





FUSION

FUSION USEF Implementation Plan





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- This document forms part of the deliverables set out in the Project FUSION Directions A plan for USEF implementation in Project FUSION.
- This document can be cross-referenced with our publications of USEF Due Diligence Report and USEF Consultation Report on the FUSION Webpage.

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EXECUTIVE SUMMARY

This document has been prepared by DNV GL on behalf of SP Energy Networks, in collaboration with Project FUSION partners, and sets out:

- The deployment of elements from the Universal Smart Energy Framework (USEF) in the upcoming flexibility market trial under Project FUSION;
- The USEF elements that are out of the FUSION trial scope due to practical considerations and avoidance of duplication with other work;
- The overview of the processes and information exchange based on the USEF Market Coordination Mechanism (MCM) and IT architecture that trial participants will implement.

The document draws on the outcomes of the due diligence study and the consultation process carried out under work package 3 of Project FUSION, for which the relevant reports are available on the Project FUSION website.¹

The objective of the Project FUSION trial is to demonstrate a fully market-based flexibility mechanism (based on USEF), that will govern the delivery of standardised flexibility products - focusing on the alleviation of network congestion in the trial area – and inform the industry and SP Energy Networks. This will culminate in a FUSION trial report that can be shared with the industry.

Following stakeholders' feedback on the USEF consultation, Project FUSION partners discussed and agreed which USEF processes and innovative USEF elements should be part of the trial, to offer more value and leanings to the industry. As such, the FUSION trial will seek to implement the following:

- 1. SP Energy Networks will create and maintain the **Common Reference (CR)**, a congestion point repository which will contain detailed information on network congestions points, their associated connections and active Constraint Management Service Providers (CMSPs) in the electricity network;
- 2. the role of **the Constraint Management Service Provider (CMSP)** will be undertaken by participating flexibility providers and aggregators;
- the trial will test D-programmes through which participating flexibility providers inform the DSO (SP Energy Networks) of planned activations of flexibility to inform the DSO grid safety analysis, as well as informing the baseline for DSO settling flexibility transactions;
- 4. flexibility transactions will take place under USEFs **yellow operating regime**, meaning that grid capacity management services are procured without trade or dispatch restrictions;
- 5. arrangements for **sub-metering** will be developed and tested, as well as validated through USEFs Metering Data Company (MDC) role;
- 6. D-programmes will be used as **baseline** to quantify the delivery of flexibility;
- 7. the trial will consider **flexibility platform interfaces** as part of the development of a flexibility platform based on a USEF dynamic market-based approach;
- 8. the trial will include **Free Bids** to gain insight into short-term and real-time flexibility procurement alongside long-term contracts;

^{1 &}lt;u>https://www.spenergynetworks.co.uk/pages/fusion.aspx</u>









- 9. flexibility transactions will follow USEF's Market Coordination Mechanism (MCM) phases;
- there will be full implementation of the 2020 USEF Flexibility Trading Protocol (UFTP)² to support SP Energy Networks' flexibility markets for grid-congestion issues and provide insights into the fit of the UFTP in the current GB message exchange architecture; and
- several USEF Aggregator Implementation Models (AIMs) uncorrected, contractual and integrated models

 will be considered to explore existing or potential future arrangements between the aggregator and other market participants.

In addition to these elements, Project FUSION partners are considering the deployment of **dynamic pooling** of flexible assets, which will be revisited and confirmed at a later stage in the trial planning process.

For practical considerations and to avoid duplication of innovation work undertaken elsewhere, Project FUSION partners have decided the following elements will be outside of the scope of the FUSION trial: the central data hub, Allocation Responsible Party (ARP), Electricity System Operator (ESO), Balancing Service Provider (BSP), Balance Responsible Party (BRP), Capacity Services Provider (CSP), non-DSO flexibility services, Processes and interactions between the Aggregator and the Prosumers, Flexibility Platforms standardisation, and redispatch mechanism. These exclusions do not undermine the compliance of the FUSION trial with USEF.

Project FUSION partners have also opted to omit USEF recommendation on applying penalties for over/under delivery of flexibility, to remove potential barriers for aggregators to enter the trial. Instead, DNV GL agreed with the USEF Foundation that the trial will explore the functionality of penalty mechanisms by applying and calculating penalties at a zero price, to ensure compliance with USEF.

Finally, Project FUSION partners have agreed on the implementation of interactive process and information exchange between trial participants based on USEFs MCM, as per element 9 above, as well as setting out the high-level IT architecture for the interactions between the DSO and the Aggregator/CMSP.

^{2 &}lt;u>https://www.usef.energy/app/uploads/2020/01/USEF-Flex-Trading-Protocol-Specifications-1.01.pdf</u>







1. Introduction

1.1. Background to the FUSION USEF Implementation Plan

In January 2019, work package 3 (WP3) of Project FUSION commenced with a due diligence study of the USEF framework against legal, regulatory and market arrangements governing the GB energy sector. The due diligence study was carried out by DNV GL and assessed the fit of USEF with the direction of likely reforms of GB energy policy and regulation, as well as forward-looking industry initiatives like the Energy Networks Association's Open Networks (ENA ON) Project, to inform the transition to a smart, flexible energy system.

The due diligence study results showed that across a number of topics there is a close fit between USEF and both the current market design and the likely direction of future market design in GB. The results showed that there are several relevant and valuable innovative elements within USEF that could enrich current discussions and views on future energy market design, both broadening and deepening these views. Project FUSION subsequently sought the feedback of GB energy industry stakeholders on the merits and viability of implementing these innovative elements. The outcomes of this consultation are summarised in the FUSION Consultation report of 15 November 2019.³

This document is also prepared by DNV GL on behalf of SP Energy Networks and describes the planned deployment of innovative elements from the USEF framework in the upcoming flexibility market trial under Project FUSION. In developing the plan set out in this document, DNV GL met with Project FUSION partners to discuss the outcomes of the FUSION Consultation and agreed which USEF elements will be part of the FUSION trial.

