Trading Platform High Level Functional Requirements Report

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Abbreviations

ANM – Active Network Management

BAU – Business-as-usual

DNO – Distribution Network Operator

ENA – Energy Networks Association

ENWL – Electricity North West Limited

MO – Market Operator

MOM – Merit Order Management

MOS – Merit Order Stack

SCADA – Supervisory Control and Data Acquisition

TP – Trading Platform

1 Introduction

This document covers the end-to-end BiTraDER market process and high-level functional requirements for the trading platform. This document also summarises roles and responsibilities of different market actors, including the role of the market operator. Lastly, this document covers the practicalities of running market trials. In this section, the trading platform's configurability for the market trials is explored.

2 Market Actors Roles and Responsibilities

This section reviews different BiTraDER market actors and their roles and responsibilities.

2.1 Market Participants

Market participants are buyers and sellers of curtailment obligations in the BiTraDER market. Market participants will be responsible for following and respecting the rules of the market, such as:

- Providing accurate information about their company and assets.

- Submitting honest bids, offers, and self-declared baselines.

- Providing accurate meter reading data.

- Cooperating in the settlement process and more.

2.2 Trading Platform

Trading Platform will be responsible for supporting the end-to-end market process which includes all steps described in the BiTraDER Market Process Overview section. More information on the exact role and responsibilities of the trading platform is available in section 4 of this document.

2.3 Host Distribution Network Operator

Host Distribution Network Operator (DNO) is the DNO whose network will be used to facilitate the BiTraDER's market. Acting neutrally, host DNO will be responsible for:

- Performing technical pre-qualification of participants' assets.

- Providing access to constraint, curtailment queue, and other ANM data which is essential for the market to function.

- Monitoring trading activity to ensure that the market does not endanger the network.

- Making adjustments to the ANM system which may be necessary to enable smooth operations of the BiTraDER market.

- Supporting the changes to standard terms and conditions that may be necessary to enable the market to function.

2.4 Market Operator

Market operator is the organisation responsible for operating the market. Market operator's role and responsibilities include:

- Defining and enforcing the rules of the market.

- Acting as an intermediary in all communication between the host DNO and market participants.

- Performing commercial pre-qualification of participant organisations.

- Resolving disputes in the settlement process.

- Facilitating payments between participants.

During the market trials, market operator's role will be fulfilled by the host DNO and the trading platform. If BiTraDER is to transition to business-as-usual operations, the role may be undertaken by an independent third-party organisation.

Better understanding of market actors' roles and the division of responsibilities will be one of the key learnings of the BiTraDER project.

3 BiTraDER Market Process Overview

3.1 BiTraDER Market Process Summary

The end-to-end BiTraDER market process is presented in the figure below.

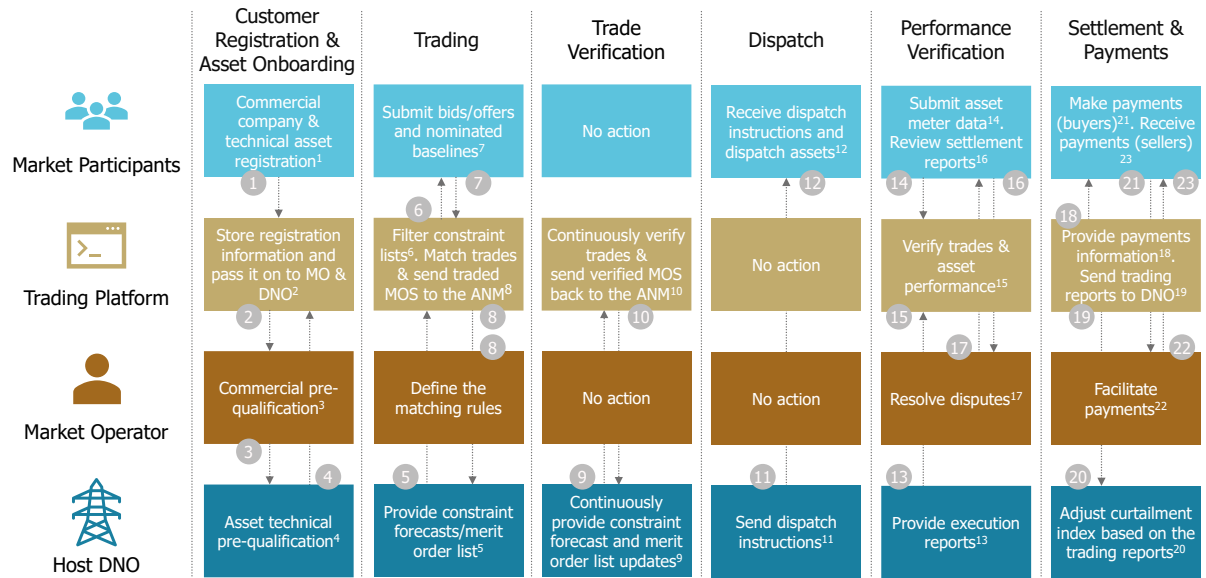|	Customer Registration & Asset Onboarding	Trading	Trade Verification	Dispatch	Performance Verification	Settlement & Payments
Market Participants	Commercial company & technical asset registration[1]	Submit bids/offers and nominated baselines[7]	No action	Receive dispatch instructions and dispatch assets[12]	Submit asset meter data[14]. Review settlement reports[16]	Make payments (buyers)[21]. Receive payments (sellers)[23]
Trading Platform	Store registration information and pass it on to MO & DNO[2]	Filter constraint lists[6]. Match trades & send traded MOS to the ANM[8]	Continuously verify trades & send verified MOS back to the ANM[10]	No action	Verify trades & asset performance[15]	Provide payments information[18]. Send trading reports to DNO[19]
Market Operator	Commercial pre-qualification[3]	Define the matching rules	No action	No action	Resolve disputes[17]	Facilitate payments[22]
Host DNO	Asset technical pre-qualification[4]	Provide constraint forecasts/merit order list[5]	Continuously provide constraint forecast and merit order list updates[9]	Send dispatch instructions[11]	Provide execution reports[13]	Adjust curtailment index based on the trading reports[20]

