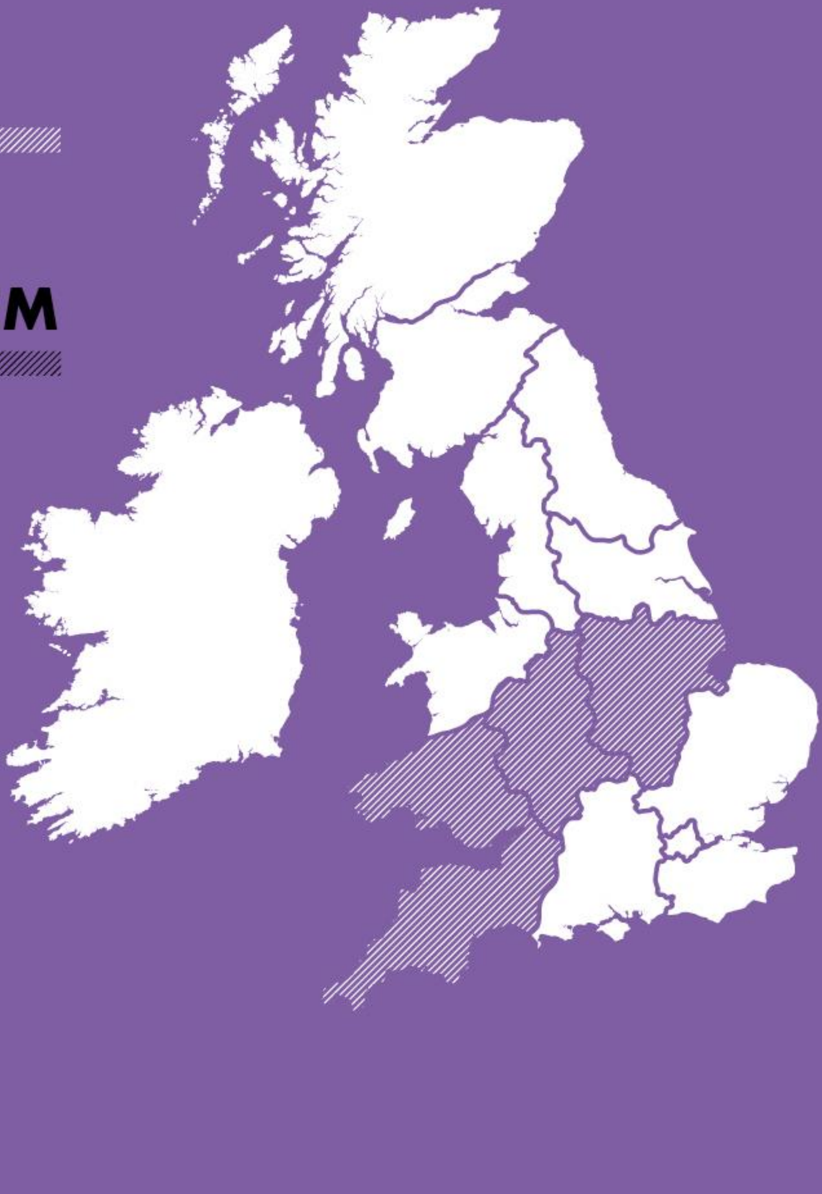
WESTERN POWER DISTRIBUTION

EFFS

ELECTRICITY FLEXIBILITY AND FORECASTING SYSTEM



Network Innovation Competition 2017
WPD/EN/NIC/03

Innovation to enable the DSO transition

RIIO NIC NETWORK INNOVATION COMPETITION

1 Section 1: Project Summary

1.1. Project Title	**Electricity Flexibility and Forecasting System**		
1.2. Project Explanation	Executing Flexibility services successfully will be key in enabling the transition to DSO. By exploring forecast and communication requirements and by sharing information, the **Electricity Flexibility and Forecasting System** project will specify, build and trial the additional system functionality required by a DNO to manage these services.		
1.3. Funding licensee:	East Midlands, West Midlands, South West and South Wales		
1.4. Project description:	1.4.1. The Problem(s) it is exploring The new capabilities DNOs require in order to perform new functions as DSOs, as outlined by the ENA workgroup. 1.4.2. The Method(s) that it will use to solve the Problem(s) The project will explore forecasting arrangements required to build a DSO system capability. It will determine system requirements incorporating common standards and will collaborate with other DSO readiness projects, enabling enhancements to be made to an existing system to deliver and prove a DSO system capability. 1.4.3. The Solution(s) it is looking to reach by applying the Method(s) The project will deliver a practical robust and accurate system capability that will enable a DNO to actively manage the provision of flexibility services necessary for transition to becoming a DSO. 1.4.4. The Benefit(s) of the project The benefit of the **Electricity Flexibility and Forecasting System** project will be an available flexibility management system, capable of harnessing multiple services and providing DNOs the ability to actively manage their networks. This capability will enable the deferment of traditional reinforcement, allowing the use of flexibility in fault restoration and enabling power supplies to be restored more quickly. It will help reduce national balancing costs by managing conflicts with the TSO and will reduce the time necessary to connect new renewable sources of energy to the network.		
1.5. Funding			
1.5.1 NIC Funding Request (£k)	£2,942.7k	1.5.2 Network Licensee Compulsory Contribution (£k)	£330.2k
1.5.3 Network Licensee Extra Contribution (£k)	£46.93k	1.5.4 External Funding –excluding from NICs (£k):	£962.73
1.5.5. Total Project Costs (£k)	£4,311.68k		

1.6. List of Project Partners, External Funders and Project Supporters (and value of contribution)	Project Partners: Project Lead: AMT-Sybex Ltd, part of Capita plc Further project partners: • A communications interface service provider • An aggregator / supplier • National Grid as TSO • An academic / consultancy partner External Funders: Project Supporters: • Centrica • UK Power Networks		
1.7 Timescale			
1.7.1. Project Start Date	February 2018	1.7.2. Project End Date	August 2020
1.8. Project Manager Contact Details: Jenny Woodruff			
1.8.1. Contact Name & Job Title	Innovation and Low Carbon Engineer	1.8.2. Email & Telephone Number	JWoodruff@ Westernpower.co.uk 07841 057580
1.8.3. Contact Address	Policy Team, WPD Tipton Office, Toll End Road, Tipton, West Midlands, DY4 0HH		
1.9: Cross Sector Projects (only complete this section if your project is a Cross Sector Project, i.e. involves both the Gas and Electricity NICs).			
1.9.1. Funding requested the from the [Gas/Electricity] NIC (£k, please state which other competition)	N/A		
1.9.2. Please confirm whether or not this [Gas/Electricity] NIC Project could proceed in the absence of funding being awarded for the other Project.	N/A		
1.10 Technology Readiness Level (TRL)			
1.10.1. TRL at Project Start Date	6	1.10.2. TRL at Project End Date	8

2 Section 2: Project Description

2.1 Aims and objectives

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 and Distribution Network Operators (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 Distribution System Operator (DSO), which, alongside greater co-ordination with the Transmission System Operator (TSO), will involve making greater use of flexibility services to operate a far more dynamic network.

The Government's recent report "Updating our Energy System: Smart Systems and Flexibility Plan" includes specific actions for DNOs to help create markets which work for flexibility, requiring DNOs to "develop timely and appropriate reforms to the way they plan, operate and engage with one another and customers, in order to manage the networks more efficiently and minimise whole system costs." It also requires DNOs to make efficient decisions by informed consideration of the full range of solutions available, and emphasises that there must be mechanisms for transmission and distribution coordination.

The report also suggests that the benefits of more flexible networks could be as much as £40bn by 2050, with part of that benefit coming from using markets in flexibility services to avoid traditional reinforcement where suitable.

Avoiding the cost and disruption associated with installing assets that might only be required for short periods of time during a limited part of the year, alongside the potential to connect customers faster without reinforcement, is generally accepted to be desirable. However, DNOs are not yet in a position to implement flexibility services as business as usual.

There have been a number of innovation projects that have increased our understanding of flexibility services such as Smarter Networks Services, FALCON and Low Carbon London. We have learned about what makes customers willing and able to provide services, different options for commercial structures, service reliability, price sensitivity, or different forms of enabling technology, for example. However, the various projects have, rightfully, focussed on individual niche areas of investigation and there are still some gaps in our knowledge in terms of how we bring the various systems together. So simply scaling up the existing projects would not result in a DSO transition. While the gaps could eventually be filled by further smaller scale individual projects, and each DNO could develop their existing trial systems for business-wide implementation, that approach would most likely be slow and would result in many DNO specific functions and interfaces that would be difficult for the TSO National Grid, aggregators and suppliers to support. Neither are there existing commercial software products on the market for DNOs that would enable DSO functionality.

In short, while work is progressing towards an agreed template for enabling flexibility services to be introduced into DNOs business as usual, including standardising the functions to be performed and the interactions with third parties, this needs finalising before developing the tools for implementation. This is what the EFFS project will deliver. It will confirm the functionality required of DSOs, consider the technical options for delivering that functionality and test a technical implementation in practice. This will enable a speedier, simpler DSO transition maximising the benefits of flexibility services.

The aim of EFFS, therefore, is to provide DNOs with a system that can support the functions of a DSO via the following objectives:

1. Enhancing the output of the ENA Open Networks project, looking at the high-level functions a DSO must perform, provide a detailed specification of the new functions validated by stakeholders, and the inclusion of specifications for data exchange.
2. Determining the optimum technical implementation to support those new functions.
3. Creating and testing that technical implementation by developing software and integrating hardware as required.
4. Using and testing the technical implementation, which will involve modelling the impact of flexibility services. As well as proving the system, this testing phase will create learning relevant to forecasting the likely benefits of flexibility services and the impact of changing network planning standards.

This will result in a proven, workable technical solution being available, and will also provide a set of blueprints, best practice guides and other learning from which DNOs can create 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 from flexibility services.

The table below demonstrates the EFFS project scope in relation to the ENA's published DSO requirements.

DSO function / Description	EFFS Solution Scope
Balancing Potential role - A DSO could operate local and regional balancing areas for whole system optimisation. This could include local actions to frequency management, local constraints and/or minimising losses, manage constraints and provide capability using risk based assessment to contribute to maintaining the national energy balance.	EFFS will support balancing by providing a means to identify, optimise and execute flexibility services. These can be enacted to provide optimised constraint management or to provide services to the TSO.
Network Operation Operate the electricity distribution network to maintain a safe and secure system. Identify and manage current and future risks. Coordinate and collaborate with Great Britain System Operator (GBSO) to manage potential conflicts to support whole system optimisation. Respond to customer needs.	EFFS will enable the use of flexibility services to operate the network in a safe and secure manner. It will also provide a coordination interface to the transmission system operator.
Investment Planning Identifying capacity requirements on the distribution network and securing the most efficient means of capacity provision to customers.	Investment planning is out of scope at this time as EFFS is being utilised as a short to medium term operational tool. However due to the nature of some of the forecasting tools being utilised, EFFS could in the future be further developed to support this DSO requirement.

Connections & Connection Rights Provide fair and cost effective distribution network access that includes a range of connection options that meet customer requirements, and system needs efficiently.	Connection & connection rights are out of scope at this time, although the EFFS solution as a whole could generally enable more connections by utilising flexibility services.
System Defence & Restoration Enhance whole system security through the provision of local and regional flexible services.	EFFS allows a DSO access to a range of flexibility services, the DSO therefore has a larger array of tools to meet system security requirements. Access to short term flexibility spot markets enables EFFS to provide support for low probability high risk events.
Facilitate Markets Interface with the GBSO (including information and control infrastructure) enable development of distribution capacity products, creation of local network service markets and enable DER access/participation in wider balancing services for whole system optimisation. Facilitate local and national markets to access services through auctions and other market arrangements for whole system efficiency. Provide data / information to facilitate distribution markets and service provision	By facilitating the use of flexibility services by DNOs, EFFS will help the development of the flexibility services market, providing new income streams. EFFS will provide a coordination interface to GBSO and enables the configuration and utilisation of multiple different types of optimised distribution orientated services and could potentially allow for wider participation in the balancing market. Access to other flexibility providers such as suppliers will be provided by a market interface.
Service Provision Potential role – A DSO could access services on behalf of others, or provide services to others, where doing so is necessary to maximise whole system efficiency, and protects competition. Uses own services to manage other risks on the network and contribute to resilience.	EFFS will enable WPD to provide services to TSO or other third parties. EFFS would support the management of third party assets that are being trialled in project Entire. WPD can trigger connected customers to provide flexibility services to manage constrains on the network.
Charging Sets Distribution Use of System prices for local network. Determines Point of Connection. Determines connections charges and informs of Transmission reinforcement charges (if applicable)	DUoS charging strategies are out of scope for the EFFS project although flexibility services will reduce costs and hence DUoS charges for customers as a whole. The information gained by modelling flexibility services can be used to inform revisions to charging methodology.

2.1.1 Development / demo being undertaken

The development required to provide a system supporting DSO functions will depend, in part, on the agreed requirements of a DSO, which are not yet finalised. However, there are some functions that are already known. The system will need to be able to;

- Create weather adjusted forecasts for load and generation at different time-frames, in order to determine the nature, duration and frequency of expected network constraints.
- Model how constraints can be managed, using either flexibility services or existing network solutions such as Active Network Management (ANM), switching in

capacitor banks / statcoms, reconfiguring the network or using equipment like Equilibrium's flexible power link, and maybe in the future devices that redirect power flow as proposed in WPD's HARP proposal.

- Determining the optimum way to resolve the predicted constraints which will involve selecting the most effective mix of network technology and flexibility interventions.
- Communicating flexibility services requirements to the market and creating an optimised set of services from those available.
- Executing flexibility services in an optimal way including arming, execution, validation of delivery and payment.
- Sharing information with interested parties to avoid conflicts in flexibility service use.
- Optimise the use of DNO controlled assets across multiple services, e.g. providing services to the TSO - National Grid by any DNO controlled storage, or supporting the managed service arrangements to be trialled within Entire where the DNO stacks revenues for third party assets.
- Support analytics and reporting.

The project does not aim to duplicate the flexibility service trading activities that expected to be performed on specialist platforms such as that being developed as part of the Cornwall Local Energy Market.

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, Trials and Conflict management
- Workstream 4 – Collaboration and Learning Dissemination

2.1.2 Workstream 1 - Forecasting, Co-ordination and Requirements

Forecasting

Generation and demand forecasting is often rudimentary and disconnected from an integrated system. We will develop forecasting capacity 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 will examine and determine the optimal forecasting arrangements. The forecasting work for 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 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 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, 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.

Therefore we need to know what approach should be taken to co-ordinate the use of flexibility services between parties. This will in turn depend on factors such as the likelihood of conflicts and the potential consequences. Where conflicts are deemed unlikely and of low impact then there is less justification for a complex system for co-ordination. This package of work will evaluate a variety of options such as notification at various timescales, live system interfaces, use of price signals etc. to determine the optimum mechanism(s) / processes for avoiding conflicts, including notification / interface formats, any failsafe procedures etc.

