WESTERN POWER DISTRIBUTION

EFFS

# ELECTRICITY FLEXIBILITY AND FORECASTING SYSTEM

**EFFS**

WPD_EN_NIC_003

**NIC MAJOR PROJECT**

**DSO Requirements Specification**

RIIO NIC NETWORK INNOVATION COMPETITION

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# Contents

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# 1 Purpose of this document

The purpose of this document is to record the functional requirements for a Distribution System Operator (DSO) that relate to the purchasing and management of flexibility services in operational timescales. This document forms a significant part of the Electricity Flexibility and Forecasting Systems (EFFS) project's third project deliverable to Ofgem. It will be used to develop a technical specification to define the technical system to support Distribution Network Operators (DNOs) in performing the relevant new functions of a DSO.

The document records the outputs of various EFFS project workshops focusing on numerous aspects of the anticipated DSO activities. Both internal and wider industry stakeholders have been engaged in this process; these have included Scottish and Southern Electricity Networks, Electricity North West, Scottish Power Energy Networks, National Grid ESO, Energy Networks Association (ENA) Open Networks, UK Power Networks, Northern Powergrid and Northern Ireland Electricity Networks.

While the high-level functions of a DSO have already been specified via the ENA Open Networks project, this document provides a greater level of detail as to how the processes and functions are expected to operate through the lens of Future World B, as defined by the Open Networks project (see Appendix 5: Overview of the Open Networks future worlds for details). This is complemented by details of the EFFS project's assumptions and decisions.

A number of specific questions (to inform and / or validate the direction taken by the project) were included in relevant sections of the document for reviewers to consider during the review cycles phase. These questions can be found in Appendix 9: Collated view of the questions to reviewer.

# 2 Glossary

| Term | Definition |
|---|---|
| Activation period | Defined by the ENA in "Open Networks Project DSO Service Requirements: Definitions", in the EFFS process and terminology this is "minimum dispatch response lead time" |
| ANM | Active Network Management |
| API | Application Programming Interface |
| BAU | Business As Usual |
| Bidding Period | Defined by the ENA in "Open Networks Project DSO Service Requirements: Definitions", in the EFFS process and terminology this is "minimum procurement response lead time" |
| Capacitor Bank | Capacitors are used to control the level of the voltage supplied to the customer by reducing or eliminating the voltage drop in the system caused by inductive reactive loads |
| CIM | Common Information Model |
| CLEM | Cornwall Local Energy Market |
| CROWN | WPD Asset Management Database |
| Contingency scenario | These are scenarios to consider when modelling the network in order to identify constraints (for example an N-1 or N-2 scenario)<br><br>As per current WPD policy this will be every combination of the following for the relevant part of the network to define the next credible fault:<br>• Each circuit fault<br>• Each busbar fault |
| Constraint | For EFFS purposes this refers to thermal network constraints (as opposed to voltage constraints) |
| Datalogger | WPD tool for storage of historic time series data, i.e. the data gathered by SCADA systems to support the control room. |
| DER | Distributed Energy Resources |
| DNO | Distribution Network Operator |
| DSO | Distribution System Operator |

| Term | Definition |
|---|---|
| Durabill | WPD Primary Billing Tool which contains details of half hourly metered customers consumption or generation. |
| EFFS | Electricity Flexibility and Forecasting Systems |
| EHV | Extra High Voltage (i.e. 33kV, 66kV or 132kV) |
| ENA | Energy Networks Association (specifically the Open Networks Project) |
| EMN | Electricity Margin Notice: a notice issued to the market by National Grid ESO to request extra generation |
| ESO | Electricity System Operator, i.e. the role carried out by National Grid ESO that includes national system balancing and frequency control |
| Flexibility platform | See Appendix 6: Flexibility platforms for details |
| Flexible Power | WPD branding for flexibility services and the name used to refer to the platform to deliver the procurement of flexibility services |
| HH | Half Hourly electricity metering |
| INM | Integrated Network Model |
| ICCP | Inter-Control Centre Communications Protocol |
| Ipsa 2 | Ipsa 2 is a software tool for power system design and operation applications provided by Ipsa Power |
| kV | Kilovolt |
| kW | Kilowatt |
| Long term | Within the context of EFFS this refers to an activity between six months ahead and one month before the event in question. |
| Medium term | Within the context of EFFS this refers to an activity between one month ahead and the day before the event in question. |
| MPAN | A Meter Point Administration Number is a 21-digit reference used in Great Britain to uniquely identify electricity supply points such as individual domestic residence |
| NIC | Network Innovation Competition |
| Networkflow | Proprietary software suite developed, licenced and maintained by AMT-SYBEX relating to the management of flexibility services for electricity networks. |

| Term | Definition |
|---|---|
| MVA | Mega Volt Amp |
| Network hierarchy | The relative configuration of the key locations of the network by voltage level. This is simpler than the integrated network model but would allow an understanding of how actions at a particular primary, for example, would impact on 33kV feeders, bulk supply points, 132kV feeders and GSPs. |
| Network model | An electronically held network arrangement that may be used to simulate the impact of load-flows or perform other analysis of the network under different scenarios.<br><br>Some further definition related to network models:<br>• Switch level = a network model that contains switchgear details to allow for contingency modelling;<br>• As built = the current network model;<br>• Committed = As built amended for future network changes that are confirmed (i.e. not proposed). |
| Ofgem | Office of Gas and Electricity Markets |
| PIN | Prior Information Notice |
| PowerFactory | Power system analysis software provided by DIgSILENT |
| Power On | WPD's Distribution Management System provided by GE |
| PSSE | Transmission planning and analysis software provided by SIEMENS |
| SCADA | Supervisory Control and Data Acquisition |
| Selection Period | Defined by the ENA in "Open Networks Project DSO Service Requirements: Definitions", in the EFFS process and terminology this is "minimum arming response lead time" |
| Service types | Types of peak shaving flexibility services that will be supported by EFFS (namely scheduled constraint management, pre-fault constraint management, post-fault constraint management, restoration support.) |
| SGS | Smarter Grid Solutions (Project forecasting partner) |
| SLA | Service Level Agreement |
| SOW | Statement Of Work |
| STATCOM | Static Synchronous Compensator (a regulating device used on alternating current electricity transmission networks) |

| Term | Definition |
|---|---|
| SVO | System Voltage Optimisation |
| T.E.F. | TRANSITION, EFFS, FUSION |
| TSDS | Time Series Data Store |
| UCR | Utilities Contracts Regulations 2016 |
| Utilisation Payment | A payment made for the dispatch of flexibility services |
| WPD | Western Power Distribution |
| WS1 | Workstream 1 of the EFFS project (forecasting evaluation, co-ordination and requirements) |
| WS2 | Workstream 2 of the EFFS project (system design, development / reconfiguration, system test) |

# 3 Related documents

| Ref | Document title | Version | Date issued | Prepared by | Location |
|---|---|---|---|---|---|
| 1 | Revised_EFFS_FSP_Redacted_v2 | 2.0 | 06/07/2018 | WPD & AMT-SYBEX | OFGEM website here |
| 2 | Open Networks Project DSO Service Requirements: Definitions | 1.0 | 07/09/2018 | ENA | ENA website here and here |
| 3 | Open Networks Project Terms and Definitions | 1.0 | 25/07/2018 | ENA | ENA website here |
| 4 | ENA Future Worlds Consultation Document | 1.0 | 31/07/2018 | ENA | ENA website here |
| 5 | Future World Impact Assessment | 1.0 | 22/02/2019 | Baringa | ENA website here |

# 4 Introduction

## 4.1 Background

The electricity network is changing with higher levels of embedded generation, the emergence of storage and the uptake of low carbon technologies such as electric vehicles and heat pumps. These changes pose challenges for networks that were not designed to include them. DNOs have been investigating a range of innovations to enable smarter networks, enabling low carbon generation without the cost and delays associated with traditional reinforcement.

Recently, it has been acknowledged that managing the challenges of future networks will require DNOs to adopt the new role of DSO, which will involve making greater use of flexibility services to operate a far more dynamic network, alongside greater co-ordination with the Electricity System Operator (ESO).

The aim of the EFFS project is to specify, implement and trial a system that supports a number of key functions of a DSO via the following objectives:

1. Enhancement of the ENA Open Networks project's output by looking at the high-level functions a DSO must perform, providing a detailed specification of the new functions validated by stakeholders;
2. Determination of a technical implementation to support those new functions, and including specifications for data exchanges identified in the high-level functions;
3. Testing of the technical implementation software and hardware integration as required;
4. Trialling the technical implementation, which will involve modelling the impact of flexibility services. As well as proving the system, this phase will create learning relevant to estimating the likely benefits of flexibility services and the impact of changing network planning standards (such as the new iteration of Engineering Recommendation P2).

This will result in a proven, workable technical solution being available, and will provide a set of blueprints, best practice guides and other learning, from which DNOs can undertake their own technical implementations that meet the same standards or embark on their own product procurements if that would provide better value for money. Streamlining the specification, design and testing work for these new tools will reduce the time and cost for DSO transition, thereby accelerating the benefits of flexibility services.

The EFFS project is collaborating with two other DSO-related NIC projects; TRANSITION led by Scottish and Southern Electricity Networks, partnering with Electricity North West, and FUSION led by Scottish Power Energy Networks. The collaborative body made up by the three DSO-related NIC projects of TRANSITION, EFFS and FUSION is known as the T.E.F. Group. Through collaboration, the T.E.F. Group will deliver better value for money and avoid unnecessary duplication. Further details on the collaboration approach are captured in '*NIC 2017 Compliance Document_V1.0*' and '*NIC 2017 Compliance Document Appendices_V1.0*'.

## 4.2 EFFS scope and capabilities

EFFS will prove the following key DSO system capabilities:

- Forecasting;
- Capacity engine;
- Service management (including notifications for conflict resolution purposes);
- Optimisation;
- Scheduling;
- Market interaction (procurement, arming & dispatch);
- Conflict avoidance;
- Synergy identification;
- Reporting and reconciliation.

It is expected that most of the functions will be carried out by a flexibility co-ordinator who will have the responsibility for ensuring that sufficient flexibility services are available to ensure the operability of the network. Another user role is that of the forecaster, with responsibility for setting up forecasts as required to support analysis, and thereafter evaluating the performance of the forecasts and recalibrating these as required. Additionally, there would be a system administrator role to manage other users, create and run standard reports etc.

EFFS will be used to manage the 132kV, 66kV and 33kV networks, including primary transformers and will not be used to manage constraints on LV or 11kV networks.

EFFS will be used to manage thermal constraints including reverse power constraints for transformers but is not expected to be used to manage voltage issues or fault level issues. Voltage management is expected to take place via control systems such as the system voltage optimisation trialled for the Network Equilibrium project or via reactive power services.

While these requirements are intended to be generic (i.e. they could be implemented by any DSO or adapted for use by other parties involved in the flexibility market from a buyer perspective), they have been developed within the context of WPD’s current IT and capability landscape. EFFS is therefore not starting from a blank canvas but is instead beginning from WPD’s current position / existing capabilities and building on that.

Assumptions have been made in terms of what systems will fulfil these requirements within WPD for example, a core part of the system is AMT-SYBEX’s Networkflow product. Although these systems may not be present within other DSOs, the capabilities they provide are common across all DSOs and therefore, the requirements are still applicable.

In terms of exactly which systems will fulfil these requirements within WPD, the technical design of the system and the integration within WPD’s current IT landscape will be defined during the next stage of the project (WS2). The systems will then be documented as part of the subsequent deliverable ‘EFFS Project system design specification’. Therefore, at this stage the requirements are aspirational and there are numerous internal and external dependencies that will determine exactly how they will be fulfilled.

# 5 Business process

## 5.1 Process timings

EFFS is intended to support the definition of DSO functions in operational time frames; EFFS will therefore typically be used to manage flexibility services from around three months ahead of their planned use. We have however chosen to include forecasting horizons of six months ahead to see whether these yield valuable results. The timing of various processes within EFFS will ultimately be driven by items that are currently difficult to specify at present, such as:

- Gate closure times for flexibility markets;
- Accuracy levels of forecasting;
- Optimal lead times to manage conflicts and utilise synergies.

We are managing these unknowns by either defining variable parameters that can be adjusted once there is a greater level of understanding or making the process as agnostic to specific timings as possible.

## 5.2 Neutral market facilitator

One of the key concepts in the transition from DNO to DSO is that of a neutral market facilitator. The requirements below for neutral market facilitation are taken from the ENA Future Worlds consultation.

- *"Ensures non-discriminatory and technology neutral solutions: favouring solutions that are optimal rather than unfairly favouring particular technologies;*

- *Uses market mechanisms that are fair, transparent and competitive, providing a level playing field for providers of network services and providers of energy products/services in order to deploy the most efficient and effective solutions;*

- *Supports flexible and innovative solutions in response to future Customer requirements and develops the network services they require, including enabling and facilitating innovation by others; and*

- *Delivers value to Customers and communities".*

There is a great deal of uncertainty as to where and how platforms will develop, and it is arguable that providing access to all parties via a single flexibility services platform would be non-discriminatory. Requiring EFFS to communicate with multiple flexibility service platforms in a standardised way is the best way of future-proofing EFFS. This assumes that platforms are providing comparable services to each other. Another way in which the requirement for neutrality has affected EFFS is in deciding that EFFS will not have direct control of assets which may be an area of difference with the TRANSITION and FUSION projects. Instead, there will one single method to dispatch flexibility regardless of whether the asset is owned by a third party or WPD, and this will be via whichever of the multiple flexibility platforms EFFS has procured the service from. This decision has been made to ensure fair, equal and consistent interaction with flexibility platforms to avoid any specific technology, provider, or flexibility platforms being treated preferentially. EFFS will be agnostic to these factors: all flexibility service providers will be treated equally as long as they can fulfil the service requirements and provide value for money. Also, from a business process point of view this single process and mechanism of procurement, dispatch and arming will prevent duplication, conflicts and inconsistencies.

The following section of document contains the end-to-end business process as defined within EFFS showing how the functions listed in section 4.2 will operate. These processes follow on from and complement the analysis and procurement that occurs in planning timescales. They will run sequentially as the time horizon for the event approaches, the assumption being that the forecasting will become more accurate closer to the event.

The use case is:

- Validation of flexibility procured in planning timescales and the requirement to procure, arm and dispatch additional flexibility services in operational timescales to resolve a forecasted constraint or enable dispatch of flexibility after multiple faults to ensure network security.

In terms of the user roles the expectation is that the following users will be involved in this process:

- Forecaster and flexibility co-ordinator up until the real time management, dispatch and monitoring. Note: these roles do not currently exist but are required, as they do not map onto an existing business function. The flexibility co-ordinator role will have a very similar skill set to that of an outage planner, whereas the forecaster role will require individuals with a mathematical / statistical background and possibly some programming experience.
- Control room engineer for real time dispatch and monitoring of the network.

This process is broken down into three stages:

- Procurement: steps 1 – 52;
- Arming: steps 53 – 94;
- Dispatch: steps 95 – 142.

There are common elements between the procurement, arming and dispatch processes as these all require power flow analysis of contingency scenarios of the network as it is expected to be at a future point in time. These iterations will differ because the forecast values will change as will the expected network configuration. The procurement iteration will involve the greatest interaction with flexibility platforms whereas the arming and dispatching stages will only involve assets that have already been procured for services.

Conflict avoidance with other parties and amendment / cancellation of existing flexibility services and the identification of synergies between parties has not been included in this process flow as these are background processes that can be invoked at any time. These have been captured separately in sections 6.8 and 0. Similarly reporting and reconciliation requirements are documented in section 6.10.

As a general principle a process deadline has been included at any stage which requires either user intervention or interaction between systems. When breached these deadlines will raise an exception. This is to ensure that the process proceeds in a timely fashion and does not fall down at these potential points of failure (either due to user error, a technical exception or breach of SLA from an external party). These deadlines will be aligned with the flexibility market closure gates once they are defined in more detail but aligning them across the various platforms may be challenging unless consistent values are defined.

## A key to the symbols used in the flow charts throughout this document is included in Appendices

Appendix 1: Process map key.

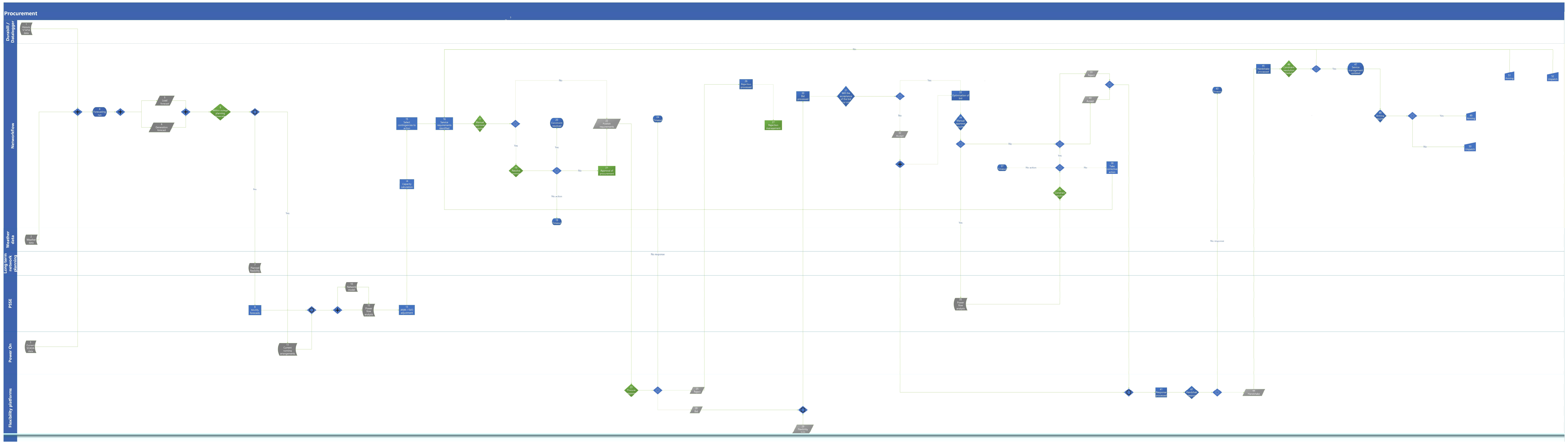
Each process step is linked to one of the functional areas specified in section 6 of the document, plus the related requirements (also in section 6). Captured within each functional area is a summary of the rationale from the relevant project workshop that led to the approach defined in this document.

Due to the complexity and size of the process maps it is recommended to view this section of the document in 250% magnification. The pages are formatted as A3 landscape so please consider this if printing this document. PDF versions of these maps are also embedded in Appendix 7: Business process maps.

### 5.3 Procurement

In this process we are referring to procurement of specific flexibility service instances in operational timescales to be carried out via a flexibility platform. The aim of the process is to have a service (or services) procured that can then be subsequently armed (if applicable) and dispatched to resolve network constraint(s) or to speed up fault restoration. At this stage there is no obligation to use the service, so it may not be armed or dispatched.

Longer term framework agreements / creating new contracts and pre-qualification of flexibility service providers to participate in markets are not included (they will be covered in planning timescales and by the relevant flexibility platforms respectively). The process defined here happens in shorter timescales and assumes these steps have already taken place. Likewise, the creation of new service types is not within the scope of EFFS.