1.2. FUSION Trial Approach

The objective of the FUSION trial is to demonstrate a fully market-based flexibility mechanism (based on USEF), that will govern the delivery of standardised flexibility products - focusing on the alleviation of network congestion in the trial area - and inform the industry and SP Energy Networks. This will culminate in a FUSION trial report that can be shared with the industry.

With regards to the timeline, the trial will start in 2021 and will be completed by 2023, aiming to develop relevant learnings for the GB energy industry. During 2020, the Project FUSION partners will finalise the trial plan and enable the technologies and parties to commence implementation of live trial in 2021.

The current plan, presented in this document, focuses on the development and implementation of USEF elements in the trial. These are divided into 'innovative USEF elements' and 'additional USEF elements' that the Project FUSION partners have agreed to include in the trial scope. In addition, the report provides an overview of the USEF processes, information exchange, and IT architecture that SP Energy Networks and flexibility providers will implement for the FUSION trial.

^{3 &}lt;u>https://www.spenergynetworks.co.uk/userfiles/file/USEF_Consultation_Report.pdf?v=1.2</u>







2. Starting points for USEF Implementation Plan

Project FUSION partners agreed the starting points for the FUSION USEF implementation Plan, covering the flexibility services and the USEF roles that the trial will seek to test.

Project FUSION will trial two **DSO flexibility services** for planned maintenance (pre-fault) and post-fault events and will draw on Electricity Networks Association (ENA) Open Networks products: *Scheduled Constraint Management* product and *Post-Fault Constraint Management* product. These products fall under USEF's Grid Capacity Management and USEF's Congestion Management categories, respectively.

Table 1 summarises the **roles** to be included in the trial and the market party that will perform them.

USEF Role	Inclusion in FUSION Trial	Performed by	Comments
Distribution System Operator (DSO)	YES	SPEN	n/a
Electricity System Operator (ESO)	NO	n/a	n/a
Active Demand Supply (ADS)	YES	To be determined by participating Aggregators	n/a
Aggregator	YES	Flexibility providers	Through industry engagement and tendering process
Supplier	NO	n/a	n/a
Capacity Service Provider (CSP)	NO	n/a	The Aggregator can also be active in the capacity market, but the trial will not trial the interactions with this role
Constraint Management Service Provider (CMSP)	YES	Flexibility providers	Through industry engagement and tendering process
Balancing Services Provider (BSP)	NO	n/a	The Aggregator can also be active in balancing products, but the Project will not trial the interactions with this role
Balance Responsible Party (BRP)	NO	n/a	The Aggregator can also be active in wholesale trading, but the Project will not trial the interactions with this role
Common Reference Operator (CRO)	YES	SPEN	n/a
Meter Data Company (MDC)	YES	SPEN	SPEN will take this role by default, subject to change during the preparation of the trial
Allocation Responsible Party (ARP)	NO	n/a	Wholesale settlement out of scope

Table 1: USEF roles in FUSION trial





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3. Innovative USEF elements within the FUSION trial scope

3.1. Common Reference Operator

Project FUSION partners have agreed that the role of the Common Reference Operator will be part of the FUSION trial to:

- Clarify responsibilities of the CRO;
- Integrate the Common Reference into SP Energy Networks' normal operations;
- Align SP Energy Networks' processes with the direction of travel in GB towards a smart digitised data system;
- Clarify data and General Data Protection Regulation (GDPR) requirements of the congestion point repository and whether this is a feasible solution for privacy and confidentiality in GB; and
- Test accessibility of the data, e.g. who can and should have access to the Common Reference and at what level.

Implementation of the CRO role:

- SP Energy Networks, as CRO, will create and maintain the Common Reference (CR), i.e. a congestion point repository which will contain information on network congestions points, their associated connections and active Constraint Management Service Providers (CMSPs) in the electricity network.
- SP Energy Networks, as DSO, will update the Common Reference with the congestion points at its network. CMSPs will update the CR with their associated connections at each congestion point. The CMSPs will provide the Meter Point Administration Number (MPAN) of each connection as a connection identifier.
- It is envisaged that the CR update will be fully automated in the FUSION trial, updated with automated messages sent by the CMSPs and SP Energy Networks.
- The FUSION trial's ambition is to have more than one flexibility providers participating and providing data to the CR in a real-test environment.

The success factors of the implementation of the CRO role are as follows:

- Successful automated submission of data of congestion point information at SP Energy Networks' operating screen;
- Interoperability between the CR and market participants as well as integration with SP Energy Networks' process;
- CMSPs can smoothly use the CR to retrieve information on congestion points that are related to the Aggregators' connections;
- The CR is timely processed, reflects the real physical conditions of the network, and both, the DSO and CMSPs, have access to real-time data; and
- The CR and associated processes are GDPR-compliant.







3.2. Constraint Management Service Provider

Project FUSION partners have agreed that the role of the Constraint Management Service Provider (CMSP) will be part of the FUSION trial to:

- Clarify responsibilities of the CMSP role in the GB context;
- Provide useful insights for the industry into mapping GB functions/ENA actors to roles and facilitate discussions on this topic;
- Test whether the existence of the CMSP is a feasible recommendation in GB arrangements. For example, the trial could provide insights into the cost of implementing the CMSP role separated from the Aggregator role, and into the potential savings of this implementation; and
- Address stakeholders' questions that were raised during the FUSION consultation, e.g. how the CMSP role is different from the Balancing Services Provider (BSP) role, what the responsibilities of the CMSP are and what the cost of implementing the CMSP role is. The FUSION trial will look into these options and will provide answers to the industry as part of the knowledge dissemination stage.

Implementation of the CMSP role:

- In the FUSION trial, participating flexibility providers can combine the role of the Aggregator and the CMSP. If so, contractual arrangements among them are not required.
- The CMSP will contract with the Aggregators and SP Energy Networks for flexibility procurement and will be responsible for delivering the Constraint Management service to SP Energy Networks.
- The CMSP will interact with the flexibility market (market-facing) while the Aggregators will interact with the prosumers (customer-facing).
- The responsibilities of the CMSP in the GB context will be developed in conjunction with the development of DSO Constraint Management products.