This work will build on the output from the ENA shared services workgroup which considered the impact of different potential conflicts, but did not assess the likely frequency of occurrence, financial impact and optimal solution.

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 projects 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 on in the requirements phase to ensure that duplication of effort is avoided.

2.1.3 Workstream 2 - System design, development and build

The work on DSO requirements, including the output from the forecasting and co-ordination 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.

2.1.4 Workstream 3 - Testing and Trials

The purpose of the trials phase of the project is not 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. More information about the trials is given in section 2.3.

2.1.5 Workstream 4 - Collaboration and learning dissemination

The purpose of this work stream will be to manage initial stakeholder input to the project e.g. validating the requirements, design approach, trials design etc. including the co-ordination 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 and a more detailed explanation of our approach to learning dissemination and collaboration can be found in Section 5 of this document.

2.1.6 High Level Project Plan

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

Workstream	Description	H1 2018	H2 2018	H1 2019	H2 2019	H1 2020	H2 2020
Workstream 1	Forecasting Evaluation, Co-ordination and Requirements		Gateway Review 1				
Workstream 2	System Design, Development and Build				Gateway Review 2		
Workstream 3	Testing, Trials and Conflict Management					Gateway Review 3	
Workstream 4	Collaboration and Knowledge Dissemination						
Project Entire	Trials Phase						
LEM/Cornwall Energy Market	Trials Phase						

Figure 1: High-level project plan

2.2 Technical description of Project

Affinity Networkflow was initially used to support the Smarter Networks Storage project undertaken by UK Power Networks, as the Forecasting Optimisation and Scheduling System. AMT-SYBEX has further developed this solution building on the experience gained from that project and from detailed discussions with DNO's, suppliers and aggregators.

The existing forecasting module will be extended to enable a large degree of flexibility in specifying forecasting models. This will include user definition of the algorithms, data items, control models and forecast horizons. Thus, it will be possible to implement different models for different forecast horizons.

Affinity Networkflow already supports the optimisation of services for individual assets, but needs to be extended to model and optimise the potential network interventions to manage constraints. This is likely to involve new developments not already supported in existing power flow engines.

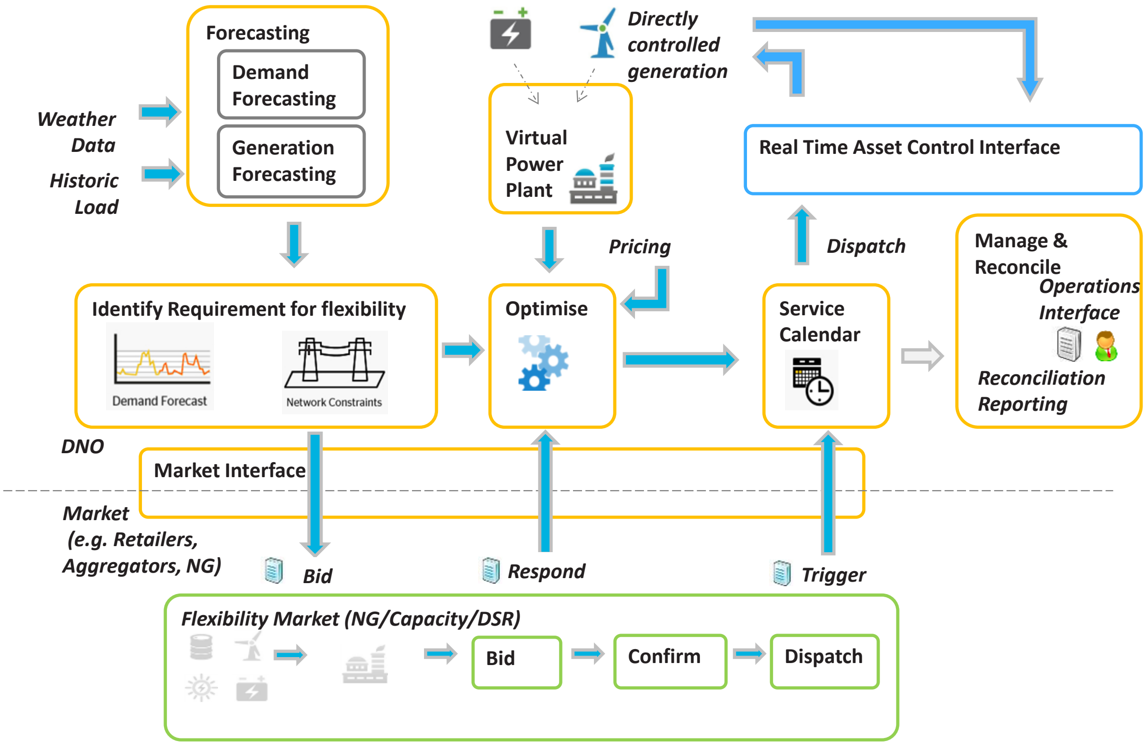


Figure 2: Our vision for a DSO flexibility Solution

Figure 2 depicts a conceptual model of what this project aims to achieve utilising Networkflow modules, existing WPD product capabilities and partnerships with other market participants that have a stake in the growing flexibility market. More details on the individual elements of EFFS are given in Appendix 13.

Figure 3 shows how the EFFS solution will be integrated into the current WPD estate.

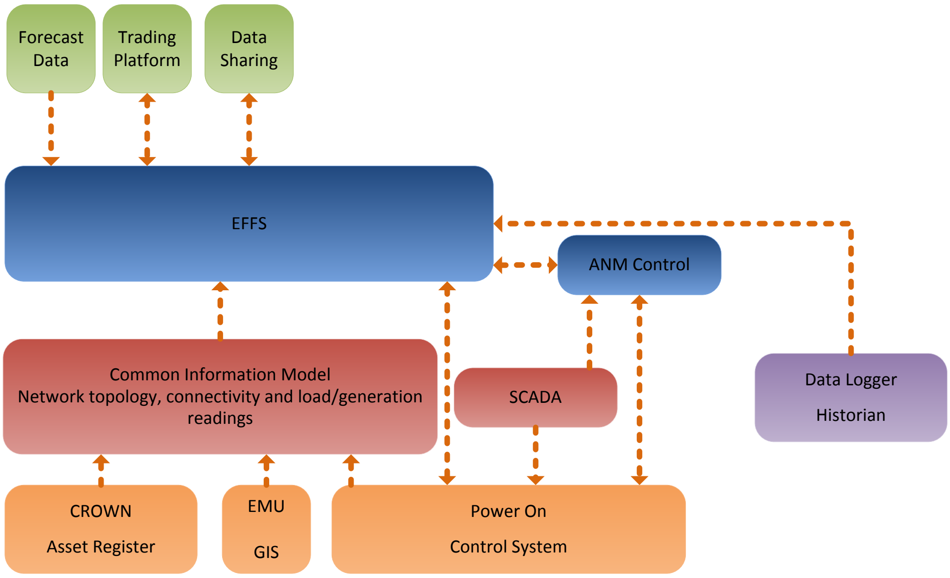


Figure 3: EFFS in the WPD Estate

2.2.1 Cybersecurity Arrangements

The need for cybersecurity for this type of deployment is essential as some assets are being directly controlled by the solution. To facilitate this, it is expected that EFFS will be an onsite installation within the WPD estate; this will minimize any potential attack surface and ensure that the product is covered not only by the robust data security protocols followed by the Capita group but also by WPD procedures.

2.3 Description of design of trials

The trials phase will:

- Measure forecasting accuracy
- Assess forecasting horizon suitability
- Measure asset response time
- Assess suitability of market & directly connected interfaces to assets
- Assess co-ordination method with other third parties (Suppliers, TSO, DSO)
- Assess energy delivery of assets upon service delivery
- Validate that the selection of flexibility assets by the software is optimal
- Compare the actual impact on the network to the modelled impact to inform strategies for flexibility service procurement and deployment
- Validate the expected operating costs of flexibility services.
- Provide output on the impact of flexibility on fault restoration to inform the P2/6 review.

To test these features comprehensively we believe it is necessary for the trials to cover:

- Different service provision technologies i.e. DSR, generation and storage
- Different generation technologies i.e. Wind, PV, CHP/other
- Different control options i.e. directly controlled or controlled via third parties
- Customers with / without existing control systems i.e. customers within an existing Active Network Management zone, or with soft intertrip or timed connections. Where possible, different types of control equipment performing the same function should be included in the trial.
- Different procurement methods or platforms i.e. via bilateral contract, flexibility services trading platform or another trading platform

- Multiple Network voltages (11kV,33kV or 66kV, 132kV)
- All Network types (Overhead and Ground Mounted/ Underground)
- Rural and Urban locations (which is likely to be covered by selecting appropriate overhead and underground networks)
- At least two areas with a high number of flexibility service providers to test optimisation.

We believe it is less important to ensure that trial design covers a range of geographic locations, seasons and variations of equipment scale.

We envisage that the trial site will be a composite of existing devices at sites recruited to support the Cornwall Local Energy Market project and Project Entire in the East Midlands, with input also coming from a third party supplier / aggregator. The trials would require the following types of asset/devices:

- Demand side response providers
- Flexible distributed generation units & energy storage devices
- Both PV and wind renewable generation
- One third party provider of services, with access to all of the above.

This asset/device type combination will allow us to test the major asset/device types in the context of the listed trial objectives. Including multiple sites for energy storage, distributed generation and demand side response is necessary to test that the directly connected interface is capable of communicating to many different control systems that administer these devices and the suitability of that interface. The third party provider of services is a different interface that allows the communication of a constraint requirement and allows the third party to respond. The inclusion of renewable generation allows us to carry out both interfacing and forecasting trial objectives as well as access to potential turn down services.

While the exact trial locations, site capacities and the functionality to be trialled will not be determined until later in the project, we are basing costings on approximately 40 locations with the assumption that recruitment costs will be low, that in the majority of cases existing communications equipment will be available. Some additional monitoring and communications equipment is expected to be installed but given the uncertainty of the trial requirements, it is reasonable to include a contingency reserve for the trial.

Having proven that the functions operate across a number of real sites, the software can be stress tested as a laboratory exercise for conditions that can’t reasonably be recreated as part of a physical trial. This would simulate an expected scenario for 2030 with much higher volumes connected generation, more challenging load profiles, reflecting future levels of EVs and heat pumps, but also with greater availability of flexibility services.

2.3.1 Forecast accuracy for constraints and generation

Accuracy metrics for each forecasting horizon will be established in the forecasting workstream. These accuracy metrics will then be used to evaluate actual forecasting that takes place and these will be compared to a baseline. Initial forecast validation can make use of any suitable existing WPD monitored locations. Once the trial locations are finalised the forecasting techniques will be applied and evaluated at those locations. Forecasting techniques developed at one location need to be able to be redeployed at other locations so it is likely that the initial evaluation will include a variety of WPD locations to test for sensitivity to factors such as scale, customer density, customer mix etc.

2.3.2 Suitability of configured forecasting horizons

Investigations will determine whether forecasting horizons:

- enable timely preparation and delivery of a flexibility response to constraints
- enable the timely changes to requirement with more accurate forecasting data
- fall in line with the current commercial agreements that deliver the flexibility requirement

2.3.3 System & Asset response time

This will be measured to ensure that the solution both from a software & hardware viewpoint is capable, of responding to a trigger for flexibility services.

2.3.4 Asset & market communication methods

The communication interfaces to facilitate flexibility service delivery either from directly connected assets or assets provided via a third-party interface will be assessed for their suitability. The focus is on the following areas:

- Is the flexibility service information provided by the directly connected or third party asset enough to ensure proper operation and delivery of the flexibility service?
- Is the flexibility service confirmation information provided by directly connected or third party assets enough to ensure the confirmation & accurate measurement of service performance?
- Is the flexibility service triggering and stand down notification provided by the interface functioning correctly and ensuring the delivery the desired outcome?

2.3.5 Co-ordination of service delivery between different parties

The schedule of all flexibility requirements will be shared with other third parties and the TSO, National Grid. This will be determined by the co-ordination workstream multilaterally by all relevant co-ordination partners. This mechanism will be measured against third party expectations for transparency and accuracy. Another element of this trial will test interoperability between our solution and other successful NIC funded innovation in the area of flexibility. To achieve this, we will validate any interface designs with the SGAM standard as being adopted by SSE & Scottish Power. The practicalities of measuring success will be further determined once design and interface documentation is made available.

2.3.6 Accuracy of reported energy delivered as part of service confirmation

This will be measured by comparing the timing and content of the service delivery confirmations to actual energy exchanges measured on the relevant localized area of the network. To facilitate this analysis all service confirmations either from directly connected or third party devices will be stored within the solution.

2.4 Changes since Initial Screening Process (ISP)

No material changes since submission of the ISP.

3 Section 3: Project business case

3.1 DSO transition

The way we generate, distribute and consume electricity is changing due to advances in technology affecting the entire electricity network. Generation is becoming cleaner and more distributed. Networks are becoming smarter and more active. Customers are beginning to benefit from an increasingly efficient and flexible system. WPD recognises that the change from a Distribution Network Operator to a Distribution System Operator is essential to driving performance and efficiency from the network and to ensure it can meet the future energy demands of all our customers. Their £125m[1] investment to transition to a DSO and the enhanced capabilities being developed will also give customers the freedom to access other opportunities within the developing energy system e.g. adoption of electric cars, low carbon heating and for further distributed generation.

