

ELECTRON

BiTraDER Platform Development Report

WP6 Application and User Interface/Experience Development

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Abbreviations

- ANM – Active Network Management
- API - Application Programming Interface
- CLA – Constraint Look-Ahead
- DNO – Distribution Network Operator
- ENA Energy Networks Association
- ENWL – Electricity North West Limited
- MOL – Merit Order List

Definitions

- BiTraDER Adapter – BiTraDER adapter service which supports BiTraDER-specific functionality
- BiTraDER Platform – The platform that is used to run the BiTraDER market
- ElectronConnect Platform – Electron’s flexibility market platform which supports a range of trading arrangements and market products

1 Introduction

This document is a summary report of the BiTraDER Platform's build phase. It discusses the approach taken to build the BiTraDER Platform, provides an overview of the components that were built or configured for the simulation trials, and captures the lessons learnt during the build phase.

2 ElectronConnect Platform

2.1 ElectronConnect Platform Overview

ElectronConnect is a flexibility market platform which enables and coordinates localised energy markets and distributed energy resources to increase the utilisation of renewable power and network capacity, guaranteeing the best available price for all parties and every transaction.

ElectronConnect supports a range of trading arrangements (e.g. payment types, matching and clearing configurations) and market products. In addition, multiple market configurations can run on the platform simultaneously, e.g. with different gate closures, payment types, qualification requirements etc.

The platform supports the end-to-end flexibility trading lifecycle, including:

- Provider and resource registration and user management processes.
- Commercial and technical pre-qualification processes.
- Flexibility requirements sign-posting process.
- Bid/ offer submissions process and trade matching.
- Rules-based market coordination.
- Dispatch instructions.
- Performance measurement and verification process.
- Invoicing and settlement process.

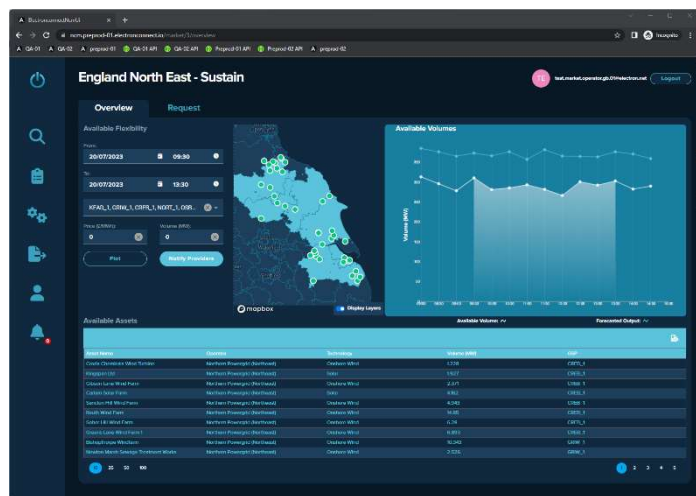


Figure 1. ElectronConnect Platform. Source: Electron.

- Data analytics and reporting.

ElectronConnect benefits:

Configurability. ElectronConnect supports many market configurations and trading use cases, e.g. peak shaving, load shifting, curtailment avoidance, and peer-to-peer transactions. Market operators can launch new markets quickly using preconfigured templates and run these simultaneously alongside other markets. The ability to define relationships between markets on the ElectronConnect Platform enables value stacking and facilitation of primacy rules.

Scalability. ElectronConnect is built with a high degree of automation and is powered by the underlying technology capable of handling real-time flexibility trading. This scalability has been proven in multiple live deployments. ElectronConnect is secure and follows best cybersecurity practices. Electron is ISO27001:2013 certified.

Inclusivity. ElectronConnect enables an ecosystem of aggregators and service providers of many types and sizes, providing access multiple market opportunities. The platform supports web application-based and flat file upload for providers who are operating at lower scale, as well as fully documented Application Programming Interfaces (APIs) for tech-enabled providers to interact with all functions programmatically.

Ease of Use. ElectronConnect is easy to use and built following the principles of Customer-Centric Design. It improves user experiences for both market operators and flexibility service providers, be it through the ElectronConnect Web App or the ElectronConnect API. ElectronConnect's user experience has been designed engaging with >30 flexibility service providers and market operators to understand and solve for key points of friction in the flexibility journey today. This feedback informed some key design choices to maximise flexibility service provider satisfaction.