Procurement
Networkflow
Weather data
Long term network planning
PSSE
Power On
Flexibility platforms

| Procurement Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 1 | Historic SCADA data reflecting the load, and generation will be provided via Datalogger / Durabill. | Forecasting | 6.2.5.1 |
| 2 | Historic and forecast weather data will be provided. | Forecasting | 6.2.5.3 |
| 3 | Current SCADA data reflecting the load and generation will be provided via Power On. This will only be required for within day time horizons. | Forecasting | 6.2.5.1 |
| 4 | Forecasting runs triggered. | Forecasting | 6.2.5.1, 6.2.5.2, |
| 5 | Output of forecasting, the expected load forecast for the relevant network location. | Forecasting | 6.2.5.1, 6.2.5.2, |
| 6 | Output of forecasting, the expected generation forecast for the relevant network location. | Forecasting | 6.2.5.1, 6.2.5.2, |
| 7 | Flexibility that has been procured prior to EFFS timescales and outside of the EFFS process will feed into the capacity calculation. | Capacity engine | 6.3.5.1 |
| 8 | Translation of forecasts into load / generation values to use in load flow analysis considering the planned flexibility from step 7. | Capacity engine | 6.3.5.1 |
| 9 | A flexibility co-ordinator user determines is the event within network outage planning timescales (i.e. will any details of outages be available)? | Capacity engine | 6.3.5.2 |
| 10 | The BAU network model and asset ratings to feed into the capacity calculation. | Capacity engine | 6.3.5.3 |
| 11 | Up to date network state information (e.g. current and future outages) will be provided by Power On. | Capacity engine | 6.3.5.2 |
| 12 | Power flow analysis data will be provided from a power flow analysis tool (in this case PSSE) based on the inputs from steps 8, 10 and 11.<br>As part of this power flow analysis all relevant contingency scenarios will be identified. | Capacity engine | 6.3.5.4, 6.3.5.5 |

| Procurement Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 13 | The activity of ANM / SVO systems will be replicated and overlaid onto the output of step 12. The output will provide a number of different HH profiles for load and generation each of which relates to different contingency scenario. | Capacity engine | 6.3.5.6 |
| 14 | A capacity calculation will be carried out to identify any constraints based on the input from step 13. All contingency scenarios will go through this process. This will identify breaches of capacity thresholds in any of the contingency scenarios (i.e. where load is greater than load rating). | Capacity engine | 6.3.5.7, 6.3.5.8, 6.3.5.9, 6.3.5.10, 6.3.5.11 |
| 15 | A composite set of flexibility requirements will be identified. This will take a worst-case scenario approach, in that the flexibility requirements will be the collated largest identified exceedances from step 14. | Capacity engine | 6.3.5.12 |
| 16 | All possible constraints / service requirements have been identified. | Service management | 6.4.5.1 |
| 17 | Whether user review of the constraints is required is optional. If not, then the process will move automatically to step 22.<br><br>This review includes assessing the contingencies included in the composite requirements from step 15. | Service management | 6.4.5.2 |
| 18 | A flexibility co-ordinator user will determine if they can resolve the constraints by means other than triggering flexibility (e.g. network re-configuration). | Service management | 6.4.5.2 |
| 19 | A flexibility co-ordinator user does not address the constraints in a timely fashion, so the transaction times out and raises an exception (deadline value to be configurable). | Service management | 6.4.5.2 |
| 20 | A flexibility co-ordinator user marks the constraint as “managed externally” in the system and no further action is required. | Service management | 6.4.5.3 |

| Procurement Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 21 | A flexibility co-ordinator user manually approves the procurement request being sent out to the market.<br><br>At this stage they will be able to view an indicative / default cost for the procurement, arming and dispatch of the service.<br><br>Note: EFFS will not be managing financial authority sign off levels. | Service management | 6.4.5.2, 6.4.5.4, 6.4.5.5, 6.4.5.6 |
| 22 | A 'Publish Requirements' signal is issued to all flexibility platforms. This details the service requirements. | Market interface | 6.7.5.2 |
| 23 | The flexibility platforms issue a 'Procurement Response' signal. The response timelines for different flexibility platforms may be different so the responses are not actioned until each of the flexibility platforms deadline for response has elapsed. | Market interface | 6.7.5.3 |
| 24 | The flexibility platforms do not issue a 'Procurement Response' signal in a timely fashion, so the transaction times out and raises an exception (deadline value to be configurable). | Market interface | 6.7.5.4 |
| 25 | The 'Procurement Response' is a rejection, so the flexibility platforms do not make a bid to fulfil the market service requirements. | Market interface | 6.7.5.3 |
| 26 | The rejection is processed in the system triggering an exception. | Market interface | 6.7.5.3 |
| 27 | The flexibility co-ordinator user invokes the rejection management process. | Market interface | 6.7.5.3 |
| 28 | The 'Procurement Response' is a bid, so the flexibility platform makes a bid (or bids) to fulfil the market service requirements. | Market interface | 6.7.5.3 |
| 29 | Flexibility platforms provide details of flexibility they have available unsolicited rather than as a response to a specific procurement message. | Market interface | 6.7.5.5 |

| Procurement Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 30 | The bid details are processed in the system. | Market interface | 6.7.5.3 |
| 31 | If accepting the bids does not incur cost then no commercial optimisation is required, all bids are auto accepted. However, they still feed into the optimisation process to ensure that the various other optimisation criteria are fulfilled. | Optimise | 6.5.5.27 |
| 32 | An accept procurement response signal will be automatically triggered to the flexibility platform. | Market interface | 6.7.5.6 |
| 33 | All the bids and available flexibility are optimised. | Optimise | 6.5.5.1-6.5.5.26, 6.5.5.28-6.5.5.32 |
| 34 | Whether user review of the optimisation result is required is optional. If not, then the process will move automatically to steps 39 and 40. | Scheduling | 6.6.5.1, 6.6.5.2 |
| 35 | The power flow analysis carried out in step 12 will be repeated but including the output of the optimisation from step 33. | Capacity engine | 6.3.5.13 |
| 36 | A flexibility co-ordinator user will validate whether the output of the optimisation from step 33 will resolve the constraints. | Scheduling | 6.6.5.2 |
| 37 | A flexibility co-ordinator user does not review the revised power flow analysis in a timely fashion, so the transaction times out and raises an exception (deadline value to be configurable). | Scheduling | 6.6.5.2 |
| 38 | The output of the optimisation from step 33 does not resolve the constraints, therefore the flexibility co-ordinator user will go back to step 16 to take corrective action (i.e. review the original constraints and where necessary go back out to the flexibility platforms to procure additional / different flexibility). | Scheduling | 6.6.5.2 |

| Procurement Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 39 | Where bids are not to be progressed a reject 'Procurement Selection' signal will be triggered to the flexibility platform. | Market interface | 6.7.5.6 |
| 40 | Where bids are to be progressed an accept 'Procurement Selection' signal will be triggered to the flexibility platforms. | Market interface | 6.7.5.6 |
| 41 | The flexibility platforms process the response. | Market interface | 6.7.5.6 |
| 42 | The flexibility platforms determine whether to issue a "handshake" signal. | Market interface | 6.7.5.7 |
| 43 | The flexibility platforms do not issue a "handshake" signal in a timely fashion, so the transaction times out and raises an exception (deadline value to be configurable). | Market interface | 6.7.5.8 |
| 44 | The flexibility platforms issue a "handshake" signal. | Market interface | 6.7.5.7 |
| 45 | The system processes the "handshake" signal. | Market interface | 6.7.5.7 |
| 46 | A flexibility co-ordinator user assesses if the resolution of the constraint has been scheduled (i.e. that the services procured will handle the peak). If not, then there is the option to run the process again in order to procure more flexibility via step 16. | Scheduling | 6.6.5.3 |
| 47 | Service management will be updated.<br><br>Note: this step will update the service data to be shared as part of conflict avoidance and synergy identification. See sections 6.8 and 6.9 for details. | Scheduling | Not related to a specific requirement |
| 48 | Does the service type require arming? | Service management | Not related to a specific requirement |
| 49 | When the procured service type requires arming this links to the arming process. | N/A, linking step | N/A |

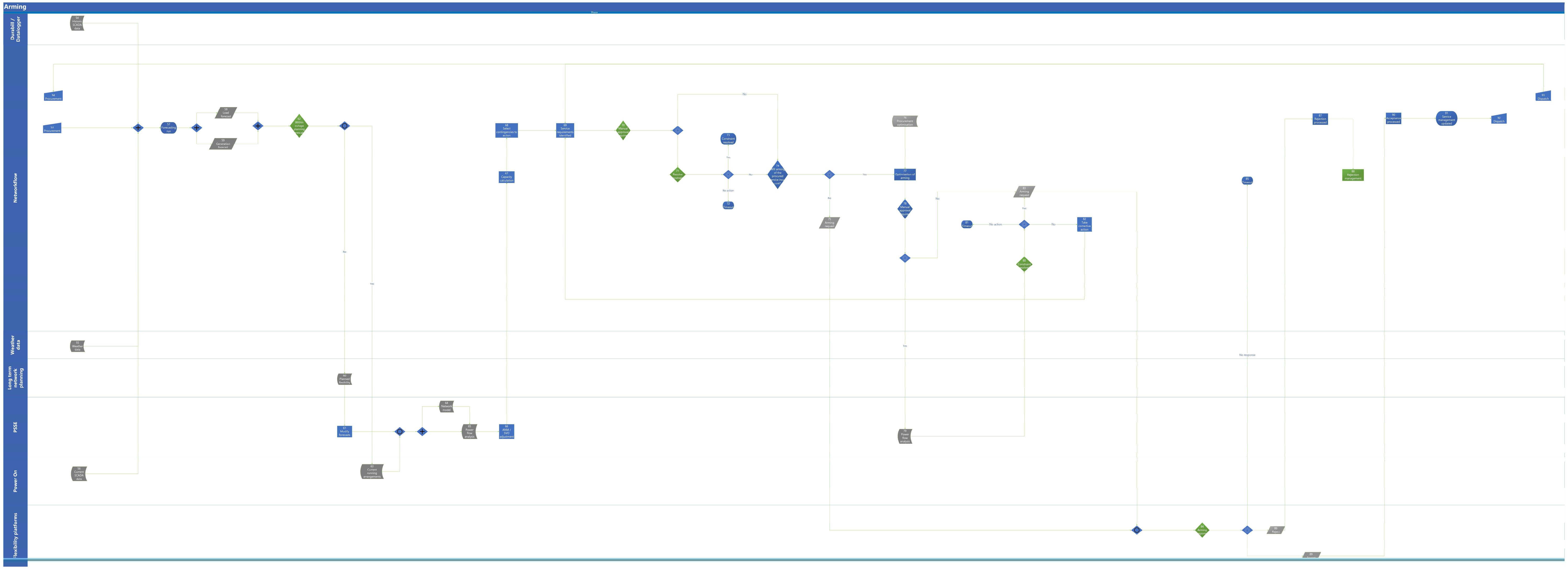
| Procurement Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 50 | Where the procured service type does not require arming this links to the dispatch process. | N/A, linking step | N/A |
| 51 | When during the arming process a flexibility co-ordinator user determines more flexibility services are required they have the option to invoke the procurement process. | N/A, linking step | N/A |
| 52 | When during the dispatch process a flexibility co-ordinator user determines more flexibility services are required they have the option to invoke the procurement process. | N/A, linking step | N/A |

## 5.4 Arming

In this process we are referring to arming of specific flexibility services instances in operational timescales to be carried out via a flexibility platform. The aim of the process is to have a service (or services) armed that can then be subsequently dispatched to resolve network constraint(s). At this stage there is no obligation to use the service, so it may not be dispatched.

The “armed” status was developed under project ENTIRE and applies to the service known as “secure” which is a scheduled constraint management service. This is a type of availability payment in that providers receive this payment when they commit to provide a service and the payment is made whether or not they are eventually dispatched.

Other types of service can be dispatched without an arming step and associated payment e.g. straight after they have been procured, or by receiving a dispatch instruction.


Arming
Durabill / Datalogger
Networkflow
Weather data
Long term network planning
PSSE
Power On
Flexibility platforms

| Arming Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 53 | The arming process will be instigated following the procurement process, if the service type requires arming. | N/A, linking step | N/A |
| 54 | Historic SCADA data reflecting the load, and generation will be provided via Datalogger / Durabill. | Forecasting | 6.2.5.1 |
| 55 | Historic and forecast weather data will be provided. | Forecasting | 6.2.5.3 |
| 56 | Current SCADA data reflecting the load and generation will be provided via Power On. This will only be required for within day time horizons. | Forecasting | 6.2.5.1 |
| 57 | Forecasting runs triggered. | Forecasting | 6.2.5.1, 6.2.5.2, |
| 58 | Output of forecasting, the expected load forecast for the relevant network location. | Forecasting | 6.2.5.1, 6.2.5.2 |
| 59 | Output of forecasting, the expected generation forecast for the relevant network location. | Forecasting | 6.2.5.1, 6.2.5.2 |
| 60 | Flexibility that has been procured prior to EFFS timescales and outside of the EFFS process will feed into the capacity calculation. | Capacity engine | 6.3.5.1 |
| 61 | Translation of forecasts into load / generation values to use in load flow analysis considering the planned flexibility from step 60. | Capacity engine | 6.3.5.1 |
| 62 | A flexibility co-ordinator user determines is the event within outage planning timescales (i.e. will any details of outages be available)? | Capacity engine | 6.3.5.2 |
| 63 | Up to date network state information (e.g. current and future outages) will be provided by Power On. | Capacity engine | 6.3.5.2 |
| 64 | The BAU network model and asset ratings to feed into the capacity calculation. | Capacity engine | 6.3.5.3 |
| 65 | Power flow analysis data will be provided from PSSE based on the inputs from steps 61, 63 and 64. | Capacity engine | 6.3.5.4, 6.3.5.5 |

| Arming Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| | As part of this power flow analysis all relevant contingency scenarios will be identified. | | |
| 66 | The activity of ANM / SVO systems will be replicated and overlaid onto the output of step 65. The output will provide a number of different HH profiles for load and generation each of which relates to different contingency scenario. | Capacity engine | 6.3.5.6 |
| 67 | A capacity calculation will be carried out to identify any constraints based on the input from step 66. All contingency scenarios will go through this process. This will identify breaches of capacity thresholds in any of the contingency scenarios (i.e. where load is greater than load rating). | Capacity engine | 6.3.5.7, 6.3.5.8, 6.3.5.9, 6.3.5.10, 6.3.5.11 |
| 68 | A composite set of flexibility requirements will be identified. This will take a worst-case scenario approach, in that the flexibility requirements will be the collated largest identified exceedances from step 67. | Capacity engine | 6.3.5.12 |
| 69 | All possible constraints / service requirements have been identified. | Service management | 6.4.5.1 |
| 70 | Whether user review of the constraints is required is optional. If not, then the process will move automatically to step 74. This review includes assessing the contingencies included in the composite requirements from step 68. | Service management | 6.4.5.2 |
| 71 | A flexibility co-ordinator user will determine if they can resolve the constraints by means other than triggering flexibility (e.g. network re-configuration). | Service management | 6.4.5.2 |
| 72 | A flexibility co-ordinator user does not address the constraints in a timely fashion, so the transaction times out and raises an exception (deadline value to be configurable). | Service management | 6.4.5.2 |
| 73 | A flexibility co-ordinator user marks the constraint as “managed externally” in the system and no further action is required. | Service management | 6.4.5.3 |

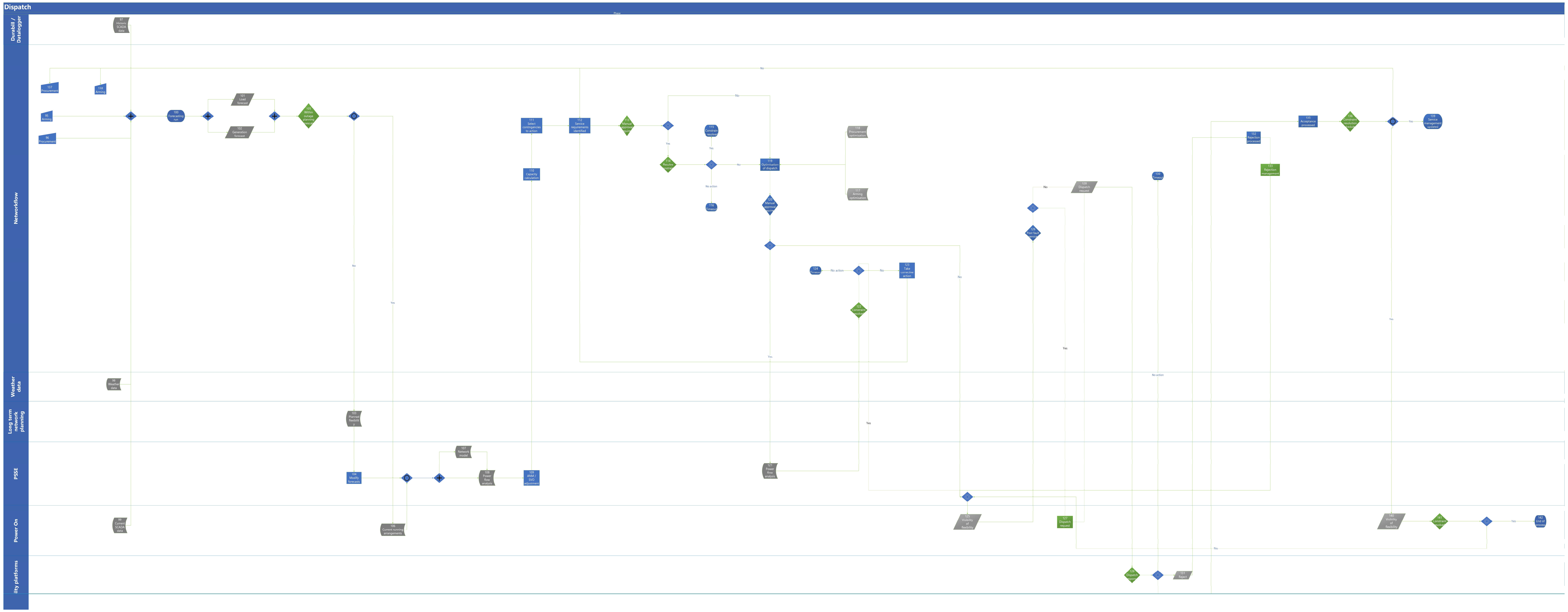
| Arming Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 74 | If arming the procured services does not incur cost then no commercial optimisation is required, all services are auto armed. However, they still feed into the optimisation process to ensure that the various other optimisation criteria are fulfilled. | Optimise | 6.5.5.27 |
| 75 | An 'Arming request' signal will be automatically triggered to the flexibility platforms. | Market interface | 6.7.5.9 |
| 76 | The output of the procurement optimisation process will feed into the arming optimisation. | N/A, linking step | N/A |
| 77 | All the procured services and available flexibility are optimised. | Optimise | 6.5.5.1-6.5.5.26, 6.5.5.28-6.5.5.32 |
| 78 | Whether user review of the optimisation result is required is optional. If not, then the process will move automatically to step 83. | Scheduling | 6.6.5.1, 6.6.5.2 |
| 79 | The power flow analysis carried out in step 65 will be repeated but including the output of the optimisation from step 77. | Capacity engine | 6.3.5.13 |
| 80 | A flexibility co-ordinator user will validate whether the output of the optimisation from step 77 will resolve the constraints. | Scheduling | 6.6.5.2 |
| 81 | A flexibility co-ordinator user does not review the revised power flow analysis in a timely fashion, so the transaction times out and raises an exception (deadline value to be configurable). | Scheduling | 6.6.5.2 |
| 82 | The output of the optimisation from step 77 does not resolve the constraints, therefore the flexibility co-ordinator user will go back to step 69 to take corrective action (i.e. review the original constraints and where necessary go back out to the flexibility platform to arm additional / different flexibility). | Scheduling | 6.6.5.2 |

| Arming Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 83 | Where bids are to be progressed an ‘Arming Request’ signal(s) will be triggered to the flexibility platforms. | Market interface | 6.7.5.9 |
| 84 | The flexibility platforms issue an ‘Arming Response’ signal. | Market interface | 6.7.5.10 |
| 85 | The flexibility platforms do not issue a ‘Arming Response’ signal in a timely fashion, so the transaction times out and raises an exception (deadline value to be configurable). | Market interface | 6.7.5.11 |
| 86 | The ‘Arming Response’ is a rejection, so the flexibility platform does not make a bid to fulfil the service requirements. | Market interface | 6.7.5.10 |
| 87 | The rejection is processed in the system triggering an exception. | Market interface | 6.7.5.10 |
| 88 | The flexibility co-ordinator user invokes the rejection management process. | Market interface | 6.7.5.10 |
| 89 | The ‘Arming Response’ is an acceptance, so the flexibility platform arms the service. | Market interface | 6.7.5.10 |
| 90 | The system processes the acceptance. | Market interface | 6.7.5.10 |
| 91 | Service management will be updated.<br><br>Note: this step will update the service data to be shared as part of conflict avoidance and synergy identification. See sections 6.8 and 6.9 for details. | Scheduling | Not related to a specific requirement |
| 92 | This links to the dispatch process. | N/A linking step | N/A |
| 93 | When during the dispatch process a flexibility co-ordinator user determines more flexibility services are required they have the option to invoke the arming process. | N/A linking step | N/A |
| 94 | When during the arming process a flexibility co-ordinator user determines more flexibility services are required they have the option to invoke the procurement process. | N/A linking step | N/A |

## 5.5 Dispatch

In this process we are referring to dispatch of specific flexibility services instances in operational timescales to be carried out via a flexibility platform. The aim of the process is to dispatch a service (or services) to resolve a network constraint(s).

The direct dispatch and real time control of the asset will not be carried out by EFFS, this will be the responsibility of the flexibility platform / service provider (EFFS is agnostic as to who the end provider is, how the dispatch is carried out and the technology involved).


Dispatch
Durabill / Datalogger
Networkflow
Weather data
Long term network planning
PSSE
Power On

| Dispatch Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 95 | The dispatch process will be triggered following the arming process, if the service type requires arming. | N/A linking step | N/A |
| 96 | The dispatch process will be triggered following the procurement process, if the service type does not require arming. | N/A linking step | N/A |
| 97 | Historic SCADA data reflecting the load, and generation will be provided via Datalogger / Durabill. | Forecasting | 6.2.5.1 |
| 98 | Historic and forecast weather data will be provided. | Forecasting | 6.2.5.3 |
| 99 | Current SCADA data reflecting the load and generation will be provided via Power On. This will only be required for within day time horizons. | Forecasting | 6.2.5.1 |
| 100 | Forecasting runs triggered. | Forecasting | 6.2.5.1, 6.2.5.2 |
| 101 | Output of forecasting; the expected load forecast for the relevant network location. | Forecasting | 6.2.5.1, 6.2.5.2 |
| 102 | Output of forecasting, the expected generation forecast for the relevant network location. | Forecasting | 6.2.5.1, 6.2.5.2 |
| 103 | Flexibility that has been procured prior to EFFS timescales and outside of the EFFS process will feed into the capacity calculation. | Capacity engine | 6.3.5.1 |
| 104 | Translation of forecasts into load / generation values to use in load flow analysis considering the planned flexibility from step 103. | Capacity engine | 6.3.5.1 |
| 105 | A flexibility co-ordinator user determines is the event within outage planning timescales (i.e. will any details of outages be available)? | Capacity engine | 6.3.5.2 |
| 106 | Up-to-date network state information (e.g. current and future outages) will be provided by Power On. | Capacity engine | 6.3.5.2 |
| 107 | The BAU network model and asset ratings to feed into the capacity calculation. | Capacity engine | 6.3.5.3 |

| Dispatch Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 108 | Power flow analysis data will be provided from PSSE based on the inputs from steps 104, 106 and 107.<br><br>As part of this power flow analysis all relevant contingency scenarios will be identified. | Capacity engine | 6.3.5.4, 6.3.5.5 |
| 109 | The activity of ANM / SVO systems will be replicated and overlaid onto the output of step 108. The output will provide a number of different HH profiles for load and generation each of which relates to different contingency scenario. | Capacity engine | 6.3.5.6 |
| 110 | A capacity calculation will be carried out to identify any constraints based on the input from step 109. All contingency scenarios will go through this process. This will identify breaches of capacity thresholds in any of the contingency scenarios (i.e. where load is greater than load rating). | Capacity engine | 6.3.5.7, 6.3.5.8, 6.3.5.9, 6.3.5.10, 6.3.5.11 |
| 111 | A composite set of flexibility requirements will be identified. This will take a worst-case scenario approach, in that the flexibility requirements will be the collated largest identified exceedances from step 110. | Capacity engine | 6.3.5.12 |
| 112 | All possible constraints / service requirements have been identified. | Service management | 6.4.5.1 |
| 113 | Whether user review of the constraints is required is optional. If not, then the process will move automatically to step 119.<br><br>This review includes assessing the contingencies included in the composite requirements from step 110. | Service management | 6.4.5.2 |
| 114 | A flexibility co-ordinator user will determine if they can resolve the constraints by means other than triggering flexibility (e.g. network re-configuration). | Service management | 6.4.5.2 |