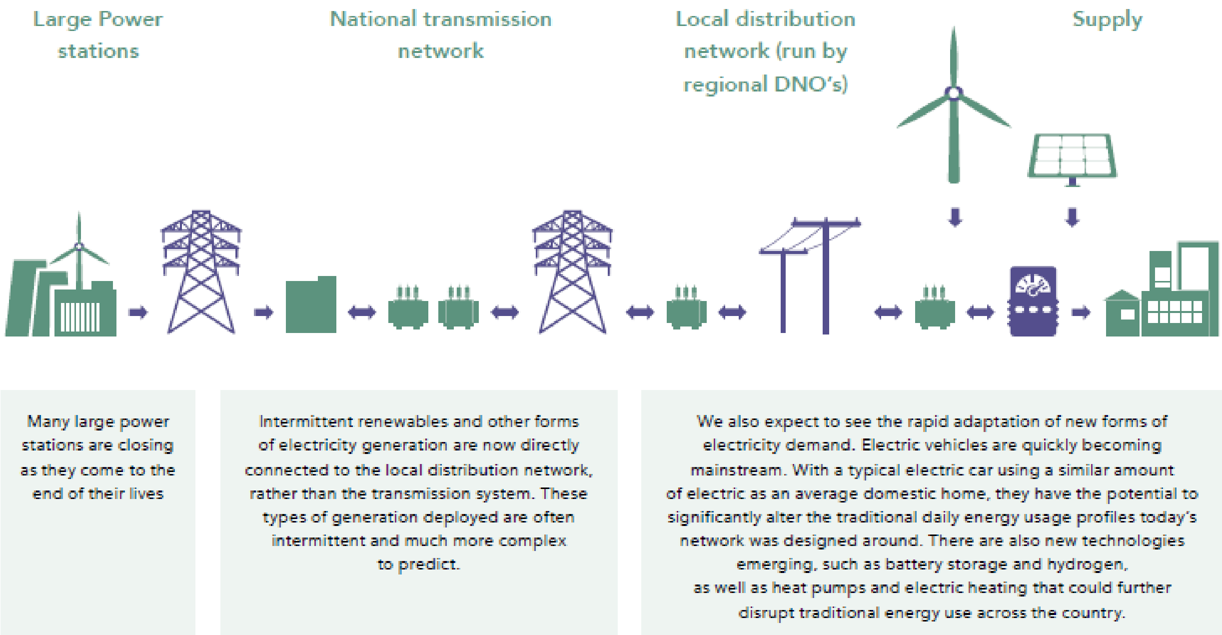


Figure 4: WPD Transition from DNO to DSO

WPD's DSO Transition Programme will focus on enhancing and developing key competences in the three core areas identified in their business plan that guide the existing delivery of the network – Assets, Customers and Network Operations. Although, as mentioned in section 2, there are still some gaps in our knowledge in terms of how we bring the various systems together. DNOS will carry out their existing functions and take on some new ones to:

- Develop and maintain an efficient, co-ordinated and economical system of electricity distribution
- Facilitate competition in electricity supply, electricity generation and flexibility services
- Improve the resilience and security of the electricity system at a local level
- Facilitate neutral markets for more efficient whole system outcomes

[1] WPD DSO Transition Document, June 2017

- Drive competition and efficiency across all aspects of the system; and
- Promote innovation, flexibility and non-network solutions.

As a DSO, WPD will have access to a portfolio of responsive demand, storage and controllable generation assets that can be used to actively contribute to both distribution network and wider system operation which allows them to build and operate a flexible network with the ability to manage load flows. The combination of a highly flexible network and access to demand and generation response allows the DSO to contribute to the increasing challenge of encouraging demand to follow generation. They will also have to consider distribution network constraints and the opportunities for using commercial innovations such as demand side response (DSR) in order to reduce the requirement for network reinforcement.

The DSO role may also entail closer interactions with the national electricity Transmission System Operator undertaken by National Grid, such as a responsibility to assist with balancing at a national level and despatching/ co-ordinating ancillary services such as reserve, frequency response, and voltage and reactive power management.

The development of the key DSO competencies is underpinned by a set of DSO Transition Principles as shown in Figure 5 below:

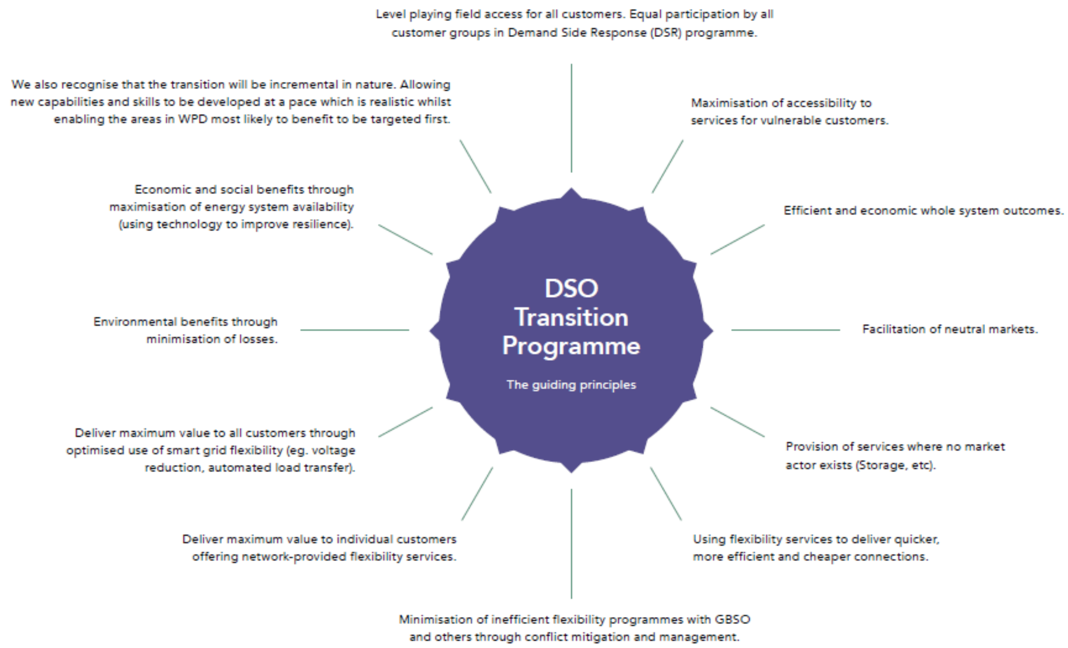


Figure 5: WPD from DNO to DSO Transition Design Principles

These new functions will in turn require new systems to support them. This project will explore in detail the additional functionality required as a DSO, to evaluate the potential options and implement systems that provide that new functionality with specific reference to, and focus on, the provision of an Electricity Flexibility and Forecasting System.

3.1.1 Electricity Flexibility and Forecasting System

Flexibility is the ability of a power system to maintain stability in the face of swings in supply or demand. Traditionally, flexibility was provided in power systems almost entirely by controlling the supply side at large power stations. The GB system has seen increasing shares of intermittent renewable generation requiring additional flexibility to maintain system reliability as the variations in supply and demand grew to levels far beyond what was originally conceived. This has led to the introduction of additional flexibility programmes by the TSO for short term reserve and fast acting frequency response services. As larger power stations continue to close and electricity generation becomes much more distributed much more flexibility will be needed across the whole system. This 'flexibility gap' will need to be covered by new flexibility options, much of which will be facilitated by a DSO. One aspect of this 'gap' is the requirement to deliver an Electricity Flexibility and Forecasting System.

3.2 Business Case

The project business case has two major components:

1. The savings from creating a tested template solution for DSO transition by validating the business logic and technology.
2. The savings from implementing flexibility services as a DSO

The first component allows for a smoother DSO transition, reducing the uncertainty, cost and timescales associated with each DNO separately identifying, implementing and testing required DSO functionality. The growing interest in storage and electric vehicles suggest that DNOs will have to act quickly to ensure the new functionality is available sooner rather than later.

The business case for implementing the DSO role, by adopting flexibility services reflects the background of challenging policies and rapidly evolving networks. The carbon plan and emissions targets have driven high levels of renewable generation, much of which is distribution connected. This in turn has created a need for significant levels of flexible capacity to provide the back-up required to manage the intermittent nature of renewable generation and to compensate for the loss of system inertia as traditional power stations are phased out.

The drive for increasing electrification of heat and transport will increase overall demand on the system including the exacerbation of peak demands.

DNOs therefore find themselves either having to carry out significant reinforcement, which may cater for peak conditions but have little utilisation at other times, or making greater use of flexibility services, to ensure security of supplies to customers at a lower cost.

Analysis by NERA[1] and Imperial College[2] suggests that the system integration costs for low carbon technologies are dependent on the level of system flexibility.

These benefits are explored in more detail in the following section which considers:

- Benefit 1 – Deferral or avoidance of traditional reinforcement
- Benefit 2 – Additional flexibility in fault restoration
- Benefit 3 – Reduced balancing costs via co-ordination with SO
- Benefit 4 – Increased / faster renewables connections

These benefits would not be available to the system without a fully integrated EFFS capability.

Benefit 1 – Deferral or avoidance of conventional reinforcement for a period of time will save money.

Work undertaken by UK Power Networks as part of the Smarter Network Storage project established that 10.8% of the 4,800 primary substation groups across GB could benefit from flexible solutions, notably DSR and storage, enabling on average 3MW of traditional reinforcement to be deferred for up to 10 years.

It is therefore reasonable to argue that over 10 years £51.1m (10% of the expected general reinforcement cost within WPD at 2017/18 costs) of conventional reinforcement could be substituted with a smart flexibility services capability as the EFFS method will provide if rolled out across the WPD licensed areas. The analysis undertaken and provided in Appendix 1 shows that savings of £33.8m in the 10 years to 2030 would be generated and £71.6m by 2050. By rolling this method out across the whole of the GB network would deliver savings of £114.4m by 2030 and £242.6m by 2050.

3.2.1 Benefit 2 – Additional flexibility in fault restoration

In areas where the EFFS system and method have been rolled out and delivering benefit as above, an additional benefit available to the network will be the option to make use of available local flexible capacity following a network fault. Ordinarily when a fault occurs at a local substation, network engineers will look to restore network capacity by reconfiguring the network through switching operations. Here, suitable flexible capacity would be utilised in addition to these switching routines in order to restore customers as quickly as possible. Using available flexibility in this way, by using generation and DSR to restore networks that would otherwise not be restored until repairs were complete, would improve restoration times. This may be especially pertinent in extreme cases where the number of concurrent faults exceeds the design assumptions. It is hoped that the high-volume testing of the EFFS system, a bench exercise including many simulated flexibility service providers, can give insights into the impact of differing levels of flexibility on restoration times to inform the potential review of p2/6 to consider the impact of flexibility services.

3.2.2 Benefit 3 – Reduced balancing costs via co-ordination with SO

The EFFS system and method will share all trigger and arming notifications with National Grid, the National Transmission System Operator (SO) and potentially to any other party purchasing flexibility services that might be affected by DNO operations. The benefit of this will be to ensure that any conflict between the TSO and the DSO are managed. This will ensure that the TSO does not attempt to call on ancillary services that would create or worsen a constraint for DNOs. Resolving conflicts should minimise the overall costs for the system.

In addition, it will also ensure that services are not called that might have a major impact upon the flexible capacity requirement of the DSO. For example, the TSO looking to manage national system frequency within a zone which is significantly capacity constrained could be very costly and may either result in a greater call on flexibility reserve or an ineffective management of system frequency. At present it is difficult to know the exact potential for conflict between DSO and other flexibility service users and this work will clarify the position and therefore the estimate of benefits. Anecdotal conversations have suggested that in the Netherlands requests to use the same asset, were relatively frequent and that where the same asset was being sought by multiple parties, it was about a 50/50 split between the two parties wanting the asset to operate in the same way and wanting to operate the asset in different directions.

3.2.3 Benefit 4 – Increased / faster renewables connections.

The use of flexibility services via the EFFS method and system to facilitate customer connections could greatly increase both the speed and cost of providing the necessary connection. Where a connection requires additional substation capacity, conventionally a substation upgrade would be required. For example, a new or upgraded transformer. Using flexibility services might avoid this work for a period of time.

3.3 References

1. Nera Economic Consulting and Imperial College London, *System integration costs for alternative low carbon generation technologies – policy implications,* October 2015
2. Imperial College London and Nera Economic Consulting, *Value of flexibility in a decarbonised grid and system externalities of low-carbon generation technologies,* October 2015

4 Section 4: Benefits, Timeliness, and Partners

This section demonstrates how the Electricity Flexibility and Forecasting System (EFFS) meets the evaluation criteria for NIC projects as set out in the Governance Document.

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

The UK Government aims to reduce carbon emissions by 80% by 2050, a significant and challenging target which will require extensive changes to the ways in which electricity is generated, distributed and utilised across the UK. Most recently in July 2017, the UK Government have also published a long-awaited response to the joint BEIS and Ofgem Call for Evidence published in November 2016. This sets out a Smart Systems and Flexibility Plan which makes clear the need and importance that the development of an Electricity Flexibility and Forecasting System will have in helping GB achieve this plan. In addition, in recognition of the need to improve the environment the UK Government have also published plans that propose that no new petrol or diesel cars will be sold after 2040. The effect of this will lead to an overwhelming number of electric vehicles being sold which will add significantly to the demand peaks seen on our distribution networks. The need for DNOs to transition to DSO by means of actively managing their networks using flexibility services will be needed more than ever.

Under the Carbon Plan, the UK aims to deliver 30% of its electricity generation from renewable sources by 2020. This target is one of the three pillars of the Government's approach to meeting the European Union's wider renewable energy target of sourcing 15% of the country's energy from renewable technologies. Running parallel to this are sub-targets of 10% and 12% renewable generation for the transport and heating sectors.

Here, we demonstrate how the EFFS can:

- Aid the UK in meeting its challenging decarbonisation and emissions reduction targets
- Deliver savings to the electricity network and customers with regards to generation, consumption and balancing costs
- Facilitate the DNO-DSO transition through the development of a system to support the new functions undertaken by DSOs

4.1.1 Reducing carbon emissions

The availability of Low Carbon Technologies (LCTs) to the distribution and transmission networks has increased significantly in recent years.[1] This increasing level of intermittent generation on the network will help contribute to the Government's Carbon Plan decarbonisation and renewable energy targets. However, to do so it will be vital to utilise the newly available low carbon generation in an optimal and efficient fashion when it is available. EFFS enabled distributed flexibility services will provide peaking capacity on-demand when required, serving to reduce the degree of curtailment needed by the distribution network and allowing low-carbon electricity to be utilised more effectively across the network.

Beyond this, the greater utilisation of LCTs and renewable generation will lead to displacement of more carbon intensive sources of peaking generation, aided by reductions in conventional LV reinforcement spurred by the availability of flexible distributed energy and the potential for demand management provided by these sources. These factors will stimulate the decarbonisation process and lead to significant emissions savings to the UK network. Work undertaken by UK Power Networks on the Smarter Network Storage LCNF project confirm these benefits accumulate on a site-by-site basis as increasing numbers of flexibility services are connected to the market. Based on our analysis of these reduced emissions, it is estimated that 630MW of capacity shortfall could be delivered using flexibility services by 2050, as enabled by this project, this would provide 19,467 tCo2e emissions savings over the period.

4.1.2 Delivering national energy security

Nationwide deployment of the EFFS approach can support the UK's energy security policy. A market for flexibility will deliver a diverse portfolio of technologies which are competing against each other for market share, driving cost reductions and innovation. The distribution-connected flexibility services enabled by the EFFS will enable flexibility services to contribute to balancing the system and maintaining secure supplies. In addition, the learning achieved and disseminated during the project will also support commercial and regulatory evolution, encouraging wider adoption of the approach and delivering performance and cost reductions as its presence increases within the marketplace.