Figure 1. BiTraDER high-level end-to-end process.

The end-to-end BiTraDER market process consists of six steps:

1. Customer registration and asset onboarding is the first step of the process. In this step, market participants will go through the commercial and technical pre-qualification process to qualify for the market.

2. Trading is the second step of the market process. In this step, market participants will make bid/ offer submissions based on the provided constraint forecast information and the trading platform will match trades.

3. Trade verification is the third step of the market process. In this step, the trading platform and the host DNO's Active Network Management (ANM) system will verify that the trades are valid and can be dispatched on the day of the delivery.

4. Dispatch instructions is the fourth step of the market process. In this step, the host DNO's ANM system will send dispatch instructions to market participants.

5. Performance verification is the fifth step of the market process. In this step, participants will submit asset meter readings to the trading platform and the trading platform will measure and verify trade performance. If disputes arise, they will be handled by the market operator.

6. Settlement and payments process is the last step of the market process. In this step, the trading platform will provide payments information and market participants will make/ receive payments for the service provided.

3.2 BiTraDER Market Process Timeline

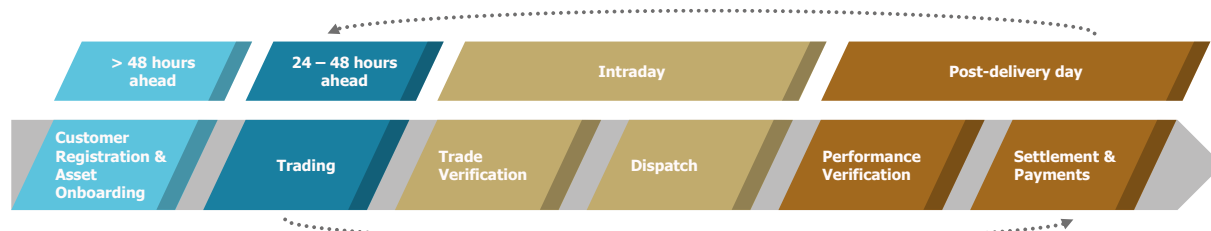BiTraDER market process timeline is presented in the figure below.

Figure 2. BiTraDER market timeline.

BiTraDER market will be running at a day-ahead:

- Customer Registration and Asset Onboarding process will have to be completed at least 48 hours prior to delivery day for customers and their assets to be eligible to take part in trading. Asset onboarding is a process that will have to be completed once, unless any changes are made to the assets.

- The trading process (generation of constraint forecasts, bids/ offers submissions, and trade matching) will take place 24 – 48 hours ahead of the delivery day. These timings will be tested with participants during the market trials to ensure that the market aligns well with the timings of other decisions that participants will need to make, e.g., other revenue streams, asset maintenance etc.

- Trade verification and dispatch processes will take place on the delivery day, ahead of every settlement period. More information on trading blocks and settlement period lengths is available in the BiTraDER Trading Rules report.

- Performance verification and settlement and payments processes will be carried out after the delivery day. The exact timings will depend on when participants' assets meter readings data becomes available. These timings will be tested with participants during the market trials.

