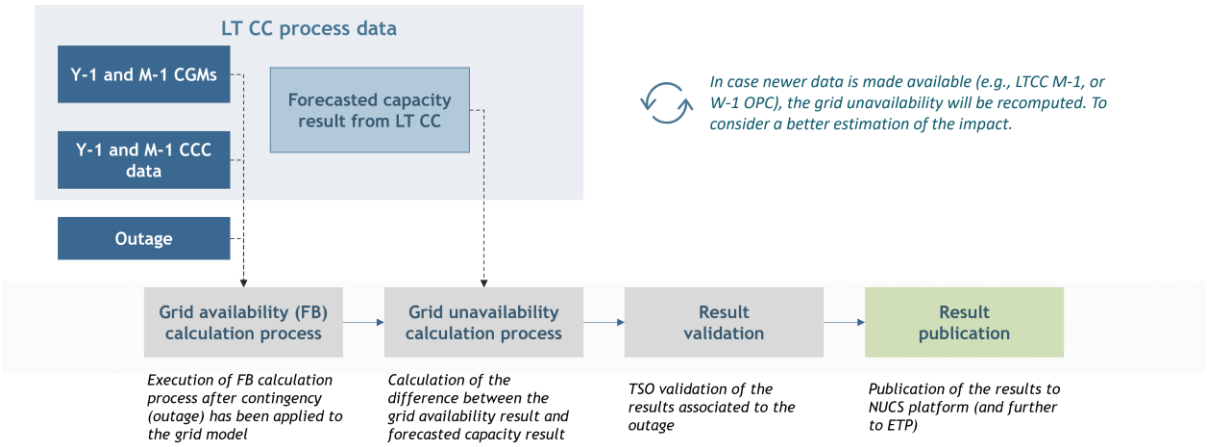

Figure 1 – NUCS High-level Business Process.

Note that always the latest available long-term grid model (as well as the latest available LTCC FB domain as reference case) is used to calculate the impact of an outage over a time period. To illustrate this point, the reader is referred to the following exemplary case illustrated in Figure 2: An outage is published on January

2, lasting from January 15 until March 15. At the time of publication, the M-1 LTCC grid model is already available for the month of January and thus used for calculating the outage impact in this month. For the remainder of the outage period, the Y-1 LTCC results are used to quantify the impact. Specifically, the monthly minimum FB domain is based on the Winter scenario for February, and the monthly minimum FB domain is based on the Spring scenario for the remaining period in March.

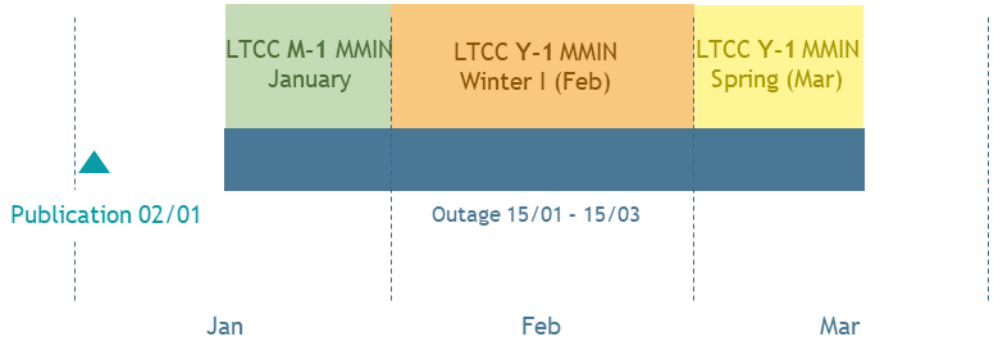

Figure 2 – Illustration of the different reference LTCC domains used for an outage lasting through multiple months.

The monthly minimum FB domain is calculated as the intersection of the resulting constraints of the peak and valley scenarios, which are detailed in the already published LTFB Handbook. The peak and valley scenarios represent high load and low load scenarios, and thus the monthly minimum FB domain is based on the combined set of constraints, depicting the most limiting constraints for the month. The monthly minimum FB calculations are derived from the original peak and valley scenario FB results.

3.2 Outages involved in NUCS FB publications

The current scope of the NUCS FB publications involve Transmission Unavailability, focusing solely on planned maintenance and forced outages (unplanned outages that persist for a longer period). UMMs for unplanned outages as well as for outages of other asset types will continue to be published with their NTC impacts.

3.3 Net positions

Net Positions (NPs) represent the maximum import/export capability of each bidding zone within the FB domain constraints. They differ significantly from traditional Net Transfer Capacities (NTC):

Table 1 - Difference between NPs and NTCs.

Concept	Definition	Key Difference
Maximum Available NP	Assumes all other bidding zones have zero NP; shows max import/export for one zone	FB-based, dynamic, scenario-dependent
Reference Case	NPs derived from LTCC domain (intact grid)	Used as baseline for comparison
Outage Case	NPs derived from outage-adjusted FB domain	Shows reduction due to outage

The difference between the reference case and the outage case defines the *grid unavailability* for each bidding zone. A visualisation of the intact grid capacity, grid availability and grid unavailability is shown in Figure 3.

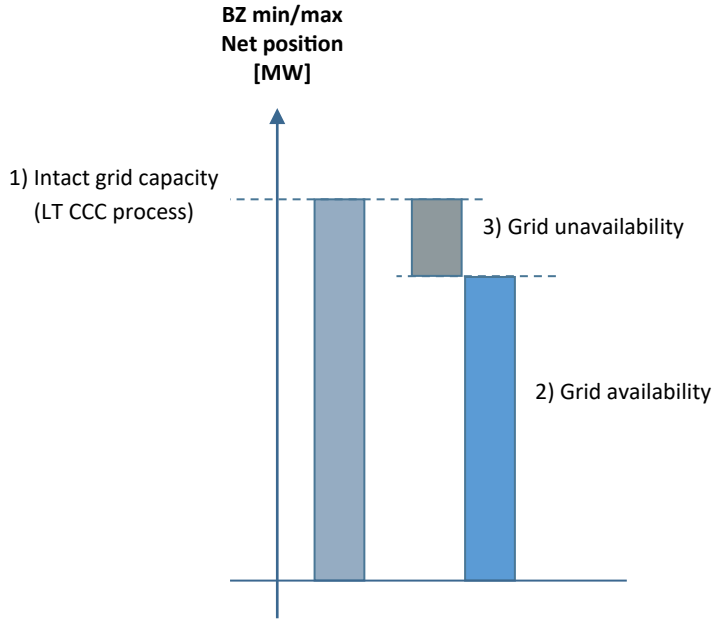

Figure 3 – Visual representation of the relationship between intact grid capacity, grid availability and grid unavailability. A grid unavailability may be positive/negative thus decreasing/increasing the grid availability.

The export capability of a bidding zone is represented by the **maximum NP,** which is a **positive value**, while the import capability is represented by the **minimum NP**, which is a **negative value.**

4. Publication data

This chapter introduces the data publication format associated with the new NUCS FB publication stream for Transmission Unavailability. Sections 4.1 and 4.2 provide a walkthrough of the updated format on the web GUI, with section 4.2 further elaborating on the concept of Forecasted FB domains. Sections 4.3 and 4.4 explain the coexistence of both NTC and FB publications and the corresponding version control that exists between them. Section 4.5 introduces additional endpoints for retrieving the new NUCS FB publications via the NUCS API. Section 4.6 concludes with an overview of the publication frequency. Finally, section 4.7 provides a supplementary illustration of a sample outage calculation.

4.1 Individual outage publications

Figure 4 showcases the new *Unavailable FB Transmission Capacity* page to accommodate the FB publications, with the numbered changes explained below. Please note that the current *Unavailable Capacity* page remains the same for NTC publications (see further details in section 4.3).

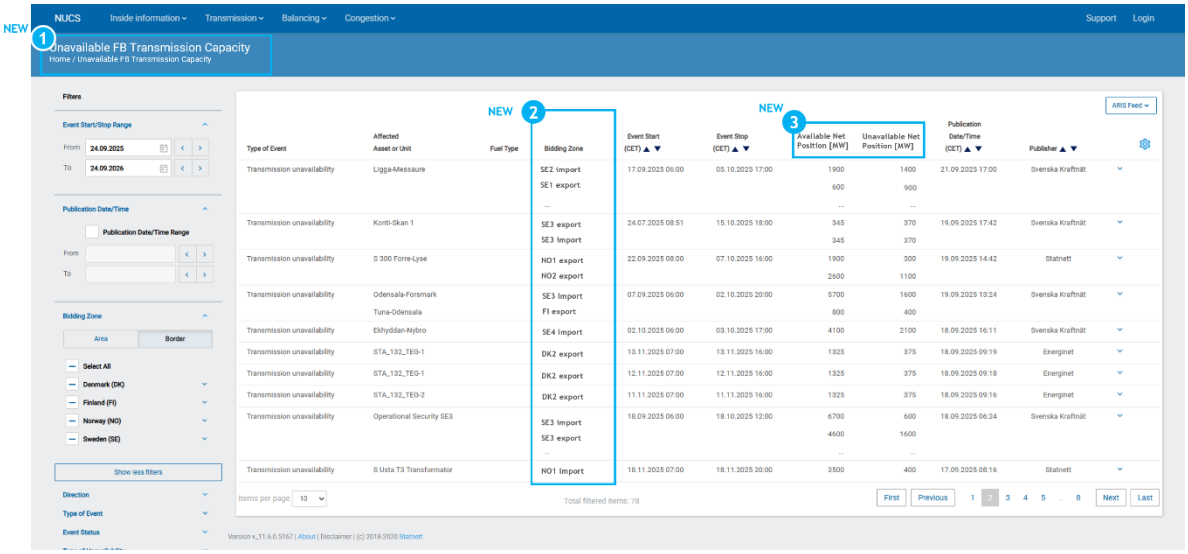

Figure 4 – New Unavailable FB Transmission Capacity (UMM) page.