| Dispatch Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 115 | A flexibility co-ordinator user marks the constraint as “managed externally” in the system and no further action is required. | Service management | 6.4.5.3 |
| 116 | A flexibility co-ordinator user does not address the constraints in a timely fashion, so the transaction times out and raises an exception (deadline value to be configurable). | Service management | 6.4.5.2 |
| 117 | The output of the procurement optimisation process will feed into the dispatch optimisation. | N/A, linking step | N/A |
| 118 | The output of the arming optimisation process will feed into the dispatch optimisation. | N/A, linking step | N/A |
| 119 | All the procured and armed services are optimised. | Optimise | 6.5.5.1-6.5.5.26, 6.5.5.28-6.5.5.32 |
| 120 | Whether user review of the optimisation result is required is optional. If not, then the process will move automatically to step 125. | Scheduling | 6.6.5.1, 6.6.5.2 |
| 121 | The power flow analysis carried out in step 108 will be repeated but including the output of the optimisation from step 120. | Capacity engine | 6.3.5.13 |
| 122 | A flexibility co-ordinator user will validate whether the output of the optimisation from step 120 will resolve the constraints. | Scheduling | 6.6.5.2 |
| 123 | The output of the optimisation from step 120 does not resolve the constraints, therefore the flexibility co-ordinator user will go back to step 112 to take corrective action (i.e. review the original constraints and where necessary go back out to the flexibility platform to procure additional / different flexibility). | Scheduling | 6.6.5.2 |
| 124 | A flexibility co-ordinator user does not review the revised power flow analysis in a timely fashion, so the transaction times out and raises an exception (deadline value to be configurable). | Scheduling | 6.6.5.2 |

| Dispatch Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 125 | Visibility of the flexibility service will be pushed to Power On and visible to a control room user. | Scheduling | 6.6.5.4 |
| 126 | If the flexibility service is either post fault constraint management or restoration support, dispatch will be triggered from Power On. Otherwise it will be triggered from EFFS. | Scheduling | 6.6.5.4 |
| 127 | A control room user triggers a 'Dispatch Request' from Power On. | Market interface | 6.7.5.12 |
| 128 | A 'Dispatch Request' signal will be triggered to the flexibility platforms. | Market interface | 6.7.5.13 |
| 129 | The flexibility platforms issue a 'Dispatch Response' signal. | Market interface | 6.7.5.14 |
| 130 | The flexibility platforms do not issue a 'Dispatch Response' signal in a timely fashion, so the transaction times out and raises an exception (deadline value to be configurable). | Market interface | 6.7.5.15 |
| 131 | The 'Dispatch Response' is a rejection, so the flexibility platform does not dispatch the service. | Market interface | 6.7.5.14 |
| 132 | The rejection is processed in the system triggering an exception. | Market interface | 6.7.5.14 |
| 133 | The flexibility co-ordinator user invokes the rejection management process. As part of this process the user will have the option to trigger alternative service(s). | Market interface | 6.7.5.14 |
| 134 | The 'Dispatch Response' is an acceptance, so the flexibility platforms dispatch the service. This message will contain the MPAN(s) associated to the service. | Market interface | 6.7.5.14 |
| 135 | The system processes the acceptance. | Market interface | 6.7.5.14 |
| 136 | The constraint resolutions are confirmed as scheduled in the system a WPD flexibility co-ordinator user makes an assessment as to whether sufficient energy is scheduled to be dispatched to resolve the constraints. | Scheduling | Not related to a specific requirement |

| Dispatch Process Flow | | | |
|---|---|---|---|
| **Step** | **Description** | **Functional area** | **Requirement(s)** |
| 137 | When during the dispatch process a flexibility co-ordinator user determines more flexibility services are required they have the option to invoke the procurement process. | N/A linking step | N/A |
| 138 | When during the dispatch process a flexibility co-ordinator user determines more flexibility services are required they have the option to invoke the arming process. | N/A linking step | N/A |
| 139 | Service management will be updated.<br><br>Note: this step will update the service data to be shared as part of conflict avoidance and synergy identification. See sections 6.8 and 6.9 for details. | Scheduling | Not related to a specific requirement |
| 140 | Visibility of the confirmed to dispatch flexibility service will be pushed to Power On and visible to a control room user. | Scheduling | 6.6.5.4 |
| 141 | A control room engineer monitors the event to ensure the constraints are resolved. If not, they have the option to trigger more available flexibility services via step 126. If no additional services are available this will be managed outside of EFFS. | Scheduling | 6.6.5.4 |
| 142 | End of process. | N/A | N/A |

# 6 System overview

## 6.1 Core functions overview

Figure 1 below is a diagrammatic representation of the functional areas within the EFFS project. The core of this functionality will be configured in the AMT-SYBEX Networkflow product.

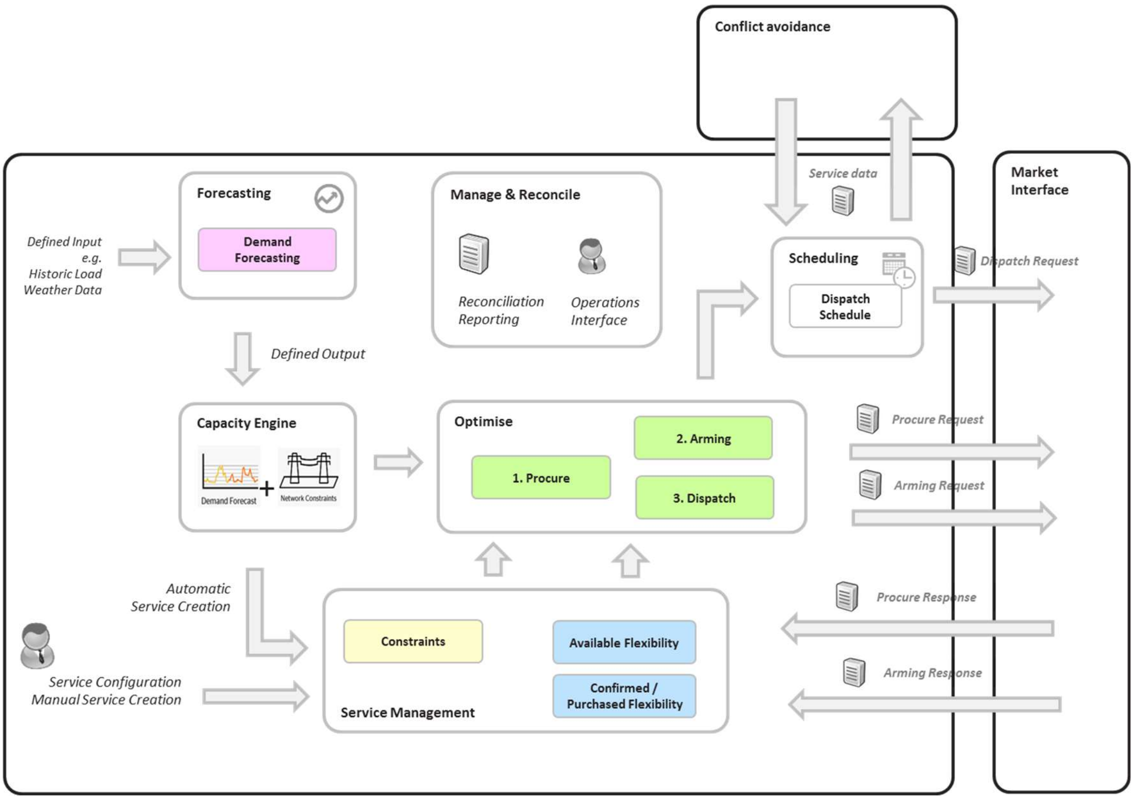



Figure 1: EFFS core functions

The scope, requirements, assumptions and dependencies for each component are detailed in sections 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 0 and 6.10 of this document.

### 6.1.1 General assumptions

| Ref | Description |
|---|---|
| 6.1.1.1 | Reactive power is out of scope (although the associated data items have been defined in section 7 to future proof these requirements). |
| 6.1.1.2 | EFFS assumes the high-level structures and processes of the future world B, see Appendix 5: Overview of the Open Networks future worlds for more details. |
| 6.1.1.3 | Longer term forecasting / investment planning will identify the geographical areas of network that will be subject to EFFS timescales / processes. Therefore, these processes will not be used on whole network areas, but subsets that are likely to have constraints based on long term planning.<br><br>Longer term forecasting / investment planning is out of scope of EFFS. |

| | |
|---|---|
| 6.1.1.4 | The different instances of Power On within WPDs license areas are functionally the same and interoperable. |

## 6.2 Forecasting

The forecasting aspect of EFFS is being carried out by the project's forecasting partner, Smarter Grid Solutions (SGS). Therefore, the following sections contain their scope of work and an early view of what their findings will suggest. However, until this work is completed the exact nature of the forecasting and the data feeds it will require is to be confirmed. This will be published in a separate paper in June 2019 which, once available, should be read in conjunction with this document.

Due to the unknown gate closures timescale for flexibility markets, a broad selection of forecasting horizons is being explored to reduce the risk of them not aligning to the market timescales once they are defined.

### 6.2.1 Pre-requisites / Scope

| In scope | Out of scope |
|---|---|
| • Demand forecasting;<br>• Generation forecasting;<br>• Data feeds (e.g. weather, location, historic load);<br>• Short to medium term forecast horizons (i.e. within day, day ahead, week ahead);<br>• Month ahead to 6-month advance forecast horizons (may not be used but to be explored). | • Long term forecast horizons (i.e. greater than 6 months);<br>• Long term investment planning;<br>• Integration of other forecasting solutions or existing algorithms. |

### 6.2.2 Description

The Forecasting module will consist of multiple processes dependent on the forecasting scenario, of which will provide a demand forecast and the other a generation forecast. These algorithms will be defined by SGS and then instantiated into AMT-SYBEX's Networkflow product.

Forecasts will be produced for:

- Transformers at relevant grid supply points, bulk supply points or primary sub-stations;
- EHV connected customers whether the connections are demand only, generation only or a combination of generation and demand;
- EHV circuits.

Forecasts will not be required for 11kV feeders, distribution substations, LV networks or HV or LV connected customers, however data can be provided for these customers and networks to support forecasting at the upstream networks if required.

Output from the forecasting will include:

- Substation load – average value for the time period (e.g. half hour) at the forecasting location in MVA;
- Substation power factor – average value for the time period at the forecasting location;
- Generation – average value for the time period forecasting location;
- Generation power factor – average value for the time period at the forecasting location;
- Net Load/generation – net average for the time period at the forecasting location (i.e. the demand on the network);
- Net power factor – average value for the time period at the forecasting location;
- Maximum load – this metric is not expected to predict the maximum instantaneous load but some other indicative metric such as the highest average value within a shorter time period e.g. five minutes within the normal forecasting time period e.g. half an hour in MVA;
- Maximum generation – as for maximum load this metric is expected to give an indication of the maximum load averaged over a shorter period within the normal forecasting period.

They will be produced at the following temporal granularity:

- At least half hourly resolution;
- Estimates for maximum power should relate to a smaller time resolution rather than an instantaneous value. This should be at least five-minute resolution.

Data feeds for the forecasting algorithms are expected to include weather, location and historic load information but are still to be determined. Below is the current view.

| | 6 Months Ahead | 3 Months Ahead | Month Ahead | Week Ahead | Day Ahead | Within Day | Now |
|---|---|---|---|---|---|---|---|
| Load/ Generation data | 6 months ahead forecast | 3 months ahead forecast | Month ahead forecast | Week ahead forecast | Day ahead forecast | Day ahead forecast adjusted to reflect today's SCADA data | SCADA via PowerOn |
| Weather data | TBC | TBC | TBC | TBC | TBC | TBC | TBC |

| | 6 Months Ahead | 3 Months Ahead | Month Ahead | Week Ahead | Day Ahead | Within Day | Now |
|---|---|---|---|---|---|---|---|
| Assumed business context | High level procurement check | Procurement check | Procurement check | Determine arming volumes | Dispatch | Dispatch | Dispatch |

SGS forecasting work has used a sample of use cases to compare the results of different forecasting methods; namely ARIMA, XGBOOST and Long/Short Memory Neural Networks. The importance of different variables to the different models has been assessed. It was originally hoped that it would be possible to create formulaic forecasts where a forecast at a new location could be created using the model developed at other locations by simply replacing the local data. The SGS forecasting work suggests this would not provide good quality models and it is likely that the various forecasts will need a degree of supervision when they are created, evaluated and retrained.

### 6.2.3 Assumptions

| Ref | Description |
|---|---|
| 6.2.3.1 | Forecasting will be triggered on a scheduled basis or manually via the solution user interface. |
| 6.2.3.2 | The migration from Data logger to TSDS will not be complete within the EFFS timescales, therefore EFFS will only support an interface from Data logger. However, it is assumed that all data used in EFFS from Data logger will also be present in TSDS. |
| 6.2.3.3 | Where historic time series data is taken from Data logger it is assumed that all data relevant for EFFS has been transferred from Power On into Data logger. |
| 6.2.3.4 | While historic weather data will be required to set up forecasts initially, the system will capture actual weather data as part of the process to validate the accuracy of the forecasts. It is expected that error in weather forecasts would have a significant impact on the error of the forecast as a whole and understanding this component would be necessary as part of the checks to see whether the forecast needed to be retrained. Actual data captured for this process would over time create a source of historic weather data. |
| 6.2.3.5 | Where weather forecasts are not available for future timeframes, then average values for that week of the year will can be used as proxy values. |
| 6.2.3.6 | Where historic demand and generation values are not available, then average values for that week of the year will can be used as proxy values. |
| 6.2.3.7 | The forecasting will not initially need to consider growth factors for low carbon technology for longer term forecast calculations (i.e. 1 and 6 month forecast horizons). |

| | |
|---|---|
| 6.2.3.8 | The forecasting will not initially need to consider forecasting market sensitive demand e.g. storage - grid services, capacity market in forecast calculations. |
| 6.2.3.9 | It is assumed that historic demand and generation data will have been cleansed and will be of a sufficient quality to be used in forecasting. |

### 6.2.4 Dependencies

| Ref | Description | Impact if not met |
|---|---|---|
| 6.2.4.1 | Historic load and generation data need to be available in a consistent and defined format for inclusion in forecasting calculations. This will be received from data logger or Durabill. | Forecasting cannot be run |
| 6.2.4.2 | Within-day load / generation data needs to be available in a consistent and defined format for inclusion in forecasting calculations. This will be received from Power On. | Forecasting cannot be run |
| 6.2.4.3 | Asset data needs to be available in a consistent and defined format for inclusion in forecasting calculations. This will be received from CROWN or CIM, but which will be dependent on the timing of the migration between the two which will occur in parallel to EFFS. | Forecasting cannot be run |
| 6.2.4.4 | An interface to receive long term historic weather data will be defined / is available, e.g. for the previous three years. | Forecasting cannot be run |
| 6.2.4.5 | An interface to receive forecast and actual weather data will be defined / is available e.g. yesterday's actual to month ahead forecast (or if not available, fortnight ahead forecast). | Forecasting cannot be run |
| 6.2.4.6 | An interface to receive network configuration (PSSE) data will be defined / is available. | Forecasting cannot be run |

### 6.2.5 Requirements

| Ref | Requirement | Business process step |
|---|---|---|
| 6.2.5.1 | The system will receive historic demand / generation data feeds from Data logger, Durabill and Power On.<br><br>The Data logger and Durabill interface will be via JBDC link using SQL scripts. | 1, 3, 54, 56, 97, 99 |

| | | |
|---|---|---|
| 6.2.5.2 | The system will support a data feed for new generators & assets. When new assets are created no historic demand or generation data will be available, so the system will hold a historic profile for each asset type or a mechanism for modelling a profile.<br><br>Note: the interface for new assets may come from PSSE. | 4, 5, 6, 57, 58, 59, 100, 101, 102 |
| 6.2.5.3 | The system will receive historic weather data. | 2, 55, 98 |

## 6.3 Capacity engine

When defining the requirements for this function there were three high-level options:

1. Simple capacity calculation;
2. Simple capacity calculation amended by a lookup table of sensitivity factors (i.e. the static output of previous power flow analysis activities);
3. Full power flow analysis considering the current state of the network and all credible contingency scenarios.

The first approach, a simple capacity calculation, where the forecast value is compared directly to an asset's rating is limited to scenarios where the load/generation values in a contingency scenario can be predicted with reasonable accuracy e.g. the load on a transformer at a two-transformer site with one transformer out of service. This was ruled out as overly simplistic and potentially leading to inaccurate flexibility requirements being sent to market.

The second method relies on carrying out a number of power flow analysis calculations to understand the relationship between reducing or increasing load/generation at one part of the network on another part of the network. The process to create sensitivity factors needs to be repeated for every different configuration of the network therefore these are specific to a particular site and a particular contingency. This is particularly useful for meshed networks where these relationships are not intuitive. This allows the power flow analysis to inform the optimised despatch of flexibility services, but enables the processes to be decoupled, so that despatch can occur quickly. This approach was rejected because of the additional complexities of EFFS, such as modelling the behaviour of ANM / SVO schemes, amending the load/generation forecasts to reflect flexibility services that would be assumed to be dispatched and amending the network configurations for each contingency to reflect the state of the network as known to Power On.

As both the second and third approaches involve multiple iterations of power flow analysis the creation of sensitivity factors does not necessarily provide a benefit and tracing through from the inputs to the outputs would be made more complex. So, the conclusion was to select option 3 on the basis that by building power flow analysis into the process the output would be more accurate and ensure network security.

However, this approach is the most complex, which may have implications on both processing times and also introduces a large number of dependencies / interfaces.

Below is the capacity analysis process expressed as pseudo code.

*Per forecasting horizon*

*Determine initial network configuration*

*Determine seasonal ratings to apply*

*Determine forecasts for load and generation reflecting normal network configuration*

*Extrapolate forecasts for nodes where none are directly available via pro-rata of forecast for circuit.*

*Determine for total load using forecast of net load and total generation.*

*For contingency = 1 to n*

*Determine how the network would be reconfigured following the failure of the transformer / linear asset associated with this contingency.*

*If existing procured / armed/ dispatched flexibility services need to be modelled, then adjust demand/generation forecasts accordingly*

*For half hour = 1 to 50 (additional two half hours included to manage clock change periods)*

*Carry out power flow analysis*

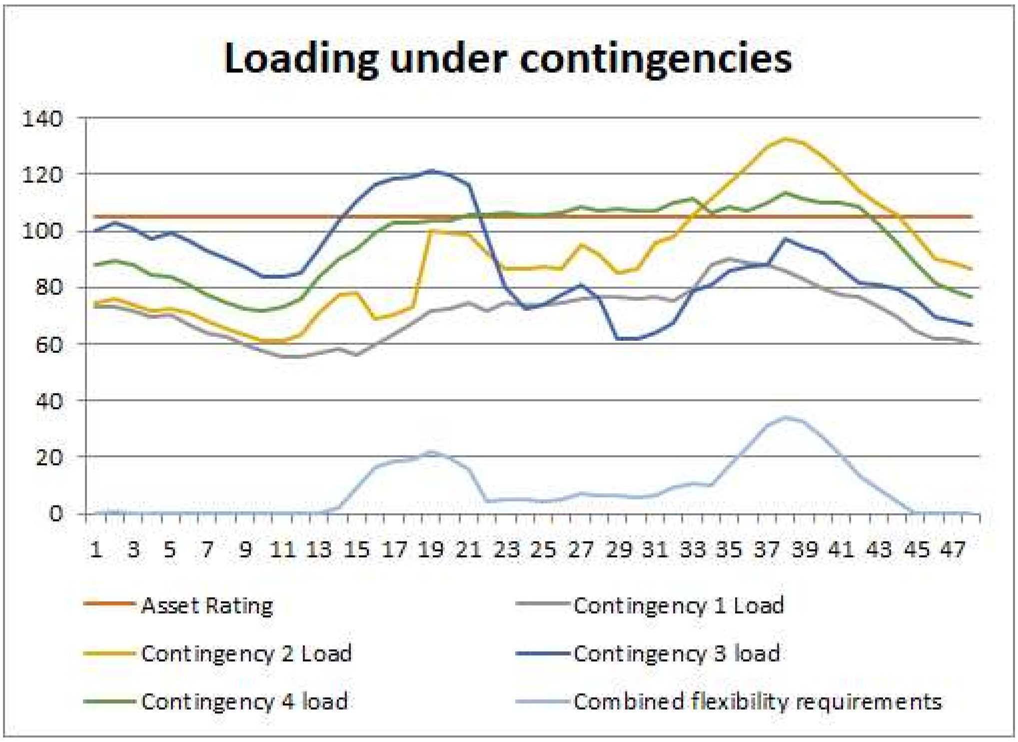
*If power flow analysis suggests constraints in an area of network managed by ANM/SVO then*
*Model ANM/SVO operation and alter load/generation forecast accordingly*
*Carry out power flow analysis with values modified for ANM/SVO*

*Determine locations where powerflow exceeds rating and record results where capacity is exceeded.*

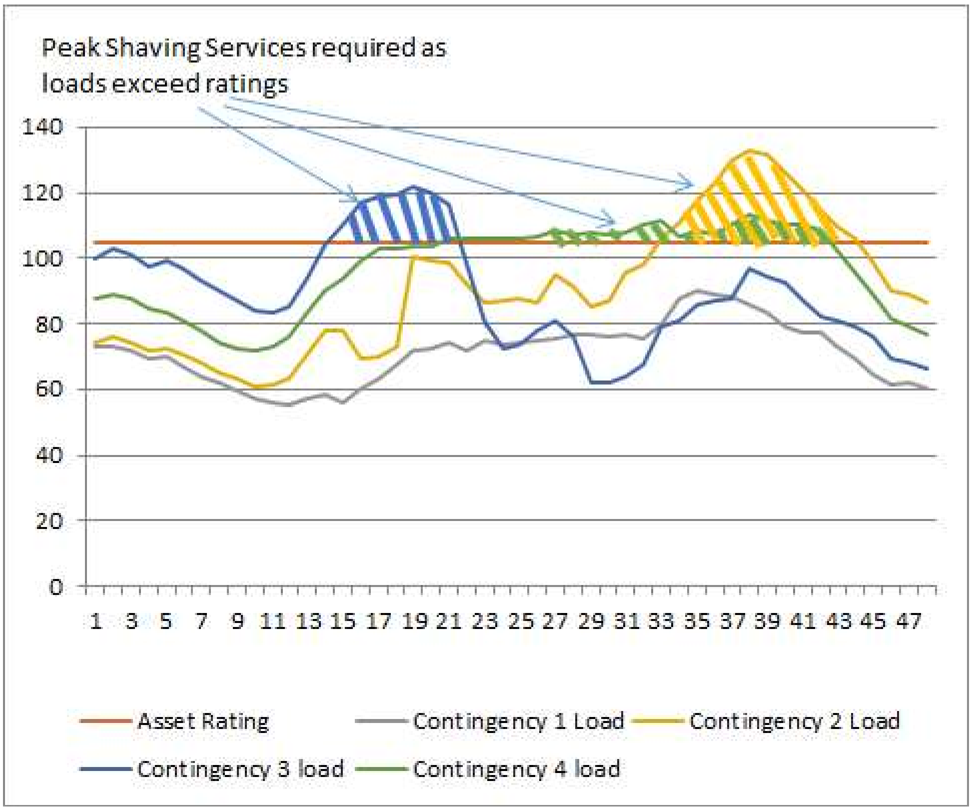
*Next half hour*

*Next contingency*

*Compile contingency results into composite view (below for details of an example)*




Therefore, the peak shaving requirements are as below.