2.2 ElectronConnect and BiTraDER

The BiTraDER Platform leverages the ElectronConnect Platform's capabilities. The unique logic and configurations developed for BiTraDER described in other sections of this report are tailored to this project and do not impact the functionality of the ElectronConnect Platform.

3 BiTraDER Platform Overview

The BiTraDER Platform consists of two key components:

- The BiTraDER Adapter, which facilitates BiTraDER-specific functionality, such as constraint look-ahead filtering, the merit order list (MOL) re-ordering processes and the interface between ENWL’s Active Network Management (ANM) system and the ElectronConnect Platform.
- ElectronConnect Platform, which supports the complete end-to-end process and functionality for many-to-many flexibility markets including user registration and commercial qualification, asset registration and technical qualification, asset bids and offers submission, many-to-many trade matching algorithm, dispatching capabilities, performance verification, and settlement processes.

BiTraDER Platform high-level architecture is presented below:

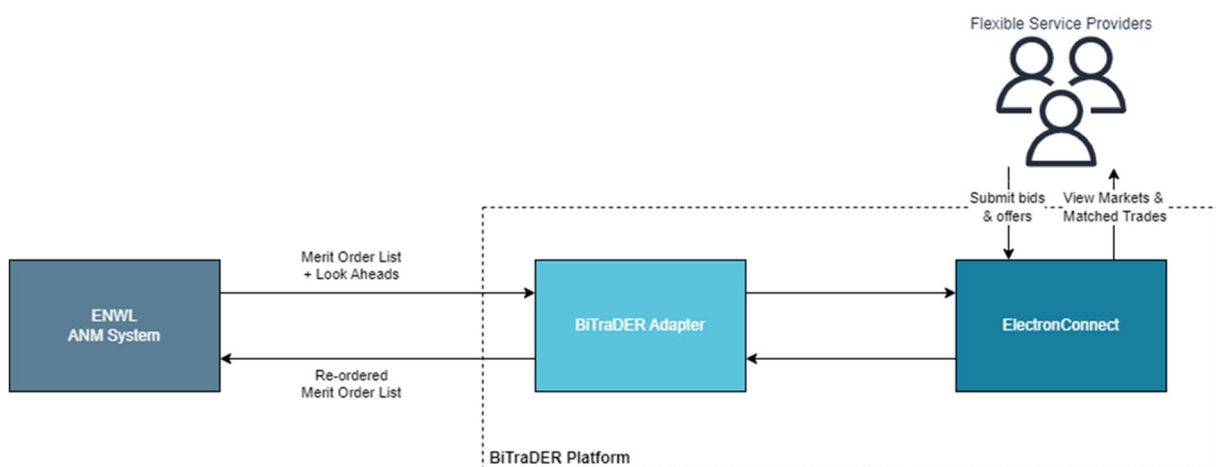


Figure 2. BiTraDER Platform Architecture. Source: Electron.

The BiTraDER Adapter has been developed to encapsulate the business logic specific to BiTraDER and the integration with the ANM system. Specifically, this BiTraDER Adapter:

- Receives and validates the MOL and the constraint look-ahead data from the ANM system.
- Identifies the potential market participants and their corresponding trading opportunities to buy or sell curtailment obligations under a specific constraint.
- Instructs ElectronConnect to create the constraint-specific day-ahead peer-to-peer markets for BiTraDER.
- Processes the resulting trades to re-order market participants position in the MOL and recalculate the size of their curtailment instructions.
- Exposes the re-ordered MOL to the ANM system.

The BiTraDER Platform also relies on the ElectronConnect Platform. Using the ElectronConnect Platform, BiTraDER market participants:

- Register their assets.
- Browse the trading opportunities related to their assets.
- Submit bids or offers depending on if their asset is covered under one of the constraint-specific markets.
- View the results of the trades they participate in.

4 BiTraDER Build Phase

BiTraDER build phase timeline and process are presented below.