The success factors of the implementation of the CMSP role are:

- To facilitate standardisation and formalisation of contractual arrangements. This work will align with the standardisation of commercial arrangements, currently developed by the ENA Open Networks project; and
- To demonstrate that the role fits into GB arrangements.

3.3. D-Programmes

Project FUSION partners have agreed that D-programmes will be part of the FUSION trial to:

- Include a core USEF function that will support USEF processes, such as plan and settlement;
- Utilise data to generate network requirements that will be delivered through an integrated value chain;
- Test how SP Energy Networks can integrate D-programmes in the operational planning and grid safety analysis;
- Explore D-programmes fit into SP Energy Networks' day-to-day activities; and
- Verify the quality level of D-programmes and their usability with regards to grid safety analysis and settlement.







Implementation of D-programmes:

- CMSPs active in congested network areas (in the trial area) will submit their D-programmes day-ahead with the forecasted net load/generation (behind the meter) of those Prosumers served by the Aggregator with a connection related to a congestion point (Validate phase of USEF Market Coordination Mechanism).
- The granularity of the forecasted net load (or generation) will be down to the settlement period (i.e. 30 minutes) of one full calendar day for day-ahead submission.
- The deadline for the submission of the D-programmes for both the Post-Fault and the Scheduled Constraint Management products will be 11:00 am the day ahead.
- SP Energy Networks will then perform the grid safety analysis based on the D-programmes and demand/generation forecasts of all connected/contracted Prosumers. The grid safety analysis will validate whether the demand and supply of energy can be distributed safely without any limitations.
- The CMSPs will update their D-programmes following a flexibility order (FlexOrder) from SP Energy Networks.
- Processes for all, SP Networks, CMSPs and Aggregators, will be automated as far as practicable.

The key success factors of the implementation of D-programmes are:

- Effective and efficient use of D-programmes for grid safety analysis, for procuring flexibility and for providing baselines in the settlement process; and
- The successful use of D-programmes implies that CMSPs and Aggregators have integrated this process within their day-to-day business and that the information is sufficient for SP Energy Networks to perform the grid safety analysis and order the required flexibility.

3.4. Operating Regimes: Yellow

Project FUSION partners have agreed to test the Yellow Operating Regime (or Capacity Management regime) in the FUSION trial to:

- Establish the processes and interactions that should be included in the Yellow Regime;
- Promote visibility and transparency on DSOs' approach to procure flexibility and provide good practice for the industry;
- Explore network capacities and limitations on when the DSO moves from the Green to Yellow regime and from the Yellow to the Orange;
- Explore how operating regimes can integrate with the day-to-day operations of a DSO; and
- Explore when Active Network Management (ANM) measures are deployed with reference to the Yellow regime.

Implementation of the USEF Yellow regime:

- The FUSION trial will test USEF processes that take place in the Yellow operating regime. Flexibility will be active on market-based mechanisms of the Yellow regime.
- SP Energy Networks should decide and explore whether they will utilise all the available flexibility before moving to the Orange regime or whether there is a maximum flexibility price that SPEN is willing to pay.
- SP Energy Networks' normal operations are part of the Green regime and will not be part of the trial. If the grid safety analysis indicates expected congestion, then the system moves to the Yellow regime where SP Energy







Networks will procure flexibility to resolve the congestion. If congestion is not solved, the system moves to the Orange regime, which is beyond the scope of the FUSION trial to implement.

The success factors of the implementation of the Yellow regime are to:

- Procure flexibility through transparent and well-communicated processes to the Constraint Management Service Providers (CMSPs);
- Solve congestion problems using a market-based mechanism; and
- Procure flexibility when this is required and is cost-effective for SP Energy Networks.

3.5. Sub-metering Arrangements

Project FUSION partners have agreed that sub-metering will be used in the FUSION trial to:

- Facilitate quantification of delivered flexibility;
- Test the sub-metering technical requirements and granularity of data for DSO Constraint Management products; and
- Trial the validation of sub-metering data and their overall use for flexibility settlement processes.

Implementation of sub-metering arrangements:

- The metering and data validation requirements across the different customer segments should be part of the product definition and offer a cost-effective solution for different types of Prosumers. ESO balancing products have higher metering requirements than DSO products, which Project FUSION partners will consider when designing the DSO Constraint Management products 2020 within.
- SP Energy Networks will use the Aggregator's sub-metering data for the quantification of flexibility as well as for the DSO flexibility settlement processes. The flexibility providers are responsible for the installation of sub-meters.
- The Meter Data Company (MDC) role is important for validation of metered data and settlements processes. In the FUSION trial, SP Energy Networks will perform this role. The MDC will receive and validate the submetering data, that will be then used to verify the flexibility that was delivered in the relevant time periods.

Successful implementation of sub-metering arrangements will demonstrate that:

- Metering requirements, as set out in the product design, are satisfied; and
- Sub-metering arrangements ensure that the DSO receives accurate, complete and comprehensive data that corresponds to the relevant settlement period.

3.6. Baselining Methodology

Project FUSION partners have agreed that D-programmes that are submitted in the Validate phase and precede the flexibility offer (FlexOffer), will form the baseline for DSO flexibility settlement, as per USEF recommendations.

This element has a straightforward implementation:

• SP Energy Networks will use the D-programme (net load or generation) that the CMSP sends for each Congestion Point at the beginning of the Validate phase. It is to note that the baseline does not use the updated D-programme which the CMSP submits following a FlexOrder.







 SP Energy Networks will receive the meter data from the Aggregator after the delivery of a flexibility order (FlexOrder). SPEN will calculate the deviation of the metered data from the D-programme (baseline). This deviation is the actual delivered flexibility. SP Energy Networks will remunerate the CMSP based on this volume.

The successful implementation of the USEF baselining methodology will be verified by both the CMSPs and SP Energy Networks: CMSPs will be confident that the remuneration they received reflects the activated flexibility and SP Energy Networks will be comfortable that the deviation reflects the actual delivery of flexibility.