Different contingencies reflect different network configurations, and this means that the flexibility service that is required to resolve issues under one contingency scenario might make the issues under a different contingency scenario worse.

Given the complexities and interactions between services there is a need to double check that the flexibility services that are procured/ armed/ dispatched are sufficient. As such the capacity calculation is re-run in the same fashion but containing the proposed flexibility services.

### 6.3.1 Pre-requisites / Scope

| In scope | Out of scope |
|---|---|
| • Calculate whether predicted load/ generation exceeds ratings for each transformer or circuit set up in the system;<br>• For each Half Hourly period where the demand exceeds the rating a "Peak Shaving Service" record will be written to the database. | |

### 6.3.1 Description

The output from the Forecasting module will be taken in conjunction with the network configuration and used to identify periods where flexibility is required to manage the network.

The output of the capacity engine will be the creation of a number of "Peak Shaving" services in the database.

The table overleaf contains the sources of various data to be used in the capacity calculation for different time horizons.

| | 6 Months Ahead | 3 Months Ahead | Month Ahead | Week Ahead | Day Ahead | Within Day | Now |
|---|---|---|---|---|---|---|---|
| Base Network Model (South West 132kV and 33kV)[1] | PSSE committed | PSSE committed | PSSE as built | PSSE as built | PSSE as built | PSSE as built | N/A |
| Adjustments to Base Network Model | None | None | Switched to reflect known planned outages | Switched to reflect known planned outages | Switched to reflect known planned outages | Adjusted to reflect current network configuration | Adjusted to reflect current network configuration |

[1] The long-term strategy is to generate the PSSE as built model from the Integrated Network Model.

| | 6 Months Ahead | 3 Months Ahead | Month Ahead | Week Ahead | Day Ahead | Within Day | Now |
|---|---|---|---|---|---|---|---|
| Existing outage model adjustments | N/A | N/A | Power On | Power On | Power On | Power On | N/A |
| Planned outage model adjustments | N/A | N/A | Power On | Power On | Power On | Power On | N/A |
| Assumed business context | High level procure ment check | Procurement check | Procurement check | Determine arming volumes | Dispatch | Dispatch | Dispatch |

### 6.3.2 Assumptions

| Ref | Description |
|---|---|
| 6.3.3.1 | EFFS will hold a fixed (e.g. nameplate) and variable (e.g. seasonal) capacity for each transformer in the network area being modelled. |
| 6.3.3.2 | There are natural boundaries within the network that can be modelled. |
| 6.3.3.3 | The Capacity Engine will be triggered on a scheduled basis or manually via the Networkflow user interface. |
| 6.3.3.4 | If network reconfiguration results in a flexibility asset no longer being associated with a substation, then this needs to trigger an update to the system; this could be manual via control room or via Update Equipment Interface. |
| 6.3.3.5 | If network reconfiguration (or other mechanism) manages a peak, then this just marks the peak as being “managed externally”. The demand forecast remains the same unless the user makes the decision to manually re-run the forecast. |
| 6.3.3.6 | Nothing is passed to and resolved by active network management from EFFS at this stage. |
| 6.3.3.7 | There is no need to factor network reinforcement into the EFFS logic, assumed this has already taken place. |
| 6.3.3.8 | Power flow analysis is carried out within the PSSE system. |

| | |
|---|---|
| 6.3.3.9 | Thermal constraints only will be considered (i.e. no voltage constraints). |
| 6.3.3.10 | To determine when outages will be reflected in Power On and therefore can be used in power flow analysis there is a dependency on the outage planning operational process timelines being confirmed, consistent and adhered to. |
| 6.3.3.11 | It is assumed that the output from the PSSE power flow analysis to be used in the capacity calculation will be 2 HH profiles (load and generation) plus the related asset rating and sensitivity factor. It will also contain a flag indicating what contingency scenario the profile relates to that the system can derive which service to resolve it with and a probability rating of the scenario occurring. |

### 6.3.3 Dependencies

| Ref | Description | Impact if not met |
|---|---|---|
| 6.3.4.1 | Assets will have a Fixed Rating, such as a nameplate rating, which we should just hold as a "for info" value but will also have a calculated "seasonal rating" which EFFS will use in the capacity engine calculation. This will need to be calculated and provided to EFFS. EFFS will also need to map calendar dates to the seasons used in seasonal ratings. These will be user configurable to ensure that each DSO can specify their own seasonal pattern (WPD seasonal definitions are unique to WPD).<br><br>Cyclical ratings, where the load profile has a regular pattern that includes a significant period where the asset is lightly loaded and can cool down, allowing higher ratings at peak times compared with steady state ratings, will also be supported in EFFS. However, it is important to clarify that EFFS will simply support switching between different ratings values that are supplied to it and will not be responsible for calculating ratings.<br><br>Real-time ratings, where the exact load pattern for the preceding half-hours alongside detailed information for how an asset dissipates heat, weather data etc. will not be implemented within EFFS, however the system design should allow for these ratings to be used in the future. | Power flow analysis in PSSE cannot be carried out therefore the output of the EFFS capacity calculation will not be accurate. |
| 6.3.4.2 | Asset ratings need to be available in a consistent and defined format for inclusion in power flow | Power flow analysis in PSSE cannot be carried out therefore the output |

| | | |
|---|---|---|
| | analysis and capacity calculations. This will be held in PSSE and provided to Networkflow. | of the EFFS capacity calculation will not be accurate. |
| 6.3.4.3 | A mechanism for the translation of forecasts into load / generation values to use in load flow analysis need to be available. | Power flow analysis in PSSE cannot be carried out therefore the output of the EFFS capacity calculation will not be accurate. |
| 6.3.4.5 | Flexibility procured prior to EFFS timescales from long term network planning needs to be available in a consistent and defined format. | Power flow analysis in PSSE cannot be carried out therefore the output of the EFFS capacity calculation will not be accurate. |
| 6.3.4.6 | The network model needs to be available in PSSE in a consistent and defined format. | Power flow analysis in PSSE cannot be carried out therefore the output of the EFFS capacity calculation will not be accurate. |
| 6.3.4.7 | Up to date network state information (e.g. outages and switch positions) needs to be available from Power On in a consistent and defined format. For planned outages it is assumed this can be requested and extracted from the schedule Oracle DB in Power On for a pre-defined set of switches. | Power flow analysis in PSSE cannot be carried out therefore the output of the EFFS capacity calculation will not be accurate. |
| 6.3.4.8 | For power flow analysis to be carried out in PSSE, an as-built switch level model of the network needs to be available. A committed switch level model of the network is available in the South West so there is a dependency on this being converted into an as built model within the timelines of the project. | Power flow analysis in PSSE cannot be carried out therefore the output of the EFFS capacity calculation will not be accurate. |
| 6.3.4.9 | Power flow analysis functionality within PSSE is required in order to feed into the Networkflow capacity calculation. The output from PSSE needs to be available in a consistent and defined format. | Power flow analysis in PSSE cannot be carried out therefore the output of the EFFS capacity calculation will not be accurate. |
| 6.3.5.10 | Modelling of ESO assets where this impacts on power flows on the DSO network needs to be present in PSSE. | Power flow analysis in PSSE cannot be carried out therefore the output |

| | | |
|---|---|---|
| | | of the EFFS capacity calculation will not be accurate. |

### 6.3.4 Requirements

| Ref | Requirement | Business process step |
|---|---|---|
| 6.3.5.1 | PSSE will modify the forecasting outputs to include all flexibility procured prior to EFFS timescales. | 7, 8, 60, 61, 103, 104 |
| 6.3.5.2 | The system will allow a user to determine whether the event in question is within outage planning business process timescales. If so Power On will provide a view of current and planned outages to PSSE for use in power flow analysis. | 9, 11, 62, 63, 105, 106 |
| 6.3.5.3 | The BAU network model will be held in PSSE and used in power flow analysis. | 10, 64, 107 |
| 6.3.5.4 | Asset ratings will be held by PSSE and are seasonal and so will be reflected according to the calendar mapping. This will support mapping by month or week to season. | 12, 65, 108 |
| 6.3.5.5 | PSSE will carry out a power flow analysis. This will include identifying all relevant contingency scenarios. As per current WPD policy this will be every combination of the following for the relevant part of the network to define the next credible fault:<br>• Each circuit fault<br>• Each busbar fault | 12, 65, 108 |
| 6.3.5.6 | PSSE will replicate the activity of any ANM / SVO activity in the area and include that in the output of the power flow analysis. | 13, 66, 109 |
| 6.3.5.7 | The system will use the output of the power flow analysis in PSSE to carry out the capacity calculation. The calculation will be load minus generation and will be carried out for each contingency scenario provided by the PSSE power flow analysis. This will identify any peaks (i.e. where net load is higher than rating). This will also include an assessment of reverse power flow capacities which are lower for transformers than their capacity for power flow in the intended direction.<br><br>For circuits that include segments with different ratings then most heavily loaded segment, i.e. with the highest | 14, 67, 110 |

| | | |
|---|---|---|
| | value of utilisation, will be used for the capacity assessment. | |
| 6.3.5.8 | Asset ratings for use in the capacity calculation will be provided by PSSE. | 14, 67, 110 |
| 6.3.5.9 | The system will contain a number of default asset ratings per asset type for when this data is not available from PSSE. | 14, 67, 110 |
| 6.3.5.10 | The system will allow a safety margin (i.e. whether a constraint is identified at 100 percent of capacity, 95 percent, 90 percent etc.) to be a configurable parameter.<br><br>Note: the default value is 97 percent. | 14, 67, 110 |
| 6.3.5.11 | The system will use the full set of time series data generated from forecasting to carry out capacity calculations (rather than selecting cardinal points, i.e. selecting a representative subset of half hours to carry out capacity calculations upon).<br><br>In terms of the selection of days to carry out capacity calculations for, while we have referred to analysis as being month ahead, week ahead etc it is likely that the analysis taking place would relate to a selection of days e.g. all the days associated with a particular outage, so that all the flexibility requirements for that outage could be purchased at the same time. | 14, 67, 110 |
| 6.3.5.12 | The system will take all of the individual exceedances identified by the capacity calculation and collate them to provide a composite view of all of the largest exceedances. These are the flexibility requirements and addressing the largest exceedance will address all the other exceedances. | 15, 68, 111 |
| 6.3.5.13 | The proposed service calendar that is an output on optimisation will be run through PSSE in conjunction with the original power flow analysis that identified the constraints in order to validate that the proposed flexibility services will resolve the constraints.<br><br>As part of this output a sensitivity factor will be provided per service. This is a co-efficient that reflects for each service how much impact it will have on the constraint under analysis. This can be used to inform used validation of the resolution of a constraint. | 35, 79, 121 |

## 6.4 Service management

The term service management is used to mean the definition of service types and the maintenance of a register of services instances and associated data.

As the exact workings of flexibility platforms are still to be confirmed, the service definitions published by the ENA ON will be the only service types to be supported by EFFS. This also aligns to the services supported by WPD's Flexible Power platform.

Due to the lack of clarity on the details of the other platforms EFFS needs to interact with the assumption has been made that these platforms will be interoperable in terms of the services they support (namely at least the four defined by the ENA ON although they may support additional services).

### 6.4.1 Pre-requisites / Scope

| In scope | Out of scope |
| --- | --- |
| • Automatic Creation of "Peak Shaving" services from Capacity Engine process;<br>• Manual Creation of services via the UI<br>• Interface for the automatic creation of delivery services from 3rd parties;<br>• The following service types (which are a sub-set of Market Services) to be supported as per ENA workstream 1 product 2;<br>  ○ Scheduled constraint management;<br>  ○ Pre-fault constraint management<br>  ○ Post-fault constraint management;<br>  ○ Restoration support.<br>Note: These are described in detail in section 6.4.2. | • Definition and creation of new service types. |

### 6.4.2 Description

Services are constructed by first defining the various service types, and service parameters to be associated to those types. These will be preconfigured within the solution reflecting asset holder and DSO requirements. The ability to modify and add new service types and parameters will also be included within the administration function of the service repository. Once these service types and parameters have been defined it is possible to associate defined parameters to various service types allowing for a highly flexible and future proof solution.

Below are the definitions of the initial services types to be supported in accordance with the ENA ON workstream 1 product 2, 'DSO Service Requirements: Definitions':

"***Scheduled Constraint Management*** *- The DSO procures, ahead of time, a pre-agreed change in input or output over a defined time period to prevent a network going beyond its firm capacity (thereby ensuring all load remains secure following the next fault). For example, a reduction in demand is procured over an evening peak period to mitigate risk of overload that might result should a fault occur on one of two in-feeds to a group*[2].

***Pre-fault Constraint Management*** *– The DSO procures, ahead of time, the ability to access a pre-agreed change in Service Provider output based on network conditions close to real-time. Utilisation is then delivered by different mechanisms, depending on whether the DSO wishes to manage network risk manually, or automatically: a. Utilisation may be instructed manually, ahead of real-time, to prevent a network going beyond its firm capacity. This will generally be a manual call based on circuit loading forecasts. For example, a Service Provider is contracted to be available to the DNO over winter evening peaks. The DNO then calls the Service Provider on days forecast to have the worst predicted loadings; or b. Utilisation may be initiated through an automated DSO system. For example, a Service Provider is contracted to be available to the DSO over winter evening peaks. The DSO system then triggers the service when the loading reaches the firm capacity.*

***Post-fault Constraint Management*** *– The DSO procures, ahead of time, the ability of a Service Provider to deliver an agreed change in output following a network fault. Utilisation is then instructed when the fault occurs on the network (but only if loading is beyond the post-fault rating of the remaining assets). This will generally be instructed through an automated system and will utilise the short-term ratings of the assets, such that a sustainable post-fault flow can be achieved. For example, a Service Provider is contracted to be available to the DSO over winter evening peaks. The DSO system instructs the Service Provider to deliver the contracted change in output when the fault occurs.*

***Restoration Support*** *– Following a loss of supply, the DSO instructs a provider to either remain off supply, or to reconnect with lower demand, to support increased and faster load restoration under depleted network conditions. For example, a Service Provider may be restored at minimal load to allow for other (perhaps less flexible) customers to be restored."*

The below summarises these service characteristics:

| Service Characteristics | Scheduled Constraint Management | Pre-fault Constraint Management | Post-fault Constraint Management | Restoration Support |
|---|---|---|---|---|
| **When to act** | Pre-fault | Pre-fault | Post-fault | Post-fault |
| **Triggering action** | Time | DSO forecast; or Asset Loading | Network fault | Network fault |

[2]This service is characterised by operating on a scheduled manner and is therefore simpler to manage and does not require sophisticated forecasting to support decision-making.

| | | | | |
|---|---|---|---|---|
| **Certainty of utilisation** | Very certain | Uncertain | Uncertain | Very uncertain |
| **Efficiency of utilisation** | Low | Medium | High | Low |
| **Risk to network assets** | Low | Medium | High | Low |
| **Frequency of use** | High | Medium | Low | Low |

### 6.4.3 Assumptions

| Ref | Description |
|---|---|
| 6.4.3.1 | Only scheduled constraint management, pre-fault constraint management, post-fault constraint management and restoration support services will be delivered i.e. no National Grid ESO ancillary market services or reactive power services. |
| 6.4.3.2 | That the spot markets within CLEM can be supported by the service types defined by the ENA workstream 1 product 2. |
| 6.4.3.3 | All flexibility platforms that EFFS will interface with will be interoperable in terms of the services provided. |

### 6.4.4 Dependencies

| Ref | Description | Impact if not met |
|---|---|---|
| N/A | None captured | N/A |

### 6.4.5 Requirements

| Ref | Requirement | Business process step |
|---|---|---|
| 6.4.5.1 | The system will take the output of the capacity calculation and transform it into flexibility requirements (i.e. a series of HH values and an associated power (MW) /energy requirement (MWh).<br><br>Note: we would use both terms in specifying requirements, but we need to be clear that we are looking for a change relative to baseline of 3MW for 2 hours rather than just a delivery of 6MWh over the 2-hour period delivered as the provider sees fit. | 16, 69, 112 |
| 6.4.5.2 | The system will have a configurable manual approval process for the validation of service requirements (i.e. | 17, 18, 19, 21, 70, 71, 72, 113, 114, 116 |

| Ref | Requirement | Business process step |
|---|---|---|
| | if not switched on then the process for procurement, arming and dispatch will be automated). This will be configurable per process (i.e. any combination of procurement, arming and dispatch could have this approval step in place or not.<br><br>The associated timeout deadlines for manual approval will be configurable and when exceeded will raise an exception. | |
| 6.4.5.3 | The system will allow exceedances to be marked as 'handled' by a user in which case the status will be updated accordingly, and no further action is required. | 20, 73, 115 |
| 6.4.5.4 | The system will capture a default procurement payment (£/kW or £/kWh) applicable as a service parameter against a service type.<br><br>Note: this is equivalent to the reservation fee used by the ESO for certain services, and it not envisaged that any services to be supported by EFFS will have this. | 21 |
| 6.4.5.5 | The system will capture a default arming payment (£/kWh) applicable as a service parameter against a service type. | 21 |
| 6.4.5.6 | The system will capture a default utilisation payment (£/kWh) applicable as a service parameter against a service type. | 21 |
| 6.4.5.7 | The system will capture whether bids for less than the full contiguous required period of flexibility services are permissible as a service parameter against a service type.<br><br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |
| 6.4.5.8 | The system will capture whether bids for less than or more than the energy offered in each HH period within the full contiguous required period of flexibility services are permissible as a service parameter against a service type.<br><br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |

| Ref | Requirement | Business process step |
|---|---|---|
| 6.4.5.9 | The system will capture whether non-contiguous bids are permissible as a service parameter against a service type.<br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |
| 6.4.5.10 | The system will capture whether the DSO can accept part of what the provider is offering either by cherry picking only some of the half hours and/or only accepting some of the capacity being provided as a service parameter against a service type.<br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |
| 6.4.5.12 | The system will capture minimum bid size as a service parameter against a service type. The initial default values to be set up are:<br>Scheduled Constraint Management = 100kW<br>Pre-Fault Constraint Management = 100kW<br>Post-Fault Constraint Management = 100kW<br>Restoration Support = 100kW<br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |
| 6.4.5.13 | The system will capture maximum bid size as a service parameter against a service type. The initial default values to be set up are:<br>Scheduled Constraint Management = no maximum<br>Pre-Fault Constraint Management = no maximum<br>Post-Fault Constraint Management = no maximum<br>Restoration Support = no maximum<br>All service instances of the relevant type will be validated against this criterion.<br><br>Note: this has been included for completeness as it is part of the ENA ON definition of services, however it is not envisaged it will have a practical impact on EFFS as there is an implicit limit in the offer. | N/A not related to a specific process step |

| Ref | Requirement | Business process step |
|---|---|---|
| 6.4.5.14 | The system will capture minimum bid duration as a service parameter against a service type. The initial default values to be set up are:<br>Scheduled Constraint Management = 30 minutes<br>Pre-Fault Constraint Management = 30 minutes<br>Post-Fault Constraint Management = 30 minutes<br>Restoration Support = 3 hours<br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |
| 6.4.5.15 | The system will capture maximum bid duration as a service parameter against a service type. The initial default values to be set up are:<br>Scheduled Constraint Management = no maximum<br>Pre-Fault Constraint Management = no maximum<br>Post-Fault Constraint Management = no maximum<br>Restoration Support = no maximum<br>All service instances of the relevant type will be validated against this criterion.<br>Note: this has been included for completeness as it is part of the ENA ON definition of services, however it is not envisaged it will have a practical impact on EFFS as there is an implicit limit in the offer. | N/A not related to a specific process step |
| 6.4.5.16 | The system will capture minimum procurement response lead time (time granted to the market parties to bid prior to the event) as a service parameter against a service type. This can be configured as a static period (e.g. the end of the calendar month or a certain day of the week) or a rolling period (e.g. four weeks from today).<br>The initial values to be set up are still to be determined but the indicative timescales are months ahead of the event.<br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |
| 6.4.5.17 | The system will capture minimum arming response lead time (time granted to the market parties to respond to arming requests prior to the event) as a service parameter against a service type. This can be configured as a static period (e.g. the end of the calendar month or | N/A not related to a specific process step |

| Ref | Requirement | Business process step |
|---|---|---|
| | a certain day of the week) or a rolling period (e.g. four weeks from today).<br>The initial values to be set up are still to be determined, but the indicative timescales are months ahead of the event.<br>All service instances of the relevant type will be validated against this criterion. | |
| 6.4.5.18 | The system will capture minimum dispatch response lead time (time granted to the market parties to respond to dispatch requests prior to the event) as a service parameter against a service type. This can be configured as a static period (e.g. the end of the calendar month or a certain day of the week) or a rolling period (e.g. four weeks from today).<br>The initial values to be set up are still to be determined, the below are indicative timescales.<br>Scheduled Constraint Management = months ahead<br>Pre-Fault Constraint Management = closer to real time (depends on driver) - e.g. day-ahead; week-ahead<br>Post-Fault Constraint Management = real time (postfault; time to be determined)<br>Restoration Support = real time (postfault; time to be determined)<br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |
| 6.4.5.19 | The system will capture maximum ramping period as a service parameter against a service type.<br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |
| 6.4.5.20 | The system will capture minimum full activation period (i.e. the minimum continuous block of HH services an asset must provide) as a service parameter against a service type.<br>The initial values to be set up are:<br>Scheduled Constraint Management = 2 hours<br>Pre-Fault Constraint Management = 30 minutes<br>Post-Fault Constraint Management = 30 minutes<br>Restoration Support = 3 hours | N/A not related to a specific process step |

