

BSP - Implementation Guide

aFRR energy activation market

Business process: aFRR energy activation market

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1.1	01.07.2026	Svenska kraftnät	<i>Added:</i> Svenska kraftnät specific: - information about the bid activation process

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1 Introduction

This implementation guide describes the interface between BSP and TSO for the aFRR energy activation market.

1.1 Background

The aFRR Energy activation market (aFRR EAM) is already operational for Fingrid and Energinet, and is planned for operation for Svenska kraftnät and Statnett.

NBM is the program for updating the Nordic balancing process to facilitate increased volumes of variable renewable energy in the system, European market integration and improved balancing market efficiency, while maintaining operational security in the most cost-effective manner.

Information about the overall roadmap for the NBM program is available at the www.nordicbalancingmodel.net webpage.

1.2 Scope

This document covers the implementation of 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 BSPs¹.

The main processes described are:

- Bid collection process, including
 - CIM-based xml message format for collecting bids
 - Bid attributes
- Energy activation process
 - Real-time signal
- Bid unavailability process
 - CIM-based xml message format

¹ In Denmark the BSP role has not been separated from the BRP role, so in Denmark the target audience for this document is the BRP. Whenever the term BSP is used throughout this document it should be interpreted - for Denmark - as the «BRP acting as BSP»

1.3 Terms and definitions

Acronym	Term	Definition
AOF	Activation Optimization Function	<i>The role to operate the algorithm applied for the optimisation of the activation of Balancing Energy bids within a Coordinated Balancing Area.</i>
Non-AOF	Local aFRR activation result	<i>Due to market design, there is always a delay between marginal price and activation volume results from AOF and the real time activations from local LFCs. Non-AOF term refers to activations that differ from AOF results.</i>
BEGCT (BSP GCT)	Balancing Energy Gate closure time	<i>The point in time when submission or update of a balancing energy bid is no longer permitted</i>
BEGOT	Balancing Energy Gate opening time	<i>The first point in time when submission of a balancing energy bid is permitted</i>
BRP	Balance Responsible Party	<i>A market participant or its chosen representative responsible for its imbalances</i>
BSP	Balancing Services Provider	<i>A market participant with reserve-providing units or reserve-providing groups able to provide balancing services to TSOs</i>
CC	Control Cycle	<i>Period in which a single optimization result is calculated in LFC and new control signals (if changed from previous cycle) are sent from TSO to BSPs. The control cycle is TSO specific.</i>
CIM	IEC Common Information Model	<i>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.</i>
CMOL	Common Merit Order List	<i>A combined list of local balancing energy bid lists (MOL) from each price area maintained by the PICASSO platform</i>
CZC	Cross Zonal Capacity	<i>The cross-zonal transmission capacity between two bidding zones</i>
FAT	Full Activation Time	<i>The period between the activation request by the connecting TSO and the corresponding full delivery of the concerned product</i>
FRCE	Frequency Restoration Control Error	<i>PICASSO platform calculates every optimization cycle a frequency restoration control error for each LFC area. This error acts as an input for the LFC optimization 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.</i>
ECP	Energy Communication Platform	<i>Reference implementation of MADES standard</i>
ETP	ENTSO-E Transparency Platform	<i>The ENTSO-E Transparency Platform is an online data platform for European electricity system data</i>
ISP	Imbalance Settlement Period	<i>The time unit for which balance responsible parties' imbalance is calculated</i>
LFC	Load Frequency Control	<i>A TSO system to maintain reasonably uniform frequency, to divide the load between the generators and to control the tie-</i>

		<i>line interchange schedules. Receives input from the PICASSO platform and distributes aFRR control signal to BSPs within the LFC area.</i>
LFC AREA	Load Frequency Control Area	<i>The control area to which the aFRR providing units or aFRR providing groups shall deliver the aFRR standard balancing energy.</i>
LMOL	Local Merit Order List	<i>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.</i>
MADES	Market Data Exchange Standard	<i>Communication IEC standard designed by ENTSO-E</i>
MOL	Merit Order List	<i>A list of balancing energy bids sorted in order of their bid prices, used for the activation of those bids</i>
MTU	Market Time Unit	<i>The period for which the market price is established as a result of PICASSO platform optimization cycle. For PICASSO the MTU is 4 seconds.</i>
OC	Optimization cycle	<i>Period in which a single optimization result is calculated in PICASSO platform and new FRCE values are sent to each LFC area. Current optimization cycle is 4 seconds, equal to MTU.</i>
TSO	Transmission System Operator	<i>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.</i>
	Connecting TSO	<i>The TSO that operates the scheduling area in which balancing service providers and balance responsible parties shall be compliant with the terms and conditions related to balancing.</i>
TSO GCT	TSO energy bid submission gate closure time	<i>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.</i>
VP	Validity Period	<i>The time 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.</i>

1.4 References

- Ref [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
- Ref [2] Common Information Model (CIM) and CIM based documents. [ENTSO-E implementation guides, see ENTSO-E Electronic Data Interchange \(EDI\) Library](#)

- Ref [3] Acknowledgement: [IEC 62325-451-1: Acknowledgement Business Process And Contextual Model For CIM European Market.](#)
- Ref [4] Reserve Bid market document [IEC 62325-451-7](#) urn:iec62325.351:tc57wg16:451-7:reservebiddocument:7:4
- Ref [5] Bid availability document [IEC 62325-451-n](#) urn:iec62325.351:tc57wg16:451-n:bidavailabilitydocument:1:1
- Ref [6] EIC codes: [The Energy Identification Coding \(EIC\)](#)
- Ref [7] ENTSO-E codelist: [ENTSO-E Codelist in ENTSO-E EDI library](#)
- Ref [8] European platform - PICASSO: [The Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation](#)
- Ref [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](#)
- Ref [10] Nordic Operate BRS: [This document is a Business Requirement Specification \(BRS\) detailing the document exchanges related to operation of the Nordic energy market.](#)
- Ref [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 activation of aFRR reserves by each Transmission System Operator (TSO) is guided by the results of the Nordic aFRR capacity market. The total calculated aFRR demand is distributed among the Nordic TSOs using a pro-rata method.

With the introduction of the aFRR energy activation market (aFRR EAM), Balancing System Providers (BSP) submit energy bids with volume and price to aFRR EAM. The TSOs will forward the energy bids to the European PICASSO platform, which then optimizes bid selection and returns activation results in real time.

BSPs with accepted bids from the aFRR capacity markets must place at least a corresponding volume of aFRR energy bids in aFRR EAM. It is possible to send bids in aFRR EAM without participating in the aFRR capacity market.