3.7. Flexibility Platform – Interfaces

Project FUSION partners have agreed that SP Energy Networks' interfaces and the use of the flexibility platform will be part of the FUSION trial. The key objectives are to:

- Demonstrate SP Energy Networks' ability to operate flexibility through an integrated and standardised approach.
- Test the system interactions for different market requirements:
 - 1) bilateral flexibility,
 - 2) competitive markets, and
 - 3) free bids
- Activate flexibility from real tangible assets that represent domestic, agricultural, I&C and generation assets at the trial location to deliver Constraint Management products as requested by the DSO.

Implementation of SP Energy Networks' interfaces:

- The trial will use a flexibility platform that SP Energy Networks will own and operate for procuring, dispatching
 and settling flexibility based on a USEF dynamic market-based approach. The same platform will be
 automatically linked to a grid safety analysis system which will inform the dispatch of flexibility and will include
 the processes of information exchanges between SP Energy Networks and the associated parties. The
 aspiration is that the processes within this platform will be executed automatically.
- Project partners are exploring the option to use existing platforms that have previously implemented USEF. The final choice is subject to the cost of implementation and ease of installation and will be subject to the outcome of a competitive tender process.
- SP Energy Networks will develop a control room screen which will enable them to monitor, operate and perform the settlement calculations of all the related flexibility transactions.

The successful implementation of this element is one of the core objectives which also underpins the success of Project FUSION to deliver a flexibility procurement platform that works through an integrated and standardised approach.

3.8. Free Bids

Project FUSION partners have agreed to include free bids in the FUSION trial to:

- Align with the direction of travel in GB towards short-term and real-time procurement;
- Test how free bids can compete with contracted flexibility in a merit order mechanism; and







• Test that resources that cannot participate in availability contracts, can still participate in constraint management.

Implementation of free bids:

- On the day, SP Energy Networks will send their flexibility request (FlexRequest), through the flexibility platform, indicating the magnitude (amount of excess power) and timing (settlement period) of the expected congestion, and how much capacity is available in the remaining settlement periods of the day. The reason to include the latter is to inform the CMSPs about the state of the grid and avoid potential rebound effects. The interaction with the CMSP will be in principle automated, while the bid selection will be manual. This information of the expected congestion will be an output of the grid safety analysis that SP Energy Networks will perform and will be automatically processed to the flexibility platform.
- CMSPs who are able and willing to change the load/generation profile of their Aggregators in line with SP Energy Networks' request create flexibility offers (FlexOffers). The CMSP submits the FlexOffer via the platform. The CMSP places a bid on the market on a day-to-day basis, provided that they have signed a prequalification contract with SP Energy Networks. A FlexOffer is valid until it expires or is revoked. The CMSP will determine the acceptance deadline.⁴
- If the offers are in the right direction, i.e. helping to mitigate congestion, the DSO procures flexibility, by placing a FlexOrder. The FlexOrder is definitive and binding once it has been placed. This process is likely to be manual at the start of the trial. The bid selection process is not designed yet and it will be manual. The decision-making process for the FlexOffer choice will be designed at later stage of the FUSION trial planning.
- Once the FlexOffer is accepted (or the FlexOrder is placed), the demand response event is triggered according to the FlexOffer specifications.
- Activated flexibility is calculated and remunerated, based on the baselining methodology that is described in section 3.6.
- In addition, Project FUSION will consider developing a decision tree to facilitate the choice of flexibility offers and will inform how free bids can compete with bids under long-term contracts.

Success factors of the implementation of free bids are:

- Close to real time flexibility trading;
- Cost-effective procurement of flexibility which is not part of availability contracts; and
- Participation in the flexibility market of assets that cannot be active in availability contracts due to technical/forecasting limitations.

3.9. Market Coordination Mechanism

The Market Coordination Mechanism (MCM) covers the interactions between market participants to facilitate effective flexibility transactions. Project FUSION partners have agreed that USEF's MCM will be part of the FUSION trial to:

• Trial a flexibility market-based mechanism based on USEF, which is one of the core objectives of Project FUSION;

⁴ Note that the CMSP role could be combined with the Aggregator role, under one market participant.







- Develop contractual arrangements for flexibility services that include innovative USEF elements and recommendations;
- Test how SP Energy Networks can implement a grid safety analysis to inform flexibility procurement and dispatch;
- Test settlement processes that are defined by SP Energy Networks and USEF to determine appropriate market requirements, including the provision of evidence for dispatching and metering considerations; and
- Test the system interactions for different market requirements: Bilateral flexibility, competitive markets and free bids.

The FUSION trial will implement the following elements. Section 7 outlines details on the processes and the information exchange in each phase of the MCM:

• **Contract phase:** Project FUSION will develop the contractual arrangements between SPEN and the flexibility service provider (in this case the CMSP/Aggregator). The context of the contract must align with ENA ON outcomes on contracts and will also include USEF elements that are relevant for the contracts.

Typically, the Contract phase will involve a pre-qualification process where the CMSP/Aggregator is assessed for its capabilities to deliver flexibility, its portfolio and its IT systems. Availability contracts are only required for long-term flexibility. Free bids require pre-qualification contracts, which will not include utilisation prices as this will be set on the day. Project FUSION will also collaborate with Dutch DNOs who have already developed USEF-compliant contracts for flexibility services.

- **Plan phase:** In the Plan phase, the CMSP will retrieve the list of congestion points, from the Common Reference, including associated connections. SPEN will retrieve "Active" Aggregators/CMSPs for each congestion point (already discussed in the 3.1). The CMSPs/Aggregators will then optimise their portfolio (see section 7 for details).
- Validate phase: This phase includes the (re-)submission of D-programmes, the grid safety analysis, the FlexRequest, FlexOffer, FlexOrder (see sections 3.3, 3.8 and 7). SPEN will develop internal processes to perform the automated grid safety analysis and integrate it into its day-to-day activities. However, this task is likely to be performed manually at the initiation of the trial.
- **Operate phase:** In this phase the actual dispatch and activation of flexibility takes place to resolve congestion. Participating CMSPs/Aggregators will be responsible for dispatching flexibility in the trial.