4.1.3 Balancing the electricity system

The EFFS project will demonstrate how flexible services can provide a range of services to different parties at short notice to help with balancing. The learning from this project will help to inform the design of new market products for balancing at the transmission level, as well as those that may be needed at the distribution level, and inform ongoing reviews of regulatory arrangements, such as the Electricity Balancing Significant Code Review. The requirements and therefore value of flexibility in the future is likely to increase due to the intermittent nature of wind and solar, or a greater proportion of inflexible nuclear. In addition, once decarbonisation of the supply system has occurred, the flexibility services will operate on decarbonised electricity, hence further reducing the carbon content of the system and further reducing the necessity of wind curtailment.

4.1.4 Net benefits to customers

Increasing the market for flexibility services and enabling coordinated use by multiple parties will reduce balancing costs across the system. NERA and Imperial College's report for the Committee on Climate Change suggested that the system integration costs for low-carbon generation technologies is significantly dependent on the level of system flexibility. At an average grid intensity of 100g CO2/kWh these benefits are in the order of £3-4bn per annum but at the lower intensity of 50g CO2/kWh benefits are in the order of £7-8bn per annum. It found that increasing flexibility was a low-regrets option reducing the overall costs even in systems with low levels of decarbonisation.

As presented in the business case section 3, the EFFS method is estimated to provide a net benefit of £242.6 million over the business as usual approach out to 2050. Further details of the financial benefits of EFFS are further described in Appendix 1.

4.1.5 Flexibility services can support balancing of the electricity system

The EFFS project will demonstrate how flexible services can support the balancing of the electricity system through the provision of a range of services to various parties at short notice. Learning gained through this project will guide the design of new market products for balancing at the transmission and distribution level, and inform ongoing reviews of regulatory arrangements. As intermittent generators become a more prominent presence on the network, the need and therefore value of flexibility will increase. Furthermore, once the network is decarbonised, flexibility services will operate on decarbonised electricity - further reducing both the carbon content of the system and the necessity of wind curtailment.

4.1.6 Facilitating the electrification of heat and transport

The electrification of heat and transportation is another area of the Carbon Plan which distributed flexibility services are uniquely placed to help address. The Carbon Plan specifies that 'achieving a cut in building emissions to virtually zero by 2050 will only be achievable if we decarbonise our supply of heat and cooling as well as reducing demand'. By enabling flexibility services to be used as an economic alternative to reinforcement, EFFS will facilitate the electrification of heat and transport, both in terms of cost and timing.

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

The benefits section has explained the potential savings that will result from deferred or avoided reinforcement which will benefit customers. We have designed the project to ensure the project delivers the greatest value for the lowest cost.

This is achieved by:

- Building on previous project work wherever possible
- Allowing for collaborative working where this can improve output quality or reduce costs
- Building on an existing software tool which includes core functionality
- Minimising the trials phase to that which is required to demonstrate the functionality
- Use of competitive tendering
- Partner contributions

4.2.1 Building on previous projects

This project will build on the learning provided from previous LCNF / NIA projects to ensure value for money is provided to electricity distribution customers. Details are provided in Appendix 11.

4.2.2 Collaborative working

Our project objectives align with two other NIC projects proposed under this year's competition: Fusion from Scottish Power (SP) and Transition from SSE. To deliver best cost and operational efficiencies, we will collaborate with these entities during the delivery of the EFFS project in several areas:

- **Specification of the DSO functional requirements and the data interface specifications**; we will work jointly with SSE and SP to provide a single, unified set of outputs in these areas to avoid developing competing views. Delivery of the specification piece will not complete until the ENA workgroup has delivered their output, and thus we do not envisage a delay to the proposed project timeline as a result of this work.
- **Trial planning**; we will work together with SP and SSE during the trial planning stage to ensure that the trials produce unique outputs with no overlap across projects, creating a comprehensive set of learning outcomes. Trials will be run independently by each DNO, with no impact on the proposed start time for each project. Where trials require the testing of data exchanges between different systems, we will coordinate with the relevant DNO to ensure these trials are

undertaken concurrently. Details of these trials can be found within the project plan in Appendix 7.

- **Learning dissemination**; where we have collaborated in the delivery of certain project activities, we will aim to coordinate the dissemination of any learning arising from these same activities. This applies particularly to the specification of the DSO functionality, data interface specification, and cross-project trial results as detailed here. Our learning dissemination approach is detailed in Section 5.

Coordination across these areas will result in cost savings to the project through the use of shared resources in the trial planning and learning dissemination stages. In addition, it will deliver enhanced value for money to distribution network customers through the avoidance of duplication at the trial phase and a widening of the project learning outcomes.

4.2.3 Building on an existing software tool

To deliver operational and cost efficiencies, we will utilise an existing forecasting and optimisation product as the foundation of the EFFS system. Further academic and development work will be undertaken to tailor the product to the requirements of the current project and ensure it provides the functionality outlined in the ENA's DSO transition workshop. Key outputs in terms of algorithms and methods used will be published for use by the wider industry.

The EFFS will be built upon the existing AMT-Sybex Affinity Suite of products, which are already in widespread use across the GB and Irish energy markets. This suite contains a dedicated energy services forecasting and optimisation product, Affinity Networkflow, which will comprise the foundation of the EFFS product. This product has already been successfully trialled within an optimisation context as part of the UKPN Smarter Network Storage LCNF project. As such, it already comprises a significant portion of the functionality required by the EFFS, and will provide the forecasting / optimisation mechanisms, a flexibility requirements identification process, virtual power plant functionality, and a management and reconciliation module.

Further development work will provide the additional functionality required to meet the objectives of the current project. This comprises:

- Forecasting algorithm – Networkflow will be updated to include specific demand forecasting algorithms recommended from the academic evaluation undertaken by the Academic Partner.
- Optimisation mechanism – the existing optimisation mechanism will be updated to accommodate the specific requirements of the project.
- Market interface – the mechanism for market interactions (issuing of requirements for flexibility to the Market), the associated tendering process and market participant notification system will be designed during the project and published for use by other IT vendors. This interface will be implemented in the product
- Asset/Device interface – the interface used to send details of the service calendar down to individual assets will be developed during this project. This will be via an integration Hub provided by Smarter Grid Solutions as part of their existing ANM Strata product offering.

Given the degree of existing fit and alignment with the product strategy for Networkflow and associated investment plan from AMT-SYBEX, utilising this product will serve to avoid development costs and limit implementation costs which would otherwise be incurred during the build of a bespoke product.

4.2.4 Minimising the trials phase

The scope of the trials has been deliberately focused on proving the functionality of the software system, rather than answering other questions relevant to flexibility – for example, the reliability of customer responses, the most appropriate market structures, etc. These questions are currently under investigation by existing, ongoing innovation projects and to cover these same areas would be unnecessary duplication. Please see Section 2.3 for more detail on the trial design.

4.2.5 Use of a competitive tender process

As part of the pre-bid planning process, a role for an additional academic supplier has been identified to deliver the necessary forecasting evaluation algorithm study work which will provide the foundation for the EFFS. To recruit this additional expertise to the project, the Project will undertake a comprehensive and competitive tender process, identifying and procuring the most economically-advantageous tender and securing the necessary expertise required to deliver this project. In doing so, we will ensure that the most appropriate solution is selected and implemented, helping to reduce the project budget by driving cost-efficiencies within the supply chain.

We will hold a full Request for Proposal (RFP) external tender for the academic work following the submission of this Full Submission Pro-forma. A draft RFP and Statement of Requirements has been drawn up.

In addition to this:

- The Project will follow the EU Directives and the Utilities Contract Regulations 2006 (UCR). Procurement over the EU threshold will be in line with these.
- The Project will allow for negotiation to take place with potential suppliers during the tender process, ensuring that best value for money is achieved at all times. The Project aims to award a contract to the “Most Economically Advantageous Tender”, to ensure performance of the product as well as the best price.

4.2.6 WPD track record

WPD has been involved in the NIC (and its predecessor, the LCNF) since its outset, and maintain an impressive track record of previous and ongoing projects. We have successfully completed four LCNF Tier-2 Projects: LV Network Templates; Sola Bristol; Lincolnshire Low Carbon Hub; and Falcon. There are currently two on-going projects: FlexDgrid and Equilibrium.

WPD has a proven track record in turning Innovation into Business as Usual. This is demonstrated by the following, which have already been rolled out across the business:

1. “Policy Relating to Revision of Overhead Line Ratings” – including the introduction of rating based on real-time weather data and a policy for applying it to other 132kV OHLs;
2. “Policy Relating to the Retro-Fitting of Monitoring Equipment in Live LV Cabinets” – A policy for how and when to fit monitoring equipment to LV cabinets, increasing the visibility of the LV network where new LCT are installed;
3. “Policy Relating to Automation Scheme Communication Design” – A policy outlining the communications solutions being deployed by WPD, supporting smart grids;
4. “Policy for Specification, Operation, Control and Maintenance of DStatcom” – A policy outlining how a Statcom is used in an existing distribution network;
5. “Policy for Alternative Connections including Timed, Soft intertrip and ANM” – A policy outlining how alternative connections are offered to DG customers;

These demonstrate how previous investments through innovation are leading to business change.

4.2.7 Funding and expected benefits

The NIC funding request for the EFFS project is £2,942,700.

Benefit to funding request ratio –: total benefits of rolling out method across network (£) / funding request (£) is 82.44

The following table provides a breakdown of the costs for each project phase. Further details are contained in the full costs spreadsheet that may be found in Appendix 14.

Costs (£k)	PM & Audit	Mobili-sation	WS1	WS2	WS3	WS4	**Sub-Total**
Labour	197.78	7.18	21.53	47.46	105.89	17.58	397.42
Equipment					40.0	28.0	68.0
Contractors	409.39	140.42	421.25	809.5	724.14	353.16	2857.86
IT		562.50		92.8	109.52		764.82
IPR Costs							
Travel & Expenses	19.78	0.72	2.15	4.75	10.59	1.76	39.75
Payments to Users							
Contingency	12.15	0.72	10.4	27.95	25.26	25.39	101.87
Decommission							
Other	81.96						81.96
Total (£k)	721.06	711.54	455.33	982.46	1015.4	425.89	4311.68

Table 1: Total costs for each project stage

Note: There may be some rounding differences between this table and the full cost spreadsheet due to the formulae used.

4.2.8 Summary

The EFFS project will deliver estimated benefits of approximately £242.6m, from a project that will cost £4,311.68k to run, but for which funding of only £2,942.7k is sought, with potential to reduce costs further dependent on the impact of collaboration and input from other concurrent projects. This represents very good value for money for the customers who ultimately fund these innovation projects.

4.3 (c) Generates knowledge that can be shared amongst all relevant Network Licensees

The EFFS project will deliver a significant uplift in our understanding of flexibility systems and their integration with the electricity network. In particular, the learning derived from this project will be directly relevant to DNOs currently preparing for the shift to a more active role within the electricity system, helping to facilitate their evolution into a DSO. This learning will potentially comprise:

- Learning on large-scale deployments of flexibility services such as operating profiles and impacts on networks when flexibility is leveraged across the system
- Experience in advanced IT platforms to manage flexible assets on the network
- Learning around the commercial arrangements that are necessary to underpin the shared use of flexibility, and the potential business models that will interact with DNOs
- Learning around the means in which DNOs can improve the economic value of flexibility assets and how this might support the use of flexibility in future investment plans

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

The transition from DNO to DSO cannot be described as business as usual, but rather is a moment of evolution in the history of distribution networks as they adopt new roles.

The EFFS project will expand on the technical learning from existing LCNF and NIA projects, such as Entire, Plugs and Sockets, and Smarter Network Storage, and will deliver a DSO support system to a market where no such system yet exists.

The range of operational activities expected to be undertaken by DSOs during the transition to a smarter grid is extensive. Output from recent Electricity Networks Association (ENA) workshops lists 9 functionalities and system requirements that DNOs will have to adapt to provide in order to function effectively. At present, there is no single software product or system within the marketplace that supports the delivery of these functionalities. Whilst systems for asset management, GIS or control systems are available as off-the-shelf, items, this is not the case for DSO support. As such, this project will both explore the additional functionality required by DSOs to operate effectively within the electricity network, and also develop and implement new software, equipment and novel operational practices to support the operation of the electricity transmission and distribution system.

The innovation within the EFFS project are the algorithms, interfaces and design models for this support system. During the initial forecasting evaluation phase, investigative work undertaken by our academic partner will determine the forecasting arrangements for short term and near real time forecasting. The processes and procedures that are identified in this forecasting evaluation work will inform the requirements design for the flexibility system and also help identify the optimal arrangements for coordination and conflict resolution with other parties utilising flexibility services. This work will be publishable and will be disseminated amongst the industry to ensure learning from this project reaches relevant industry stakeholders. The outputs from this activity will be combined with learning from the ongoing Energy Networks Association (ENA) DSO transition workshops to ensure the system meets the emerging demands of the industry. This project will therefore demonstrate the most cost effective, replicable way to integrate systems to unlock the value of flexible networks.

As no comparable off-the-shelf flexibility system yet exists in the marketplace, the EFFS will represent an entirely novel approach to managing flexibility within the electricity network. Given this, there is currently no available data on which to build a business case to adopt this software and the operational processes it supports. Implementing this software in a Business as Usual context would involve accepting significant commercial risks, and a risk to participating customers rendering the project unfeasible without direct funding.

4.5 (e) Involvement of other partners and external funding

4.5.1 Partners

WPD's website www.westernpowerinnovation.co.uk sets out the work being delivered through the LCNF / NIC and provides contact details.

WPD followed the now-established process for selecting ideas for the ISP. An external call for NIC proposals was undertaken at the start of the year, from which twelve submissions were received. From this pool, WPD shortlisted six potential projects for further consideration based on their quality, estimated value and perceived innovativeness. A second evaluation process identified a single candidate for progression to the Initial Screening Phase stage.

WPD's evaluation process tests:

- The quality of the idea;
- How well developed the idea is;
- The quality of the documentation / research
- The value the Solution may deliver;
- The appropriateness for NIC (particularly the scale of the project);
- How likely it is that the Solution would become a normal business solution (for example, ease of implementation and need for legal or regulatory changes);
- Project risk; and
- Timeliness

The EFFS project was developed from concepts identified and submitted by AMT-Sybex and, being successful at ISP stage, was selected for development at the FSP stage after careful evaluation and challenge by WPD Senior Management.

Following the decision to take forward the EFFS project, a number of partners have been selected to ensure the required expertise and experience is available to this project.

Additionally, as described above we will issue a competitive tender for the specialist academic services needed to support the development of the EFFS product.
This service will be procured in line with WPD's standard procurement principles.

A summary of the project partners is provided in Section 6.1.2.

4.5.2 External Funding

Reflecting the benefits in an innovative project that will help drive forward the adoption of flexibility services, project partners are contributing approximately £1,339.85 to the project. Further details about partners' contributions are included in Appendix 14 (Full Submission Spreadsheet).

Key supporters of the project include Centrica and UK Power Networks. Letters of support for the project are provided in Appendix 12.

