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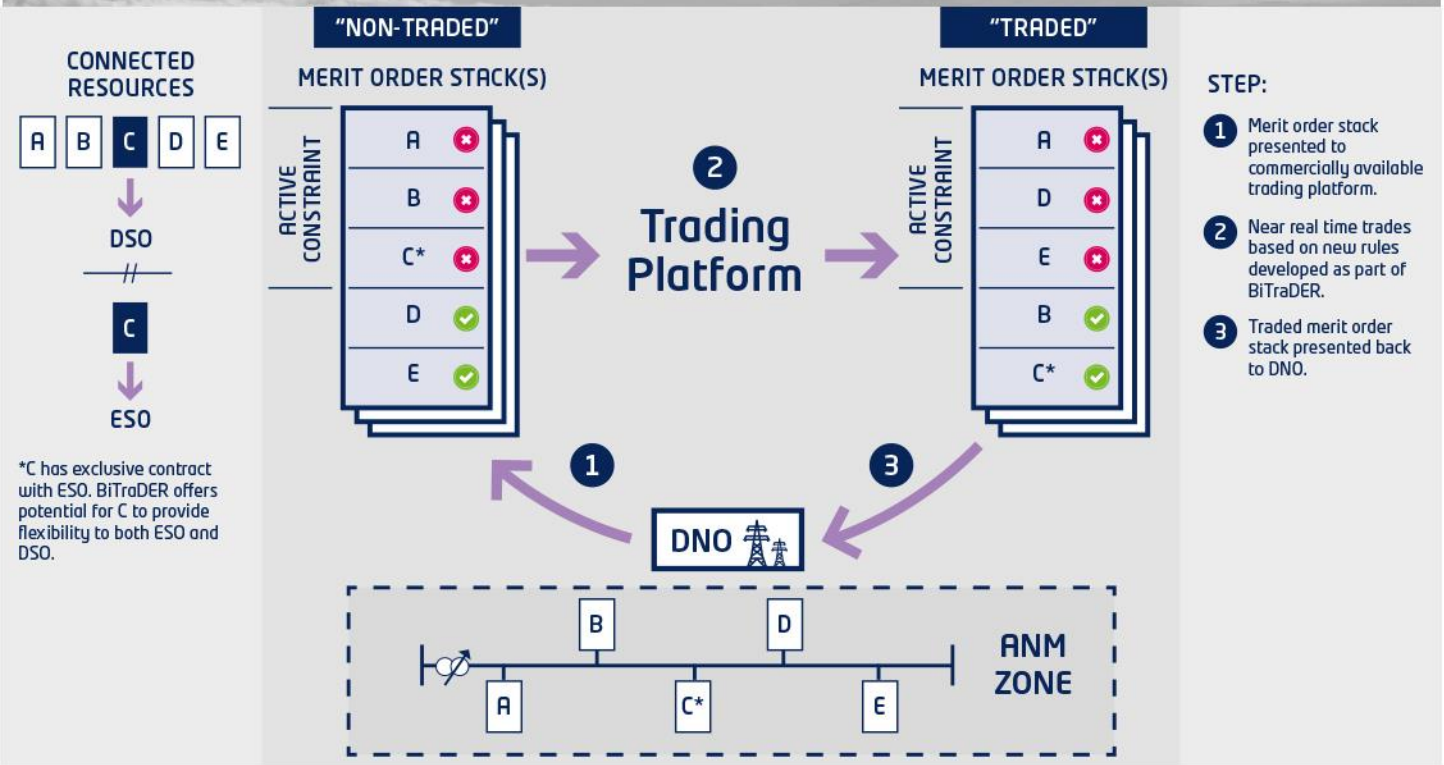
Bringing energy to your door

BiTraDER

Network Innovation Competition 2021



Project Partners

AFRY AF PÖYRY

ELECTRON

DELTA-EE

Network Innovation Competition: Full Submission Application (ENWEN04)

1. Project Summary

1.1 Project Title	BiTraDER		
1.2 Project Explanation	Using extensive engagement with connected resources, culminating in their participation in a real-life trial, BiTraDER will demonstrate how access to a neutral market allows connected resources to trade their obligations bilaterally, encouraging more of them to offer flexible services, increasing availability of flexibility and thereby reducing whole system costs.		
1.3 Funding Licensee	Electricity North West Ltd. (ENWL)		
1.4 Project Description	1.4.1. *The Problem:* BiTraDER will address problems faced by the DNO with accessing flexible resources on the electricity distribution network and concerns providers have in operating flexibly. Currently, connected resources are reluctant to accept a flexible connection or offer flexibility services owing to the risk of curtailment. While not an issue for carbon intensive resources, flexible connections are problematic for those wishing to connect low carbon, renewable energy sources. This results in a lack of competition, making it more challenging and expensive for the DNO to obtain flexibility, and resulting in expensive and carbon intensive network reinforcement. In addition, when contracted to provide services to the ESO, a connected resource cannot also provide services to the DNO – neutralising capacity associated with the use of ANM and limiting opportunities for customers. 1.4.2. *The Method:* BiTraDER will investigate, develop and trial – live on our network – options for introducing a transparent trading market for connected resources to trade curtailment obligations bilaterally, within regionally aggregated stacks. 1.4.3. *The Solution:* acting neutrally, the DNO will facilitate this market. Through optimisation of the stacks, the risk of curtailment can be mitigated, encouraging wider participation in flexible services and leading to increased availability of flexibility for the DNO/ESO. 1.4.4. *The Benefit:* this will improve the likelihood of customers accepting flexible connections and services, reduce barriers to the uptake of low carbon RES, introduce a new source of flexibility to the ESO, boost value for connected resources, and address concerns of capacity being neutralised by ESO contracts. BiTraDER will produce a functional specification detailing the requirements for facilitating bilateral trading, including platform, market model, data requirements and interface. This, alongside the Method, will be made available to all DNOs to allow these benefits to be passed to customers across GB.		
1.5. Funding			
1.5.1. NIC Funding Request (£k)	£6,789,709.47	1.5.2. Network Licensee Compulsory Contribution (£k)	[redacted]

1.5.3. Network Licensee Extra Contribution (£k)		1.5.4. External Funding – excluding from NICs (£k)	[redacted]
1.5.5. Total Project Costs (£k)	£8,367,858.49		
1.6. List of Project Partners, External Funders and Project Supporters (and value of contribution)	Project Partners: Electron [redacted], AFRY [redacted], Delta-EE [redacted] Supporters: National Grid ESO, SPEN, ENA Open Networks		
1.7. Timescale			
1.7.1. Project Start Date	11/05/2022	1.7.2. Project End Date	31/07/2026
1.8. Project Manager Contact Details			
1.8.1. Contact Name and Job Title	Dan Randles, Head of Network Innovation	1.8.2. Email and Telephone Number	Dan.Randles@enwl.co.uk 07917658031
1.8.3. Contact Address	Electricity North West Ltd, Innovation Forum, 51 Frederick Road, Salford, M6 6FP.		
1.9. Cross Sector Projects (only complete this section if your project is a Cross Sector Project, ie involves both the Gas and Electricity NICs).			
1.9.1. Funding requested the from the [Gas/Electricity] NIC (£k, please state which other competition)			
1.9.2. Please confirm whether or not this [Gas/Electricity] NIC Project could proceed in the absence of funding being awarded for the other Project.			
1.10. Technology Readiness Level (TRL)			
1.10.1. TRL at Project Start Date	6	1.10.2. TRL at Project End Date	8

2. Project Description

BiTraDER will demonstrate how access to a neutral secondary market can allow connected resources to trade their curtailment obligation bilaterally, encouraging more customers to provide flexibility and reducing whole system costs.

2.1. Aims and objectives

The Problem

As part of the UK's journey toward net zero, Distribution Network Operators (DNOs) are experiencing an increase in requests by customers to connect low carbon, renewable energy sources to the network. To avoid the need for expensive, time-consuming and disruptive network reinforcement, DNOs have introduced flexible connection arrangements for customers.

Where a generation customer accepts a flexible connection to the network, the DNO can curtail that generator's output to ease pressure on the network when the demand exceeds capacity. This is known as a "curtailment obligation", which rests with the connected customer. Similar obligations may be introduced for demand customers who choose to connect flexibly. Known as a flexible connection, the curtailment obligation is captured in the customer's connection contract and is therefore a contractual obligation or liability. In return for accepting these obligations, customers can connect to the network at lower cost than they would pay if their connection was non-flexible (i.e. firm). The customer is essentially agreeing to operate flexibly within the real-time network capacity limit.

Separate from this, customers sometimes agree to increase generation output (or reduce demand) at times defined by the DNO. Known as flexible services, these customers are remunerated appropriately for providing them.

DNOs use both flexible connections and flexible services alongside advance network automation algorithms, known as Active Network Management (ANM), providing real-time control of the connected customer's generation or demand output.

However, owing to the commercial risk associated with accepting a flexible connection (i.e. the risk of not being able to operate normally), many customers are hesitant to accept the DNO's offer of a flexible connection (or provide a flexible service), preferring instead a firm connection to the network with zero curtailment obligation.

In the case of low carbon generation such as solar, owing to the high capital investment required to establish the facility in the first instance, customers need certainty of a high in-service utilisation factor, meaning they are particularly sensitive to the risk of curtailment and much less likely to accept a flexible connection.

Furthermore, customers that might wish to offer flexible services are similarly concerned about the risk of their having to do so during a period where they cannot meet this obligation and where they have no means of mitigating this risk.

BiTraDER will allow new and existing customers to mitigate the risks associated with curtailment obligations.

To summarise, the active operation by DNOs of distribution networks and the connection of customers on flexible connections has several problems. If unresolved, these could limit the availability of flexible resources, resulting in delays to or reductions in the connection of renewable technologies, and require expensive and time-consuming network reinforcement. These problems include:

- Customers planning to connect to an actively managed network, particularly low carbon resources such as solar farms, are often reluctant to accept a flexible connection as the potential restrictions on export or import associated with the curtailment obligation often undermine the business case.

- Existing customers with firm connections to the network are reluctant to offer flexible services because of the long-term commitment involved in accepting a flexible services contract and the risk they cannot meet the associated commitment, combined with the inability to mitigate the risk.
- Existing customers with firm connections to the network may have a desire to offer flexibility services but are reluctant to enter into long-term contracts and would instead prefer to offer such services on an ad hoc basis.
- A lack of competition means it is often expensive for the DNO to buy flexible services, meaning they are unviable. This can lead the network requiring expensive and time-consuming reinforcement and thus delays the connection of low carbon, renewable energy sources.
- Exclusivity in ESO contracts and the lack of operational co-ordination between DNO and ESO with regards flexible service contracts reduces the scope for firm-connected resources to offer the DNO flexible services if they are already committed to the ESO (and vice versa), preventing the customer from obtaining stacked benefits.
- The interaction between the ESO and DNO may result in operational conflicts. Often a DNO's ANM system needs to take account of ESO contracts in order to ensure available capacity should the ESO contracts activate, otherwise the DNO's ANM systems may nullify the ESO contracted service (and vice versa).

Further detail on flexible connections, flexible services, ESO services and curtailment obligations can be found in Appendix B.1.

The Method

BiTraDER will investigate, design, build and trial – on our live network – a brand new and highly innovative market allowing flexible resources connected to the distribution network to trade their curtailment obligation bilaterally. BiTraDER will assess current and future customers' appetite for bilateral trading, examining existing techniques that could facilitate such a market, and determining the data requirements to support operation of the market, the DNO and ESO systems, and the interfaces needed to present all necessary information to a suitable market trading platform, with the appropriate cyber security considerations. BiTraDER will develop the bilateral market trading rules, determining what is and isn't a valid trade, exploring the market's ability to operate in near real-time, and determining the functionality required to return the output of the market to the DNO and ESO systems for execution in real time.

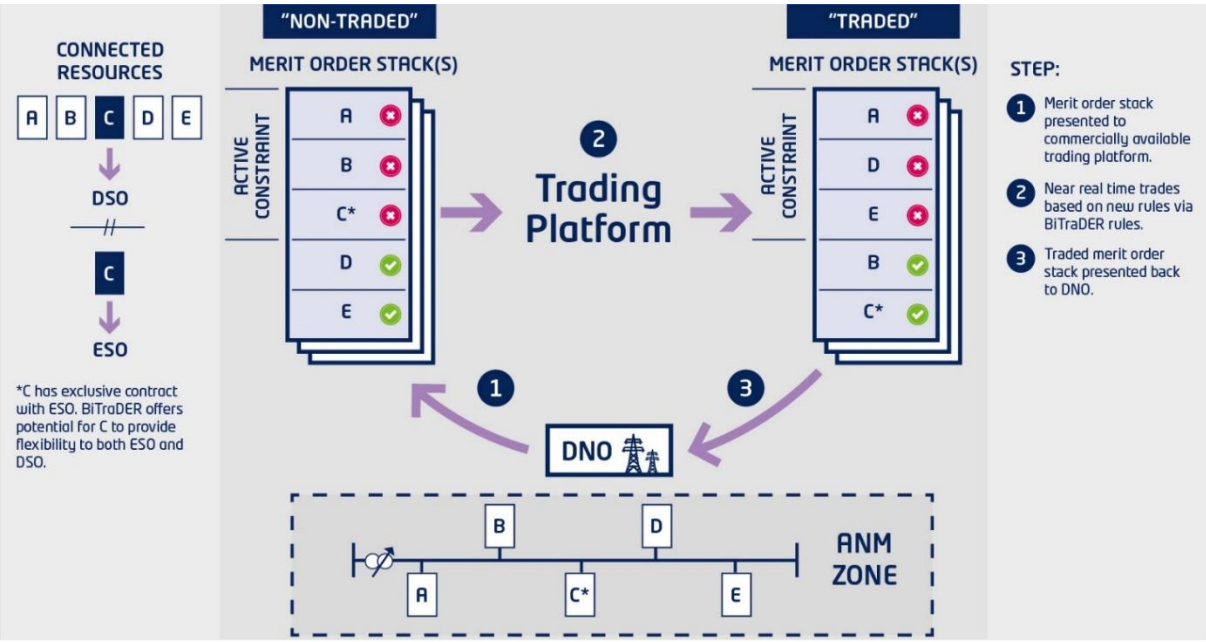
BiTraDER will require the DNO to be a neutral market facilitator, meaning that the market will be external to the DNO and the DNO will not be involved in trading. The DNO will be responsible for providing necessary information to the market and for receiving the output of the market after close of trading. As such, BiTraDER will examine the role of the market administrator and propose who might be best placed to operate the market and why, and whether more than one market can exist.

The BiTraDER market will be run via the ElectronConnect platform. Further technical details of this platform can be found in Appendix B.3.

As illustrated in Figure 2.1, the DNO will provide an initial "non-traded" merit order stack to the market based on look ahead forecasting of network constraints from an ANM system and, after gate closure, receive back the final "traded" merit order stack from the market for execution in real time. As neutral market facilitator, the DNO will not seed the market with any price signals or influence trading. We expect the bilateral trading market will determine the true cost of providing flexibility based on the likelihood of curtailment and will reveal the value to participants of having the ability to remove a constraint for any given network condition. For post-fault constraints, we expect the market will determine the price to trade obligation for an active constraint, i.e. what is it worth not to be curtailed

for an active network event and whether it is possible to resolve such a constraint through a short-term trading market.

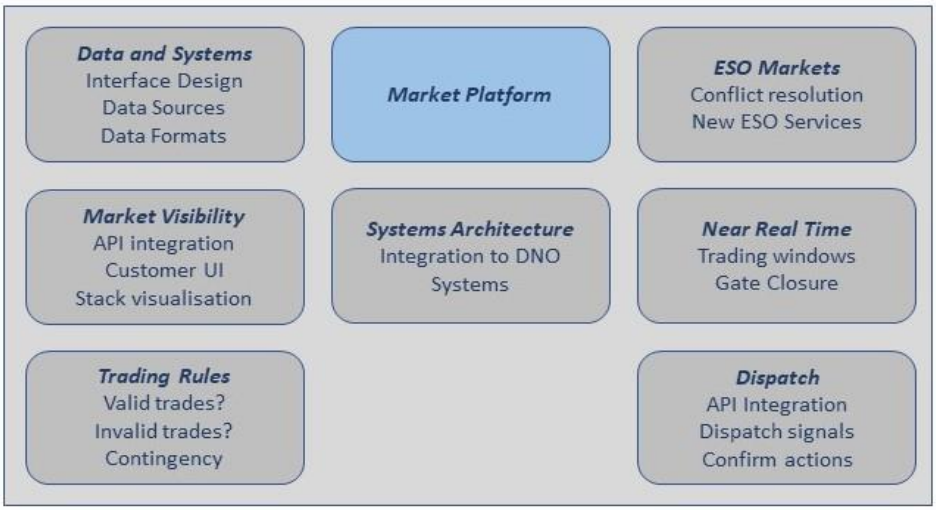
Figure 2.1: BiTraDER Method diagram



The merit order stack is an ordered list of flexible resources. Each stack represents a potential network constraint and contains all flexible resources that could be used by the DNO to resolve the constraint. Using appropriate contingency analysis software, merit order stacks will be generated periodically through a look-ahead function. These stacks will contain any flexible resource connected to the distribution network. This will include resources with a firm connection that don't currently have curtailment obligations. BiTraDER will investigate options for allowing participants to trade obligations for both system normal and post-fault constraints, including whether this can be done in the same market platform using different trading rules.

Figure 2.2 shows the research areas that we will explore in BiTraDER.

Figure 2.2: BiTraDER research areas



Data and system design

Through a series of customer, supplier and Partner workshops including the ESO and other DNOs via the Energy Networks Association (ENA) Open Networks project, BiTraDER will

determine the technical requirements to enable integration of a bilateral trading platform into typical DNO systems, in addition to the customer requirements to enable participation in the market, including access and trading rules.

Market visibility

BiTraDER will identify ways to create visibility of merit order stacks in a market platform by exploring the various operating models and interfaces between all participants, including how the market can be presented to a range of users and stakeholders in a user-friendly format through simple interfaces, including Application Programming Interface (APIs), apps and web portals.

Trading Rules

During the design phase of the Project, BiTraDER will develop a set of core trading rules to determine that trades are valid both through the resolution of constraints in all stacks in which they appear, including transmission system boundary limits, and in terms of the total energy traded, to ensure that all constraints in all ANM zones are safely resolved in the final traded merit order stacks.

ESO/DNO conflict resolution

Resources connected to the distribution network frequently participate in ESO markets in order to supply services to the ESO in resolving transmission constraints. In many instances, the contractual terms between the flexible resource and the ESO prevent them from participating in other markets, such as DNO flexible services. In addition, insufficient knowledge of ESO contracts and their impact on the distribution network can cause operational problems in designing automated systems such as ANM on the distribution network. As such, automated systems can often negate ESO services if not co-ordinated. This results in conflicts between DNO systems and ESO services and prevents efficient use of capacity on the distribution network.

We will work alongside the ESO to examine how BiTraDER can be used to resolve these conflicts and how, in doing so, we can allow flexible resources to participate in both ESO and DNO markets, potentially using the concept of obligation trading to provide resource for both ESO and DNO services.

Near real-time trading

Trading in near real-time boosts the value in the flexibility market, allowing system operators to exploit flexibility more fully, to resolve network constraints. We believe this could be particularly useful in the resolution of short-term constraints caused by network events or faults. Using appropriate short-term ratings, customers may be more likely to respond to events if they are known to be short-term.

BiTraDER will assess how to enable near real-time trading and how close to real-time the market can operate whilst still allowing constraints for all parties involved to be resolved safely, whilst maintaining security of supply.

Dispatch of Traded Stacks

In order to simplify participation, BiTraDER will investigate appropriate mechanisms to allow the market participants to receive and respond to dispatch signals from DNO systems without the need to invest in technology on-site that communicates directly with DNO SCADA equipment. This will likely be through the use of APIs, apps and web portals. BiTraDER will determine how DNO systems can determine whether a dispatched resource took appropriate action through appropriate messages, signals and measurements.

System Architecture

The BiTraDER architecture will necessarily be designed and developed for Electricity North West's current real-time operational systems; however, we believe the data and systems required to implement BiTraDER, whilst not entirely consistent across the DNO population, are common. As such, the high-level architecture proposed by BiTraDER will be easily

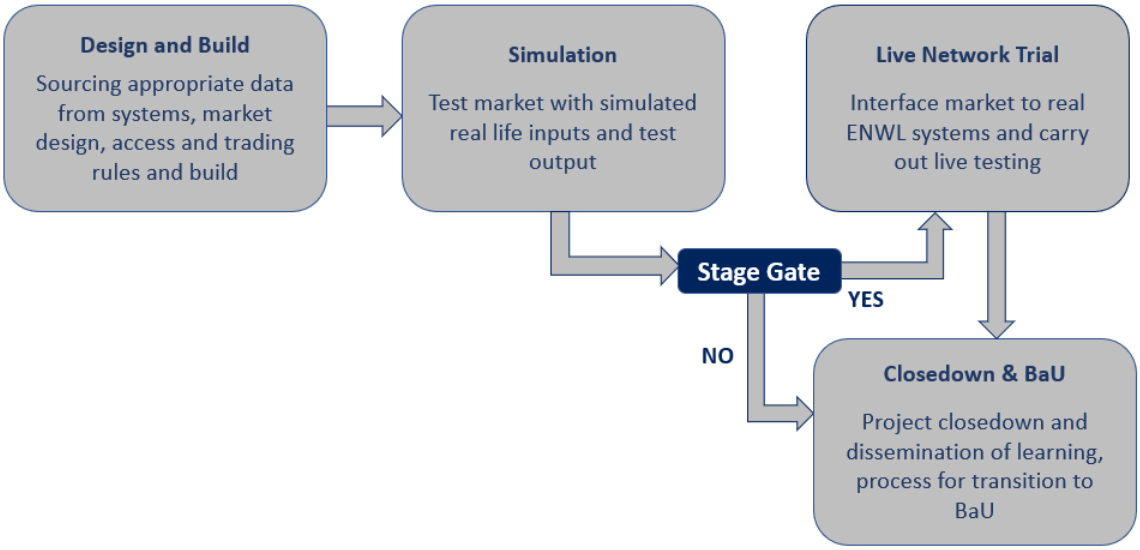
transferrable across the UK DNO population. This assumption will be tested with the Open Networks and necessary adjustments to the Method will be made as appropriate.

There is more information on the proposed Method in Appendix B.2.

The Development / Demonstration undertaken

BiTraDER will run in several phases, as shown in Figure 2.3.

Figure 2.3: BiTraDER Project phases



Design and Build phases

This will involve detailed design workshops to determine the data, systems, interfaces and rules required to facilitate bilateral trading of curtailment obligation in real time, as outlined above. During this phase, we will build the trading platform based on the output from the design phase and develop a set of market rules that will allow trading of curtailment obligations under various scenarios and for a selection of use cases.

Simulation phase

The trading platform will be tested through engagement with our customer stakeholder group through a series of "war games" scenario workshops. 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. These will be as close to live data as possible and based on a number of network scenarios, using a typical section of distribution network and the data formats determined during the design phase. Outputs from the platform will be tested for compatibility with Electricity North West's systems using the requirements determined during the design phase.

The simulation of the market model will use an offline representation of part of our network, and will help us to further refine market rules and trading processes. This means that implementing the market rules will require a highly flexible trading platform. We will seek participants from parts of the network most likely to experience constraints within the Project duration to take part in these simulations.

Stage gate

Owing to the inherent uncertainty associated with including a live network trial, upon completing the simulation trial and before proceeding to the network trial, we propose to introduce a stage gate into the overall Project programme. The stage gate will occur at the end of the simulation trial and allows us to bypass the live network trial and progress immediately to Project closedown and BaU transition upon completion of the simulation trial. The stage gate will include consideration of the following three issues:

- Quality: we will check whether the simulation trial has delivered in line with its objectives and that sufficient work has been completed to allow progression to the live network trial.
- Rationale: we will check if the need for a live network trial remains. This check will include that the economics of a live network trial remain valid and the forecast benefits are also valid.
- Action: we will check if the necessary resources are available and that the plan for implementation of the live trial is both reasonable and deliverable within the constraints of the approved Project.

Live Network Trial phase

Here we will connect a section of our live network, fed from Harker 132kV substation (see Section 2.3 for selection criteria), via the market platform to Electricity North West's operational systems to allow customers to trade curtailment obligation based on real network constraints. This phase of the Project will test the full end-to-end process including extraction of merit order lists from DNO systems such as ANM, making these stacks available through a trading platform, allowing real trades to take place, and passing the traded stacks back to DNO systems for execution in real time, with appropriate safety and cyber security measures in place.

The output of this phase will be an understanding of the real behavioural impact of the rules on participants, their practicality (including verification), and actual payments creating financial benefits.

Closedown and BaU

Once the simulated and (as long as requirements to pass the project stage gate are met) live network trials are complete, we will proceed to Closedown and BaU. This phase will see the closedown of the Project, during which we will analyse the costs and benefits of BiTraDER and produce a closedown report for dissemination. We will also develop the process for transition of the Solution into BaU, provide training to internal planners and operational engineers on all new codes of practice, and publish our Functional Specification for BiTraDER.

The Solution

BiTraDER will produce a high-level functional specification and data schema "how to guide" demonstrating how the introduction of a bilateral market could be applied to typical DNO systems regardless of the mechanism used to derive the initial merit order stacks. Electricity North West uses the concept of curtailment index; however, the principle of implied obligation is equally valid where a DNO uses Last-In-First-Off (LIFO) principles to determine the initial stack order.

The "how to guide" will include data sources, data formats, appropriate interfaces, market rules, APIs and user interface to the market platform, the market platform and trading rules, including the likely technology and data required to facilitate delivery of the bilateral trading mechanism into BaU in a typical DNO.

The functional specification will include details of the physical arrangement of the different systems and the interface hardware /software required, including appropriate cyber security measures that protect DNO Operational Systems from external interference.

The functional specification will be derived from live trials using Electricity North West's operational systems and a third-party trading platform through interaction with real customers connected to a real section of our network, and will therefore demonstrate how such an arrangement can be implemented into a real-world scenario.

BiTraDER will investigate the relationships between distribution connected ESO and DNO flexible services and propose a market model(s) that will facilitate bilateral trading of whole system flexible services for both ESO and DNO in near real time, including how the trades

will be made, what information will be required to facilitate them, and what, if any, impact this will have on existing markets and contractual arrangements.