USEF does not provide specific guidance on dispatch mechanisms. USEF, however, acknowledges that due to the inherent uncertainty within the energy system there will be deviations from forecasts and submitted plans and therefore CMSPs/Aggregators may activate additional flexibility to meet SPEN's need. Due to time constraints, this will proceed on the basis of pre-arranged contracts between SPEN and the CMSPs/Aggregators or flexibility offers from the Validate phase that are still valid.

• Settlement: In the trial, SPEN will perform the quantification of activated flexibility and remuneration for it. This process will be integrated in SPEN's platform; At the first stages of implementation, settlement will be a manual task, with the possibility to automate it in a later stage. SPEN, as the MDC, will do the validation for the metered data.

Success factors of the implementation of the USEF MCM are to:

- Implement USEF-compliant flexibility trading processes;
- Integrate the MCM phases into SP Energy Networks' day-to-day activities; and







Demonstrate that USEF provides a feasible mechanism for DSOs to procure flexibility and interact with the market.

3.10. Full USEF Flexibility Trading Protocol

The USEF Flexibility Trading protocol (UFTP) is a subset of the USEF Framework and describes the interactions between CSMPs/Aggregators and DSOs to exchange flexibility in a market-based approach to resolve grid constraints either in the form of constraint management or grid-capacity management. UFTP can be used as a stand-alone protocol for the flexibility forecasting, offering, ordering and settlement processes.

The USEF Foundation published the first set of USEF specifications in 2015, which is currently being updated. The updated UFTP was made available during January 2020 and provides a simplified version of the 2015 version. It should be noted that the main processes that are related to Aggregator flexibility trading are same in both the 2015 and 2020 UFTP.

The full implementation of the 2020 UFTP will be included in the FUSION trial to support SPEN's flexibility markets for grid-congestion issues and provide insights into the fit of the UFTP in the current GB message exchange architecture, from a technical point of view. In addition, the UFTP purpose is to standardise the set-up and operation of flexibility market across different DSOs. In order to be USEF compliant, specifications will be implemented according to the use case descriptions that the USEF Foundation provides in the 2020 USEF Flexibility Trading Protocol⁶ (or in the 2015 USEF: The framework specifications).⁶

The UFTP defines the content of XML messages between role processes as required for implementation of the USEF market-based processes. Each message has a unique recipient, identified by the Internet domain and USEF role of the participant. The message transfer mechanism is responsible for sending and receiving these messages.

3.11. Aggregator Implementation Models

USEF has developed seven models (Aggregator Implementation Models (AIMs)) that describe existing or potential future arrangements between the aggregator and other market participants. USEF has developed the AIMs to answer questions around balance responsibility, open supply positions and contractual arrangements between Aggregators and Suppliers.

The design and definition of flexibility products will consider which of these arrangements are suitable and costeffective for DSO constraint management. The inclusion of AIMs in the trial will provide useful insights across the industry into feasible options for DSO constraint management, will raise awareness and facilitate discussions across the industry.

Implementation of suitable AIMs:

- For the FUSION trial, the Uncorrected, the Contractual and the Integrated AIMs are applicable. These models • can be applied in GB across all DSO flexibility products at the early stages of the development of the DSO flexibility services. Arrangements for these models are already in place in GB and facilitate aggregators' participation in the market without additional complexity and barriers. The AIM(s) to be tested in the trial will depend on the participating aggregator(s) and their relationship, if any, with the relevant supplier for a site. This will be confirmed closer to the trial dates.
- Additional to the Uncorrected, the Contractual and the Integrated AIMs, other AIMs could be feasible in the • future GB arrangements. Discussions on AIMs should explore alignment with GB arrangements that are

https://www.usef.energy/app/uploads/2016/12/USEF_TheFrameworkSpecifications_4nov15.pdf





⁵ https://www.usef.energy/app/uploads/2020/01/USEF-Flex-Trading-Protocol-Specifications-1.01.pdf 6



applied in future GB products, including, among others the TERRE platform and arrangements that will be in place in the next 1-2 years. For instance, Ofgem and BEIS are considering changes in regulation so that open supply and imbalance costs are allocated to the market participants that occur these costs. In addition, AIMs for DSO flex products should seek compliance with the EU Clean Energy Package regulations which recommend balance responsibility for aggregators.

3.12. Dynamic Pooling

Dynamic pooling allows flexibility providers to decide which assets from their portfolio to activate up to real time. This possibility facilitates flexibility portfolio optimisation and value stacking. Project FUSION considers the implementation of dynamic pooling for the trial. However, it is dependent on the size and features of the available flexibility. In addition, for settlement purposes, it might be interesting to investigate the involvement of ELEXON for the implementation of dynamic pooling. Therefore, implementation of dynamic pooling will be discussed and agreed at later stage in the development of the FUSION trial.







4. Additional USEF elements within the FUSION trial scope

The FUSION USEF Implementation Plan requires the implementation of additional USEF elements, that are not considered innovative, but will be included in the trial for USEF compliance and for testing the interaction with the innovative USEF elements. These elements are:

- **4.1 Active Demand and Supply**: This is a USEF role that describes energy consuming or producing devices that can be actively controlled. Flexible assets in Aggregators' portfolio will perform this role in the trial.
- **4.2 Meter Data Company**: Section 3.5, on sub-metering arrangements, describes the Meter Data Company role and its fit within the FUSION trial.
- **4.3 Long-term contracts**: In addition to "free bids," the FUSION trial will test long-term flexibility contracts that require contractual arrangements between the DSO and the CMSPs/Aggregators. Long-term contracts will offer flexibility under the same mechanism as free bids and the same USEF MCM processes are applied (see section 3.9). The main difference between the processes that are applied to long-term contracts and the "free bids" is that in long-term contracts the activation of flexibility options is prearranged in bilateral contracts, while flexibility of "free bids" is offered and activated on the same day. This product guarantees a certain availability of flexibility, but the flexibility price is arranged in advance.