4 BiTraDER End-to-End Market Process and High-Level Functional Requirements

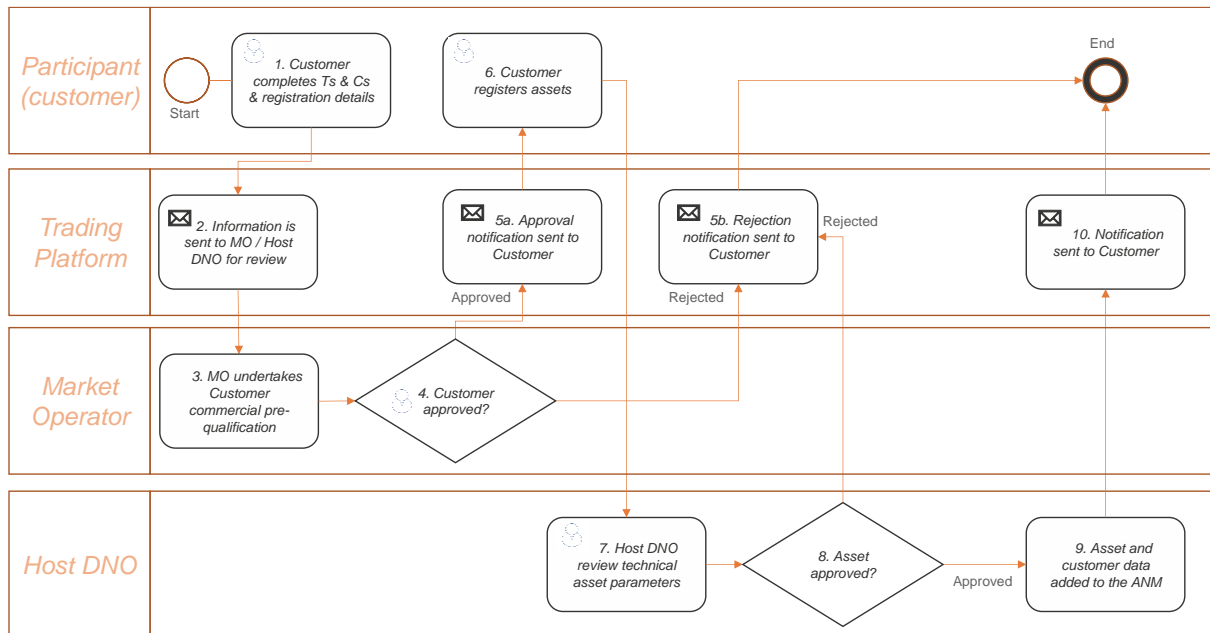## 4.1 Customer Registration and Asset Onboarding

Figure 3. Customer (participant) registration and asset onboarding process. Produced by Enzen, refined by Enzen, ENWL, Electron.

The end-to-end market process starts with the customer (participant) registration and asset onboarding. Participants will provide their registration details (company name, number, address, contact person details etc.), accept trading platform's terms and conditions, and fill out the commercial pre-qualification questionnaire to access the platform. Their application information will be passed on to the market operator for commercial pre-qualification checks and approval (steps 1-5 in Figure 3).

Once approved, participants will be granted access to the trading platform and will be asked to fill out the technical pre-qualification questionnaire to onboard their assets. The questionnaire will include questions on assets' technical capabilities (active/ reactive export/ import capacity, response time, run times, recovery time etc.), assets' location information, assets' meter information (available meter data granularity, meter IDs etc.), other technical information about the assets (step 6 in Figure 3). The full technical pre-qualification questionnaire will be aligned to the Energy Networks Association's ongoing standardisation work and will be included in the next project deliverable.

Host DNO's team will review the information provided and approve the assets. Market operator will act an intermediary in all communication between the host DNO and market participants.

Following the approval, approved assets will be added to the ANM system if they are not already in the system (steps 7-10 in Figure 3).

Customer registration and asset onboarding high-level functional requirements are listed in the table below. Functional requirements are listed using the MoSCoW prioritisation method. The list of requirements is not exhaustive and will be updated in line with learning from the future stages of the project.

Table 1. Customer registration and asset onboarding functional requirements.

| No.	Process Step	Functional Requirement	MoSCoW
1	Customer Registration and Asset Onboarding	Capability to provide company registration details and accept platform's T&Cs (for participants).	Must
2	Customer Registration and Asset Onboarding	Capability to create (and remove) user accounts in the platform (for participants, host DNO, market operator).	Must
3	Customer Registration and Asset Onboarding	Capability to upload commercial and technical pre-qualification questionnaires to the trading platform.	Must
4	Customer Registration and Asset Onboarding	Capability to approve or reject participant organisations from the market (commercial pre-qualification).	Must
5	Customer Registration and Asset Onboarding	Capability to approve or reject participants' assets from the market (technical pre-qualification).	Must
6	Customer Registration and Asset Onboarding	Capability to send notifications to participants, market operator, and the host DNO.	Must
7	Customer Registration and Asset Onboarding	Capability to download commercial and technical pre-qualification questionnaires in their original formats.	Must
8	Customer Registration and Asset Onboarding	Capability to edit technical asset data in the platform (for the host DNO).	Should