| Ref | Requirement | Business process step |
|---|---|---|
| | All service instances of the relevant type will be validated against this criterion. | |
| 6.4.5.21 | The system will capture mode of activation as a service parameter against a service type<br>The initial values to be set up are:<br>Scheduled Constraint Management = Scheduled<br>Pre-Fault Constraint Management = Manual or Automatic<br>Post-Fault Constraint Management = Automatic (triggered by signal from DSO<br>Restoration Support = Manual | N/A not related to a specific process step |
| 6.4.5.22 | The system will capture maximum number of activations (per day, per week, per year) as a service parameter. Activations is defined as a continuous block of HH services provided by an asset.<br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |
| 6.4.5.23 | The system will capture minimum number of flexibility services to fulfil energy requirement per HH as a service parameter against a service type. This allows the DSO to spread the risk of non-delivery by ensuring no single party has responsibility to deliver all the flexibility in a half hourly period. This parameter would be used by the optimisation process.<br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |
| 6.4.5.24 | The system will capture maximum number of flexibility services to fulfil energy requirement per HH as a service parameter against a service type. This would allow the optimisation process to limit the number of providers contributing towards the flexibility in a half hourly period. If this is not required, setting this to a high value will remove its impact on the optimisation process.<br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |
| 6.4.5.25 | The system will capture minimum percentage of energy in the HH sourced from 1 asset to fulfil energy requirement as a service parameter against a service type. This would allow the optimisation process to limit | N/A not related to a specific process step |

| Ref | Requirement | Business process step |
|---|---|---|
| | the number of providers contributing towards the flexibility in a half hourly period. A similar effect could be achieved by specifying larger values for the minimum bid size, so it may be that this field is not used in practice.<br>If this is not required, setting this to a low value will remove its impact on the optimisation process.<br>All service instances of the relevant type will be validated against this criterion. | |
| 6.4.5.26 | The system will capture maximum percentage of energy in the HH sourced from 1 asset to fulfil energy requirement as a service parameter against a service type.<br><br>This is another means by which the optimisation process can be driven to reduce the risk of non-delivery by providers by limiting the contribution of any provider. Setting this value to zero removes this aspect from the optimisation process.<br>All service instances of the relevant type will be validated against this criterion. | N/A not related to a specific process step |
| 6.4.5.27 | The system will capture reliability factor for an organisation. It is not yet clear whether the reliability factor will be calculated by flexibility platforms, which will have the best view of the overall performance of that provider/asset or whether this is updated by calculations based on services known to EFFS alone. | N/A not related to a specific process step |
| 6.4.5.28 | The system will capture reliability factor for an asset.<br>It is not yet clear whether the reliability factor will be calculated by flexibility platforms, which will have the best view of the overall performance of that provider/asset or whether this is updated by calculations based on services known to EFFS alone. | N/A not related to a specific process step |
| 6.4.5.29 | The system will capture reliability factor for a platform. This captures the risk of the platform failing to transfer a dispatch request to a service provider such as may occur if the platform is not available or the process to control an asset from the platform is not reliable. | N/A not related to a specific process step |
| 6.4.5.30 | The system will capture service type against each service instance. | N/A not related to a specific process step |

| Ref | Requirement | Business process step |
|---|---|---|
| 6.4.5.31 | The system will capture MPAN(s) against each service instance e.g. the MPANs associated with generators or load customers that can provide demand response. | N/A not related to a specific process step |
| 6.4.5.32 | The system will capture asset ID(s) against each service instance. It is assumed the form of this asset ID will be determined with Open Networks as part of WS1B as defined in the 2019 programme of work. | N/A not related to a specific process step |
| 6.4.5.33 | The system will capture network location against each service instance, i.e. the point at which the asset is connected to the network. | N/A not related to a specific process step |
| 6.4.5.34 | The system will capture service status against each service instance (e.g. awaiting procurement response, procured, awaiting dispatch). | N/A not related to a specific process step |
| 6.4.5.35 | The system will capture availability windows (i.e. the actual list of HH values the service is available) against each service instance. | N/A not related to a specific process step |
| 6.4.5.35 | The system will capture the power / energy requirements against each service instance. | N/A not related to a specific process step |
| 6.4.5.36 | The system will capture the power / energy available against each service instance. | N/A not related to a specific process step |
| 6.4.5.37 | The system will capture the actual market procurement payment (£/kW) against each service instance.<br>Note: this is equivalent to the reservation fee used by the ESO for certain services, and it not envisaged that any services to be supported by EFFS will have this. | N/A not related to a specific process step |
| 6.4.5.38 | The system will capture the actual market arming payment (£/kWh) against each service instance. | N/A not related to a specific process step |
| 6.4.5.39 | The system will capture the actual market utilisation payment (£/kWh) against each service instance. | N/A not related to a specific process step |

## 6.5 Optimise

EFFS uses optimisation when:

1. Selecting bids for a flexibility service when this is oversubscribed;
2. Selecting which services to arm when there are more services available for arming than required;

3. Selecting which services to dispatch where there are more services armed than required.

As part of the definition of optimisation one of the key considerations was the complexity and number of variants that could be generated. Previous optimisation exercises have quickly become too complex to solve in anything like a timely fashion. Therefore, the optimisation criteria captured are configurable parameters that can be adjusted dependent on factors such as performance and volumes / complexity of bids.

Commercial optimisation / getting value across multiple flexibility platforms whilst ensuring the service requirements are fulfilled is the key focus of optimisation of EFFS. However, to reflect the dispatch principles defined for WPD’s Flexible Power, the following considerations have also been fed into the optimisation criteria:

- Fairness;
- Minimising the risk from non-delivery of service.

Fairness in this context means that where other selection criteria result in two or more service providers achieving very similar rankings, then the previous history of payments to the service providers would be used as a tie-breaker with the service selected being that which had received the least payment within a recent user-definable period. The rationale for this approach is that we do not yet have a mature market for flexibility services and spreading the payments between the available providers is more likely to maintain their participation in flexibility markets than if payments are focussed to fewer providers.

Previous innovation projects that have involved flexibility services have shown that 100% service delivery from all participants is unlikely. This risk can be managed by including a safety margin in the amount of services that are procured, armed or dispatched but it is also possible to reflect risk management approaches in the optimisation process, such as ensuring that service delivery does not rely on a single provider.

Optimal load flow analysis in tools such as PSSE, PowerFactory and Ipsa 2 were explored as a possible avenue to optimise the selection of services.  Powerfactory, for example includes a commercial optimisation function where the cost of altering load or generation at each node of the network can be combined with power flow analysis to determine the optimum power flow where loads/generation are within capacity limits. However, that approach was not thought suitable due to the inability to consider additional criteria such as fairness. This may be an avenue for other organisations to explore if they have different polices and priorities for commercial optimisation.

Given the complexity of the process to perform capacity calculations and generate network flexibility requirements, and also the complexity of the optimisation process then there is also a risk that combining the processes together may result in a problem that is not tractable or requires excessive processing resources or time.

#### 6.5.1 Pre-requisites / Scope

| In scope | Out of scope |
|---|---|
| • Commercial optimisation that will assess all requirements for flexibility and provide an optimised solution;<br>• Output will be flexibility service calendar. | • Changes to scheduling method;<br>• Changes to optimisation method and algorithm definition;<br>• Changes to data sources for optimisation other than those specified;<br>• Network optimisation. |

#### 6.5.2 Description

The optimisation module will assess possible selections of flexibility services available via flexibility platforms to meet the requirements for services within a given time window and geographical boundary.

The optimisation algorithm will take pricing information as an input.

The output of the optimisation process will be a set of recommended selections of services which are then used to populate the flexibility service calendar. It should be possible to either make this an automatic process or optionally include the generation of variants which can then be accepted or rejected by the EFFS user, i.e. it would be possible to present different selections of services that reflected different emphasis in the optimisation criteria (lowest cost, lowest risk etc.).

The notifications of bid selection, arming, dispatch required to achieve this service calendar will be issued via the market interaction layer. The execution of the service is then expected to be controlled by the individual participants / aggregators. Responsibility for monitoring service delivery and responding to notifications of bid selection, arming and dispatch is most likely to reside with the flexibility platform via which the service has been procured, however it is too early to rule out this responsibility residing with the service provider themselves.

#### 6.5.3 Assumptions

| Ref | Description |
|---|---|
| 6.5.3.1 | Optimisation will be based on lowest score which will be a combination of cost and a number of weighting factors. |
| 6.5.3.2 | Optimisation will schedule based on 30-minute windows but will optimise over a sequence of 30-minute windows that defines a service rather than optimising each 30-minute period separately. |
| 6.5.3.3 | Optimisation will be triggered on a scheduled basis or manually via the Networkflow user interface. |

| | |
|---|---|
| 6.5.3.4 | Non-flexibility solutions (e.g. network reconfiguration, STATCOM, capacitor bank) are not considered at this stage having already being explored external to EFFS within other WPD processes. |
| 6.5.3.5 | In terms of the ENA future worlds EFFS assumes World B, therefore the DSO is responsible for the procurement and dispatch of distribution network connected flexibility (and **not** responsible for the procurement and dispatch of distribution network connected flexibility on behalf of the ESO). |
| 6.5.3.6 | For the trials EFFS will be exempt from Utilities Contracts Regulations 2016 (UCR) and therefore does not need to take the associated lead times into consideration.<br>See section Appendix 4: EU Procurement Assessment for details. |
| 6.5.3.7 | The best solution returned by the optimisation engine will be acceptable. |
| 6.5.3.8 | The safety margin percentage will typically decrease as the process nears the service delivery date as the forecasting is assumed to become more accurate (i.e. the percentage of flexibility that you over procure will be higher than the percentage over armed, which will itself be higher than the percentage over dispatched. Where this is not the case more flexibility services would need to be procured. |
| 6.5.3.9 | The optimisation problem can be solved with proportionate computational resources and that the benefit of optimising the selection of services warrants the cost of resources used to carry out the optimisation function. If this is not the case then a deadline to find an acceptable solution will be implemented. |
| 6.5.3.10 | That the platforms operate with compatible timescales, that services offered by the same asset on different platforms can be de-duplicated, and that the complexity involved does not make this form of optimisation too slow or uneconomic to use. |
| 6.5.3.11 | Bid prices as used in optimisation are not subject to change (i.e. a quote and tender mechanism is in place rather than a spot market). |
| 6.5.3.12 | Any ANM / SVO connected customers will not be treated preferentially through virtue of being ANM / SVO connected (i.e. this will not be a factor considered in the EFFS optimisation). |

### 6.5.4 Dependencies

| Ref | Description | Impact if not met |
|---|---|---|
| N/A | None captured | N/A |

### 6.5.5 Requirements

There are three optimisation processes that relate to the different stages of the EFFS flexibility service life cycle: procurement, arming and dispatch. The relevance of the requirements below to each stage is shown in the columns titled Procurement, Arming and Dispatch.

| Ref | Requirement | Procurement | Arming | Dispatch | Business process step |
|---|---|---|---|---|---|
| 6.5.5.1 | The system will use the following as a pre-selection criterion for optimisation (i.e. any bid that does not meet this criterion will not be included in the optimisation process):<br>• minimum procurement response lead time (time granted to the market parties to bid prior to the event (mins)<br>Note: this is to filter out unsolicited bids that do not adhere to the procurement timescale. | Y | Y | Y | 33, 77, 119 |
| 6.5.5.2 | The system will use the following as a pre-selection criterion for optimisation (i.e. any bid that does not meet this criterion will not be included in the optimisation process):<br>• minimum arming response lead time (time granted to the market parties to arm prior to the event (mins / days) | Y | Y | Y | 33, 77, 119 |
| 6.5.5.3 | The system will use the following as a pre-selection criterion for optimisation (i.e. any bid that does not meet this criterion will not be included in the optimisation process):<br>• minimum dispatch response lead time (time granted to the market | Y | Y | Y | 33, 77, 119 |

| Ref | Requirement | Procurement | Arming | Dispatch | Business process step |
|---|---|---|---|---|---|
| | parties to after dispatch notification (mins) | | | | |
| 6.5.5.4 | The system will use the following as a pre-selection criterion for optimisation (i.e. any bid that does not meet this criterion will not be included in the optimisation process):<br>• Maximum ramping period | Y | Y | Y | 33, 77, 119 |
| 6.5.5.5 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• procurement payment (£/kW) | Y | N | N | 33, 77, 119 |
| 6.5.5.6 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• arming payment (£/kWh) | Y | Y | N | 33, 77, 119 |
| 6.5.5.7 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• utilisation payment (£/kWh) | Y | Y | Y | 33, 77, 119 |
| 6.5.5.8 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• minimum bid size (kW) | Y | Y | Y | 33, 77, 119 |
| 6.5.5.9 | The system will take the following parameter / constraint into account as part of the procurement optimisation process:<br>• maximum bid size (kW) | Y | Y | Y | 33, 77, 119 |

| Ref | Requirement | Procurement | Arming | Dispatch | Business process step |
|---|---|---|---|---|---|
| 6.5.5.10 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• minimum bid duration (mins) | Y | Y | Y | 33, 77, 119 |
| 6.5.5.11 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• maximum bid duration (mins) | Y | Y | Y | 33, 77, 119 |
| 6.5.5.12 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• minimum full activation period (i.e. the minimum continuous block of HH services an asset must provide) | Y | Y | Y | 33, 77, 119 |
| 6.5.5.13 | The system will take the following parameter / constraint into account as part of the procurement optimisation process:<br>• availability windows | Y | Y | Y | 33, 77, 119 |
| 6.5.5.14 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• maximum number of activations (per day, per week, per year)<br>Activations is defined as a continuous block of HH services provided by an asset. | Y | Y | Y | 33, 77, 119 |

| Ref | Requirement | Procurement | Arming | Dispatch | Business process step |
|---|---|---|---|---|---|
| 6.5.5.15 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• reliability factor for an organisation | Y | Y | Y | 33, 77, 119 |
| 6.5.5.16 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• reliability factor for an asset | Y | Y | Y | 33, 77, 119 |
| 6.5.5.17 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• reliability factor for a market | Y | Y | Y | 33, 77, 119 |
| 6.5.5.18 | Where the outcome of all optimisation criteria is equal (or within a narrow range) the system will choose the asset that was used less in total within the recent past. If this factor does not differentiate then the choice of asset will be random. | Y | Y | Y | 33, 77, 119 |
| 6.5.5.19 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• whether bids for less than the full contiguous required period of flexibility services are permissible<br>Note: the default values for this is 'Yes' (i.e. this will be allowed). | Y | Y | Y | 33, 77, 119 |

| Ref | Requirement | Procurement | Arming | Dispatch | Business process step |
|---|---|---|---|---|---|
| 6.5.5.20 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• whether bids for less than or more than the energy offered in each HH period within the full contiguous required period of flexibility services are permissible<br>Note: the default values for this is 'Yes' (i.e. this will be allowed). | Y | Y | Y | 33, 77, 119 |
| 6.5.5.21 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• whether non-contiguous bids are permissible<br>Note: the default values for this is 'No' (i.e. this will not be allowed). | Y | Y | Y | 33, 77, 119 |
| 6.5.5.22 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• whether the DSO can accept part of what the provider is offering either by cherry picking only some of the half hours and/or only accepting some of the capacity being provided<br>Note: the default values for this is 'No' (i.e. this will not be allowed). | Y | Y | Y | 33, 77, 119 |
| 6.5.5.23 | The system will allow the percentage of over procurement / arming / | Y | Y | Y | 33, 77, 119 |

| Ref | Requirement | Procurement | Arming | Dispatch | Business process step |
|---|---|---|---|---|---|
| | dispatch per peak shaving event to be configurable. | | | | |
| 6.5.5.24 | The system will allow the percentage of over procurement / arming / dispatch per flexibility platform to be configurable.<br><br>Note: this is to manage non-delivery for a whole platform, so to mitigate the risk of platform X not delivering the expected flexibility services you would increase the over procurement / arming dispatch for platform Y accordingly. This would also decrease as the number of flexibility platforms used increases as a single platform's failure has less impact. | Y | Y | Y | 33, 77, 119 |
| 6.5.5.25 | The system will allow the percentage split of procurement / arming / dispatch between different flexibility platforms (CLEM, Flexible Power and EDF) to be configurable. The percentage is to be considered per peak shaving event. | Y | Y | Y | 33, 77, 119 |
| 6.5.5.26 | The system will consider tentative flexibility that has been procured by framework agreement as well as flexibility services where there is no framework agreement in place. | Y | Y | Y | 33, 77, 119 |
| 6.5.5.27 | The system will auto accept all bids where no cost is incurred. | Y | Y | N | 31, 74 |
| 6.5.5.28 | The system will carry out optimisation across multiple | Y | Y | Y | 33, 77, 119 |

| Ref | Requirement | Procurement | Arming | Dispatch | Business process step |
|---|---|---|---|---|---|
| | flexibility platforms rather than once per flexibility platform. | | | | |
| 6.5.5.29 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• minimum number of flexibility services to fulfil power / energy requirement per HH as a service parameter. | Y | Y | Y | 33, 77, 119 |
| 6.5.5.30 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• maximum number of flexibility services to fulfil power / energy requirement per HH as a service parameter. | Y | Y | Y | 33, 77, 119 |
| 6.5.5.31 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• minimum percentage of energy in the HH sourced from 1 asset to fulfil energy requirement as a service parameter. | Y | Y | Y | 33, 77, 119 |
| 6.5.5.32 | The system will take the following parameter / constraint into account as part of the optimisation process:<br>• maximum percentage of power / energy in the HH sourced from 1 asset to fulfil energy requirement as a service parameter. | Y | Y | Y | 33, 77, 119 |

## 6.6 Scheduling

The output of the optimisation process is a selection of bids to be accepted, services to be armed or services to be dispatched. Once these notifications are accepted, this updates the service register / calendar. While for the secure service, there will be time to optimise the assets for dispatch and to issue notifications in advance, the situation for dispatching post-fault services is less likely to include an optimisation step. Since post-fault services are highly dependent on the fault event that has occurred and how the network has been reconfigured after the fault has occurred (for example as a result of automatic switching) then it may be possible to automatically dispatch post-fault services where the contingency and network configuration match that used in the requirements analysis and the actual power flows on the network are within a certain tolerance of the forecast values. Otherwise the dispatch of flexibility services is likely to require human intervention.

The key decision in this area was whether a user would want to be able to view and dispatch flexibility within EFFS or in Power On. The latter was the consensus position reached in the associated workshop based on the thinking it would be inefficient for the control room users (who would actually be dispatching the post-fault services in near real time and then monitoring the network) to use two systems rather than Power On only. This does however lead to the additional complication of integration with Power On and plus inefficiency as the signal will then go via EFFS and the flexibility platform, which may not be performant.

Below is a representation of the dispatch mechanism for post fault services.


There have also been manual approval steps included for both the approval of the proposed and confirmed service calendar. This is unlikely to be scalable across the whole of WPDs network licence areas but for the limited trials within EFFS is a sensible control / validation step. Therefore, there manual validation steps are configurable.

### 6.6.1 Pre-requisites / Scope

| In scope | Out of scope |
|---|---|
| • Confirmation of scheduled services required (i.e. the outcome of the three optimisation types: procurement, arming and dispatch);<br>• Output of optimisation to schedule for third party market interfaces. | |

### 6.6.2 Description

Output of optimisation to schedule for third party market interfaces.

### 6.6.3 Assumptions

| Ref | Description |
|---|---|
| N/A | None captured |

### 6.6.4 Dependencies

| Ref | Description | Impact if not met |
|---|---|---|
| 6.6.4.1 | A consistent and defined interface to Power On to provide users with visibility of flexibility, procured, armed and dispatched in EFFS. | Control room users will need to view available flexibility across multiple systems reducing efficiency and usability. |

### 6.6.5 Requirements

| Ref | Requirement | Business process step |
|---|---|---|
| 6.6.5.1 | The system will convert the output of the optimisation processes (i.e. procurement, arming and dispatch optimisation) into a proposed service calendar. | 34, 78, 120 |
| 6.6.5.2 | The system will have a configurable manual approval process for the validation of the proposed service calendar (i.e. if not switched on then the process for procurement, arming and dispatch will be automated). This will be configurable per process (i.e. any combination of procurement, arming and dispatch could have this approval step in place or not) and per service type. | 34, 36, 37, 38, 78, 80, 81, 82, 120, 122, 123, 124 |
| 6.6.5.3 | The system will have a configurable, manual approval process for the validation of the confirmed service calendar (i.e. if not switched on then the process for procurement, arming and dispatch will be automated). This will be configurable per process (i.e. any combination of procurement, arming and dispatch could have this approval step in place or not. | 46, 83 |

| | | |
|---|---|---|
| 6.6.5.4 | The system will only allow the post – fault dispatch signals for triggering flexibility services to be sent from Power On via EFFS. Therefore, visibility of the flexibility services and current status needs to be passed to Power On from EFFS. As part of this data exchange average market prices per service type also will be made available.<br><br>Dispatch of scheduled or pre-fault services can be achieved within EFFS without the use of Power On. | 125, 126, 140, 141 |

## 6.7 Market interface

Standardised interfaces to flexibility platforms have yet to be defined at an industry level, therefore within EFFS the decision was made to define a default set of signals between EFFS and flexibility platforms that it is assumed that any flexibility platform integrating to EFFS will use this standard. i.e. there will be no requirement to develop customised interfaces for EFFS to interface with platforms. The signals and associated data items are derived from the four service types defined by the ENA ON and also the operational procurement, arming and dispatch processes defined in this document. It is possible that flexibility platforms will also be used to disseminate data exchanges that support conflict management where this is not already covered by the notifications relating to procurement, arming and dispatch.

### 6.7.1 Pre-requisites / Scope

| In scope | Out of scope |
|---|---|
| • Mechanism to issue requirements of flexibility to the market and for the market to respond;<br>• Interfaces with the following platforms/ participant portals are to be supported:<br>  ○ Flexible Power participant portal;<br>  ○ CLEM;<br>  ○ EDF Energy. | • Industry settlements (i.e. settlement agent role). |

### 6.7.2 Description

Once the requirement for flexibility has been identified, this will be issued to the market (e.g. generators, flexible load customers, aggregators) via an agreed mechanism.