1. The page header is updated to reflect a new UMM page dedicated to FB publications only.
2. Instead of listing the impacted (directed) bidding zone borders, the impacted **bidding zone(s)** are mentioned with their 'import/export' directions, representing the minimum and maximum available net positions of the BZ (maximum NP is the export side, minimum NP is the import side).
3. In the **titles of these columns**, the word 'capacity' is changed to reflect net positions.

When selecting the dropdown of a FB publication for a detailed view, this view is also adapted for the FB format accordingly, which is showcased in Figure 5. Note that the detailed view for NTC publications does not change. The numbered highlights of the changes in the detailed view are explained below.

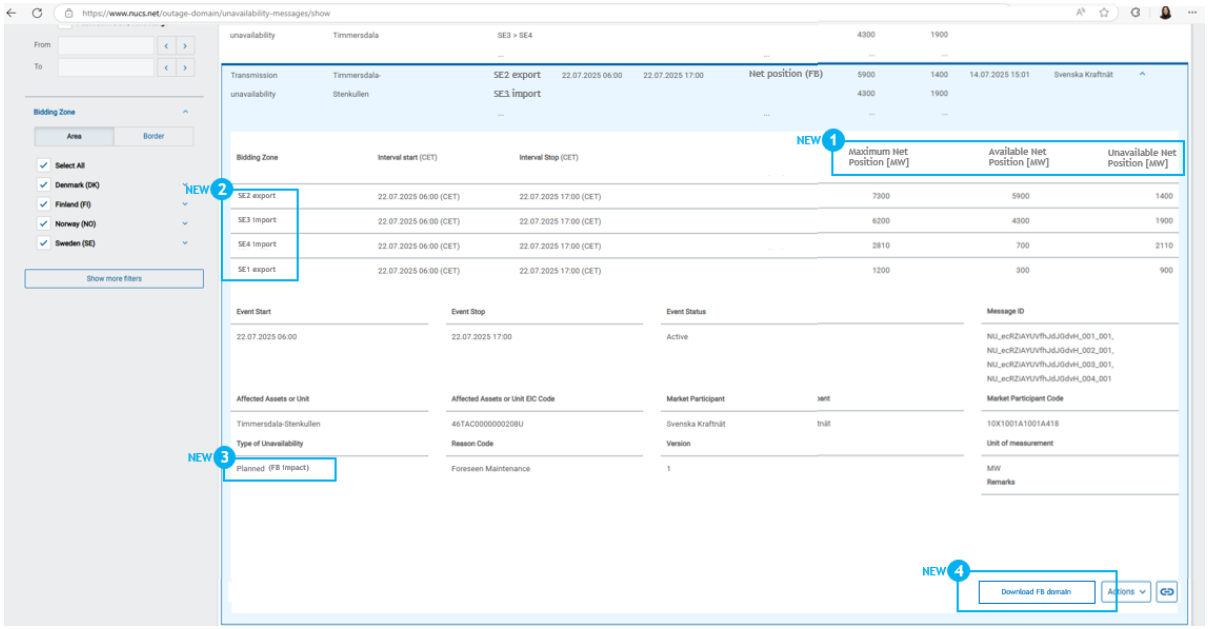

Figure 5 – Detailed FB impact view for a Transmission Unavailability.

1. The **column titles** here are updated to 'Maximum Net Position [MW]' (instead of 'Installed Capacity'), 'Available Net Position [MW]' (instead of 'Available Capacity') and 'Unavailable Net Position [MW]' (instead of 'Unavailable Capacity').
2. Instead of displaying a specific Bidding Zone Border direction, (e.g., DK1 > DK2), the total available **Bidding Zone** import, and export will be mentioned**.** Each row represents an import or export availability in a specific BZ. **Note that there will be as many rows for a BZ import/export as there are months impacted by the outage (a different reference FB domain is available for each month based on the LTCC process and hence one 'set' of min/max net positions impacts will be delivered per month).** This is also illustrated in Figure 6.
3. In the field 'Type of Unavailability', an additional label should be displayed in brackets to highlight the type of the impact (e.g. 'Planned (**FB impact**)').
4. An additional button provides the opportunity to **download the FB domain**, which entails downloading the corresponding IG-183 (CriticalNetworkElement_MarketDocument) file for the outage publication.

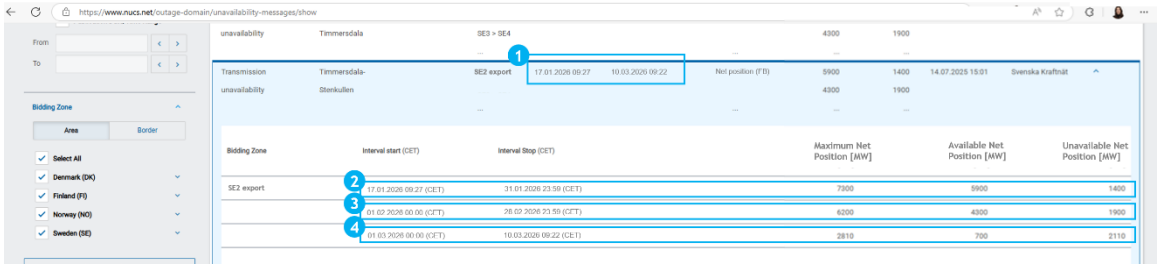

Figure 6 – Example of outage impact over multiple months.

Figure 6 illustrates the fact that for outages spanning through multiple months, a specific bidding zone impact (SE2 export in this example) is delivered for each month. In the example, the event start date is in January 2026 and the event end date is in March 2026 (see marker *1*). This means three different months are affected by the outage and hence three different FB domains were calculated, resulting in three different sets of net positions: see markers *2*, *3* and *4*.

4.2 Forecasted FB domains

The following section details the new Forecasted FB Domains dashboards that will replace the Forecasted Transfer Capacities dashboards. The Forecasted FB Domains dashboards consist of separate pages for the week-ahead (W-1), month-ahead (M-1) and year-ahead (Y-1) time horizons. On these dashboards, forecasted minimum/maximum available net positions of the respective bidding zones are displayed (instead of NTC values per bidding zone borders) along with the downloadable FB domains for each time horizon.

Figure 7 illustrates the Forecasted FB Domains dashboard for W-1:

- The ‘Event Start/Stop’ selection allows for browsing through all the historical forecasts for the previous weekly periods up until the latest W-1 period.
- The ‘Bidding Zone’ section allows selecting specific bidding zones for which the Net Position Chart is plotted on the right.
- The Net Position Chart displays the changing levels of maximum/minimum available net positions for a given bidding zone during the forecast interval. The changing levels are due to different outages being active during the given time intervals.
- The Table View presents the different disjoint time intervals during the forecast period for which the flow-based domains are calculated. These disjoint intervals can be characterised by 3 different cases:
    - (1) A single outage is observed during this interval. In such case, the FB domain and net positions correspond to the matching individual outage publication shared on the UMM page

- (2) Multiple outages occur during this interval. In this case, a combined impact of the overlapping outages is calculated. The resulting FB domain and net positions of this additional outage calculation will be associated with this interval.
- (3) No outages occur during this interval. In such case, the latest available intact LTCC FB domain and net positions are associated with this interval (monthly minimum results either from the M-1 or Y-1 LTCC processes).

- A separate button is provided for downloading the Forecasted FB Domains for the selected forecast horizon. The download will consist of a single IG-183 file (format is detailed in section 5.2), which will contain the FB domains for each disjoint time interval.

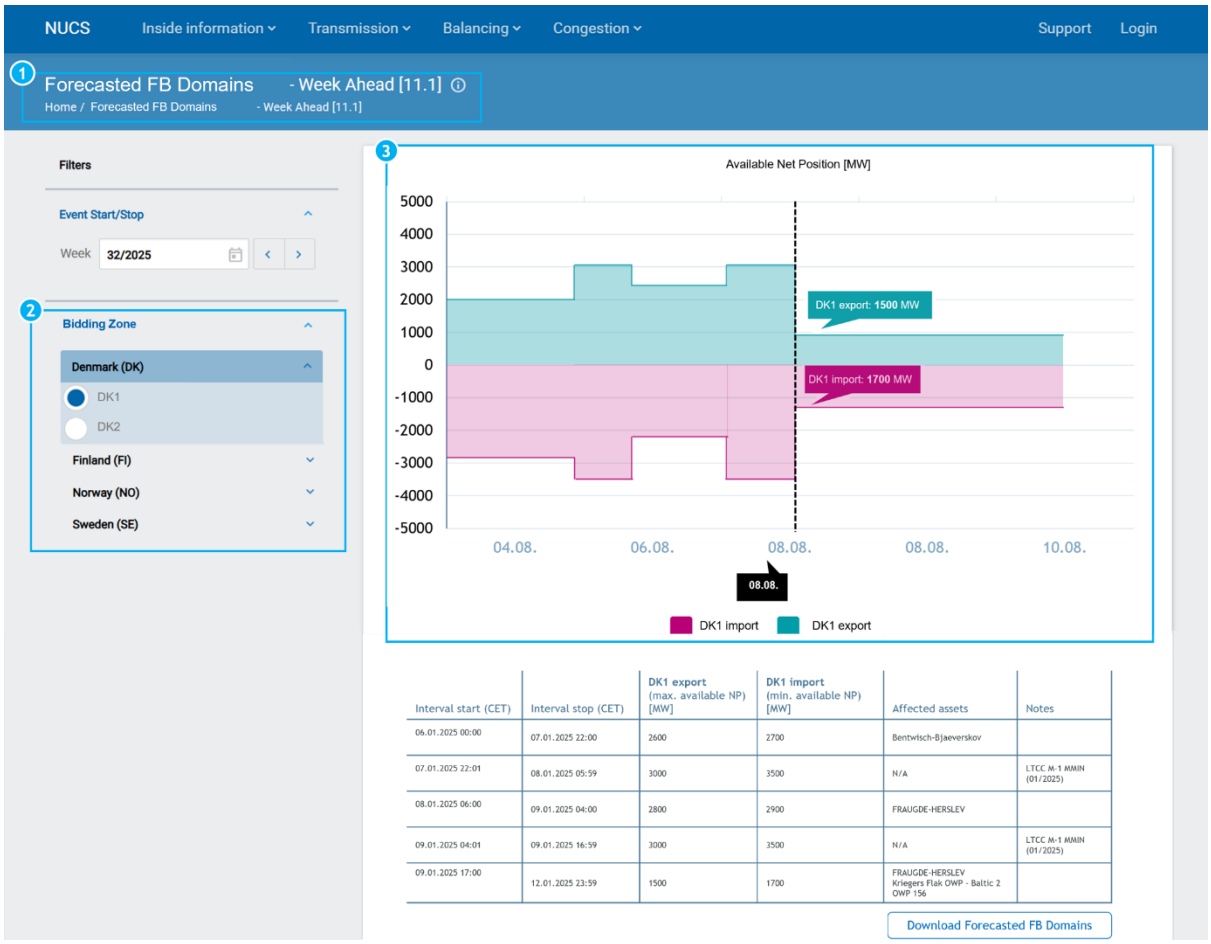

Figure 7 – Example page for Forecasted FB Domains (W-1).