4.2 Trading
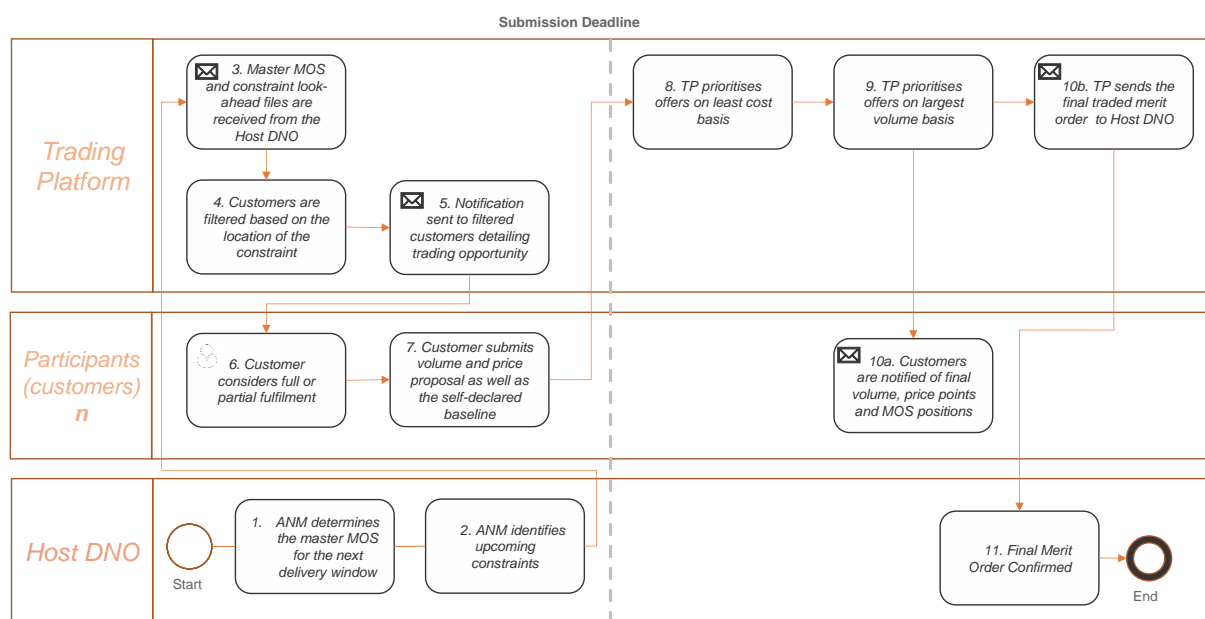
Figure 4. Trading process. Produced by Enzen, refined by Enzen, ENWL, Electron.

The trading process starts with the host DNO's ANM system identifying upcoming constraints, determining the master merit order stack, and feeding this information to the trading platform to enable trading (steps 1-3 in Figure 4). Using this information, the trading platform will identify assets that are expected to get curtailed the next day (buyers of flexibility) and assets that are capable of providing a curtailment avoidance service (sellers of flexibility) and will notify the participants (steps 4-5 in Figure 4).

After receiving the notification, participants will have to finalise their bids/ offers on the trading platform before the day-ahead submissions deadline (steps 6-7 in Figure 4). Participants that do not wish to trade can simply ignore the notification – no action is required on their behalf. Participants that do want to trade will have to make a bid/ offer submission with the following information:

- Asset name (or an alternative method to identify the asset).
- Price (availability and/ or utilisation, depending on the rules of the market).
- Traded volume.
- Self-declared baseline.
- Time window.

Following the day-ahead bid/ offer submissions deadline, the trading platform's matching engine will match the trades. The matching algorithm will match bids and offers on a two-part price (availability and utilisation). In market designs which a require a single price input (e.g., utilisation-only), the matching algorithm will ignore the second price input

(steps 8-9 in Figure 4). BiTraDER's matching algorithm is described in more detail in the BiTraDER Trading Rules report.

After matching the trades, the trading platform will re-order the master merit order stack by moving the buyers down to the bottom of the master merit order stack (curtailment queue) and bringing the sellers to the top. More details on the master merit order stack re-ordering process are available in the BiTraDER Trading Rules report. The "traded" master merit order stack will then be returned to host DNO's ANM system, awaiting execution (steps 10-11 in Figure 4).

Trading process functional requirements are listed in the table below.

Table 2. Trading process functional requirements.

| No.	Process Step	Functional Requirement	MoSCoW
9	Trading	Capability to receive and store constraint look-ahead and master merit order stack files from the host DNO's ANM system.	Must
10	Trading	Capability to filter constraint look-ahead and master merit order stack by participant.	Must
11	Trading	Capability to notify participants about the upcoming trading opportunities.	Must
12	Trading	Capability to accept bid/ offer submissions from participants, consisting of asset identifier field, price, volume, self-declared baseline, and time windows.	Must
13	Trading	Capability to impose market deadlines, e.g., bid/ offer submissions deadline and others.	Must
14	Trading	Capability to match trades based on the agreed trade matching process.	Must
15	Trading	Capability to re-order the master merit order stack, following trade matching.	Must
16	Trading	Capability to return the "traded" master merit order stack to host DNO.	Must