4.6 (f) Relevance and timing

In its position paper from September 2015, titled "Making the electricity system more flexible and delivering the benefits for consumers", Ofgem sets out its plans for delivering a new energy system where 'generation is distributed and more variable, where consumers can better monitor and manage their energy use, and where new technologies and business models are emerging'.

The relevance has been confirmed by the publication of the Ofgem / government document in July 2017 entitled "Upgrading our Energy System : Smart Systems and Flexibility Plan". This highlights the need for DNOs to make swift progress towards opening up the markets for non-network solutions.

Flexibility services are the cornerstone of this new energy market, providing smart reinforcement to the network, enabling cheaper and more timely connections, and enabling more efficient resolution of network issues. Given this, Ofgem are committed to driving uptake of flexibility within DNOs as a priority action in order to deliver 'significant cost savings, both for the decarbonised electricity system, and for individual consumers'.

EFFS is therefore both timely and highly relevant to achieving the outcomes already recognised as being vital to the efficient operation of the electricity system as a whole.

4.6.1 Base Case Cost Selection

The base case cost has been taken to be the planned cost of reinforcing a primary substation group on the WPD network resulting from load growth on the network. Work undertaken by UK Power Networks on their Smarter Network Storage project identified that 520 primary substations or 10.8% of the 4,800 substations across GB could benefit from flexible solutions and that each reinforcement requirement would have on average a shortfall of 3MW.

Using data from the WPD business plan published in 2014, adjusting to 2017/18 costs and factoring in the Smarter Network Storage learning, over £[redacted] would be spent on this form of reinforcement each year for the 8 years of the ED1 period. It has been assumed that this level of reinforcement would be required of the following price control periods up until 2050. Assuming this annual spend represented 2 such projects with a shortfall of 3 MW, per year projects a total base cost of £[redacted] required to conventionally reinforce 60 sites across the WPD licensed areas up until 2050. By proportioning up, a GB wide cost across all 14 licensed areas over the same time frame would cost £[redacted] assuming 210 sites of the estimated 520 sites possible. A summary of the NPV analysis is contained within Appendix 1.

4.6.2 Capacity Released

The total capacity saving on the network is given in Appendix 2. This has been based upon an average expected saving of 3 MW per investment scheme site which is being reinforced by means of flexibility services rather than conventionally. Assuming 210 sites across GB gives a saving of 630 MW.

However, conventional reinforcement does not work in such small steps. Instead when the network is reinforced, even if the predicted shortfall is 3 MW over say 10 years, a substation will require a whole new transformer. This may be either a new upgraded replacement transformer or an additional transformer. Also, incoming and outgoing circuits may also require replacement or additional circuits may be required. For example, a new 38MW or replacement 38MW transformer in place of a 23 MW. Either way, additional capacity of 8 or 10 times the nominal requirement may have to be installed.

Therefor the nominal capacity saving on the network on a GB rollout scale is 210 MW to 2030, 420 MW to 2040 and 630 MW to 2050, as given in the table Appendix 2, however in reality may release 8 or 10 times this in practice.

4.6.3 Carbon Benefits

Work undertaken by ENW on their Capacity to Customers (C2C) project[2] gave a total saving of 92.7 tCo2e for each new 38 MVA transformer saved be not being installed. It also reported that a saving of 32.8 tCo2e was achieved for each kilometre length of 300mm Al cable saved.

The carbon savings figures given in Appendix 3 have been calculated on an assumption that each site reinforced by flexibility services, in place of conventional means have saved on the need to install one 38 MW transformer, or an equivalent in carbon terms of using 300mm Al cable. In practice, both are likely to be required and therefore the figures calculated have been conservatively estimated and are very likely to be vastly understated. On a GB rollout scale carbon savings were estimated to achieve 6,489 tCo2e by 2023, 12,978 tCo2e by 2040 and 19,467 tCo2 by 2050.

4.7 References

3. Department of Energy and Climate Change (DECC), Digest of UK Energy Statistics (DUKES), *Plant installed capacity, by connection - United Kingdom (DUKES 5.12) (MS Excel spreadsheet)*, July 2015
4. Imperial College London and Nera Economic Consulting, *System integration costs for alternative low carbon generation technologies – policy implications,* October 2015

[2] Capacity to Customers, carbon Impact Assessments Scenario Results by Dr John Broderic, report published February 2015

5 Section 5: Knowledge dissemination

5.1 Learning generated

This project will provide extensive learning opportunities for DNOs, aggregators, suppliers, the TSO, academia, and other key stakeholders such as the ENA, ETI, BEIS and Ofgem. A learning and dissemination work stream has been established to ensure effective learning, capture, translation and dissemination. This work stream will focus on both internal and external learning and dissemination activities and builds on the experiences and best practice emerging from prior LCNF and NIC projects. The additional learning that EFFS will deliver is provided below.

5.1.1 Incremental learning

New knowledge will be generated across a wide variety of areas, all of which will positively benefit relevant stakeholders and the industry at large. Specific instances of incremental learning developed as a result of this project include:

- A novel and innovative demand forecasting methodology, accuracy, approach and application to flexibility services
- Further insight into DNO-SO coordination and conflict avoidance strategies
- Development of interface protocols to 3rd parties working collaboratively and jointly with other DSO projects under a natural party e.g. the ENA
- Additional DSO system requirements
- The integration of a flexibility management system, working and operating as per specification

5.1.2 Applicability of new learning to other Network Licensees

All DNOs are facing the same challenge of DSO transition, so learning will be widely applicable. The project includes analysis of functional requirements and existing standards which will be highly relevant to other DNOs.

Similarly, the investigation of optimal forecast timings and whether simplified analysis methods can be used in preference to full optimised power flow analysis is practical knowledge that can be used by all DNOs.

The project aims to make use of standardisation and modular systems to maximise the potential for adoption by others.

5.2 Learning dissemination

Our high-level approach to delivering the learning objectives of the EFFS project is demonstrated in Figure 6 below:

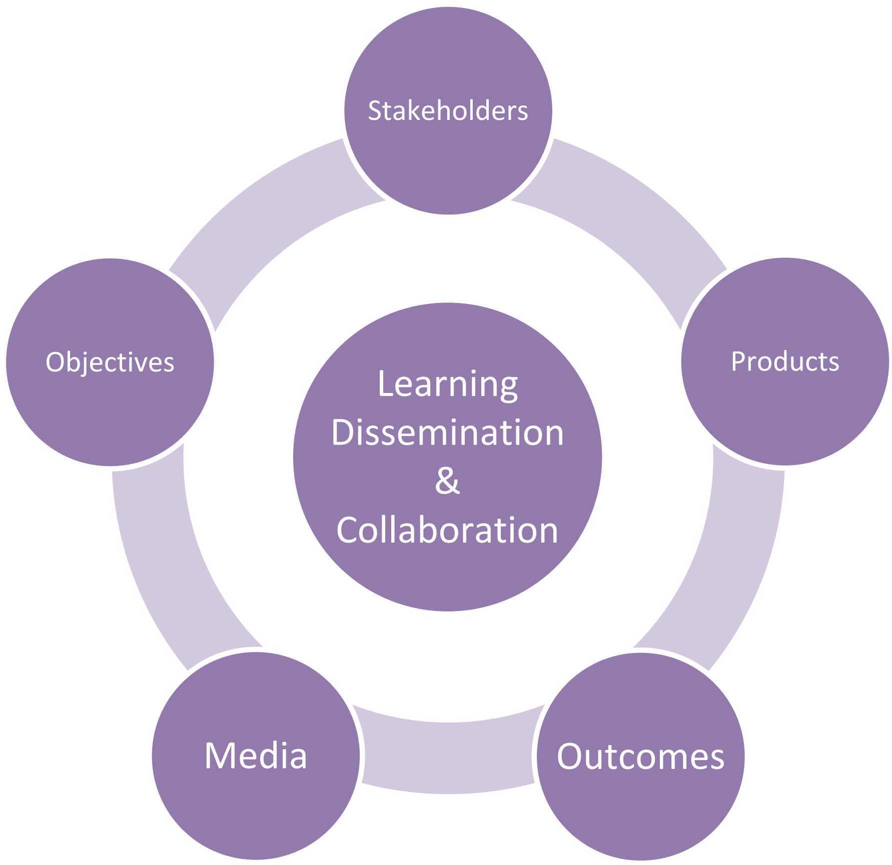


Figure 6 - Dissemination approach flow diagram

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:

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 web site
- 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

5.3 IPR

5.3.1 Conforming to default IPR arrangements

The project will conform to standard NIC IPR requirements, and a Memorandum of Understanding has or if not yet appointed, will be signed with each project partner that reflects acceptance of these arrangements in full.

5.3.2 Background IPR and Commercial Products

For the avoidance of doubt, the algorithms developed for the EFFS system in the project will be freely disseminated, and implemented using an existing core product of AMT SYBEX. Any development of this product is being undertaken and funded in full by AMT SYBEX. This core product is already commercially available for other DNOs, and will continue to be available for use by other DNOs after the end of the project incorporating the algorithms developed.

6 Section 6: Project Readiness

6.1 Evidence of why the Project can start in a timely manner

The following key focus areas provide the evidence that this Project is ready to start in February 2018:

1. Senior Management Commitment
2. Key Project Partners and Contractors Are Engaged for the Provision of the Overall Solution
3. Experience of Partnership Working
4. Experience from Relevant Projects
5. Project Structure & Governance
6. Project Planning
7. Flexible Implementation Methodology
8. Experienced Project Delivery Team

The following sections explain these elements.

6.1.1 Senior Management Commitment

Directors' from both WPD and AMT-Sybex are fully engaged with the **EFFS** Project, having been involved from project inception and throughout the entirety of the bid process. The Boards of both organisations have been briefed on the Project, its scope and drivers. In addition, a Collaboration Agreement has been signed between WPD and AMT-Sybex, which signifies a solid commitment by both parties.

As WPD is chairing the ENA Workstream 3: DNO to DSO Transition, the EFFS project will be in a good position to recognise its outputs.

To support and enable the project to start in February 2018, whilst ensuring continuity, key personnel of the bid team will transfer into the project delivery phases. This will help mitigate the risk of losing project knowledge and relationships that have been built with project partners gained through the bid process.

6.1.2 Key Project Partners and Contractors Are Engaged for the Provision of the Overall Solution

The key project partners for the EFFS project are engaged and ready to mobilise following project award, subject to project direction requirements. Descriptions of the project partners are detailed below.

Western Power Distribution: WPD has an excellent record for key performance indicators including network reliability, outperforming the targets for customer interruptions and customer minutes lost and customer service, where it ranks highest in customer satisfaction.

WPD manages a diverse portfolio of innovation projects and has recently been praised by Ofgem in a review of the tier 1 portfolio. WPD's previous tier 2 projects have created useful learning that has been adopted within new policies that are now part of business as usual.

AMT-Sybex brings significant experience in providing leading-edge software solutions to the utilities sector and will provide and configure the Energy Flexibility Forecasting System for the project. AMT-Sybex will also project manage the delivery, from mobilisation through to the final learning dissemination and project closedown report.

An **Academic Partner** with appropriate expertise of forecast algorithms and modelling will be appointed to carry out the forecasting and conflict avoidance evaluation study, and provide significant input into the design and learning dissemination for Learning Phase 1. Selection of this partner will be via a competitive RFP tender process to ensure wide awareness of the project and best value for this critical element.

A communications interface provider will provide a provide multi-interface capability based on their Active Network Management technology. This will be of value during the trials to demonstrate an interaction between flexibility services and existing systems for Active Network Management.

National Grid as TSO will engage in conflict management and trial interface activity, as well as providing input into stakeholder reviews of the DSO functionality, data exchange formats etc.

An aggregator/supplier will be appointed as a project partner in order to provide access to flexibility services, for example Demand-Side Management, storage or plants required during the trials. They will also be expected to provide experience and familiarity with the commercial and technical issues of aggregators, which will influence their interactions with DNOs.

To ensure the EFFS project starts in a timely fashion and with the full support of all the project affiliates, WPD has engaged in significant partner preparation to secure appropriate commitments. A project collaboration agreement has been signed with AMT-Sybex. Memoranda of Understanding / letters confirming participation are in place with National Grid, and with an aggregator / supplier. In addition, we have formulated the project costs based upon a framework agreement that it has in place with Smarter Grid Solutions, although this will not preclude using an alternative provider if better value for money could be achieved. To ensure the competitive tender process for the selection of the Academic Partner goes ahead in a timely manner, we already have a draft RFP and Scope of Work for the forecasting evaluation activity for the start of the project.

We also have letters of support from Centrica, endorsing the project's aim to build on the Cornwall LEM output and from UK Power Networks, see Appendix 12.

6.1.3 Experience of Partnership Working

AMT-Sybex's success over the last 25 years is built upon working in partnerships with its clients in long term relationships. The nature of these partnerships is diverse and they bring a depth of experience to mould the style of working to deliver the best outcome.

AMT-Sybex has a strong track record of bringing innovative and widely adopted enterprise IT systems to market with localised support of UK specific utility and transport requirements. Sample energy sector customers include National Grid, British Gas, UK Power Networks, Northern Powergrid, Scotia Gas Networks, Electricity North West, Scottish Power, EDF Energy, npower, Scottish and Southern Energy, ESB (Ireland), Gas Networks Ireland, Gazprom and Corona Energy.
The AMT-Sybex Affinity Suite:

- Manages market data flows for over 35 million electricity and gas customers
- Is licensed on 35,000 devices across three continents
- Is licensed for meter data management for over 25 million meter points and growing
- Is used by many of the UK's large Energy and Water companies to manage core business processes in enterprise mobility, market communication, meter data management and intelligent management of distributed energy resources as part of a smarter grid.

6.1.4 Experience gained from other relevant projects

Western Power Distribution: While EFFS is delivering new learning, WPD has already gained expertise in some of the relevant areas. For example, FALCON, LV Network Templates and Equilibrium have involved a degree of forecasting, which provides a solid foundation on which to build. Similarly, WPD has gained experience in DSR relating to industrial and commercial customers through FALCON, SYNC and we will continue with Plugs and Socket, Solar Storage and ENTIRE. The development of Active Network Management zones has provided experience of control of third party equipment and integration with control systems which WPD will also develop through project ENTIRE.

AMT-Sybex: AMT-Sybex was a project partner with UK Power Networks (UKPN) and a number of other parties in the Low Carbon Networks Fund Smarter Network Storage project between 2013 and 2016. The Smarter Network Storage project delivered a unique energy storage management system on the largest energy storage device of its kind in the UK, as part of the Smarter Network Storage project run by UKPN, a GB Distribution Network Operator. AMT-Sybex developed and delivered the Forecasting, Optimisation and Scheduling System after designing its novel demand forecasting and commercial optimisation principles in partnership with UK Power Networks and Newcastle University. AMT-Sybex implemented the operational algorithms and applications to bring this product to market. This “first of its kind” product has enabled UKPN to test novel commercial arrangements whilst continuing to deliver security of supply to customers.