4.3 Coexistence of NTC and FB publications

As a temporary solution, both NTC and FB publications will continue to co-exist for Transmission Unavailability. This is due to the fact that currently an ad-hoc NUCS is not yet supported outside the regular publication frequency (see section 4.6). For unplanned outages and for outages occurring in between the NUCS FB publication

timings, TSOs will continue to publish NTC impacts to comply with REMIT governing the publication frequency of insider information. If unplanned outages persist, turning into 'forced outages', the FB impacts will be published in the next NUCS FB calculation round, replacing the initial NTC estimates (see in section 4.4).

4.4 Version control

Updating NTC publication with FB impact

Next to the stream of FB impacts of outages, TSOs will continue to have the ability to upload outages manually via the NUCS Platform directly in an NTC format (as explained in 4.3). There is a possibility that a TSO uploads an outage with its NTC impacts on a short notice, for which an FB impact publication *might* become available later on (e.g., after the next W-1 process concludes), if the outage is not resolved before. In this case, the NTC impact publication on the UMM page will be marked outdated, informing the viewer that a new FB publication is available (which is presented separately in its distinct row in the table).

Updating FB publication

During subsequent publication periods, it is possible for the same outage publications to be updated. For example, an outage that is published and goes through a given monthly period, may be updated during the subsequent weekly publications. Please note that this only applies to individual outage publications to be presented on the UMM page. If changes occur, this can be highlighted in the detailed view in green, as it is done today (see Figure 8 for illustration).

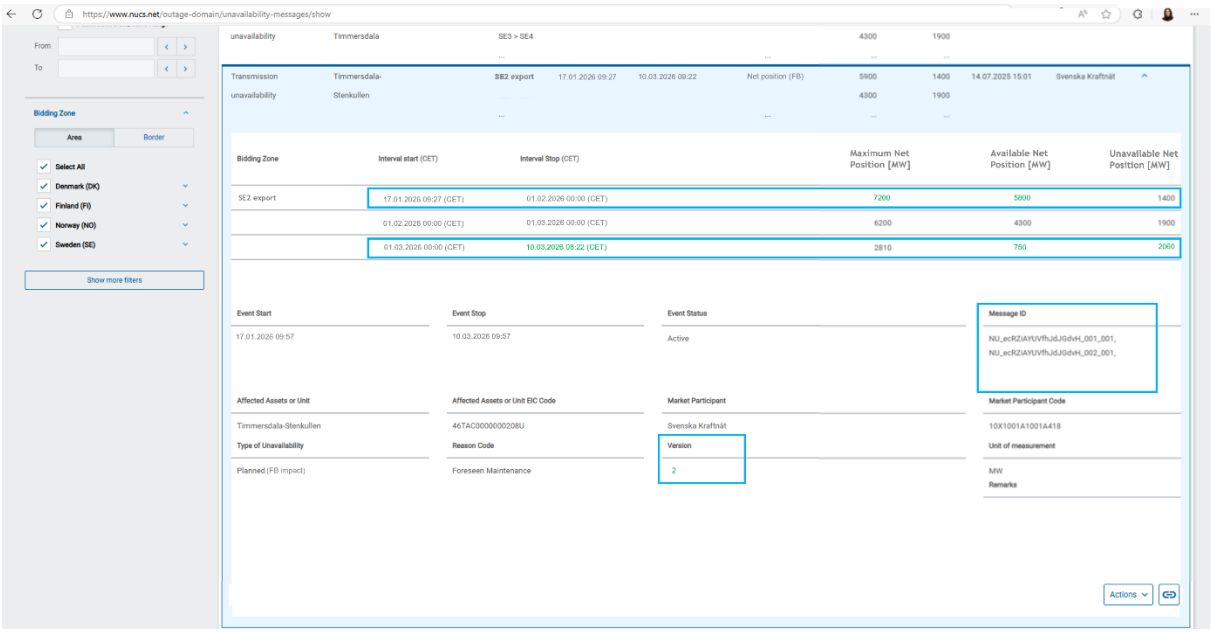

Figure 8 – Version control indication in the detailed view on the UMM page.

4.5 Querying FB publications via NUCS API

Enabling users to directly query the result files (IG-182, IG-183, IG-184) of flow-based outage publications, updates are also made to the NUCS API. Section 4.5.1 describes the Request Components for the relevant endpoints, while the detailed format descriptions of the result files are presented in the Appendix.

4.5.1 Request Components

The presentation of the Request Components for each document type here complements the up-to-date NUCS API Reference, which will soon be available in the NUCS portal accessible via a Keycloak login[1]. The already existing request type for the Unavailability_MarketDocument, now accommodates both NTC and FB publications. In addition to this, two new request types are established to be able to query the additional two document types (for IG-182 and IG-183).

4.5.1.1 Grid availability due to an outage in bidding zone net positions (IG-184)

Table 2 – Request components for grid availability due to an outage in BZ NPs.

AttributeInstanceComponent	Description
DocumentType [1..1]	A78 = Grid availability due to an outage in bidding zone net positions (IG-184)
DocStatus [0..1]	A36 = Planned A05 = Active A09 = Cancelled Note that for FB outage publications, *A36* can also be used.
BusinessType [0..1]	A53 = Planned maintenance A54 = Forced unavailability
In_Domain [0..1]	Unique identification of the bidding zone the availability relates to. In the case of FB publications, the In_Domain corresponds to the availability of import capability of the bidding zone (minimum available net position).
Out_Domain [0..1]	Unique identification of the bidding zone the availability relates to. In the case of FB publications, the Out_Domain corresponds to the availability of export capability of the bidding zone (maximum available net position).
TimeInterval [0..1]	Time interval in UTC time zone. *Mandatory if combination of PeriodStart and PeriodEnd is not used.*
PeriodStart [0..1]	*Mandatory if TimeInterval is not used.*

[1] Additional information and further details will be provided in an upcoming update of this handbook.

PeriodEnd [0..1]	*Mandatory if TimeInterval is not used.*
TimeIntervalUpdate [0..1]	Time interval in UTC time zone. Filters outages based on timestamp of last update.
PeriodStartUpdate [0..1]	Mandatory if PeriodEndUpdate is used. Not used if TimeIntervalUpdate is used.
PeriodEndUpdate [0..1]	Mandatory if PeriodStartUpdate is not used. Not used if TimeIntervalUpdate is used.
Mrid [0..1]	Unique identification of Unavailability Message in the system. In case that Mrid parameter is used, then all **parameters for time-based filtering** are ignored even if used. In the XML document it can be found in the mRID element on document level. In the GUI it can be found in the URL of the Permanent link as first part of attribute ummId (followed by "|" character and EIC code of the original sender).
DocumentVersion [0..1]	Version Number of the Unavailability in the system. In the GUI it can be found in attribute Version on Unavailability Detail Screen. *If DocumentVersion is used then parameter Mrid is mandatory.*
fbOnly[0..1]	The parameter is used to return FB publications only (the same DocumentType is also being used by NTC publications). 0 = both NTC and FB publications included in API response 1 = only FB publications included in API response
fbForecast[0..1]	The parameter is used to return Forecasted FB Domain publications (in available net positions). A31 = Week-ahead A32 = Month-ahead A33 = Year-ahead *If the fbForecast parameter is used, only parameters for time-based filtering apply, the rest of the parameters are ignored.*

4.5.1.2 Grid unavailability due to an outage in bidding zone net positions (IG-182)

Table 3 – Request components for grid unavailability due to an outage in BZ NPs.

AttributeInstanceComponent	Description
DocumentType [1..1]	B31 = Grid unavailability due to an outage in bidding zone net positions (IG-182)
DocStatus [0..1]	A36 = Planned A05 = Active A09 = Cancelled Note that for FB outage publications, *A36* can also be used.
In_Domain [0..1]	Unique identification of the bidding zone the availability relates to. In the case of FB publications, the In_Domain corresponds to the availability of import capability of the bidding zone (minimum available net position).
Out_Domain [0..1]	Unique identification of the bidding zone the availability relates to.

	In the case of FB publications, the Out_Domain corresponds to the availability of export capability of the bidding zone (maximum available net position).
TimeInterval [0..1]	Time interval in UTC time zone. *Mandatory if combination of PeriodStart and PeriodEnd is not used.*
PeriodStart [0..1]	*Mandatory if TimeInterval is not used.*
PeriodEnd [0..1]	*Mandatory if TimeInterval is not used.*
TimeIntervalUpdate [0..1]	Time interval in UTC time zone. Filters outages based on timestamp of last update.
PeriodStartUpdate [0..1]	Mandatory if PeriodEndUpdate is used. Not used if TimeIntervalUpdate is used.
PeriodEndUpdate [0..1]	Mandatory if PeriodStartUpdate is not used. Not used if TimeIntervalUpdate is used.
Mrid [0..1]	Unique identification of Unavailability Message in the system. In case that Mrid parameter is used, then all **parameters for time-based filtering** are ignored even if used. In the XML document it can be found in the mRID element on document level. In the GUI it can be found in the URL of the Permanent link as first part of attribute ummId (followed by "|" character and EIC code of the original sender).
DocumentVersion [0..1]	Version Number of the Unavailability in the system. In the GUI it can be found in attribute Version on Unavailability Detail Screen. *If DocumentVersion is used then parameter Mrid is mandatory.*
fbForecast[0..1]	The parameter is used to return Forecasted FB Domain publications (in available net positions). A31 = Week-ahead A32 = Month-ahead A33 = Year-ahead *If the fbForecast parameter is used, only parameters for time-based filtering apply, the rest of the parameters are ignored.*

4.5.1.3 Grid availability due to an outage in FB parameters (IG-183)

Table 4 – Request components for grid availability due to an outage in FB parameters.