Related project learning

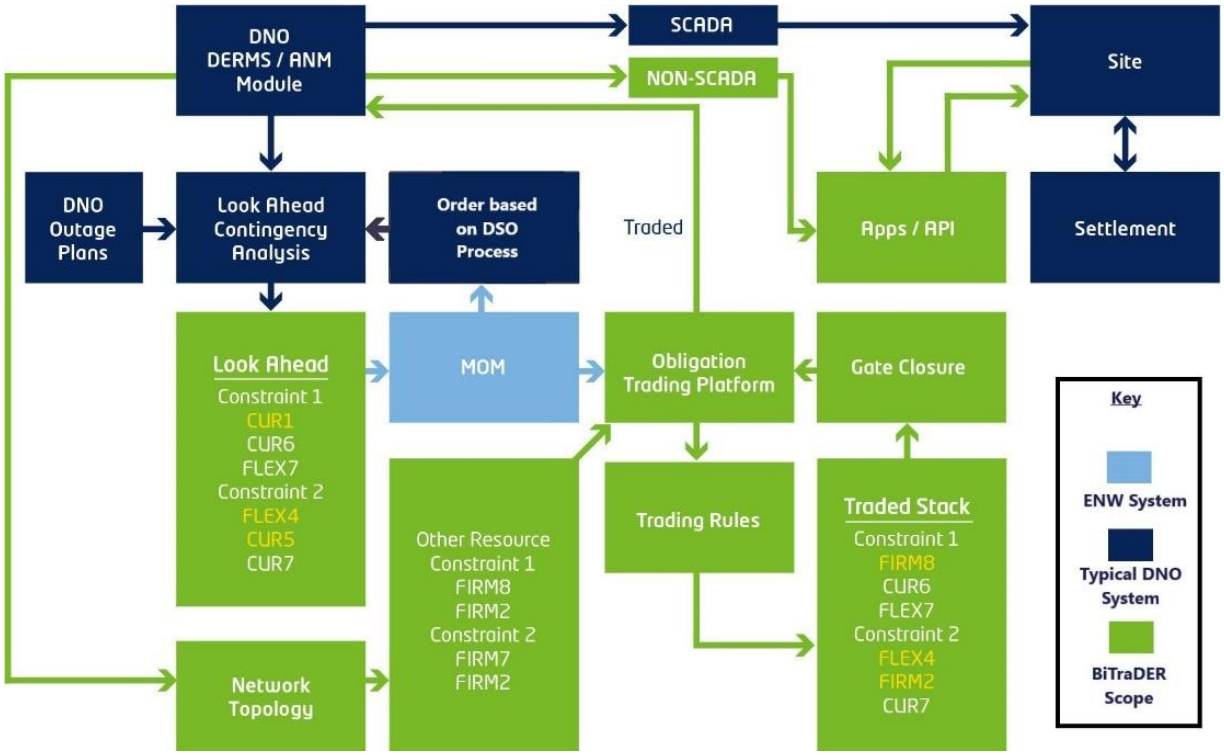
We have engaged with the Energy Networks Association (ENA) Open Networks project and concluded jointly that BiTraDER is well suited to the overall Open Networks work plan, but particularly relating to the Product 6 workstream, which covers non-DNO services. The ENA has written a letter to this effect, which is included in Appendix H. We have agreed with that we will include regular reports to the Open Networks Steering Group and the Product 6 workstream as part of our Project dissemination.

We also note that there has been a number of projects in the secondary trading space, the learning from which BiTraDER can build upon. These include the UKPN Energy Exchange project, WPD IntraFlex Project and the SSE Trader project. Please see Appendix C for a review of our forerunner projects.

2.2. Technical description of Project

Figure 2.4 provides a technical overview of BiTraDER, showing how the various components that might be expected to comprise the overall system will interact, including the various connections and data flows between them. We understand the merit order management component is specific to Electricity North West, but contains functionality typically found in DNO ANM/ Distributed Energy Resource Management System (DERMS) /contingency analysis software. Therefore, differences in DNO capabilities will not present an issue to transferability of BiTraDER to other DNOs. Naturally, this will be examined more closely during the Project.

Figure 2.4: BiTraDER technical overview diagram



The key phases necessary for the technical development for BiTraDER are outlined below.

Data and systems interface design

During our initial design workshops, described in Appendix B.2, we will gather all the details necessary to source the required data from our operational systems in order to

enable merit order stacks to be passed to the market platform and to enable traded stacks to be passed back to our operational systems. This data will be used both in the simulation phase in order to test input and outputs to and from the market platform and in the live trials through a fully integrated solution. In addition, these workshops will include the design of user interfaces to the market platform and market access arrangements.

Development of market platform and trading rules

Based on the information gathered in the data and systems interface design workshops, our Project Partner, Electron, will design and build a market platform and a set of core trading rules based on their ElectronConnect platform. This platform will be tested in the simulation phase of the Project, during which the core trading rules will be refined as necessary. Customers will also interact with the market platform during the simulation phase based on simulated network constraint data in order to refine user interfaces and market access arrangements.

Integration of DNO systems with a market platform

Following completion of the simulation phase of the Project, and subject to successfully passing the stage gate criteria described above, our Advanced Distribution Management System (ADMS) supplier will work with Electron to fully integrate the market platform with our ANM system in order to transfer live network merit order stacks into the market platform based on real network constraints, and to pass traded stacks back to our ANM system.

Integration of DNO systems with 'ad hoc' flexibility providers

As some customers who participate in trades are likely to do so on an 'ad hoc' basis, they will not have existing, directly accessible control systems connected to DNO systems. These are likely to be customers with a firm connection who have not previously signed up for curtailment or flexible service contracts. Our ADMS supplier will develop, build and test low-cost interfaces (e.g. through APIs and apps) that will enable the DNO to signal these resources in real time via the DNO systems during the live trial phase.

The Project will also determine the most appropriate approach for settlement of any trades made within the platform.

2.3. Description of design of trials

Simulated BiTraDER trials

To develop a core set of trading rules, implement and test them in the market platform and refine them as appropriate, we first intend to develop the trading platform in a standalone environment. We will use simulated data based on the output from the design phase to generate constraint stacks based on stakeholder-validated use cases that test all possible constraint conditions, both for system normal and post fault. Under supervision by our Project Partner, Delta-EE, participants will be encouraged to interact with the market and simulate real life behaviour.

The simulated BiTraDER trials will take place after the build phase, during the third year of the Project.

The simulation phase is intended to help develop and refine the market and trading rules. It will also allow us to test the robustness of the integrated solution before we connect it into our real-time systems ahead of the live network trial. The learning obtained from the simulation phase will be crucial in informing if and how we proceed with the live network trials. Using the results from the simulation phase, we will develop the detailed scope and requirements for the live network trial, ensuring where possible to consult with stakeholders.

We will use the simulation phase to identify and enrol participants wishing to take part in the live network trials. It is hoped that many of the participants assisting with the

simulation phase will continue to do so as we move into the live network trial. Taking customers on this journey through design, simulation and live network trial will significantly improve the quality of the findings obtained from the Project. This will be a key objective of our customer engagement workstream.

Live network trials

Site selection and trial size methodology

To demonstrate the benefits of BiTraDER fully, and subject to identifying suitable trial participants, we will perform a live network trial on a section of our network where the complete range of network issues addressed by BiTraDER can be considered. To fulfil this requirement, we reviewed the GSPs on our network and assessed each against the following criteria:

- *ESO constraints at the transmission interface:* the trial area should include an area of the distribution network where active constraints exist at the grid intake point.
- *DNO constraints on the distribution network:* the trial area should include an area of the distribution network where active constraints exist.
- *Firm-connected customers with ESO contracts:* the trial area should include an area of the distribution network where there are firm-connected customers that supply services to the ESO through secondary services markets.
- *Firm connected customers with no flexibility contracts:* the trial area should include an area of the distribution network where there are firm-connected customers that do not currently supply services to either the ESO or DNO.
- *Customers with DNO flexible services contracts:* the trial area should include an area of the distribution network where there are connected customers that supply flexible services contracts to the DNO.
- *Customers with flexible connection contracts:* the trial area should include an area of the distribution network where there are customers that are connected on the basis of a flexible connection contract.
- *A reasonable size of connection queue:* the trial area should include an area of network where there is a reasonable queue of connections awaiting either a distribution network or transmission network reinforcement to enable connection.

Using these criteria, we have determined that the most appropriate section of distribution network for the trial is likely to be our network in Cumbria, fed from the Harker Grid intake substation. We have designed the live network trial based on the assumption that it will take place in Cumbria. However, it could be equally applied elsewhere with only minor adjustment. The choice of Cumbria will be revalidated at the appropriate point during delivery of the Project, i.e. during the simulation phase. The Cumbria network currently has an active connection queue awaiting both distribution network and transmission network reinforcement, has customers with flexible connections and offering flexible services contracts, and a number of firm connections – some that offer services to the ESO and some that don't.

Subject to passing the stage gate assessment, the live network trials will take place after the simulated trial, during the final year of the Project.

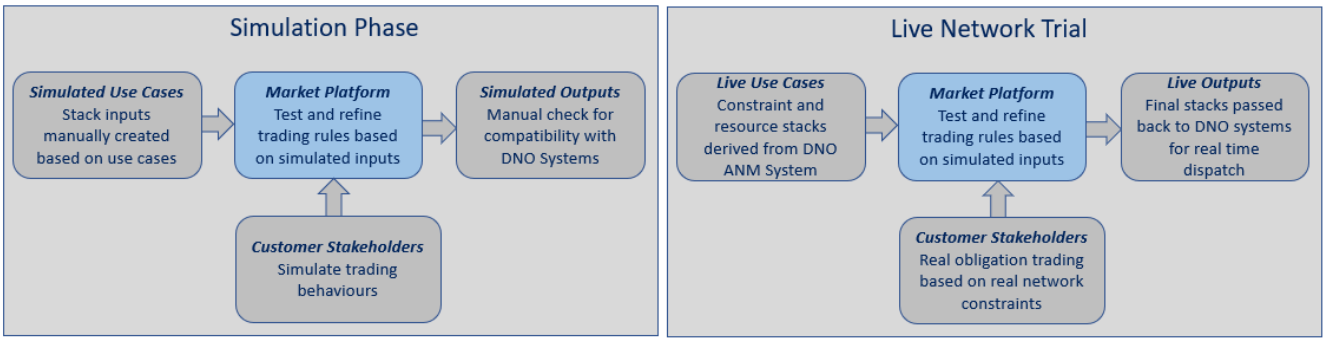
BiTraDER trials

Initially, we will build and test the trading platform using simulated inputs from DNO systems based on the requirements and data developed during the design phase. This will include ensuring that stacks can be sourced from appropriate systems, presented to market participants through the trading platform, and that trades can take place. The platform will be tested for both functionality and, working with real-life participants, ease of use, and during this phase we will test the market rules for validity under a range of

scenarios. We will examine if the outputs from trades are valid and that the traded stacks can be applied to network resources in near real time. During the simulation phase we intend to engage a wide range of customers; we don't need to limit our stakeholder group to those connected to our network, so can broaden our engagement nationally.

Figure 2.6 provides detail on the trials.

Figure 2.6: BiTraDER trials



Following the simulation phase, and subject to our passing the stage gate, we will integrate the platform into our operational systems and test the full end to end process, taking real output data from the network and allowing customers to trade their curtailment obligation. We will take the output from these trades back into our operational systems for use on our live network. This will be the first time in GB that such trades have taken place on a live network with integration into live systems. For this phase of the Project we intend to engage with and select trial participants from the Cumbria area.

Although we have selected a section of network likely to experience a wide range of constraints during the live trial, it is difficult to ensure that all use cases will occur during the trial period. As a consequence, it may be necessary to deliberately change asset ratings in our operational systems to ensure use cases can be tested. As a consequence, we have included a contingency to compensate customers taking part in the trial where their energy output is impacted due to rating changes imposed, in order to test all use cases.

2.4. Changes since Initial Screening Process (ISP)

As we have moved forward from the ISP stage, we have made necessary adjustments to the overall scope of the Project. These changes have been made to ensure overall Project deliverability and value to customers.

We have endeavoured to Partner with National Grid ESO, but they have been unable to commit to a full partnership role. However, they have provided a letter of support for the Project expressing their commitment to provide a technical consultancy role to the Project and representation on the Project Steering Group (PSG).

We have secured technical and customer research Partners, namely AFRY and Delta-EE.

Following detailed discussions with our Project Partners, we have extended the Project length by 15 months to account for the complexities associated with the trading rules development and to allow for a live network trial, although we have introduced a stage gate prior to the commencement of the network trial.

This has resulted in an increase to the Project costs due the additional level of resource and the increased IT integration required. The overall cost of the Project is now £8,367,858.49, but we have secured [redacted] in contributions from our Project Partners. We are therefore seeking £6,789,709.47 in NIC funding.

3. Project Business Case

If rolled out, BiTraDER will provide a benefit of £35.5m NPV to ENWL (£581m to GB) and a carbon reduction of 7,649 tCO_2e (92,114 tCO_2e to GB) by 2050.

3.1 Background

To mitigate the need for distribution network investment, it has become commonplace for DNOs to contract selected customers to provide flexibility under various arrangements, thereby enabling the DNO to curtail activities at the customer's premises at critical times. Typically, the curtailment actions are called upon in a defined order, without considering the situation of the connected resources at the time.

BiTraDER will provide a transparent, neutral, near real-time secondary market to allow customers to trade curtailment obligations; effectively creating an optimised merit order for curtailment. Participants could include those with contracted flexibility arrangements and ad hoc flexibility providers. DNOs will maintain a passive, neutral position in the secondary market; likely limited to the monitoring of trading activity and facilitating information sharing, rather than as active participants.

Curtailment obligation trading under BiTraDER will enhance the efficiency of flexibility, as obligations are traded out to providers with lower costs. This will make flexibility contracts more attractive to customers and as new participants enter flexible contracts, would result in further mitigation of DNO investment needs.

BiTraDER will examine the ability for the market to:

1. Increase availability of flexible resources and its subsequent accessibility for use by system operators (DNOs and ESO).
2. Enhance competition between providers in the supply of flexible services to system operators, reducing the overall cost of flexibility.
3. Deliver whole system benefits by increased use of cost-effective flexibility services to deliver system security and stability as an alternative to network reinforcement.

As a result, this innovation has the potential to deliver many benefits to DNOs and the wider GB system. These benefits are set out in more detail in Section 3.2 below.

3.2 BiTraDER benefits summary

This section identifies the benefits from the development of BiTraDER and Figure 3.1 shows a summary of the benefit type aligned to the beneficiary.

Figure 3.1: Summary of benefit type and beneficiary

<table>
<tr><th></th><th>DNO</th><th>DSO</th><th>ESO</th><th>DER</th><th colspan="2">Flexible Resource</th><th>Customers</th></tr>
<tr><th></th><th></th><th></th><th></th><th></th><th>RES</th><th>non-RES</th><th></th></tr>
<tr><td>More efficient curtailment decisions</td><td></td><td>- Reduced cost of operating system</td><td></td><td></td><td>- Reduced curtailment</td><td></td><td></td></tr>
<tr><td>Increased participation of existing connections in flexibility markets</td><td>- Reduced or deferred need for LRE</td><td colspan="2" rowspan="2">- Reduced cost of operating system
- Increased flexibility resource
- More competitive flexibility provision</td><td rowspan="2">- Access to new commercial value stream
- Realise new business models</td><td rowspan="2">- Lower risk of offering flexibility
- Opportunities for accelerated deployment</td><td rowspan="2">- Access to new commercial value streams</td><td rowspan="2">- Reduced cost of operating system
- Lower carbon emissions</td></tr>
<tr><td>Greater use of flexible contracts for new connections</td><td>- Reduced or deferred need for LRE</td></tr>
</table>

At this proposal stage, we have included both quantitative and qualitative elements. As the Project develops and real data from the trials emerges, it is our intention to extend quantitative analysis to more of the benefits listed below, to the extent that data permits.

Quantitative Benefits (financial)

Reduction in load related expenditure: we anticipate that the deployment of secondary trading through the bilateral trading market will encourage future connected resources to accept flexible contracts. This will give new tools to DNOs to manage constraints, and lead to reductions in load-related expenditure in the short to medium term.

ESO interaction: we anticipate that the increased availability of flexible resources enabled by the bilateral trading market will provide benefits to the ESO in addition to the DNO. These benefits will include improving competition in existing markets, such as ancillary services and congestion management.

Reduced generation investment: we anticipate the potential for flexible resources to reduce system peak demand, as a result of BiTraDER, could provide a system benefit through reduced need for investment to meet adequacy requirements. We will quantify this by proxy, by looking at the value of capacity in the capacity market.

Optimised curtailment: at present, flexible resources are curtailed according to contractual terms, without consideration of economic merit or on-the-day conditions. BiTraDER will permit secondary trading of curtailment obligations, leading to socio-economic efficiency gains as curtailment is reallocated to parties with lower costs. We have separated this into two elements: reduced curtailment of Renewable Energy Sources (RES) and optimised curtailment of non-RES.

Qualitative Benefits (financial)

Accelerated connections: the deployment of the bilateral trading market should help to release available network capacity, enabling faster connection of Renewable Energy Sources (RES). We have also identified both demand and generation connections that could be accelerated as a result of BiTraDER, including low carbon generation, batteries, and flexible demand associated with Electric Vehicle (EV) charging and heat pumps (HPs). The impact of these benefits is uncertain at this time and will only be appraised qualitatively at this stage. However, we hope to be able to quantify at least some of these aspects as part of the trial.

Altered energy consumption: to the extent that BiTraDER enables demand side participation, we anticipate financial benefits resulting from the shifting of demand from (net) peak hours to off-peak hours. This potential impact is difficult to estimate at this stage, and so it will be added to the quantitative analysis as data becomes available during the Project.

Reduced losses: any reduction in peak energy flows has the potential to reduce distribution losses. If the effect is material, we will quantify it during the Project if data permits.

Reduced cost of flexibility: the increased level of competition that BiTraDER enables by attracting more flexible capacity to the market should lead to a reduction in the cost of flexible resources for DNOs. This potential impact is difficult to estimate at this stage, and so it will be added to the quantitative analysis if suitable data becomes available during the Project.

Quantitative Benefits (carbon)

Reduced curtailment of RES: a more economic selection of resources for curtailment using BiTraDER is expected to reduce RES curtailment, which will then displace less economic non-RES generation. We have constructed a simple estimate of the potential associated carbon savings in line with the volume of reduction in RES curtailment estimated under the financial benefit "optimised curtailment".

Qualitative Benefits (carbon)

Accelerated connections: accelerated connections of low carbon generation and flexible demand (e.g. EV chargers replacing combustion engines, HPs replacing gas boilers) is expected to lead to a reduction in carbon emissions. The methodology for quantification of carbon benefits will be re-examined as part of the Project.

Altered energy consumption: the shift of demand from (net) peak hours to off-peak hours has potential carbon benefits if it enables a low-carbon generation to substitute fossil-based generation to meet demand. The methodology for quantification of carbon benefits will be re-examined as part of the Project.

3.3 Quantified financial benefits

The approach to calculating each of the quantified financial benefits is summarised below (more details are provided in Appendix A.1). The calculation of these benefits is based on a combination of real world data and assumptions (detailed in Appendix A.2), drawing on the expert knowledge of the wider Project team.

Figure 3.2: Approach for quantification of financial benefits

Benefits	Calculation approach
Reduction in load related expenditure	This benefit is achieved by unlocking additional flexible resources as a result of BiTraDER, reducing the need for load-related expenditure versus a Base Case. To quantify this benefit, we have assumed that a small share of the Base Case investment requirement will be avoided in each year. In practice, this benefit might grow over time until the market reaches maturity.
ESO interaction	BiTraDER should release flexible resources, a share of which could offer services to both ESO and DNO, resulting in reduced ESO balancing service costs. To quantify this benefit, we assumed that in both the Base and Method cases a share of flexible resources is able to offer services both to the ESO and DNO. The additional share in the Method case compared to the Base Case is expected to deliver financial benefits. The total financial benefit is calculated by estimating the utilisation of these additional resources by the ESO (ultimately in MWh) and multiplying by an assumed cost saving (£/MWh) compared to the alternative balancing resources.
Reduced generation investment	BiTraDER unlocks the potential for flexible resources to reduce peak demand, meaning that less firm generation capacity is needed to deliver system adequacy. To quantify this benefit, we assume that a share of flexible resources can also contribute to the capacity market, in both the Base and Method cases. Observed capacity market prices are used as a proxy to determine the level of cost saved per MW of capacity offered, adjusted for an assumed de-rating factor.
Reduced curtailment of RES	BiTraDER will enable a more economic selection of resources for curtailment, expected to lead to a reduction in curtailment of RES generation with flexible connections. To quantify this benefit, assumptions are made of the % share of RES among flexible connections and % share of curtailment in RES volumes, effectively allowing the MWh of RES curtailment to be derived for both Base and Method cases. We apply a unit cost

	for each MWh reduction in curtailed RES, using the cost of wind curtailment of NGESO in 2020 (£/MWh) as a proxy.
Optimised curtailment of non-RES	A more economic selection of parties for curtailment will also bring the benefit of the curtailment of non-RES resources, as curtailment is applied to lower-cost resources. We apply a similar methodology for the calculation of reduced RES curtailment with a lower assumed cost saving per MWh.

3.4 Financial modelling methodology

Our modelling is based on an NPV calculation in line with Ofgem's guidance document for NIC. We have assessed the Method case for each benefit item quantified against the Base Case where the bilateral trading market is not introduced. These are summarised below:

Base Case: this case assumes that in the absence of the bilateral trading market, no costs or benefits will be realised: the assessment of BiTraDER is made on an 'incremental' basis.

BiTraDER Method case: this case assumes an incremental assessment in terms of benefits and costs from the Base Case.

We envisage the benefits will be realised from three key participation groups, defined as follows:

- *Participation group (G1):* represents existing and future resources with contracted flexibility arrangements in the absence of BiTraDER.
- *Participation group (G2):* represents resources without contracted flexibility arrangements (or existing customers with flexibility arrangements for part of their capacity) who might be willing to offer (additional) capacity to BiTraDER on an ad hoc basis.
- *Participation group (G3):* represents resources who might in future accept a contracted flexibility arrangement in the knowledge that there are ad hoc arrangements in place to trade their curtailment obligations.

The GB scale benefits have been calculated from the ENWL benefits via a simple scaling factor, based on the proportion of Primary and BSP substations in the Electricity North West licence area compared to that in GB, derived using the DNOs' Long-Term Development Statements (LTDS).

BiTraDER rollout costs

The costs of implementing the bilateral trading market have been split into those costs faced by the DNO and those faced by market participants. These are:

- *ENWL costs:* the costs include upfront costs associated with the investment in developing the software to operate and monitor the bilateral trading market. Additionally, there will be ongoing operating costs associated with maintaining the platform infrastructure and additional staff costs associated with increased interaction with the market participants.
- *Market participants:* upfront costs include installation of appropriate IT infrastructure to interface with the bilateral trading platform and the DNO's real-time systems (noting that existing market participants will already have the interface to the DNO's systems). There will also be ongoing costs of interacting with the BiTraDER platform daily.

We believe the initial upfront costs for new participants will be low due to the use of an API for communication as opposed to SCADA-based systems. This approach also ensures that the daily costs of interacting with bilateral trading platform will be minimised.

The GB scale BiTraDER rollout costs have been calculated from the ENWL rollout costs via a scaling factor based on the number of DNO groups (parent companies) in GB (with a phasing in the early years).

Financial Costs and Benefits

The financial costs and benefits of BiTraDER are shown cumulatively for years 2030, 2040 and 2050 in the table below.

Figure 3.3: Financial NPV cost and benefits of BiTraDER (@3.5% discount rate)

Scale	Benefit or Cost	£m NPV 2021 prices		
		2030	2040	2050
ENWL scale	BiTraDER benefits	[redacted]	[redacted]	[redacted]
	BiTraDER Costs	[redacted]	[redacted]	[redacted]
	Total NPV	**-0.9**	**17.3**	**35.5**
GB scale	BiTraDER Benefits	[redacted]	[redacted]	[redacted]
	BiTraDER Costs	[redacted]	[redacted]	[redacted]
	Total NPV	**62.1**	**325.7**	**581.4**

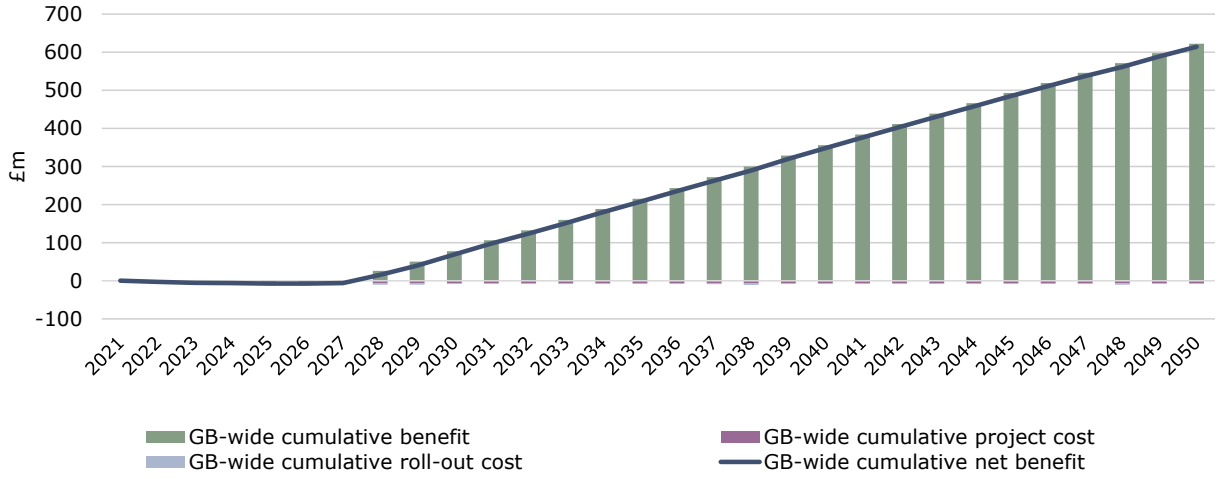
The result of the NPV analysis demonstrates a strong business case for BiTraDER, both at ENWL scale (with a net benefit of over £35.5m by 2050) and at GB scale (with a net benefit of over £581.4m by 2050).

BiTraDER breakeven analysis

Figure 3.4 shows the breakeven analysis which compares the BiTraDER Project and rollout costs with the benefits up to 2050. Figures are shown in real terms based on 2021 prices.

This shows a breakeven for the GB wide costs and benefits in the first year of rollout, meaning that the total costs of BiTraDER are covered by GB benefits within the first year of rollout of the BiTraDER Project, 2028. The benefits will climb gradually beyond 2028 as BiTraDER continues to deliver a significant net benefit well into the future. At ENWL scale, breakeven for the BiTraDER Project will be reached within year 2030.

Figure 3.4: Breakeven analysis for BiTraDER



Sensitivity analysis

To illustrate the impact that different assumptions have on the overall benefits at GB scale, a sensitivity analysis was carried out. This included a definition of sensitivity ranges on the input assumptions made for the calculation of each of the benefit items. This analysis and the results are described in Appendix A.2.5.

3.5 BiTraDER carbon benefits

The carbon benefits associated with BiTraDER are based on the expected reduction in RES curtailment through the implementation of BiTraDER. By more economic selection of flexible resources, RES will be curtailed less and will therefore displace higher carbon generation sources. The reduction in carbon emissions associated with avoided reinforcement was not included, as reinforcement is generally only deferred rather than avoided, resulting in no significant carbon reduction.

To calculate the benefit, we used the reduction in the RES curtailment volume measured as the difference between RES curtailment volumes under the Base Case and Method case in "Reduced RES curtailment" benefit. We then calculated the reduction in carbon emissions using the average grid carbon emission intensity projections from the Committee on Climate Change's Sixth Carbon Budget. This implies the conservative assumption that the displaced generation reflects the average generation mix, whereas the marginal emissions savings may be higher. Figure 3.5 summarises the carbon benefits at ENWL and GB scale cumulatively for years 2030, 2040 and 2050.

Figure 3.5: Carbon benefits of BiTraDER

Scale	Benefit	Cumulative Carbon Benefit tCO2e		
		2030	2040	2050
ENWL scale	Accelerated connection of RES	3,052.9	6,138.8	7,649.0
GB scale	Accelerated connection of RES	30,526.3	71,877.5	92,113.7

We anticipate there will be additional carbon and environmental benefits beyond those quantified above (e.g. accelerated connection of low carbon generation and flexible demand, and altered patterns of energy consumption). However, as these are more difficult to define, they have not been included as part of the business case. They are driven by increased visibility, co-ordination, and adaptability of the system; but we have chosen a simple approach for the present assessment. If the trials permit, we will attempt a more thorough quantification during the Project.

4. Benefits, Timeliness, and Partners

BiTraDER will develop a new obligation trading market, increasing the value of flexibility for participants and system operators, creating a truly flexible electricity system.