The mechanism includes a series of request / responses so that participants can bid for periods of flexibility.

### 6.7.3 Assumptions

| Ref | Description |
|---|---|
| 6.7.3.1 | Dispatch of flexibility can all be managed via a market interface that connects with several flexibility platforms; therefore, no direct physical dispatch component is required. |
| 6.7.3.2 | EFFS does not need to support additional functions to identify and manage late delivery or under delivery of flexibility as it is assumed that service delivery will be validated by the flexibility platform providing the service. Financial penalties are included in the service terms and conditions and will also be factored into the reliability measures to be considered in optimisation (EFFS does need to take the risk of late / under delivery into account however). |
| 6.7.3.3 | System response times for a dispatch, additional dispatch or cancellations are all within a HH period. |
| 6.7.3.4 | The dispatch of flexibility will be managed by the associated platform (e.g. services procured via Flexible Power will be dispatched via the Flexible Power participant portal, services procured from CLEM will be dispatched via CLEM). |
| 6.7.3.5 | EFFS will deliver a standardised interface rather than a different interface per platform. |
| 6.7.3.6 | If a service is not progressed to the next stage by the appropriate signal to the market (e.g. moving from 'armed' to 'dispatch') then it will not change status and the flexibility service will not be triggered. |
| 6.7.3.7 | Flexibility platforms cannot swap service providers once a bid has been accepted. |

### 6.7.4 Dependencies

| Ref | Description | Impact if not met |
|---|---|---|
| 6.7.4.1 | There is a dependency on interfaces to the platforms EFFS is to interface with being defined. | EFFS will be unable to communicate with the CLEM, Flexible Power and EDF platforms in order to procure, arm and dispatch flexibility. |
| 6.7.4.2 | There is a dependency on CLEM, Flexible Power and EDF having sufficient customers involved to be able to leverage this for the EFFS trials phase. | EFFS will not be recruiting customers and therefore is reliant on existing flexibility providers. Limited numbers will impact the size and validity of the trials. |

| | | |
|---|---|---|
| 6.7.4.3 | There is a dependency on flexibility platforms including MPANs or another unique identifier used by all parties in their response messages in order for EFFS to spot duplication of bids across different flexibility platforms. | There is a potential for the same services to be purchased multiple times for the same period across different flexibility platforms. |
| 6.7.4.4 | There is a dependency on a consistent and defined interface with Power On in order to support a post-fault flexibility dispatch mechanism. | Control room users will need to trigger dispatch across multiple systems reducing efficiency and usability. |

### 6.7.5 Requirements

| Ref | Requirement | Business process step |
|---|---|---|
| 6.7.5.1 | The system will allow a user to view what flexibility has been procured and the associated dispatch status. | N/A not related to a specific process step |
| 6.7.5.2 | The system will support a 'Publish Requirements' signal from the DSO to the flexibility platforms. The deadline for this signal being issued to the flexibility platform will be configurable per flexibility platform. However, to support optimisation the responses from platforms will need to be synchronised. | 22 |
| 6.7.5.3 | The system will support a 'Procurement Response' signal from the flexibility platform to the DSO. This must contain a data item indicating whether the bid relates to single or multiple assets, and the associated MPANs or other unique and industry agreed identifier. | 23, 25, 26, 27, 28, 30 |
| 6.7.5.4 | The system will monitor for the receipt of a 'Procurement Response' signal from the flexibility platform to the DSO. When not received within a configurable deadline an exception will be raised. This configurable deadline may be different dependent on the flexibility platform. | 24 |
| 6.7.5.5 | The system will support an 'Available Flexibility' message from the flexibility platforms. This is an unsolicited list of the available flexibility rather than in response to a specific procurement request. | 29 |
| 6.7.5.6 | The system will support a 'Procurement Selection' signal from the DSO to the flexibility platform. The | 32, 39, 40, 41 |

| | | |
|---|---|---|
| | deadline for this signal being issued to the market will be configurable per flexibility platform. | |
| 6.7.5.7 | The system will support a 'Handshake' signal from the flexibility platform to the DSO to validate that interfaces are operating as expected. | 42, 44, 45 |
| 6.7.5.8 | The system will monitor for the receipt of a 'Handshake' signal from the flexibility platform to the DSO. When not received within a configurable deadline an exception will be raised. This configurable deadline may be different dependent on the flexibility platform. | 43 |
| 6.7.5.9 | The system will support an 'Arming Request' signal from the DSO to the flexibility platform. The deadline for this signal being issued to the market will be configurable per flexibility platform. | 75, 83 |
| 6.7.5.10 | The system will support an 'Arming Response' signal from the flexibility platform to the DSO. | 84, 86, 87, 88, 89, 90 |
| 6.7.5.11 | The system will monitor for the receipt of an 'Arming Response' signal from the flexibility platform to the DSO. When not received within a configurable deadline an exception will be raised. This configurable deadline may be different dependent on the flexibility platform. | 85 |
| 6.7.5.12 | The system will support a 'Dispatch Request' signal from Power On to EFFS. | 127 |
| 6.7.5.13 | The system will support a 'Dispatch Request' signal from the DSO (from EFFS) to the flexibility platform.<br>This will be a closed instruction with a defined start time and a defined end time.<br>The deadline for this signal being issued to the market will be configurable per flexibility platform. | 128 |
| 6.7.5.14 | The system will support a 'Dispatch Response' signal from the market to the DSO. | 129, 131, 132, 133, 134, 135 |
| 6.7.5.15 | The system will monitor for the receipt of an 'Dispatch Response' signal from the flexibility platform to the DSO. When not received within a configurable deadline an exception will be raised. This configurable deadline may be different dependent on the flexibility platform. | 130 |
| 6.7.5.16 | The system will support a Dispatch notification from EFFS to Power On. | |

## 6.8 Conflict avoidance

National Grid ESO is the main user of flexibility services. However, DNOs are expected to increasingly use flexibility services as they transition to DSOs and local energy trading and balancing actions may well involve purchasing services from the same providers.

The need for co-ordination and conflict avoidance has been highlighted within the Open Networks project which has already carried out some work in this area and has further work planned in 2019.

As EFFS is being designed to support Future World B, where the ESO and DSOs work together to co-ordinate procurement and dispatch of flexibility services. It is likely that the processes required will be more complex than for the other Future Worlds where service requirements from multiple parties are managed by a single party.

EFFS has defined a conflict avoidance process whereby the ESO and DSO share data related to the services they have planned. Our proposal is to put in place a matrix of services with an agreed mechanism to identify the conflict and resolve the conflict. This formal framework will enable transparency and consistency across all industry parties (as well as reducing potential disputes over the use of assets if everyone is following the same logic). Obviously, this will require a cross industry consensus and as such what we lay out here is a provisional matrix to be further developed, enhanced and tweaked through the relevant ENA ON workstreams, the EFFS trials and other related NIC projects.

As this is an ongoing activity that is triggered by data exchanges between flexibility service users. It is not related to a specific step in the procurement, arming or dispatch process it has not been included within the main process flow, however the notifications following procurement, arming or dispatch as contained in a “flexibility services file” may well result in a potential conflict being identified.

### 6.8.1 Pre-requisites / Scope

| In scope | Out of scope |
|---|---|
| • Interface to notify other parties (e.g. NG) when flexibility services are to be used;<br>• Conflict avoidance. | • Co-ordination. |

### 6.8.2 Description

The terms conflict avoidance and co-ordination are both used in relation to flexibility services. While both activities will involve exchanges of information and aim to improve the outcomes when using flexibility services, we believe these represent different activities.

Coordination refers to flexibility service providers and purchasers working together to ensure whole system optimisation. Typically, these are longer term activities that aim to align policy rather than relating to the control of specific assets at specific times.  Coordination activities would include:

- Using common terminology;
- Defining service requirements to maximise consistency between flexibility users and the ability for services to be sold into more than one market;
- Defining procurement timescales to allow for coordination;
- Sharing real time data via ICCP links;
- Supporting service provision to the TSO via DSO connected assets e.g. reactive power;
- Services via Power Potential.

Conflict avoidance relates to shorter term actions aimed at resolving conflicts in how specific assets are used to provide flexibility services.

What is or is not considered a conflict has not yet been defined at an industry-wide level but would be expected to include some of the following scenarios:

- More than one user of flexibility services trying to use the same asset at the same time (regardless of whether they want the same action);

- More than one flexibility service user trying to user the same asset, only if working on opposite directions;

- Different flexibility service users procuring/dispatching services on different assets that are electrically arranged so that one service negates or partially negates the other;

- DNOs ANM /SVO scheme reducing generation constriction (or load restriction on Load ANM scheme in the future) which negates the impact of a flexibility service procured/dispatched by a third party. This would also include any typical network operation / reconfiguration action (switching etc.);

- A flexibility service user (other than a DNO) procuring/dispatching a service that results in a capacity threshold being breached on the DNO network, and then causes the DNO to act (may or may not be flexibility service) to avoid that threshold. This could be intentional (market manipulation) or unintentional;

- A DNO procuring/dispatching a service that results in a capacity threshold being breached at the Grid Supply Point and then causes the ESO a problem;

- Changes to customer behaviour that may cause a conflict (Note: this is almost impossible to predict).

Due to the focus on operational timescales, EFFS is only concerned with conflict avoidance.

### 6.8.3 Assumptions

| Ref | Description |
|---|---|
| 6.8.3.1 | Due to the industry defined decision-making approach there is no need for a complex automated dispute resolution process as all parties will be making |

| | |
|---|---|
| | decisions based upon the same criteria. Therefore, any disputes to the requested action in the 'Amend Flexibility Services' services file (requirements 6.8.5.6 and 6.8.5.7) will be exceptions and handled by a manual offline process. |
| 6.8.3.2 | The power flow analysis to support conflict avoidance will consider the activity of ANM / SVO systems. |
| 6.8.3.3 | Where services need to be amended / cancelled to avoid conflicts it is the responsibility of the party who procured the service to do so (via the route that they procured the service, in EFFS case the relevant flexibility platform). |

### 6.8.4 Dependencies

| Ref | Description | Impact if not met |
|---|---|---|
| 6.8.4.1 | There is a dependency on a co-ordination and communication mechanism with National Grid ESO being defined. This will be dependent on the following ENA ON 2019 products: WS1A P5, WS1B P3, WS1B P4. | EFFS will not be able to specify a co-ordination and communication mechanism with National Grid ESO that has cross industry agreement. This could lead to conflicts in the use of flexibility services in the trials. |
| 6.8.4.2 | There is a dependency on universally accepted rules for calculation of the cost of having to take alternative action to avoid a conflict occurring being defined. | Where difference in additional cost is the deciding factor, then if there are two or more courses of action this will be impossible to decide objectively. |
| 6.8.4.3 | Consistent network hierarchy information must be available and shared between industry parties. | It will not be possible to identify when services will impact each other without a consistent view of where they are connected on the network. |
| 6.8.4.4 | ENM scenarios must be visible within the system. | It will not be possible to take this into account when resolving conflicts. |

### 6.8.5 Requirements

| Ref | Requirement | Business process step |
|---|---|---|
| 6.8.5.1 | The system will generate a 'Flexibility Services' file to go to National Grid ESO / other interested industry parties which will contain the all future services within EFFS and the associated status. | N/A not related to a specific process step |
| 6.8.5.2 | The 'Flexibility Services' file will be generated at a regular, configurable interval (for example daily) and will indicate which items have changed since the previous file. | N/A not related to a specific process step |

| | | |
|---|---|---|
| 6.8.5.3 | The system will process a 'Flexibility Services' file from National Grid ESO / other interested industry parties which will contain all of their future services and the associated status. | N/A not related to a specific process step |
| 6.8.5.4 | The system will determine if any services in the 'Flexibility Services' are in a relevant part of the network to potentially cause a conflict. If not, then no further action is required. Similarly, some forms of conflict can be ruled out if the service windows do not overlap. | N/A not related to a specific process step |
| 6.8.5.5 | The system will pass the details of any services in the 'Flexibility Services' file to PSSE in order to carry out power flow analysis and determine if it will cause any constraints. | N/A not related to a specific process step |
| 6.8.5.6 | A matrix similar to that embedded below will be used in order to identify all the combinations of services that could result in conflicts and the actions required for resolving each specific conflict.<br>Conflict resolution.xlsx<br>The actions required will need to be agreed by all the relevant stakeholders. Determining these actions will be a part of the process of setting up a new service.<br>The full matrix will not be determined as part of the EFFS project, but rather agreement will be sought for a subset of the potential conflicts for use in the trial. The selection of the subset of conflicts to include and the means of resolution is not within the scope of this document.<br>The matrix used to resolve conflicts would need to clarify whether the process used to resolve conflicts depends on whether an EMN has been issued.<br>While the Future Worlds Impact Assessment suggests *"that the DSO's needs would be prioritised, with the residual flexibility offered by DER being available to the ESO. Where the distribution networks are not constrained, the full flexibility from DER could be offered to the ESO".* In the EMN scenario it would be expected for the ESO needs to take priority and that the DSO would amend their planned services. | N/A not related to a specific process step |

| | | |
|---|---|---|
| 6.8.5.7 | Based on the outcomes of requirement 6.8.5.6 the system will generate a 'Amend Flexibility Services' file. This will contain all identified conflicts by the DSO, and the instruction for resolution / action taken. | N/A not related to a specific process step |
| 6.8.5.8 | The 'Amend Flexibility Services' file will be generated at a regular, configurable interval (for example daily). | N/A not related to a specific process step |
| 6.8.5.9 | The system will process an 'Amend Flexibility Services' file from ESO / other interested industry parties. This will contain all identified conflicts by the ESO / other parties, and the instruction for resolution / action taken. | N/A not related to a specific process step |
| 6.8.5.10 | The system will support a 'Cancel Service' signal to the flexibility platforms.<br><br>This can be invoked either as part of the conflict resolution or at any point in the procurement, arming and dispatch business process (dependent on the relevant market closure gate timescales which are to be determined).<br><br>Note: there is provision in the contractual agreements with providers to be able to cancel a dispatch although dependent on timescales (e.g. very close to the dispatch or once the dispatch has begun) this may be best carried out as an offline process. | N/A not related to a specific process step |
| 6.8.5.11 | The system will support an 'Amend Service' signal to the flexibility platform. This can only be used to reduce the energy requirement of a specific service. Any new HH periods or additional energy requirements require a new service to be procured / armed / dispatched.<br><br>This can be invoked either as part of the conflict resolution or at any point in the procurement, arming and dispatch business process (dependent on the relevant market closure gate timescales which are to be determined). | N/A not related to a specific process step |
| 6.8.5.12 | The system will support a 'Cancel Service' signal from Power On to EFFS. | N/A not related to a specific process step |

## 6.9 Synergy identification

The opposite of conflict avoidance is identifying potential synergies of flexibility requirements between different industry parties. This will function in a very similar way to conflict avoidance as defined in section 6.8.

As this is an ongoing activity that is triggered by data exchanges between flexibility service users. It is not related to a specific step in the procurement, arming or dispatch process it has not been included within the main process flow, however the notifications following procurement, arming or dispatch as contained in a "flexibility services file" may result in a potential synergy being identified.

### 6.9.1 Pre-requisites / Scope

| In scope | Out of scope |
|---|---|
| • Interface to notify other parties (e.g. NG) when flexibility services are to be used;<br>• Synergy identification. | • Co-ordination. |

### 6.9.2 Description

Synergy identification will operate in the same timescales as conflict avoidance (as defined in 6.8.2); it will use the same data exchange mechanism and very similar processes. These will include:

a. Efficiencies between DSO & ESO services for thermal constraints;
b. Data exchange of planned services between parties that solve both DSO and ESO network requirements;
c. Prioritise services which solve both ESO and DSO network issues to deliver efficiencies to the consumer;
d. Key decisions – put in place a matrix of services which benefit both DSO and ESO thermal constraint requirements;
e. Key decisions – use power flow analysis to identify thermal constraints where efficiencies can be delivered through applying DSO / ESO procured services;
f. Key decisions – define DSO / ESO priority of service use to deliver efficiencies to the consumer & minimise costs and actions.

### 6.9.3 Assumptions

| Ref | Description |
|---|---|
| 6.9.3.1 | Due to the industry defined decision-making approach there is no need for a complex automated dispute resolution process as all parties will be making decisions based upon the same criteria. Therefore, any disputes to the requested action in the 'Amend Flexibility Services' services file (requirements 6.9.5.6 and 6.9.5.7) will be exceptions and handled by a manual offline process. |
| 6.9.3.2 | The power flow analysis to support synergy identification will consider the activity of ANM / SVO systems. |

| | |
|---|---|
| 6.9.3.3 | Where services need to be amended / cancelled to exploit synergies it is the responsibility of the party who procured the service to do so (via the route that they procured the service, in EFFS case the relevant flexibility platform). |
| 6.9.3.4 | The DSO is responsible for identifying ESO services that will fulfil their requirements and vice a versa. |

### 6.9.4 Dependencies

| Ref | Description | Impact if not met |
|---|---|---|
| 6.9.4.1 | There is a dependency on a co-ordination and communication mechanism with National Grid ESO being defined. This will be dependent on the following ENA ON 2019 products: WS1A P5, WS1B P3, WS1B P4. | EFFS will not be able to specify a co-ordination and communication mechanism with National Grid ESO that has cross industry agreement. This could lead to an inability to exploit synergies in the use of flexibility services in the trials. |
| 6.9.4.2 | There is a dependency on market rules being developed, especially in terms of how synergies of requirements are handled (e.g. can a provider be paid multiple times for the same service provided to different parties?). | No consistent method of exploiting synergies of flexibility requirements can be defined. |
| 6.9.4.3 | There is a dependency on universally accepted rules for calculation of the cost of having to take alternative action to avoid a conflict occurring being defined. | Where difference in additional cost is the deciding factor, then if there are two or more courses of action this will be impossible to decide objectively. |
| 6.9.4.4 | Consistent network hierarchy information must be available and shared between industry parties. | It will not be possible to identify when services will impact each other without a consistent view of where they are connected on the network. |

### 6.9.5 Requirements

| Ref | Requirement | Business process step |
|---|---|---|
| 6.9.5.1 | The system will generate a 'Flexibility Services' file to go to National Grid ESO / other interested industry parties which will contain all future services within EFFS and the associated status. | N/A not related to a specific process step |

| | | |
|---|---|---|
| 6.9.5.2 | The 'Flexibility Services' file will be generated at a regular, configurable interval (for example daily) and will indicate which items have changed since the previous file. | N/A not related to a specific process step |
| 6.9.5.3 | The system will process a 'Flexibility Services' file from National Grid ESO / other interested industry parties which will contain all their future services and the associated statuses. | N/A not related to a specific process step |
| 6.9.5.4 | The system will determine if any services in the 'Flexibility Services' are in a relevant part of the network to potentially exploit a synergy. If not, then no further action is required. Similarly, some forms of synergy can be ruled out if the service windows do not overlap. | N/A not related to a specific process step |
| 6.9.5.5 | The system will pass the details of any services in the 'Flexibility Services' file to PSSE in order to carry out power flow analysis and to determine if it will resolve any constraints. | N/A not related to a specific process step |
| 6.9.5.6 | A matrix similar to that embedded in requirement 6.8.5.6 will be used in order to identify all the combinations of services that could result in synergies and the actions required for progressing each synergy.<br>The actions required will need to be agreed by all the relevant stakeholders. Determining these actions will be a part of the process of setting up a new service.<br>The full matrix will not be determined as part of the EFFS project, but rather agreement will be sought for a subset of the potential synergies for use in the trial. The selection of the subset of conflicts to include and the means of resolution is not within the scope of this document. | N/A not related to a specific process step |
| 6.9.5.7 | Based on the outcomes of requirement 6.9.5.6 the system will generate a 'Amend Flexibility Services' file. This will contain all identified synergies by the DSO, and the instruction for resolution / action taken. | N/A not related to a specific process step |
| 6.9.5.8 | The 'Amend Flexibility Services' file will be generated at a regular, configurable interval (for example daily), | N/A not related to a specific process step |
| 6.9.5.9 | The system will process an 'Amend Flexibility Services' file from ESO / other interested industry parties. This will contain all identified synergies by the ESO / other parties, and the instruction for resolution / action taken. | N/A not related to a specific process step |

| | | |
|---|---|---|
| 6.9.5.10 | The system will support a 'Cancel Service' signal to the flexibility platforms.<br><br>This can be invoked either as part of the synergy identification process or at any point in the procurement, arming and dispatch business process (dependent on the relevant market closure gate timescales which are to be determined).<br><br>Note: there is provision in the contractual agreements with providers to be able to cancel a dispatch although dependent on timescales this may be best carried out as an offline process. | N/A not related to a specific process step |
| 6.9.5.11 | The system will support an 'Amend Service' signal to the flexibility platform. This can only be used to reduce the energy requirement of a specific service. Any new HH periods or additional energy requirements require a new service to be procured / armed / dispatched.<br><br>This can be invoked either as part of the synergy identification or at any point in the procurement, arming and dispatch business process (dependent on the relevant market closure gate timescales which are to be determined). | N/A not related to a specific process step |
| 6.9.5.12 | The system will support a 'Cancel Service' signal from Power On to EFFS. | N/A not related to a specific process step |

## 6.10 Reporting and reconciliation

It is not intended for EFFS to support a reporting interface allowing a user to create and customise reports, but rather that a small selection of standard reports can be called off within the system and ad-hoc reports would be created by a system administrator directly from the database underlying the EFFS system.

The expected key focus of the standard pre-set reporting will be:

1. Procurement, arming and dispatching summaries to allow a comparison between the costs incurred in an area over a period of time against budget;

2. Fairness (i.e. that no particular provider type, technology or market is being treated preferentially);

3. Market development, providing information to determine trends in the number of flexibility service providers, average prices paid etc. to inform policy development and budgeting.

Financial settlements will be handled via the associated flexibility platforms then the flexibility platforms will be remunerated in line with existing processes.

