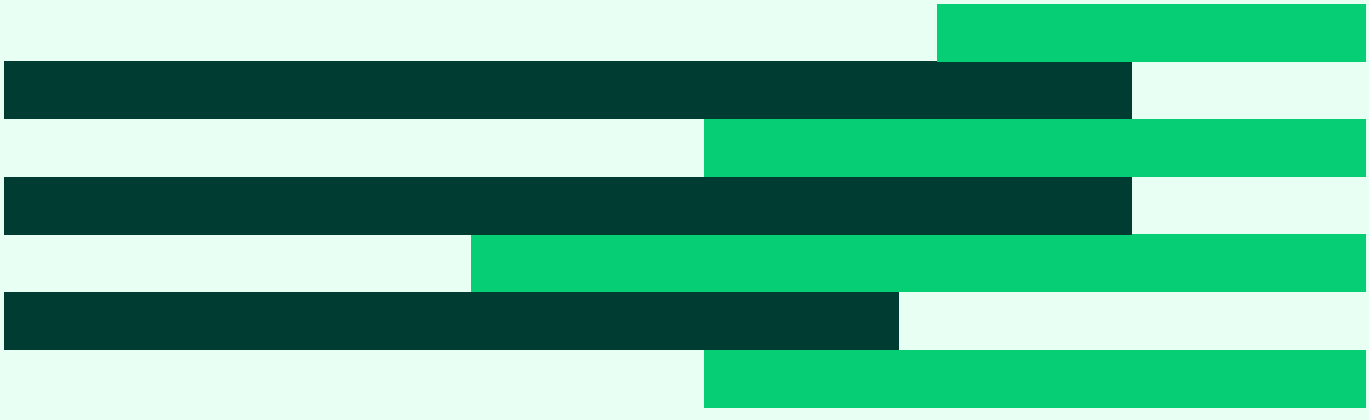
Statnett

Implementation Guide for Norwegian BSPs in the aFRR Energy Activation Market



Revision History

Version	Date	Changed by	Comments
1.0	2025-11-28	Statnett	Initial version of the Norwegian aFRR EAM implementation guide.

Contents

1 Introduction

This implementation guide specifies the functional and technical requirements for Norwegian Balancing Service Providers (BSPs) to connect to Statnett and participate in the European aFRR Energy Activation Market (EAM). It defines messaging interfaces, real-time signal requirements, and fallback processes.

This document covers the implementation required for connection to the European aFRR Energy Activation Market and provides information about the processes required to support this market. Both functional and technical aspects are covered. The intended users of this document are the participating Norwegian BSPs.

The main processes covered include:

- Bid collection and submission (CIM-based XML format)
- Bid attributes and validation rules
- Bid activation and real-time signalling
- Bid unavailability management
- Message exchange principles and fallback procedures

1.1 Terms and definitions

Acronym	Term	Definition
AOF	Activation Optimisation Function	The algorithmic function operated by the PICASSO platform that optimizes the activation of balancing energy bids across all participating Load-Frequency Control areas
BEGCT (BSP GCT)	Balancing Energy Gate Closure Time	The point in time when submission or update of a balancing energy bid is no longer permitted
BEGOT	Balancing Energy Gate Opening Time	The first point in time when submission of a balancing energy bid is permitted
BRP	Balance Responsible Party	A market participant or its chosen representative responsible for its imbalances
BSP	Balancing Services Provider	A market participant with reserve-providing units or reserve-providing groups able to provide balancing services to TSOs
CIM	IEC Common Information Model	A standard for describing information about an electrical network. The European style market profile is a profile derivation

		from the CIM to harmonize the energy market data exchanges in Europe.
CMOL	Common Merit Order List	A combined list of local balancing energy bid lists (MOL) from each bidding zone maintained by the PICASSO platform
CZC	Cross Zonal Capacity	The cross-zonal transmission capacity between two bidding zones
FAT	Full Activation Time	The period between the activation request by the connecting TSO and the corresponding full delivery of the concerned product
FRCE	Frequency Restoration Control Error	PICASSO platform calculates every optimisation cycle a frequency restoration control error for each LFC area. This error acts as an input for the LFC optimisation calculation. The sign convention is positive value where the LFC area is in power surplus and indicates that negative aFRR balancing energy needs to be activated; and negative value where the LFC area is in power deficit and indicates that positive aFRR balancing energy needs to be activated.
ECP	Energy Communication Platform	Reference implementation of MADES standard
ETP	Entso-E Transparency Platform	The ENTSO-E Transparency Platform is an online data platform for European electricity system data
ICCP	Inter-Control Center Communications Protocol	A standard for communication within the electric power industry, officially known as TASE.2 under the IEC 60870-6 standard.
ISP	Imbalance Settlement Period	The time unit for which balance responsible parties' imbalance is calculated
LFC	Load-Frequency Control	A TSO system to maintain reasonably uniform frequency, to divide the load between the generators and to control the tie-line interchange schedules. Receives input from the PICASSO platform and distributes aFRR control signal to BSPs within the LFC area.
LFC AREA	Load Frequency Control Area	The control area to which the aFRR providing units or aFRR providing groups shall deliver the aFRR standard balancing energy. In Norway, this corresponds to a bidding zone.
LMOL	Local Merit Order List	After the BSP GCT the TSO creates a merit order list consisting of balancing energy bids from the BSPs in the respective LFC area which will be sent to PICASSO platform. Often just referred as MOL.
MADES	Market Data Exchange Standard	Communication IEC standard designed by ENTSO-E

MOL	Merit Order List	A list of balancing energy bids sorted in order of their bid prices, used for the activation of those bids
MTU	Market Time Unit	The period for which the market price is established as a result of PICASSO platform optimisation cycle. For PICASSO the MTU is 4 seconds.
CC	Control Cycle	Period in which a single optimisation result is calculated in LFC, and new control signals (if changed from previous cycle) are sent from TSO to BSPs
OC	Optimisation cycle	Period in which a single optimisation result is calculated in PICASSO platform and new FRCE values are sent to each LFC area. Current optimisation cycle is 4 seconds, equal to MTU.
PCORR	PICASSO correction	Adjustment sent from the PICASSO platform to a TSO every 4 seconds, aligning local aFRR demand with cross-border optimization results.
TSO	Transmission System Operator	A party that is responsible for a stable power system operation (including the organisation of physical balance) through a transmission grid in a geographical area. In the Nordic synchronous area, there are four TSOs: Svenska kraftnät, Fingrid, Energinet and Statnett.
	Connecting TSO	The TSO that operates the LFC-area in which balancing service providers and balance responsible parties shall be compliant with the terms and conditions related to balancing;
TSO GCT	TSO energy bid submission Gate Closure Time	The latest point in time when a connecting TSO can forward the balancing energy bids received from a balancing service provider to the activation optimisation function
VP	Validity Period	The period when the balancing energy bid offered by the BSP can be activated, whereas all the characteristics of the product are respected. The amount of time for which a bid is valid and firm. The first validity period of each day begins right at 00:00 market time. Validity periods are consecutive and not overlapping. The length of a single validity period is 15 minutes.