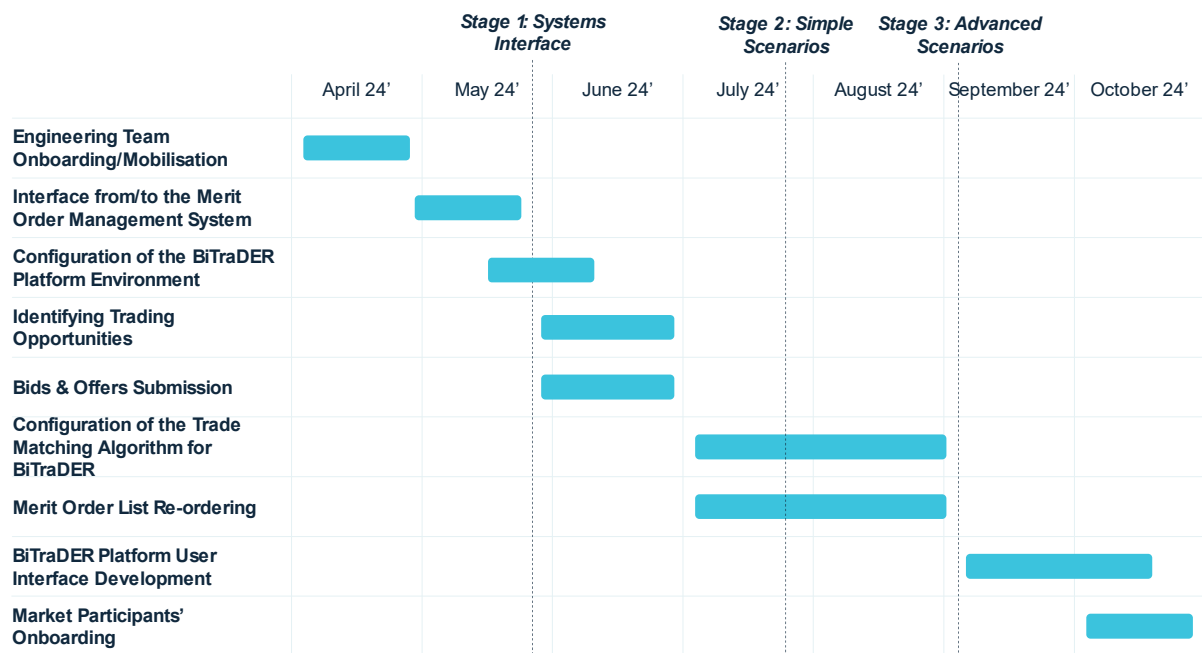


Figure 3. BiTraDER Build Phase Timeline. Source: Electron.

During the build phase of the BiTraDER project, the project team adopted a staged delivery approach, with the solution being developed in three stages. At the conclusion of each stage, newly implemented functionality was demonstrated to the project team. These demonstrations involved thorough integration testing which served multiple purposes:

- It validated that the new functionality met the specified requirements and allowed for early identification and resolution of issues and misalignments.
- It ensured smooth integration between two external systems.
- It provided tangible evidence of progress to project partners at regular intervals.
- It promoted transparency and collaboration throughout the development process between Electron and ENWL.

4.1 Development Stages

4.1.1 [Stage 1: ElectronConnect and ENWL ANM Interface](#)

The first round of integration testing focused on establishing the interface between the BiTraDER Platform and ENWL's ANM replica system, the Orchestrator tool. This test involved the ElectronConnect Platform receiving constraint look-ahead and MOL information from the Orchestrator tool and returning the MOL unchanged. Both Electron and ENWL teams confirmed successful API responses (200), proving successful integration between the two systems.

4.1.2 [Stage 2: Simple Trials Scenarios](#)

The second round of testing aimed to prove the BiTraDER Platform's ability to support trading for simple trial scenarios. This included functionality to identify trading opportunities by filtering constraint look-aheads and MOLs, ElectronConnect Platform's functionality to submit bids and offers into the market, ElectronConnect Platform's trade matching algorithm, and MOL re-ordering logic and mechanism. The test was successfully completed by trading on simulation trials scenario 1, with the ENWL team confirming a successful GET API response (200) and successfully retrieving re-ordered MOLs from the platform. This round was crucial in demonstrating the BiTraDER Platform's trading capabilities. This functionality was further developed for Stage 3 of testing where more complex trading scenarios were validated.