4.3 Trade Verification
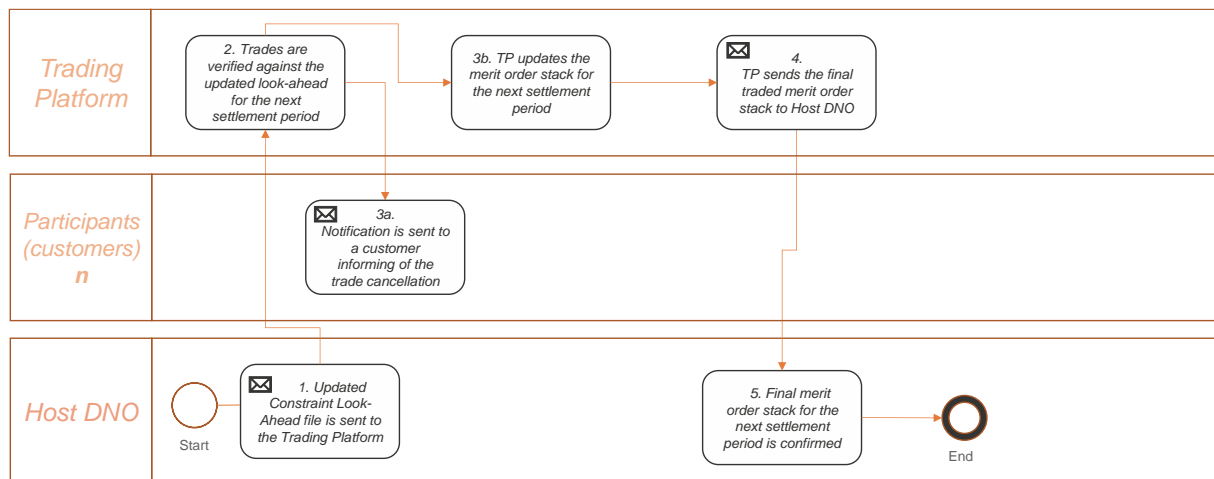
Figure 5. Trade verification process. Produced by Enzen, refined by Enzen, ENWL, Electron.

Trade verification process starts with the host DNO's ANM system sending updated constraint forecasts to the trading platform ahead of every settlement period before the dispatch (step 1 in Figure 5). Using this information, the trading platform will verify that the trades are valid and can be dispatched. This step of the end-to-end market process will help to ensure that the two trading parties remain on the same part of the network following any topology changes that may happen if a fault has occurred (step 2 in Figure 5).

Trades will be treated as valid if both trade counterparties appear on the updated constraint forecast. During the market trials, the trading platform will not consider the order in which assets appear on the updated constraint forecast and if the order changed from the initial forecast. In addition to this, during the trials the trading platform will treat both trade counterparties as equally effective in resolving the constraint, i.e., a 1 MW capacity increase/ decrease in one location (substation) is equal to 1 MW capacity decrease/ increase in another location. Trade verification process is going to be one of the key learnings of the BiTraDER project.

Once the trades are verified, the trading platform will re-order the master merit order stack and notify participants in case of trade cancellations (steps 3a and 3b in Figure 5). Then, the trading platform will return the updated master merit order stack to host DNO (steps 4-5 in Figure 5).

Table 3. Trade verification process functional requirements.

No.	Process Step	Functional Requirement	MoSCoW
17	Trade verification	Capability to receive and store updated constraint forecasts.	Must

No.	Process Step	Functional Requirement	MoSCoW
18	Trade verification	Capability to compare the updated constraint forecast with the original constraint forecast.	Must
19	Trade verification	Capability to cancel trades if one of the trade counterparties no longer appears on the constraint forecast.	Must
20	Trade verification	Capability to update the master merit order stack following trade cancellations.	Must
21	Trade verification	Capability to notify participants about trade cancellations.	Must
22	Trade verification	Capability to return the updated master merit order stack to host DNO.	Must

4.4 Dispatch

Following the trade verification process, host DNO's ANM system will issue dispatch instructions to participants. Participants with on-site technology capable of communicating with the host DNO's SCADA equipment directly will receive dispatch instructions from the ANM. Participants who do not have technology on-site to communicate with the host DNO's SCADA directly, dispatch instructions will be issued via the dispatch API.

Table 4. Dispatch process functional requirements.