AttributeInstanceComponent	Description
DocumentType [1..1]	B11 = Grid availability due to an outage in FB parameters (IG-183)
TimeInterval [0..1]	Time interval in UTC time zone. *Mandatory if combination of PeriodStart and PeriodEnd is not used.*
PeriodStart [0..1]	*Mandatory if TimeInterval is not used.*
PeriodEnd [0..1]	*Mandatory if TimeInterval is not used.*
TimeIntervalUpdate [0..1]	Time interval in UTC time zone. Filters outages based on timestamp of last update.
PeriodStartUpdate [0..1]	Mandatory if PeriodEndUpdate is used. Not used if TimeIntervalUpdate is used.
PeriodEndUpdate [0..1]	Mandatory if PeriodStartUpdate is not used. Not used if TimeIntervalUpdate is used.

Mrid [0..1]	Unique identification of Unavailability Message in the system. In case that Mrid parameter is used, then all **parameters for time-based filtering** are ignored even if used. In the XML document it can be found in the mRID element on document level. In the GUI it can be found in the URL of the Permanent link as first part of attribute ummId (followed by "|" character and EIC code of the original sender).
DocumentVersion [0..1]	Version Number of the Unavailability in the system. In the GUI it can be found in attribute Version on Unavailability Detail Screen. *If DocumentVersion is used then parameter Mrid is mandatory.*
fbForecast[0..1]	The parameter is used to return Forecasted FB Domain publications (FB parameters). A31 = Week-ahead A32 = Month-ahead A33 = Year-ahead *If the fbForecast parameter is used, only parameters for time-based filtering apply, the rest of the parameters are ignored.*

4.6 Publication frequency

The NUCS Business Process will follow the timelines of the Pan-European Outage Planning Coordination Process (PE OPC), which include Y-1, M-1 and W-1 time horizons. The FB calculated outage impact for the individual outages is a continuous process and will be presented in the UMM table as soon as the information is gathered in one of the PE OPC processes. Combined outage impacts are calculated after each OPC process is finalized and visualized as a static view as Forecasted FB Domains (see section 4.2). This means the yearly combined outage calculation is performed after the Y-1 OPC process concludes. Once the monthly (M-1) calculation is executed, it provides a more refined and up-to-date forecast, outranking the yearly estimate with improved accuracy. The same applies for the weekly (W-1) calculation that provides an updated view compared to the monthly view. It is important to note that the W-1 process continues to use the LTCC M-1 domains, potential updates can only occur from revising the outage plans. An overview of the NUCS publication timings for each horizon is presented in Figure 9.

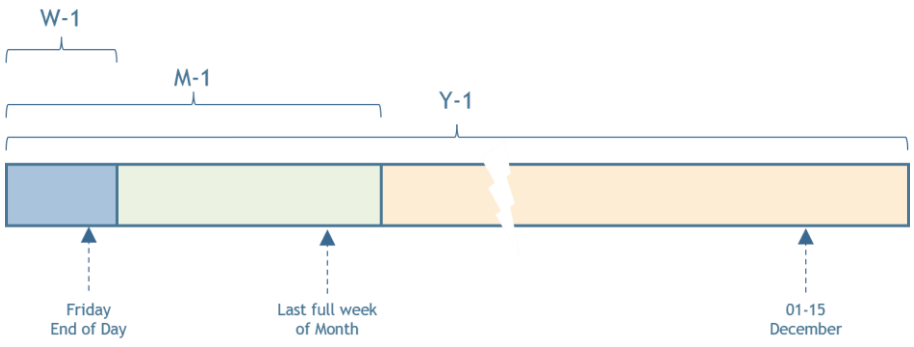

Figure 9 – Overview of NUCS publication timings.

An anonymization of CNECs is performed per FB calculation execution for each specific process. Hence, it is not guaranteed that the identifiers are the same for different outage calculations.

4.7 Sample outage calculation of the NUCS process

This section focuses on providing an exemplary calculation of the NUCS proof-of-concept process. This section outlines the expected depth of information on how outages impact the import and export capabilities of affected bidding zones.

4.7.1 Disclaimer for performed calculations and associated results

The basis for this exemplary calculation of the NUCS process is a 2026 Y-1 LTCC domain serving as a reference for the individual outage impact calculation. Please note that although the reference domain has been calculated with same process steps as the eventual Y-1 LTCC production one—which will be published on the Nordic RCC website at the time of the Y-1 CC process go-live targeted for 31st of October 2025—this calculation is not derived from the final Y-1 production data.

To provide stakeholders with an actual calculation of the NUCS process, two outages have been chosen from the year 2025. Please note that both the interval start and end date (as well as the publication date) for these outages have been adjusted to match the 2026 LTCC reference domain. The outages have originally occurred or are planned for the same dates in 2025.

A further point of caution is that only bidding zone net position impacts greater than 100 MW are reported; smaller net position impacts (less than 100 MW) are not included in the following tables. The reported maximum (reference) and available net positions do not represent the actual physical limits of the bidding zones but rather indicate the theoretical export and import capabilities of a bidding zone based on FB parameters such as PTDFs and RAM. The maximum net positions are calculated as mathematical boundaries to ensure flow feasibility under worst-case assumptions and should not be interpreted as forecasts of actual trades. The capabilities reported on the NUCS platform may be positive or negative for both export and import. In this context, a positive unavailability for either export or import indicates a reduction in the effectively available net position, while a negative unavailability indicates an increase in export or import capability compared to the LTCC reference domain (i.e., the maximum net position).

Due to the FB methodology, the change in topology for a considered outage alters how flows are affected. As a result, limitations for certain zones may be reduced or increased, thus net positions changes may be positive or negative. Net positions are

determined by a multidimensional domain constrained by network elements and their sensitivities (PTDFs). When an outage occurs, the algorithm recalculates this domain and associated CNECs with that outage need to be updated in that process. In general, the FB methodology aims to maximize social welfare and can thus be seen as a global optimization for the whole Nordic region, and as such, these theoretical net positions of bidding zones may both increase or decrease due to an outage.

For outages on HVDC links, the export and import definitions for virtual bidding zones (VBZs) are different from the ones of normal bidding zones. A maximum net position (export) is defined towards the associated normal bidding zone, and not towards the virtual bidding zone pair. If an outage of a DC link thus has an impact on the available net position of a VBZ1 (import) and the available net position of a VBZ2 (export), then the flow is limited in the direction of VBZ1 > VBZ2.

The information that will be published on the NUCS platform will contain the type of event; the affected asset or unit; the affected bidding zone (either export or import); interval dates; maximum, available and unavailable net positions. Other attributes such as impact type, publication date and publisher are neglected in this sample overview but will be included on the NUCS webpage.

4.7.2 Tie line outage between NO4 and SE1

The first example is the NUCS outage calculation for the tie line between NO4 and SE1 (Ritsem – Ofoten), which was a foreseen maintenance outage reported jointly by Statnett and Svenska Kraftnät. The tie line was out of operation from 28.07.2025 06:00 – 03.08.2025 17:00. As stated, for this exemplary calculation, the dates were adjusted to 2026 which does not imply that in 2026 this exact outage will necessarily occur. Table 5 details the maximum (reference), available and unavailable net positions of affected bidding zones.

Table 5 – Impact on bidding zone NPs from the NUCS prototype results for an outage of the tie line between NO4 and SE1.

Type of Event	Affected Asset or Unit	Bidding Zone[1]	Interval Start (CET)[2]	Interval Stop (CET)[2]	Maximum Net Position [MW]	Available Net Position [MW]	Unavailable Net Position [MW]
Transmission unavailability	Ritsem - Ofoten	NO3 (export)	28.07.2026 06:00	01.08.2026 00:00	3110	4063	-953
			01.08.2026 00:00	03.08.2026 17:00	3034	4009	-975
		NO4 (export)	28.07.2026 06:00	01.08.2026 00:00	2039	1660	379

		01.08.2026 00:00	03.08.2026 17:00	1972	1637	335
	SE2 (export)	28.07.2026 06:00	01.08.2026 00:00	12161	11962	199
		01.08.2026 00:00	03.08.2026 17:00	12087	11903	184
	NO3 (import)	28.07.2026 06:00	01.08.2026 00:00	3930	3682	248
		01.08.2026 00:00	03.08.2026 17:00	3850	3606	244
	NO4 (import)	28.07.2026 06:00	01.08.2026 00:00:00	1329	2690	-1361
		01.08.2026 00:00	03.08.2026 17:00	1327	2665	-1338
	SE1 (import)	28.07.2026 06:00	01.08.2026 00:00	5502	5074	428
		01.08.2026 00:00	03.08.2026 17:00	5465	5044	421

[1] Please note that only those BZs are listed that experience an absolute impact of 100 MW for at least one month compared to the reference domain.

[2] For this sample calculation, the interval start and stop time (and publication date) were adjusted to fit the 2026 reference LTCC domain. The outage originally occurred for the same dates in 2025.

For this specific outage, the NUCS FB recalculation of the NPs shows an increase in available export capability of NO3, while those of NO4 and SE2 are decreased. The import capabilities of NO3 and SE1 decreased as well, while NO4 ends up with a larger available import capability. Differences between months may occur in case different flow-based input data have been provided by the TSOs for the calculation process. Please note that these figures are for illustrative purposes only and may not accurately represent the actual net position impacts within a production process.