6.1.5 Project Structure and Governance

The **EFFS** project will succeed through strong project structure and governance. The governance framework, based on Prince2 methodology, will meet NIC requirements. A clear leadership structure is essential to support the complexities of the project and maintain focus on delivery across the partners. We have designed an organisational structure to ensure all team members understand the project hierarchy, escalation routes and stakeholder breakdown for the four workstreams. This arrangement empowers staff to work freely within clear boundaries and to feel confident when considering risk, change and jeopardy in the project.

Figure 7 illustrates the project organisational structure:

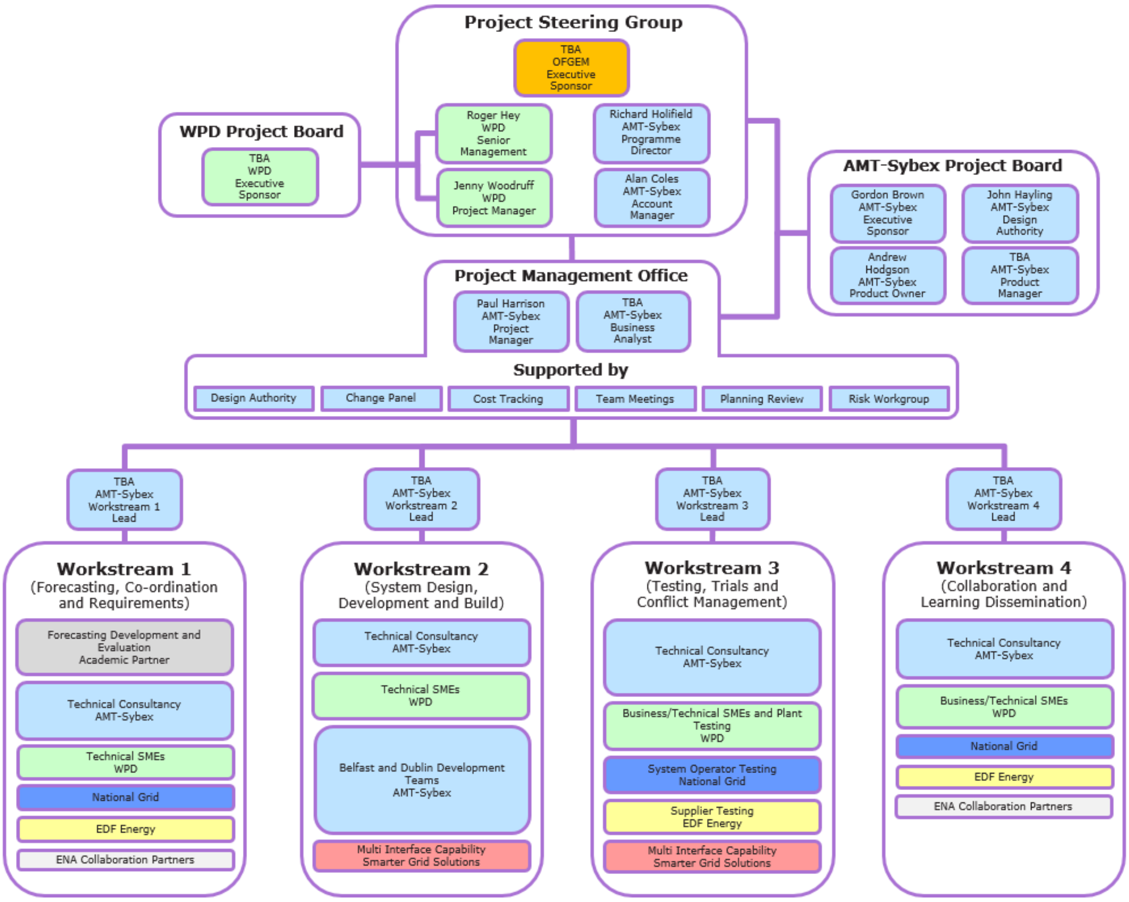


Figure 7: Project Organisational Structure

The main governing body of the project will be the Project Steering Group (PSG), comprising management representatives from WPD and AMT-Sybex. Two separate internal boards in the respective organisations will support the PSG, namely the WPD Project Board and the AMT-Sybex Project Board.

Project Steering Group (PSG): The PSG will be the executive group tasked with establishing and maintaining the project mandate. It will act as the main board for the project and will include senior management and directors from both companies, as well as the OFGEM Executive Sponsor.

The PSG is responsible for:

- Giving direction to the project
- Delegating the appropriate authority to the Project Manager
- Ensuring decisions are made effectively at all levels within the project
- Visibly supporting the Project Manager throughout the project
- Facilitating communication within the project and with other stakeholders, both internal and external
- Approving major plans and resourcing
- Defining the acceptable risk profile and risk thresholds for the project
- Making key decisions on escalated project risks and issues
- Authorising deviation from tolerances
- Approving completion of a project stage
- Authorising transition to next project stage.

The PSG will be informed by the Project Manager about the project's status at mandatory meetings monthly from project dashboards, progress reports and a review of the project plan.

WPD Project Board: The WPD Project Board will meet monthly to direct and control the WPD actions and activities. As a direct delegate of the PSG it is responsible for the day to day execution of actions and outcomes from PSG directives. It will establish processes and appoint team members to undertake the project activities, which include financial controls, appointments, management systems, business engagement and workplace logistics. The WPD Project Board will mobilise and sustain the wider WPD business team, subject matter experts and operational leads.

AMT-Sybex Project Board: The AMT-Sybex Project Board assumes responsibility for all of its project activities and team members, ensuring they operate effectively and efficiently. This means making sure the teams are properly resourced and correctly led, establishing internal controls on design, development, budgets and change control. The AMT-Sybex Project Board shall be the focal point for the software development cycle.

The PSG and the respective project boards will be supported by the Project Management Office (PMO). The PMO will be responsible for project planning, cost management and reporting. The PMO will be supported by the following project controls:

- **Design Authority:** A design authority with a technological and commercial oversight will be in place throughout the project to ensure the solution remains compatible and capable of delivering the learning outcomes. It will be divided into design inputs relating to design approvals and design outputs referring to any design variations or requests for impact assessments. The design authority leader will ensure that the project fully considers the infrastructure, cutover and environment management to ensure the project is prepared at critical points. The design authority will meet weekly and an agenda shall be prepared and submitted at least 24 hours in advance of meetings so that the appropriate expertise can be called in. The design authority's input and oversight may increase or decrease at certain points of the project to fit the project's needs.
- **Change Panel:** A change panel will govern and track project changes to accept or reject variations. Robust change management procedures will be in place to ensure that change request impacts are fully assessed. The change panel will rely upon the impact assessments and supporting evidence from other groups to sign off and commission changes.
- **Cost Tracking**: During the project, costs will be monitored constantly through a variety of financial mechanisms and cost modelling tools by the AMT-Sybex Project Manager, who will in turn feed the project's financial progress to the WPD Project Manager. A financial tracking and reporting system will be established during the project mobilisation stage to process project costs. In accordance with NIC Licence Condition, the Governance Document and the relevant Project Direction, the WPD Project Manager will be accountable for project costs.
- **Project Meetings:** Regular project meetings will occur at various levels of the project's structure to facilitate strong project coordination and information symmetry. All project meetings will have a detailed agenda and meeting minutes will be captured and sent out to all attendees following all project meetings to ensure effectiveness.
- **Planning Review:** The project plan will be monitored daily and reviewed formally in a two-weekly checkpoint cycle by the AMT-Sybex and WPD Project Managers. The project's progress and scheduling will also be presented to the Project Steering Group monthly. The Project Steering Group meetings will form key touch points for the project plan to be reviewed and challenged.

- **Risk Workgroup:** A risk workgroup or risk management committee will proactively identify, analyse, control and review all risks, whilst calculating the potential cost impact throughout the project. All risks will be continually monitored and, where appropriate, pre-emptive actions will be implemented to prevent the risk materialising. Where prevention is not possible, mitigating actions will be deployed to reduce the impact as far as practicable.

  A Risk, Assumption, Issue and Dependency (RAID) log will be maintained throughout the project as a key tool to support the workgroup. Risk management and contingency plans devised at the project bid stage will form the base of the Project's RAID. During project mobilisation, risk tolerances will be agreed between the risk workgroup and the Project Steering Group. The Project Manager is responsible for ensuring all risks and issues are effectively managed and those above the agreed tolerance are escalated to the Project Steering Group.

In addition, the RACI matrix, included in Appendix 6, sets out who is responsible, accountable, consulted and informed for each of the project governance and control components.

6.1.6 Project Planning

Appendix 7 contains the project plan for the EFFS project at the bid stage. The plan outlines the tasks and estimated scheduling for the EFFS project in terms of pre-contract award and post-contract award. As detailed in Section 2, the project will be split into four workstreams, namely:

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

Following contract award, we will add further detail to the project plan at two key project stages. Firstly, during the project mobilisation phase and, secondly, following the forecasting evaluation, ENA collaboration and determination of the requirements.

6.1.7 Flexible Implementation Methodology

AMT-Sybex will employ their AIM3 methodology, an in-house implementation methodology based on PRINCE 2. AMT-Sybex has developed AIM3 over many years to provide an effective, flexible and comprehensive methodology that covers not only project management but also the development and delivery of the underlying solutions themselves.

AIM3 is a pragmatic methodology with a menu of processes and products that can be tailored to suit the needs of the EFFS project. It sets out to optimise PRINCE 2 strategies and products so as not to overburden the governance regime with excessive reports and documents, while at the same time, allowing for sufficient controls to ensure a quality delivery.

This strong and agile management tool demonstrates we have the capability and quality systems in place to manage the project. Both WPD and AMT-Sybex have the correct amount of flexibility and pragmatism for agreeing and defining ways of working, and close collaboration will be emphasised throughout the project.

6.1.8 Experienced Project Delivery Team

WPD and AMT-Sybex have the resources and experience to deliver the EFFS project. The start of the project allows for sufficient time to fully enable the project team and to ensure that the commercial agreements for all parties can be detailed and agreed during project mobilisation.

The resource-base is of a sufficient size, experience and quality to ensure EFFS delivery. We outline the Lead Team in Appendix 10.

6.2 Evidence of the measures that the Project will employ to minimise possible cost overruns and shortfalls in Direct Benefits

The Project will employ the following key measures to minimise cost overruns and shortfalls in direct benefits.

- A defined project structure and governance, supported by project controls will minimise the possibility of cost overruns and/or shortfalls in direct benefits. As detailed in section 6.1.5, these project controls include a design authority, change panel, cost tracking, project meetings, planning reviews and risk workgroups. In particular, the change panel will execute a robust process throughout the project to challenge requests and protect the project benefits, unless unavoidable.
- A project breakdown into four distinct and manageable work packages. The work packages in turn produce ten defined project deliverables, as demonstrated in Section 9 to enable effective tracking of project benefits.
- The appointment of experienced WPD and AMT-Sybex resources and project contractors with the relevant competencies.
- A requirements and benefits traceability matrix provided in the design stage will outline specific items and the intention for them to deliver benefits. This matrix will also support the impact assessment of any changes and variations.
- Project tolerances and key performance indicators will be established at the project mobilisation stage by the Project Steering Group to ensure that project progress and benefits are tracked effectively.
- Robust and proactive risk management processes will be employed throughout the EFFS project. A Risk Register, included in Appendix 8, outlines the key risks to the EFFS project at the bid stage.
- A contingency plan has been developed for the most severe risks on the Risk Register. Further information is provided in Appendix 9.

We recognise there are overlaps with some of our intended project outputs and the ENA Workgroup, the Centrica Local Energy Market projects and the competing NIC projects, namely Fusion from Scottish Power and Transition from SSE. At present, these overlaps are included in our project delivery to ensure that the required deliverables and work are accounted for. To mitigate overlaps, the EFFS project will proactively engage and collaborate with the other projects to ensure EFFS aligns and builds on existing work wherever possible. If any project outputs can be delivered with less resource from these projects, then we will reduce the costs and, where possible, timescales of the EFFS project.

6.3 Verification of all the information included in the proposal

WPD and AMT-Sybex have endeavoured to ensure that the information contained within this proposal is accurate. The proposal has been verified through:

- Preparation by an experienced team of engineers, in partnership with dedicated project managers from WPD and AMT-Sybex
- An independent checking processes and peer review processes to ensure the accuracy of the information
- Reviews of technical sections by subject matter experts
- Information from other collaborators has been reviewed by WPD and AMT-Sybex to ensure accuracy
- Review and sign off of the full submission pro-forma by WPD Senior Management and Directors and AMT-Sybex Senior Management and Directors.

6.4 How the Project plan will still deliver learning in the event that the take up of low carbon technologies is lower than anticipated

The project is not reliant on low carbon technologies being installed in a particular trial area in order to create constraints which are then managed using flexibility services, but rather the ability of the flexibility system will be demonstrated against mock constraints, achieved by altering either the reported network loads or their capacities. An equivalent question for EFFS would be: "How will the project still deliver learning in the event that there is insufficient customer participation to support the activities of the trial?". The risk of this has been minimised by using the trial to demonstrate the interactions work as designed, but carrying out bulk testing off-line as a laboratory exercise. The risk of being able to interact with sufficient customers is minimised by having multiple potential sources of such customers by building on the customer recruitment for Cornwall Local Energy Market and Project Entire, as well as partnering with EDF.

6.5 Processes to identify circumstances to suspend the Project

The following processes will be in place to identify circumstances where the most appropriate course of action will be to suspend the Project, pending permission from Ofgem, that it can be halted. This approach will give all the parties involved clarity and consistency from the outset.

6.5.1 Gateway Reviews

To ensure that the Project proceeds smoothly, the Project Plan includes gateway reviews at critical stages in its lifecycle. The gateway reviews will take place at Project Steering Group level with the aim of assessing whether or not the Project can progress successfully to the next stage. These reviews provide assurance that the Project is on track and being run in an efficient and cost-effective manner and give further assurance to stakeholders and Project team members alike that the Project can proceed. Further details on the Gateway Reviews can be found in Section 9 – Project Deliverables.

6.5.2 Regular Project Review Group Meetings

WPD and AMT-Sybex Senior Management, together with the Project Managers and the Workstream Lead will:

1. Be briefed on Project progress
2. Review the Project Plan, cost model and the Risk, Assumptions, Issues and Dependencies (RAID) log
3. Approve key outputs and milestones since the previous meeting
4. Assess delivery against the Successful Delivery Reward Criteria
5. Discuss and recommend Project changes
6. Document and review actions
7. Assign an overall Red/Amber/Green (RAG) status to the Project, where red means the Project has severe delays affecting output, amber means the Project has delays affecting output or additional cost are required to deliver outputs on time and green means the Project is on time and budget.