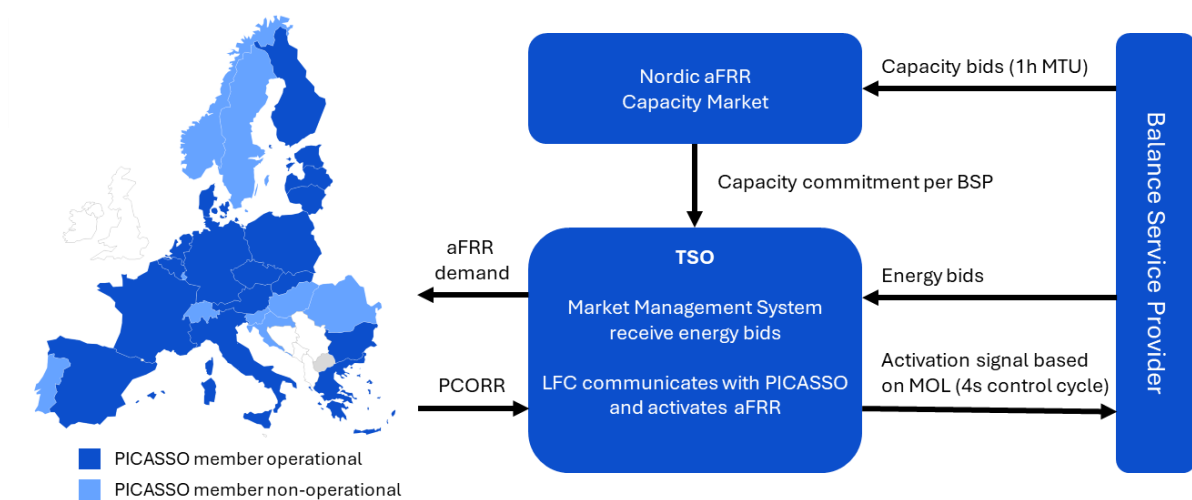


Figure 1 High level schematic diagram of aFRR energy markets

Additional information on PICASSO can be found in [PICASSO \(entsoe.eu\)](https://entsoe.eu).

2.1.1 Business process and timeline

The aFRR EAM process starts from Balancing Energy Gate Opening Time (BEGOT) and ends at settlement and invoicing. Figure 2 illustrates the steps in that process.

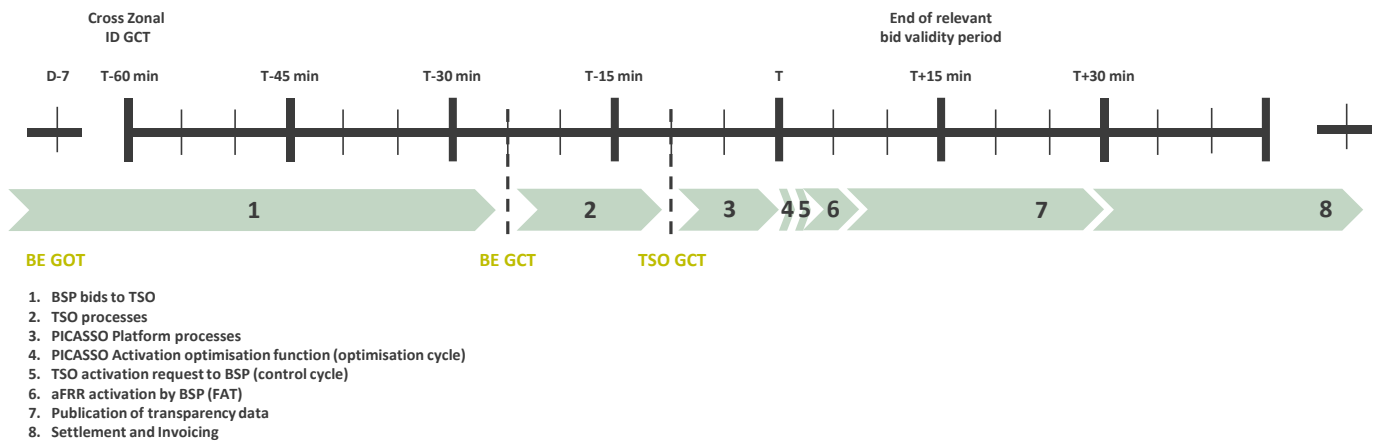


Figure 2 The timing for the bidding and activation processes is illustrated

BSPs send aFRR energy bids to the TSO after the Balancing Energy Gate Opening Time (BEGOT) and before the Balancing Energy Gate Closure Time (BEGCT). BSPs are responsible for activating aFRR energy bids according to the real-time signal received from the 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.

TSOs submit Local Merit Order Lists (LMOL) of aFRR energy bids to the PICASSO platform before TSO GCT. TSOs send aFRR demand to PICASSO as a real-time signal. PICASSO fulfills TSOs aFRR demands by selecting an optimal set of bids from the Common Merit Order List (CMOL) for each optimisation cycle given the constraints (cross-border capacity limits). PICASSO delivers results in real-time to TSOs, which send aFRR activation signals to BSPs for each control cycle.

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.

	Go-live of aFRR EAM
BSP GOT (BEGOT bids)	TSO specific
BSP GCT (BEGCT bids)	T-25 min
TSO GCT	T-10 min
Bid validity period	T to T+15 min
TSO aFRR demand	real-time
PICASSO run	real-time
PICASSO results	real-time
Activation orders are sent to BSPs	real-time
Delivery time (seconds)	30
Full Activation Time, FAT (minutes)	TSO specific

T-x means x minutes before the start of the validity period, T+y means y minutes after the start of the validity period.