4.7.3 Grid line outage in SE4

The second example is connected to the refurbishment of the 400 kV overhead line in between Breared and Söderåsen in the west coast corridor of Sweden, which is under a three-month maintenance ranging from 11.08. – 09.11.2025, as reported by Svenska Kraftnät. As stated, for this exemplary calculation, the dates were adjusted to 2026 which does not imply that in 2026 this exact outage will necessarily occur. Table 6 lists the impacts of this outage.

Table 6 – Impact on bidding zone NPs from the NUCS prototype results for an outage of the west coast corridor of Sweden.

Type of Event	Affected Asset or Unit	Bidding Zone[1]	Interval start (CET) [2]	Interval stop (CET) [2]	Maximum Net Position [MW]	Available Net Position [MW]	Unavailable Net Position [MW]
Transmission unavailability	Breared - Söderåsen	SE3 (export)	11.08.2026 06:00	01.09.2026 00:00	16910	16149	761
			01.09.2026 00:00	30.09.2026 00:00	16804	16362	442
			01.10.2026 00:00	31.10.2026 00:00	16804	16362	442
			01.11.2026 00:00	09.11.2026 17:00	16804	16362	442
		SE4 (import)	11.08.2026 06:00	01.09.2026 00:00	7344	7423	-79
			01.09.2026 00:00	30.09.2026 00:00	7179	7363	-184
			01.10.2026 00:00	31.10.2026 00:00	7179	7363	-184
			01.11.2026 00:00	09.11.2026 17:00	7179	7363	-184
		DK2 (export)	11.08.2026 06:00	01.09.2026 00:00	2896	2322	574
			01.09.2026 00:00	30.09.2026 00:00	3021	2421	600
			01.10.2026 00:00	31.10.2026 00:00	3021	2421	600
			01.11.2026 00:00	09.11.2026 17:00	3021	2421	600

[1] Please note that only those BZs are listed that experience an absolute impact of 100 MW for at least one month compared to the reference domain.

[2] For this sample calculation, the interval start and stop time (and publication date) were adjusted to fit the 2026 reference LTCC domain. The outage originally occurred for the same dates in 2025.

The NUCS process for this outage results in net positions changes for the bidding zones SE3 (export), SE4 (import) as well as DK2 (export). Four values are provided as part of the NUCS process as each month is associated with a reference domain from the Y-1 LTCC process. Hence, the impact for August is different from the impact of the other months of the reported period.

5. Appendix

In sections 5.1 – 5.3, the XML structures for the publication results of the NUCS process are presented. While this document focuses on the specific XML implementation of the result files, the reader is directed to the publication handbook for the Y-1 long-term flow-based calculations published on the Nordic RCC website for general clarifications and definitions: Publication-Handbook-Y-1-LT-FB.

5.1 IG-182 NUCS Grid unavailability due to an outage in bidding zone net positions

This section of the Appendix covers the structure of exchanges of bidding zone net positions calculated based on the FB domain results for an outage and the FB domain results for Y-1 and M-1 processes. These net position values reflect the grid unavailability due to an outage. The content is structured based on the official ENTSOE *Capacity_MarketDocument*.

The XML structure of the *TimeSeries* of the unavailability is exemplified in Table 7, containing the minimum and maximum net positions (minimum and maximum limit a BZ can reach through the grid constraints) as a result of the calculation process. Each minimum or maximum net position is represented by a dedicated *TimeSeries*. In this class, each *TimeSeries* has only one Period that equals to a specific interval in the month the outage was relevant for, and each Period would contain just a single Point, as the calculation for the outage is performed monthly. Each Point shall subsequently list the minimum and maximum net position values per applicable bidding zone. The attributes are further detailed in Table 8 and Table 9.

The *Period* class provides for a given *TimeSeries* the MTU information for unavailable capacity. The unavailable capacity is defined by bidding zone net position (minimum and maximum) values. Within the *Period*, the *Point* information defines the values associated with the given *TimeSeries*. If an outage covers multiple months and more than one FBDomain is computed, at least one Period per FB Domain will be defined. Using the curveType with variable-sized blocks (set in the TimeSeries), only changes in position and quantity need to be specified. Although FB calculations are monthly, this data exchange uses mainly hourly resolution. When an outage starts or ends within an hour, intervals are split into finer resolutions.

Table 7 – XML example of a TimeSeries of an outage unavailability

```
<!-- Min (import) net positions for a virtual Bidding Zone (NO2_NK) -->
<TimeSeries>
  <mRID>23ad6b0e60f48af46eabccd53e58ca2f</mRID>
<!-- As we want to define both minimum and maximum net position values for a BZ, we need to distinguish which one is which by the businessType -->
<!-- B69 = minimum value of netted area position, B70 = maximum value of netted area position -->
  <businessType>B69</businessType>
  <product>8716867000016</product>
<!-- In a minimum NP case, the value relates to an import case and hence the in_Domain equal to the BZ and the out_Domain to Nordic Market Area -->
  <in_Domain.mRID codingScheme="A01">50YNBFFTWZRAHA3P</in_Domain.mRID>
  <out_Domain.mRID codingScheme="A01">10Y1001A1001A91G</out_Domain.mRID>
  <measurement_Unit.name>MAW</measurement_Unit.name>
  <curveType>A03</curveType>
 <!-- First Period is defined to start from outage effective start and continue until end of March -->
<!-- However, in case the outage begins or ends within an hour, the shorter timeinterval until the full hour will have different resolution (PT30M or PT15M or PT1M) -->
  <Period>
    <timeInterval>
      <start>2024-03-22T15:22Z</start>
      <end>2024-03-22T15:30Z</end>
    </timeInterval>
    <resolution>PT1M</resolution>
    <Point>
      <position>1</position>
      <quantity>700</quantity>
    </Point>
  </Period>
  <Period>
     …
  </Period>
</TimeSeries>
<!-- Max (export) net positions for a virtual Bidding Zone (NO2_NK) -->
<!-- In a maximum NP case, the value relates to an export case and hence the out_Domain equal to the BZ and the in_Domain to Nordic Market Area -->
<TimeSeries>
  <mRID>23aabb0e60f48af46e6d6cd53e58ca2f</mRID>
  <businessType>B70</businessType>
  <product>8716867000016</product>
  <in_Domain.mRID codingScheme="A01">10Y1001A1001A91G</in_Domain.mRID>
  <out_Domain.mRID codingScheme="A01">50YNBFFTWZRAHA3P</out_Domain.mRID>
  <measurement_Unit.name>MAW</measurement_Unit.name>
  <curveType>A03</curveType>
  <Period>
    <timeInterval>
      <start>2024-04-02T11:00Z</start>
      <end>2024-04-02T11:15Z</end>
    </timeInterval>
    <resolution>PT15M</resolution>
    <Point>
      <position>1</position>
      <quantity>1200</quantity>
    </Point>
  </Period>
  <Period>
     …
  </Period>
</TimeSeries>
```

Table 8 – XML elements and datatypes for TimeSeries (min/max net position)

XML Element	ESMP Datatypes / primitive	Values
mRID	ID_String / String	Unique Identification of Time series within document.
businessType	BusinessKind_String / BusinessTypeList	B69 = minimum value of netted area position B70 = maximum value of netted area position
product	EnergyProductKind_String / EnergyProductTypeList	8716867000016 = Active Power
in_Domain.mRID	AreaID_String / String	Normal or Virtual Bidding Zone EICode. One of the Domains shall relate to the Nordic Market Area =10Y1001A1001A91G
in_Domain.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
out_Domain.mRID	AreaID_String / String	Normal or Virtual Bidding Zone EICode. One of the Domains shall relate to the Nordic Market Area =10Y1001A1001A91G
out_Domain.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
measurement_Unit.name	MeasurementUnitKind_String / UnitOfMeasureTypeList	MAW = MW
curveType	CurveType_String / CurveTypeList	The identification of the coded representation of the type of curve being described. A03 = Variable sized block The curve is made of successive Intervals of time (Blocks) of variable duration (size), where the end date and end time of each Block are equal to the start date and start time of the next Interval. For the last Block the end date and end time of the last Interval would be equal to EndDateTime of TimeInterval.

Table 9 – XML elements and values for Period class.

XML Element	ESMP Datatypes / primitive	Values
Period:timeInterval:start	YMDHM_DateTime / DateTime	DateTime in format “YYYY-MM-DDThh:mmZ”
Period:timeInterval:end	YMDHM_DateTime / DateTime	DateTime in format “YYYY-MM-DDThh:mmZ”
Period:resolution	Duration / Duration	PT60M = Values per 60 minute PT30M = Values per 30 minute PT15M = Values per 15 minute

		PT1M = Values per 1 minute
Period:Point:position	Position_Integer / Integer	A sequential value representing the relative position within a given time interval.
Period:Point:quantity	Decimal / Decimal	Principal quantity identified for a point. This information defines the unavailability associated with the specific bidding zone within the interval period. In this data exchange can be either a positive or a negative value.

The *Capacity_MarketDocument* is the main class that packs each individual *TimeSeries*. The example message is illustrated in Table 10 and the associated attributes are described in Table 11.

Table 10 – XML example to pack all TimeSeries into the Capacity_MarketDocument.

```
<?xml version="1.0" encoding="utf-8"?>
<!-- OPDE PUBLIC -->
<Capacity_MarketDocument xmlns="urn:iec62325.351:tc57wg16:451-3:capacitydocument:8:2">
  <mRID>6d795431fd1bdff9859a750c5d1a2c5f</mRID>
  <revisionNumber>1</revisionNumber>
  <type>B31</type>
  <process.processType>A26</process.processType>
  <sender_MarketParticipant.mRID codingScheme="A01">10X1001C--00008J</sender_MarketParticipant.mRID>
  <sender_MarketParticipant.marketRole.type>A36</sender_MarketParticipant.marketRole.type>
  <receiver_MarketParticipant.mRID codingScheme="A01">10V1001C--000187</receiver_MarketParticipant.mRID>
  <receiver_MarketParticipant.marketRole.type>A33</receiver_MarketParticipant.marketRole.type>
  <createdDateTime>2024-10-01T12:54:49Z</createdDateTime>
  <period.timeInterval>
    <start>2024-12-31T23:00Z</start>
    <end>2025-12-31T23:00Z</end>
  </period.timeInterval>
  <domain.mRID codingScheme="A01">10Y1001A1001A91G</domain.mRID>
  <TimeSeries>
    <!-- Include Table XXX for a min or max NP value -->
  </TimeSeries>
  <TimeSeries>
    <!-- Include Table XXX for another min or max NP value -->
  </TimeSeries>
</Capacity_MarketDocument>
```

Table 11 – XML elements and datatypes for Capacity_MarketDocument.