1.2 References

1. Implementation Framework for aFRR Platform
https://documents.acer.europa.eu/Official_documents/Acts_of_the_Agency/Pages/Annexes-to-the-DECISION-OF-THE-AGENCY-FOR-THE-COOPERATION-OF-ENERGY-REGULATORS-No-02-2020.aspx

2. Common Information Model (CIM) and CIM based documents. ENTSO-E implementation guides, see ENTSO-E Electronic Data Interchange (EDI) Library
3. Acknowledgement: IEC 62325-451-1: Acknowledgement Business Process And Contextual Model For CIM European Market.
4. Reserve Bid market document IEC 62325-451-7 urn:iec62325.351:tc57wg16:451-7:reservebiddocument:7:4
5. Bid availability document IEC 62325-451-n urn:iec62325.351:tc57wg16:451-n:bidavailabilitydocument:1:1
6. EIC codes: The Energy Identification Coding (EIC)
7. ENTSO-E code list: ENTSO-E Code list in ENTSO-E EDI library
8. European platform - PICASSO: The Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation
9. Nordic Trading System BRS: This document is a Business Requirement Specification (BRS) detailing the document exchanges related to trade in the Nordic energy market
10. Nordic Operate BRS: This document is a Business Requirement Specification (BRS) detailing the document exchanges related to operation of the Nordic energy market.
11. NMEG Code List Library: Description of additional codes used for the Nordic Market, Code list schema.

2 Business context

2.1 Overall process and timeline

In the current Nordic setup, the demand for automatic Frequency Restoration Reserves (aFRR) is calculated based on the measured frequency in the Nordic synchronous area. The activation of aFRR reserves by each Transmission System Operator (TSO) is guided by the results of the Nordic aFRR Capacity Market and the control signal from the Nordic aFRR controller.

The total calculated aFRR demand is distributed among the Nordic TSOs using a pro-rata method. This means that each control area receives a share of the total demand proportional to the distribution of aFRR according to Nordic System Operation Agreement (SOA). Each TSO then allocates this demand internally among its accepted capacity bids.

2.1.1 Introduction to aFRR EAM and participation in PICASSO

Once a TSO begins participating in the European aFRR Energy Activation Market (PICASSO), the process becomes more dynamic and localized. Instead of relying solely on the centralized Nordic control signal, each TSO calculates its own Area Control Error (ACE) for its Load-Frequency Control (LFC) area. The ACE reflects the real-time imbalance between generation and consumption, adjusted for scheduled exchanges and frequency deviations.

Based on the ACE, the TSO submits activation requests to the aFRR Energy Activation Market. These requests are matched with available bids in the market, allowing for merit-order based activation of aFRR energy. This ensures that the most cost-efficient bids are activated first, improving both economic efficiency and system balancing. In this new setup, TSOs that are not yet participating in the EAM will continue to activate aFRR based on the Nordic controller signal and the pro-rata demand allocation. Over time, as more Nordic TSOs join the EAM, the system will transition toward a fully market-based and ACE-driven activation model across the Nordic region.

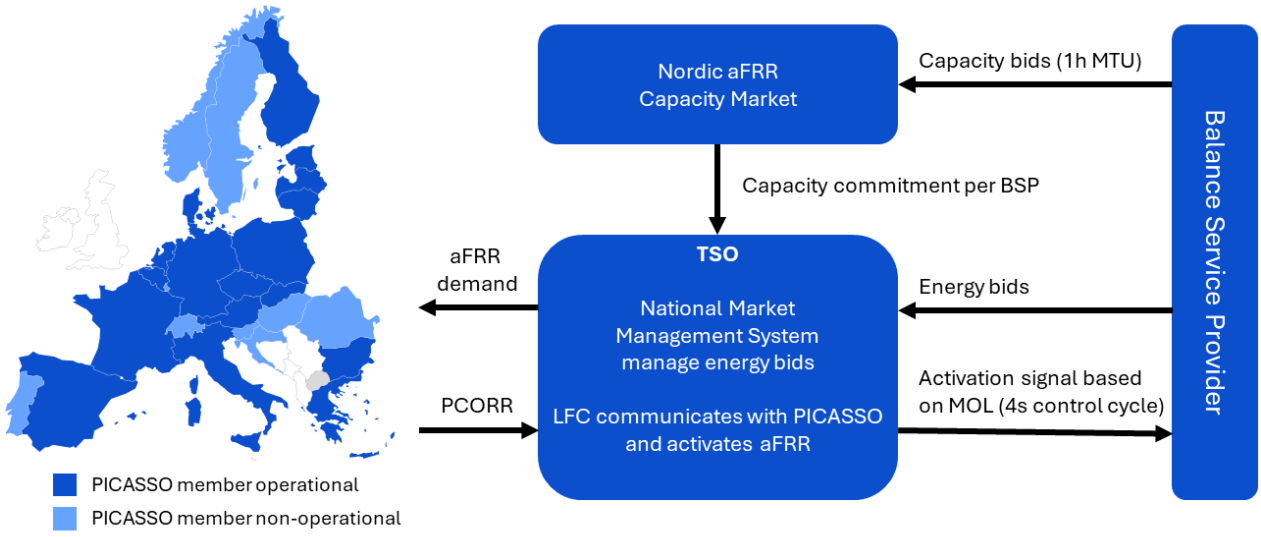


Figure 1: High level schematic diagram of the European aFRR Energy Market.

For Balancing Service Providers (BSPs), the shift from the current Nordic aFRR setup to the aFRR Energy Activation Market (EAM) introduces several important changes in how balancing energy is offered, activated, and settled.

Today, and until PICASSO go-live, BSPs participate in the Nordic aFRR Capacity Market, where they submit bids for available aFRR capacity. If their bids are accepted, they are obligated to be available for activation based on the centralized Nordic aFRR control signal. Activation is not based on price but rather on the need to balance the system, and all accepted capacity may be activated simultaneously, regardless of cost.

Once a TSO begins using the aFRR EAM, the activation of balancing energy becomes market-based, and merit-order driven. This introduces several key changes for BSPs:

- BSPs will now submit energy bids in addition to capacity bids. These energy bids include both volume and price, and are submitted to the TSO.
- If a BSP has bids accepted at aFRR Capacity Markets, it must place at least corresponding volume of aFRR Energy bids in the activation market. A BSP can send bids for the aFRR Energy Activation Markets, even if it has not participated in aFRR Capacity Markets.
- Instead of being activated based on a centralized control signal, BSPs' bids will be activated based on price, demand in the bidding platform, and available transfer capacity between LFC-areas.
- BSPs will be settled based on the activated energy volume and the cross-border marginal price, rather than a fixed price or pro-rata allocation. This introduces a stronger link between market behaviour and financial outcomes.

2.1.2 Transition to the European aFRR Energy Activation Market (EAM)

During a transition phase, not all Nordic TSOs will be immediately connected to the European aFRR EAM. To ensure continued system balance across the region, a hybrid approach will be used:

- **Connected TSOs** will calculate their own Area Control Error (ACE) and submit activation requests directly to the European aFRR EAM. These requests are matched with energy bids in the market, enabling localized, merit-order based activation of balancing energy.
- **Non-connected TSOs** will continue to rely on the centralized Nordic aFRR controller. The controller will receive ACE values from the connected TSOs and subtract these from the total Nordic imbalance. The remaining demand will then be distributed among the non-connected TSOs using the existing pro-rata method.

This setup ensures that both connected and non-connected TSOs contribute to system balancing in a coordinated manner, while gradually shifting toward a fully market-based model.