5. USEF elements outside the FUSION trial scope

There are some USEF elements that are out of scope of FUSION trial. Their exclusion does not risk the USEFcompliance of the trial. These elements are listed below:

- 5.1 Central data hub: The use of a central data hub as USEF recommends is out of the scope of the FUSION trial, because it is an innovative element that would require complex modifications in GB industry and the participation of wider energy industry stakeholders. Project FUSION also acknowledges that other GB initiatives such as the Energy Data Taskforce are exploring related topics and therefore the implementation of USEF's central data hub can be part of these discussions.
- **5.2 Allocation Responsible Party (ARP):** This role involves establishing and communicating the actual electricity volumes that are used as inputs on processes underpinning wholesale products. The trial will not test wholesale market services.
- **5.3 Electricity System Operator (ESO):** The coordination between the ESO and DSOs is not within Project FUSION's scope.
- 5.4 Roles of the Balancing Service Provider (BSP), Balance Responsible Party (BRP), Capacity Services Provider (CSP): In the full trial the Aggregator can also be active in balancing products, capacity market or be a supplier. Even if the participating aggregator is combining these roles, Project FUSION does not aim to test the interaction with these roles.
- **5.5 Operating Regimes Orange and Red:** The Orange regime (Graceful Degradation) and the Red regime (Power Outage) are out of scope of the FUSION trial, since mechanisms within these two regimes are already available in GB and regulated. USEF does not prescribe which mechanisms should be applied.
- **5.6 Flexibility services:** The trial will not test flexibility services that are not relevant to the DSO, such as BRP optimisation. This implies that processes/information exchange underpinning BRP optimisation are also excluded. For example, USEF describes the settlement processes between the Aggregator and the BRP and specifies that Aggregators active in BRP optimisation should send their A-plans to the BRP for validation. These elements will not be tested in the trial.
- **5.7 Processes and interactions between the Aggregator and the Prosumers:** The FUSION trial will focus on the interactions between the DSO and the Aggregators/CMSP. Contractual relationships and settlement arrangements between Aggregators and Prosumers will take place out of the scope of the FUSION trial.
- **5.8 USEF Flexibility Platforms standardisation:** USEF proposes the standardisation of interactions between flexibility service providers and flexibility platforms, and standardisation of the interface between TSO/DSO platforms and third-party commercial platforms. This standardisation is not in the scope of the trial since it requires wider industry involvement and does not serve the core objectives of Project FUSION.
- **5.9 Re-dispatch Mechanism:** USEF proposes several re-dispatch mechanisms to neutralise the impact of activated flexibility on the overall system balance. However, in the trial, the impact of activated flexibility will be negligible because of the relatively small activated volumes. In this case, the implementation of a re-dispatch mechanism is not necessary and therefore, it is out of the trial scope.







6. Ensuring USEF compliancy in the trial

After coordinating with the USEF Foundation, all but one of the potential compliancy conflicts were addressed.

USEF recommends the use of penalties for under/over delivery of flexibility, whereas Project FUSION partners and stakeholders consider penalties as a barrier for aggregators to enter a trial flexibility market. The USEF Foundation considers that the absence of penalties reflects the nascent state of flexibility markets but agrees that imposing penalties on trial participants does not benefit the trial.

Therefore, the FUSION trial will not levy penalties on trial participants. However, to comply with USEF recommendations, the trial will explore the functionality of penalty mechanisms as follows:

a) include the function of applying and calculating penalties within the IT set up of the Settle process;

- b) carry out the calculation of the under/over delivery volume; and
- c) set the penalty price to zero, to prevent inclusion of penalties in the settlement process.







7. Overview of processes and information exchange

This section outlines the processes and the information exchange between the Aggregator/CMSP,⁷ CRO, MDC, and the DSO, based on USEF's MCM.

7.1. Contract Phase

The USEF Market Coordination Mechanism (MCM) phases start with the Contract phase. Figure 1 shows the processes that take place during the Contract phase, which is more applicable to long-term flexibility contracts between Aggregator/CMSP and DSO:

- The phase includes a pre-qualification process for both free bids and long-term contracts.
- Aggregators/CMSPs publish their connections in the Common Reference Operator (CRO).
- DSOs publish their congestion points in the CRO.
- If the Aggregator has active connections at the DSO's congestion point, then contract negotiations take place.



Figure 1 Contract phase processes

⁷ USEF framework included the CMSP role in the paper *Flexibility Value Chain* in 2018. The process charts, created in 2015, have not been updated yet in the USEF framework and therefore they do not differentiate between the two roles.





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7.2. Plan Phase

The plan phase takes place day-ahead and intra-day in iteration with the Validate phase. The iteration stops before gate closure (or a deadline that FUSION trial will specify).⁸

Figure 2 outlines the processes under the Plan phase:

- The Aggregator/CMSP updates their connections in the CRO and retrieves information of the congestion points posted by the DSO.
- The Aggregator/CMSP identifies whether they have active connections in the congestion point.
- The Aggregator/CMSP collects the forecasts from their portfolio of assets, identifies long-term contract obligations and prepares D-programmes for the connections in the congestion point.
- The DSO retrieves information of Aggregators/CMSPs active in the congestion points and creates the forecast for the connections which are not served by Aggregators/CMSPs.



Figure 2 Plan phase processes

⁸ FUSION trial will does not need to adhere with the gate closure of wholesale energy markets, but it will need to specify a time of the day, after which no more D-programmes can be submitted.





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7.3. Validate Phase

The Validate phase takes place day-ahead and intra-day in iteration with the Plan phase. The iteration stops before gate closure.