XML Element	ESMP Datatypes / primitive	Values
mRID	ID_String / String	Unique identification to be kept the same for an Outage throughout its lifetime.
revisionNumber	ESMPVersion_String / String	Version will start with 1 and will increment with each publication.
type	MessageKind_String / MessageTypeList	B31 = Additional Constraint document
process.processType	ProcessKind_String / ProcessTypeList	A26 = Outage information

sender_MarketParticipant.mRID	PartyID_String / String	10X1001C--00008J = NRCC
sender_MarketParticipant.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
sender_MarketParticipant.marketRole.type	MarketRoleKind_String / RoleTypeLit	A36 = Capacity Coordinator
receiver_MarketParticipant.mRID	PartyID_String / String	NUCS_EIC_X_CODE = NUCS platform
receiver_MarketParticipant.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
receiver_MarketParticipant.marketRole.type	MarketRoleKind_String / RoleTypeLit	A33 = Information receiver
createdDateTime	ESMP_DateTime / DateTime	DateTime in format “YYYY-MM-DDThh:mm:ssZ”
period.timeInterval:start	YMDHM_DateTime / DateTime	DateTime in format “YYYY-MM-DDThh:mmZ”
period.timeInterval:end	YMDHM_DateTime / DateTime	DateTime in format “YYYY-MM-DDThh:mmZ”
domain.mRID	AreaID_String / String	10Y1001A1001A91G = Nordic Market area
domain.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC

5.2 IG-183 NUCS Grid availability due to an outage in FB parameters

This section of the Appendix covers the XML structure for the exchange of FB constraints and their RAM and PTDF values extracted from the FB domain result for an outage. The content is based on the official ENTSOE *CriticalNetworkElement_MarketDocument*. This publication covers the exchange of RAMs, PTDF values and additional quantities associated to a CNEC.

These two attributes are included as a *Monitored_Series* element within the *Constraint_Series*, as exemplified by Table 12. This class defines the container for all FB parameters for a single CNEC and a single MTU. The optional element *constraintStatus_MarketObjectStatus.status* with A54 value is used if the constraint is denoted as presolved (non-redundant), while the optional element *Optimization_MarketObjectStatus.status* is used with A64 value if the constraint is denoted as relevant (significant). Relevant information contained in the *Monitored_Series* as *Measurements* cover Individual value adjustments (IVAs), maximum allowed flow (Fmax), Reference flow (Fref), assumed external exchanges (Fext), linear flow approximation (F0), adjustment for minimum RAM (AMR), already allocated capacity (AACs), flow reliability margin (FRM), average voltage (Uavg), and maximum admissible current (Imax).

Table 12 – XML example to pack FB values into Constraint_Series.

```
<Constraint_Series>
  <mRID>declassified mRID of the CNEC</mRID>
  <businessType>B40</businessType>
  <name>declassified name of the CNEC</name>
<!-- constraintStatus is only recorded if the element is significant (A50) or non-redundant (A54) -->
<Optimization_MarketObjectStatus.status>A64</Optimization_MarketObjectStatus.status>
  <constraintStatus_MarketObjectStatus.status>A54</constraintStatus_MarketObjectStatus.status>
  <Monitored_Series>
    <mRID>0a1ee6401-9325-1afb-611e-6645ee4ec93e</mRID>
    <RegisteredResource>
     <mRID codingScheme="A02">345ae6401-83a3-3fe3-17e8-663ef144c23e</mRID>
      <name>name of the Monitored element</name>
      <in_Domain.mRID codingScheme="A01">10Y1001A1001A48H</in_Domain.mRID>
      <out_Domain.mRID codingScheme="A01">10YNO-2--------T</out_Domain.mRID>
      <in_AggregateNode.mRID codingScheme="A02">SubIn</in_AggregateNode.mRID>
      <out_AggregateNode.mRID codingScheme="A02">SubOut</out_AggregateNode.mRID>
<!-- Individual value adjustment (IVA) -->
     <Measurements>
       <measurementType>A25</measurementType>
       <unitSymbol>MAW</unitSymbol>
       <analogValues.value>0</analogValues.value>
     </Measurements>
<!-- Maximum allowed flow (Fmax) -->
     <Measurements>
     ….
     </Measurements>
<!-- Reference flow (Fref) -->
     <Measurements>
     ….
     </Measurements>
     ...
     <flowBasedStudy_Domain.flowBasedMargin_Quantity.quantity>1000</flowBasedStudy_Domain.flowBasedMargin_Quantity.quantity>
<!-- Array(PTDF values) – List of PTDFs per BZs for the current CNEC. As many PTDF_Domain as number of BZs (2 as example) in the Nordic FB topology -->
      <PTDF_Domain>
        <mRID codingScheme="A01">10Y1001A1001A44P</mRID>
        <pTDF_Quantity.quantity>0.23</pTDF_Quantity.quantity>
      </PTDF_Domain>
      <PTDF_Domain>
        <mRID codingScheme="A01">10Y1001A1001A45N</mRID>
        <pTDF_Quantity.quantity>0.51</pTDF_Quantity.quantity>
      </PTDF_Domain>
    ...
    </RegisteredResource>
  </Monitored_Series>
</Constraint_Series>
```

The *Constraint_Series* elements are then packed into a *TimeSeries* class that contains all the CNECS of the FB domain for the given period the grid availability was calculated for. In case there was more than a single FB domain computed for an outage (i.e., if the outage extends to two different months), one *TimeSeries* per FB domain will be defined. See the exemplary XML structure in Table 13.

Table 13 – XML example to pack Constraint_Series into TimeSeries.

```
<TimeSeries>
  <mRID>23ad6b0e-60f4-8af4-6e6d-6cd53e58ca2f</mRID>
  <businessType>B38</businessType>
  <curveType>A03</curveType>
  <Period>
<!-- TimeInterval defines the period for which the given FBDomain is applicable for -->
    <timeInterval>
      <start>2023-03-01T23:00Z</start>
      <end>2023-03-05T23:00Z</end>
    </timeInterval>
    <resolution>PT60M</resolution>
    <Point>
      <position>1</position>
<!-- As many Constraint_Series as the CNECs to exchange -->
      <Constraint_Series>
        <!-- Include Table 12 for a constraint -->
      </Constraint_Series>
      <Constraint_Series>
        <!-- Include Table 12 for another constraint -->
      </Constraint_Series>
      ...
    </Point>
  </Period>
</TimeSeries>
```

The *CriticalNetworkElement_MarketDocument* is the main class that packs each individual *TimeSeries*, see an example message in Table 14.

Table 14 – XML example to pack all TimeSeries into the CriticalNetworkElement_MarketDocument.

```
<?xml version="1.0" encoding="utf-8"?>
<!-- OPDE PUBLIC -->
<CriticalNetworkElement_MarketDocument xmlns="urn:iec62325.351:tc57wg16:451-n:cnedocument:2:5">
  <mRID>6d795431fd1bdbc9859a750c5d1a2c5f</mRID>
  <revisionNumber>1</revisionNumber>
  <type>B11</type>
  <process.processType>A26</process.processType>
  <sender_MarketParticipant.mRID codingScheme="A01">10X1001C--00008J</sender_MarketParticipant.mRID>
  <sender_MarketParticipant.marketRole.type>A36</sender_MarketParticipant.marketRole.type>
  <receiver_MarketParticipant.mRID codingScheme="A01">10V1001C--000187</receiver_MarketParticipant.mRID>
  <receiver_MarketParticipant.marketRole.type>A33</receiver_MarketParticipant.marketRole.type>
  <createdDateTime>2023-03-01T12:54:49Z</createdDateTime>
<!-- The Related_MarketDocument class is used to associate this file to the Grid unavailability due to an outage in bidding zone net positions (IG-xxx) created by NRCC BA (Error! Reference source not found.) -->
  <Related_MarketDocument>
    <mRID>5c3495146a76105295416338865a16cfa</mRID>
    <revisionNumber>1</revisionNumber>
  </Related_MarketDocument>
<!-- Another Related_MarketDocument class is used to associate this file to the Grid availability due to an outage in bidding zone net positions file (IG-yyy) created by NRCC BA (Error! Reference source not found.) -->
  <Related_MarketDocument>
    <mRID>abcd95146a76105295416338865a222fa</mRID>
    <revisionNumber>1</revisionNumber>
  </Related_MarketDocument>
<!-- The timeinterval on the header information shall be made matching with the Outage effective time -->
  <time_Period.timeInterval>
```

```
    <start>2024-01-14T22:00Z</start>
    <end>2024-02-03T15:00Z</end>
  </time_Period.timeInterval>
<!-- TimeSeries' originating from FBDomains associated to the outage related calculations -->
  <TimeSeries>
    <!-- Include Table 13 for all CNECs for one FBDomain associated to the calculation -->
  </TimeSeries>
 <TimeSeries>
    <!-- Include Table 13 for all CNECs for another FBDomain associated to the calculation (if
applicable) -->
  </TimeSeries>
</CriticalNetworkElement_MarketDocument>
```

The XML elements are further detailed in Table 15, Table 16, Table 17 and Table 18.

Table 15 – XML elements and datatypes for CriticalNetworkElement_MarketDocument.