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

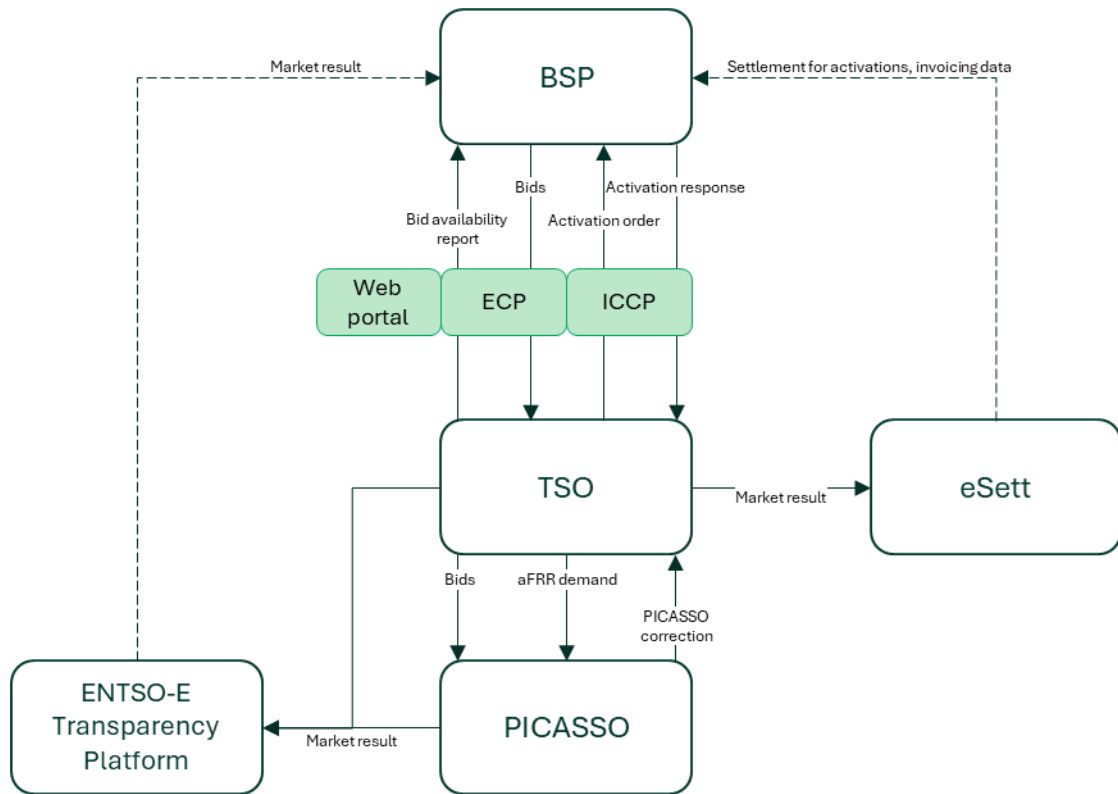


Figure 3 High level information flow of aFRR energy activation market

2.3 Fallback

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 merit order approach but without the ability to exchange energy or net aFRR demands between different scheduling areas. This fallback solution does not require any changes to the BSPs' processes, so BSPs will continue to operate as usual.

See more on the TSO specific details in chapter 4.

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

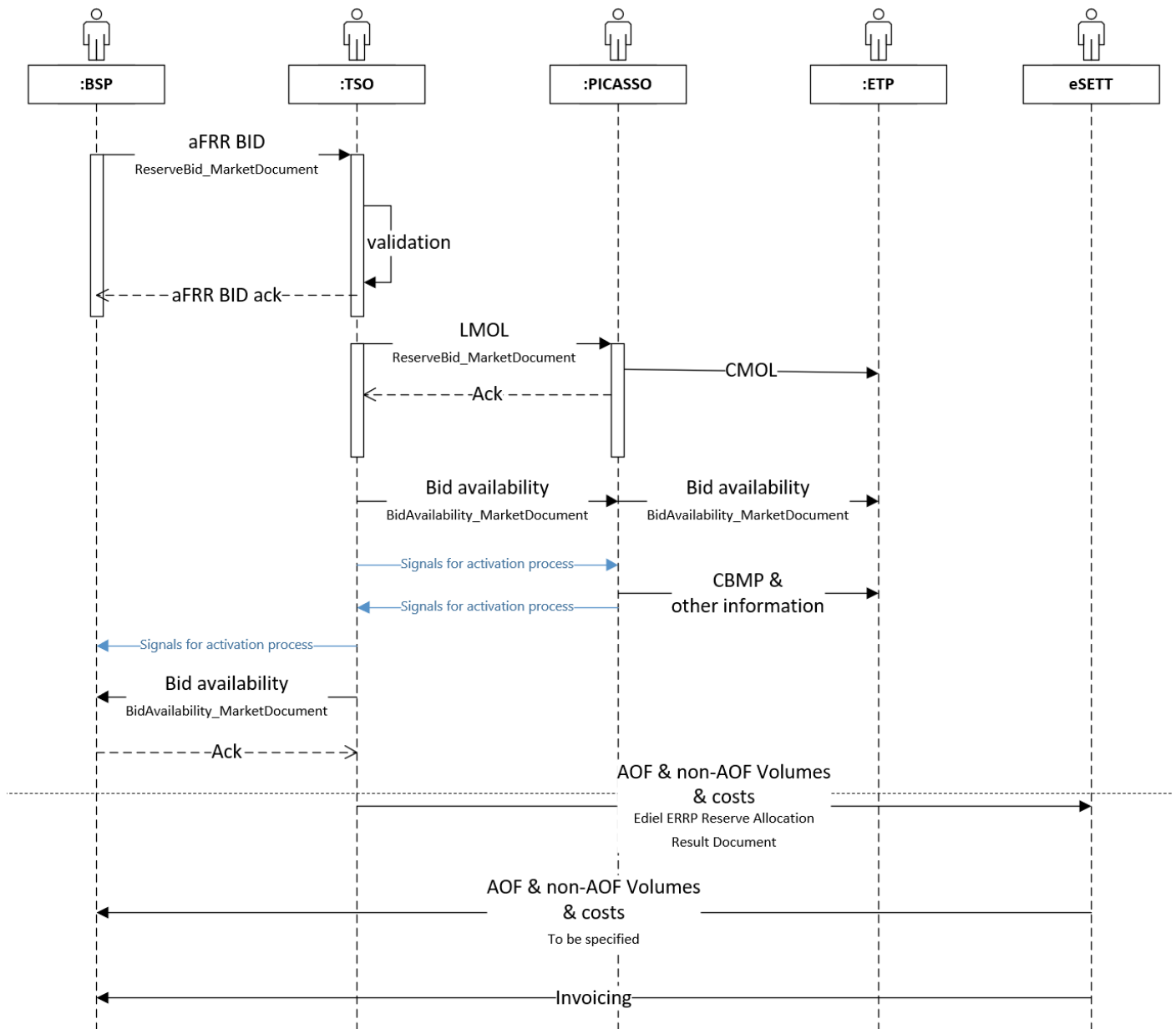


Figure 4: Sequence diagram for Energy Market bid information on energy market

3.2 Submit bid process

The preferred channel for bid submission is 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. Bids can also be submitted incrementally; it is important to note that there is no need to resend unchanged bids.

3.2.1 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)
BSP portfolio limit	Based on prequalified capacity
Bid granularity (MW)	1
Activation granularity (MW)	float
Bid validity period (minutes)	15

3.2.2 Bid validation rules

Document level

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

All bids:

- Bid size and resolution
- Price resolution
- Bid validity periods are within the document time interval

Rules for updating bids:

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

See chapter 5.7 for general rules on updating and cancellation of bids.

3.2.3 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.

If acknowledgement is not received, the BSP should interpret the missing acknowledgement as a problem. The BSP should check the status of submitted bids by using the web interface provided by the TSO and set bids to corresponding status in own system.

3.3 Bid availability process

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) 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 validity period.

If a bid is set as unavailable by the TSO, the BSP is informed about this through a bid availability document that is sent to the BSP. The BSP will receive a bid availability document if there are bids from that BSP that were partly or fully unavailable during the validity period. If there are no unavailable bids, the document is not sent. See more on the TSO specific details in chapter 4.