4.1.3 [Stage 3: Advanced Trials Scenarios](#)

The final stage of integration testing expanded to cover all simulation trial scenarios, including those with Flexible Services contracts, multiple buyer contracts, and Curtailment Index updates. Additionally, this stage validated the BiTraDER Platform's capability for partial capacity trading, allowing larger contracts to be split into multiple smaller ones. The test was completed by successfully trading on simulation trials scenarios 2-7, with ENWL's team confirming successful GET API responses (200) for all described scenarios and successfully retrieving re-ordered MOLs from the BiTraDER Platform. This phased integration testing approach allowed the project team to systematically verify the BiTraDER Platform's functionality, from basic communication to complex trading scenarios, ensuring a robust and reliable system ready for deployment.

4.2 Development Process

Typically, the ElectronConnect Platform supports network and system operators to increase participation and value in existing flexibility markets. The BiTraDER project complements this model, by including the development of new rules for trading curtailment obligations, as well as an interface to communicate between ENWL's ANM

system and the trading platform. Therefore, the BiTraDER platform's discovery process was a joint venture between multiple project partners with varied expertise including market design, flexibility services and network management.

During the design phase, the project partners collaborated to agree functional requirements for the BiTraDER Platform, the system data architecture and the API specification, to ensure consistency when developing a technical product collaboratively.

Before starting the build phase, the Electron team conducted internal domain knowledge sessions to equip developers with a thorough understanding of the ENWL ANM system, ensuring they were well-prepared to develop the interface between this system and the trading platform.

During the build phase, the BiTraDER project team split the development into 3 stages, as previously outlined. The Electron product team broke these stages down further into epics, large work packages used to manage deadlines and plan the expected workload on the engineering team. These epics were prioritised in weekly planning sessions by the product and engineering leads. Once epics were prioritised, the product and engineering teams used epic refinement sessions to break down epics into smaller, more manageable user stories.

The product team and the engineering team collaborated to fill in the details of each user story as they approached the start of its development. In story refinement sessions, they engaged in discussion so that the scope and desired outcome of the user story was clear. Additional outcomes of these sessions were an estimation of the effort required to complete development of each user story, and acceptance criteria - a checklist that verified the completed user story would meet project requirements.

Once the entire team had agreed to the content and scope of the user stories, the engineering team underwent task breakdown sessions, where they split each user story into a set of manageable tasks containing detailed steps for implementation and testing. Once all tasks within a user story were completed, the engineering and product teams would carry out a review where the engineering team demonstrated that the completed user story fulfilled the agreed acceptance criteria.

5 BiTraDER Platform Components

This section of the report covers the BiTraDER Platform functionality that was built or configured for the simulation trials.

5.1.1 [Constraint Look-Ahead Filtering and Merit Order List Re-ordering](#)

As part of the constraint look-ahead filtering and master MOL re-ordering process, the BiTraDER Platform:

- Identifies all predicted constraints, their sizes, duration, start and end times.
- Identifies all resources (buyers and sellers) in the constraint look-ahead and checks whether they are registered on the BiTraDER Platform.
- Identifies resources from the constraint look-ahead in the MOL and filters out (excludes) resources that are not allowed to trade in the market, such as resources that are contracted to provide a flexible service or resources that are not signed up to BiTraDER. In some cases, resources can have multiple contracts in the MOL, some of which can be traded in the BiTraDER market while other contracts of the same resource cannot.
- Calculates the maximum capacity that buyers and sellers can trade in the BiTraDER market.
- Produces constraint-specific MOLs, which are used to notify participants about trading opportunities.

5.1.2 [User Registration](#)

Using the ElectronConnect platform's capabilities, the BiTraDER Platform allows market participants to register on the BiTraDER deployment. As part of this process, participants are required to provide top-level company information which needs to be reviewed and approved by the BiTraDER market's market operator. For the simulation trials, this functionality was used to register and approve 10 market participant accounts.