XML element	ESMP Datatypes / primitive	Values
mRID	ID_String / String	Unique identification to be kept the same for an Outage throughout its lifetime.
revisionNumber	ESMPVersion_String / String	Version will start with 1 and will increase with each publication.
type	MessageKind_String / MessageTypeList	B11 = Anonymized flow-based parameters publication
process.processType	ProcessKind_String / ProcessTypeList	A26 = Outage information
sender_MarketParticipant.mRID	PartyID_String / String	10X1001C--00008J = NRCC
sender_MarketParticipant.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
sender_MarketParticipant.marketRole.type	MarketRoleKind_String / RoleTypeLit	A36 = Capacity Coordinator
receiver_MarketParticipant.mRID	PartyID_String / String	NUCS_EIC_X_CODE = NUCS platform
receiver_MarketParticipant.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
receiver_MarketParticipant.marketRole.type	MarketRoleKind_String / RoleTypeList	A33 = Information Receiver
createdDateTime	ESMP_DateTime / DateTime	DateTime in format “YYYY-MM-DDThh:mm:ssZ”
Related_MarketDocument.mRID	ID_String / String	Identifies the related MarketDocument mRID that these FB parameters have a relation to. Two Related_MarketDocument elements shall be defined: 1) One that relates to the grid unavailability due to BZ net positions file (IG-xxx) 2) Another that relates to the grid availability due to BZ net positions file (IG-yyy) See Appendix for details.
Related_MarketDocument.revisionNumber	ESMPVersion_String / String	Identifies the related MarketDocument revisionNumber that these FB parameters have a relation to. See Appendix for details.
time_Period.timeInterval:start	YMDHM_DateTime / DateTime	DateTime in format “YYYY-MM-DDThh:mmZ”
time_Period.timeInterval:end	YMDHM_DateTime / DateTime	DateTime in format “YYYY-MM-DDThh:mmZ”

Table 16 - XML elements and values for RAM, PTDF and additional quantities.

XML element	ESMP Datatypes / primitive	Values
mRID	ID_String / String	A unique identification of the series.
RegisteredResource:mRID	ResourceID_String / String	A unique identification of the series.
RegisteredResource:mRID (codingScheme)	CodingSchemeTypeList	A02 = CGM
RegisteredResource: name	ID_String / String	Name of the monitored element
RegisteredResource: in_Domain.mRID	AreaID_String / String	EIC of Area To
RegisteredResource: in_Domain.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
RegisteredResource: out_Domain.mRID	AreaID_String / String	EIC of Area From
RegisteredResource: out_Domain.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
RegisteredResource: in_AggregateNode.mRID	ResourceID_String / String	Name of Station To
RegisteredResource: in_AggregateNode.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
RegisteredResource: out_AggregateNode.mRID	ResourceID_String / String	Name of Station From
RegisteredResource: out_AggregateNode.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
RegisteredResource:flowBasedStudy_Domain.flowBasedMargin_Quantity.quantity	Decimal / Decimal	RAM value of the constraint
RegisteredResource:PTDF_Domain:mRID	AreaID_String / String	Identification of the BZ (EICode) the PTDF value relates to.
RegisteredResource:PTDF_Domain:mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
RegisteredResource:PTDF_Domain:pTDF_Quantity.quantity	Decimal / Decimal	Identification of the actual PTDF value
RegisteredResource:**Measurements**:measurementType	AnalogTypeList	Specifies the type of measurement (for example maximum line flow, reference line flow, etc.) A25 = IVA, A02 = Fmax, A22= Fref, A34= RA, A35 = Fext, A26 = F0, A18 = AMR, A33 = FAAC, A03 = FRM, A14 = U (voltage), A24 = ImaxA
RegisteredResource:Measurements:unitSymbol	UnitSymbolList	The unit of measure of the measured quantity. “KVT” for A14, “AMP” for A24 “MAW” for all the rest
RegisteredResource:Measurements:analogValues.value	Float / Float	The value of the given measurement.

Table 17 – XML elements and datatypes for Constraint_Series.

XML Element	ESMP Datatypes / primitive	Values
mRID	ID_String / String	Identification of the Constraint (CNEC) by the mRID defined by the TSO. However, classified in case the constraint has relation to Svk.
businessType	BusinessKind_String / BusinessTypeList	B40 = Network Element Constraint

name	Characters200_String / String	Identification of the Constraint by the name defined by the TSO. However, classified in case the constraint has relation to Svk.
constraintStatus_MarketObjectStatus.status (optional)	Status_String / StatusTypeList	A54 = Used to indicate if the constraint is presolved (non-redundant)
Optimization_MarketObjectStatus.status (optional)	Status_String / StatusTypeList	A64 = Used to indicate if the constraint is relevant (significant)

Table 18 – XML elements and datatypes for TimeSeries.

XML Element	ESMP Datatypes / primitive	Values
mRID	ID_String / String	A unique identification of the series.
businessType	BusinessKind_String / BusinessTypeList	B38 = Initial Domain
curveType	CurveType_String / CurveTypeList	The identification of the coded representation of the type of curve being described. A03 = Variable sized block The curve is made of successive Intervals of time (Blocks) of variable duration (size), where the end date and end time of each Block are equal to the start date and start time of the next Interval. For the last Block the end date and end time of the last Interval would be equal to EndDateTime of TimeInterval.
Period:timeInterval:start	YMDHM_DateTime / DateTime	DateTime in format "YYYY-MM-DDThh:mmZ"
Period:timeInterval:end	YMDHM_DateTime / DateTime	DateTime in format "YYYY-MM-DDThh:mmZ"
Period:resolution	Duration / Duration	PT60M = Values per hour
Period:Point:position	Position_Integer / Integer	Position the data related to. Given that we use variable sized block, it is expected that there is a single position for a TimeSeries.

5.3 IG-184 NUCS Grid availability due to an outage in bidding zone net positions

This section of the Appendix covers the XML structure used to exchange bidding zone net positions, which are calculated based on the Flow-Based (FB) domain results related to an outage. These net position values indicate grid availability when an outage occurs. The content is based on the official ENTSOE *Unavailability_MarketDocument*.

Net position availability for a specific bidding zone impacted by an outage is represented as a *TimeSeries*, with each *TimeSeries* identifying the effect on minimum and maximum net positions for transmission grid related assets. The number of *TimeSeries* entries in the publication corresponds to the number of affected bidding zones and their respective net positions, though only a subset of zones from the FB topology may be impacted and thus included. These net positions are derived from FB domain results related to outages.

The *Available_Period* class provides for a given time series the MTU information for available capacity, defined by (minimum and maximum) bidding zone net position values. Each Period within a *TimeSeries* contains Point elements for relevant intervals. In case there were more than a single FB domain computed for an outage (i.e., if the outage extends to multiple months), at least one Period per FB Domain will be defined. By utilizing the *curveType* with variable sized block (defined within the *TimeSeries*), it is only necessary to define positions and quantities where a change occurred. Typically, each Period has one Point, and a *TimeSeries* may include multiple Periods. Although FB calculations are monthly, data exchange occurs hourly, with intervals split if outages begin or end mid-hour. The *in_Domain.mRID* and *out_Domain.mRID* elements indicate whether values pertain to minimum (import) or maximum (export) net positions, with the other *Domain.mRID* always referring to the Nordic area. An *out_Domain.mRID* with a corresponding Bidding Zone EICode indicates export values, while *in_Domain* denotes import values.

An example of the XML implementation of a *TimeSeries* of an outage availability is presented in Table 19. The *Asset_RegisteredResource* class represents an affected asset within the outage publication, containing the asset EIC code, the name of the resource, as well as the asset type. Please note that depending on the number of assets impacted, there can be one or multiple *Asset_RegisteredResource* elements present in the document. The used attributes are further detailed in Table 20, Table 21, and Table 22, for the *Available_Period* class, *Asset_RegisteredResource* class, and *TimeSeries* within the *Unavailability_MarketDocument*, respectively.

Table 19 – XML example of a TimeSeries of an outage availability.

```
<TimeSeries>
  <mRID>6fafff327cb84efa9abc73b4f8040e79</mRID>
  <businessType>A53</businessType>
  <in_Domain.mRID codingScheme="A01">10Y1001A1001A91G</in_Domain.mRID>
  <out_Domain.mRID codingScheme="A01">10YFI-1--------U</out_Domain.mRID>
  <outage_Period.timeInterval>
    <start>2024-03-22T15:22Z</start>
    <end>2024-04-02T11:22Z</end>
  <outage_Period.timeInterval>
  <start_DateAndOrTime.date>2024-03-22</start_DateAndOrTime.date>
  <start_DateAndOrTime.time>15:22:00Z</start_DateAndOrTime.time>
  <end_DateAndOrTime.date>2024-04-02</end_DateAndOrTime.date>
  <end_DateAndOrTime.time>11:22:00Z</end_DateAndOrTime.time>
  <Quantity_Measurement_Unit.name>MAW</Quantity_Measurement_Unit.name>
  <curveType>A03</curveType>
  <Asset_RegisteredResource>
    <mRID codingScheme="A01">EIC code</mRID>
    <name>Name of the resource</name>
    <asset_PSRType.psrType>B22</asset_PSRType.psrType>
  </Asset_RegisteredResource>
  <Available_Period>
<!-- Include for first timeinterval -->
    <timeInterval>
      <start>2024-03-22T16:00Z</start>
      <end>2024-03-31T22:00Z</end>
    </timeInterval>
    <resolution>PT60M</resolution>
    <Point>
      <position>1</position>
      <quantity>1200</quantity>
    </Point>
  </Available_Period>
  <Available_Period>
<!-- Include for second timeinterval (if applicable) -->
  </Available_Period>
  <Reason>
    <code>B19</code>
    <text>Maintenance on line</text>
  </Reason>
</TimeSeries>
```

Table 20 – XML elements and datatypes for the Available_Period class.

XML Element	ESMP Datatypes / primitive	Values
timeInterval.start	YMDHM_DateTime / DateTime	DateTime in format "YYYY-MM-DDThh:mmZ"
timeInterval.end	YMDHM_DateTime / DateTime	DateTime in format "YYYY-MM-DDThh:mmZ"
resolution	Resolution / Duration	PT60M = Values per 60 minute PT30M = Values per 30 minute PT15M = Values per 15 minute PT1M = Values per 1 minute
Point:position	Position_Integer	A sequential value representing the relative position within a given time interval.
Point:quantity	Decimal	Principal quantity identified for a point. This information defines the availability associated with the specific bidding zone within the interval period. In this data exchange can be either a positive or a negative value.