3.3.1 Bid availability report

Submitted bids must be available for activation ordering. If bids become unavailable for activation before BEGCT for any reason, the BSP must cancel the bids. In case bids become unavailable for activation after BEGCT, the BSP must inform the TSO as quickly as possible by phone.

The TSO will assess the availability of activation for each bid for each validity period.

The TSO can mark a bid unavailable for the following reasons:

- 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
- Local congestions

The TSO will inform the BSP about bids that have been marked unavailable for activation by sending a *BidAvailability_MarketDocument*. Please see Appendix 1 for further details on the message document.

3.4 Activate bid process

The TSO will send activation orders for selected bids to the respective BSPs every control cycle via real-time communication protocol. TSO-specific real-time signals and processes are defined in chapter 4.

Each TSO defines aFRR demand for said LFC area in real time and sends this as an input to the PICASSO platform. PICASSO Activation Optimizaton Function (AOF) uses aFRR demand, local merit order lists (LMOL) and available cross zonal capacities to define possible activations for each LFC area. These values are sent to respective TSO, which then activates bids from LMOL's accordingly. The AOF also looks at activations which the TSO's have sent to the BSPs in order to calculate cross border marginal price.

3.5 Publication and reporting of market results

3.5.1 Publication of market prices and volumes

Market prices and volumes for the aFRR Energy Market will be published on the ENTSO-E Transparency platform (transparency.entsoe.eu). Additional TSO specific channels are described in the TSO specific chapters. After Nordic PICASSO accession, it will be decided whether the Nordic Transparency platform NBiS (www.nucs.net) will be used additionally as a common platform for publishing market data.

3.5.2 Invoicing data per BSP

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

4 TSO specific information

4.1 Energinet

4.1.1 TSO contact information

Any questions and concerns regarding this implementation guide, and the follow-up of the implementation in Energinet, can be directed to: electricitymarket@energinet.dk

4.1.2 Submit bid process

The aFRR energy market process starts at the BEGOT, which is 30 days before T (T is the start of the validity period), and ends with settlement and invoicing.

4.1.3 Fallback

In the case of a loss of communication to the PICASSO platform, the Energinet LFC will enter what is called “Local Mode”, where the aFRR EAM continue to work and ensure clear operations. Due to the lack of connection to the PICASSO platform, exchange of aFRR EAM cross borders will in this mode, not be possible.

4.1.4 Publication of market prices and volumes

To ensure sufficient transparency of aFRR EAM at Energinet, data is published on the centralised Energi Data Service found [here](#). Data in aFRR EAM is updated live during the day and matched with Energinets LFC. It includes also relevant correction signals from PICASSO, as well as available capacity on selected interconnector.

For further in depth information regarding PICASSO data, it is recommended to visit the Transparency platform.

4.1.5 Bid Availability use cases

TSO has a possibility to change the availability status of a bid. By default, all bids have status available. TSO can declare a bid or all bids of a BRP unavailable. Reasons for unavailability can originate from automatic procedures in LFC (e.g. losing real-time connection towards the BRP) or manual actions done by the TSO operator. TSO operator can also declare a bid unavailable on request from the BRP. A bid can also be partly unavailable during the validity period.

If a bid is declared as unavailable by the TSO, the BRP is informed about this through a bid availability document that is sent to the BRP. The document is sent after the validity period of the bid. The BRP will receive a bid availability document if there were bids from that BRP that were partly or fully unavailable during the validity period. If there are no unavailabilities, the document is not sent.

Bid availability report

Submitted bids must be available for activation ordering. If bids become unavailable for activation before BEGCT for any reason, the BRP must cancel the bids. In case bids become unavailable for activation after BEGCT, the BRP must

inform the TSO as quickly as possible by phone.

The TSO will assess the availability of activation for each bid for each market period.

The TSO can mark a bid unavailable for the following reasons:

- local congestions
- unavailability of the BRP electronic ordering process
- BRP informs TSO that bid is unavailable due to failure on reserved delivery unit
- System security

The TSO will inform the BRP about bids that have been marked unavailable for activation by sending a BidAvailability_MarketDocument.

Reason found in Schema

Reason – exactly one instance per time series		
Code	M	- When business type = C40 the following reason only applies: B16 = Tender unavailable in MOL list - When business type = C41 or C44 the following reason only applies: B46 = Internal congestion - When business type = C42 one of the following reasons apply: B58 = Insufficiency of reserves B59 = Unavailability of reserve providing units - When business type = C43, C45 or C46 one of the following reasons apply: B18 = Failure B46 = Internal Congestion B47 = Operational security constraints B60 = Unavailability of automatic protection systems

text	O	May be populated to provide additional explanation in free text format
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4.2 Fingrid

4.2.1 Submit bid process

The Balancing energy gate opening time (BEGOT) for BSPs is 7 days. The preferred channel for bid submission is sending a reserve bid document via ECP/EDX².

Alternative channel for bid submission

Additionally, bids may be submitted manually in TSO's MMS (Vaksi Web). A more detailed description of manual bid submission can be found in Fingrid's reserve trading and information exchange guidelines (Fingridin reservikaupankäynti- ja tiedonvaihto-ohje).

Bid volumes are restricted by the configured aFRR portfolio size. Bid validity check has automated bid total volume and aFRR portfolio size comparison.

Bid attribute	Implemented
Maximum duration	No
Resting time	No
Inclusive bids	No
Locational information on bids	No
Faster activation	No
Technically linked bids	No

4.2.2 Activate bid process

Fingrid will have real-time signals in use at aFRR process (some of them relating to aFRR Capacity Markets). Comprehensive list can be found from Fingrid web pages ([Reservien tiedonvaihto - signaalilista](#)) Watchdog real-time signal is an increasing number, that is mirrored back to Fingrid by BSP. If the watchdog feedback signal of BSP is not updated for 180 seconds, Fingrid interprets that aFRR real-time communication is not working properly and will

² https://www.fingrid.fi/en/electricity-market/reserves_and_balancing/reserve-trading-and-information-exchange/ecp-messaging2/ and <https://ediel.org/nordic-ecp-edx-group-nex/market-actor-onboarding/>

automatically mark all BSP bids as unavailable. After the watchdog signal delay is again below 180 seconds, Fingrid will mark all bids as available and possible activation continues.

Realtime communication must use ICCP protocols. Detail information of setting up realtime communication with Fingrid is gone through at the aFRR Market Accession process.