(a) Accelerates the development of a low carbon energy sector and/or delivers environmental benefits whilst having the potential to deliver net financial benefits to future and/or existing Customers

By enabling flexible resources to trade their curtailment obligations bilaterally, BiTraDER will increase the amount of flexibility available to system operators, reducing load-related investment requirements. By increasing the value proposition and reducing their risk of curtailment, the new market to be trialled in BiTraDER will encourage new low carbon sources of renewable energy to accept a flexible connection. In addition, BiTraDER will address concerns regarding the interaction between the ESO and DNO, and allow DNO connected flexible resources to provide services to the ESO (and vice versa) boosting the availability of flexible services to both the ESO and the DNO.

Our DFES states that electricity use is expected to increase by 40% before 2030 and more than double by 2050 to help support government decarbonisation plans. The increase in demand will lead to increased constraints on the electricity network. To help manage these constraints, network operators have entered into flexible service contracts with customers to modify their generation and/or consumption patterns. Customers with these contracts are then placed into a "stack" which determines in what order the associated curtailment obligations are called upon. The order is set at the time of the customer's connection and then only re-ordered following a request by the DNO for the customer to curtail their output.

BiTraDER will design, develop, build and trial a new, transparent market to facilitate the bilateral trading of obligations between market participants.

As set out in Section 3 and Appendix A1, BiTraDER is forecast to deliver significant environmental benefits, totalling roughly 92,114 tCO2e by 2050 across GB and has the potential to deliver net financial benefits to customers of nearly £518.4m across GB by 2050.

Contributing to the Carbon Plan

BiTraDER will contribute towards the aims set out in the government's Carbon Plan, and the more recent Ofgem Decarbonisation Action Plan, by promoting electricity system flexibility and providing more effective co-ordination across the electricity system.

BiTraDER supports Ofgem's policy ambition for flexible service providers to realise the true value of their flexibility as laid out in the Smart Systems and Flexibility Plan. A real-time trading market will provide transparency of the curtailment stack for all participants, encouraging participants to trade obligations bilaterally, based on the real-time cost of curtailment to the participants, thereby delivering a truly flexible marketplace.

Without co-ordination, use of flexibility on the ESO network can have unintended consequences on the DNO network, and vice versa. Owing to concerns regarding failure to meet a commitment, these operational conflicts can act to discourage customers from actively participating in more than one contract. BiTraDER will examine market-based methods to mitigate these conflicts resulting in more effective management of both the transmission and distribution networks and removing uncertainty among flexibility providers. This benefits the flexibility market in that Distributed Energy Resources (DER) can actively participate in multiple contracts, making the offering of flexible services more attractive and boosting value.

Low carbon, renewable energy resources typically operate with a high fixed cost and low running cost as opposed to carbon intensive, non-renewable resources such as diesel generators, which have a low fixed cost and a high running cost. Therefore, when combined with the risk of curtailment, the build and connection costs associated with low carbon resources can deter these technologies from connecting flexibly. Having the ability to trade their constraint and to participate in more than one service provides greater value. Additionally, the initial stack optimisation could value carbon intensity ensuring that a carbon intensive resource is used before a low carbon resource with equal curtailment.

The transparent market afforded by BiTraDER will encourage wider participation in flexible services, as the value proposition is greater for connected resources, leading to increased availability of flexibility to the ESO and DNO, allowing constraints to be managed without the need for extensive reinforcement.

Additionally, BiTraDER will encourage greater use of low carbon connected resources such as energy storage or smaller scale generation connected to the distribution network and reduce the barriers to entry for new, innovative entrants.

Currently, flexible resources are curtailed according to contractual terms, without consideration of economic merit or on-the-day conditions. Through trading of curtailment obligations, BiTraDER will enable reallocation of curtailment to participants with lower costs (i.e. RES) leading to socio-economic efficiency gains.

The carbon benefits associated with BiTraDER have been calculated based on this expected reduction in RES curtailment and our benefits calculations demonstrate carbon savings of 7,649 tCO_2e across ENWL by 2050, and 92,114 tCO_2e across GB by 2050.

Finally, BiTraDER is applicable to other market types, for example it could be used to resolve other local network issues through demand turn-up or turn-down, as well as integration with ESO flexibility markets to provide services from distribution-connected assets, further reinforcing low carbon connected resources' connection and operation.

Delivering significant financial and network capacity benefits

Through optimising the order in which flexible resources are curtailed, BiTraDER will maximise the value of flexibility on the network, create added value for participants by enabling more effective resolution of any constraint violations, thereby boosting the value for flexibility services and therefore releasing more capacity.

Those customers who operate flexible resources will further significantly boost the value of their investment through bilaterally trading with other market participants and, if suitable, using their resource to participate in more than one flexible contract.

BiTraDER will allow DNOs to reduce load-related expenditure associated with customer connections, whilst the optimisation of the merit order stack will release additional capacity for the connection of RES, thereby supporting the government's carbon targets.

The financial and network capacity benefits that BiTraDER will provide are quantified below as well as in Section 3, Appendices A.1 (Benefits Tables) and A.2 (Method and Base Case methodologies). These benefits are then extrapolated across GB.

BiTraDER Project/ENWL benefits

BiTraDER will develop a DNO-scale Solution as the market developed will be applicable to the whole distribution system. Therefore, it is not appropriate to represent the benefits at a Project scale.

Once the market is developed and operational, any merit stack can be presented for obligation trading. BiTraDER will deliver net benefits of £35.5m across our network by 2050.

At a Project scale BiTraDER will allow us, via the live trial, to improve understanding of participants' requirements, the neutral market facilitator role and how obligation trading

can help solve long-duration and real-time constraints more economically and flexibly, using a common set of market and trading rules.

GB benefits

The Method is readily replicable by all DNOs as all DNOs use flexibility to alleviate constraints and this flexibility is called upon based on an order within a stack.

As the ENWL benefits are calculated based on the number of HV substations on our network, the benefits for GB have been scaled proportionally based on the number of HV substations at GB level compared with the number on the Electricity North West network.

Application of the Method to GB will provide a net benefit of £581.4m by 2050 and will release network capacity which will help to facilitate RES load growth.

BiTraDER will provide a common approach to local constraint obligation trading that delivers an optimised outcome

Customer benefits

The Method will provide the ability for any market participant, including aggregators and suppliers to trade their position in the stack which will boost the value proposition of providing flexibility to the DNO.

(b) Provides value for money to electricity distribution/transmission customers

Potential for Direct Impact

BiTraDER will have a direct impact on the distribution network by developing and demonstrating, including via a live network trial, a market to allow the trading by participants of their curtailment obligation, bilaterally and in near real-time.

As well as ensuring that the correct resources are curtailed (i.e. those for whom the marginal cost is highest), BiTraDER has potential to boost the value of flexibility services for all participants in the market and thereby encourage new participants, promote increased competition amongst providers of flexibility services, and thus provide further potential benefit to customers through reduced overall costs.

Through a third-party trading platform in combination with other DNO-provided network-based data, BiTraDER will provide participants with enhanced visibility of the markets, potentially facilitating operation across the interface with the transmission network, enabling more effective operation and co-ordination of the two systems, optimising the use of existing connected resources, and potentially improving the number of flexible contracts available.

The resolution of network constraint violations will create additional capacity, while mitigating the need for reinforcement, allowing faster and cheaper connection of Distributed Energy Resources (DER) and other sources of renewable energy.

Through a series of trials, including a live network trial, BiTraDER will build and test the integration of DNO ANM systems with a third-party trading platform. Initially this will use simulated inputs, scenarios and trades, and then, by integrating the platform into our operational systems, BiTraDER will test the full end-to-end process using real data and actual real-life participant trading. During the trials we will engage with a wide range of customers, including many that are not currently connected to our network but are very active in other regions. The trials are described in more detail in Section 2.3.

The learning from BiTraDER will result in a functional specification detailing the requirements for facilitating bilateral trading, including the integration with a third-party trading platform, a recommended market model and its operation, necessary data requirements, and interface arrangement with all parts of the system, including flexible resources. The functional specification, alongside the Project Method, will be made available to all DNOs to allow for these benefits to be passed on to all customers across GB.

Processes to ensure competitive cost

BiTraDER is a highly technical Project. To assist with the development of the bid we have approached those known to possess the necessary technical knowledge to undertake the Project. To-date, we have sought partnership with experts on market trading, trading platform design and development, and markets delivery. We requested that these parties produce fully-costed proposals, which were then reviewed and scrutinised to ensure they deliver value for money for customers.

We conceived the idea for BiTraDER from our understanding of the industry challenges from operation of active networks and flexibility. We then approached Electron directly owing to their extensive expertise in this field. Electron is an energy technology firm which specialises in digitally optimised energy marketplaces, and has previously worked on projects such as TraDER on the Orkney Islands, for which they developed a platform that functions as a real-time distribution-level marketplace. We felt this experience placed Electron in a unique position to assist with development of the BiTraDER bid and to take on a meaningful role in delivery of the Project as a Project Partner.

In seeking technical consultancy support for development of the bid, we undertook a competitive tender process. We received several responses to the tender which were evaluated against the criteria of relevant experience and expertise, cost, and, on the assumption that tenderers would continue on to perform a role on the Project as a Partner, Partner contribution.

We appointed AFRY to provide support in developing the cost-benefit analysis for our business case during bid preparation and further consultancy support in the form of cost-benefit assessment and ongoing monitoring and analysis of trades and outcomes, amongst other things, as Project Partner. AFRY have supported on a number of relevant innovation projects outside of Electricity North West.

BiTraDER includes for necessary customer engagement and after evaluating responses to our competitive tender, we identified that due to their extensive background working with emerging distributed energy markets, Delta-EE were ideally placed to deliver the customer engagement and trial design aspects of the Project.

In addition, we will hold a competitive tender once the Project starts to fill the role of Solution Architect. The Solution Architect will assist us with the design of the functional specification and integration of the trading platform with Electricity North West Ltd and the participating connected resources.

We will adopt use of our well-developed NIC Partner contracts alongside our rigorous and professional project management and governance processes used on similar projects in the past – including CLASS and Smart Street, which are now BaU.

Our established processes for ensuring value for money in the delivery of NIC projects has been evaluated by Ofgem during C2C, CLASS, Respond and Celsius and the lessons learnt from each of these have been retained for application to BiTraDER.

We will apply best practice project management techniques to ensure timely and cost-effective delivery of Project outcomes. Regular Project steering group meetings including risk and mitigation reviews will be conducted. In addition to members of the project team and Project Partners, this group will include oversight by a Project director and federated management accountant from the finance directorate for driving delivery to budget. Competitive procurement processes will be used to select Project Partners and suppliers, which will ensure value for money.

Clear roles and responsibilities for all Project participants will ensure that there is no duplication of activities. Figure 4.1 shows the expected number of person days and day rates per Project Partner.

Figures 4.1 to 4.4 illustrate the total cost split by Project stage, the split of total personnel cost by Project Partner and Project stage, the staffing and equipment costs by Project stage and the Project Partner day rates. These costs are all pre-contribution.

Figure 4.1: Total cost split by Project stage

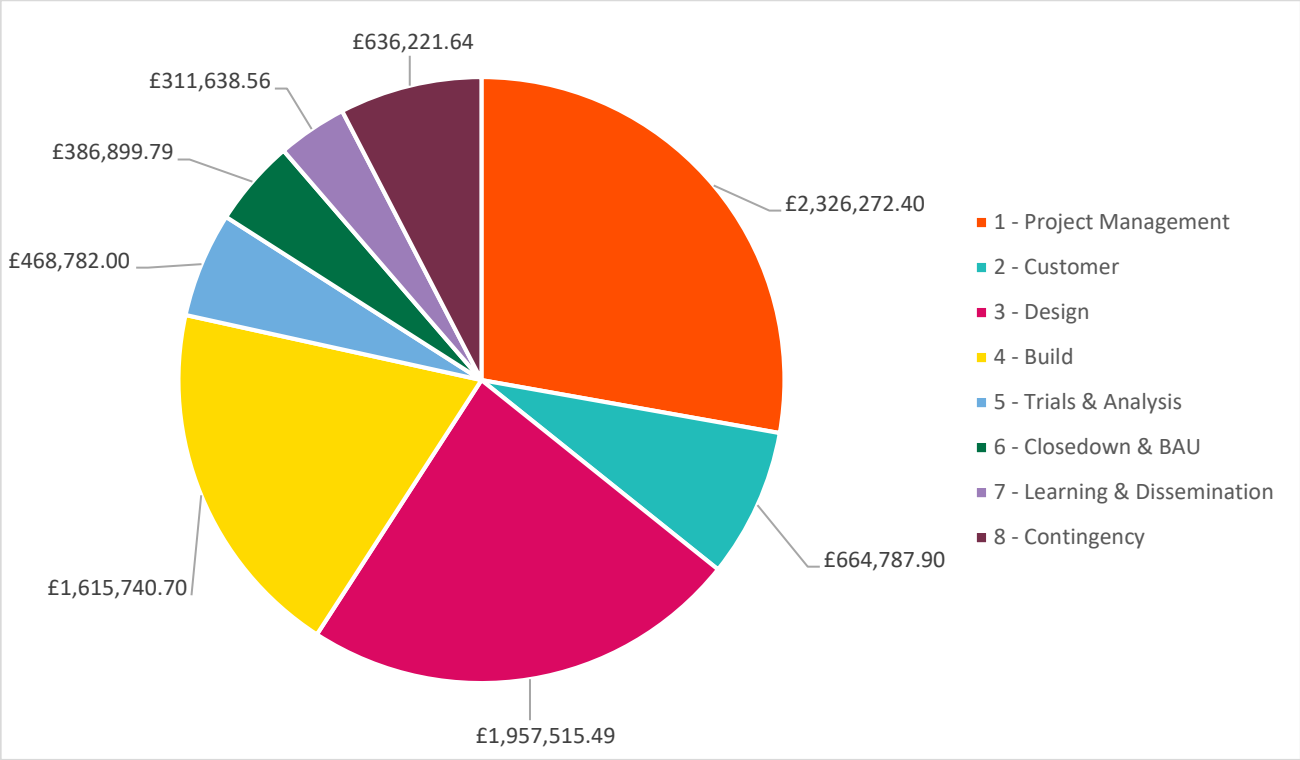


Figure 4.2: Personnel cost split by Project stage and Partner

[redacted]

Figure 4.3: Staffing and equipment cost by Project stage

Figure 4.4: Project participant day rates

Planned Supply Interruptions

No planned supply interruptions are expected to occur during Project implementation.

Direct Benefits

No direct benefits are expected to accrue to Electricity North West Ltd during Project implementation.

(c) Generates knowledge that can be shared amongst all relevant network licensees

The criterion for 4c is evaluated in Section 5: Knowledge dissemination. This is in line with Ofgem's guidance notes for completion of the full submission documents.

(d) Is innovative (ie not business as usual) and has an unproven business case where the innovation risk warrants a limited Development or Demonstration Project to demonstrate its effectiveness

For the first time ever, BiTraDER will allow flexible resources to trade their curtailment obligations bilaterally with others, in a transparent market independent of the DNO.

The appetite amongst market participants is untested. This is crucial, as customers must be convinced of the efficacy of the market if they are to be expected to participate fully. The information and associated data needed to facilitate the market and to encourage customers to partake is key, and as yet unknown. The Method will allow us to conduct meaningful engagement with customers at scale to understand their views on a marketplace such as that proposed in BiTraDER and the network trial will provide a new understanding of how participants will react to this market.

The rules for a bilateral trading market are unknown and untested, and the business case is unproven as the value from bilateral trading is not yet established.

The IT systems integration necessary to support the real-time operation of a market to manage actual constraints, including bidirectional data flows to aid transparency and efficiency, is unproven and the ability to operate trades in near real-time has yet to be understood. The closer to real-time the market operates, the more challenging the operation of the market becomes; at present, the appropriate balance is unknown. Trading in near real-time will improve the timeliness and scale of response, as well as address the longer-term challenges on maximising network headroom and reducing load-related network investment.

Unlike forerunner projects, BiTraDER will be trialled in a real-life situation and fully integrated with operational systems, including actual transactions with real participants. This important step is necessary to understand how trading will work in practice and what the participants would require to make the market attractive to them. Our preliminary site selection, detailed in Section 2.3, has determined that the most appropriate section of distribution network to use for the trial is our network in Cumbria fed from the Harker Grid intake substation.

In addition to facilitating optimisation of the merit order stack, BiTraDER addresses problems associated with the current operation of the merit order stack, namely its lack of operational transparency, inability for participants to trade, and the potential operational conflict between the ESO and the DNO. For this, new, innovative and as yet unproven techniques are required.

Given the above, there remain many areas of uncertainty that must be examined before the benefits of a bilateral trading market for the merit order stack can be assessed and adopted as proven innovation in BaU. Therefore, a limited NIC project including a live network trial is required to fully understand how a market such as this works in practice, how it is best constructed, the data and other information required to support its operation, and what benefits can be derived from bilateral trading of obligations.

BiTraDER will interact with other markets and add new market features incrementally based on learning obtained during the Project. It is designed to be transferable to other DNOs with minimum effort and common interfaces that allow participants to trade in multiple markets easily. This will help ease the transition to business as usual.

BiTraDER is the start of a journey to create the transparency and efficiency necessary to make local flexibility markets mainstream within GB. BiTraDER will use proven technology

applied in an innovative way to solve a real Problem. This will be the first in a series of interconnected and dynamic markets engaging with a broad range of market participants, resulting in lower cost and more extensive provision of flexibility, leading to lower cost operations in all timeframes. Ultimately, we wouldn't expect to define the rules for all of these markets; we might set some parameters of what they would need to deliver, but market participants would play an increasing role in specifying how these would work in detail.

(e) Involvement of other partners and external funding

We endeavour to make it as simple as possible for stakeholders to interact with the Innovation team and suggest ideas. There are various channels by which our stakeholders can make contact, including our customer contact centre, the Innovation page on our website, our Innovation email inbox, and our social media channels.

Our Future Networks Steering Group (FNSG), chaired by the Engineering and Technical Director, assesses all project suggestions and makes a decision about which to take forward.

The idea for BiTraDER was generated internally to investigate, develop and trial options for introducing a bilateral obligation trading market for resources connected to the distribution network. As more resources connect, it is important that we find a solution to maximise our use of flexible services to avoid expensive network reinforcement.

The Project concept has been reviewed by our Project Partners, who recognise that we are addressing an area of key challenge, and have helped to shape the idea through initial discussions and workshops. The FNSG selected and approved this innovation idea as the basis for the 2021 submission to the NIC.

Project Partner selection is determined in part by the FNSG, where partners have previously demonstrated experience, ability or interest in this area, and in part through a competitive tender process, in cases where more than one potential Partner could fulfil the project requirements. Successful Partners will also be able to commit resources to deliver the Project and disseminate the learning to other GB DNOs and stakeholders.

We will deliver BiTraDER alongside three Project Partners: Electron, AFRY and Delta-EE. The Project Partners will make a combined contribution to the Project of [redacted] Figure 4.5 below outlines each Partner's role on the Project and confirms their individual contribution, and Appendix G provides further Partner details.

We have endeavoured to Partner with National Grid ESO as we felt their inclusion would have provided added value to the Project. They have been unable to commit to a full partnership role due to concerns regarding their capacity to implement a full network trial and time constraints associated with obtaining approval to Partner ahead of submission. However, they have provided a letter of support, included in Appendix H expressing their commitment to provide a technical consultancy role to the Project and representation on the Project Steering Group (PSG). We have agreed a scope of work which outlines the specifics of their consultancy role on the project including workshop attendance, design sessions attendance, review of workshop outputs, review of final work outputs, contribution to BiTraDER Steering Group meetings as well as additional support such as telephone and email engagement, and general information gathering. Any support additional to that identified above will require further discussion and agreement between National Grid ESO and the BiTraDER project, therefore contingency has been factored into the BiTraDER cost estimate for National Grid ESO participation. If funding is awarded, we will work to sign up National Grid ESO under a commercial, binding contract to ensure we get value for money for their support.

Figure 4.5: Project Partner details

Prior experience	Role on Project	Contribution
Electron		
An energy technology firm which specialises in digitally optimised energy marketplaces. Their experience includes building ElectronConnect, a platform that supports marketplaces for SSE, NG ESO and London Hydro, and technology deployed in a real-time local marketplace in Orkney.	• Support customer engagement to understand optimal solution for DER. • Develop and provide market trading platform to enable DER to trade their curtailment obligations via a neutral secondary market. • Develop a simulated version of the trading platform using modelled live systems to simulate real operations. • Transition to a 'live' system using live network data and real transactions • Support stakeholder engagement within industry.	[redacted]
AFRY		
A leader in engineering, design and consulting service. They have previously supported on a number of innovation fund projects such as Low Carbon London and Smarter Network Storage, and have provided support to Ofgem on development of the Strategic Innovation Fund during the RIIO-ED2 advisory review.	• CBA of wider rollout based on observed outcomes. • Provide ongoing monitoring, analysis and evaluation of trades and outcomes. • Support in design of market trading platform. • Identification of interface and interaction frameworks with ESO and regulatory/policy changes to enhance outcomes. • Support stakeholder engagement within industry.	[redacted]
Delta Energy and Environment (Delta-EE)		
An energy research and consultancy service with a background in emerging distributed energy markets. They have previously worked on projects involving DNO demand side flexibility markets across Europe and have conducted studies geared towards finding the right strategies for using demand side flexibility.	• Design of customer engagement process. • Conduct customer engagement on Project. • Support in design of Project trials. • Support in design of market trading rules.	[redacted]

BiTraDER will specify, design, build and trial a market to allow the trading by flexible resources of their curtailment obligations. Once the functional specification for BiTraDER has been published, it is possible that Electron will have a limited opportunity to exceed a reasonable return on their financial contribution through first-mover advantage if other DNOs opt to implement the BiTraDER Solution. However, it is likely that competitors will develop and sell their own equivalent solutions, especially as the learning will be shared, so this potential advantage is not believed to be significant enough to warrant a profit-sharing arrangement.

(f) Relevance and timing

During the development of our 2021 DSO strategy, our stakeholders informed us that at certain times, and if suitably compensated, they may be willing to release some or all of their network capacity for use by others, locally. Additionally, they see us as a trusted source of information while remaining commercially neutral.

Based on this and to allow customers to directly benefit from such trading on local networks, we have committed in our DSO strategy to put in place a market mechanism whereby customers can bilaterally trade their capacity. While we will facilitate and technically enable the market, our neutrality principle means that we will not participate in it.

This is further reinforced by our RIIO-ED2 DSO Transition Plan, which commits to develop during RIIO-ED2 the capabilities for users to trade positions in curtailment and flexibility services stacks. This opens up a new market of energy trading and ensures that users have the opportunity to trade their way out of a curtailment stack, enabling them to fulfil contracts with other network and system operators.

In their 2021-2025 innovation vision, Ofgem have stated that flexibility is one of the essential components of our net zero energy system, and key priority areas of innovation are those which test and develop new approaches incorporating non-build solutions.

Given the importance of flexibility to the industry and our stakeholders, it is imperative that we look to develop ways of encouraging participants and maximising the value proposition of participating in such a market.

By developing the Method now, we can prove the concept, identify the appropriate architecture for deployment, and demonstrate the benefits of a secondary market to all market participants, thereby facilitating the ongoing roll-out of the Solution. This will ensure that all associated benefits are realised in as timely a fashion as possible.

The work we will undertake in BiTraDER complements a number of projects around flexibility – both completed and currently underway – run by other DNOs and industry groups. We believe that BiTraDER is timely because it will fill a gap in this existing work by exploring a number of specific areas, including:

- Resolution of the potential operational conflict between the ESO and DNO due to increasing use of ANM.
- DNO acting as neutral market facilitator to test the appetite for a flexibility market and the associated technology and market rules.
- How network operators can best support non-DSO services, which feeds into P6 WS1A of ENA's Open Networks project – see Appendix H for a letter confirming that BiTraDER aligns with the Open Networks project's plans.

We have included a review of forerunner projects in Appendix C.

5. Knowledge Dissemination

BiTraDER will generate learning applicable to all licensees which will be shared as early as possible.

5.1. Learning generated

BiTraDER will demonstrate how access to a neutral market will allow connected resources to trade their curtailment obligations bilaterally. We anticipate that this will encourage more customers to offer flexibility to the DNO, increasing competition in the flexibility market and thereby reducing whole system costs. BiTraDER will develop and publish a functional specification detailing the requirements for facilitating bilateral trading, including platform design, market model, data requirements and detailed interface requirements incorporating the necessary cyber security arrangements. This, alongside the Project Method, will be made available to all DNOs to allow these benefits to be passed on to customers across GB.

BiTraDER will build on the learning from previous IFI, First and Second Tier LCNF projects on flexibility, including markets, models and services. An analysis of relevant projects can be found in Appendix C, and all key deliverables for the Project are outlined in Figure 5.1 below.

Figure 5.1: BiTraDER deliverables

Deliverable	Evidence	Responsible
BiTraDER Initial Report – Customer Engagement and Scenarios	Document introducing the Project and detailing the BiTraDER scenarios and initial findings from the customer engagement	ENWL, Electron, AFRY, Delta-EE
BiTraDER Trials Plan, Trading Rules and Initial Specification Report	Document explaining Project progress including the following outputs: • End to end trading rules • Cyber security report • Technical requirements for the trading platform • Simulation trial plan • Network trial plan	ENWL, Electron, AFRY, Delta-EE
BiTraDER Interim Report – Trading Platform Design	Document detailing Project progress to date including the requirements and design of the following: • Connected resource interfaces • Data formats • Data flows • Trading platform • ANM interface	ENWL, Electron

Deliverable	Evidence	Responsible
BiTraDER Architecture Build Lessons Learned Report	Document detailing the lessons learned from the build of the BiTraDER system including build and integration of the trading platform with ENWL's real-time systems.	ENWL, Electron
BiTraDER Simulation Trials Report	Document detailing the results from the simulation trials including • recommendations for any amendments required for network trials. • assessment of Project readiness to move to network trials	ENWL, Electron, AFRY, Delta-EE
BiTraDER Network Trials Report	Document detailing the final results from the network trials. **This deliverable is only produced if we pass the Stage Gate.**	ENWL, Electron, AFRY, Delta-EE
BiTraDER Functional Specification	Final functional specification for BiTraDER, including: • Trading rules • Interface requirements • Data requirements • Platform design	ENWL, Electron, AFRY, Delta-EE
BiTraDER Final Report	Report on the conclusion of the BiTraDER Project including all the lessons learned and detailing the next steps, including BaU transition.	ENWL
Comply with knowledge transfer requirements of the Governance Document	1. Annual Project Progress Reports which comply with the requirements of the Governance Document. 2. Completed Close Down Report which complies with the requirements of the Governance Document. 3. Evidence of attendance and participation in the Annual Conference as described in the Governance Document.	ENWL

There is significant potential for BiTraDER to provide benefits to the GB distribution system as a whole. As such, we have agreed to provide regular updates to ENA's Open Networks project via a six-monthly Open Networks Steering Group and a quarterly report to the Product 6 Work Stream 1A working group during the Project. The Open Networks project aims to establish how network operators can support non-DSO services, and BiTraDER will feed into their understanding of how we can facilitate emerging markets in a neutral manner. We have included in Appendix H a letter from the Open Networks confirming that BiTraDER aligns well with their "learn-by-doing" approach.

5.2. Learning dissemination

The detailed Project Plan, which can be found in Appendix E, incorporates timely dissemination of the learning and knowledge that BiTraDER expects to generate.

Stakeholder groups

BiTraDER will generate a wealth of knowledge that will be of interest and benefit to various stakeholder groups. It is important to identify and understand these groups to ensure that our chosen knowledge-sharing and dissemination methods meet their individual requirements. Our history of the successful delivery and closedown of LCNF projects has enabled us to develop a consistent approach to capturing and sharing learning effectively.