Figure 3 shows the processes under the Validate phase:

- The Aggregator/CMSP creates the D-programmes based on the forecasts (of the Plan phase) and shares the D-programmes with the DSO.
- The DSO aggregates forecasts from connections not served by Aggregators/CMSPs and the D-programmes from the Aggregators/CMSPs to conduct the grid safety analysis.
- If the grid safety analysis does not indicate congestion, USEF moves to the Operate phase.
- Alternatively, USEF moves to the flexibility trading process for grid capacity management (Yellow Regime). The DSO creates a flexibility request (FlexRequest) to the Aggregators/CMSPs active in the congestion area. The FlexRequest indicates the magnitude (amount of excess power) and timing (Settlement Period) of the expected congestion, and how much capacity is available in the remaining Settlement Period. If no flexibility providers are available, USEF will move to the Orange regime (not in scope of the trial).
- The Aggregator/CMSP responds to the FlexRequest with a flexibility offer (FlexOffer). The DSO can then place a flexibility order (FlexOrder) to accept the Aggregator's FlexOffer. The D-programmes that were submitted before the FlexOrder are used as the baseline of the settlement process.
- The DSO places the FlexOrder and USEF moves to the Plan phase for the Aggregator/CMSP to update the D-programmes. This is the step where there is any iteration between the Plan and the Validate phase. USEF will move from the Validate to the Operate phase only when the grid safety analysis indicates that congestion is solved through the flexibility trading process or at the deadline (or gate closure).
- If the offered flexibility is not sufficient to resolve the expected congestion or no flexibility is offered, USEF moves to the Orange regime (not in scope of the trial). SP Energy Networks will consider moving to Orange regime if the flexibility price is significantly high.



Figure 3 Validate phase processes







7.4. Operate Phase (Aggregator/CMSP – DSO)

The Operate phase takes place after the gate closure. Figure 4 outlines the processes and information exchange between the Aggregator and the DSO at the Operate phase:

- The DSO continuously monitors the grid. If the DSO detects congestion at the Operate phase, the DSO can still request Aggregators to dispatch flexibility power options to resolve potential grid problems. This will employ on the basis flexibility offers from the Validate phase which are still valid.
- If the DSO does not have available FlexOffers or the flexibility ordered is not sufficient, then USEF moves to the Orange regime (not in scope of the trial).
- In the Operate phase, the Aggregator operates the assets to adhere to its D-programme. If deviations occur, the Aggregator re-optimises its portfolio to solve the deviation. If re-optimisation is not possible, the Aggregator must change its plan and control the assets in such a way that the new plans are realised. As a courtesy to the DSO, the Aggregator/CMSP could re-send the D-programme, so the DSO can incorporate it into their operation, but these updates will not be considered for settlement purposes.



Figure 4 Operate phase processes







7.5. Settle Phase

Figure 5 shows the processes under the Settle phase:

- The DSO calculates the procured flexibility based on their FlexOrders and retrieves the metered data from the Meter Data Company (MDC). In the trial, SPEN will perform the role of the MDC, therefore SPEN will directly receive the data from the CMSPs/Aggregators.
- The DSO validates the delivery of the flexibility using the meter data and the D-programme as the baseline (see section 3.6). The DSO then consolidates the flexibility volumes that the Aggregator/CMSP activated and calculates the remuneration, based on the flexibility price that was agreed during the Flex. trading processes (or in the long-term contracts).
- The Aggregator/CMSP on their behalf calculates the flexibility that the Aggregator/CMSP activated and validates the D-programmes.
- The DSO consolidates the delivered volumes and prices and sends the settlement to the Aggregator/CMSP.
- The Aggregator/CMSP validates the settlement received from the DSO. The Settle process is completed when both the DSO and the Aggregator/CMSP agree on the remuneration.



Figure 5 Settle phase processes







8. IT Architecture

This section outlines the high-level IT architecture for the interactions between the DSO and the Aggregator/CMSP in FUSION trial.

Figure 6 outlines the topology of the trial. The number of the CMSPs and the Aggregator is indicative and subject to future participation in the provision of trial location constraint management services.

The following criteria has to be fulfilled to offer Constraint Management services to the DSO:

- All parties providing Constraint Management Services at the given congestion point have operating assets that • are physically located in the congested area.
- All parties have passed the pregualification process. •
- All parties are registered in the CRO, including registration of their connections.

The topology for the FUSION trial describes the following elements and highlights the main differences between the free bidding and contracted parties:

- All contracted parties could perform the CMSP role, combined with the Aggregator role. •
- Aggregators that operate from a portfolio of smaller assets must implement aggregation, so that sufficient • amount of flexibility is offered.
- Contracted parties (through long-term availability contracts) are obliged to provide bids (FlexOffers) according • to the contract conditions.
- Contracted parties are allowed to provide additional free bids. •
- Free bidding parties may respond to a FlexRequest by providing bids (FlexOffers). .
- DSO decides which bids to accept. This may be a mix of contracted bids and free bids, typically based on a • merit order mechanism. Contract conditions could ensure a minimum amount of activations to provide sufficient remuneration to contracted parties.



Figure 6 Topology diagram for FUSION trial







Figure 7 describes the interactions between the Aggregator (AGR) and the CMSP. This diagram only applies when the roles are performed by different parties. The CMSP exchanges information with both the DSO and the Aggregator throughout all the MCM phases. The interactions between the CMSP and the DSO take place to request, offer and settle flexibility. In parallel, the CMSP interacts with the Aggregator to request and order flexibility, while the Aggregator provides the CMSP with the relevant information regarding the flexibility portfolio, such as forecast, bids and meter data. On the portfolio side, the Aggregator interacts with its flexibility portfolio for dispatching flexibility, collecting meter data, and configuring and controlling assets.



Figure 7 USEF Functions for information exchange between the CMSP and the Aggregator

Figure 8 describes the USEF communication mechanism which is based on HTTPS. The USEF privacy and security guidelines require all participants to be able to securely transmit and authenticate messages. For these purposes, a transport-independent cryptographic scheme is specified, identified as Cryptographic Scheme Type 1 (CS1). The CS1 is a recommended practice for all implementations. The scheme requires participants to generate public/private key pairs. One private key pair is required to sign the message (Digital Signatures), while public keys are exchanged beforehand, typically by mail. This process is mandatory.

In addition, USEF specifies (optional) encryption of the payload, but this is not used in USEF deployments yet (and not included in the figure).