4.2.3 BidAvailability_MarketDocument use cases

use case	requestingParty_MarketParticipant. marketRole.type	requestingParty_ MarketParticipant.mRID	businessType	Reason/Code	Reason/Text
<i>Erroneous bid</i>	A49 = TSO	TSO EIC	C41	B09 = Rejected	Bid rejected as erroneous
<i>Unavailable on BSP's request</i>	A46 = BSP	Empty	C41 – Thermal limit	B18 = Failure	On BSP's request
<i>Real-time connection is lost with BSP</i>	A49 = TSO	TSO EIC	C42 – Frequency limit	B59 = Unavailability of reserve providing units	Connection lost to BSP
<i>Unavailable on TSOs decision</i>	A49 = TSO	TSO EIC	C42 – Frequency limit	B58 = Insufficiency of reserves	TSOs decision
<i>Unavailable due to faulty bid</i>	A49 = TSO	TSO EIC	C41 – Thermal limit	B18 = Failure	Faulty bid
<i>Unavailable due to conditional bid</i>	A46 = BSP	Empty	C40 – Conditional bid	B16 = Tender unavailable in MOL	Due to conditional bid

4.2.4 Fallback

In case of lost PICASSO connection, a local fallback is implemented automatically. aFRR energy market bids are still submitted to Vaksi MMS, but the bid handling is done by Fingrid LFC, without any possibilities of netting or sharing energy market bids with other LFC areas. Fallback initiation does not affect the BSP process in any way.

In case of bid submission issues to Vaksi MMS, either via UI or via ECP/EDX, or in case of severe Fingrid LFC malfunction, the aFRR energy market is terminated completely, resulting to OMW activation requests for all BSPs. Fingrid publishes market messages on any technical issues affecting the aFRR energy market.

4.2.5 Publication of market prices and volumes

Market prices and volumes for the aFRR Energy Market will be published on the ENTSO-E Transparency platform (transparency.entsoe.eu), as well as TSO's open data service. Fingrid publishes series of aFRR market data on the Fingrid Open Data platform.

4.2.6 TSO contact information

Any questions and concerns regarding this implementation guide, and the follow-up of the implementation in Fingrid, can be directed to reserve market information exchange experts or Fingrid aFRR experts, contact details found from [Reserve Trading and Information Exchange - Fingrid](#) and [Fingrid – aFRR](#).

4.3 Statnett

4.3.1 Submit bid process

The Balancing energy gate opening time (BEGOT) for BSPs is at 12:00 market time for all validity periods of the next day.

Alternative channel for bid submission

The preferred channel for bid submission is sending a reserve bid document via ECP/EDX. Alternatively, bids may be submitted in the graphical user interface FiftyWeb (fiftyweb.statnett.no).

Bid validation rules:

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.

4.3.2 Activate bid process

This section 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.

Real-time system design

The following requirements apply for BSPs to participate in the aFRR energy activation 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.

Protocol

aFRR should have a dedicated ICCP connection. Other SCADA signals should go on another ICCP connection. To ensure lowest possible downtime, 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 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.

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.

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.

4.3.3 Fallback

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 merit order approach but without the ability to exchange energy or net aFRR demands between different scheduling areas. This fallback solution does not require any changes to the BSP's processes, so BSPs will continue to operate as usual.

Communication timeout

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 set 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, 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.

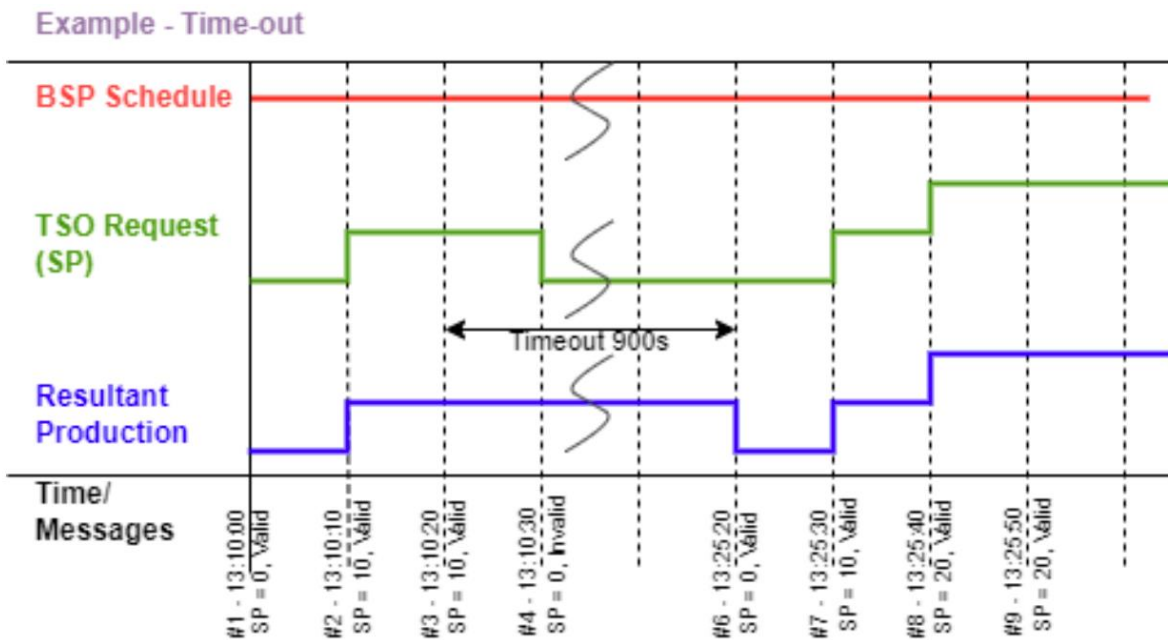


Figure 5 Illustration of the timeout functionality. The resultant production does not change in the timeout period. The illustration is an example, and the actual timeout period is not necessarily set as 900 seconds

4.3.4 TSO contact information

Any questions and concerns regarding this implementation guide, and the follow-up of the implementation in Norway, can be directed to: BSP@statnett.no.

4.4 Svenska kraftnät

4.4.1 Submit bid process

The balancing energy gate opening time (BEGOT) for BSPs is at D-1 12:00 market time for all validity periods. The method for bid submission is sending a reserve bid document via ECP/EDX. A future alternative for bid submission is the graphical user interface FiftyWeb (fiftyweb.svk.se). However, it will be communicated at a later stage if this functionality will be in place when connecting to PICASSO or at a later stage.

4.4.2 Rules for updating and cancellation of bids before BSP GCT

To update or cancel previously sent time series, a new document is sent containing the following information:

- The new unique document mRID (document identification)
- To ensure the update of the correct time series, the bid identification (BidTimeSeries.mRID) of the original time series must be used
- Fixed revision number (always equal to '1')
- A newer created date-time than the previously sent document

ReserveBid_MarketDocument updates are done by sending the affected time series with new data. The preferred way of cancelling a bid is to set BidTimeSeries.status to unavailable. If the volume (BidTimeSeries.period.point.quantity) is 0 and a bid with matching mRID preexists, the status will be set to unavailable. Bids with a new mRID and a quantity of 0 will be ignored.

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.