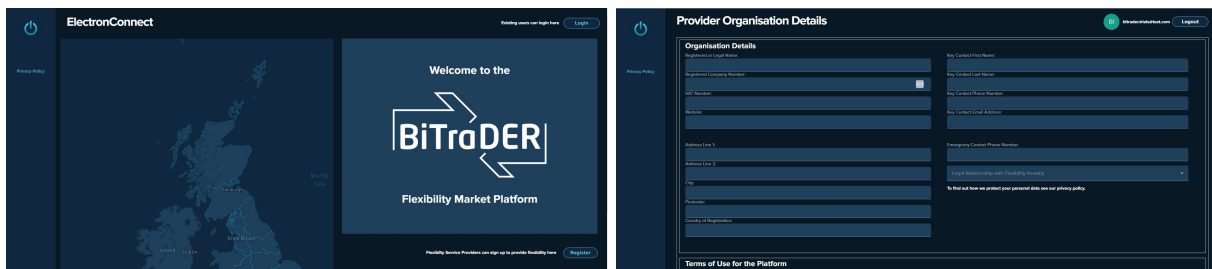


Figure 4. BiTraDER Platform User Registration. Source: Electron.

5.1.3 [Asset Registration](#)

The BiTraDER Platform offers asset registration workflows supported by the ElectronConnect platform. The registration form follows the ENA ON Flexibility Service Pre-qualification Standard Template, ensuring consistency with industry standards. For the first group of simulation trial scenarios, ten assets were registered - one for

each participant. The project team anticipates a total of 40 assets to be registered throughout the simulation trials.

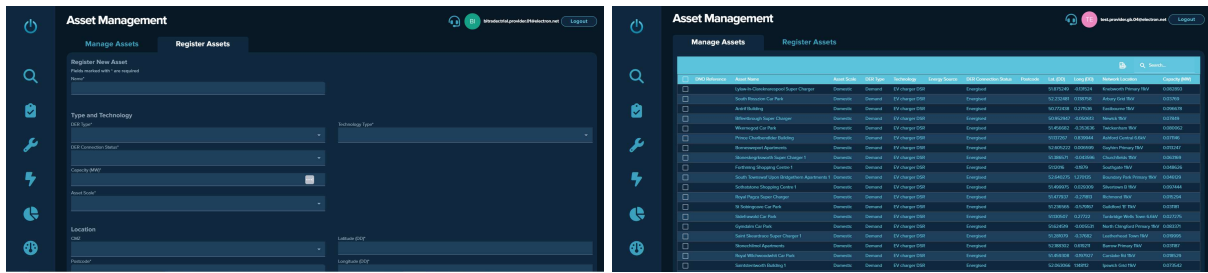
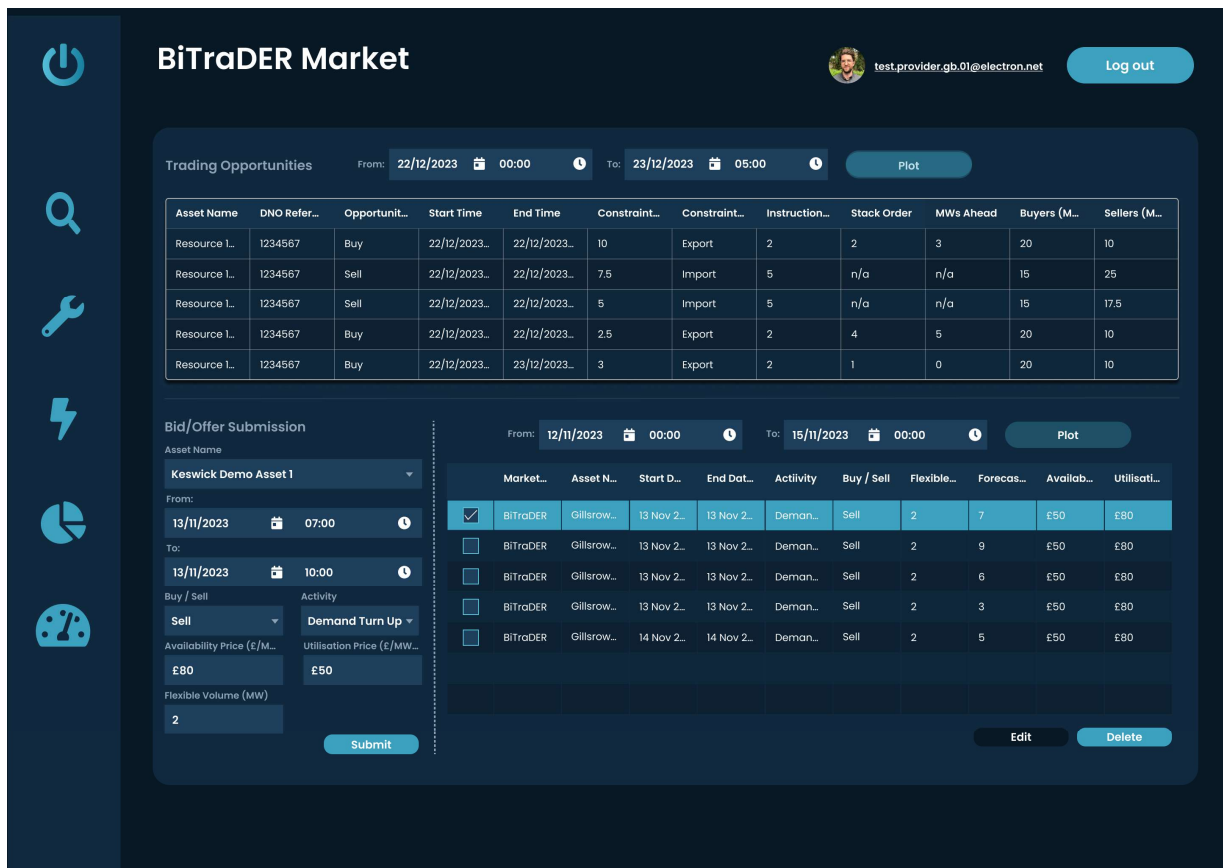