No.	Process Step	Functional Requirement	MoSCoW
23	Dispatch	Capability by the trading platform to issue dispatch instructions to participants via SCADA.	Will not have
24	Dispatch	Capability by the trading platform to issue dispatch instructions to participants via API.	Will not have

4.5 Performance Verification and Settlement

The process diagram presented below covers both the performance verification and settlement steps of the end-to-end market process.
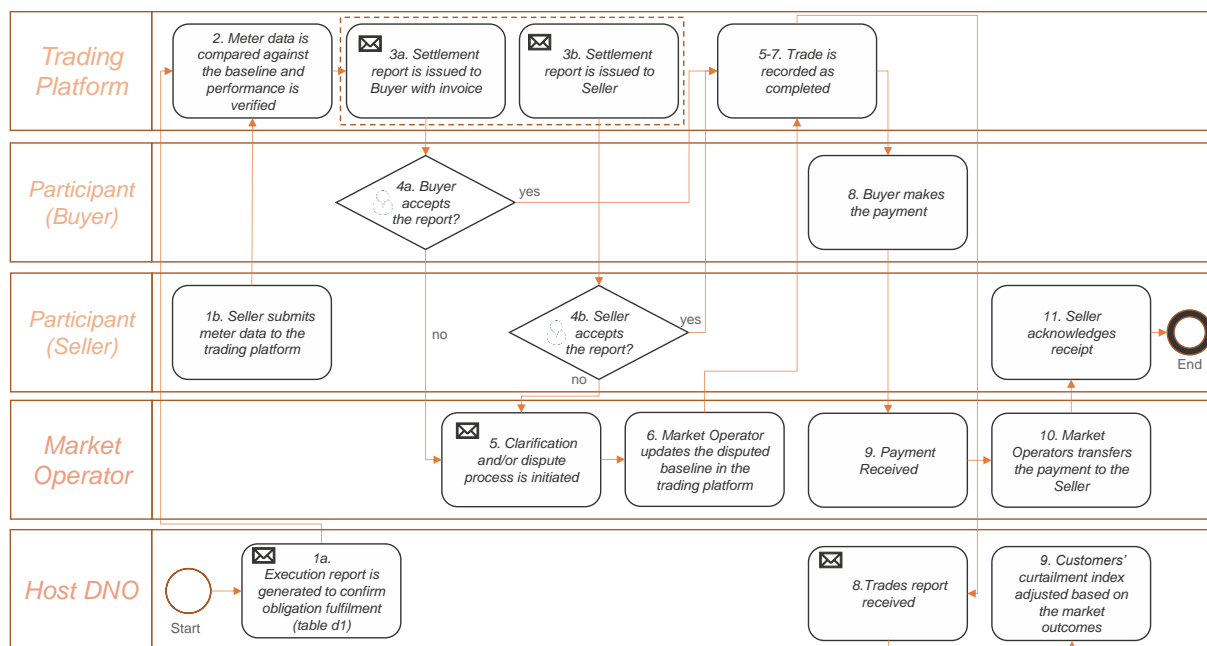
Figure 6. Performance verification and settlement processes. Produced by Enzen, refined by Enzen, ENWL, Electron.

4.5.1 Performance Verification

Once the service is delivered, trade performance will be measured and verified. The trading platform will receive the execution report from the host DNO detailing actions taken by the ANM system and asset meter readings from participants (steps 1a and 1b in Figure 6). Using the execution report and asset meter readings, the trading platform will measure the service provided by comparing the meter readings against the self-declared baselines provided by participants as part of their bid/ offer submissions (step 2 in Figure 6). More detailed information on the baseline methodology used in the BiTraDER market is available in the BiTraDER Trading Rules report.

After the performance is measured, the trading platform will issue settlement reports detailing provided service volumes and payments due (steps 3a and 3b in Figure 6). Settlement reports will be deemed accepted after 3 working days unless contested by either the buyer or the seller (steps 4a and 4b in Figure 6). If either one of the counterparties rejects the report, a dispute is raised. Disputes will be handled by the market operator who will initiate the dispute resolution process. Following the resolution of the dispute, market operator will confirm the volumes delivered and will record the trade as completed (steps 5-7 in Figure 6).

Table 5. Performance verification functional requirements.

No.	Process Step	Functional Requirement	MoSCoW
25	Performance verification	Capability to receive and store participant meter data.	Must

26	Performance verification	Capability to receive and store host DNO's Execution reports.	Must
27	Performance verification	Capability to carry out performance measurement and verification.	Must
28	Performance verification	Capability to generate settlement reports and present them to buyers and sellers.	Must
29	Performance verification	Capability to accept or reject settlement reports (by market participants).	Must
30	Performance verification	Capability to update self-declared baseline volumes and meter data readings in the system (by participants and by the market operator).	Must
31	Performance verification	Capability to record trades as completed (by the market operator after a dispute is resolved).	Must
32	Performance verification	Capability to notify the market operator about rejected settlement reports and other events.	Must
33	Performance verification	Capability to notify participants about settlement reports and other events.	Must

4.5.2 Settlement

After the trade is completed, the trading platform will generate the Trades report and send it to host DNO. Host DNO will utilise the information in the report to adjust participants' curtailment indices (steps 8-9 in Figure 6). Further details about this process can be found in the BiTraDER Trading Rules report.