Figure 8 USEF Communication protocols





Glossary

Aggregator	A service provider that contracts, monitors, aggregates, dispatches and remunerates flexible assets at the customer side. (USEF terminology)
Aggregator Implementation Model (AIM)	USEF term that describes the relation of the aggregator with the supplier and the Balance Responsible Party (BRP). It covers relevant aspects of aggregation implementation, such as contractual arrangements, imbalance responsibility and transfer of energy.
Balance Responsible Party (BRP)	A market participant or its chosen representative who is responsible for balancing electricity supply and demand of its portfolio in each settlement period.
Balancing Service Provider (BSP)	A market participant who provides energy volumes to the TSO for the purposes of balancing the total system. In GB, this role is usually undertaken by aggregators, suppliers or customers directly connected to the transmission network.
Balancing Settlement Code (BSC)	The Balancing and Settlement Code (BSC) is a legal document which defines the rules and governance for the balancing mechanism and imbalance settlement processes of electricity in Great Britain. The BSC is administered by ELEXON, the Balancing and Settlement Code Company.
Central data hub	The central data hub is a repository where data for flexibility processes, such as the coordination of flexibility deployment, measurement, validation and settlement of flexibility services, is recorded.
Common Reference (or congestion point repository)	USEF defines the Common Reference as a repository which contains information about connections and congestions points in the network.
Common Reference Operator (CRO)	In USEF, the CRO is responsible for operating the Common Reference. The CRO's role is to ensure the publication of both the DSO flexibility requirements and the associated flexibility assets in each congested point as well as the standardisation of this publication for all distribution areas.
Congestion Management	The avoidance of the thermal overload of system components by reducing peak loads. The conventional solution to thermal overload is grid reinforcement (e.g. cables, transformers). Congestion management may defer or even avoid the necessity of grid investments.
Constraint Management Service Provider (CMSP)	A provider of constraint management services to a DSO or the TSO. This is a USEF role and is not currently used in GB. This role takes on specific responsibilities in communicating and coordinating flexibility transactions with the ESO and DSOs, to ensure effective deployment of flexibility as well as effective management of network constraints. Responsibilities also involve ensuring efficient dispatch of flexibility to maintain the safety and reliability of the networks.
D-programmes	Aggregator forecasts of planned activations of flexibility (day-ahead and intraday) to be shared with DSOs in congested distribution network areas.
Distributed Energy Resources (DER)	Small scale power generation technologies (typically in the range of up to 10MW and including electric energy storage facilities) and larger end-use electricity consumers (e.g. industrial and commercial) with the ability to flex their demand (i.e. demand-side response) that are directly connected to the electricity distribution network.
Distribution Network Operator (DNO)	Company licensed to distribute electricity in GB.
Distribution System Operator (DSO)	As defined in DIRECTIVE 2009/72/EC: A natural or legal entity responsible for operating, ensuring the maintenance of and, if necessary, developing the distribution system in a given area and, where applicable, its interconnections with other systems and for ensuring the long-term ability of the system to meet reasonable demands for the distribution of electricity.





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Distribution Use of System (DUoS) Charges	Charges levied by distribution network operators on users to recover the cost of operating and maintaining the distribution network.		
Energy Networks Association (ENA)	The industry association for operators of gas and electricity transmission and distribution networks in the UK and Ireland.		
Flexibility Value Chain (FVC)	The potential of demand-side flexibility to create value to multiple participants through several markets and in the form of different products and services.		
Flexibility Value Stacking	This is a concept where the Aggregator can provide multiple services from the same portfolio, or even from the same flexible asset(s), potentially to multiple parties to maximise the value of flexibility.		
Flexibility	Ability of an asset or a site to purposely deviate from a planned or normal generation or consumption pattern.		
Independent aggregation	Situation where a customer has an agreement with an aggregator to dispatch and market (parts of) its flexibility, whereas this aggregator operates without the consent from or a contract with the electricity supplier of the customer.		
Independent Aggregator	A market party who performs the role of Aggregator and is not affiliated to a supplier or any other market participant.		
Market Coordination Mechanism (MCM)	The Market Coordination Mechanism in USEF includes all the steps of the flexibility trading process, from contractual arrangements to the settlement of flexibility. USEF splits the flexibility trading process in five phases and describes the interactions between market participants and information exchange requirements in each phase of the MCM.		
Operating Regimes	A USEF concept for a traffic light mechanism to govern the (un)restricted trade and dispatch of flexibility. The USEF market design of operating regimes aims to ensure well-functioning short-term electricity markets, where flexibility is dispatched based on market signals to where it is most essential and valuable.		
Prosumer	This role refers to end-users who only consume energy, end-users who both consume and produce energy, as well as end-users that only generate (including on-site storage). (USEF terminology)		
Post-fault products	Flexibility products under which the DSO procures, ahead of time, the ability of a Service Provider to deliver an agreed change in output following a network fault.		
Re-dispatch	A mechanism that neutralises the impact of the activated flexibility on the overall system balance, by activating the same amount of flexibility in the opposite "direction" outside the congested area.		
Restoration Support Services	Flexibility services provided following a loss of supply; the DSO instructs a provider to either remain off supply, or to reconnect with lower load, to support increased and faster load restoration under depleted network conditions.		
Supplier	The role of the Supplier is to source and supply energy to end-users, to manage (hedge) delivery and imbalance risks, and to invoice its customers for energy.		
Transfer of Energy (ToE)	USEF term for a wholesale electricity transaction between the Supplier and the Aggregator, triggered by a Demand Response activation by the Aggregator on the retail side, restoring the energy balance of both the Aggregator and the Supplier (and their BRPs).		
Transmission System Operator (TSO)	A physical or legal entity responsible for operating, ensuring the maintenance of and, if necessary, developing the transmission system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the transmission of electricity.		
	In GB, the party responsible for the system balance and operability is the Electricity System Operator (ESO), National Grid ESO. Separate parties, the electricity Transmission Owners (TOs), are responsible for investing, building and maintaining their electricity transmission network.		







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