Once all Nordic TSOs are integrated into the European aFRR EAM, the centralized Nordic aFRR controller will be decommissioned. This change will be seamless for Balancing Service Providers (BSPs), who will continue to operate through the market platform without noticing any disruption in the activation or settlement processes.

2.1.3 aFRR Energy Activation Market process

The aFRR EAM process starts from Balancing Energy Gate Opening Time (BEGOT) and ends at settlement and invoicing. The timeline is further illustrated in the figure below.

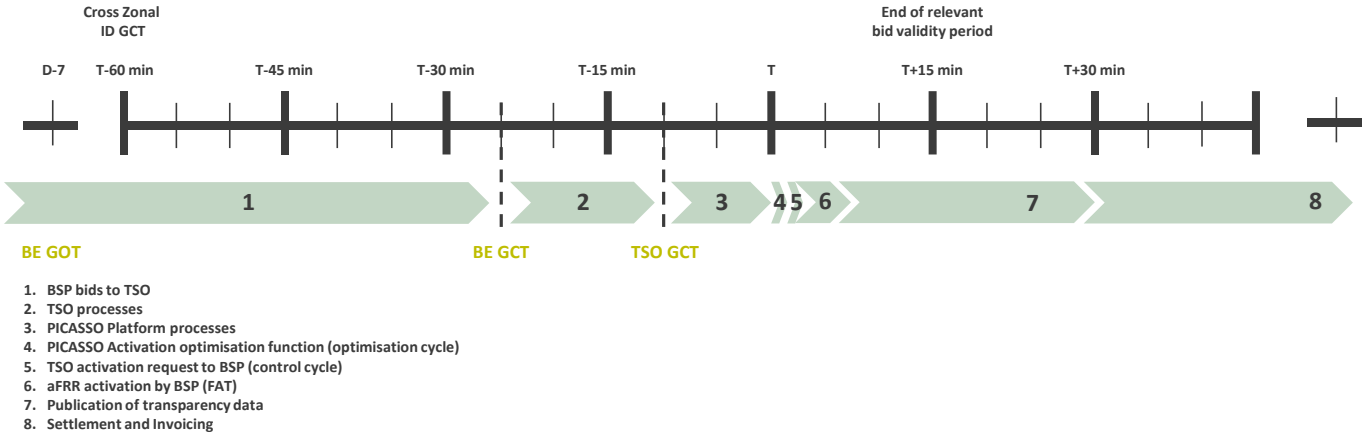


Figure 2:The timing for the bidding and activation processes is illustrated.

The BSPs send aFRR energy bids to TSO after the Balancing Energy Gate Opening Time (BEGOT) and before the Balancing Energy Gate Closure Time (BEGCT). TSOs submit the Local Merit Order Lists (LMOL) of aFRR energy bids to the PICASSO platform before the TSO GCT.

TSOs then send their aFRR demand to PICASSO as a real-time signal. The PICASSO AOF fulfils TSOs aFRR demands by selecting an optimal set of bids from the Common Merit Order List (CMOL) each optimisation cycle given the constraints (cross-border capacity limits). The AOF delivers results in real-time to TSOs, which send aFRR activation signals to BSPs for each control cycle.

BSPs are responsible for activating aFRR energy bids according to the real-time signal received from the connecting TSO. Activation follows the standard product for aFRR energy, and a new signal value can be received from the TSO for each control cycle during the bid validity period.

Publication of transparency data of the aFRR Energy Activation Market is done on ENTSO-E Transparency Platform and TSOs' own webpages after the validity period. Settlement of aFRR energy activations is done according to local rules for settlement. Settlement and invoicing for Nordic BSPs is done by eSett.

	Value from go-live of aFRR EAM	Comment
BSP GOT (BEGOT bids)	D-1 12:00	
BSP GCT (BEGCT bids)	T-25[1]	
TSO GCT	T-10[1]	
Bid validity period	[T+0, T+15)[1]	
TSO aFRR demand	real-time	
AOF run	real-time	
AOF results	real-time	
Activation orders are sent to BSPs	real-time	
Delay time (seconds)	30 (maximum value)	
Full Activation Time, FAT (seconds)	120 (preferred value) 300 (maximum value)	
Accuracy of delivery at FAT	1 MW or 10% of set-point delta	Total sustained error from set-point shall not exceed 5 MW.

[1] T-x means x minutes before the start of the validity period; T+y means y minutes after.

2.2 System context

The diagram below shows the system context of the aFRR Energy Activation Market from a BSP viewpoint. This document provides detailed information about the message exchanges between BSP and TSO. The other exchanges are shown for information purposes only and are outside the scope of this document.

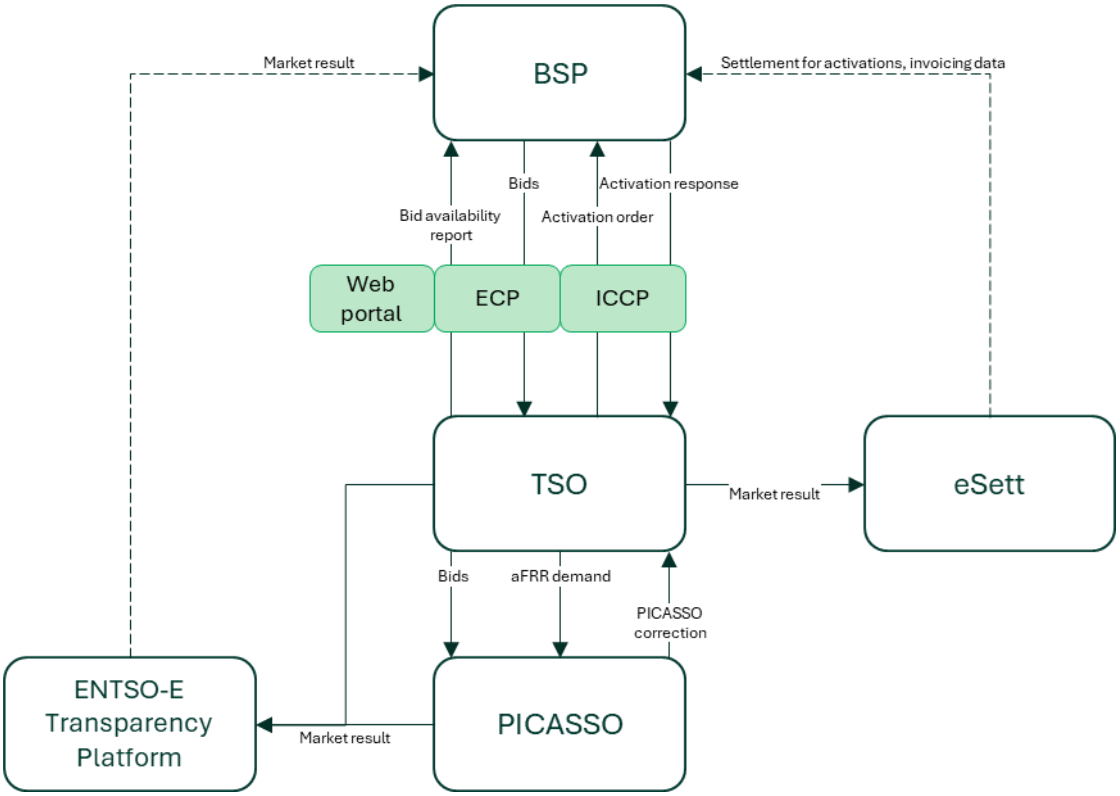


Figure 3: High level information flow of aFRR Energy Market.