Our main stakeholder audiences fall broadly into the following categories:

Network operators: this includes the ESO, IDNOs, Ofgem, BEIS and the wider government. DNOs will be keen to understand how BiTraDER can maximise capacity of existing assets by encouraging connected resources to provide flexibility, increasing market competition and provides savings in load related expenditure, reducing barriers to the uptake of low carbon connected resources, and addressing concerns of capacity being neutralised by ESO contracts.

Industry groups: this includes organisations such as the ENA, specifically the Open Networks project, and other UK and EU industry lobbyist groups, who will be interested in the development of a market such as that proposed in BiTraDER and any potential impact on network design and operation.

Owners and operators of connected resources: including generator operators, aggregators and suppliers who will be interested the development of a market such as that proposed in BiTraDER and the added value proposition providing flexible services can bring.

Academic institutions: including universities and higher education establishments who could access the raw data generated in BiTraDER to support wider research in the area of flexibility markets, models and services. Knowledge dissemination with this stakeholder group presents a unique opportunity to invite alternative conclusions.

Local authorities and customers: these groups will be interested in the customer benefits to be gained from the rollout of BiTraDER, such as reduced network operation costs and lower disruption associated with reinforcement activities, as well as removing barriers to uptake of RES. It is also possible that they will be interested in the results from customer engagement undertaken as part of BiTraDER.

Electricity North West: colleagues from across the organisation have been highly engaged and interested in the innovation programme and the BiTraDER Project team will be proactive in disseminating to this key stakeholder group. Close links with the Customer Contact Centre, those responsible for Policy and Standards, and the Commercial and Procurement departments will help with successful Project delivery. The Electricity North West community has a vested interest in working together to establish how learning and knowledge will be incorporated into BaU in the future.

Dissemination activities

Knowledge-sharing and dissemination activities are designed around the Project deliverables. In addition to planned learning, our experience has shown that unplanned learning is also likely. Timely dissemination of all planned and unplanned learning is crucial to keeping stakeholders engaged. To facilitate this, a designated knowledge and dissemination workstream will capture all learning and promote simple, targeted and pragmatic dissemination activities.

We will use dissemination methods which support direct feedback from our stakeholders to enable Project responsiveness and further incremental learning. These are outlined in Figure 5.2 below.

In previous years we have used advertorials in magazines, such as the IET, to disseminate Project learning. We have decided not to continue with this method because it does not generate any customer engagement.

Figure 5.2: BiTraDER Project dissemination activities

Dissemination method	Description	Audiences
Website	We will set up a page for BiTraDER on our website, providing an easily accessible platform to share knowledge and materials generated during the Project.	All stakeholder groups
Seminars, conferences and workshops	Certain dissemination activities will be delivered in this traditional manner, allowing for valuable face-to-face time with stakeholders and stimulating active participation from the audience. Events may be filmed and added to the webpage or YouTube for a wider audience.	All stakeholder groups
Open Networks Steering Group engagement	Six-monthly engagement with the Open Networks Steering Group and quarterly engagement with Product 6 Work Stream 1A working group, which aligns with the work we are doing in BiTraDER.	ENA, Open Networks project, DNOs
Annual online engagement sessions	Annual engagement sessions will be held online to provide Project updates and maximise accessibility to stakeholders.	All Stakeholders
Social media	Social media channels such as Twitter, LinkedIn and YouTube will be used as appropriate to promote learning from the Project.	Customers, local authorities, DNOs, IDNOs
Press releases	Issued during the course of the Project by an in-house press officer, these articles will be designed to publicise BiTraDER activities and events throughout the industry and will be published online.	All stakeholder groups
Internal communications	This will include articles in the company magazine 'Newswire', the weekly email bulletin and The Volt intranet, which will communicate the Project's aims and objectives across ENWL, as well as providing updates to prepare the company for BaU once the methodology is proven.	ENWL
Reports, documents and training material	Milestones and deliverables will be agreed to govern when these documents are produced and ready to share with stakeholders.	DNOs, IDNOs, Ofgem, DECC, academic institutions, ENWL

Figure 5.3 below shows the knowledge dissemination activities planned throughout the course of the Project.

Figure 5.3: Dissemination programme

2022	2023	2024	2025	2026
BiTraDER webpage	BiTraDER webpage updates	BiTraDER webpage updates	BiTraDER webpage updates	BiTraDER webpage updates
Internal communication	Internal communication	Internal communication	Internal communication	Internal communication
Annual report	Annual report	Annual report	Annual report	Closedown report
Knowledge sharing event	Knowledge sharing event	Knowledge sharing event	Knowledge sharing event	Knowledge sharing event
Open Networks	Open Networks	Open Networks	Open Networks	Open Networks
Annual online engagement session	Annual online engagement session	Annual online engagement session	Annual online engagement session	
ENIC Conference	ENIC Conference	ENIC Conference	ENIC Conference	

5.3. IPR

ENWL intends to conform to the NIC default Intellectual Property Rights (IPR) arrangements. All Partner contracts will include the standard NIC default IPR clause.

6. Project Readiness

BiTraDER has been planned using a robust methodology and is ready to implement.

We have a proven track record of delivering innovation projects to time and budget. We have developed a robust project plan in line with our proven process, and together with our chosen partners we are confident that we can deliver the Project learning and benefits.

Requested level of protection required against cost over-runs (%): 0%
Requested level of protection against Direct Benefits (%): 0%

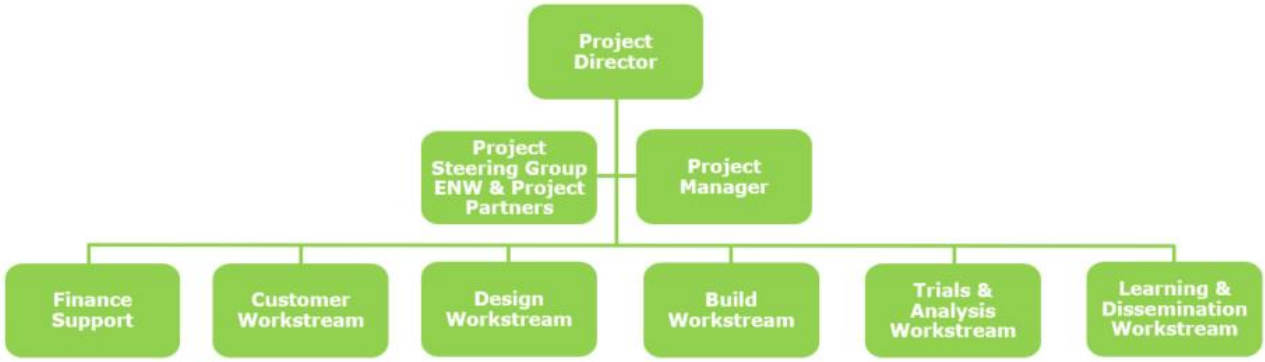
6.1 Measures taken to ensure the project can start in timely manner

Electricity North West is confident that, if funding is awarded, BiTraDER will be able to start in a timely manner due to the significant amount of preparatory work which has taken place prior to the Full Submission. In addition to producing a comprehensive project plan, we have established relationships with all project partners, taken steps to set up our PSG, and completed our site selection. We also have dedicated teams set up within the Innovation section who will build on past experience from previous successful submissions to assist with delivery.

Project management and governance

BiTraDER will use the programme management and governance approach employed for the delivery of our previous Second Tier / NIC projects. Following the success of projects such as CLASS, Smart Street and Celsius, our proven project governance methodology will ensure that BiTraDER meets the defined milestones and project deliverables. Enhancements to the methodology identified in the delivery of previous and ongoing projects can be easily transferred into BiTraDER. The philosophy to be open and collaborative, with the commitment to get it right first time to achieve delivery success, will be embedded in the BiTraDER Project team. The project management structure is shown below.

Figure 6.1: Project management organogram



Project Partners and contractual arrangements

Project Partners and suppliers are carefully selected dependent on experience, cost and their ability to commit skilled resources to deliver the Project and disseminate learning to other GB DNOs. The process by which the BiTraDER Partners have been selected is described in Section 4 (e).

We have established a dedicated consortium and confirmed with each partner that they will have sufficient resource available to meet the requirements of the project plan. We have also confirmed contributions, costs, roles and responsibilities, which will form the basis of our contractual agreements. The key outcome of this approach is to minimise time spent on contractual agreements and ensure that BiTraDER can be mobilised very quickly if funding is awarded.

Defined roles and responsibilities and financial costing and contributions for the provision of services and/or products is included in the Full Submission workbook (see Appendix J).

6.2 Minimise possibility of cost overruns or shortfalls in direct benefits

Project costs and Direct Benefits

The costs and Direct Benefits have been compiled by a management accountant federated into the bid team. Inputs were generated by our internal and external Project Partners/suppliers and have been approved through Electricity North West's internal investment appraisal process. The cost information included in the proposal has an accuracy of between 5% and 7% and within the overall cost calculation we have added an additional 7.6% as contingency against any potential changes to costs as the Project progresses.

A management accountant, responsible for managing all costs and constructing and delivering the reporting requirements, will be embedded in the Project team along with the PMO to manage the budget. Electricity North West runs a robust financial tracking and reporting system in line with current internal policies and frameworks. The Project finances will be held in a separate Project Bank Account as required by the NIC Governance Document. This will meet the following requirements:

- Show all transactions relating to BiTraDER only.
- Be capable of supplying a real-time statement (of transactions and current balance) at any time.
- Accrue expenditures when a payment is authorised (and subsequently reconciled with the actual Bank Account).
- Accrue payments from the moment the receipt is advised to the bank (and then subsequently reconciled with the actual Bank Account).
- Calculate a daily total and calculate interest on the daily total according to the rules applicable to the Bank Account within which the funds are held.

In addition, our auditors, will be made aware of our responsibilities should funding for BiTraDER be awarded.

6.3 Verification of all information included in proposal

Assurance and sign off

We have undertaken various assurance activities throughout the bid preparation process to substantiate our financial costings and benefits, including:

- Developing detailed internal cost models to evaluate the required Project resources, using proposals from third parties subject to fixed-price contracts.
- Documenting and challenging all contributions by Partner organisations individually.
- Collating all costs and contributions for review by the Project's management accountant.
- Compiling our benefits estimate with independent third-party support from AFRY Management Consulting Limited.

We have also conducted an internal process audit for the submission. This audit found no material errors or issues and will form the basis of a report to be presented to the responsible director.

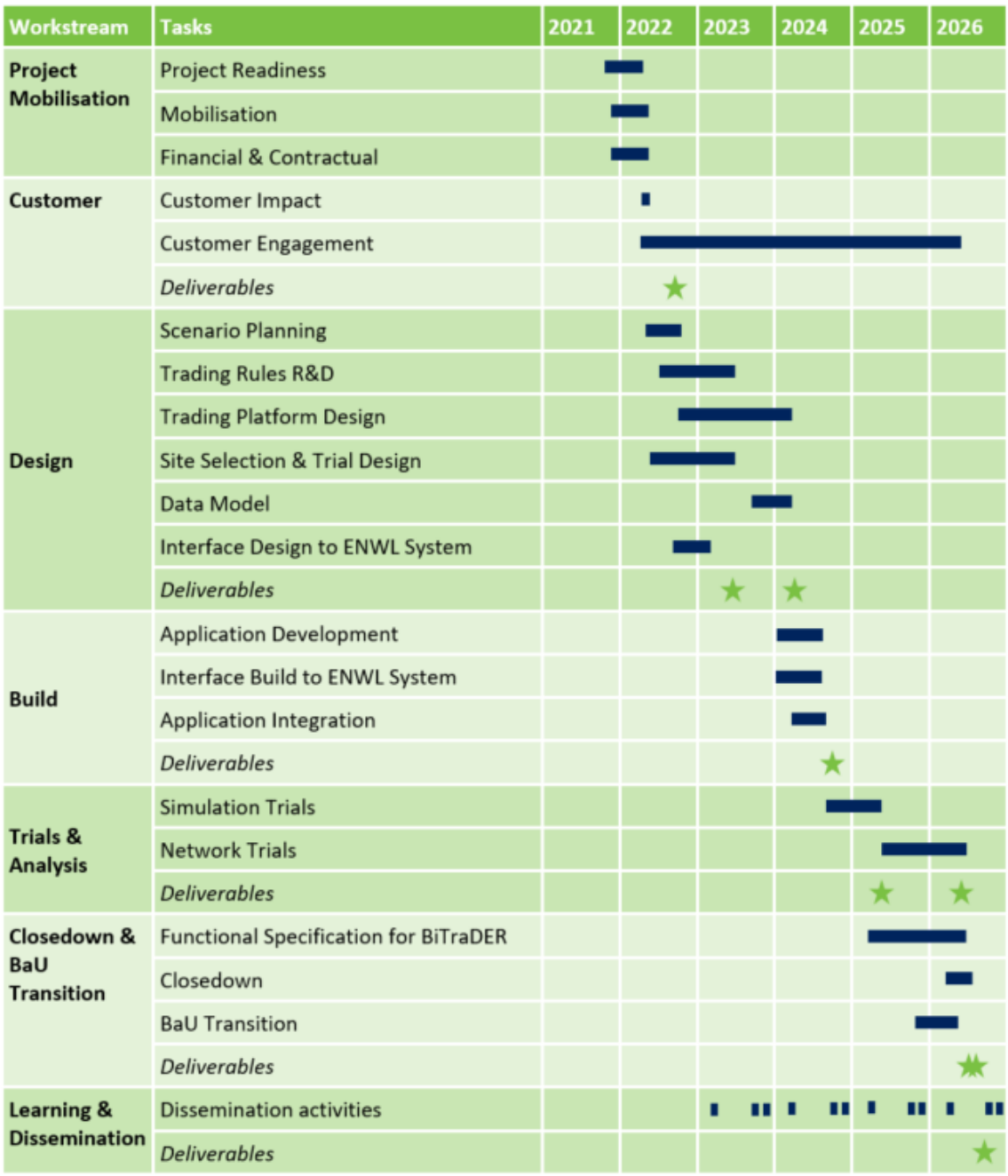
A review of this nature represents the most appropriate form of challenge for this type of submission. Our final submission will be reviewed and signed off by our Head of Engineering and Technical, Dan Randles, supervised by the Engineering and Technical Director, Steve Cox, and approved by the Executive Leadership Team for submission.

Project plan

The Project will be delivered via seven workstreams: Project Mobilisation, Customer, Design, Build, Trials and Analysis, Closedown and BaU, and Learning and Dissemination. The Project plan outlines our approach by defining the activities required within each workstream and identifying who has been assigned to undertake each, and when.

The plan is shown in Figure 6.2 and a more detailed version can be found in Appendix E. Any tasks which are associated with passing the stage gate are highlighted in blue in the detailed plan.

Figure 6.2: High level Project plan



Mobilisation: the mobilisation of both internal and external teams, as well as the retention of those individuals across the Project delivery lifecycle, is crucial to the successful start and continued delivery of the Project. Electricity North West has identified delegate resources to deliver BiTraDER, managed by a full time Electricity North West project manager. The team will also receive significant help from within the wider Innovation team. Furthermore, the Project Partners have identified resources that will be dedicated to BiTraDER.

Customer: the customer workstream runs in parallel with the other Project workstreams and a detailed Customer Engagement Plan will be issued to Ofgem in May 2022. Further details about the planned customer engagement can be found in Section 8.

Design: the design workstream will involve research, design and planning in advance of the build phase. We will look at scenarios, trading rules, platform, site selection and trial design in this phase, and will produce several reports: the Scenarios and Trading Rules Report; the Trials, Design and Specification Report; and the Trading Platform Design Report.

Build: during the build workstream we will develop the application designed to enable curtailment obligation trading, build both the customer interface and the interface with Electricity North West's system, and integrate the application. During this phase we will publish the Architecture Build Lessons Learned Report.

Trials and analysis: we will conduct two sets of trials during the Project – simulation trials and network trials, both involving customer engagement. During this workstream we will publish a report on each set of trials, the Simulation Trials Report and the Network Trials Report. Due to the inherent uncertainty associated with a live network trial phase, upon completion of the simulation trial, we propose to introduce a stage gate into the overall project programme. The stage gate will occur at the end of the simulation trial and allows for the by-passing of the live network trial and progressing immediately to the closedown and BaU phase.

Closedown and BaU: this workstream will see the closedown of the Project, during which we will analyse the costs and benefits of BiTraDER and produce a closedown report for dissemination. We will also develop the process for transition of the Solution into BaU, provide training to internal planners and operational engineers on all new codes of practice, and publish our Functional Specification for BiTraDER.

Learning and dissemination: this workstream will incorporate all learning and dissemination activities and will run throughout the Project in line with our Deliverables, to ensure timely dissemination of all learning. We will make best use of all available channels to ensure maximum reach, including online resources such as our website, social media, Open Networks Steering Group, and online engagement sessions, as well as knowledge sharing events, and presentations at the ENIC. These activities are described in more detail in Section 5.

The Project plan provides a clear roadmap to steer and support the Project delivery team in achieving the relevant milestones and Deliverables on time and within budget.

6.4 Project will deliver learning if LCT uptake is lower than anticipated

The Project scope is designed to deliver learning and develop outputs without the need for further low carbon or renewable energy uptake on the trial networks.

Our methodology will be applicable to any distribution network allowing bilateral curtailment obligation trading between market participants, thereby optimising the merit order stack and enabling management of network constraints.

In addition, the Project benefits will remain relevant even if there is minimal RES uptake. For example, for the distribution system, the capacity release benefits will support load growth from any source and the increase in flexibility will still provide carbon and financial benefits. The ESO will also gain many of the same Project benefits, such as the resolution

of any ESO/DNO contract conflicts thereby delivering a more effective operation of the transmission and distribution networks through improved co-ordination of contracts.

6.5 Processes to identify circumstances in which to suspend project

Risks, mitigation and contingency plans

A key aspect of our project delivery methodology is the identification and management of risks and issues. We have employed Electricity North West's proven risk model which has been refined to better reflect the increased significance of impacts at project level.

Appendix F contains our Risks and Issues Register, including mitigating and contingency actions. We have used the format and scoring matrix from our proven risk model to evaluate the likelihood and impact of an identified risk or issue and to re-evaluate the controlled risk or issue following mitigating activity. Tables showing the scoring matrix and associated description have been included in Appendix F, for reference.

The definition and creation of mitigating and contingency activities form a key part of our risk management strategy. The project management team and PSG will use this methodology to continually identify and review the Project risks, mitigating actions and contingencies, to ensure that risks are managed in priority order. When a risk is raised the project management team will be responsible for creating a mitigating action that can be brought into play should the risk be realised. Standard considerations in the risk identification process include the monitoring of cost management, specifically cost overruns or shortfalls in Direct Benefits.

During the course of the Project we will hold regular PSG meetings at which the Risks and Issues Register will be reviewed. In addition to the Project team and Partners, this group will include a Project director and a federated management accountant from the finance directorate, to drive delivery to budget.

The PSG will identify the circumstances in which the Project is either suspended until sufficient risk mitigation has taken place to enable ongoing management of the risk or issue; or halted with further commitment deferred until agreement on how to proceed has been reached with Ofgem.

We received feedback on our ISP that this competition would be a good time to convert to the new phasing structure outlined in plans for the Strategic Innovation Fund: Discovery, Alpha and Beta, with the Discovery phase being focussed on what is wrong with the current regulatory structures. However, we have decided instead that a stage gate would be the most appropriate way to manage some of the risk associated with BiTraDER.

Project stage gates can be used to allow for a decision to be made on whether or not to proceed with some or all of the Project. This decision is based on Project forecasts and current information available (which was not available at the time of the Project starting), including the business case, risk analysis, and availability of necessary resources.

Owing to the inherent uncertainty associated with including a live network trial, upon completing the simulation trial and before proceeding to the network trial, we propose to introduce a stage gate into the overall Project programme. The stage gate will occur at the end of the simulation trial and allows for the by-passing of the live network trial and progressing immediately to the Closedown and BaU transition upon completion of the simulation trial. Naturally, we see significant value in undertaking a live network trial and will try to deliver this aim, including working with Project participants throughout the course of the Project. However, we are conscious of the cost of undertaking the network trial and the requirement for inclusion for actual participants that wish to trade curtailment obligations in the BiTraDER market. There is a risk that in the Spring/Summer of 2025, when the network trials are scheduled to occur, there is an insufficient number of participants able or willing to join BiTraDER, and that owing to these low levels of engagement we are unlikely to gain the learning outcomes considered necessary to justify the trial.

The stage gate will include consideration of the following three main issues:

- *Quality:* We will check whether the simulation trial has delivered in line with its objectives and that sufficient work has been completed to allow progression to the live network trial.
- *Rationale:* We will check if the need for a live network trial remains. This check will include that the economics of a live network trial remain valid and the forecast benefits are also valid.
- *Action:* We will check if the necessary resources are available and that the plan for implementation of the live trial is both reasonable and deliverable within the constraints of the approved Project.

Subject to the outcome of the stage gate assessment, we will do one of two things:

1. Suspend the live network trial and move immediately to the Closedown and BaU transition phase.
2. Continue with the live network trial as planned.

7. Regulatory Issues

BiTraDER will have a positive impact on the future operation of electricity networks and will reduce costs for customers.

It is not expected that the BiTraDER Project will require any derogation, licence consent or licence exemption for its delivery.

BiTraDER will investigate, develop and trial options for introducing a bilateral obligation trading market for resources connected to the distribution network. BiTraDER could have profound implications on the operation of electricity networks.

BiTraDER will prove that access to a neutral secondary market will optimise the curtailment of flexible resources, meaning the correct resources are constrained in all instances, and increases the likelihood that customers will provide flexibility services thereby creating a transparent, consistent and smart flexible energy system that will reduce costs for consumers and industry.

Impact of Access and Forward Looking Charges Significant Code Review

Ofgem has only recently published a consultation on its Minded to Position for the Access and Forward Looking Charges Significant Code Review. Therefore, it is currently difficult to determine what, if any, impact there will be on BiTraDER.

For example, if the proposals on the change in connection boundary were implemented, this would affect aspects of the BiTraDER business case. More notably, the appetite of new customers to accept flexible connections might be influenced more by the proposed access reforms than by their ability to trade curtailment obligations bilaterally with other customers. The precise effects are difficult to estimate without further information on the proposed implementation of the reforms, how customer behaviours might be influenced by the reforms, and how the reforms might affect extant contracts.

Alongside other regulatory considerations, the impact of the Access & Forward Looking Charges Significant Code Review decision will be.considered as part of the regulatory assessments performed during delivery of BiTraDER.

Long term regulatory impact

The learning from the Trials will deliver a functional specification to facilitate delivery of the bilateral trading mechanism and propose a market model for the bilateral trading of whole system flexible services.

The longer-term impact on the regulatory regime applied to network operators is significant and positive with the following areas potentially seeing change:

- Common connection and use of system charging methodologies applied by distribution network operators;
- Regime for the provision of connections;
- National Terms of Connection within Distribution Connection and Use of System Code (DCUSA); and
- Future DSO operational management.
- Governance of the bilateral obligation trading market, its operation and management and the role of the DNO and ESO in its operation.

8. Customer Impact

BiTraDER will engage with customers to determine their understanding of, requirements for, and likelihood of participation in a bilateral curtailment obligation trading market.

During the Project, we will undertake engagement with up to 50 potential market participants to ensure that BiTraDER's Method and Solution meet the requirements of our customers, with a view to enabling maximum participation of connected resources in the flexibility market. The Problem we face is a lack of available flexibility on the network, and we will therefore start by speaking to customers to determine:

- Their understanding of the merit order stack and flexibility market
- How they currently interact with the flexibility market
- Suitability of the market platform for all users, ranging from those with a mature energy competency to those with limited knowledge
- What might encourage customers to participate in the flexibility market to allow dynamic, bilateral trading

We will also select 10 - 15 connected resources to participate in simulated and real-life network trials to test customer appetite for a curtailment obligation trading market and assess suitability and accessibility of the user interface. For more information on the trials, see Section 2.3.

We believe that if we can facilitate a curtailment obligation trading market, we can improve the likelihood that connected resources will participate. This will increase the availability of flexibility, and thus competition in the market, enabling the DNO to maximise the capacity of existing assets and procure flexibility for less.

There are a number of benefits to customers associated with the increased competition in the flexibility market we aim to develop through BiTraDER, for example:

- The business case for investment in low carbon resources improves as the customer will have more control over export and import restrictions, enabling further uptake of RES.
- Increased network capacity will enable faster, cheaper connections for new RES as the DNO will be able to procure flexibility at a lower cost.
- Customers have the option to reduce their curtailment obligation as required, removing the rigid, long-term commitment to provide flexibility to the DNO associated with accepting a flexible services contract.
- Customers in contract with the ESO will benefit from the improved co-ordination between ESO and DNO, enabling them to provide flexible services to both.

Customer engagement

After running a competitive tender seeking support for customer engagement, we appointed Delta-EE as Project Partner to assist with this element of the Project. We will work together with Delta-EE to produce the Customer Engagement Plan (CEP) and Data Privacy Statement (DPS), which will set out the detail around how we intend to engage with customers in BiTraDER. This will document the communication strategy and customer research methodology, from recruitment of participants to reporting and analysis.

BiTraDER will target two key groups of customers from across GB participation in the Design and Simulation phases of the Project:

1. Customers with existing firm connections
2. New customers with flexible connections

For the Build and Network Trials we will engage with the same two key groups, but focussed on the trial area in Cumbria.

We will utilise existing relationships and contacts (complying with all necessary GDPR and other rules) in addition to directly approaching new customers that we wish to include in the trial.

Prior to customer engagement, the following key preparation tasks outlined in Figure 8.1 will be carried out.

Figure 8.1: Key preparation tasks for customer engagement

Development and refinement of robust CEP

- Identify which customers to target during the Project
- Define how many customers in each group to target to get the required number of participants for Project simulation and trial
- Define what we need customers to do during the Project, and the associated timescales
- Define the most appropriate strategies for approaching different customers
- Determine the most appropriate engagement materials for support during the Project

Preparation of necessary supporting materials

- Must be accessible to a range of customers with different levels of knowledge
- Must be brief, clear, engaging and easy to digest
- Must be in an effective format, e.g. brochure for introduction to Project, slides for further information, leaflet describing requirements

The Project will use proven engagement methods and channels to ensure customers participating in the research fully understand the benefits and requirements of participation. Suitable communications materials will be generated to support customers that participate. All materials generated as part of the Project will be developed collaboratively with Delta-EE and guided by customer and stakeholder feedback. These materials will confirm that Electricity North West Ltd is the research sponsor and will highlight any potential implications and benefits of BiTraDER.

Feedback received from customers and stakeholders may be used to revise research plans in order to continually improve the customer research and engagement strategy. The Project team will consult Ofgem in advance of any significant changes from the original approach.

Figure 8.2 summarises the customer engagement and research approach in BiTraDER, by stage.

Figure 8.2: Stages of customer engagement in BiTraDER

Stage	Focus	Detail
Stage 1: Initial outreach and onboarding Start of project	• introducing the project, it's aims, the timescales and the input needed from participants • identifying the most interested and relevant customers – and onboarding them.	Initial contact, follow-up meetings to address clarifications/questions as necessary. Aim, to approach up to 50 customers with intention of onboarding 10 - 15 for Project participation.
Stage 2: In-depth interviews with customers Early in year 1 following initial engagement	• Needs around flexibility / network connections and current challenges or experiences • Attitudes towards curtailment, flexible contracts, etc • Ideas / views on the platforms or tools that they would find most useful today • Outcomes that would cause them to consider BiTraDER a success	Detailed conversations with customers, duration of 1-2 hours per customer.
Stage 3: Annual workshops with customers Years 1-4	• Gather input into the initial design of the trading rules / market / platform • Gather feedback on experiences in the trial and improvements that can be made on the next iteration of the trading rules / market design / platform • Key learnings and lessons from the project • Information dissemination (e.g. project progress updates, next steps, input and support required from customers)	Annual workshops to support ongoing participation in the project and feedback gathering in convenient location attended by representatives from BiTraDER and Project Partners, and as many customers as possible.
Stage 4: Customer feedback gathering Years 1-4	To gather feedback on the Project to understand if any improvements can be made or are needed to ensure their continued support.	Regular calls with customers, est. every 6-12 months, and online surveys with questions on Project and participation.
Stage 5: Ad hoc support for customers Years 1-4	To ensure customers can get in touch with the Project team if they require any support.	An avenue for customers to get in touch and a process to manage any queries to ensure they receive a response in a timely and effective manner.