4.4.3 Bid availability report

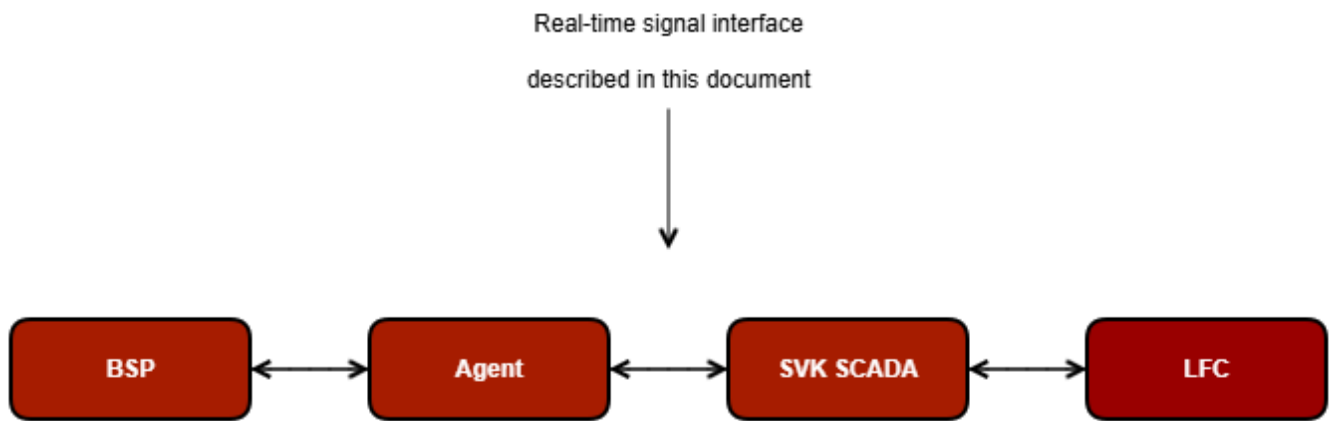
The TSO will inform the BSP about bids that have been marked unavailable after BSP GCT by sending a BidAvailability_MarketDocument. The report will be sent after T+16.

BidAvailability_MarketDocument use cases

use case	requestingParty_Market Participant.marketRole.type	requestingParty_Market Participant.mRID	businessType	Reason/ Code	Reason/ Text
<i>Unavailable on BSP's request</i>	A46 = BSP	Empty	C41 – Thermal limit	B18 = Failure	<i>On BSP's request</i>
<i>Real-time connection is lost with BSP</i>	A49 = TSO	TSO EIC	C42 – Frequency limit	B59 = Unavailability of reserve providing units	<i>Connection lost to BSP</i>
<i>Unavailable on TSO's decision</i>	A49 = TSO	TSO EIC	C42 – Frequency limit	B58 = Insufficiency of reserves	<i>TSO's decision</i>
<i>Unavailable due to faulty bid</i>	A49 = TSO	TSO EIC	C41 – Thermal limit	B18 = Failure	<i>Faulty bid</i>
<i>Unavailable due to conditional bid</i>	A46 = BSP	Empty	C40 – Conditional bid	B16 = Tender unavailable in MOL	<i>Due to conditional bid</i>

4.4.4 Activate bid process

This section outlines the real-time signal interface between Svenska kraftnät and the Agent that connects the Balancing Service Providers (BSPs) participating in the Swedish implementation of the aFRR Energy Activation Market (EAM).



The real-time signals facilitate continuous communication between the SCADA systems at Svenska kraftnät and the Agent, ensuring accurate activation, monitoring, and feedback of balancing energy delivery. Signals are exchanged with the characteristics given by the real-time protocol ICCP and are designed to support both operational control and verification of delivery performance.

The Load Frequency Control (LFC) system is responsible for the control of the aFRR service.

This section provides information about:

- A list of signals sent from Svenska kraftnät to BSPs via Agent
- A list of signals sent from BSPs to Svenska kraftnät via Agent
- Descriptions of signal behavior 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.

Protocol

All signals between Svenska kraftnät and the Agent shall use the ICCP protocol. All indications are transferred spontaneously, while all measurements are sent cyclically.

The type of ICCP signal can either be measurement or indication, indicated by an M or an I in the column named Type in the tables below.

Signals related to aFRR should have a dedicated ICCP data set. Other SCADA signals should go on another ICCP data sets and the data set should be monitored by a watchdog function.

The ICCP object type needs to be agreed between Svenska kraftnät and Agent based ICCP version supported.

The ICCP-names must only contain the following characters:

[A-Z]

[0-9]

[_]

The ICCP-name has the following format:

<Sending party>_<Receiving party>_<BSP>_AFRR_<Area>_<Signal abbreviation>

<Sending party> is the sender of the ICCP signal. SVK in case Svenska kraftnät sends the signal else the three characters identifying the Agent.

<Receiving party> is the receiver of the ICCP signal. SVK in case Svenska kraftnät receives the signal else the three characters identifying the Agent.

<BSP> is three characters identifying the BSP.

<Area> is either SE1, SE2, SE3 or SE4.

For example:

- when SVK is sending the signal Setpoint to BSP called XYZ for area SE1 via Agent called ABC, the following ICCP name would be used: SVK_ABC_XYZ_AFRR_SE1_SP
- when SVK is receiving the signal Unit Active from BSP called XYZ for area SE4 via Agent called ABC, the following ICCP name would be used: ABC_SVK_XYZ_AFRR_SE4_UA

Signals sent from Svenska kraftnät to BSP via Agent

Signal	ICCP-name	Unit	Type	Description
Setpoint	SVK_<Agent>_<BSP>_AFRR_<Area>_SP	MW	M	Whenever the LFC system is controlling the aFRR providing unit this value will be updated; it will not be updated if LFC system 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.
Unit Active	SVK_<Agent>_<BSP>_AFRR_<Area>_UA	-	I	Indication signal stating if the BSP is enabled in the LFC system.

Signals sent from BSP to Svenska kraftnät via Agent

Signal	ICCP name	Unit	Type	Description
Remote Control Permitted	<Agent>_SVK_<BSP>_AFRR_<Area>_RCP	-	I	When set, this signal means that the LFC system is permitted to control the aFRR providing unit. This does not imply that LFC system has taken control of the aFRR providing unit, but it is a pre-requirement for LFC to use it in regulation.

Setpoint Confirm	<Agent>_SVK_<BSP> _AFRR_<Area>_SPC	MW	M	To verify that the BSP control system has received the setpoint value, a measurement containing the last received setpoint value is returned to LFC system.
Actual MW	<Agent>_SVK_<BSP> _AFRR_<Area>_AMW	MW	M	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.
Capacity Up	<Agent>_SVK_<BSP> _AFRR_<Area>_CU	MW	M	Available reserves up. This is a confirmation that there is available sufficient regulation with reference to the contractual obligations of the BSP.
Capacity Down	<Agent>_SVK_<BSP> _AFRR_<Area>_CD	MW	M	Available reserves down. This is a confirmation that there is available sufficient regulation with reference to the contractual obligations of the BSP.