Upon completion of the trade, the seller will generate the invoice and the market operator will transfer the funds to the seller. Simultaneously, the market operator will generate the invoice to the buyer and the buyer will make the payment to the market operator. Once the payment is received, the seller will acknowledge the receipt (following the seller's standard accounting processes) (steps 8-11 in Figure 6). This step signifies the end of the BiTraDER market process. The settlement process will provide valuable learnings from the BiTraDER project.

Table 6. Settlement process functional requirements.

No.	Process Step	Functional Requirement	MoSCoW
34	Settlement	Capability to generate Trades reports and send them to host DNO.	Must
35	Settlement	Capability to generate invoices after trades are completed.	Could

5 Practicalities of Running Market Trials

The BiTraDER market will be tested in market trials. The purpose of the market trials is to further refine market rules, trading processes, and the trading platform's functionality as well as test customers' interest in the curtailment obligations trading. The BiTraDER market trials will be conducted in three phases:

- **Mini trials.** The BiTraDER market will be tested through a series of paper trading workshops with the customer stakeholder group. These workshops will use digital tools to simulate market activity and test the trading rules.

- **Simulation trials.** The trading platform and the market will be tested through a series of "war games" scenario workshops with the customer stakeholder group. These workshops will interact with the trading platform, testing ease of access, functionality, and trading rules. Inputs to the platform will be simulated using data descriptions determined in the design phase.

- **Live network trials.** The trading platform and the market will be tested through live curtailment obligations trading using real network constraint information. This trial will test the full end-to-end market trading process, including real-time interactions between the trading platform and the host DNO's ANM system, with appropriate safety and cyber security measures in place.

Further detail on the market trials plan is available in the section 6 Trials plan of the BiTraDER Trials Plan, Trading Rules and Initial Specification Report.

One of the key objectives of the market trials is to test different market configurations and platform functionality, so it is important that the trading platform is configurable, and the functionality can be updated quickly. To align the expectations of all project stakeholders, we categorised the trading platform's functionality into three groups:

- **Core functionalities.** These are the functionalities that will be defined during the design and build phases of the project. Core functionalities will not be configurable during the market trials because of the amount of time and effort the changes will require.

- **Non-core functionalities.** These are the functionalities that will be defined during the design and build phases of the project, but non-core functionalities will be configurable during the trials. Configurations will need to be planned ahead of time and the amount of time required to configure a non-core functionality will depend on the complexity of change.

- **Configurable functionalities.** These are the functionalities that will be defined during the design and build phases of the project, but they will be fairly quick to configure during the trials. The changes will still need to be planned ahead, especially when tested in a series of back-to-back workshops.

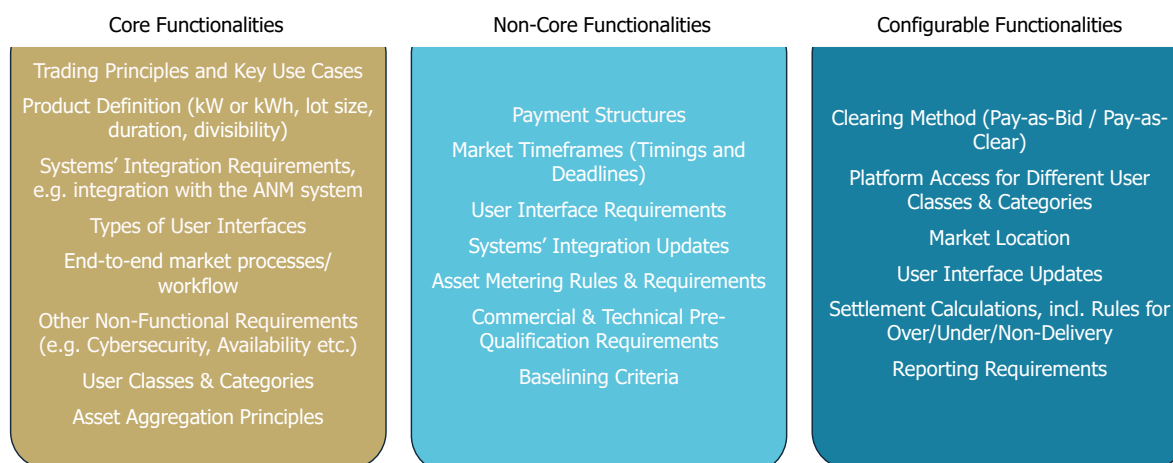The full list of functionalities is available in Figure 7 below.

Core Functionalities	Non-Core Functionalities	Configurable Functionalities
Trading Principles and Key Use Cases		
Product Definition (kW or kWh, lot size, duration, divisibility)	Payment Structures	Clearing Method (Pay-as-Bid / Pay-as-Clear)
Systems' Integration Requirements, e.g. integration with the ANM system	Market Timeframes (Timings and Deadlines)	Platform Access for Different User Classes & Categories
Types of User Interfaces	User Interface Requirements	Market Location
End-to-end market processes/ workflow	Systems' Integration Updates	User Interface Updates
Other Non-Functional Requirements (e.g. Cybersecurity, Availability etc.)	Asset Metering Rules & Requirements	Settlement Calculations, incl. Rules for Over/Under/Non-Delivery
User Classes & Categories	Commercial & Technical Pre-Qualification Requirements	Reporting Requirements
Asset Aggregation Principles	Baselining Criteria	

Figure 7. Core, non-core, and configurable trading platform functionality.