6.5.3 Proactive risk management

Throughout the EFFS project life-cycle, we will maintain a number of specialised risk management strategies. Our proactive approach to risk is reflected in our Risk Register in Appendix 8, which captures a number of key risks and mitigation strategies at the bid stage. In addition, as part of the overall project controls detailed in section 6.1.5, the project will regularly review risk to ensure we proactively manage and mitigate them. The process will escalate any major risks to the Project Steering Group based on the agreed risk appetite and tolerances.

During the EFFS project, the risk management objectives will be to:

- Ensure that risk management is clearly and consistently integrated into the project management activities and evidenced through the project documentation
- Comply with WPD's risk management processes and any governance requirements as specified by OFGEM
- Anticipate and respond to changing Project requirements.

We will achieve these objectives by:

- Defining the roles, responsibilities and reporting lines within the team for risk management
- Including risk management issues when writing reports and considering decisions
- Maintaining a risk register
- Communicating risks and ensuring suitable training and supervision is provided
- Preparing mitigation action plans and contingency action plans
- Monitoring and updating risks and risk controls on a regular basis.

7 Section 7: Regulatory issues

It is the intention that flexibility services used in the trial are provided by third parties. If sufficient third party resources cannot be secured, there is the possibility of using WPD owned assets, e.g. storage assets from Solar Storage or FALCON. It is not the intention to purchase new assets to enable testing of flexibility services, other than any required changes to telecommunications/ control equipment for those assets.

The design of the trials will be to carry out the minimum number of operations required to prove the functionality of the software and data interfaces, rather than a protracted trial aiming to understand flexibility service provider behaviour and seasonal variations. Minimising the number of flexibility service calls will ensure that costs for the trial are kept as low as possible, but will also reduce the chances of the trial interfering with the normal operation of flexibility service markets.

7.1 Derogations

No derogations will be required as part of the EFFS project.

7.2 Licence consent

No additional Licence consents will be required as part of the EFFS project.

7.3 Licence exemptions

No Licence exemptions will be required as part of the EFFS project.

7.4 Changes to regulatory arrangements

No changes to regulatory arrangements will be required as part of the EFFS project.

8 Section 8: Customer Impact

8.1 Customer Impacts

The EFFS project, through the deployment of the overall Solution, will have positive Customer impacts as described in the Benefits section.

During the project, itself, customers will benefit from having, where applicable:

- Access to shared forecasts
- Better notification of DNO requirements in a standard format
- The benefit of a conflict avoidance process allowing confident service provision to multiple parties

8.2 Interaction or engagement with customers or customers' premises

Other than customers that have volunteered to participate in the trials, no customer impact is anticipated.

Where a customer volunteers to participate, we will be required to fit monitoring and telecoms equipment to their properties. We will engage proactively with the customer to arrange a programme for installation, ensuring disruption during this period is minimal.

8.3 Direct impact the project may have on customers

Trial participation will require customers to alter their load or generation as required. Further information on this requirement is detailed in Section 2.

8.4 Planned interruptions

We do not anticipate any planned interruptions during the course of the project. Therefore, no protection from planned interruptions has been requested.

8.5 Unplanned interruptions

Whilst we do not anticipate any unplanned interruptions during the course of the project, to ensure this risk is minimised a plan to mitigate any risk of tripping from ramping third parties up and down will be developed.

Therefore, no protection from unplanned interruptions has been requested.

8.6 Alternative ways to implement the Project

We have designed the project to avoid the requirement for customer interruptions.

8.7 Protection from incentive penalties

We do not expect any planned or unplanned interruptions during construction or operation. Therefore, no protection from incentive penalties has been requested.

9 Section 9: Project Deliverables

9.1 Project deliverables summary table:

Reference	Project Deliverable	Deadline	Evidence	NIC funding request (%, must add to 100%)
1	Mobilisation Exit Report	05/02/18	A mobilisation exit report will be produced, including evidence of: • Academic partner tender accepted • Collaboration agreements signed • Detailed plan with breakdown by project workstream and milestones • Project staff mobilised • Workplaces set up • Governance structure in place • Project Mandate/Charter Agreed • Project Initiation Document signed off • Co-ordination plan developed with any other successful DSO related NIC bid to minimise overlap.	10%
2	Output from the forecasting and conflict avoidance	19/07/18	Publication of report showing forecasting and conflict avoidance options evaluated and selected options. Presentations at conferences and workshops to disseminate output. Conflict avoidance plan.	6%
3	Development of requirements specification for DSO functionality	03/12/18	Production of requirements specification document outlining for DSO functionality, common protocols and approach to supporting these functionalities. ENA and stakeholder collaboration strategy document (delivered a fixed period of time following publishing of ENA workshop output). Letters of support from key	9%

Reference	Project Deliverable	Deadline	Evidence	NIC funding request (%, must add to 100%)
			stakeholders (e.g. ENA Working Group) outlining agreement with specification document.	
4	Development of EFFS Design Specification document	21/03/19	Production of set of Design models and documents outlining specific EFFS functionality and approach to delivering this functionality. Report detailing review of functional specification document at key stages.	15%
5	Implementation and System Delivery	26/11/19	Build and delivery of the completed EFFS system, including technical design package release, deployment and configuration and system handover.	3%
6	Completion of on-site system testing	05/03/20	Test report demonstrating completion of on-site testing to required standards; includes integration, user acceptance, operational and performance testing. Supply of additional supporting documentation evidencing this claim, to include test plans, scripts, exit reports and screenshots. Report detailing completed user training.	22%
7	Trials design and preparation	14/02/20	Strategy document outlining trials approach and methodology, detailing approach to plant, system operations, supplier / aggregator and tandem operations trials. Co-operation plan showing how duplication with other DSO NIC projects has been avoided and, if possible, how testing between projects will be carried out.	31%

Reference	Project Deliverable	Deadline	Evidence	NIC funding request (%, must add to 100%)
8	Trials – execution and knowledge capture	02/07/20	Completion report demonstrating outcomes of trial phases alongside test scripts, exit reports etc. Letter of support from external stakeholders and partners confirming completion of project trial phase and acceptance of results.	2%
9	Gateway reviews	04/09/18 24/10/19 03/07/20	Delivery of gateway report at the end of Workstream 1, Workstream 2 and Workstream 3, detailing progress against the project benefits and costs.	2%
[Note this is a common Project Deliverable to be included by all Network Licensees as drafted below]				
10	Knowledge Dissemination Co-ordinate with any other DSO related NIC projects and comply with knowledge transfer requirements of the Governance Document.	End of project	1. Plan for co-ordinated knowledge dissemination with other DSO NIC projects. 2. Annual Project Progress Reports which comply with the requirements of the Governance Document. 3. Completed Closedown Report which complies with the requirements of the Governance Document. 4. Evidence of attendance and participation in the Annual Conference as described in the Governance Document.	N/A

10 Section 10: Appendices

1. Financial Benefits Table	Financial benefits table
2. Capacity Benefits Table	Capacity benefits table
3. Carbon benefits table	Carbon benefits table
4. Explanatory notes for the benefits tables, above	Explanatory notes for Appendices 1-3
5. Arming, Confirmation & Stand Down Process	Diagram showing the Arming, Confirmation & Stand Down Process
6. RACI Matrix	RACI matrix
7. Detailed Project Plan	Project Plan, detailed GANTT chart showing the project activities and timelines
8. Risk Register	Document capturing the project risks and their severity and the plans for risk management and mitigation
9. Contingency Plan	Document capturing the most severe project risks identified at the bid stage and provision of an appropriate contingency if the risk turns into an issue
10. Lead Delivery Team	Overview of the lead team with a summary of their experience
11. Details for other Low Carbon Projects, Maps and Network diagrams	Details for the Local Cornwall Energy Market (Plugs & Sockets) project and Project Entire areas, including maps and network diagrams to help explain the technical detail of the project.
12. Letters of Support	Letters of support provided by organisations that see value in this project being awarded and delivered to add knowledge and learning to the electricity network industry
13. Expected EFFS Functionality	Details on the individual elements of EFFS
14. Costs	Detailed cost spreadsheet showing the complete cost of the project and the spend per regulatory year

Appendix 1 – Financial Benefits Table

Electricity NIC – financial benefits

	Cumulative net financial benefit (NPV terms; £m)								
Scale	**Method**	**Method Cost**	**Base Case Cost**	**Benefit**				**Notes**	**Cross-references**
				2020	**2030**	**2040**	**2050**		
Post-trial solution *(individual deployment)*	Method 1	[redacted]	[redacted]	0	3.1	2.6	2.2	As the purpose of project is not intended to trial an actual network constraint, no savings will accrue by 2020. Future savings in this scenario will only accrue if trial sites do enable a network constraint to be managed using flexibility services enabled via the trial sites selected.	Appendix 4
Licensee scale *If applicable, indicate the number of relevant sites on the Licensees' network.*	Method 1	[redacted]	[redacted]	0	33.8	56.7	71.6	It is assumed that the EFFS method could roll-out to 60 sites / locations over 30 years at a rate of two per year. As the total potential number of sites that might benefit is as much as 98, roll out could be faster (or slower) and the profile may differ.	Appendix 4
GB rollout scale *If applicable, indicate the number of relevant sites on the GB network.*	Method 1	[redacted]	[redacted]	0	114.4	192.2	242.6	This assumes a roll-out to 210 sites / locations across the 14 licensed networks in GB at a rate of 7 per year for 30 years. As the total potential number of sites that might benefit is estimated to be 520, roll out could be faster (or slower) and the profile may differ.	Appendix 4

Appendix 2 – Capacity Benefits Table

Electricity NIC – capacity released [if applicable]

	Cumulative capacity released (MVA)								
Scale	**Method (£m)**	**Method Cost(£m)**	**Base Case Cost**	**Benefit**				**Notes**	**Cross-references**
				2020	**2030**	**2040**	**2050**		
Post-trial solution *(individual deployment)*	Method 1	[redacted]	[redacted]	0	6	6	6	Capacity savings in this scenario will only accrue if trial sites do enable a network constraint to be managed using flexibility services enabled via the trial sites selected.	Appendix 4
Licensee scale *If applicable, indicate the number of relevant sites on the Licensees' network.*	Method 1	[redacted]	[redacted]	0	60	120	180	It is assumed that capacity will be released at the rate of 3MW per site location as flexibility services replaces traditional reinforcement. This is an average in reality, both the profile of the capacity released and the timing of the change will affect the precise capacity benefit realisation.	Appendix 4
GB rollout scale *If applicable, indicate the number of relevant sites on the GB network.*	Method 1	[redacted]	[redacted]	0	210	420	630	It is assumed that capacity will be released at the rate of 3MW per site location as flexibility services replaces traditional reinforcement. This is an average in reality both the profile of the capacity released and the timing of the change will affect the precise capacity benefit realisation.	Appendix 4

Appendix 3 – Carbon Benefits Table

<u>Electricity NIC – carbon and/or environmental benefits</u>

	Cumulative carbon benefit (tCO2e)								
Scale	**Method**	**Method Cost (£m)**	**Base Case Cost (£m)**	**Benefit**				**Notes**	**Cross-references**
				2020	**2030**	**2040**	**2050**		
Post-trial solution *(individual deployment)*	Method 1	[redacted]	[redacted]	0	185	185	185	Carbon savings in this scenario will only accrue if trial sites do enable a network constraint to be managed using flexibility services enabled via the trial sites selected.	Appendix 4
Licensee scale *If applicable, indicate the number of relevant sites on the Licensees' network.*	Method 1	[redacted]	[redacted]	0	1,854	3,708	5,562	It is assumed that one transformer or the equivalent cable in carbon terms, would be required at each site.	Appendix 4
GB rollout scale *If applicable, indicate the number of relevant sites on the GB network.*	Method 1	[redacted]	[redacted]	0	6,489	12,978	19,467	It is assumed that one transformer or the equivalent cable in carbon terms, would be required at each site.	Appendix 4

If applicable, indicate any environmental benefits which cannot be expressed as tCO2e.		**Post-trial solution:** [Explain any environmental benefits which cannot be expressed as tCO2e]		
		Licensee scale: [Explain any environmental benefits which cannot be expressed as tCO2e]		
		GB rollout scale: [Explain any environmental benefits which cannot be expressed as tCO2e]		

Appendix 4 – Explanatory notes for benefits tables given in Appendices 1 to 3

Financial Benefits

The financial benefits of the project have been calculated using solely the deferral or avoidance of traditional reinforcement benefit, benefit 1 identified in section 3. Whilst there are further benefits defined in this section which it is believed would add significantly to the business case, we have chosen not to attempt to quantify these as to do so would require making some assumptions that may be difficult to reference with any great certainty. Therefore the quantified benefits tabulated in Appendix 1 represent a conservative view of true benefits of the EFFS method.

Base Case Cost

The base case cost has been taken to be the cost of conventionally reinforcing a primary substation group on the WPD network resulting from load growth on the network. Work undertaken by UK Power Networks on their Smarter Network Storage project identified that 520 primary substations or 10.8% of the 4,800 substations across GB could benefit from flexible solutions and that each reinforcement requirement would have on average a shortfall of 3MW.

Using data from the WPD business plan published in 2014, adjusting to 2017/18 costs and factoring in the Smarter Network Storage learning, over £[redacted] would be spent on this form of reinforcement each year for the 8 years of the ED1 period. It has been assumed that this level of reinforcement would be required of the following price control periods up until 2050. Assuming this annual spend represented 2 such projects with a shortfall of 3 MW, per year projects a total base cost of £[redacted] required to conventionally reinforce 60 sites across the WPD licensed areas up until 2050. By proportioning up, a GB wide cost across all 14 licensed areas over the same time frame would cost £[redacted] assuming 210 sites of the estimated 520 sites possible.

Method Cost

The method costs used in the calculations represent the cost of replicating the EFFS method less one-off project costs, once the project has been proved successful following the trials phase. Incorporating the running costs of two schemes, each representing a 3 MW shortfall, over 30 years would cost £[redacted]. To replicate similar schemes at 60 sites across the WPD footprint area over the same time frame would cost £[redacted] or £[redacted] to cover 210 sites across all 14 licenced areas across GB. The licensee and GB wide roll-out cost represent a significant discount around four times, on the post-trial solution due to assumed savings that would be achieved for license costs, other enabling charges and bulk discounts.

Replications

It has been assumed that no project replications will occur by 2020 as the project trials will not have been completed until then.

Summary of Financial Benefits

The financial benefits for the EFFS method, scaled up to licensee and GB roll-out levels are presented in Appendix 1. At GB scale, a financial benefit of at least £242.6m is anticipated by 2050, while £71.6m minimum saving would be expected across the WPD licensed area over the same time frame.

Capacity Released

The total capacity saving on the network is given in Appendix 2. This has been based upon an average expected saving of 3 MW per investment scheme site which is being reinforced by means of flexibility services rather than conventionally. Assuming 210 sites across GB gives a saving of 630 MW.