We will produce a number of short reports to feed into other workstreams and support the wider project delivery, including the CEP, outcomes and key learnings from the initial customer engagement, results and outcomes of the in-depth interviews to feed into and inform initial trading rules design, outcomes and feedback from the workshops, general feedback from customers.

Customers in the BiTraDER trial area

BiTraDER requires no active involvement from the wider community and no customer impact is anticipated. Therefore, the Project will not involve a large scale general customer awareness campaign in advance of the trials. This rationale leverages learning from previous research.

Planned supply interruptions

We do not anticipate that this customer engagement will involve any planned interruptions and no other element of BiTraDER is anticipated to cause interruptions to customers' supplies.

It is possible that the new trading rules will lead to a change in the flexible contract a provider currently operates under. These are not amended charging arrangements, but amended operating arrangements.

Unplanned supply interruptions

Customers will not be affected by an unplanned supply interruption as a result of BiTraDER.

Learning and dissemination

We have planned an extensive knowledge dissemination programme that employs a range of communication methods and channels to engage with and impart information to our customers and other stakeholders, details of which are summarised in Section 5.

Managing customer enquiries

Our aim is to maintain a positive customer experience throughout the duration of BiTraDER. This upholds Electricity North West's core values of putting our customers at the heart of our business. This commitment will be achieved by employing a number of communication channels so that customers will find it simple to raise any questions or concerns at a time convenient for them.

9. Project Deliverables

Reference	Project Deliverable	Deadline	Evidence	NIC funding request (%, must add to 100%)
1	BiTraDER Initial Report – Customer Engagement and Scenarios	30/11/22	Document introducing the Project and detailing the BiTraDER scenarios and initial findings from the customer engagement.	10%
2	BiTraDER Trials Plan, Trading Rules and Initial Specification Report	30/06/23	Document explaining Project progress including the following outputs: • End to end trading rules • Cyber security report • Technical requirements for the trading platform • Simulation trial plan • Network trial plan	15%
3	BiTraDER Interim Report – Trading Platform Design	28/02/24	Document detailing Project progress to date including the requirements and design of the following: • Connected resource interfaces • Data formats • Data flows • Trading platform • ANM interface	10%
4	BiTraDER Architecture Build Lessons Learned Report	29/11/24	Document detailing the lessons learned from the build of the BiTraDER system including build and integration of the trading platform with ENWL's real-time systems.	15%

Reference	Project Deliverable	Deadline	Evidence	NIC funding request (%, must add to 100%)
5	BiTraDER Simulation Trials Report	30/06/25	Document detailing the results from the simulation trials including • recommendations for any amendments required for network trials. • assessment of project readiness to move to network trials	15%
6	BiTraDER Network Trials Report	30/05/26	Document detailing the final results from the network trials. **This deliverable will be produced if we pass the Stage Gate**	15%
7	BiTraDER Functional Specification	30/06/26	Final functional specification for BiTraDER, including: • Trading rules • Interface requirements • Data requirements • Platform design	10%
8	BiTraDER Final Report	31/07/26	Report on the conclusion of the BiTraDER Project including all the lessons learned and detailing the next steps, including BaU transition.	10%
9	Comply with knowledge transfer requirements of the Governance Document.	End of Project	1. Annual Project Progress Reports which comply with the requirements of the Governance Document. 2. Completed Close Down Report which complies with the requirements of the Governance Document. 3. Evidence of attendance and participation in the Annual Conference as described in the Governance Document.	N/A

10. List of Appendices

Appendix number	Title
A.1	Benefits Tables
A.2	Base Case Method and Solution (Business Case)
B.1	Relevant Background Technical Information
B.2	Supplementary Method Detail
B.3	Technical Description of ElectronConnect Platform
C	Review of Forerunner Projects
D	Organogram
E	Project Plan
F	Risks and Issue Register and Contingency Actions
G	Project Partner Details
H	Supporting Letters
I	Glossary
J	Full Submission Spreadsheet

Appendix A.1: Benefits Table

A.1.1 Financial benefits

Figure A.1.1 summarises the results as calculated by the BiTraDER financial business case model.

Figure A.1.1: BiTraDER financial benefits

Scale	Method	Method case cost (£m)	Base case cost (£m)	Net Benefit £m NPV 2021 prices			Cross references	Notes
				2030	2040	2050		
ENWL scale	BiTraDER	[redacted]	[redacted]	-0.9	17.3	35.5	Appendix A.2.1, A.2.2 A.2.4	1, 2, 4, 5
GB scale	BiTraDER	[redacted]	[redacted]	62.1	325.7	581.4	Appendix A.2.1, A.2.2, A.2.4	3, 4, 5
Additional Benefits - quantified	None							
Additional Benefits - not quantified	Accelerated connections: there will be financial and carbon benefits expected to be realised through accelerated connections of low carbon generation, flexible and non-flexible demand. Altered Energy Consumption: To the extent that BiTraDER enables demand side participation, we anticipate potential benefits (financial and carbon) resulting from the shifting of demand from (net) peak hours to off-peak hours. This potential impact is difficult to estimate at this stage, and so it will be added to the quantitative analysis as data becomes available during the project itself. Reduced Losses: Any reduction in peak energy flows has the potential to reduce distribution losses. If the effect is material, we will quantify it in the project itself if data permits. Reduced cost of flexibility: The increased level of competition that BiTraDER enables by attracting more flexible capacity to the market should lead to a reduction in the cost of flexible sources for DNOs. This potential impact is difficult to estimate at this stage, and so it will be added to the quantitative analysis if suitable data becomes available during the project itself. The increased level of competition resulting from BiTraDER platform attracting more flexible resources should lead to a reduction in the cost of flexible sources for ENWL.							

Explanatory notes to the financial benefits table:

1. *Project scale benefits have not been calculated for BiTraDER* because it will develop a DNO scale solution. The BiTraDER platform will be applicable to the entire distribution network.

2. *The ENWL scale benefits include impacts of deferred investment, increased co-ordination and reduced curtailment.* These benefits are assessed against the cost

of developing and operating a platform to deliver BiTraDER, for both Electricity North West and market participants. Benefits for ENWL begin from 2027, which is when we plan to roll-out BiTraDER, while project costs begin from 2022. We also anticipate there are benefits linked to the acceleration of connections, energy consumption and reduced losses that have not been quantified. However, we anticipate as the project develops, we may be in a position to add these benefits to the quantitative assessment.

3. *GB scale financial benefits are scaled from the ENWL results:* the GB scale benefits have been calculated from the ENWL results based on the proportion of Primary and BSP substations in ENWL compared to that in GB. This scalar was derived using the DNOs' LTDS. It is assumed that the other GB DNOs will be in a position to roll-out the BiTraDER platform from 2028, in line with the beginning of RIIO-ED3.

4. *The sensitivity analysis shows significant variation in results, but generally shows a positive benefits case:* the central view assumptions stated in Appendix A.2.1 reflect our balanced view on potential value of the benefits. In addition to our central view, we have also produced two sensitivity scenarios: high and low for each benefit item. The sensitivity analysis found that the most influential factor is the assumed level of "% share of flexible resources which have additional combined service offering to DNO and the Capacity Market". This reflects the fact that DNOs and the ESO are competing for the distributed generation with non-firm connections which can also participate in the capacity mechanism: if BiTraDER can bring new resources to the table there are benefits all round; if it reallocates resources in a more efficient way between the DNOs and ESO then there are net benefits overall but some negative line items, particularly in the low sensitivity, reflecting the limited ability of distributed generation with non-firm connections to participate in the capacity mechanism.

5. The methodology and input parameters the sensitivity scenarios use and the resulting benefits we observe in high and low sensitivities for each quantified benefit item are summarised below. Some benefits are calculated separately for the different participation groups[1].

   - *Reduction in Load Related Expenditure:* using the distribution investment reduction shares of 1.5% and 0.5% in high and low sensitivities, respectively (central assumption: fixed 1% reduction each year throughout 2050), the NPV of the GB-wide benefits in 2050 range from £8.7m to £26.2m.

     This benefit is recognised as positive from G3 connections in the central Method case as well as high and low sensitivities.

   - *ESO interaction:* high and low sensitivities are produced as a higher and lower % share of flexible resources, respectively, for each participant group level that may offer flexibility services to both DNO and ESO. The benefit calculation reflects both the potential for increased flexibility provision arising from BiTraDER and better collaboration between ESO and DNOs on the deployment of flexibility. Our current view of how the G1, G2 and G3 connections collaboration potential with ESO and DNO will evolve to facilitate the ESO on balancing services is as follows:

[1] G1: those who would have had a flexible connection in the absence of BiTraDER, G2:ad hoc connections without contracts; G3: additional capacity with flexible connections as a result of BiTraDER.

  - In the central Method case, this benefit is assumed to be recognised as positive for G1 and G3 connections and no benefit/cost is realised from G2 connections.
  - In the high sensitivity, a positive benefit is realised for all G1, G2 and G3 connections.
  - In the low sensitivity, we consider a case in which the net impact on the ESO may become negative for G2 and G3 connections, to the extent that offering services to the DNO takes resources away from the ESO. A positive benefit is assumed to be realised from G1 connections which outweighs the negative benefits from G2 and G3 connections.

  The NPV of the GB benefits in 2050 range from £17.0m to £100.0m. In practice, we expect that any potential negative effects can be mitigated by the detailed rules for flexibility connections.

- *Reduced Generation Investment:* the range of outcomes is relatively more varied in sensitivities for this benefit compared to other benefits. High and low sensitivities are produced as a higher and lower % share of flexible resources, respectively, which is determined for each participant group that may offer flexibility services to the DNOs while offering firm capacity to the Capacity Market.

  - In the central Method case, the benefit is assumed to be recognised as positive for only G1 connections and no benefit/cost is realised from G2 and G3 connections.
  - In the high sensitivity, a positive benefit is realised for all G1, G2 and G3 connections.
  - In the low sensitivity, we consider a case in which the net impact on generation investment could be negative for G2 and G3 connections, e.g. if distributed resources with non-firm connections become ineligible for participation in the capacity market. A positive benefit is assumed to be realised from G1 connections which is not sufficient to make the net benefit positive except in the following couple of years.

  The NPV of the GB benefits in 2050 range from -£55.7m to £424.2m. In practice, we expect that any negative effects would be mitigated by the detailed rules for flexibility connections.

- *Reduced Curtailment of RES:* high and low sensitivities are produced as a lower and higher % share of curtailment in the Method case, respectively. As a higher/lower difference between the curtailment % assumed in the base case and Method case brings higher/lower benefit.

  This benefit is recognised as positive for all G1, G2 and G3 connections in the central Method case as well as High and Low sensitivities.

  The NPV of the GB benefits in 2050 range from £252.9m to £325.2m.

- *Optimised Curtailment of non-RES:* similar to the "Reduced curtailment of RES" benefit, high and low sensitivities are produced as a lower and higher % share of curtailment in the Method case, respectively in order to estimate the cost saving from curtailment being reallocated to parties with lower costs.

  This benefit is recognised as positive for all G1, G2 and G3 connections in central Method case as well as high and low sensitivities.

  The NPV of the GB benefits in 2050 range from £64.0m to £82.3m.

A.1.2 Capacity benefits

There will be distribution capacity benefits as a result of the bilateral trading facilitated by BiTraDER. This will arise from two sources. First, BiTraDER will encourage more existing

connected parties to offer flexibility into the system which may release existing network capacity to be used by new connections. Second, future connected resources will accept flexible contracts that reduce the requirement for network investment. These factors are recognised under the "Reduction in Load Related Expenditure" financial benefit. No distribution capacity benefit (i.e. in MVAs) is quantified at this stage due to the difficulty to estimate.

A.1.3 Carbon benefits

Figure A.1.2 summarises the carbon benefits of reduced curtailment of RES calculated by the BiTraDER business case model. Further explanation is provided in the notes below the table.

Figure A.1.2: Carbon benefits of BiTraDER

Scale	Method	Cumulative Benefit tCO_2e			Cross references	Notes
		2030	2040	2050		
ENWL scale	BiTraDER	3,052.9	6,138.8	7,649.0	Appendix A.2.6	6
GB scale	BiTraDER	30,526.3	71,877.5	92,113.7	Appendix A.2.6	7
Additional Benefits – not quantified	BiTraDER will also lead to substantial carbon and environmental benefits through accelerating low-carbon generation and flexible demand (i.e. accelerated electrification of EV chargers and heat pumps) and the reduction of peak demand, resulting from the movement of demand from peak hours to off-peak hours. The methodology for quantification of carbon benefits will be re-examined as part of the project.					

Explanatory notes to the carbon benefits table:

6. *ENWL scale carbon benefits are driven by reduced curtailment of RES:* BiTraDER market is expected to produce a potential carbon benefit by enabling a more economic selection of flexible resources for curtailment which is expected to reduce the RES curtailment and displace less economic sources (i.e. non-RES) via optimisation. To quantify the associated carbon emission reduction, the non-RES volume (that is expected to replace some of the RES curtailment) estimated under the financial benefit "Reduction in RES curtailment") is multiplied by the average grid carbon emission intensity numbers (based on "The Sixth Carbon Budget, Electricity Generation", CCC) that reflects the carbon emission intensity of the underlying generation mix the curtailed RES volume displaces (RES is assumed to have zero electricity generation carbon intensity).
7. *GB scale carbon benefits are scaled from the ENWL results:* The GB scale benefits have been calculated from the ENWL results based on the proportion of Primary and BSP substations in ENWL compared to that in GB was derived using the DNOs' LTDS. It is assumed that the carbon benefits resulting from the roll-out of BiTraDER will begin in 2027 for ENWL, in 2028 for the remaining DNOs.

Appendix A.2 Quantified Business Case Methodology

The BiTraDER quantified business case model is reflective of the benefits and drivers for BiTraDER. All assumptions used in the calculations are based on validated data and credible assumptions. In general, conservative assumptions have been chosen in recognition of the uncertainty of future benefits forecasts.

We have assessed the NPV of the BiTraDER market based on the Method case alongside the base case. These are set out below.

Base Case: the Base Case for the analysis reflects the case without BiTraDER where no benefit or cost is realised in the absence of the BiTraDER project.

Method case: this case assumes an incremental assessment in terms of changes in benefits and costs from the base case.

The benefits are envisaged to be realised from three key participation groups which are defined as follows:

Participation group (G1): this group represents existing and future connected resources with contracted flexibility arrangements in the absence of BiTraDER.

Participation group (G2): this group represents connected resources without contracted flexibility arrangements (or existing customers with flexibility arrangements for part of their capacity) who might be willing to offer (additional) capacity to BiTraDER on an ad hoc basis.

Participation group (G3): this group represents connected resources who might in future accept a contracted flexibility arrangement in the knowledge that there are ad hoc arrangements in place to trade their curtailment liabilities.

The GB scale benefits have been calculated from the ENWL benefits via a simple scaling factor, based on the proportion of Primary and BSP substations in ENWL compared to that in GB derived using the DNOs' LTDS.

The NPV calculation is based on the benefits and costs described in Section A.2.1 and Appendix A.1.1.

A.2.1 BiTraDER benefits assumptions

The project will provide further learning to inform the input assumptions. At this stage, to assign quantitative values to each of the benefits, we have developed a set of detailed assumptions, which are presented in Figure A.2.1 below.

Figure A.2.1: Assumptions used in the BiTraDER benefits analysis

Description	Assumptions	Notes
Reduction in load related expenditure	• Using demand forecasts from DFES 2020, the year that each Primary and BSP substation is expected to reach its firm capacity is identified. The cost to solve the capacity constraint (i.e. intervention cost) is identified. This is chosen from the least cost option between flexible services and traditional reinforcement. The total intervention costs are then aggregated for each year to 2050.	• This benefit will be realised through G3 connections only.

Description	Assumptions	Notes
	• 1% of the annual base case distribution investment requirement is assumed to be reduced by BiTraDER through to 2050. • A sensitivity of ±0.5% is assumed for high and low scenarios.	
ESO interaction	• 915MW of existing G1 connection capacity is assumed to grow in line with the sum of the maximum demand forecasted for each primary substation in DFES 2020 Central Outlook scenario. • A unit cost of [redacted] is assumed as an average bid/offer price difference between DER and non-DER participants in the balancing market. • A 5% DER utilisation rate is assumed based on balancing bid/offer volume acceptance rates of DSR in the first half of 2021. This assumption is used to calculate the utilisation of flexible resources enabled by BiTraDER in balancing services (expressed in MWh). • Base case: % of BiTraDER participants also offering ESO services: (G1: 0%, G2: 50%, G3:15%). • Collaborative % share which could offer services to ESO+DNO with BiTraDER: G1 and G3: 20% (high: 30%, low:10%) G2: 50% (high: 60%, low: 40%)	• A fixed share of G1, G2 and G3 connections would have additional service offering to both ESO and DNO (same percentage is used in future years for simplicity). • In central view this benefit is realised from G1 and G3 connections. • In high sensitivity this benefit is realised via all G1, G2 and G3 connections. • In low sensitivity, we consider a case in which the impact on the ESO remains positive in G1 connections, while it may become negative in G2 and G3 connections, to the extent that offering services to the DNO takes resources away from the ESO. The net impact of G1, G2 and G3 on the ESO remains positive in all future years.
Reduced generation investment	• The average of historical capacity market prices is used as a proxy to determine the level of cost saved per each MW (£18/kW) between years 2027-2031, £19/kW in years 2032-2037, £20/kW in 2038 onwards). • A de-rating factor of 90% is assumed for flexible generation.	• A fixed share of G1, G2 and G3 connections for each participant group are assumed to have additional combined service offering to DNO and the Capacity Market (same percentage is used in the future years for simplicity). • Unit cost multiplied with the estimated MW of additional

Description	Assumptions	Notes
	• Base Case: % offering to Capacity Market: G1: 0%, G2: 50%, G3: 5%) • Combined offering % to Capacity Market with BiTraDER: G1 and G3: 5% (high: 8%, low:2%) G2: 50% (high: 60%, low: 40%)	capacity that will provide a combined service offering to DNO and the Capacity Market with BiTraDER is assumed to yield the total financial benefit. • In central view this benefit is realised from only G1 participants. • In high sensitivity this benefit is realised via all G1, G2 and G3 participants. • In Low sensitivity, we consider a case in which the net impact on generation investment in which the impact on the ESO remains positive in G1 connections while it may be negative in G2 and G3 connections, e.g. if distributed (generation or battery) resources with non-firm connections might become ineligible for participation in the capacity market. The net impact of G1, G2 and G3 on the ESO remains positive only in the first couple of years after the roll-out and becomes negative for the remaining future years out to 2050.
Reduced curtailment of RES	• G1 current connection capacity is assumed to grow in the same pace with DFES max demand (primary substation) growth rate. • % share of RES among G1 participants: gradually increasing from 10% in 2027 to 33% in 2050. • % share of curtailment in G1 connection's RES volume in Base case: gradually increasing from 5% in 2027 to 9% in 2031, 10% from 2032 onwards. • % share of curtailment in G1 connection's RES volume in Method case: gradually increasing from 1% in 2027 to 5% in 2031, 6% from 2031 onwards.	• This benefit is realised through G1 participants only. • Unit cost of RES is calculated as a proxy by using the total cost of wind curtailment of NGESO divided by total wind capacity curtailed in 2020. • Unit cost is multiplied with the difference between the estimated base case and Method case MWh of RES curtailment volume.

Description	Assumptions	Notes
	• For Method case curtailment percentages, a sensitivity of ±0.5% is assumed for high and low scenarios (i.e. 0.5% lower curtailment in Method case high sensitivity, 0.5% higher share of curtailment in Method case low sensitivity). • A load factor of 25% is assumed for the calculation of curtailed RES volume. • Unit cost of curtailed RES: [redacted]	
Optimised curtailment of non-RES	• % share of non-RES; gradually decreasing from 90% in 2027 to 67% in 2050. • A unit cost of [redacted] set as per MWh saving with more economic selection of non-RES resources.	• This benefit is realised through G1 participants only. • The same RES curtailment % shares in G1 connections is assumed for non-RES, too. • % share of curtailment in G1 connection's RES volume is assumed to be the same for non-RES curtailment volume for simplicity. • The unit cost is applied to the difference between the estimated base case and Method case MWh of non-RES curtailment volume.

A.2.2 BiTraDER costs assumptions

The assumption used to translate the costs of the BiTraDER market to GB are set out in Figure A.2.2 below.

The GB scale rollout costs have been calculated from the ENWL rollout costs via a scaling factor based on the number of DNO groups (parent companies) in GB (with a phasing in the early years).

Figure A.2.2: Assumptions used in the BiTraDER cost analysis

Description	Assumptions	Notes
Project cost for ENWL	• as per Full Submission Cost spreadsheet	• This cost is for the BiTraDER NIC project
DNO IT infrastructure to support	[redacted]	• For ENWL-scale, this cost is assumed to be incurred in 2027

Description	Assumptions	Notes
BiTraDER market		• [redacted]
Management of infrastructure and licensing costs	[redacted]	• This is an annual cost incurred for all DNOs in each future year
Participants IT infrastructure to support BiTraDER market.	[redacted]	• Cost to set up and configure the interface per new participants joining to the platform each year • Number of participants estimated based on based on expected G1 connection capacity in future years divided by 10MW of connection capacity assumed per participant
Cost to participate in the market	[redacted]	• Annual operating expense that will incur for each participant in every future year • Number of participants estimated based on expected G1 connection capacity in future years divided by 10MW of connection capacity assumed per participant

A.2.3 BiTraDER carbon impact assumptions

The assessment of the carbon benefits of BiTraDER are based on the reduced curtailment of RES. More economic selection of resources for curtailment with BiTraDER is expected to enable RES to displace less economic non-RES technologies. We have made a simple estimate of the potential associated carbon savings in line with the volume of reduction in RES curtailment estimated under the financial benefit "Optimised curtailment". To assign quantitative values to this benefit, we have used a set of input assumptions, which are presented in Figure A.2.3 below.

The GB scale benefits have been calculated from the ENWL benefits via the scaling factor of 13.4, based on the proportion of Primary and BSP substations in ENWL compared to that in GB derived using the DNOs' LTDS.

Figure A.2.3: Assumptions used in the carbon benefits analysis

Description	Assumptions	Notes
Carbon intensity of generation	• 2019: 220gCO2/kWh • 2030: 50gCO2/kWh • 2035: 10gCO2/kWh • 2050: 2gCO2/kWh	• Based on: The Sixth Carbon Budget, Electricity Generation, CCC • The years in between 2019, 2030, 2035 and 2050 are interpolated

Description	Assumptions	Notes
		• The electricity generation intensity of RES is assumed to be zero
CO_2 emission of a non-RES volume replaced by RES	• Difference of RES curtailment volume between Base Case and Method case estimated in "Reduced RES curtailment" benefit	

A.2.4 Results of financial business case modelling

The detailed breakdown of the benefits and costs are given in Figure A.2.4.

Figure A.2.4: Costs and breakdown of benefits of the BiTraDER Method using central view assumptions

Scale	Benefit or Cost	Cumulative benefit/cost (£m NPV 2021 prices)		
		2030	2040	2050
ENWL scale benefits and costs	Reduced Curtailment of RES	[redacted]	[redacted]	[redacted]
	Reduced Generation Investment	[redacted]	[redacted]	[redacted]
	Optimised Curtailment of non-RES	[redacted]	[redacted]	[redacted]
	ESO Interaction	[redacted]	[redacted]	[redacted]
	Reduction in Load Related Expenditure	[redacted]	[redacted]	[redacted]
	BiTraDER Rollout Costs	[redacted]	[redacted]	[redacted]
	Total NPV	**-0.9**	**17.3**	**35.5**
GB scale benefits and costs	Reduced Curtailment of RES	[redacted]	[redacted]	[redacted]
	Reduced Generation Investment	[redacted]	[redacted]	[redacted]
	Optimised Curtailment of non-RES	[redacted]	[redacted]	[redacted]
	ESO Interaction	[redacted]	[redacted]	[redacted]
	Reduction in Load Related Expenditure	[redacted]	[redacted]	[redacted]
	BiTraDER Rollout Costs	[redacted]	[redacted]	[redacted]
	Total NPV	**62.1**	**325.7**	**581.4**

Figure A.2.4 above shows that in central view, the highest share of benefits is driven by Reduced Curtailment of RES, followed by Reduced Generation Investment. As highlighted

in assumptions, the weights of the benefits change substantially in high and low sensitivities, and in Reduced Generation Investment it may even turn into a cost rather than a benefit in low sensitivity.

The results show that there is a strong business case for the BiTraDER in central view, with a cumulative net benefit of over £35.5m across ENWL by 2050, and over £581.4m across GB by 2050.

A.2.5 Financial benefits sensitivity analysis

In this section, we present the effect of parameters chosen for sensitivity analysis affecting the final NPV for each benefit item.

Reduction in load related expenditure

Figure A.2.5 presents the results of the sensitivity analysis on the % share of connected resources which could collaboratively offer ESO+DNO with BiTraDER.

Figure A.2.5: Sensitivity analysis of reduction in load related expenditure

		% reduction in load related expenditure		
% reduction in investment / Participation groups	Base Case	Central view	High sensitivity	Low sensitivity
G3	0%	1%	+0.5%	-0.5%
GB-wide net benefit 2050 £m NPV 2021 prices		**Central**	**High**	**Low**
Reduction in Load Related Expenditure		17.5	26.2	8.7

ESO interaction

Figure A.2.6 presents the results of the sensitivity analysis on the % share of connected resources which could have collaborative service offering to ESO and DNO with BiTraDER.

Figure A.2.6: Sensitivity analysis of ESO interaction

		Collaborative: % which could offer ESO+DNO with BiTraDER		
% share of connections / participation groups	Base Case - % offering ESO services	Central view	High sensitivity	Low sensitivity
G1	0%	20%	30%	10%
G2	50%	50%	60%	40%
G3	15%	20%	30%	10%
GB-wide net benefit, 2050, £m NPV 2021 prices		**Central view**	**High sensitivity**	**Low sensitivity**
ESO interaction		58.5	100.0	17.0

Reduced generation investment

Figure A.2.7 presents the results of the sensitivity analysis on the % share of connected resources which have additional combined service offering to DNO and the Capacity Market with BiTraDER.

Figure A.2.7: Sensitivity analysis of avoided generation investment

		Combined offering % to Capacity Market with BiTraDER		
% share of MW / Participation groups	Base Case - % offering to Capacity Market	Central view	High sensitivity	Low sensitivity
G1	0%	5%	8%	2%
G2	50%	50%	60%	40%
G3	5%	5%	8%	2%
GB-wide net benefit, 2050, £m NPV 2021 prices		**Central view**	**High sensitivity**	**Low sensitivity**
Reduced Generation Investment		184.2	424.2	-55.7

Optimised curtailment

Figure A.2.8 presents the results of the sensitivity analysis on the % share of curtailment with BiTraDER.