2.3 Fallback

2.3.1 Bid collection

Statnett will have redundancy mechanisms to receive bids from BSPs. In addition to machine-to-machine via ECP, bids may be submitted through the graphical user interface, FiftyWeb (fiftyweb.statnett.no).

2.3.2 Bid selection

If the connection to PICASSO is lost, the selection of aFRR energy bids will be handled locally by the TSO's own system, using a local merit order approach but without the ability to exchange energy or net aFRR demands between different LFC-areas. This fallback solution does not require any changes to the BSPs' processes, so BSPs will continue to operate as usual.

2.3.3 Bid activation process

In case of a communication breakdown, the aFRR providing unit should maintain its current aFRR contribution level for some time. This timeout should be for a pre-defined period from the last change of the set-point. The timeout period is defined by the TSO and should be possible to configure. This function is added to allow for smooth recovery after a short communication breakdown.

With a loss of communication between the aFRR providing unit and TSO's SCADA system, or if the set-point signal received is invalid, the current aFRR contribution will be maintained for the timeout period from the last received

change from the TSO. This regime ensures that the BSPs do not set their aFRR contribution to zero at the same time, should the TSO communication be lost, keeping the last received change for some time.

If the communication is not restored within the set timeout period and within the MTU, all bids for upcoming two quarters will be set to unavailable. When the contact and remote control of the BSP system becomes reinstated, the bids will be considered available again.

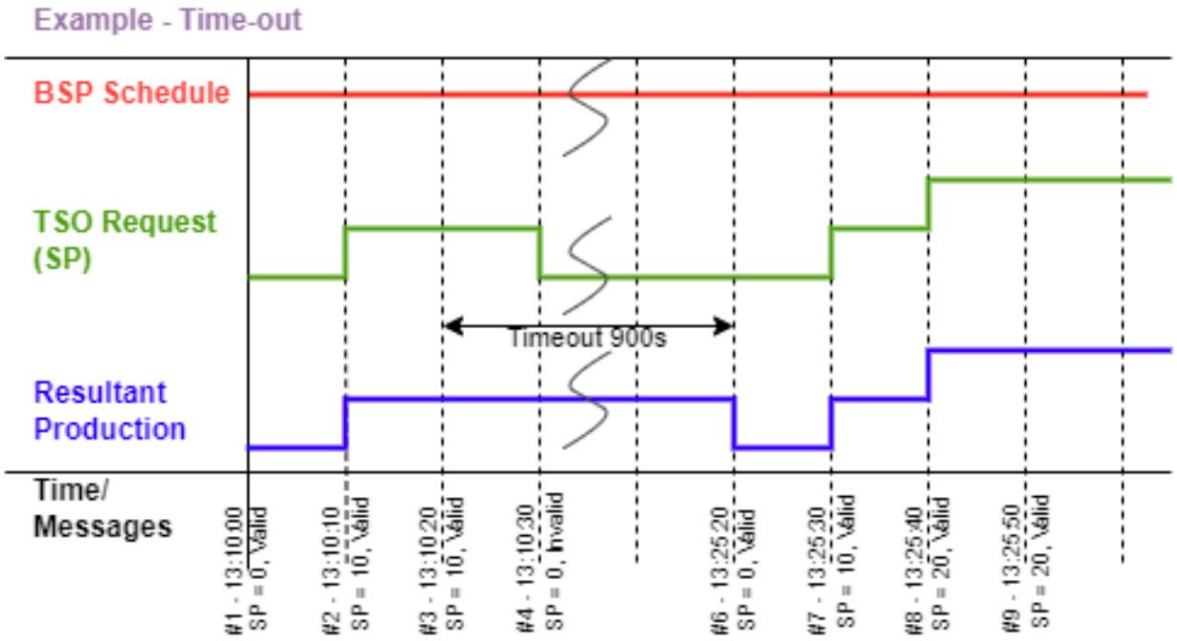


Figure 4: Illustration of the timeout functionality. The resultant production does not change in the timeout period. The illustration is an example, and the actual timeout period is not necessarily set as 900 seconds.

3 Business process

This chapter describes the aFRR Energy Activation Market process from a BSP perspective with a focus on implementation of non-real-time message exchanges. In addition to this implementation guide, the BSPs need to comply with the relevant national Terms & Conditions.

3.1 The aFRR Energy Activation Market sequence diagram

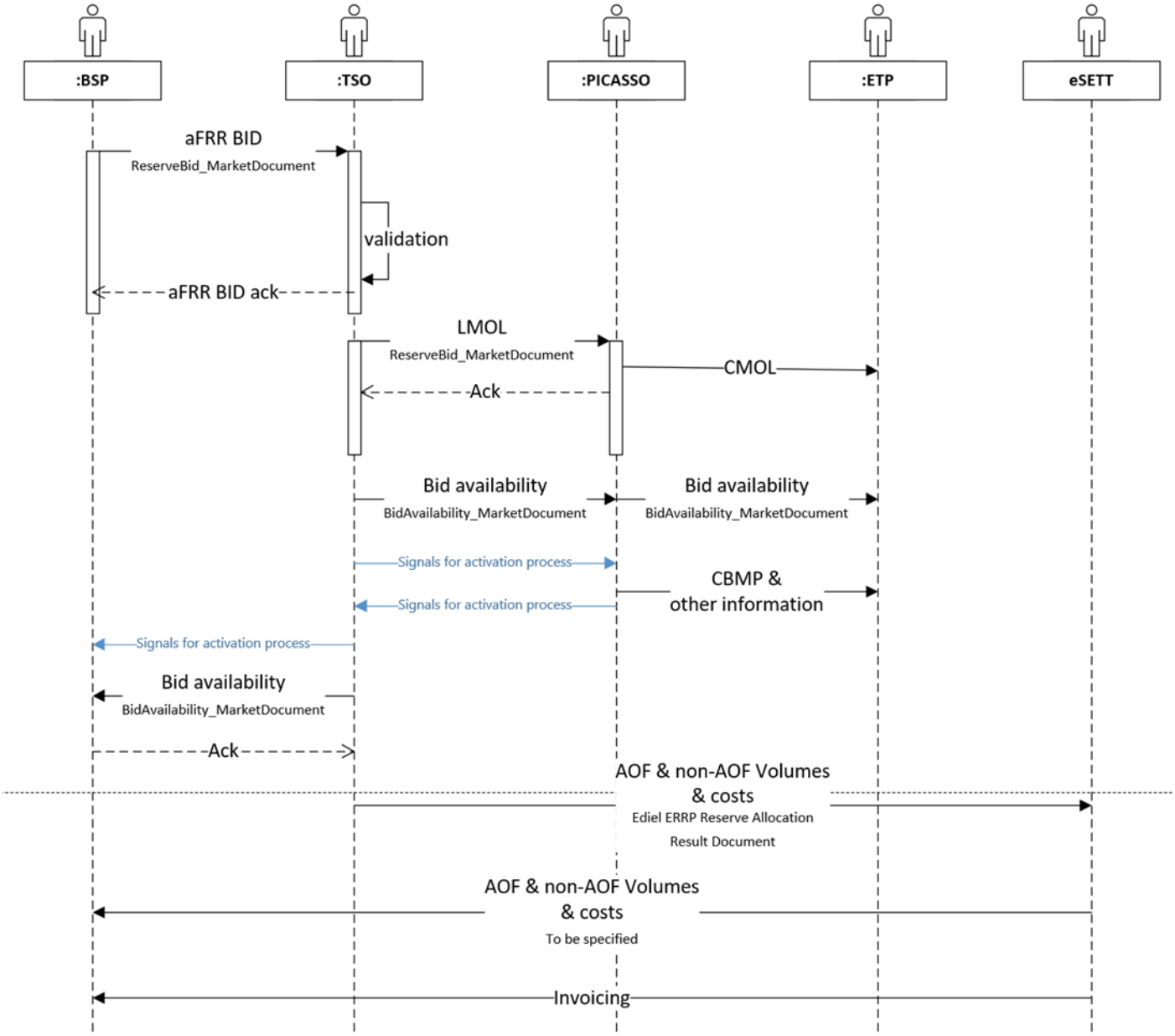


Figure 5: Sequence diagram for the aFRR Energy Activation Market. Blue arrows indicate real time signals.