Table 21 – XML elements and datatypes for the Asset_RegisteredResource class.

XML Element	ESMP Datatypes / primitive	Values
mRID	ResourceID_String / String	CGMES formatted string corresponding to the cim:Object the outage related to.
mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC A02 = CGMES
name	String	Any number of human readable names for an object
pSRType.psrType	PsrType_String / AssetTypeList	<table><tr><th>Type</th><th>Asset</th></tr><tr><td>A01</td><td>TIE (tieline)</td></tr><tr><td>A02</td><td>LINE (internal OHL or cable)</td></tr><tr><td>A04</td><td>GEN (generating unit)</td></tr><tr><td>A05</td><td>LOAD (consumption unit)</td></tr><tr><td>A08</td><td>BUB (busbar)</td></tr><tr><td>A09</td><td>CAP (capacitor)</td></tr><tr><td>A10</td><td>IND (inductor)</td></tr><tr><td>A11</td><td>PPL (Power plant connection)</td></tr><tr><td>A13</td><td>Production unit</td></tr><tr><td>B21</td><td>AC Link</td></tr><tr><td>B22</td><td>DCL (DC-Link)</td></tr><tr><td>B23</td><td>SUB (Substation)</td></tr><tr><td>B24</td><td>TRA (Transformer)</td></tr></table>
location.name	String	The name of the location of the asset.

Table 22 – XML elements and datatypes for the TimeSeries within the Unavailability_MarketDocument.

XML Element	ESMP Datatypes / primitive	Values
mRID	ID_String / String	Unique identification of the series
businessType	BusinessKind_String / BusinessTypeList	A53 = Planned maintenance A54 = Unplanned outage
in_Domain.mRID	AreaID_String / String	The unique identification of the bidding zone the availability relates to. Defined only in case the value is corresponding to an *import* capability of the bidding zone.
in_Domain.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
out_Domain.mRID	AreaID_String / String	The unique identification of the bidding zone the availability relates to. Defined only in case the value is corresponding to an *export* capability of the bidding zone.

out_Domain.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
start_DateAndOrTime.date	YMDHM_DateTime / DateTime	A start date associated with a TimeSeries in format “YYYY-MM-DD”.
start_DateAndOrTime.time	YMDHM_DateTime / DateTime	A start time associated with a TimeSeries in format “hh:mm:ssZ”
end_DateAndOrTime.date	YMDHM_DateTime / DateTime	A end date associated with a TimeSeries in format “YYYY-MM-DD”.
end_DateAndOrTime.time	YMDHM_DateTime / DateTime	A end time associated with a TimeSeries in format “hh:mm:ssZ”.
Quantity_Measurement_Unit.name	MeasurementUnitKind_String / UnitOfMeasureTypeList	MAW = MW
curveType	CurveType_String / CurveTypeList	The identification of the coded representation of the type of curve being described. A03 = Variable sized Block The curve is made of successive Intervals of time (Blocks) of variable duration (size), where the end date and end time of each Block are equal to the start date and start time of the next Interval. For the last Block the end date and end time of the last Interval would be equal to EndDateTime of TimeInterval.
Asset_RegisteredResource class	Association end	See Table 21
Available_Period class	Association end	See Table 20
Reason.code	ReasonCode_String / ReasonCodeTypeList	B19 = Foreseen maintenance B18 = Failure
Reason.text	ReasonText_String / String	Remarks and Special condition

The *Unavailability_MarketDocument* is the main class that will pack the *Asset_RegisteredResource* and *TimeSeries* into the full XML document. One market document defines the result associated with one outage entity within the NUCS calculation process.

Table 24Table 23 provides an exemplary *Unavailability_MarketDocument, with a full example of the associated attributes in* Table 24.

Table 23 – XML example to pack all TimeSeries into the Unavailability_MarketDocument.

```
<?xml version="1.0" encoding="utf-8"?>
<!-- OPDE PUBLIC -->
<Unavailability_MarketDocument xmlns="urn:iec62325.351:tc57wg16:451-6:outagedocument:4:1">
  <mRID>6fa390327cb840e4945673b4f8040e79</mRID>
  <revisionNumber>1</revisionNumber>
  <type>A78</type>
  <process.processType>A36</process.processType>
  <createdDateTime>2024-01-14T12:54:49Z</createdDateTime>
  <sender_MarketParticipant.mRID codingScheme="A01">10X1001C--00008J</sender_MarketParticipant.mRID>
  <sender_MarketParticipant.marketRole.type>A36</sender_MarketParticipant.marketRole.type>
  <receiver_MarketParticipant.mRID codingScheme="A01">10V1001C--000187</receiver_MarketParticipant.mRID>
  <receiver_MarketParticipant.marketRole.type>A33</receiver_MarketParticipant.marketRole.type>
  <unavailability_Time_Period.timeInterval>
    <start>2024-03-22T15:22Z</start>
    <end>2024-04-02T11:22Z</end>
  </unavailability_Time_Period.timeInterval>
  <docStatus>
    <value>docstatus value</value>
  </docStatus>
  <TimeSeries>
    <!-- Include Table XXX for an BZ the outage had an impact on -->
  </TimeSeries>
  <TimeSeries>
    <!-- Include Table XXX for another BZ the outage had an impact on -->
  </TimeSeries>
  <Reason>
    <code>A95</code>
    <text>Text</text>
  </Reason>
</Unavailability_MarketDocument>
```

Table 24 – XML elements and datatypes for Unavailability_MarketDocument.

XML Element	ESMP Datatypes / primitive	Values
mRID	ID_String / String	Unique identification to be kept the same for an Outage throughout its lifetime.
type	MessageKind_String / MessageTypeList	A78 = Transmission unavailability
process.processType	ProcessKind_String / ProcessTypeList	A26 = Outage information
createdDateTime	ESMP_DateTime / DateTime	DateTime in format “YYYY-MM-DDThh:mm:ssZ”
sender_MarketParticipant.mRID	PartyID_String / String	10X1001C--00008J = NRCC
sender_MarketParticipant.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
sender_MarketParticipant.marketRole.type	MarketRoleKind_String / RoleTypeList	A36 = Capacity Coordinator
receiver_MarketParticipant.mRID	PartyID_String / String	NUCS_EIC_X_CODE = NUCS platform
receiver_MarketParticipant.mRID (codingScheme)	CodingSchemeTypeList	A01 = EIC
receiver_MarketParticipant.marketRole.type	MarketRoleKind_String / RoleTypeList	A33 = Information receiver
unavailability_Time_Period.timeInterval.start	ESMP_DateTime / DateTime	DateTime in format “YYYY-MM-DDThh:mmZ”
unavailability_Time_Period.timeInterval.end	ESMP_DateTime / DateTime	DateTime in format “YYYY-MM-DDThh:mmZ”
docStatus.value	Status_String / StatusTypeList	Identification of the condition or position of the document with regard to its standing. It is used to identify an unavailability

		document that has been withdrawn or cancelled.
Reason.code	ReasonCode_String / ReasonCodeTypeList	A95 = Complementary information B29 = Special Condition
Reason.text	ReasonText_String / String	Remarks and Special condition

5.4 Bidding Zones Codes and EIC Codes

Short Code (name)	Description	EIC code
NO1	Norwegian Area Elspot Area 1	10YNO-1--------2
NO2	Norwegian Area Elspot Area 2	10YNO-2--------T
NO3	Norwegian Area Elspot Area 3	10YNO-3--------J
NO4	Norwegian Area Elspot Area 4	10YNO-4--------9
NO5	Norwegian Area Elspot Area 5	10Y1001A1001A48H
SE1	Swedish Elspot Area 1	10Y1001A1001A44P
SE2	Swedish Elspot Area 2	10Y1001A1001A45N
SE3	Swedish Elspot Area 3	10Y1001A1001A46L
SE4	Swedish Elspot Area 4	10Y1001A1001A47J
FI	Finland	10YFI-1--------U
DK1	Denmark DK1	10YDK-1--------W
DK2	Denmark DK2	10YDK-2--------M
NO2_SK	Skagerrak (NO2-DKW) in NO2	50YCUY85S1HH29EK
DK1_SK	Skagerrak (NO2-DKW) in DK1	45Y000000000001C
DK1_SB	Storebelt (DKW-DKE) in DK1	45Y0000000000038
DK2_SB	Storebelt (DKW-DKE) in DK2	45Y0000000000062
FI_FS	Fenno-Skan (FI-SE3) in FI	44Y-00000000160K
SE3_FS	Fenno-Skan (FI-SE3) in SE3	46Y000000000001Y
DK1_KS	Konti-Skan (SE3-DKW) in DK1	45Y000000000002A
SE3_KS	Konti-Skan (SE3-DKW) in SE3	46Y000000000002W
SE4_SP	SVE-POL in SE4	46Y000000000003U
SE4_NB	Nord-Balt SE4	46Y000000000004S
SE4_BC	Baltic Cable SE4	46Y000000000005Q
FI_EL	Est-Link in FI	44Y-00000000161I
DK1_DE	DK1 to DE	45Y0000000000054

DK2_KO	Kontek in DK2 (DKE-DE)	45Y0000000000070
DK1_CO	COBRA (DK1-NL) in DK1	45Y0000000000046
NO2_NL	NordLink (NO-DE) in NO2	50YNBFFTWZRAHA3P
NO2_ND	NorNed (NO-NL) in NO2	50Y73EMZ34CQL9AJ
NO2_NSL	NorthSeaLink (NO2-GB) in NO2	50Y0JVU59B4JWQCU
SE3_SWL	Sydvästlänken (SE3-SE4) in SE3	46Y000000000017J
SE4_SWL	Sydvästlänken (SE3-SE4) in SE4	46Y000000000018H