Figure A.2.8: Sensitivity analysis of reduced curtailment of RES and optimised curtailment of non-RES for G1 connections

		% curtailment (RES and non-RES)		
Periods \ % share of MWh	Base Case - % offering ESO services	Central view	High sensitivity	Low sensitivity
2027 - 2031	Gradually increasing (5% - 9%)	Gradually increasing (1% - 5%)	- 0.5% (all years)	+0.5% (all years)
2032 - 2050	10%	6%	- 0.5% (all years)	+0.5% (all years)

GB-wide net benefit 2050 £m NPV 2021 prices	Central view	High sensitivity	Low sensitivity
Reduced curtailment of RES	289.0	325.2	252.9
Optimised curtailment of non-RES	73.2	82.3	64.0

Final results with sensitivity scenarios

The final results given in Figure A.2.9 demonstrate that BiTraDER will result in very large additional benefits for customers across GB for central and high scenarios, and relatively limited amount of benefit for low sensitivity.

Figure A.2.9: Sensitivity analysis of cumulative total benefits, costs and net benefits

Scale	Benefit or Cost	2050, £m NPV 2021 prices		
		ENWL Central view	High sensitivity	Low sensitivity
ENWL scale	BiTraDER benefits	[redacted]	[redacted]	[redacted]
	BiTraDER costs	[redacted]	[redacted]	[redacted]
	Total NPV	**35.5**	**61.3**	**9.6**
GB scale	BiTraDER benefits	[redacted]	[redacted]	[redacted]
	BiTraDER costs	[redacted]	[redacted]	[redacted]
	Total NPV	**581.4**	**916.9**	**246.0**

Using the sensitivities described above, the financial net benefit ranges from £9.6m to £916.9m across GB, up to 2050.

Reduction in available flexibility

A reduction in available flexibility is represented as a 10% reduction in the capacity of G1 connections as the lower sensitivity accompanied by an upper sensitivity of +10% increase in G1 connections. Figure A.2.10 presents the results for this analysis.

Figure A.2.10: Sensitivity analysis of number of flexible connections

Participation groups \ % share of MW		High sensitivity	Low sensitivity
G1		+10%	-10%
G2		+10%	-10%
G3		+10%	-10%
GB-wide net benefit, 2050, £m NPV 2021 prices	Central view	High sensitivity	Low sensitivity
Total net benefit	581.4	692.1	470.8

A.2.6 Carbon impact

The carbon impact of BiTraDER was assessed based on the reduced curtailment of RES that BiTraDER may enable through G1 connections. The carbon emissions associated with avoided reinforcement were not assessed, as reinforcement was generally deferred, rather than avoided, resulting in no significant carbon reduction.

Reduced curtailment of RES connection that BiTraDER is expected to enable was translated into carbon emissions reduction based on the following:

- Average grid carbon emission intensity numbers for future years (based on The Sixth Carbon Budget, Electricity Generation) is used to reflect carbon emission intensity of the underlying generation mix expected to replace curtailed RES volume with BiTraDER.
- Non-RES volume that replace curtailed RES is based on the difference of RES curtailment volume between Base Case and Method case estimated under "Reduced RES curtailment" benefit.

Figure A.2.11 presents the annual GB-wide carbon benefits up to 2050 with the reduced curtailment of RES, and shows that the carbon benefits rise as BiTraDER is rolled out and the carbon benefit decreases year on year due to the carbon intensity of the grid decreasing throughout years. This benefit is realised in 2027 and 2028, for ENWL and the rest of GB, respectively.

Figure A.2.11: Annual carbon emissions reduction

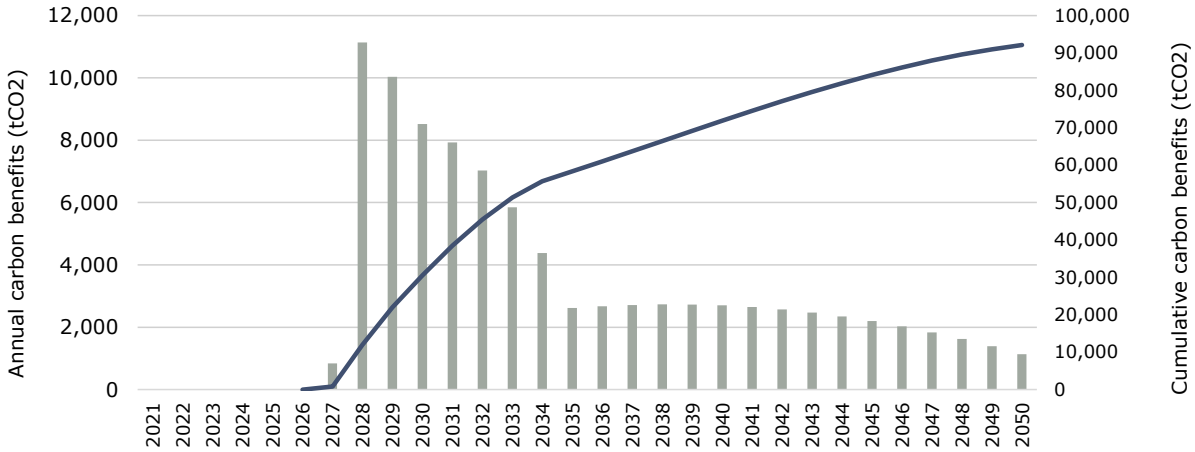


Figure A.2.12 presents the results of the sensitivity analysis on the carbon benefit of the reduced curtailment of RES. The difference of RES curtailment volume between Base Case and Method case in "Reduced RES curtailment" benefit is used for High and Low sensitivities, respectively.

Figure A.2.12: Sensitivity analysis of "Accelerated connection of RES" carbon benefit for G1 connections

Scale	Total cumulative carbon benefit in 2050, tCO2		
	ENWL Central view	High sensitivity	Low sensitivity
ENWL scale	7,649.0	8,605.1	6,692.9
GB scale	92,113.7	103,628.0	80,599.5

Appendix B.1: Relevant Background Technical Information

DNO services – flexible connections and flexible services

The curtailment obligations associated with flexible connections and the provision of flexible services vary dependant on the timescales required for operation. These range from the longer-term requirement to peak lop, often predicted months ahead, and the shorter-term emergency requirements, typically in response to network events such as faults and short-term overloads.

Furthermore, DNO's have introduced ANM systems into operation of the network. These systems utilise flexible connections and services to resolve network constraint violations, thereby maximising the utilisation of existing network asset capacity without breaching operational limits. ANM systems typically determine the order for utilising the flexible connection resources through use of merit order stacks. The higher its position in the merit order stack, the more likely a connected resource will be asked to curtail its generation.

In addition to flexible connections, DNOs have introduced flexible services. These services are typically provided by existing customers and give DNOs additional options to manage constraints.

Some DNOs currently keep flexible connections and flexible services separate to avoid the complexity of dispatching flexible services contracts, curtailment contracts and ANM contracts through the same system.

Although there is some degree of standardisation of flexible service and flexible connection contracts in use across the industry, developed through the Energy Networks Association (ENA) Open Networks project, different DNOs currently have different approaches to both long-term and short-term flexibility requirements.

Long-term flexibility requirements are typically dispatched through week-ahead and day-ahead flexibility platforms such as Flexible Power, currently in use at Western Power Distribution, Northern Powergrid, Scottish and Southern Electricity Networks, SP Energy Networks and Electricity North West. Once customers are signed up to Flexible Power, they can declare their asset availability and are dispatched week ahead following gate closure, and dispatch is confirmed a day ahead. In the case of short-term flexibility requirements, these are typically dispatched through an automated system such as ANM/DERMS. For short-term flexibility, most DNOs use a LIFO stack. Here, the resource that was last connected to the network is disconnected first during network events and short-term overloads.

Electricity North West uses the concept of a "Curtailment Index", which is assigned at the time of connection and provides customers with an estimate of the amount of time the network will be unavailable for their connected resource within a year; for example, in the case of a network fault or planned outage. Each time the resource is curtailed, the index is decremented in near real time. Where a connected resource approaches or exceeds the advised Curtailment Index, Electricity North West will investigate and potentially intervene. This approach has the advantage of sharing available network capacity equitably amongst customers as the order in which a resource is utilised changes over time, dependant on the current Curtailment Index value of each connected resource.

ESO Services

In addition to DNO/Distribution System Operator (DSO) requirements, the Electricity System Operator (ESO) is increasingly using flexible resource connected to the distribution network to resolve constraints associated with the transmission network. In the main, this is via the Ancillary Services Market.

In general, distribution connected resource used by the ESO are connected via firm connections to the distribution network and the DNO has little, if any, influence over these contracts and resources, which usually require exclusivity. A firm connection is one that

can generally operate in an unrestricted manner within the limits set out in their connection agreement. These resources are typically dispatched through the ESO Platform for Ancillary Services (PAS). The DNO currently does not participate in this platform. This presents issues to the DNO when implementing automated systems such as ANM, as there is a risk the system may negate the intended action of an ESO service. For example, if the ESO asks a firm connected distribution generator to run (i.e. generate) to resolve a system frequency issue and the DNO's ANM system detects the additional capacity created on the distribution network as a consequence, flexible demand may be automatically increased to utilise this additional capacity, thus negating the ESO frequency response.

Obligation Trading

There are several situations where a flexible connection or service has a contractual obligation that can be traded:

- New connections offered a flexible connection, which typically allows a faster and lower-cost connection in exchange for flexibility, often preferable for a developer because it removes the time and expense involved in procuring a firm connection, and provided with a Curtailment Index informed by local network constraints.
- Customers without a flexible connection who sign up to provide a flexible service. The customer would agree to reduce demand or increase generation at certain times in exchange for payment, for example, at peak demand during winter months.
- ESO service contracts with resources connected to the distribution network; however, in this case the obligation is to the ESO not the DNO.

Here, the obligation could be traded in exchange for compensation, either between parties with existing liabilities in order to change their position in a merit order stack, or with other parties connected to the same network who do not currently have any such obligation.

ANM systems typically perform some form of look-ahead functionality that predicts future constraints on the network using forecast demand and load profiles under various scenarios, such as system normal or post fault, and determine which resources to constrain, in what order, should the predicted constraint occur. These ordered lists of constraint and resource are typically referred to as merit order stacks. Having determined an initial merit order stack for a future network constraint, it is reasonable to assume that an individual resource might be willing, for a limited time, to forego its current position in the stack either in return for compensation or because its plans mean it cannot export or import energy. In such cases, that resource might wish to trade its low stack position (with higher potential value) with one or more other resources higher in the stack (with lower potential value). In doing so, the stack can be dynamically optimised based around the true market value of flexibility at the time. This merit order stack optimisation through bilateral trading of curtailment obligation represents higher customer value overall. We also see value in allowing customers with a firm connection, who do not currently have contract obligations via flexible connections or flexible services, to trade position in these merit order stacks with customers that do have an obligation in order to resolve network constraints in near real time. As an example, a customer with a firm connection may be more likely to participate in a short-term market when circumstances enable them to reduce demand or increase generation within their maximum import and export capacity without the requirement for signing up to a long-term contractual arrangement with the DNO or ESO.

Appendix B.2: Supplementary Method Detail

Data and System Design

Through a series of workshops with Project Partners and key customer stakeholders, we will determine the current appetite among customers to trade curtailment obligations and identify customers' concerns or issues regarding operating flexibly with access to a secondary market. We will examine stakeholder requirements for access to a trading platform to trade bilaterally. We will determine how best to represent merit order stacks on the trading platform to participating customers. We will determine appropriate trading rules, including on what constitutes a valid and an invalid trade. We will work alongside the ESO to determine how BiTraDER can resolve known and potential ESO/DNO co-ordination issues, and whether customers contracted to the ESO could trade these obligations via BiTraDER and in doing so participate in other markets e.g. DNO. The stakeholders will comprise customers with resources connected to the distribution network with flexible connection contracts, flexible services contracts, firm connections, and ESO-contracted resources.

Through a separate set of workshops, we will determine the data required to derive the merit order stacks from typical DNO systems and the most appropriate interfaces required to source the data from these systems. We intend to include our Project Partners and our ANM supplier, Schneider Electric, in these workshops in addition to representatives from other DNOs through the Open Networks project, and the ESO. We will produce a set of high-level functional building blocks from these workshops, covering:

- Extraction of look-ahead constraint and resource lists from DNO systems with appropriate interfaces and data formats.
- Method for loading these merit order lists into the trading platform, which will be based upon a platform designed and built by Project Partner, ElectronConnect.
- User interaction with the merit order stacks within the trading platform and trading rules.
- Returning "traded" merit order stacks to DNO systems for dispatch in real time through typical DNO systems.
- Settlement of traded positions within the platform.
- Integration with ESO systems, markets and processes.

The workshops will determine the high-level functionality for subsequent work. Further technical details regarding the ElectronConnect platform can be found in Appendix B2.

Market Visibility

BiTraDER will identify ways to create visibility of merit order stacks in a market platform by exploring the various operating models and interfaces between all participants, including how the market can be presented to a range of users and stakeholders in a user-friendly format through simple interfaces, including APIs, apps and web portals.

BiTraDER will achieve this by engaging stakeholders to identify and assess the common stack mechanisms and trading platforms currently in use. We will engage with generators, storage operators, flexible services customers, flexible connections customers and firm connected customers to explore the operating models and interfaces between DNO, DSO, ESO, service providers and customers.

We will initially use simulation to develop, test and demonstrate inputs and outputs to the market platform and will develop the platform to allow access through a range of user interfaces to understand the pros and cons of each option, enabling recommendation of the most appropriate solution. We will then transition to a live network trial with real transactions between participants.

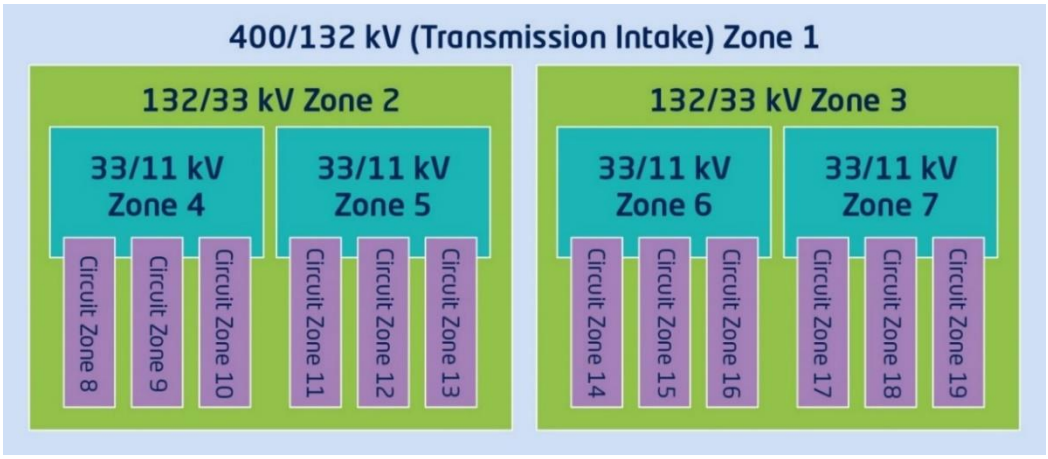
We will research the platforms and user interfaces required, potentially through the use of APIs and apps, including how the market should be presented to a range of different users.

During the simulation phase our trial participants will engage with the market platform and carry out simulated trades based on several use cases created through simulated network constraints. During the live network trial phase, our trial participants will carry out real trades in response to real network constraints based on real output from our operational systems, and the "traded" merit order positions will be passed back to our operational systems for execution in real time.

Trading Rules

We have introduced a system-wide ANM capability that operates across multiple voltage levels. As such, resources connected to the network may appear in multiple merit order stacks across multiple voltage levels and in multiple ANM zones. These ANM zones may be embedded in other ANM zones or adjacent to other ANM zones. As a consequence, a connected resource may appear in multiple merit order stacks but not all resource can resolve constraints in all ANM zones. At the highest level in the network hierarchy is the transmission system interface, as such, appropriate interfaces between DNO and ESO systems to exchange data such as ANM boundary flow limitations may facilitate the procurement of ESO services through the same curtailment obligation trading market.

Figure B.2.1: ANM zone hierarchy



In addition, it may be possible for a connected resource to trade their obligation with multiple other parties in order that the same energy value (i.e. MW) is traded. As an example, a resource with a liability to reduce demand by 2MW may trade with two parties, each delivering a reduction of 1MW.

During the design phase BiTraDER will develop a set of core trading rules to determine that trades are valid both through the resolution of constraints in all stacks in which they appear, including transmission system boundary limits and, in terms of the total energy traded to ensure that all constraints in all ANM zones are safely resolved in the final traded merit order stacks.

During the simulation phase, we will test these core trading rules with market participants against a range of different constraint combinations to ensure that the rules are robust under all conditions and refine them as necessary.

This will allow assessment of the efficacy of the trading rules and different market models resulting in a proposed set of trading rules and a preferred market model and a trial of their operation. A key aspect of the design and testing will be ease of use – we want BiTraDER to be accessible and low-effort for market participants. This will be vital to building broader participation and driving liquidity.

We will also consider constraints at different voltage levels in our network, focusing on how the trading rules would reflect the interactions as we move from more general to hyper-local constraints.

ESO/DNO Conflict Resolution

Resources connected to the distribution network frequently participate in ESO markets in order to supply services to the ESO in resolving transmission constraints. In many instances, the contractual terms between the flexible resource and the ESO prevents the resource from participating in other markets, such as DNO flexible services. In addition, insufficient knowledge of ESO contracts and their impact on the distribution network can cause operational problems in designing automated systems such as ANM on the distribution network as such automated systems can often negate ESO services if not co-ordinated. This results in conflicts between DNO systems and ESO services and prevents efficient use of capacity on the distribution network.

ESO involvement on the BiTraDER project will provide clarity in helping answer questions relating to the operation of the BiTraDER market, including:

- Could an ESO contracted resource take part in a distribution level flexibility market, e.g. by trading its liability to the ESO through a trading platform?
- Could a DNO contracted resource take part in an ESO market by trading its liability to the DNO through a trading platform?
- Would it be possible for a such a market to offer alternative services to the ESO?
- Would linking or merging ESO and DNO markets offer valid solutions to both parties and deliver the best whole-system outcomes thereby increasing the value for the customer?
- Could better co-ordination of DNO and ESO contracted resources deliver whole-system benefits such as servicing both a DNO and ESO constraint concurrently?

We will work alongside the ESO to examine how BiTraDER can be used to resolve these conflicts, and how in doing so we can allow flexible resource to participate in both ESO and DNO markets and potentially using the obligation trading concept to provide resource for both ESO and DNO services. We intend to explore the provision of both ESO and DNO services through the BiTraDER project by engaging with the ESO throughout the project. We have worked actively with the ESO in the preparation of this bid through a series of workshops and the ESO has been actively involved in helping develop the ESO scope of work for the BiTraDER bid.

Near Real-Time Trading

Trading in near real-time boosts the value in the flexibility market, allowing system operators to exploit more fully flexibility to resolve network constraints. We believe this could be particularly useful in the resolution of short-term constraints caused by network events or faults. Using appropriate short-term ratings, customers may be more likely to respond to such events if they are known to be short-term. As an example, a customer with a firm connection may be more willing to trade obligation with a customer higher in a merit order stack (and therefore more likely to be curtailed) on a flexible connection if they are not obliged to do so through a long-term commitment such as a flexible services contract.

BiTraDER will assess how to enable near real-time trading and how close to real-time the market can operate whilst still allowing all constraints for all parties involved to be resolved safely.

Near real time trading of constraint obligations will require a different level of interaction with ESO systems than in previous studies as we intend that the ESO will procure real services through the BiTraDER platform as part of our live trial. A core component of the BiTraDER market design will be to define and manage how potential multiple local obligation trading markets and related ESO markets could be co-ordinated and whether

the local markets could supplement or replace current flexible services products and improve market access to distribution connected resource.

Dispatch of Traded Stacks

In order to simplify participation, the BiTraDER project will investigate appropriate mechanisms to allow the market participants to receive and respond to dispatch signals from DNO systems without the need to invest in technology on-site that communicates directly with DNO SCADA equipment. This will likely be through the use of APIs, apps and web portals. BiTraDER will determine how DNO systems can determine whether a dispatched resource took appropriate action through appropriate messages, signals and measurements.

System Architecture

The BiTraDER architecture will be designed and developed specifically for Electricity North West's current real-time operational systems; however, we believe that the data and systems needed to implement such a solution, whilst not entirely consistent across the DNO population, are typical across UK DNOs. As such, the high-level architecture proposed by the BiTraDER project will be easily transferrable across the UK DNO population. This assumption will be tested with the Open Networks and necessary adjustments to the method will be made as appropriate.

BiTraDER and the Flexibility Landscape

Without intervention, we expect the future landscape to present a number of barriers to flexibility:

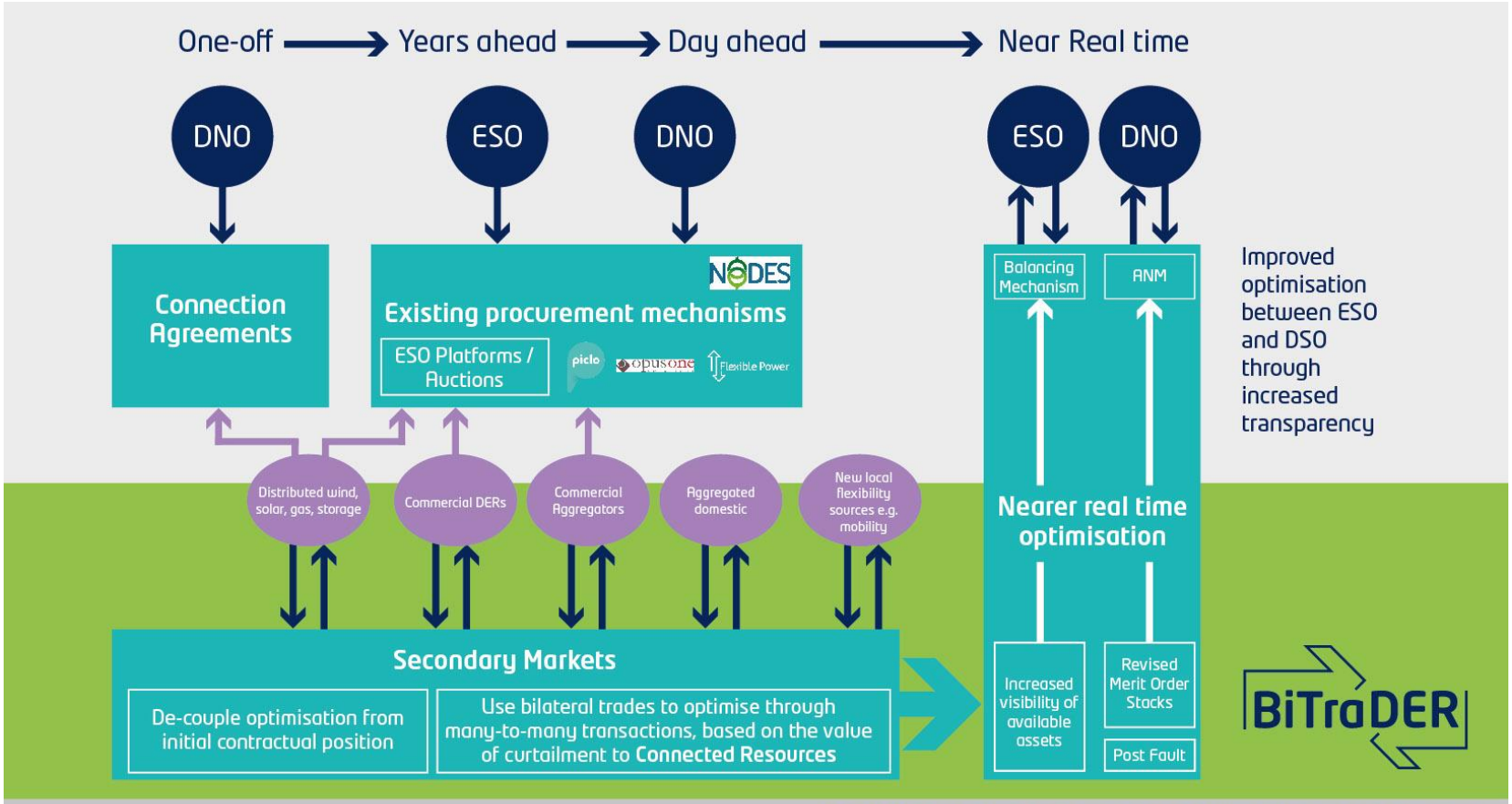
- We will see ANM in action across the entire network, potentially limiting the engagement for certain connected resources;
- there will be further cases of interaction between the ESO and DSO, resulting in operational and commercial conflicts;
- there will be a greater requirement for the ESO to secure response contracts due to greater intermittency;
- low carbon resources will remain reluctant to agree to a flexible connection if they have no control over their risk of curtailment, potentially reducing connection of low carbon generation and reducing availability of flexibility to the DSO;
- a lack of competition in the flexibility market, making it expensive for the DNO to buy flexibility and leading to expensive and time-consuming network reinforcement/ delays to the connection of LCTs; and
- non-optimised merit order stacks resulting in LCTs being curtailed before carbon-generating customers.

BiTraDER will address these issues by neutrally facilitating a transparent trading market for connected resources to trade their curtailment obligations bilaterally as shown in Figure B.2.2.

This will facilitate an "ad hoc" approach to flexibility by removing the need for customers to sign up to a long-term commitment, enabling connected resources to accept a flexibility agreement on the basis that they will have some control over their obligation to curtail generation.

Additionally, it removes the risk associated with inability to meet a contracted commitment, improving the likelihood of customers accepting flexible connections and services and reducing barriers for uptake of low carbon renewable energy sources.

Figure B.2.2: BiTraDER and the flexibility landscape



Making providing flexibility more attractive to participants

BiTraDER allows optimised allocation of flexibility by facilitating existing and new connected resources to trade obligations bilaterally in near real-time.

Connection Agreements - Decision on firm vs flexible connections made once and grant DNOs a permanent option to curtail output. Flexible connections challenging for RES business case in particular. Not being able to revisit the decision means potentially fewer and delayed new flexible connections.

Existing Procurement Mechanisms - Existing flexibility markets are "one-to-many" where one buyer is asking a connected resource to grant a flexibility option. These platforms are often one-off and ahead of real time. The commitment required mean that many potential providers tend not to participate, excluding possibly valuable sources of flexibility which is suboptimal.

Secondary Markets - Enabling near real-time trading of obligations through a "many-to-many" platform would allow connected resources to commit to a flexible connection at less risk because they could trade-out if needed. A commitment to provide flexible services could be traded with someone who values providing that service more. Therefore, any dispatched curtailment can be allocated across connected resources based on how they value it.

Near real-time optimisation - Providing real-time visibility to the DNO and ESO will allow them to coordinate their flexibility dispatch options better and to understand how to structure future procurement more efficiently. It would also lead to more flexibility providers entering the market, increasing diversity and liquidity, levelling the playing field.

Appendix B.3: Technical Description of ElectronConnect Platform

ElectronConnect is the umbrella name for the systems and services that together comprise Electron's market platform. It includes all the various back end and user-facing elements for any given deployment. ElectronConnect is capable of being deployed within any region that is supported by Microsoft's Azure Cloud, including private, public or hybrid cloud deployments if required.