3.2 Submit bid process

The preferred channel for bid submission is sending a reserve bid document via ECP/EDX.

Bids can be submitted in a ReserveBid_MarketDocument. A bid is placed in the market when the TSO has provided a positive Acknowledgement referring to the bid document.

3.2.1 Implementation of product characteristics

The bid characteristics and bid attributes used in the aFRR Energy Activation Market are described in the table below.

	Go-live of aFRR EAM
Currency	EUR
Maximum/minimum price (EUR/MWh)	[15000, -15000]
Price granularity (EUR)	0.01
Minimum bid size (MW)	1
Maximum bid size (MW)	9 999 (technical limit)
Bid granularity (MW)	1
Activation granularity (MW)	float
Bid validity period (min)	15

3.2.2 Attribute descriptions

All bids submitted to the aFRR Energy Activation Market are considered simple bids and are fully divisible, meaning they can be activated in increments down to the minimum activation granularity defined by the product. This ensures flexibility in activation and alignment with the merit-order based dispatch principles of the PICASSO platform. Detailed specifications and dependencies for each attribute are provided in Appendix 1 – Document Attributes and Dependencies.

3.2.3 Bid validation rules

All bids submitted to the aFRR Energy Activation Market must comply with a set of validation rules to ensure technical correctness, consistency, and compliance with market requirements. These rules apply both at the document level and at the individual bid level, and are enforced by the connecting TSO upon receipt of the bid message. Validation includes checks on bid timing, structure, resolution, and portfolio limits. Only bids that pass all validation criteria will be acknowledged as accepted and considered for activation.

Document level

- The bid document must be submitted by the BSP and received by the TSO after the BEGOT and before the BEGCT of every bid in the document.
- Technical validation of the bid file.

All bids:

- Bid size and resolution.
- Price resolution.
- Time period is within the document time period.

Rules for updating bids:

- The time period of a bid cannot be changed. If a bid has been submitted with an incorrect time period, the bid must be cancelled and a new bid (with new bid identification) must be submitted for the correct time period.
- The resource object of a bid cannot be changed. If a bid has been submitted with incorrect resource object the bid must be cancelled and a new bid (with new bid identification) must be submitted for the correct resource object.

See section 4.7 Update and cancellation principles for general rules on updating and cancellation of bids.

3.2.4 Bid acknowledgment

Each time a BSP submits a Reserve bid document to the TSO, the TSO will return an Acknowledgement document. If all bids in the bid document are valid, a positive Acknowledgement will be returned. If one or more of the bids in the bid document are invalid, according to the bid validation rules, a negative Acknowledgment will be returned and all bids in the document will be rejected. The negative Acknowledgement will contain error codes and text that indicate the reason why the bids are not valid.

3.3 Activate bid process

The TSO will send activation orders for selected bids to the respective BSPs every control cycle (4 seconds) via real-time communication protocol (ICCP). Real-time signals and processes are defined in Appendix 2 - Real-time signal list.

3.4 Publication and reporting of market results

3.4.1 Publication of market prices and volumes

Market prices and volumes for the aFRR Energy Activation Market will be published on the ENTSO-E Transparency platform (transparency.entsoe.eu).

After Nordic PICASSO accession, it will be decided whether the Nordic Transparency platform NBiS (http://www.nucs.net/) will be used as an additional common platform for publishing market data.

3.4.2 Invoicing data per BSP

Information of each BSP's activations and activation costs will be available from eSett to the BSP after each ISP. The information contains aggregated data on ISP (15 minutes) resolution including activation volumes and costs of activated volumes.

3.4.3 Bid availability report

A TSO has a possibility of changing the availability status of a bid. By default, all bids have status available. TSO can set a bid or all bids of a BSP as unavailable. Reasons for unavailability can originate from automatic procedures in LFC (e.g., losing real-time connection towards the BSP), due to congestion management, or manual actions done by the TSO operator. TSO operator can also set a bid unavailable on request from the BSP. A bid can also be partly unavailable during the bid validity period. The TSO will assess the availability of activation for each bid for each market period.

The TSO can mark a bid as unavailable for different reasons, e.g.:

- local congestions
- unavailability of the BSP electronic ordering process
- BSP informs TSO that bid is unavailable due to failure on reserved delivery unit
- IT or other technical issue
- system security

The TSO will inform the BSP about bids that have been marked unavailable for activation by sending a BidAvailability_MarketDocument. The report will be sent after each ISP. Please see Bid availability document – Attributes and dependencies for further details on the message document.

4 General rules for messaging

4.1 Date and time

Date and Times are based on ENTSO-E Standards and shall be expressed in universal time (UTC+0) in compliance with ISO 8601 as YYYY-MM-DDThh:mm:ssZ. The last 'Z' stands for Zero and indicates UTC+0.

4.2 Document coverage

The beginning and ending date and time of the period covered by the document must be on the same CET/CEST day.

4.3 Daylight saving time

The day is always expressed in local time, i.e.:

- A day is from 23:00 to 23:00 during wintertime.
- A day is from 22:00 to 22:00 during summertime (daylight saving time).
- When changing from wintertime to summertime there are 23 hours in the time series (from 23:00 to 22:00).
- When changing from summertime to wintertime there are 25 hours in the time series (from 22:00 to 23:00).

4.4 Unique identifiers - UUID

Unique identifiers should be proper UUIDs as per RFC 4122 (UUID v1, v4 or v5).

4.5 Document identification and revision number

The document identification must be unique over time for the sender in question and should be a proper UUID. The document identification will then not have any significant meaning. The revision number is not used and shall always be equal to '1'.

4.6 Message size limit

The maximum allowed number of time series in a message is 4000.

If a BSP wants to submit more bids than this limit the bids must be split into several messages.

The upper limit of number of bid messages sent from a BSP during one bid validity period is 100.

The total number of bid time series sent within an MTU should be kept at a reasonable level.

4.7 Update and cancellation principles

update or cancel time series previously sent a new document is sent with the following information:

- A new unique document mRID (document identification)
- Fixed revision number (always equal to '1')
- A newer created date-time than the previously sent document

For ReserveBid_MarketDocument updates are done by sending the affected time series with new data. Cancellation of time series is done by sending value 0 for quantity. To ensure the update of the correct time series, the bid identification of the original time series must be used.