### 6.10.1 Pre-requisites / Scope

| In scope | Out of scope |
|---|---|
| • A set of reconciliation reports which will retrospectively analyse each service from both an operational and financial perspective;<br>• A user interface which will allow users to monitor key aspects of the system. | • Financial settlements. |

### 6.10.2 Description

The analytics and reporting function will allow the production of the following:

- Load and generation forecasts in graphical and numerical form with overlaid time series data;
- Data of various forecasting trends and drivers on a site by site basis (local and network level);
- Visualisation of optimisation & scheduling results;
- Aggregate energy exchange data in graph and numerical form with overlaid time series data.

### 6.10.3 Assumptions

| Ref | Description |
|---|---|
| 6.10.3.1 | Asset response time will be measured by the relevant flexibility platform and will not be visible to EFFS. |
| 6.10.3.2 | Flexibility platforms will carry out the settlement function with providers and existing renumeration processes to the flexibility platforms are sufficient.<br><br>DSOs will have the ability to audit the settlements process when required. |
| 6.10.3.3 | Flexibility platforms will provide reports to the asset owner rather than EFFS. |

### 6.10.4 Dependencies

| Ref | Description | Impact if not met |
|---|---|---|
| 6.10.4.1 | Flexibility platforms will provide a data feed of which services where delivered and when vs what was requested by the DSO (i.e. a service delivery report). | Requirements 6.10.5.3 and 6.10.5.4 cannot be fulfilled as EFFS will not have a view of what |

| | | |
|---|---|---|
| | | service was actually delivered. |

### 6.10.5 Requirements

| Ref | Requirement | Business process step |
|---|---|---|
| 6.10.5.1 | The system will measure forecasting accuracy: namely comparison between the forecast value and the actual value for a given time period highlighting the degree of divergence.<br><br>This will not consider any action taken as a result of the forecast that has changed the actual value. | N/A not related to a specific process step |
| 6.10.5.2 | The system will measure flexibility platform response times and the compliance to the relevant process deadlines as configured within the system. | N/A not related to a specific process step |
| 6.10.5.3 | The system will support a service delivery confirmation report from the flexibility platform to the DSO. | N/A not related to a specific process step |
| 6.10.5.4 | The system will compare what was requested to be dispatched with what has actually dispatched (both in terms of timeliness and also fulfilment of the energy requirement). | N/A not related to a specific process step |
| 6.10.5.5 | The system will compare the actual impact on the network to the modelled impact. | N/A not related to a specific process step |
| 6.10.5.6 | The system will measure the running costs of flexibility services (average cost per MW hour for a particular time period, geographic area, flexibility platform). | N/A not related to a specific process step |
| 6.10.5.7 | The system will have a manually maintained budget value for flexibility services for user visibility to inform procurement, arming and dispatch decisions. | N/A not related to a specific process step |

# 7 Data items

Below is a collated and expanded view of the data items defined in this document relating to the definition of services, flexibility platform data exchanges and conflict avoidance.

### 7.1.1 Service data items

| Service type |
|---|
| Default procurement payment (£/kW or £/kVAr) |

| |
|---|
| Default arming payment (£/kWh or £/kVAr) |
| Default utilisation payment (£/kWh or £/kVAr) |
| Whether bids for less than the full contiguous required period of flexibility services are permissible (Y/N) |
| Whether bids for less than or more than the energy offered in each HH period within the full contiguous required period of flexibility services are permissible (Y/N) |
| Whether non-contiguous bids are permissible (Y/N) |
| Whether the DSO can accept part of what the provider is offering either by cherry picking only some of the half hours and/or only accepting some of the capacity being provided (Y/N) |
| Minimum bid size (kW or kVAr) |
| Maximum bid size (kW or kVAr) |
| Minimum bid duration (mins) |
| Maximum bid duration (mins) |
| Minimum procurement response lead time (days) |
| Minimum arming response lead time (days) |
| Minimum dispatch response lead time (hours) |
| Maximum ramping period (mins) |
| Minimum full activation period (mins) |
| Mode of activation (text) |
| Minimum number of flexibility services to fulfil power /energy requirement per HH (integer) |
| Maximum number of flexibility services to fulfil power / energy requirement per HH (integer) |
| Minimum percentage of energy in the HH sourced from 1 asset to fulfil energy requirement (%) |
| Maximum percentage of energy in the HH sourced from 1 asset to fulfil energy requirement (%) |

| Service instance (also inherit all data items from Service Type). |
|---|
| Service type (text) |
| MPAN(s) (integer) |
| Asset ID(s) (to be determined) |
| Network location (to be determined) |
| Service status (text) |
| Availability windows (timestamp(s)) |
| Power / energy requirements (kW or kVAr) |
| Power / energy available (kW or kVAr) |
| Actual market procurement payment (£/kW or £/kVAr) |
| Actual market arming payment (£/kWh or £/kVAr) |
| Actual market utilisation payment (£/kWh or £/kVAr) |

### 7.1.2 Flexibility platform interface data items

| ‘Publish Requirements’ signal |
|---|
| Service type (text) |
| Network location (to be determined) |
| Availability windows (timestamp(s)) |
| Power / Energy requirements (kW or kVAr) |

| ‘Procurement Response’ signal (market to DSO) |
|---|
| Service type (text) |
| Network location (to be determined) |
| Availability windows (timestamps) |
| Power / Energy available (kW or kVAr) |
| Actual market procurement payment (£/kW or £/kVAr) |
| Actual market arming payment (£/kWh or £/kVAr) |
| Actual market dispatch payment (£/kWh or £/kVAr) |

| |
|---|
| MPAN(s) (integer) |
| Asset ID(s) (to be determined) |

| **'Available Flexibility' signal (market to DSO)** |
|---|
| Service type (text) |
| Network location (to be determined) |
| Availability windows (timestamp(s)) |
| Power / energy available (kW or kVAr) |
| Actual market procurement payment (£/kW or £/kVAr) |
| Actual market arming payment (£/kW or £/kVAr) |
| Actual market dispatch payment (£/kW or £/kVAr) |
| MPAN(s) (integer) |
| Asset ID(s) (to be determined) |

| **'Procurement Selection' signal (DSO to market)** |
|---|
| Transaction ID (integer) |
| Service type (text) |
| Network location (to be determined) |
| Availability windows (timestamp(s)) |
| Power / energy required (kW or kVAr) |
| MPAN(s) (integer) |
| Asset ID(s) (to be determined) |
| Status ('Accept / Reject') |

| **'Handshake' signal** |
|---|
| Transaction ID (integer) |
| Status ('Accept / Reject') |
| Status reason (text) |

| ‘Arming Request’ |
|---|
| Transaction ID (integer) |
| Service type (text) |
| Network location (to be determined) |
| Availability windows (timestamp(s)) |
| Power / energy required (kW or kVAr) |
| MPAN(s) (integer) |
| Asset ID(s) (to be determined) |

| ‘Arming Response’ |
|---|
| Transaction ID (integer) |
| Service type (text) |
| Network location (to be determined) |
| Availability windows (timestamp(s)) |
| Power / energy required (kW or kVAr) |
| MPAN(s) (integer) |
| Asset ID(s) (to be determined) |
| Status (‘Accept / Reject’) |
| Status reason (text) |

| ‘Dispatch Request’ |
|---|
| Transaction ID (integer) |
| Service type (text) |
| Network location (to be determined) |
| Availability windows (timestamp(s)) |
| Power / energy required (kW or kVAr) |
| MPAN(s) (integer) |
| Asset ID(s) (to be determined) |

| ‘Dispatch Response’ |
|---|
| Transaction ID (integer) |
| Service type (text) |
| Network location (to be determined) |
| Availability windows (timestamp(s)) |
| Power / energy required (kW or kVAr) |
| MPAN(s) (integer) |
| Asset ID(s) (to be determined) |
| Status (‘Accept / Reject’) |
| Status reason (text) |

### 7.1.3 Conflict avoidance data items

| ‘Flexibility Services’ file |
|---|
| Service type (text) e.g. Scheduled Constraint Management |
| Service impact for this asset e.g. generator turn up/down load turn up/down |
| MPAN(s) (integer) |
| Asset ID(s) (to be determined) |
| Network location (to be determined) |
| Service status (text) |
| Availability windows (timestamp(s)) |
| Power / energy requirements (kW or kVAr) |
| Power / energy available (kW or kVAr) |
| Scenario (BAU / EMN) |
| Marginal price of alternative |

# 8 Contact

If you have any questions relating to this document, please use the following points of contact:

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Derbyshire
DE74 2TU

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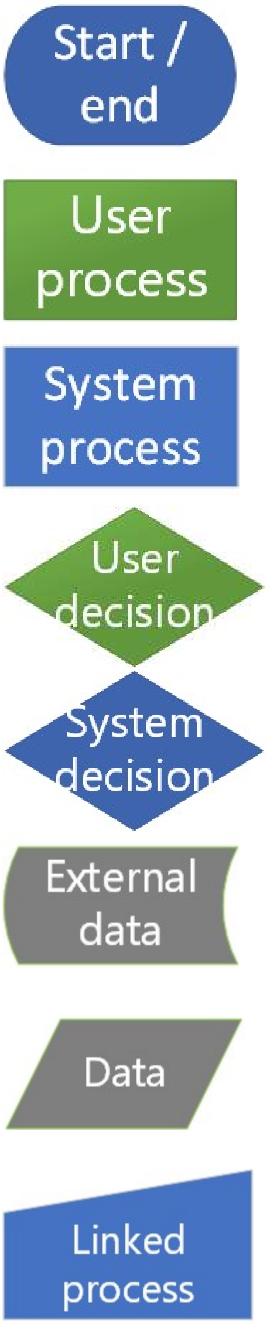
# Appendices

## Appendix 1: Process map key

Below is a key to the symbols used in the process maps throughout this document.



Parallel gateway

Exclusive gateway

Inclusive gateway

# Appendix 2: EFFS workstreams

The project will be undertaken across a number of Workstreams:

- Workstream 1 – Forecast Evaluation, Co-ordination and Requirements;
- Workstream 2 – System design, development and build;
- Workstream 3 – Testing and Trials;
- Workstream 4 – Collaboration and Learning Dissemination.

## Workstream 1 - Forecasting, Co-ordination and Requirements

**Forecasting**

Generation and demand forecasting are often rudimentary and disconnected from an integrated system. Forecasting capacity is being developed within EFFS which is directly integrated into the one solution with automatically scheduled runs delivering the required profiles. It is also intended that forecasting element within EFFS will be highly configurable, supporting a range of forecasting algorithms developed outside of EFFS.

The first step, therefore, is to develop those forecasting algorithms. This is addressed with a 6-month package of work which is examining and determining the optimal forecasting arrangements. The TRANSITION and FUSION NIC funded projects have been included within the selection process for this work to ensure that a combined scope for the three projects is considered. The forecasting work for Network Equilibrium has shown that weather corrected statistical models can result in large variations in accuracy across different feeder types. The forecasting work will build on the learning from Network Equilibrium by considering the fundamental methods of forecasting (multi linear regression, heuristic/machine learning etc.), together with data sources, data interfaces and accuracy. A further determination will be made in this period to assess if forecasts from other parties, such as National Grid ESO load or generation forecasts from third parties, can be utilised in a meaningful way to increase accuracy of local forecasting. Another aspect to the forecasting evaluation period is to assess the capabilities of machine learning in a broader context that underpins the entire forecasting process to try and identify key drivers, parameters and patterns to active demand forecasting methodologies and use these outputs to enable the deployment of these methodologies in any locality.

The forecasting horizon required will be driven by the commercial agreements put in place for delivery of flexibility services by third parties. The anticipated operational horizons will be within day, day ahead and week ahead. While longer term forecasting will also be required to identify required services sufficiently ahead of need to allow for the installation of new equipment or recruitment of new customers, this forecasting has recently been addressed within WPD and is not included in the scope of EFFS.

**Co-ordination**

With the use of flexibility services extending beyond National Grid ESO, to include DNOs and potentially suppliers, and the move towards contracts that are not exclusive, there is a greater need to co-ordinate the use of flexibility services. Without co-ordination actions by one party could negate the actions of another, and the potential for actions by other parties introduces additional uncertainty into forecasting flexibility requirements.

The EFFS project will utilise the output from the ENA shared services workgroup which considered the impact of different potential conflicts, and plans to assess the likely frequency of occurrence, financial impact and optimal solution within the project timelines.

**Requirements**

Requirements for DSO transition have already been specified in part by the ENA Open Networks work stream 3 and there is still work ongoing within the ENA on this subject. These will be referenced within the project's requirements phase.

As outputs are produced and published these will be reviewed by the project and integrated where necessary into the overall requirements for the solution.

Co-ordination with other potential NIC funded projects, notably FUSION and TRANSITION that have compatible objectives and outcomes will also be consulted in the requirements phase to ensure that duplication of effort is avoided.

## Workstream 2 - System design, development and build

The work on DSO requirements, including the output from the forecasting and coordination work, will provide a catalogue of the business functions that DSOs must perform, and some details of the transactions required to perform those functions. The next phase of the project determines how those transactions are enabled using hardware and software. This phase will consider the existing functionality and data of key systems, such as the control system, asset register, GIS and flexibility trading platform and that of the existing Affinity Networkflow software suite before determining the optimum arrangement.

## Workstream 3 - Testing and Trials

The purpose of the trials phase of the project is not to repeat existing demonstrations proving flexibility works, rather it is to demonstrate that the software and interfaces developed support DSO functionality and that the forecasting and co-ordination elements function as intended. In particular, it should demonstrate that the system can accurately forecast flexibility requirements over various time frames and then act upon this requirement by communicating with the various flexibility services available. These will be a combination of:

1. Flexibility services that the DNO can control directly e.g. DG, storage, DSR provided by industrial and commercial customers;

2. Local DG comprising conventional plant, storage, or renewables, that does not have direct DNO control for flexibility services, but which may or may not have some controlling equipment as part of an alternative connection arrangement;

3. Indirectly connected DSR / flexibility providers via an aggregator or supplier i.e. a third-party system.

Therefore, the purpose of the trials will be to test the fundamental aspects of the system deployment and the suitability of the business & technical processes that support it in a real-world scenario.

## Workstream 4 - Collaboration and learning dissemination

The purpose of this workstream will be to manage initial stakeholder input to the project e.g. validating the requirements, design approach, trials design etc. including the coordination checkpoints with other similar NIC projects and then share the various outputs and results at project milestones. The formal information check points are detailed in the high-level project plan.

WPD has considerable experience gained over the past seven years and has developed knowledge capture and dissemination methods which we will leverage in the delivery of this project. Developed during the preparation and delivery of previous LCNF and NIC projects, this structured approach will ensure any new knowledge produced across the project is captured and distributed to relevant stakeholders and industry participants in a timely manner. A knowledge dissemination roadmap and stakeholder map will be produced and mapped onto the overall project plan to facilitate this.

Knowledge captured during the project delivery will comprise:

- Details from the forecast evaluation study;
- Co-ordination learning and the management of conflict with third parties;
- System implementation, testing and trials benefit.

Learning obtained through the project will be disseminated using a variety of methods and communications media, including:

Within the T.E.F. projects:

- Regular project meetings in line with T.E.F. governance;
- Common Stage Gate review;
- Joint engagement with external stakeholders.;
- Collaboration workshops;
- Output of EFFS forecasting work to be available to TRANSITION and FUSION.

For external stakeholders:

- Regular project stakeholder and team meetings;
- Presentations at conferences and workshops, in addition to the NIC annual conference;
- Technical reports and analysis;
- Contributions to and communication with relevant electricity industry working groups Academic journals and papers;

- E-newsletters and press releases;
- A project website providing a source of technical and commercial learning and reports from the project;
- Reports and papers posted on the project website;
- Co-ordinated and joint events with other relevant DSO readiness projects e.g. TRANSITION (SSE), and FUSION (Scottish Power);
- Webinars.

For customers and interested parties:

- Press releases and briefings;
- Frequently Asked Questions (FAQ) document to provide information about electricity flexibility services and the technology for customers;
- Use of social media to provide a channel for feedback, comments and perceptions of the project.

For internal WPD stakeholders:

- Internal workshops and training materials;
- Internal reports;
- Development of internal business champions;
- FAQ document to support new project team members and others in each of the partner businesses who need to understand the function and operation of the SNS project;
- Raw data and models to inform the WPD business plans and strategic investment models.

# Appendix 3: High level project plan

The timing of the four workstreams can be seen on the high-level project plan below:

| Work Type | Workstream | Description | H1 2018 | H2 2018 | H1 2019 | H2 2019 | H1 2020 | H2 2020 | H1 2021 | H2 2021 |
|---|---|---|---|---|---|---|---|---|---|---|
| Implementation | 1 | Forecasting Evaluation, Co-ordination and Requirements | Ofgem Approval | | Gateway Review 1 | | | | | |
| Implementation | 2 | System Design, AMT-SYBEX Development / Reconfiguration, System Test | | | | | | Gateway Review 2 | | |
| Implementation | 3 | Onsite Testing, Trials and Conflict Management | | | | | | | | Gateway Review 3 |
| Implementation | 4 | Collaboration and Knowledge Dissemination | | | | | | | | Closedown Report |

# Appendix 4: EU Procurement Assessment

From discussion with WPD procurement specialists it has been determined that the EFFS trial is not subject to UCR for the following reasons:

- As it is an innovation project it is exempt;
- The requirements are very location specific;
- The contract value threshold (£363,000) will not be breached.

However, the process should allow this to be rolled out into BAU (whereby the contract value could be breached) and therefore should consider UCR. As such the below steps would be carried out.

## Procurement for services to be delivered > 2 months in the future

- We assume that very few contracts will breach the threshold value (as EFFS will be 'topping up' existing flexibility that has been procured in planning rather than operational timescales).

- A PIN will be issued to engage interested parties for 30 days communicating the procurement requirements on the relevant flexibility platforms. This process is external to EFFS.

- Advise them to carry out all further communication via the flexibility platform.

## Procurement for services to be delivered < 2 months in the future

- We assume that even fewer contracts will breach the threshold value in these timescales as the volumes being procured at this stage are expected to be very small.

It could be argued this is an unforeseen procurement, meaning it is exempt from UCR.

# Appendix 5: Overview of the Open Networks future worlds

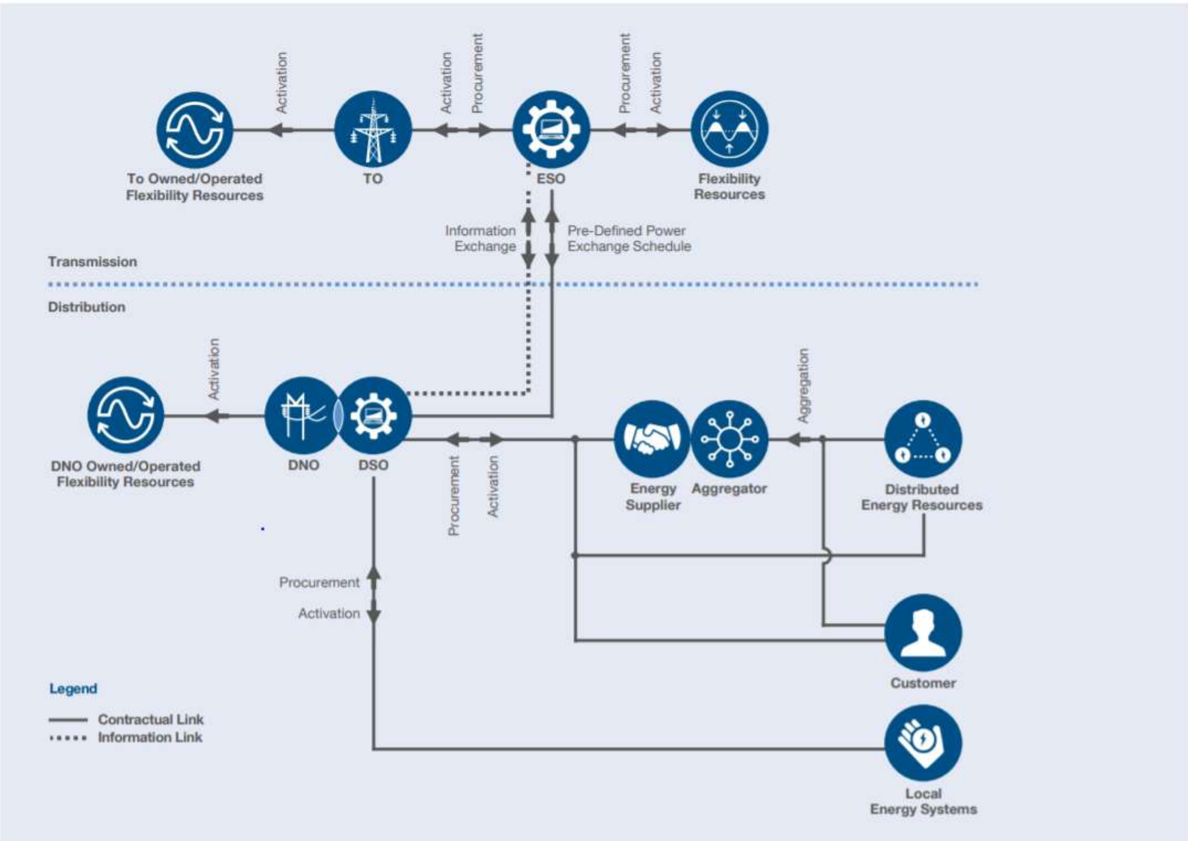
The below summary is taken from the ENA ON Future Worlds consultation document.

"In 2018, the Open Networks Project showcased five potential industry structures, known as Future Worlds. Extensive work was carried out with stakeholders to define these five Future Worlds and they were modelled using the Smart Grid Architecture Model (SGAM) to further define the information flows necessary for each world to operate. These detailed definitions and the SGAM models were presented as part of the Future Worlds consultation in 2018.