4.4.5 Fallback

If the connection to PICASSO is lost, the selection of aFRR energy bids will be handled locally by Svenska kraftnät, using a 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.

4.4.6 Publication of market data

Market prices and volumes for the aFRR Energy Market will be published on the ENTSO-E Transparency platform (transparency.entsoe.eu). Svenska kraftnät will at a later date publish market data to its own open data platform (SDS).

4.4.7 TSO contact information

Any questions and concerns regarding this implementation guide, and the follow-up of the implementation in Sweden, can be directed to: afrr@svk.se

5 General rules for messaging

5.1 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.

5.2 Document coverage

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

5.3 Daylight saving time

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

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

5.4 Unique identifiers - UUID

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

5.5 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'.

5.6 Message size limit

The maximum allowed number of time series in a message is 2000. For Statnett the number 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 a validity period should be kept at a reasonable level.

5.7 Update and cancellation principles

To update or cancel previously sent time series, 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. 3.2.2 Bid validation rules.

5.8 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.

5.9 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/).

6 Appendix 1 – Document attributes and dependencies

This chapter provides the attributes and dependencies for the documents used to support the aFRR Energy 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

6.1 Bid document – Attributes and dependencies

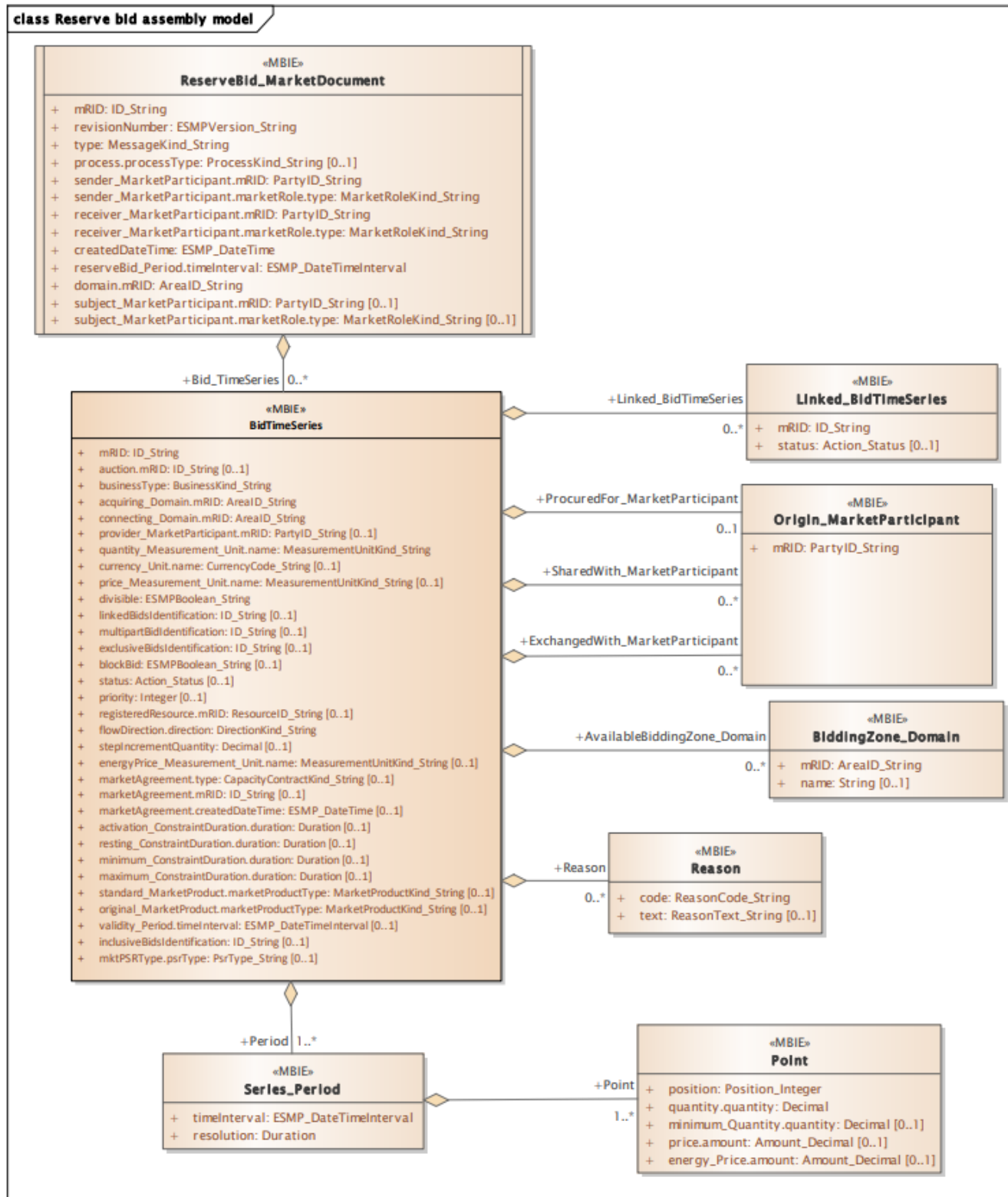
ReserveBid_MarketDocument		iec62325-451-7-reservebiddocument.xsd – version 7.4
mRID	M	Unique identification of the document. Proper UUID is required.
revisionNumber	M	Constant value of 1
Type	M	A37 - Reserve bid document
process.processType	M	A51 = automatic frequency restoration reserves
sender_MarketParticipant.mRID	M	Identification of the party sending the document See 6.4 for supported coding schemes.
sender_MarketParticipant.marketRole.type	M	A46 - Balancing Service Provider (BSP) A39 - Service Provider (Data Provider) In Denmark BRPs act as BSP and must use the BSP-role. Statnett: A46 - Balancing Service Provider (BSP)
receiver_MarketParticipant.mRID	M	Identification of the party receiving the document. One of: - Energinet.dk - Fingrid - Statnett - Svenska kraftnät A01 - EIC coding scheme
receiver_MarketParticipant.marketRole.type	M	A04 – TSO

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 identification of the Control Area Denmark: 10Y1001A1001A796 Finland: 10YFI-1-----U Norway: 10YNO-0-----C Sweden: 10YSE-1-----K A01 - EIC coding scheme
subject_MarketParticipant.mRID	M	Identification of the party responsible for the bid See 6.4 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	O	EIC or national code for the resource (regulation object) or sub-station. Only used for Statnett: National market code for the resource object (NOKG code). <i>Support for generator level is currently under consideration</i>
flowDirection.direction	M	A01 - Up A02 - Down
energyPrice_Measurement_Unit.name	M	MWH - Megawatt hours.
activation_ConstraintDuration.duration	O	Only used for Energinet. Activation time - The minimum time for full activation of the physical resource including preparation time and ramping time. For bids that have a standard FAT of 5 activation time can be left blank or omitted. For bids that can be activated faster than 5 minutes the activation time should be specified and should assume a preparation time of 0.5 minute. E.g. PT3M, PT5M
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

6.1.1 ReserveBid_MarketDocument assembly model



Note: the cardinalities indicated in the assembly model are further restricted for the implementation according to this guide, please see Attributes and dependencies table above.