To update bids for upcoming bid validity period, only the updated bids should be sent in a new bid message. There is no need to resend unchanged bids.

It is not allowed to include bids for any bid validity period which is closed for bidding in a bid message, ref. 3.2.3 Bid validation rules.

For BidAvailability_MarketDocument a new document completely replaces a previously sent document for the same period. Cancellation of time series is thus done by omitting the time series in the new document.

4.8 Acknowledgment

For each electronic data interchange defined in this document, an acknowledgement document, as defined in IEC 62325-451-1, should be generated either accepting the whole received document or rejecting it completely.

- All received messages shall be validated at both a technical and an application level.
- The Acknowledgement document shall be used as the tool to exchange errors.
- At a technical level, the reason code in the acknowledgement document shall reflect the error type, and the reason text should have a reference to the element containing the error.
- At the application level, the reason code shall reflect the error type, and the reason text should reflect the appropriate business rule that is broken.
- An Acknowledgement document may contain many reason objects, to reflect multiple errors in the received document.

4.9 Energy Communication Platform

All the non real-time messages described in this document shall be communicated over the Energy Communication Platform (ECP) provided by each TSO.

Implementation guide for ECP can be requested from the respective TSO (ediel.org/nordic-ecp-edx-group-nex/market-actor-onboarding/).

5 Appendix 1 – Document attributes and dependencies

This chapter provides the attributes and dependencies for the documents used to support the non-real time communication between TSO and the BSPs in the aFRR Energy Activation Market.

The following classifications are used for the attributes:

- M – Must be used for the document in the process described in this guide
- D – Must be used if a defined condition is met
- O – Optional, can be used

5.1 Bid document – Attributes and dependencies

ReserveBid_MarketDocument		**iec62325-451-7-reservebiddocument.xsd – version 7.4**
mRID	M	Unique identification of the document. Proper UUID is required.
revisionNumber	M	Constant value of **1**
type	M	**A37** - Reserve bid document
process.processType	M	**A51** = automatic frequency restoration reserves
sender_MarketParticipant.mRID	M	Identification of the party sending the document See **Feil! Fant ikke referansekilden.**5.4 for supported coding schemes.
sender_MarketParticipant.marketRole.type	M	**A46 -** Balancing Service Provider (BSP)
receiver_MarketParticipant.mRID	M	EIC of the party receiving the document.
		A01 - EIC coding scheme
receiver_MarketParticipant.marketRole.type	M	**A34** – Reserve Allocator
createdDateTime	M	Date and time of document creation (in ISO 8601 UTC format) YYYY-MM-DDTHH:MM:SSZ
reserveBid_Period.timeInterval	M	The period covered by the document (in ISO 8601 UTC format) Start: YYYY-MM-DDTHH:MMZ End: YYYY-MM-DDTHH:MMZ

domain.mRID	M	EIC of the Control Area. Norway: **10YNO-0--------C**
		A01 - EIC coding scheme
subject_MarketParticipant.mRID	M	Identification of the party responsible for the bid See **Feil! Fant ikke referansekilden.**5.4 for supported coding schemes.
subject_MarketParticipant.marketRole.type	M	**A46 -** Balancing Service Provider (BSP)
BidTimeSeries		
mRID	M	Unique identification of the bid. Proper UUID is required.
businessType	M	**B74 – Offer**
acquiring_Domain.mRID	M	**10Y1001A1001A91G** (Nordic Market Area)
		A01 - EIC coding scheme
connecting_Domain.mRID	M	The EIC identification of the bidding zone where the resource is located.
		A01 - EIC coding scheme
quantity_Measurement_Unit.name	M	**MAW** – megawatt
currency_Unit.name	M	**EUR** – euro
divisible	M	**A01** = Yes - quantity may be reduced to the zero by increments of minimum activation granularity
status	M	**A06** – Available
registeredResource.mRID	M	National market code for the resource object (NOKG code). *Support for generator is currently under consideration*.
flowDirection.direction	M	**A01** - Up **A02** - Down
energyPrice_Measurement_Unit.name	M	**MWH -** Megawatt hours.
standard_MarketProduct.marketProductType	M	**A01** = Standard product
Series_Period – exactly one instance per BidTimeSeries		
timeInterval	M	Period covered (in ISO 8601 UTC format). Must be 15 minutes. There must be one, and only one, period for each Bid_TimeSeries. Start: YYYY-MM-DDTHH:MMZ End: YYYY-MM-DDTHH:MMZ

Resolution	M	**PT15M**– the time resolution. Must be equal to the duration of the timeInterval.
Point – exactly one instance per Series_Period		
Position	M	Position is always: **1**
quantity.quantity	M	Offered quantity
energy_Price.amount	M	The price of the product offered