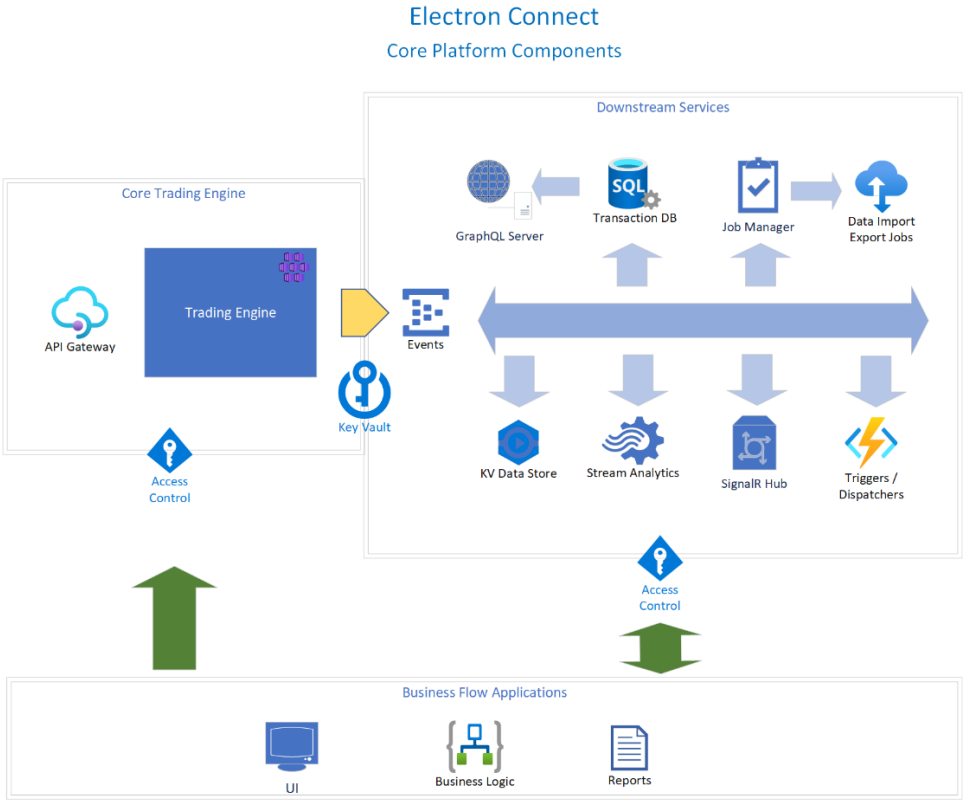
The platform design reflects the general requirements that ElectronConnect needs to meet. The use cases (many of which are at the heart of BiTraDER's scope) involve the simultaneous operation of many markets (potentially hundreds or even thousands) and a large number of connected assets (possibly millions). Each of these needs to be capable of being operated independently or in collaboration with one another, for example to build multiple geographic and voltage stacks. Furthermore, the system must be capable of near real time transactions and dispatch. Finally, security and data privacy considerations mean that the platform must be capable of being completed, deployed and managed within a targeted geographical region.

Structurally, the ElectronConnect platform is broken down into three main areas:

1. The core trading engine
2. Downstream services
3. Business flow applications

Figure B.2.1 below shows these three main areas and the technology that underpins them, enabling ElectronConnect to be a highly configurable, scalable platform capable of operating and stacking multiple markets.

Figure B.2.1: Core platform components



The following sections describe the ElectronConnect design and technology in more detail

Core trading engine

The trading engine is a highly scalable, resilient and modular set of nodes deployed as part of a Kubernetes cluster, permitting the co-existence of thousands of markets, with which millions of assets can interact to provide grid services. The system uses an event driven architecture and is implemented using a stateful actor system that is capable of handling throughputs exceeding a million messages a second.

The trading engine has several core features, including:

- Support for many different trading protocols
- Inter-market collaboration, when required
- Asset dispatch instruction generation
- Ongoing trade operation management

The core technology is capable of delivering these features at scale.

A key challenge the trading engine has to meet is that as markets start to work in collaboration, their need to access assets rapidly leads to a dramatic increase in complexity. [redacted]

Downstream services

The Trading Engine receives commands and outputs events. In the Downstream Services components, events are captured by Event Hub and routed using Event Grid to enable actions in real time. An IoT hub is also included so that data from sources such as ANM systems can be aggregated with platform generated events, which, along with other data

[2] Using the notion of complexity rather loosely here, this should not be confused with its formal computer science definition.

[3] Carl Hewitt; Peter Bishop & Richard Steiger (1973). "A Universal Modular Actor Formalism for Artificial Intelligence". IJCAI.

captured from sources such as ANM systems, meter data etc. streams the events and other data to the downstream services.

These downstream services, which are designed to be applicable to an extremely broad array of market types, provide a wide range of supporting applications including:

- Transaction capture and storage
- Asset dispatch and other types of event routing
- Job managers that, for example, can trigger and release external data capture
- Streaming analytics services that can be used in real time dashboards
- Supplementary data management for Markets and Assets

The main components of the downstream services are shown in Figure B.2.1 above. These are implemented using a variety of technologies. [redacted]

[redacted]

Consequently, the volume of trading engine events is likely to be substantial, and the requirement to incorporate asset performance monitoring and potentially other external events requires a highly scalable messaging bus that can ingest the large volumes of events expected and route access to downstream systems that can process or forward these. [redacted]

Business flow applications

Individual market arrangements and service requirements often vary markedly based on local circumstances. ElectronConnect is designed to provide maximum configurability through its Business Flow Applications to call on the services described above.

A business flow application interacts with the Trading Engine and the Downstream Services to deliver the functionality for a specific market(s) and service(s). For example, pre-and post-trade visibility arrangements, stack priority ordering, asset forecast submissions, service need communications etc. may all require configured UIs and integration with participants. These configurable applications are collectively called the business flow applications. We have developed a number of UIs which are available to interact with the system, using multiple approaches to meet user needs. [redacted]

Finally, it is noted that the core trading engine and the downstream services operate inside a secure environment. [redacted] The system implements role-based access control.

Appendix C: Review of Forerunner Projects

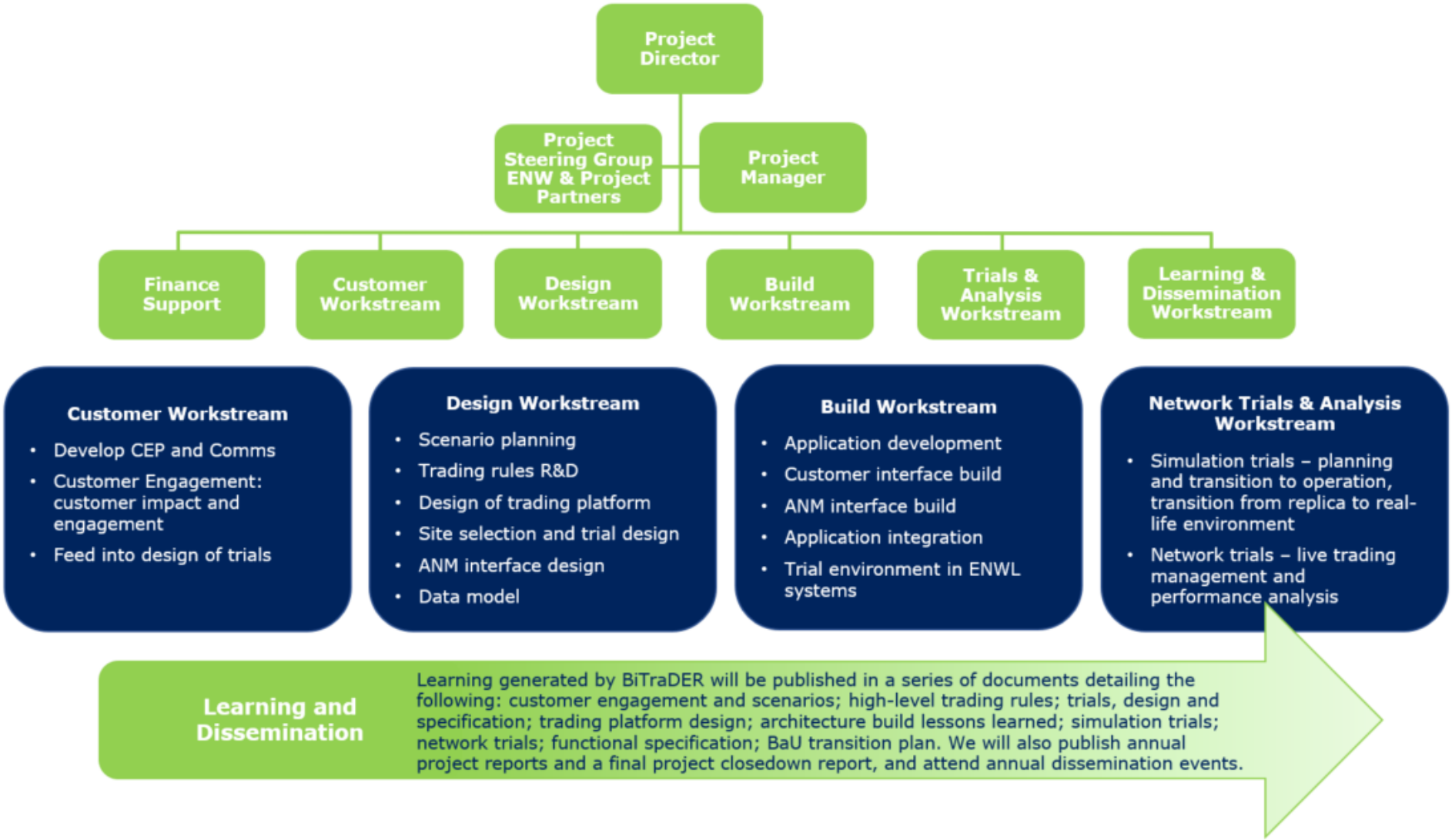
BiTraDER builds on the learning from previous projects which included flexible services and undertaken using Ofgem Innovation stimulus. Figure C.1 provides an overview of the related projects and the incremental learning that is relevant to BiTraDER.

Figure C.1: Incremental learning

Innovation funding mechanism	Project name	Delivering DNO	Learning
NIC	Capacity to Customers (C2C)	ENWL	This project developed the concept of flexible connections for system abnormalities. This learning will be used to inform the customer engagement approach for BiTraDER. Additionally, customers signed up for flexible connections will be considered as trial participants.
NIC	EFFS	WPD	This project is exploring DSO functionality including improved forecasts for flexibility service dispatch, communication of flexibility requirements to a market and sharing of information to avoid conflicts. This learning will inform the design of interfaces to the market platform and design of the trading rules, particularly how forecasts can be used to inform trading.
NIC	FUSION	SPEN	This project is creating an open, competitive, local flexibility market and developing standard procurement procedures for flexibility. This learning will inform the development of the BiTraDER market platform and trading rules taking into account any industry standard procedures.
NIC	Power Potential	NGESO/UKPN	This project created a regional reactive power market including the commercial frameworks. This power market could be incorporated into the BiTraDER trading platform, this will be reviewed within the Project.

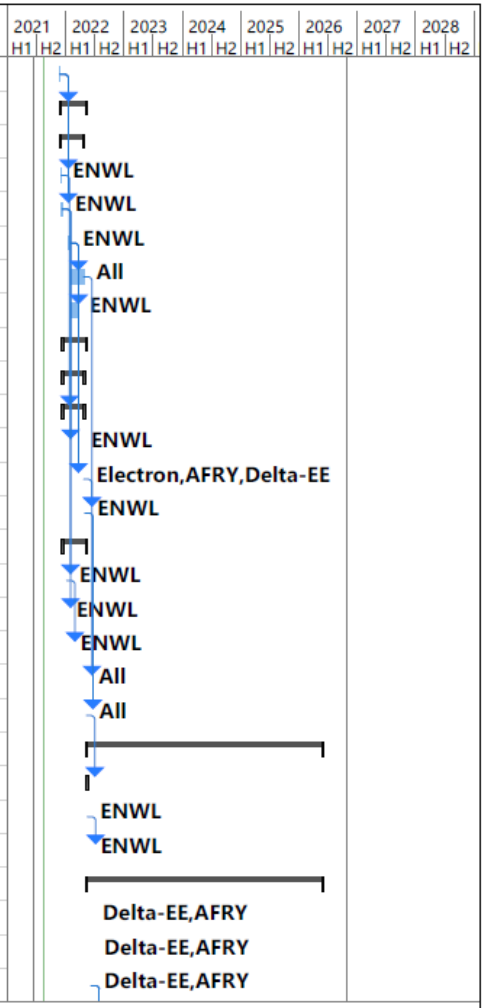
Innovation funding mechanism	Project name	Delivering DNO	Learning
NIC	TRANSITION	SSE	This project will inform the design requirements of a Neutral Market Facilitator including the roles, responsibilities and market rules. BiTraDER, through its concept of obligation trading independent of the DSO, is different to the concept of TRANSITION but we will take advantage of learning from the market design and contracts to inform our Solution.
NIA	Energy Exchange	UKPN	The project is developing and testing market-based approaches for managing curtailment of generators and will explore generators trading their 'place in the queue', these trades will be facilitated by the DSO. The learning on market models and design will be used as part of the trading rules design in BiTraDER.
NIA	Intraflex	WPD	This project is developing learning on the operability of short term flexibility market. This learning will be used to inform the BiTraDER market design with regard to near real time operation.
NIA	Testing co-ordinated DSO-ESO procurement and dispatch	NGESO	The project tested ESO participation in a Local Energy Market, including placing bids and observing procurement conflicts and has shown that ESO and DSO can procure flexibility in a co-ordinated manner through a single platform. This learning can be used to inform the conflict resolution elements of the BiTraDER market design.
NIA	TraDER	SSE	This research project is investigating the development and trade of a near real time distribution constraint product. BiTraDER will take the learning from this project a stage further by integrating a market platform with real time systems and facilitating a live network trial.
NIA	Visibility Plug and Sockets	NIA	This project investigated the potential for DNOs to purchase flexibility services from a third-party market platform. The learning produced by this project can help to inform the interfacing arrangements and data flow required for BiTraDER.

Appendix D: Organogram



Appendix E: Project Plan

ID	Task Name	Duration	Start	Finish
1	**NIC Fund Award Announcement**	**1 day**	**Fri 26/11/21**	**Fri 26/11/21**
2	**Workstream - Project Mobilisation**	**107 days**	**Mon 29/11/21**	**Tue 10/05/22**
3	**Project Readiness**	**95 days**	**Mon 29/11/21**	**Fri 22/04/22**
4	Project governance embedded into existing governance structure	5 days	Mon 29/11/21	Fri 03/12/21
5	Review and agree Project Direction	10 days	Mon 29/11/21	Fri 10/12/21
6	Develop and send out partner contracts	10 days	Mon 17/01/22	Fri 28/01/22
7	Review and negotiate contracts	60 days	Mon 31/01/22	Fri 22/04/22
8	Design, develop and issue the Project Implementation Document	30 days	Mon 31/01/22	Fri 11/03/22
9	**Mobilisation**	**97 days**	**Mon 13/12/21**	**Tue 10/05/22**
10	**Project Management Office start up**	**90 days**	**Mon 13/12/21**	**Fri 29/04/22**
11	**Identify and mobilise Project Management Office**	**90 days**	**Mon 13/12/21**	**Fri 29/04/22**
12	Identify and mobilise project team	60 days	Mon 13/12/21	Fri 18/03/22
13	Partner resourcing	60 days	Mon 31/01/22	Fri 22/04/22
14	Project Management Office and Partner resources mobilisation	5 days	Mon 25/04/22	Fri 29/04/22
15	**Financial and contractual**	**97 days**	**Mon 13/12/21**	**Tue 10/05/22**
16	Identify and implement project budget controls with ENWL	9 days	Mon 13/12/21	Thu 06/01/22
17	Set up project bank account	5 days	Mon 13/12/21	Fri 17/12/21
18	Financial contracts established	3 days	Fri 07/01/22	Tue 11/01/22
19	Partnership relationship discussions	10 days	Mon 25/04/22	Fri 06/05/22
20	Contractual agreement signed	7 days	Mon 02/05/22	Tue 10/05/22
21	**Workstream - Customer**	**1016 days**	**Wed 11/05/22**	**Fri 29/05/26**
22	**Customer Impact**	**5 days**	**Wed 11/05/22**	**Tue 17/05/22**
23	Customer Impact Assessment	4 days	Wed 11/05/22	Mon 16/05/22
24	Customer contact centre training and briefing	1 day	Tue 17/05/22	Tue 17/05/22
25	**Customer Engagement**	**1016 days**	**Wed 11/05/22**	**Fri 29/05/26**
26	Develop Customer Engagement Plan and Data Privacy Statement	16 days	Wed 11/05/22	Wed 01/06/22
27	Development of engagement materials	11 days	Wed 25/05/22	Wed 08/06/22
28	Survey Design for Engagement 1	16 days	Wed 18/05/22	Wed 08/06/22



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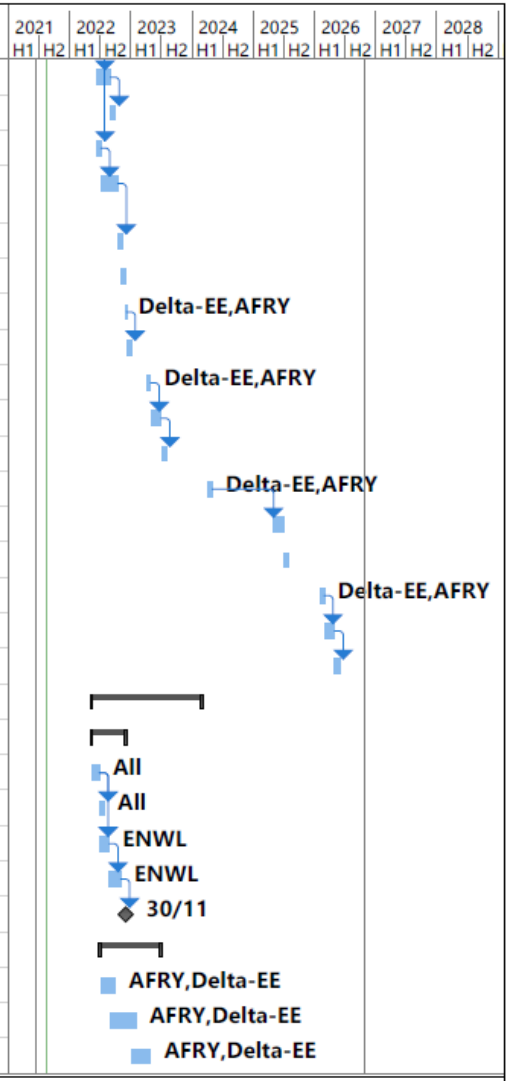
ID	Task Name	Duration	Start	Finish
29	Engagement 1: Initial outreach & onboarding	61 days	Thu 09/06/22	Thu 01/09/22
30	Feedback on engagement 1	21 days	Fri 02/09/22	Fri 30/09/22
31	Survey Design for Engagement 2	20 days	Thu 09/06/22	Wed 06/07/22
32	Engagement 2: Indepth interviews - initial input on trading rules, needs, attitudes, etc	71 days	Thu 07/07/22	Thu 13/10/22
33	Feedback on engagement 2	21 days	Fri 14/10/22	Fri 11/11/22
34	Survey Design for Engagement 3	20 days	Tue 01/11/22	Mon 28/11/22
35	Engagement 3: Annual WS 1	6 days	Tue 29/11/22	Tue 06/12/22
36	Feedback on engagement 3	12 days	Wed 07/12/22	Wed 04/01/23
37	Survey Design for Engagement 4	20 days	Mon 03/04/23	Fri 28/04/23
38	Engagement 4: Annual WS 2	45 days	Mon 01/05/23	Fri 30/06/23
39	Feedback on engagement 4	21 days	Mon 03/07/23	Mon 31/07/23
40	Survey Design for Engagement 5	20 days	Wed 03/04/24	Tue 30/04/24
41	Engagement 5: Annual WS 3	42 days	Thu 01/05/25	Fri 27/06/25
42	Feedback on engagement 5	21 days	Tue 01/07/25	Tue 29/07/25
43	Survey Design for Engagement 6	20 days	Mon 02/02/26	Fri 27/02/26
44	Engagement 6: Annual WS 4	44 days	Mon 02/03/26	Thu 30/04/26
45	Feedback on engagement 6	21 days	Fri 01/05/26	Fri 29/05/26
46	**Workstream - Design**	**453 days**	**Wed 11/05/22**	**Wed 28/02/24**
47	**Scenario Planning**	**146 days**	**Wed 11/05/22**	**Wed 30/11/22**
48	Review of Open Networks	34 days	Wed 11/05/22	Mon 27/06/22
49	Identify scenarios	20 days	Tue 28/06/22	Mon 25/07/22
50	Document scenarios	42 days	Tue 28/06/22	Wed 24/08/22
51	Peer Review of scenarios by Open Networks	50 days	Thu 25/08/22	Wed 02/11/22
52	D1 BiTraDER Initial Report - Customer Engagement and Scenarios	20 days	Thu 03/11/22	Wed 30/11/22
53	**Trading Rules Research & Development**	**252 days**	**Fri 01/07/22**	**Fri 30/06/23**
54	Literature Review	65 days	Mon 04/07/22	Fri 30/09/22
55	Objective definition	100 days	Thu 01/09/22	Tue 31/01/23
56	Building block components and options identification	83 days	Wed 04/01/23	Fri 28/04/23



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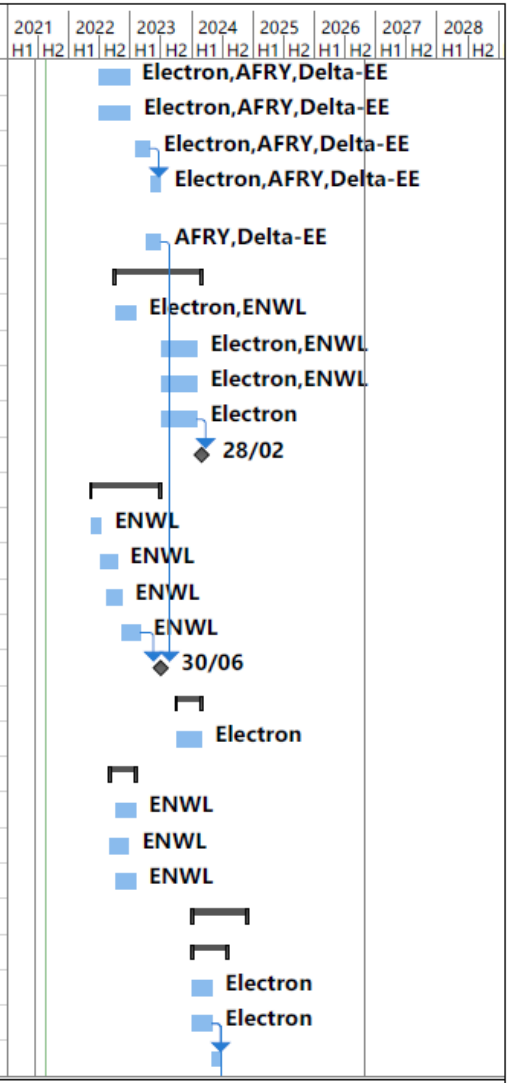
ID	Task Name	Duration	Start	Finish
57	Design validation with market participants	124 days	Fri 01/07/22	Fri 30/12/22
58	Consulting on market operational and settlement / clearing	124 days	Fri 01/07/22	Fri 30/12/22
59	Development of materials for external technical engagement with parti	63 days	Wed 01/02/23	Fri 28/04/23
60	Participant requirements - scope and practicalities of simulation and participation	45 days	Mon 01/05/23	Fri 30/06/23
61	Specification of end to end trading rules	65 days	Mon 03/04/23	Fri 30/06/23
62	**Trading Platform Design**	**350 days**	**Mon 03/10/22**	**Wed 28/02/24**
63	Technical requirements gathering (Internal workshops & Design)	78 days	Mon 03/10/22	Tue 31/01/23
64	Identify user interfaces	144 days	Mon 03/07/23	Wed 31/01/24
65	Identify data requirements	144 days	Mon 03/07/23	Wed 31/01/24
66	Define platform requirements	144 days	Mon 03/07/23	Wed 31/01/24
67	D3 BiTraDER Interim Report - Trading Platform Design	20 days	Thu 01/02/24	Wed 28/02/24
68	**Site Selection & Trial Design**	**289 days**	**Wed 11/05/22**	**Fri 30/06/23**
69	Network model for simulation trials	44 days	Wed 11/05/22	Mon 11/07/22
70	Simulation trial plan	67 days	Mon 11/07/22	Tue 11/10/22
71	Site selection for network trials	66 days	Fri 12/08/22	Fri 11/11/22
72	Network trial plan	68 days	Mon 14/11/22	Tue 28/02/23
73	D2 BiTraDER Trials Plan, Trading Rules and Initial Specification Report	20 days	Mon 05/06/23	Fri 30/06/23
74	**Data Model**	**99 days**	**Mon 02/10/23**	**Wed 28/02/24**
75	Develop data architecture	99 days	Mon 02/10/23	Wed 28/02/24
76	**Interface Design to ENWL Systems**	**100 days**	**Thu 01/09/22**	**Tue 31/01/23**
77	Cyber Security	78 days	Mon 03/10/22	Tue 31/01/23
78	Specify and Design interface to Customer's premises	80 days	Thu 01/09/22	Wed 21/12/22
79	ANM interface Design	78 days	Mon 03/10/22	Tue 31/01/23
80	**Workstream - Build**	**237 days**	**Thu 04/01/24**	**Fri 29/11/24**
81	**Application Development**	**150 days**	**Thu 04/01/24**	**Wed 31/07/24**
82	Configuration of user interface in market platform	84 days	Thu 04/01/24	Tue 30/04/24
83	Configuration of clearing interface	84 days	Thu 04/01/24	Tue 30/04/24
84	Platform installation and set up	43 days	Wed 01/05/24	Fri 28/06/24