Figure 5. BiTraDER Platform Asset Registration. Source: Electron.

5.1.4 Trading Opportunities and Bids and Offers Submission

Supported by the ElectronConnect Platform’s capabilities, the BiTraDER Platform presents trading opportunities to BiTraDER market participants and allows them to submit bids and offers into the market. The trading opportunities table on the BiTraDER deployment is configured to display BiTraDER-specific information – the type of trading opportunity, constraint start and end time, constraint size, curtailed capacity, asset’s position in the MOL, and more.



After reviewing this information, participants can submit a bid (to buy a service) or an offer (to sell a service) into the BiTraDER market. To do this, participants are required

Figure 6. BiTraDER Platform Trading Opportunities. Source: Electron.

to select an asset they want to trade with and specify the prices (availability and utilisation) and the capacity they want to trade. As part of their offers, sellers are also required to specify the type of service they want to provide.

5.1.5 [Trade Matching Algorithm](#)

The BiTraDER Platform utilises the ElectronConnect Platform's trade matching algorithm to facilitate the BiTraDER trading rules. In the BiTraDER market, each bid or offer consists of an availability price and a utilisation price, which are added together to calculate the total bid or offer price. Bids and offers are matched based on the total price (availability plus utilisation) and the availability payment. The matching algorithm supports trade matching for bids and offers of different sizes (capacity) - a large bid can be matched to multiple smaller offers (or vice versa), as long as the price conditions are met.

More information about the BiTraDER trading rules are available in the [BiTraDER Trading Rules report](#).

5.1.6 [Performance Verification](#)

Using the capabilities of the ElectronConnect Platform, the BiTraDER Platform offers performance verification workflows to market participants. As part of this process, sellers in BiTraDER will be required to submit their meter data and baselines to the BiTraDER Platform, which will then calculate the capacity delivered during dispatch events. During the simulation trials, this functionality will be used in a select number of scenarios to introduce participants to the performance verification concept and test different baselining methods.

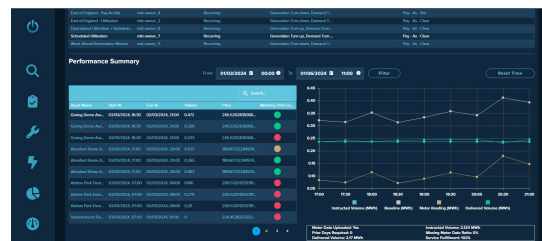


Figure 7. BiTraDER Platform Performance Verification. Source: Electron.

6 BiTraDER Lessons Learnt

The iterative development process was crucial in enabling Electron and ENWL to work collaboratively to create a valuable product that implemented novel trading algorithm logic for a variety of realistic constraint scenarios.