5.1.1 ReserveBid_MarketDocument assembly model

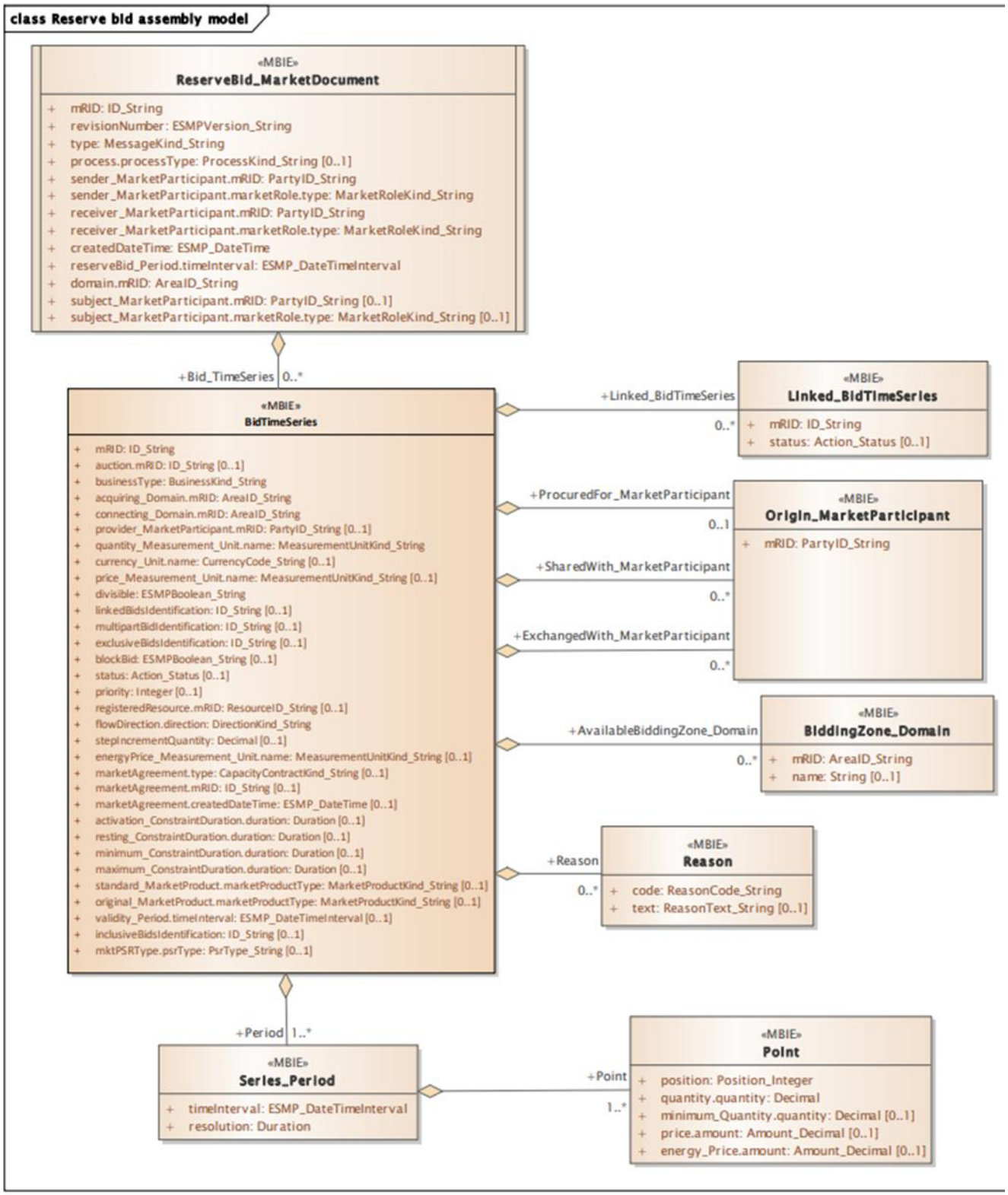


Figure 6: ReserveBid_MarketDocument assembly model. Note that the cardinalities indicated in the assembly model are further restricted for the implementation according to this guide. Please see the Attributes and dependencies table above.

5.2 Bid availability document – Attributes and dependencies

BidAvailability_MarketDocument		**urn:iec62325.351:tc57wg16:451-n:bidavailabilitydocument:1:1**
mRID	M	Unique identification of the document. Proper UUID is required.
revisionNumber	M	Constant value of **1**
Type	M	**B45** – Bid availability document
process.processType	M	**A51** = automatic frequency restoration reserves
sender_MarketParticipant.mRID	M	**EIC of the party receiving the document.**
		A01 – EIC coding scheme
sender_MarketParticipant.marketRole.type	M	**A04** – System Operator
receiver_MarketParticipant.mRID	M	Identification of the party receiving the document. See 5.4 for supported coding schemes.
receiver_MarketParticipant.marketRole.type	M	**A46** – Balancing Service Provider (BSP)
createdDateTime	M	Date and time of document creation (in ISO 8601 UTC format) YYYY-MM-DDTHH:MM:SSZ
time_Period.timeInterval	M	The period(s) covered by the bid(s) referenced in the document (in ISO 8601 UTC format) Start: YYYY-MM-DDTHH:MMZ End: YYYY-MM-DDTHH:MMZ
BidTimeSeries – one or more instances		
mRID	M	Unique identification of the bid
bidDocument_MarketDocument.mRID	M	Constant value of **NA**
bidDocument_MarketDocument.revisionNumber	M	Constant value of **1**
requestingParty_MarketParticipant.mRID	M	Identification of the party that requested the update of bid availability
requestingParty_MarketParticipant.marketRole.type	M	**A46** – Balancing Service Provider **A49** – Transmission System Operator
businessType	M	**C40** – Conditional bid **C41** – Thermal limit **C42** – Frequency limit **ZA0** – Missing heartbeat response

domain.mRID	M	The EIC of the bidding zone where the resource is located
		A01 – EIC coding scheme
Reason – exactly one instance per time series[1]		
Code	M	When business type = C40 the following reason only applies: B16 = Tender unavailable in MOL list When business type = C41 one of the following reasons apply: B18 = Failure B46 – Internal congestion B47 – Operational security constraints B60 – Unavailability of automatic protection systems When business type = C42 one of the following reasons apply: B58 = Insufficiency of reserves B59 = Unavailability of reserve providing units When business type = ZA0 the following reason apply: Z81 – BSP unavailable for activation
text	O	May be populated to provide additional explanation in free text format

[1]The business types and reasons can be subject to changes due to do the development of the local PICASSO integration project.

RegisteredResource (associated with BidTimeSeries) – only when BusinessType is Thermal Limit = C41		
mRID	O	EIC code of concerned network element

5.2.1 BidAvailability_MarketDocument assembly model

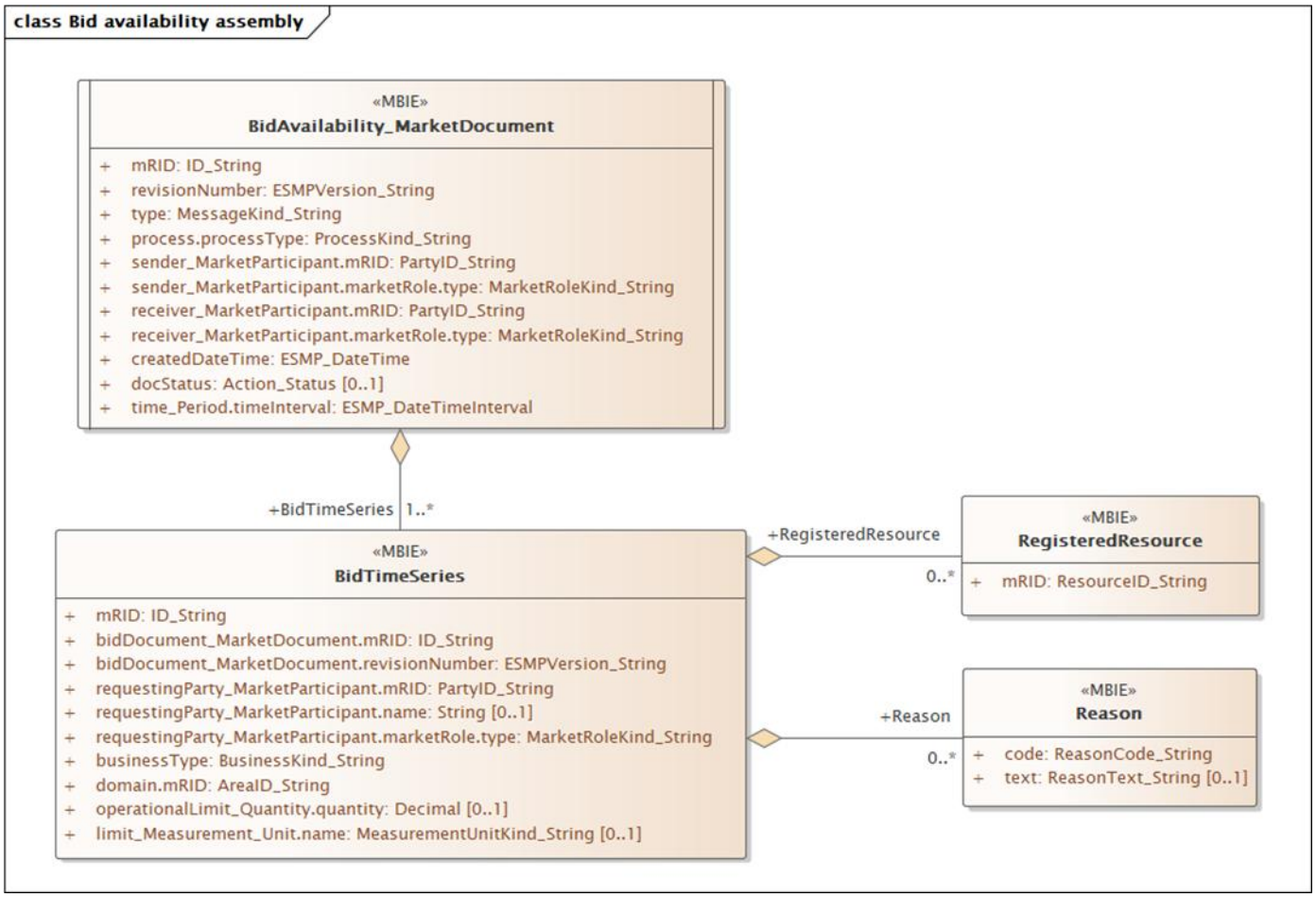


Figure 7: BidAvailability_MarketDocument assembly model. Note that the cardinalities indicated in the assembly model are further restricted for the implementation according to this guide. Please see the Attributes and dependencies table above.