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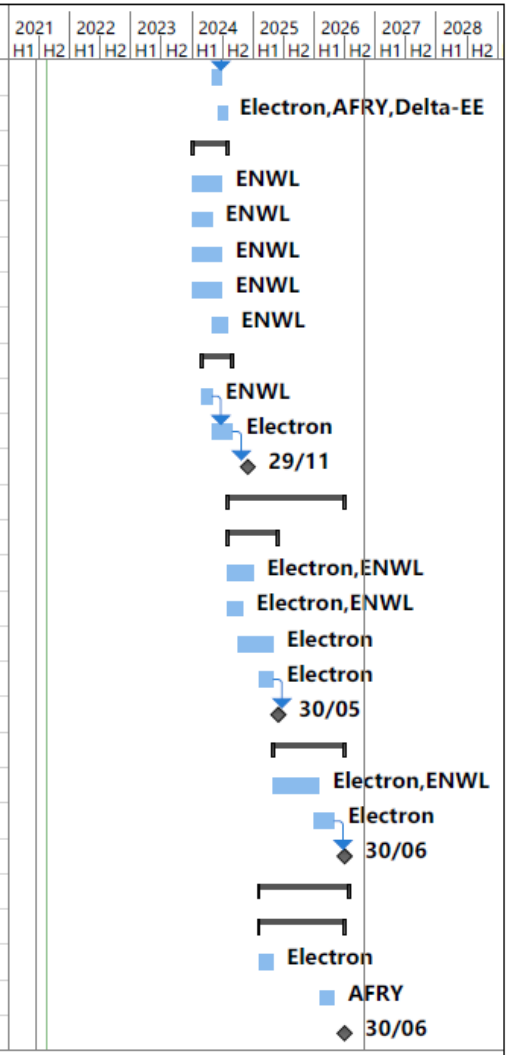
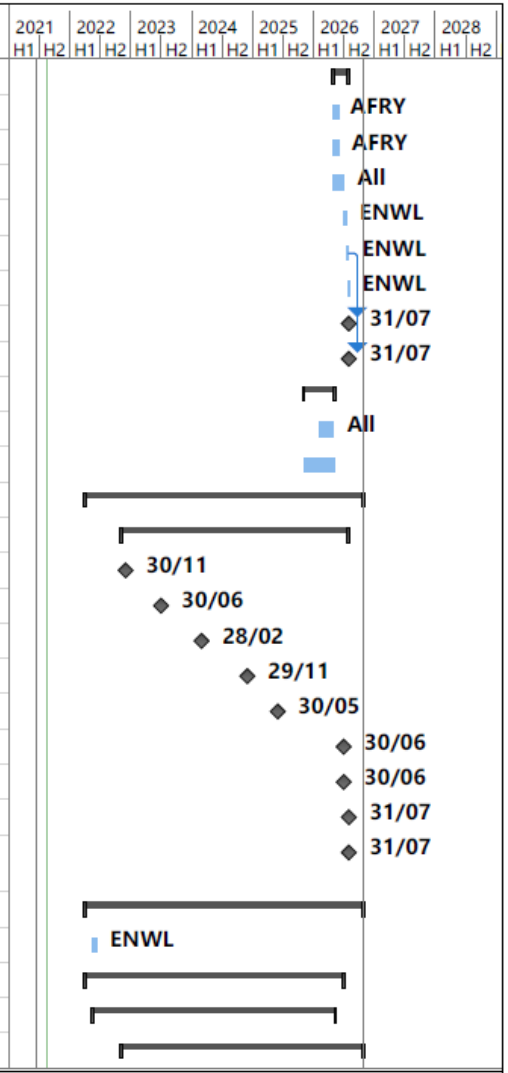
ID	Task Name	Duration	Start	Finish
85	Platform FAT / SAT	43 days	Wed 01/05/24	Fri 28/06/24
86	Test market signals and validation with participants	43 days	Mon 03/06/24	Wed 31/07/24
87	**Interface build to ENWL Systems**	**150 days**	**Thu 04/01/24**	**Wed 31/07/24**
88	Cyber Security Build	127 days	Thu 04/01/24	Fri 28/06/24
89	Customer Interface API development - access to platform	84 days	Thu 04/01/24	Tue 30/04/24
90	Customer Interface API development - access to ANM	127 days	Thu 04/01/24	Fri 28/06/24
91	ANM Interface Build	127 days	Thu 04/01/24	Fri 28/06/24
92	Create trial environment in ENWL systems	66 days	Wed 01/05/24	Wed 31/07/24
93	**Application Integration**	**131 days**	**Fri 01/03/24**	**Fri 30/08/24**
94	Create replica environment of data required to support simulation	43 days	Fri 01/03/24	Tue 30/04/24
95	Create and operationalise links to replica system	88 days	Wed 01/05/24	Fri 30/08/24
96	D4 BiTraDER Architecture Build Lessons Learned Report	20 days	Mon 04/11/24	Fri 29/11/24
97	**Workstream - Trials & Analysis**	**475 days**	**Thu 01/08/24**	**Tue 30/06/26**
98	**Simulation Trials**	**205 days**	**Thu 01/08/24**	**Fri 30/05/25**
99	Simulation operations support	101 days	Thu 01/08/24	Tue 31/12/24
100	Simulation planning & transition to operation	66 days	Thu 01/08/24	Thu 31/10/24
101	Transition from replica environment to real life trading	140 days	Tue 01/10/24	Wed 30/04/25
102	Test documentation	63 days	Mon 03/02/25	Wed 30/04/25
103	D5 BiTraDER Simulation Trials Report	20 days	Mon 05/05/25	Fri 30/05/25
104	**Network Trials**	**292 days**	**Thu 01/05/25**	**Tue 30/06/26**
105	Live trading management	185 days	Thu 01/05/25	Fri 30/01/26
106	Performance analysis	83 days	Thu 01/01/26	Thu 30/04/26
107	D6 BiTraDER Network Trials Report	20 days	Wed 03/06/26	Tue 30/06/26
108	**Workstream 4 - Closedown & BAU Transition**	**378 days**	**Mon 03/02/25**	**Fri 31/07/26**
109	**Functional specification for BiTraDER**	**355 days**	**Mon 03/02/25**	**Tue 30/06/26**
110	Design documentation for operational platform	63 days	Mon 03/02/25	Wed 30/04/25
111	Specification of Trading Rules model	64 days	Mon 02/02/26	Thu 30/04/26
112	D7 BiTraDER Functional Specification	20 days	Wed 03/06/26	Tue 30/06/26



BiTraDER Project Plan | Task | Milestone | Summary

ID	Task Name	Duration	Start	Finish
113	**Closedown**	**67 days**	**Thu 30/04/26**	**Fri 31/07/26**
114	Analysis of costs and benefits	22 days	Thu 30/04/26	Fri 29/05/26
115	Carbon Impact Assessment	22 days	Thu 30/04/26	Fri 29/05/26
116	Development of Close Down Report	43 days	Fri 01/05/26	Tue 30/06/26
117	Peer review of Close Down Report	11 days	Wed 01/07/26	Wed 15/07/26
118	Finalise Close Down Report	11 days	Thu 16/07/26	Thu 30/07/26
119	Close Down Report issued to Ofgem and published on BiTraDER websit	1 day	Fri 31/07/26	Fri 31/07/26
120	D8 BiTraDER Final Report	20 days	Mon 06/07/26	Fri 31/07/26
121	D9 BiTraDER Close Down Report	20 days	Mon 06/07/26	Fri 31/07/26
122	**BAU Transition**	**120 days**	**Mon 03/11/25**	**Tue 05/05/26**
123	Roadmap for BAU deployment	64 days	Mon 02/02/26	Thu 30/04/26
124	Explore mechanisms for BAU operation of BiTraDER market	120 days	Mon 03/11/25	Tue 05/05/26
125	**Workstream - Learning and Dissemination**	**1158 days**	**Mon 28/03/22**	**Fri 30/10/26**
126	**Deliverables**	**935 days**	**Thu 03/11/22**	**Fri 31/07/26**
127	D1 BiTraDER Initial Report - Customer Engagement and Scenarios	20 days	Thu 03/11/22	Wed 30/11/22
128	D2 BiTraDER Trials Plan, Trading Rules and Initial Specification Report	20 days	Mon 05/06/23	Fri 30/06/23
129	D3 BiTraDER Interim Report - Trading Platform Design	20 days	Thu 01/02/24	Wed 28/02/24
130	D4 BiTraDER Architecture Build Lessons Learned Report	20 days	Mon 04/11/24	Fri 29/11/24
131	D5 BiTraDER Simulation Trials Report	20 days	Mon 05/05/25	Fri 30/05/25
132	D6 BiTraDER Network Trials Report	20 days	Wed 03/06/26	Tue 30/06/26
133	D7 BiTraDER Functional Specification	20 days	Wed 03/06/26	Tue 30/06/26
134	D8 BiTraDER Final Report	20 days	Mon 06/07/26	Fri 31/07/26
135	D9 BiTraDER Comply with knowledge transfer requirements of the Governance Document	20 days	Mon 06/07/26	Fri 31/07/26
136	**Dissemination**	**1158 days**	**Mon 28/03/22**	**Fri 30/10/26**
137	Design, build, install, test and commission BiTraDER website	23 days	Wed 11/05/22	Fri 10/06/22
138	Open Networks Reporting	1073 days	Mon 28/03/22	Fri 03/07/26
157	Annual Knowledge Sharing Events	999 days	Mon 16/05/22	Mon 11/05/26
163	Conference Attendance	1002 days	Tue 01/11/22	Fri 30/10/26



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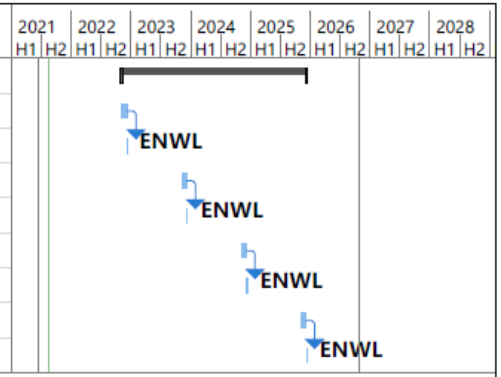
ID	Task Name	Duration	Start	Finish
169	**Ofgem Annual Reports**	**776 days**	**Mon 07/11/22**	**Mon 08/12/25**
170	Preparation of Annual Report 1	25 days	Mon 07/11/22	Fri 09/12/22
171	Issue Annual Project Progress Report 1 and publish on BiTraDER Website	1 day	Mon 12/12/22	Mon 12/12/22
172	Preparation of Annual Report 2	25 days	Mon 06/11/23	Fri 08/12/23
173	Issue Annual Project Progress Report 2 and publish on BiTraDER Website	1 day	Mon 11/12/23	Mon 11/12/23
174	Preparation of Annual Report 3	25 days	Mon 04/11/24	Fri 06/12/24
175	Issue Annual Project Progress Report 3 and publish on BiTraDER Website	1 day	Mon 09/12/24	Mon 09/12/24
176	Preparation of Annual Report 4	25 days	Mon 03/11/25	Fri 05/12/25
177	Issue Annual Project Progress Report 4 and publish on BiTraDER Website	1 day	Mon 08/12/25	Mon 08/12/25



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Appendix F: Risks and Issues Register and Contingency Actions

The risk model employed by ENWL in the delivery of NIC projects looks at risks in much the same holistic manner as the well-established risk model employed by ENWL at a corporate level. However, using previous experience, the risk and issues register has been refined to better reflect the increased significance of impacts at a project level. In this model, risk impact areas have been categorised into time, cost and scope/quality which are given a score of 1 to 5 along with the likelihood of occurrence. The resulting product of these two ratings is used to score and rank the risks on the project. The format of the ENWL NIC risk scoring matrix is below.

Risk impact descriptors

RISK AREA	1 Negligible	2 Minor	3 Moderate	4 Significant	5 Serious
Time	There will be no impact on deliverables. No re- planning necessary	Any delays are likely to be small ie <one week and manageable. Minor re- planning necessary	Some delays likely to project/programme milestones, but the overall project/programme delivery date will not be affected. An element of re-planning will be necessary	There is likely to be a delay which causes the overall project/programme delivery end-date to slip. Significant re-planning will be essential	There is likely to be a delay which causes the overall project/programme delivery end-date to slip. Serious re-planning will be essential
Cost	£0	<£10k	<£20k	<£50k	>£50k
Scope/ Quality	There will be no impact on the overall quality of the deliverables in the project/programme. All requirements will still be met	There will be negligible impact (if any), on the overall quality of the deliverables in the project/programme. Most, if not all requirements will still be met	Some requirements will not be met, or a small number of business process(es) will need to be modified to accommodate shortcomings in the delivery	A significant number of requirements will not be met, or business process(es) will need to be modified to accommodate shortcomings in the delivery	Major requirements, key to the success of the delivery, are not likely to be delivered as planned

Risk probability descriptors

5	Almost certain	>80%
4	Likely	60-80%
3	Moderate	30-60%
2	Low	10–30%
1	Rare	<10%

.

Risk score

Impact						
	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
		Probability				

The following potential risks have been identified. These risks have been based on the scoring matrix set out above and linked to the Project phase or workstream in which they will occur

Project phase/ workstream	Description	Probability score	Impact score	Mitigating action/ contingency action	Revised probability score	Revised impact score
Delivery	There is a risk that COVID-19 will impact delivery of the project if we experience further restrictions. This could have a significant effect, potentially causing delays to Project completion.	2/3	4/5	We will monitor government advice both in the UK and Europe to identify any risks as early as possible.	1/2	4/5
Mobilisation	There is a risk that the Project Partners are not able to mobilise their resources in time because of other commitments leading to a delay in achieving potential milestones which could have a Project reputational and financial repercussion.	2	4	Suitable partnership agreements that ensure collaborative working, value for customers' money and achievement of learning objectives in a timely manner have been identified for all Partners. A project initiation document will be issued to the Project Partners to ensure that all parties are ready. *Contingency: ENWL will seek new Partners should existing Partners fail to mobilise.*	1	4
Customer	There is a risk that it takes longer than anticipated to agree contracts with customers involved in the trials.	3	5	We will start the customer engagement early in the project and have ensured there is sufficient time in the project plan. *Contingency: additional budget allowed to extend the project to allow more time for customers to sign up.*	1	5

Project phase/ workstream	Description	Probability score	Impact score	Mitigating action/ contingency action	Revised probability score	Revised impact score
Customer	There is a risk that there is insufficient interest from customers to sign up to take part in the network trials.	3	5	A patch of our network in Cumbria fed from Harker Grid intake has been chosen for the trials through preliminary site selection. This will provide a large pool of customers from which to sign up the trial participants. *Contingency: we would not pass the stage gate for the network trials and will expand the simulation to cover more scenarios.*	1	5
Build	There is a risk that the market build and integration takes longer than anticipated	2	5	We have selected competent partners who have advised on the Project plan which allows sufficient time. *Contingency: budget allowed for additional resource to assist with build and integration.*	1	5
Build	There is a risk that the configuration of the Trading Platform on BiTraDER takes longer than anticipated	2	5	We have selected competent Partners who have advised on the Project plan which allows sufficient time. *Contingency: budget allowed for additional resource to assist platform configuration*	1	5
Build	There is a risk that the cyber-security requirements will affect	3	5	We have allowed time for appropriate cyber-security considerations and design in the Project plan.	1	5

Project phase/ workstream	Description	Probability score	Impact score	Mitigating action/ contingency action	Revised probability score	Revised impact score
	the performance of the integrated system.			*Contingency: additional budget allowed for build phase to enable compliance with cyber-security requirements.*		
Simulation	There is a risk that we lose participants due to lack of understanding on the aims of the market and the operation of the platform.	3	5	We will start the customer engagement early in the project and sign up more participants than needed. We will involve the participants in the design of the platform and simulation trials as meaningful collaborators. We have ensured there is sufficient time in the Project plan the simulation phase. *Contingency: additional budget allocated to extend the to allow for further education of participants.*	1	5
Network trials	There is a risk that no constraints occur on the network during the trial phase	3	5	Our preliminary site selection, which included a review of constraints, has selected the network in Cumbria fed from the Harker Grid intake substation as the trial area *Contingency: apply false constraints for trading. Budget allowed for compensation of customers who respond to false constraints.*	1	5
Network trials	There is a risk that participants may not trade if they do not understand the benefit and risks	2	4	We have significant customer engagement planned throughout the project to educate participants in the benefits and risks associated with obligation trading.	1	4

Project phase/ workstream	Description	Probability score	Impact score	Mitigating action/ contingency action	Revised probability score	Revised impact score
	of trading, or they are waiting for others to start the trading.			*Contingency: additional budget allocated to provide an initial incentive to stimulate trading amongst participants.*		
Network Trials	There is an opportunity for National Grid ESO to participate in the network trials	2	5	There is no mitigation for this as it is an opportunity not a risk *Contingency: additional budget allowed for integration to the ESO systems*	2	5
Learning and dissemination	There is a risk that attendance at events may be low due to other dissemination events/current restrictions preventing attendance. Learning may be inhibited due to stakeholders having different interests and learning styles.	2	3	ENWL will choose dissemination channels optimised to achieve maximum reach and coverage. *Contingency: dissemination will be carried out through multiple communication channels including use of online resources.*	2	2
Closedown	There is a risk that new obligations and guidance will be released on key deliverables, such as the closedown report leading to a longer preparation and review period required.	3	3	Communication channels from Ofgem will be monitored and any updates to such requirements identified as early as possible. *Contingency: additional time allowed for closedown reporting.*	3	3

Appendix G: Project Partner and Supplier Details

Name	Experience	Contribution	Contractual Relationship	Role of Project Partner	Funding Benefits to Project
Electron	An energy technology firm which specialises in digitally optimised energy marketplaces. Their experience includes building ElectronConnect, a platform that supports marketplaces for SSE, NG ESO and London Hydro, and they designed the technology deployed in a real-time local marketplace in Orkney.	[redacted]	Terms & Conditions, contract drafting, and work schedules required.	• Support customer engagement to understand optimal solution for DER. • Develop and provide market trading platform to enable DER to trade their curtailment obligations via a neutral secondary market. • Develop a simulated version of the trading platform using modelled live systems to simulate real operations. • Transition the trading platform to enable a live network trial • Support stakeholder engagement within industry.	Discount on day rates and on ElectronConnect licence fee.
AFRY	A leading engineering, design and consultancy service. They have previously supported on a number of innovation fund projects such as Low Carbon London and Smarter Network Storage, and have provided support to Ofgem on development of the Strategic Innovation Fund during the RIIO-ED2 advisory review.	[redacted]	Terms & Conditions, contract drafting, and work schedules required.	• CBA of wider rollout based on observed outcomes. • Provide ongoing monitoring, analysis and evaluation of trades and outcomes. • Support in design of market trading platform. • Identification of interface and interaction frameworks with ESO and regulatory/policy changes to enhance outcomes. • Support stakeholder engagement within industry.	Discount on day rates.

Name	Experience	Contribution	Contractual Relationship	Role of Project Partner	Funding Benefits to Project
Delta-EE	An energy research and consultancy service with a background in emerging distributed energy markets. They have previously worked on projects involving DSO demand side flexibility markets across Europe and have conducted studies geared towards finding the right strategies for using demand side flexibility.	[redacted]	Terms & Conditions, contract drafting, and work schedules required.	• Design of customer engagement process. • Conduct customer engagement on Project. • Support in design of Project trials. • Support in design of market trading rules.	Discount on day rates.

Appendix H: Supporting Letters

ena energynetworks association

FAO Dan Randles
Head of Network Innovation
Electricity North West Ltd
Pavilion 3, Innovation Forum
51 Frederick Road
Salford
M6 6FP

2nd August 2021

Dear Dan,

RE: BiTraDER NIC Project – 2021 Competition

Further to our recent call about BiTraDER, Electricity North West Ltd's submission to the 2021 Network Innovation Competition, I am writing to express my view that this project aligns with our plans within the Open Networks project, and more specifically Workstream 1A, Product 6.

Product 6 aims to establish how distribution network companies can best support non-DSO services. It is clear that services such as peer-to-peer trading could utilise commercially sterilised capacity on the network through non-traditional methods, including discovering the value of that capacity through market-based mechanisms. The Open Networks project is keen to develop an understanding of non-DSO Services and how the electricity networks can facilitate these emerging markets in a neutral manner.

I understand that BiTraDER will produce a functional specification detailing how DNOs can facilitate the bilateral trading of curtailment obligations between connected resources, via a neutral secondary market. The learning from this project will enable all DNOs to benefit, with the hope that any successful outcome could be rolled out across GB.

Thank you for sharing the detail on your plans for BiTraDER, and we look forward to bringing the learning from this project back into the Open Networks project as part of our 'learn-by-doing' approach.

Yours Sincerely,

Randolph Brazier
Director of Innovation & Electricity Systems

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for energy consumers

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CV34 6DA

13th August

RE: Letter of support for Energy North West Ltd. (ENWL) BiTraDER NIC Bid.

Dear Sir/Madam,

Great Britain (GB) is going through a period of major change in respect of its sources of electricity, a journey that continues as we transition to a low-carbon future. Much of the country's electricity needs are now met from renewable resources, which are changing the way the electricity system behaves, creating new challenges for its operation and resilience, not just in the long-term but also over the next few years. The National Grid's Electricity System Operator (ESO) is responsible for day-to-day operation of the GB electricity transmission system, ensuring safe, stable operation and procuring balancing services to enable it.

BiTraDER will demonstrate how access to a dynamic, neutral, distribution-level marketplace enables connected resources to optimise their use of the electricity system by:

- Trading curtailment obligations bilaterally; and
- Participating in existing ESO markets via nodally aggregated "stacks" of flexibility

The BiTraDER project seeks to demonstrate how encouraging more liquidity and trading opportunities for flexible service providers reduces whole system costs for both DSOs and ESO.

BiTraDER will be wholly managed and delivered by ENWL using project resources and project partners. Though not an active partner in this project, the ESO will provide appropriate technical consultancy support to ensure that the BiTraDER-ESO use cases are correctly calibrated and that the project produces validated results that are of tangible benefit to the ESO.

[redacted]

Yours sincerely

Anna Carolina Tortora

Head of Innovation and Digital Transformation

ofgem
Making a positive difference
for energy consumers

SP ENERGY NETWORKS

Network Planning & Regulation

FAO: Dan Randles
Head of Network Innovation
Electricity North West Ltd
Pavilion 3, Innovation Forum
51 Frederick Road
Salford
M6 6FP

Date
10th August 2021
Contact / Extension
+44 (0) 141 614 1789

Dear Dan,

RE: Electricity North West Ltd – BiTraDER, 2021 NIC Submission

Further to our recent discussions, I am writing to express my support for the Electricity North West Ltd NIC submission BiTraDER.

BiTraDER will facilitate the bilateral trading of curtailment obligations between connected resources, via a neutral secondary market, testing the appetite for shared network access arrangements. This is particularly relevant as more DNOs move toward the adoption of Active Network Management systems, which use flexible connections to manage generation and demand, and free up latent capacity.

The project will design and share a functional specification detailing the requirements for facilitating bilateral trading, including the platform, market model, data requirements and interface, enabling other DNOs to implement this technology.

I believe this project will facilitate important learning and has the potential to drive positive change within the industry.

Yours Sincerely,

Gerard Boyd
DSO Delivery Manager
SP Energy Networks

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Dan Randles
Head of Network Innovation
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King Charles House
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Oxford
Stephen Woodhouse; stephen.woodhouse@afry.com
+44 7970 572444

13 August 2021

Attn: Dan Randles

REF: BiTraDER Network Innovation Competition Letter of Support

Dear Dan,

Further to our recent discussions I am pleased to confirm our full support, as a project partner, to Electricity North West in its bid for Network Innovation Competition for the BiTraDER project. We believe there is significant potential value from the project to ENWL, the GB DNOs and the wider GB power system.

BiTraDER will provide a transparent, DNO-facilitated near-to-real-time secondary market to allow customers to re-trade curtailment liabilities; effectively creating a merit order for curtailment between contracted parties and *ad hoc* providers.

The re-trading of curtailment liabilities under BiTraDER could enhance the efficiency of curtailment, as liabilities are traded out to providers with lower costs. This in turn will make flexibility contracts more attractive. As new participants enter flexible contracts, this permits further mitigation of DNO investment needs.

AFRY has significant understanding of innovation in the energy sector. In the UK, AFRY has worked on a number of innovation fund projects, in addition to developing and evaluating the funding mechanisms; we would be happy to provide further details on request.

We have collaborated with the Electricity North West team, and the other partners, to design a project that we believe delivers the benefits described above. Our track record, and that of our other partners, in delivering successful innovation outcomes is first class and we believe the outcome from this project will accelerate the GB industry to realise the full benefit of multiple innovations.

Yours sincerely

Stephen Woodhouse
Director

ELECTRON
Floor 3
86-90 Paul Street
London
W24HQ

Dan Randles
Head of Network Innovation
Electricity North West
Technology House
Lissadel Street
Salford
M6 6AP

11th August 2021

REF: BiTraDER Network Innovation Competition Letter of Support

Dear Dan,

Further to recent discussions, I am pleased to confirm our full, board-approved, support as a project partner to Electricity North West (ENW) in its bid for Network Innovation Competition for project BiTraDER, in our trading platform delivery role.

We are thrilled that ENW has proposed a project with the scope and ambition to tackle some of the most important impediments to the transition to a distributed, Net Zero grid including how to optimise network capacity with an bilateral, market-based approach and how to maximise the value of the flexibility this creates to asset owners, DSOs and the ESO alike.

While previous Open Networks and Innovation projects have made great progress in advancing DSO-led capacity procurement markets, BiTraDER goes further. It examines the DSO role as neutral market facilitator; supports the development of an asset-to-asset optimisation marketplace; will bring to market new flexible capacity in regionally aggregated "stacks"; and explore new models of DSO/ESO coordination within this construct. As such, we judge the value of the project to GB to be timely and highly significant.

Over the last four years, Electron has been at the forefront of developing dynamic, distribution-level flexibility markets in UK and beyond. We have raised and deployed millions of pounds of private capital into developing the technologies and team capabilities to deliver these markets. We have also participated in many related industry working groups and dissemination events. This has enabled us to develop category-leading insight into the requirements of these new markets and the assets that trade in them. We have also built up a first class track-record in delivering successful innovation outcomes.

Over the past months we have collaborated with the Electricity North West team, and partners, to design a project that delivers the benefits outline above on a "learning by doing" approach. Moreover, the scope of BiTraDER, will substantially advance learnings to date, particularly in terms of market arrangements, asset inclusion and DSO OT system integration.

We believe the BiTraDER project, and the experience of all of the project partners that it brings together, will accelerate the ability of flexible resources, and the GB grid, to realise the full benefits of Net Zero.

Yours sincerely,

Joanna Hubbard, CEO

ofgem
Making a positive difference
for energy consumers

12 August 2021

DELTA-EE

Dan Randles
Head of Network Innovation
Electricity North West
Technology House
Lissadel Street
Salford
M6 6AP

REF: BiTraDER Network Innovation Competition Letter of Support

Dear Dan,

This letter is to confirm our full support for the BiTraDER project proposal to be submitted by Electricity North West (ENW) to OFGEM within the Network Innovation Competition (NIC) framework.

The electricity system is currently undergoing a significant transformation of decarbonisation, digitalisation and decentralisation and there is a growing need for flexibility in the system. With increasing numbers of renewable energy assets, curtailment is likely to increase and this needs to be done in an optimal way to provide best value for consumers and benefits for the electricity system. The BiTraDER is an important project in enabling greater flexibility in the electricity system at the distribution level.

Delta-EE has been a leading research organisation in the energy transition for over fifteen years, with a growing focus on flexibility. We commend ENW in bringing this project forwards: it would enable them – and other DNOs – to facilitate and enable greater flexibility at the distribution level. By creating a secondary market for customers to trade curtailment liabilities, BiTraDER will make flexibility contracts more attractive, increase access for customers to flexibility and reduce the cost of flexibility.

The project will only be successful if the needs of customers are considered and integral in the design of the secondary market and this is where our role will be focused. Through customer engagement, we will ensure the needs, challenges and attitudes to curtailment amongst a range of customers are paramount in the project design. Being immersed in flexibility research, and with significant expertise in customer research, we are excellently placed to lead this piece of work.

We have collaborated with ENW and the other partners to develop a project proposal which we believe will bring significant benefits to the UK electricity system. We believe the capabilities and expertise of the consortium partners will ensure the project is highly successful and look forward to working on the project.

Yours sincerely,

Andrew Turton
Head of Consulting

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Appendix I: Glossary

ANM	Active Network Management
ADMS	Advanced Distribution Management System
API	Application Programming Interface
BaU	Business as usual
CCC	Committee for Climate Change
CEP	Customer Engagement Plan
CLASS	Customer Load Active System Service
CQRS	Command Query Responsibility Segregation
DCUSA	Distribution Connection and Use of System Code
DER	Distributed Energy Resources
DERMS	Distributed Energy Resource Management System
DFES	Distribution Future Electricity Scenarios
DNO	Distribution Network Operator
DPS	Data Privacy Statement
EV	Electric Vehicle
ENA	Energy Networks Association
ENIC	Energy Networks Innovation Conference
ENWL	Electricity North West
FNSG	Future Networks Steering Group
GDPR	General Data Protection Regulation
GSP	Grid Supply Point
HP	Heat Pump
HV	High Voltage

IET	The Institution of Engineering and Technology
IFI	Innovation Funding Incentive
IPR	Intellectual Property Rights
LIFO	Last-in-first-off
LCNF	Low Carbon Networks Fund
LCT	Low Carbon Technology
LTDS	Long-Term Development Statements
LV	Low Voltage
NG ESO	National Grid Energy System Operator
NIC	Network Innovation Competition
PAS	Platform for Ancillary Services
PMO	Project Management Officer
PSG	Project Steering Group
RES	Renewable Energy Sources
RIIO-ED1	Electricity Distribution Price Control that will run from 2015 to 2023
RIIO-ED2	Electricity Distribution Price Control that will run from 2023 to 2031
TRL	Technology Readiness Level

Appendix J: Full Submission Spreadsheet