Core functionalities:

- Trading principles and key use cases.

- Product definition (unit of trade, lot size, trade duration, trade divisibility).

- Systems' integration requirements.

- User interface types.

- End-to-end market processes/ workflow.

- Non-functional requirements, e.g., cybersecurity, reliability, availability, performance, and others.

- User classes and categories.

- Asset aggregation principles and rules.

Non-core functionalities:

- Payment structures (availability and utilisation, utilisation-only).

- Market timeframes (timings and deadlines).

- User interface requirements.

- Systems' integration updates.

- Asset metering rules and requirements.

- Commercial and technical pre-qualification requirements.
- Baselining criteria.

Configurable functionalities:

- Clearing methods (pay-as-bid, pay-as-clear).
- Platform access for different user classes and categories.
- Market location.
- User interface updates.
- Settlement calculations, including rules over-delivery and under-delivery.
- Reporting requirements.

Appendix A. Trading Platform's High Level Functional Requirements (Full List)

No.	Process Step	Functional Requirement	MoSCoW
1	Customer Registration and Asset Onboarding	Capability to provide company registration details and accept platform's T&Cs (for participants).	Must
2	Customer Registration and Asset Onboarding	Capability to create (and remove) user accounts in the platform (for participants, host DNO, market operator).	Must
3	Customer Registration and Asset Onboarding	Capability to upload commercial and technical pre-qualification questionnaires to the trading platform.	Must
4	Customer Registration and Asset Onboarding	Capability to approve or reject participant organisations from the market (commercial pre-qualification).	Must
5	Customer Registration and Asset Onboarding	Capability to approve or reject participants' assets from the market (technical pre-qualification).	Must
6	Customer Registration and Asset Onboarding	Capability to send notifications to participants, market operator, and the host DNO.	Must
7	Customer Registration and Asset Onboarding	Capability to download commercial and technical pre-qualification questionnaires in their original formats.	Must
8	Customer Registration and Asset Onboarding	Capability to edit technical asset data in the platform (for the host DNO).	Should
9	Trading	Capability to receive and store constraint look-ahead and master merit order stack files from the host DNO's ANM system.	Must
10	Trading	Capability to filter constraint look-ahead and master merit order stack by participant.	Must
11	Trading	Capability to notify participants about the upcoming trading opportunities.	Must
12	Trading	Capability to accept bid/ offer submissions from participants, consisting of asset identifier field, price, volume, self-declared baseline, and time windows.	Must
13	Trading	Capability to impose market deadlines, e.g., bid/ offer submissions deadline and others.	Must
14	Trading	Capability to match trades based on the agreed trade matching process.	Must
15	Trading	Capability to re-order the master merit order stack, following trade matching.	Must

16	Trading	Capability to return the "traded" master merit order stack to host DNO.	Must
17	Trade verification	Capability to receive and store updated constraint forecasts.	Must
18	Trade verification	Capability to compare the updated constraint forecast with the original constraint forecast.	Must
19	Trade verification	Capability to cancel trades if one of the trade counterparties no longer appears on the constraint forecast.	Must
20	Trade verification	Capability to update the master merit order stack following trade cancellations.	Must
21	Trade verification	Capability to notify participants about trade cancellations.	Must
22	Trade verification	Capability to return the updated master merit order stack to host DNO.	Must
23	Dispatch	Capability by the trading platform to issue dispatch instructions to participants via SCADA.	Will not have
24	Dispatch	Capability by the trading platform to issue dispatch instructions to participants via API.	Will not have
25	Performance verification	Capability to receive and store participant meter data.	Must
26	Performance verification	Capability to receive and store host DNO's Execution reports.	Must
27	Performance verification	Capability to carry out performance measurement and verification.	Must
28	Performance verification	Capability to generate settlement reports and present them to buyers and sellers.	Must
29	Performance verification	Capability to accept or reject settlement reports (by market participants).	Must
30	Performance verification	Capability to update self-declared baseline volumes and meter data readings in the system (by participants and by the market operator).	Must
31	Performance verification	Capability to record trades as completed (by the market operator after a dispute is resolved).	Must
32	Performance verification	Capability to notify the market operator about rejected settlement reports and other events.	Must
33	Performance verification	Capability to notify participants about settlement reports and other events.	Must

| 34 | Settlement | Capability to generate Trades reports and send them to host DNO. | Must |
| 35 | Settlement | Capability to generate invoices after trades are completed. | Could |