5.3 Acknowledgement document – Attributes and dependencies

Acknowlegdement_MarketDocument		**iec62325-451-1-acknowledgement.xsd – version 8.1**
mRID	M	Unique identification of the document.
createdDateTime	M	Date and time of document creation (in ISO 8601 UTC format) YYYY-MM-DDTHH:MM:SSZ
sender_MarketParticipant.mRID	M	Identification of the party sending the document. See 5.4 for supported coding schemes.
sender_MarketParticipant.marketRole.type	M	*One of:* **A04** – System Operator

		A46 - Balancing Service Provider (BSP) **A34** – Reserve Allocator
receiver_MarketParticipant.mRID	M	Identification of the party receiving the document. See 5.4 for supported coding schemes.
receiver_MarketParticipant.marketRole.type	M	*One of:* **A04** – System Operator **A46** – Balancing Services Provider (BSP)
received_MarketDocument.mRID	M	The unique identification of the received document.
received_MarketDocument.revisionNumber	M	The revision of the received document.
received_MarketDocument.type	M	The type of the received document.
received_MarketDocument.process.processType	M	The processType of the received document.
received_MarketDocument.createdDateTime	M	The date and time of the creation of the received document.
Reason – one or more instances		
code	M	**A01** – Message fully accepted **A02** – Message fully rejected More specific error codes may be used.
text	O	May be populated to provide additional explanation in free text format.
Reason – zero or more instances per time series		
code	M	**999** – Errors not specifically identified More specific error codes may be used.
text	O	May be populated to provide additional explanation in free text format. For rejected bids a specific reason for the rejection will be provided.

5.4 Supported coding schemes for sender/receiver identification

The following coding schemes are supported for identification of sender/receiver.

- **A01** – EIC
- **A10** – GS1

6 Appendix 2 - Real-time signal interface

This appendix outlines the real-time signal interface between Statnett and Balancing Service Providers (BSPs) participating in the Norwegian implementation of the aFRR Energy Activation Market (EAM). These signals are essential for enabling dynamic and automated control of aFRR-providing units in accordance with the European PICASSO platform requirements.

The real-time signals facilitate continuous communication between the TSO and BSP SCADA systems, ensuring accurate activation, monitoring, and feedback of balancing energy delivery. Signals are exchanged every control cycle (typically every 4 seconds) and are designed to support both operational control and verification of delivery performance.

This section provides information about:

- The real-time system design that must be set up for BSPs delivering bids in aFRR EAM
- A list of signals sent from Statnett to BSPs, including control set-points and enablement status.
- A list of signals sent from BSPs to Statnett, including confirmation of control permissions, received set-points, actual delivery, and reserve availability.
- Descriptions of signal behaviour and expected response mechanisms.

These signals form the foundation of the real-time interaction required for successful participation in the aFRR EAM and must be implemented in accordance with the specifications provided in this guide. Further national-specific configurations may be defined in Statnett's technical onboarding documentation.

6.1 Real-time system design

The following requirements are valid for BSPs to partake in the aFRR capacity market:

- The BSP must have two separate physical connections to the network called E-NETT.
- The BSP must have a Control Centre with two separate redundant SCADA servers.
- The BSP should have two separate networks with two firewalls connecting their SCADA servers to the E-NETT network.

6.1.1 Protocol

aFRR should have a dedicated ICCP connection. Other SCADA signals should go on another ICCP connection. To ensure lowest possible down-time, the TSO will install duplicate routers at the BSP site, each of them connected to a separate BSP firewall. This configuration will ensure redundancy in the complete chain from the TSO SCADA servers to the BSP SCADA servers. BSP will be responsible for the duplication of firewalls and network at the BSP site.

All signals between the TSO and the BSP shall be use ICCP protocol. This communication may be encrypted using ICCP in the future. All indications and set-point values are transferred spontaneously, while all measurements are sent cyclically.

6.2 Signals sent from Statnett to BSP

The following table contains the signals that Statnett will send to the BSP SCADA system. The aFRR providing unit name will be appended to the listed ICCP name in the following format: <aFRR providing unit>_<ICCP name>; e.g.: "*aFRR-providing-unit*_**FRR_ENABLED**".

Signal	ICCP name	Unit	Description
aFRR set point	FRR_SET_POINT	MW	The set-point is sent as a value over ICCP. Whenever the TSO is controlling the aFRR providing unit this value will be updated; it will not be updated if the TSO is not controlling it. If this value is not valid the BSP control system should not use this signal. A time out should be applied before considering this signal invalid to handle temporary loss of communication.
aFRR enabled	FRR_ENABLED		Indication signal stating if the BSP is enabled in the TSO LFC system.

6.3 Signals sent from BSP to Statnett

The following table contains the signals sent from the BSP SCADA system to Statnett. The aFRR providing unit name will be appended to the listed ICCP name in the following format: <aFRR providing unit>_<ICCP name>; e.g.: "*aFRR-providing-unit*_**AGC_RCP**".

Signal	ICCP Name	Unit	Description
Remote control permitted	AGC_RCP	-	When set, this signal means that the TSO is permitted to control the aFRR providing unit. This does not imply that the TSO has taken control of the aFRR providing unit, but it is a pre-requirement for the TSO to use it in regulation
Received set-point	AGC_RECV_SP	MW	To verify that the BSP control system has received the set-point value, a measurement containing the last received set-point value is returned to the TSO.
Actual aFRR contribution	AGC_ACTUAL_MW	MW	The actual aFRR contribution from an aFRR providing unit. This signal should be a continuous measurement, reflecting how much the aFRR providing unit is contributing to the aFRR.
Current aFRR reserves up	AGC_RES_UP	MW	Available reserves up. This is a confirmation that there is available sufficient regulation with reference to the contractual obligations of the BSP.

Current aFRR reserves down	AGC_RES_DOWN	MW	Available reserves down. This is a confirmation that there is available sufficient regulation with reference to the contractual obligations of the BSP.
Unit in limitation up	AGC_LIM_UP		When this signal is sent, it means that the aFRR providing unit has reached its available reserves limits up. This signal is used by the BSP to no longer increase regulation as long as the corresponding signal is sent.
Unit in limitation down	AGC_LIM_DOWN		When this signal is sent, it means that the aFRR providing unit has reached its available reserves limits down. This signal is used by the BSP to no longer decrease regulation if the corresponding signal is sent.
Generator Participation Flag	GEN_FRR_ON		Signal indicating if individual generators can participate in the aFRR EAM. ICCP name is preceded with generator name.

7 Appendix 3 – Examples

Examples for the ECP messages referenced in this implementation guide will be provided at a later stage.