6.2 Bid availability document – Attributes and dependencies

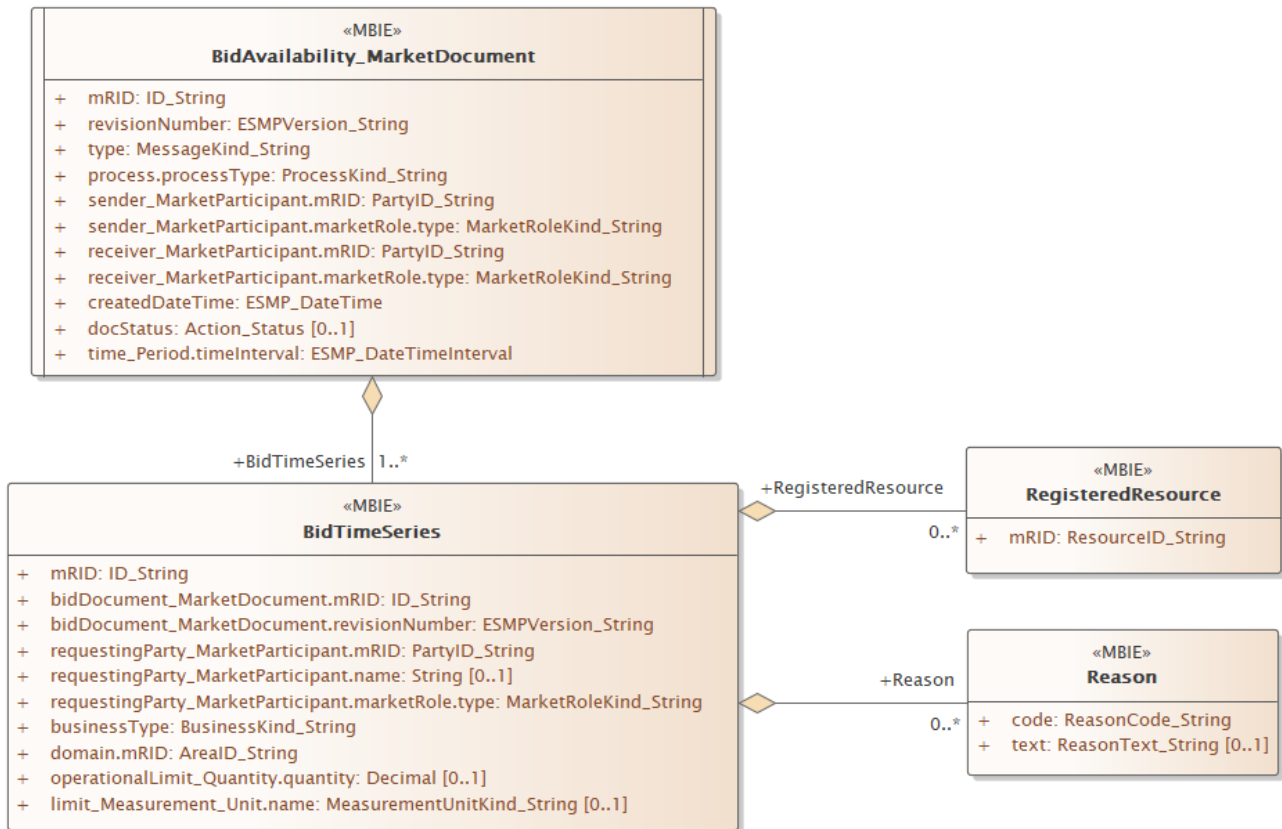
BidAvailability_MarketDocument		urn:iec62325.351:tc57wg16:451-n:bidavailabilitydocument:1:1
mRID	M	Unique identification of the document. Proper UUID is required.
revisionNumber	M	Constant value of 1
Type	M	B45 – Bid availability document
process.processType	M	A51 = automatic frequency restoration reserves
sender_MarketParticipant.mRID	M	10X1001A1001A264 A01 – EIC coding scheme
sender_MarketParticipant.marketRole.type	M	A04 – System Operator
receiver_MarketParticipant.mRID	M	Identification of the party receiving the document. See 6.4 for supported coding schemes.
receiver_MarketParticipant.marketRole.type	M	A46 – Balancing Service Provider (BSP) A39 - Service Provider (Data Provider) Statnett: 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	EIC code of Party that requested the update of bid availability

requestingParty_MarketParticipant.marketRole.type	M	A46 – Balancing Service Provider A49 – Transmission System Operator
businessType	M	C41 – Thermal limit C42 – Frequency limit ZA0 – Missing heartbeat response C44 – Current limit
domain.mRID	M	The EIC identification of the bidding zone where the resource is located A01 – EIC coding scheme
OperationalLimit_Quantity.quantity	M	Fingrid only Decimal number between [0,1] describing the bid usability in percentage during bid validity period (Fully unavailable = 0, fully available = 1)
Reason – exactly one instance per time series *)		
Code	M	When business type = C41 one of the following reason applies: B18 = Failure When business type = C42 one of the following reasons apply: B58 = Insufficiency of reserves B59 = Unavailability of reserve providing units Statnett: When business type = ZA0 the following reason apply: Z81 – BSP unavailable for activation Energinet: C44 is translated to a B46 Fingrid: B09 = Bid not accepted
Text	O	May be populated to provide additional explanation in free text format

RegisteredResource (associated with BidTimeSeries) – only when BusinessType is Thermal Limit = C41

mrID	O	EIC code of concerned network element
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6.2.1 BidAvailability_MarketDocument assembly model

class Bid availability assembly

6.3 Acknowledgement document – Attributes and dependencies

Acknowledgement_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 6.4 for supported coding schemes.

sender_MarketParticipant.marketRole.type	M	<i>One of:</i> A04 – System Operator A46 – Balancing Service Provider (BSP) A39 – Service Provider (Data Provider)
receiver_MarketParticipant.mRID	M	Identification of the party receiving the document. See 6.4 for supported coding schemes.
receiver_MarketParticipant.marketRole.type	M	<i>One of:</i> A04 – System Operator A46 – Balancing Service Provider (BSP) A39 – Service Provider (Data Provider)
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 Rejected 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.
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6.4 Supported coding schemes for sender/receiver identification

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

A01 – EIC

A10 – GS1

7 Appendix 2 – Examples

Examples for the messages referenced in this implementation guide are available for download on the respective Transmission System Operators' (TSOs) websites:

- [Fingrid webpage](#)