Below is a high-level summary of each of the 5 future worlds:

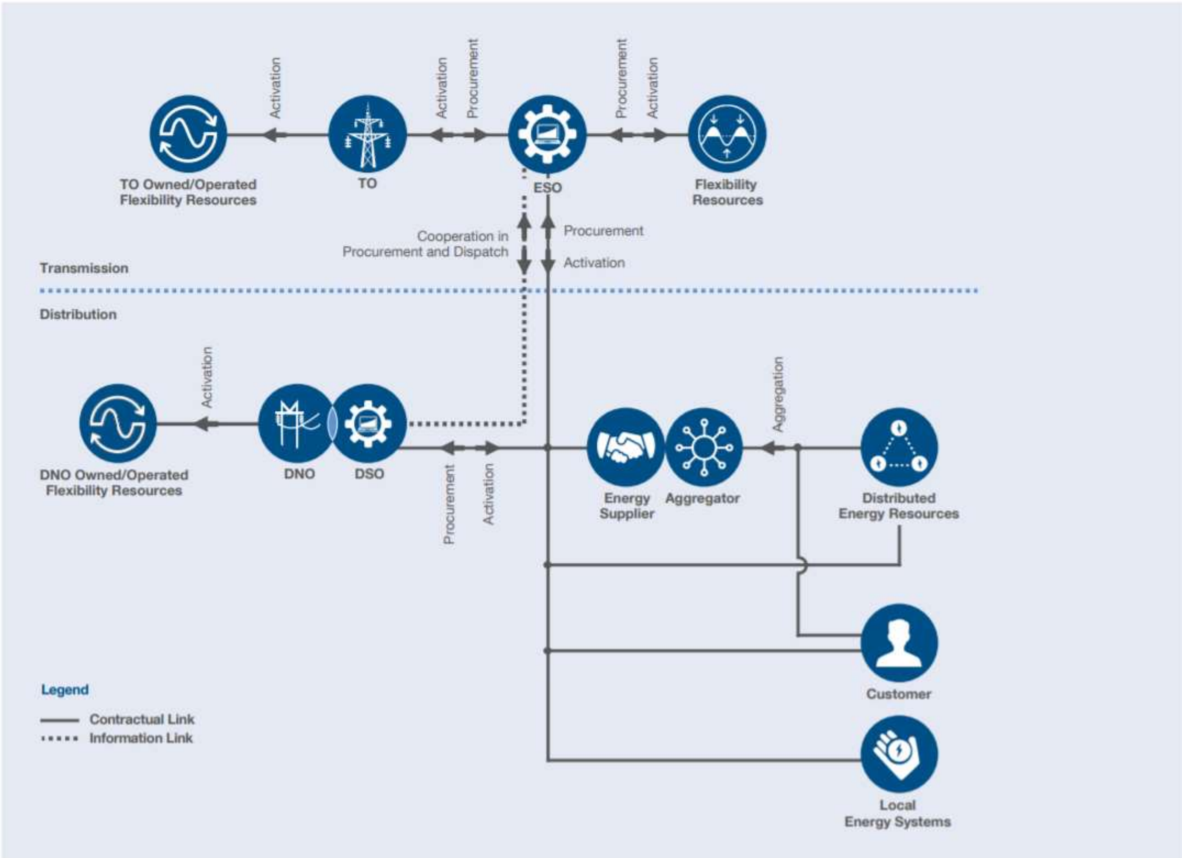
## World A: DSO Coordinates

In this world, the DSO takes on a central role for all active Customers and DER. It procures and activates distribution network connected flexibility resources for distribution network constraint management and for providing services to the ESO for regional and national requirements. The DSO also schedules flows to and from the electricity transmission system based on a pre-defined power exchange schedule agreed with the ESO. From a transmission perspective, the DSO behaves in a similar manner to other transmission connected parties and the services it can provide from DER connected within its networks are evaluated on a regional transmission and national level by the ESO in a non-discriminatory manner along with other transmission connected service providers.



## World B: Coordinated DSO-ESO Procurement and Dispatch

In this World, flexibility resources can provide services to multiple SOs and are able to stack revenues from these differing SOs. It is recognised that, on occasion, the needs of different SOs will conflict and it will be the joint responsibility of these SOs to coordinate service procurement and dispatch activities. This will be done in a transparent manner which creates the most efficient outcome for the end consumer.

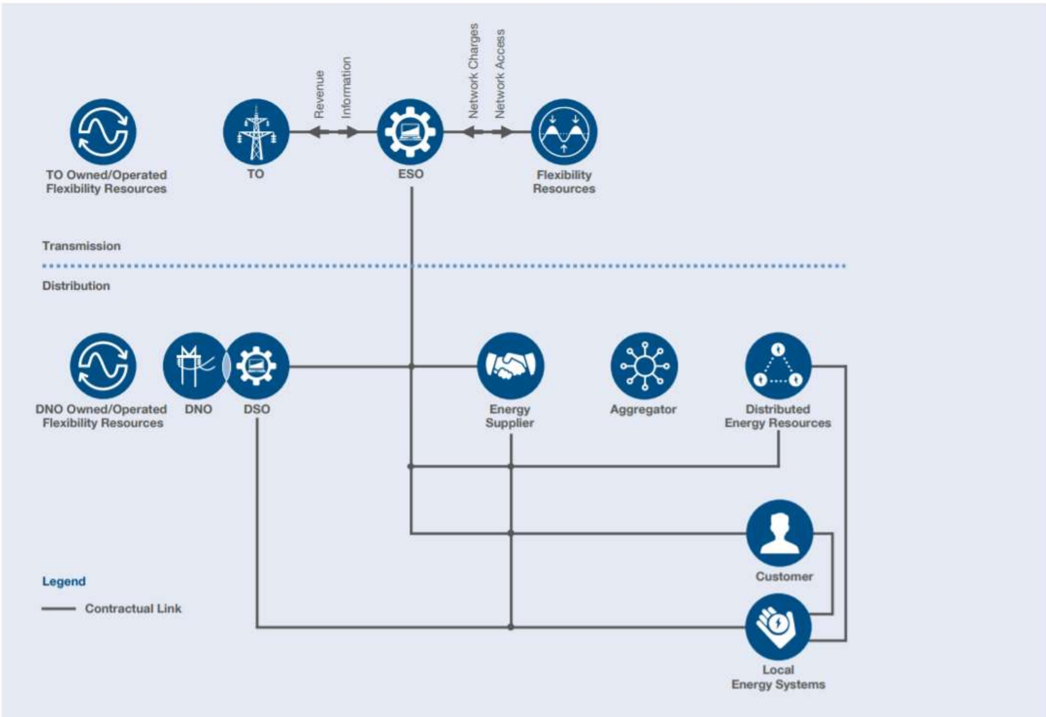


## World C: Price Driven Flexibility

World B considered a World based on enhanced contracted flexibility arrangements. In World C, changes are made to price flexibility arrangements such that active parties vary their demand or generation in response to either or both energy price and network signals, such as time and location.

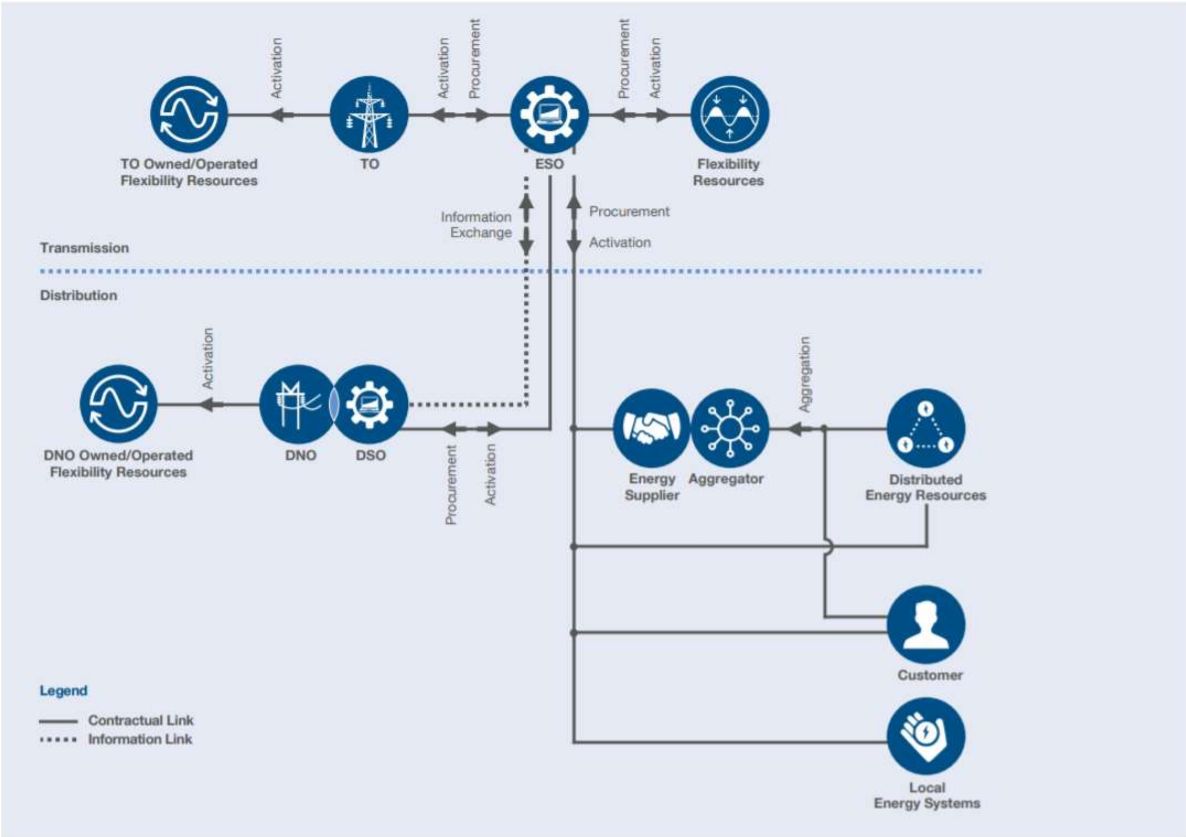
This World has been developed cognisant of Ofgem's reform of electricity network access and forward-looking charges programme and considers potential changes to future charging and access arrangements. Given the relatively early stage of this programme and the nature of the SGAM modelling it has not been possible to define a detailed option. The World does consider high level principles for changes to charging and access arrangements that are consistent with the work of Charging Futures including;

– Ensuring greater alignment of arrangements between transmission and distribution
– More effective influencing of user operations through network charging arrangements
– More appropriately influencing user investments through access and user commitment arrangements
– Consideration of connection rights and arrangements



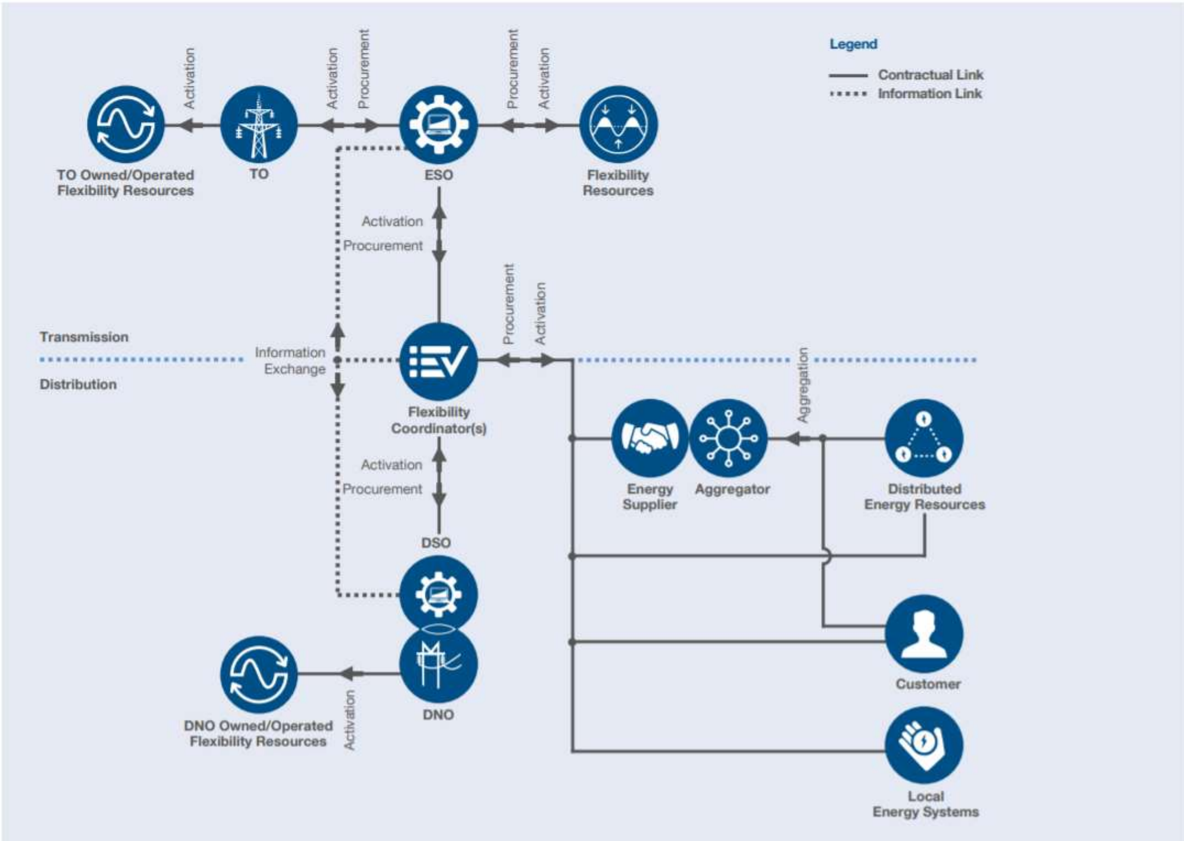
## World D: ESO Coordinate(s)

In this World, the ESO takes a more central role than in previous Worlds in many of the Customer facing activities of an SO. This potentially includes connection and charging arrangements as well as flexibility services (Figure 2.4). The DSO role would become more focused on identifying short term and long-term service opportunities from third-party providers which would be passed as service requests to the ESO for procurement.



## World E: Flexibility Coordinator(s)

In this World, a new party, the Flexibility Coordinator, acts as an independent, neutral market facilitator for all flexibility markets. This party could either be a national entity or one of a number of standardised regional monopoly entities. The Flexibility Coordinator(s) is responsible for collecting service requirements from both DSOs and the ESO, optimising the requirements and identifying the most efficient solution. This is achieved through the use of a common platform(s) which aids transparent decision making. The Flexibility Coordinator(s) also needs to work closely with SOs through design and operation processes to ensure a coordinated system is efficiently developed and security of supply is maintained.



## Appendix 6: Flexibility platforms

'Flexibility platforms' is a term used throughout this document and is deliberately generic due to the current lack of industry consensus on what this role entails and the differences between the existing platforms. Whilst it is not the purpose of EFFS to specify how these platforms will operate we have made various assumptions about what functions they will perform throughout the document.

For ease of reference these are collated below. Please note that this list is not meant to be exhaustive, rather it is an overview of assumed capabilities and their relationship to EFFS.

| Function | Carried out by flexibility platform? | Required by EFFS? |
|---|---|---|
| Interface for registering flexible resources | Yes | Yes |
| Allows buyers and sellers to match their requirements | Yes | Yes |
| Communication with flexibility resources | Yes | Yes |
| Dispatch of flexibility resources | Yes | Yes |
| Commercial optimisation | Yes | No, as EFFS will use multiple platforms therefore needs a cross platform view |
| Conflict avoidance with other parties | Yes | No, as EFFS will use multiple platforms therefore needs a cross platform view |
| Synergy identification with other parties | Yes | No, as EFFS will use multiple platforms therefore needs a cross platform view |
| Settlements (payment of flexibility providers) | Yes | Yes |
| Measurement of flexibility providers performance | Yes | Yes |

# Appendix 7: Business process maps

The procurement business process map as a PDF.

Procurement.pdf

The arming business process map as a PDF.

Arming.pdf

The dispatch business process map as a PDF.

Dispatch.pdf

# Appendix 8: Overview of related projects

Below are overviews of the two related projects: Project Entire and the Cornwall Local Energy Market.

## Project Entire

Summary taken from the WPD Project Entire website, more details are available here.

**Objective(s)**
The trial will identify and address many of the key challenges a DNO is presented with as they develop DSR and other commercial service capabilities within what is a traditional engineering and asset management organization. In doing so WPD will create a roadmap for WPD's other regions as well as other DNOs to assist development of a commercial service capability and deliver increased value to their customers.

In order to start this transition, it is necessary to ensure that the data held regarding customers with generation or sufficient volumes of flexibility to affect the network operation, is accurate and comprehensive. It is therefore our intention to carry out a deep audit of customer assets within the trial zones and ensure that they are compliant with the current standards, while taking advantage of this interaction to engage with them to educate and where appropriate recruit for demand side management activity.

By carrying out this project we will ensure that the underlying assumptions regarding our networks are correct and that we have increased visibility of dynamic users that will affect operational decisions as we migrate to local system operation.

**Problem(s)**
With the successful completion of previous trials that have sought to determine the principals of Demand Response and interaction with customers to modify behaviour, project Entire will progress the understanding of customers and their operational priorities. The trials have so far been limited in their scope with only small sample groups being engaged to offer quite limited functionality specifically for distribution constraint management. As the name 'Entire' suggests, we will now extend the previously limited scope to fully develop the skills, relationships and systems necessary for a DNO to provide a comprehensive DSR capability.

**Method(s)**
Building on the successes and the learning achieved during the commercial trials in Project FALCON, this project aims to develop and test comprehensive DSR capability to control generators and customer loads. Based on our previous small-scale interventions using a very manually controlled DSR arrangement it has been proven that DSR can potentially provide a valuable tool in the management of transient or temporary network issues, particularly where the case is uncertain for a large capital investment.

We are therefore seeking to develop our understanding and capability of DSR both in terms of advanced systems that would support BaU operation, but also the operational framework that would allow DNO DSR customers to participate more in wider DSR schemes operated by other parties, including National Grid ESO. BAU use of DSR is likely to require regulatory approval and new policies from a governance perspective as well as new systems capabilities to operate and manage.

Finally, this is not an engineering-based solution and therefore skills development in the commercial DSR markets will also feature as a key deliverable.

**Areas of Work**
The project will be focussed on two areas within the East Midlands that have been identified as requiring new grid supply points which are very major capital works that will take several years to complete. WPD will use the new DSR capability to reduce peak winter demands and potential constraints on the existing grid supply points, which are becoming increasingly heavily loaded and reduce any operational risks associated with them.

## Cornwall Local Energy Market – Plugs and Sockets

This NIA funded project forms part of the larger EU funded Cornwall Local Energy Market project led by Centrica to create a local energy market and involves the development of a trading platform for flexibility services; in this context, the "socket" is a hub to which many parties connect to using their "plugs". This project will provide learning about the suitability of different market types and market operations for flexibility services, for example, whether spot markets offer better value than setting up long term contracts. The wider project will consider the different use cases that flexibility services can enable and whether incorporating locational price signals in energy trading would reduce reinforcement costs.

We have deliberately excluded work on determining the market rules applicable to different flexibility services from EFFS on the basis that this will most likely be delivered by Plugs and Socket. However, even if a position is reached it may still evolve over time and it is important that the systems to support flexibility services are able to cater for a range of different market models. Plugs and Socket may provide an input to the work to specify service requirements and data interfaces, but it is not expected that all the learning from Plugs and Socket will be available to EFFS as they will operate concurrently.

This work has been included within EFFS on the basis that it must be delivered and so should be accounted for in the estimates of time and cost for EFFS. However, where outputs from Plugs and Socket reduce the costs for EFFS this will result in an underspend. Plugs and Socket may also reduce the overall project costs by providing a pool of customers that are able to provide flexibility services and may be willing to participate in an additional trial.

# Appendix 9: Collated view of the questions to reviewer

## Business process

1. ***Are there any potential issues from DNOS being neutral to technology and owner / operator e.g. negative impacts on network performance?***

2. ***Are there any elements necessary for neutral market facilitation that have not been included in EFFS?***

## Forecasting

3. ***What is your view of the forecasting horizons selected? Are there any others that you would expect forecasts to be produced for within the timescales EFFS will operate in (i.e. operational)?***

## Capacity engine

4. ***Do you consider power flow analysis as part of this process reasonable in terms of complexity and possible impact on processing times? If not, what approach would provide a better result?***

5. ***Is it reasonable to assume that the capabilities required for this functionality (a power flow analysis tool such as PSSE, PowerFactory or Ipsa 2, as built switch level model, integration with Power On) will be in place or achievable for other DNOs?***

6. ***Do you agree with the definition of contingencies to model as part of the power flow analysis and also how to determine which one to action (as Modelling every contingency and ensuring that the most onerous requirements for each asset for each contingency are reflected in the composite requirements ensures the worst-case scenario can be catered for)? Is there a way we can which specific contingencies to action or determine the most likely to occur?***

## Service management

7. ***Is the assumption about the interoperability of services reasonable?***

8. ***Are there any other service parameters that need to be considered other than those in following section?***

## Optimise

9. ***Based on your experience of commercial optimisation do you feel the complexity of the criteria defined in the following sections will lead to solvable optimisation problems?***

10. *Are there any other optimisation criteria that need to be considered?*

11. *What is a reasonable security margin percentage for over procurement, arming or dispatch? Is this an appropriate way of managing risk of non / under delivery or are there other approaches that should be considered (for example assume the loss of the single largest service provider)?*

## Scheduling

12. *Is the visibility and dispatch of post-fault flexibility from Power On (via EFFS and the relevant flexibility platform) feasible in terms of timeliness of action?*

13. *What manual approval steps do you feel are appropriate?*

## Market interface

14. *Do the signal types defined align to your understanding of how flexibility platforms operate?*

15. *Are the signal types defined reasonable or are any others required?*

## Conflict avoidance

16. *Does the approach of an industry wide matrix to resolve conflicts seem achievable? What barriers to putting this in place can you see? How could they be overcome?*

17. *Do you have alternative resolution paths for the conflicts between services identified below?*

18. *Is an automated dispute management process required?*

19. *Do you agree with the assumption that in World B the DSO and ESO will each be responsible for procuring, arming and dispatching flexibility to fulfil their own requirements on the distribution network?*

20. *How should potential synergies of flexibility requirements be handled?*

21. *Is there a minimum threshold of service size that would be of interest to the ESO / other parties (i.e. anything under this value would not be considered for conflict avoidance?*

22. *Do any other aspects of reporting need to be taken into consideration?*

23. *Do you agree that financial settlement with service providers is the role of the flexibility platform?*

## Data items

24. ***What other data items need to be considered?***

25. ***In terms of unique identifiers associated to flexibility services what do you think will work best both in terms of identification of assets and relevant areas of network? What level of granularity is required?***

26. ***Do you think that a unique transaction ID to track a service through its lifecycle would be useful?***