Early integration testing between the Orchestrator and the BiTraDER Adapter allowed potential issues to be quickly identified and addressed, reducing the risk of major setbacks later in the process. Splitting the scenario-based testing into two stages – simple and advanced – allowed the development of the BiTraDER Platform to be successfully broken down into manageable sections.

Product demonstrations at the end of each development stage validated that agreed requirements had been met and provided evidence of progress to external partners, increasing their confidence in project feasibility. Regular meetings with project stakeholders enhanced transparency between organisations and allowed for adjustments to requirements when new information emerged during development. For example, additional scenarios were incorporated which had not been identified during the design phase. This flexible approach was especially useful because the ANM and ElectronConnect systems which the BiTraDER Platform is dependent on are both being continually developed in real time.

The development process was also supported by comprehensive documentation created in earlier project phases. An example is the detailed API interface specification which ensured consistent naming conventions and data formats between the ENWL ANM and ElectronConnect trading platform systems. Additional design documentation and decision logs proved to be invaluable reference sources for explaining the latest design rationale. This was particularly valuable as BiTraDER contains novel trading rules and complex, evolving domain knowledge.

The underlying logic developed during the design phase played a pivotal role in shaping the integration process between the ANM system and the ElectronConnect trading platform. Whilst there was thorough design documentation explaining this logic, test data used during integration did not consistently follow these agreed rules. This caused confusion during the build and test of the BiTraDER Platform.

The ENWL ANM system is a highly complex system that contain logic specific to the associated DNO and network area. The above example outlines the importance of using high quality test data in innovation projects such as BiTraDER, to ensure clarity among numerous stakeholders from different organisations working with multiple complex systems.

Additionally, establishing a space for collaborative, synchronous updates to working documentation would further support collective product development, and provide a more direct communication path between engineers and DNO subject matter experts.

7 BiTraDER Platform Transition to Live Network Trials

This section of the report provides an early assessment of the changes required to transition the BiTraDER Platform from the simulation trials to the live network trials, contingent upon the project passing the stage gate.

7.1 Integration with a Live ANM System

To support the simulation trials, the project team has designed and implemented an interface, the BiTraDER Adapter, between the ElectronConnect Platform and the Orchestrator tool. The Orchestrator tool is a replica ANM system which provides simulated network scenarios that are crucial for running the simulation trials.

For the live network trials, a new interface between the BiTraDER Platform and the live ANM system will need to be established. This transition will require:

1. **Cyber Security:** Implementing robust security measures to protect the live network.
2. **Comprehensive Testing:** Ensuring the new interface functions correctly and safely in a live environment.

7.2 Trade Verification

The trade verification process ensures that all agreed trades remain valid on the day of dispatch. This step is crucial because network topology may change after a trade has been agreed upon. The verification process checks that sellers can still provide a useful service to buyers and confirms whether trading counterparties are still connected to the same part of the network. If they are no longer appropriately connected, the trade will be cancelled.

This process protects buyers from paying for services that do not help them avoid curtailment. If a trade is cancelled, the MOLs will be re-ordered to reflect this change. This functionality may need to be introduced to the BiTraDER Platform for the upcoming live network trials.

7.3 Dispatch

For the simulation trials, the project team has simplified the dispatching process by instructing participants via email. This method will change for the live trials, as assets will require real-time dispatch in alignment with ENWL's ANM system operations.

The ElectronConnect Platform is capable of real-time asset dispatch via API. To receive instructions, each asset operator must configure a web-hook URL. During the live trials, dispatch instructions will originate from ENWL's ANM system, requiring an interface between the BiTraDER Platform and ENWL's ANM system.

If the project passes the stage gate, the team will assess the need for utilising ElectronConnect Platform's dispatching capabilities during the live network trials.

7.4 Settlement Process and Methodology

The ElectronConnect Platform adheres to the ENA's standardised settlement methodology, which extends to the BiTraDER Platform. This methodology defines specific settlement parameters for different standard flexibility products in the UK, including Grace Factors and Performance Multipliers.

If the project transitions to live network trials, the team will need to evaluate the suitability of standard settlement parameters for BiTraDER's many-to-many trading model and the implications of any deviations from the ENA's standardised methodology. The project team's analysis will help determine whether the existing methodology can effectively support BiTraDER's market design or if customisations are required.