However, conventional reinforcement does not work in such small steps. Instead when the network is reinforced, even if the predicted shortfall is 3 MW over say 10 years, a substation will require a whole new transformer. This may be either a new upgraded replacement transformer or an additional transformer. Also, incoming and outgoing circuits may also require replacement or additional circuits may be required. For example, a new 38MW or replacement 38MW transformer in place of a 23 MW. Either way, additional capacity of 8 or 10 times the nominal requirement may have to be installed.

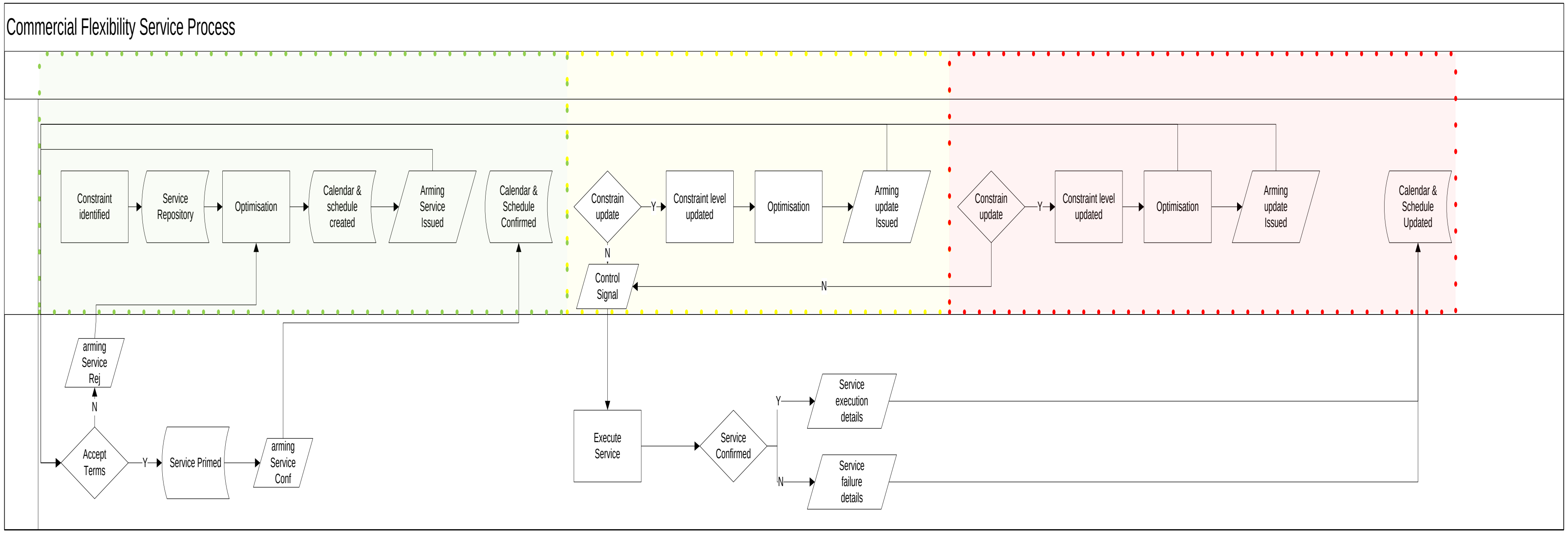
Therefor the capacity saving on the network may be 8 or 10 times the savings given in the table.

Carbon Benefits
Work undertaken by ENW on their Capacity to Customers (C2C) project[3] gave a total saving of 92.7 tCo2e for each new 38 MVA transformer saved be not being installed. It also reported that a saving of 32.8 tCo2e was achieved for each kilometre length of 300mm Al cable saved.

The carbon savings figures given in Appendix 3 have been calculated on an assumption that each site reinforced by flexibility services, in place of conventional means have saved on the need to install one 38 MW transformer, or an equivalent in carbon terms of using 300mm Al cable. In practice, both are likely to be required and therefore the figures calculated have been conservatively estimated and are very likely to be vastly understated.

[3] Capacity to Customers, carbon Impact Assessments Scenario Results by Dr John Broderic, report published February 2015

Appendix 5 – Arming, Confirmation & Stand Down Process

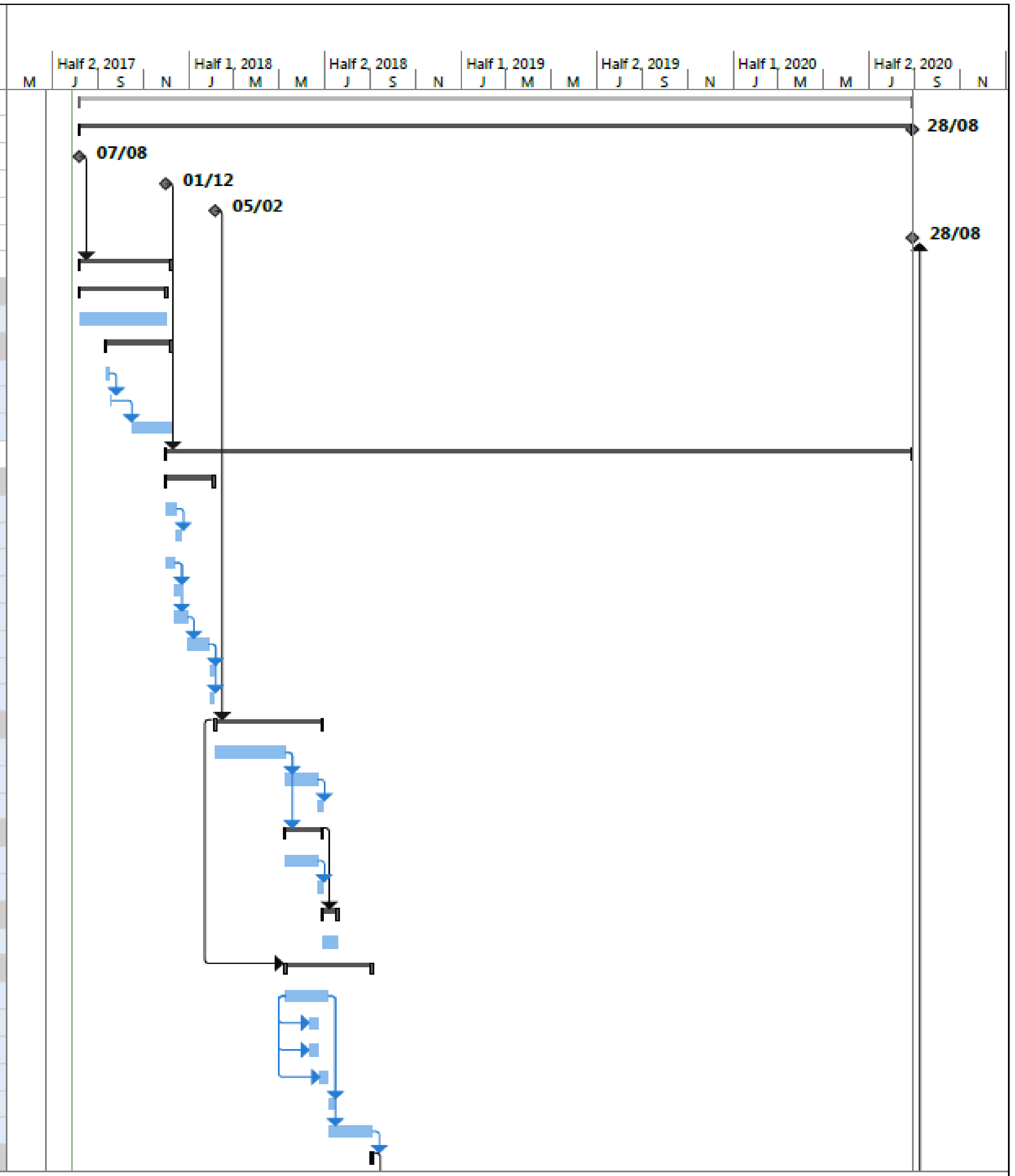


Appendix 6 – RACI Matrix

	Frequency	OFGEM Representative	WPD Executive Sponsor	WPD Senior Manager	WPD Project Manager	AMT-Sybex Executive Sponsor	AMT-Sybex Programme Director	AMT-Sybex Account Manager	AMT-Sybex Product Owner	AMT-Sybex Product Manager	AMT-Sybex Project Manager	AMT-Sybex Workstream Lead
Project Steering Group	monthly	C	I	A	R	R	R	R			R	
WPD Project Board	monthly		C	A	R	C/I	C/I	C/I			C/I	C/I
AMT-Sybex Project Board	monthly				C/I	C	A	C	C	C	R	C/I
Design Authority	weekly				I				C	A	R	R
Change Panel	2-weekly			C/I	A		C	C	C	C	R	R
Cost Tracking	2-weekly			C/I	A		C	C			R	R
Project Meetings	weekly				R		I	I			A	R
Planning Review	2-weekly			C/I	A		C	C			R	R
Risk Workgroup	weekly			C/I	A		C	C			R	R

Appendix 7 – Detailed Project Plan

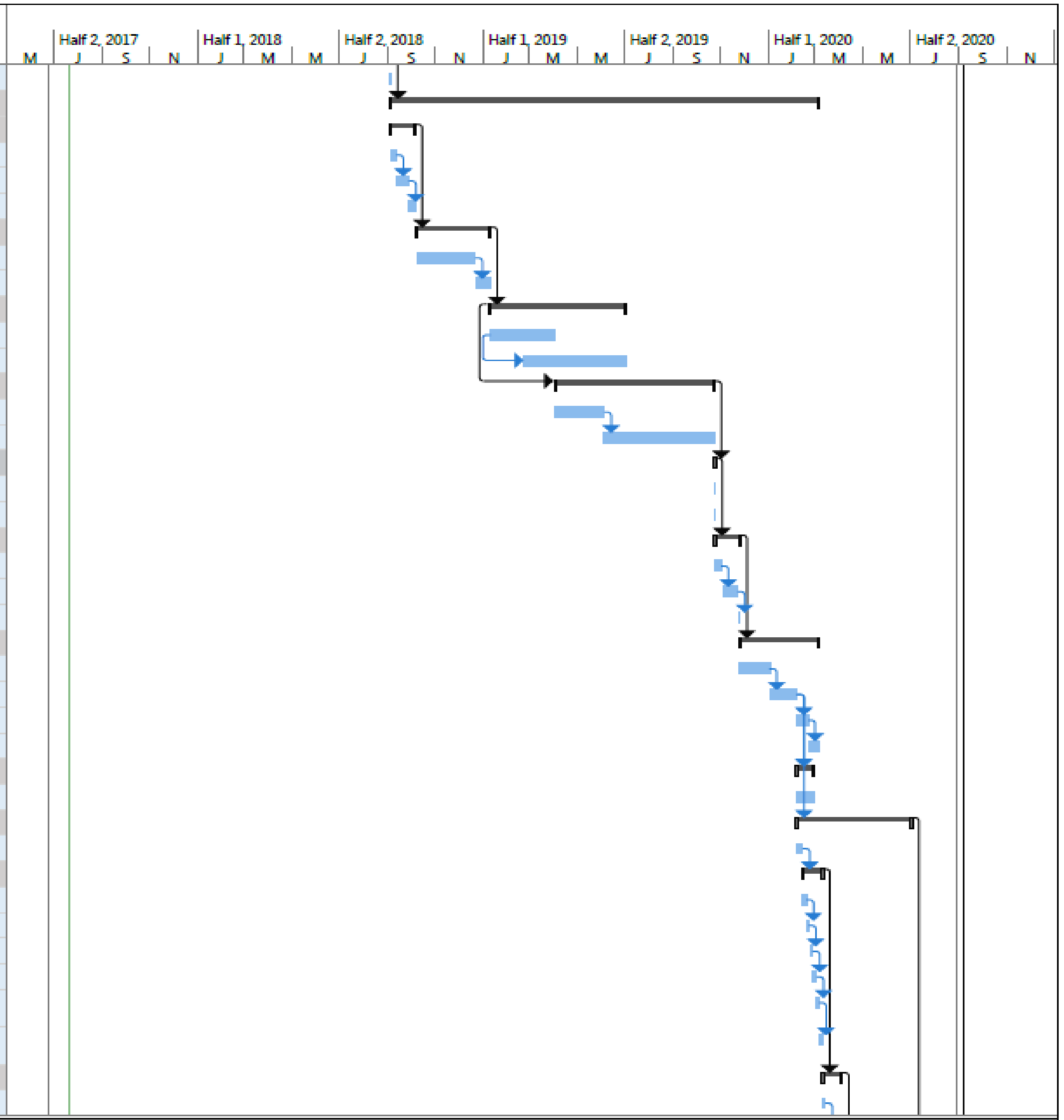
ID	Outline Level	Workstream	Task Name	Duration	Start	Finish
0	0		EFFS Project	776 days?	Mon 07/08/17	Fri 28/08/20
1	1		Milestones	776 days?	Mon 07/08/17	Fri 28/08/20
2	2		OFGEM Submission	0 days	Mon 07/08/17	Mon 07/08/17
3	2		Contract Award	0 days?	Fri 01/12/17	Fri 01/12/17
4	2		Start EFFS Project	0 days?	Mon 05/02/18	Mon 05/02/18
5	2		Finish EFFS Project	0 days?	Fri 28/08/20	Fri 28/08/20
6	2		Pre Contract Award	89 days?	Mon 07/08/17	Fri 08/12/17
7	3		OFGEM Meetings & Review of FSP	84 days	Mon 07/08/17	Fri 01/12/17
8	4		Expert Panel Meetings	84 days	Mon 07/08/17	Fri 01/12/17
9	3		Forecast Evaluation Procurement	65 days?	Mon 11/09/17	Fri 08/12/17
10	4		Kickoff Procurement	5 days?	Mon 11/09/17	Fri 15/09/17
11	4		Issue Tender	1 day?	Mon 18/09/17	Mon 18/09/17
12	4		Receive Responses from Academic Institutions	40 days?	Mon 16/10/17	Fri 08/12/17
13	2		Post Contract Award	693 days?	Fri 01/12/17	Fri 28/08/20
14	3		Project Mobilisation	43 days?	Fri 01/12/17	Fri 02/02/18
15	4		Analyse Responses from Academic Institutions	10 days?	Fri 01/12/17	Thu 14/12/17
16	4		Accept Academic Partner Tender	5 days?	Fri 15/12/17	Thu 21/12/17
17	4		Sign Collaboration Agreements	8 days?	Fri 01/12/17	Tue 12/12/17
18	4		Project Kickoff	5 days?	Wed 13/12/17	Tue 19/12/17
19	4		Team Mobilisation	10 days?	Wed 13/12/17	Thu 28/12/17
20	4		Prepare Detailed Workstreams	20 days?	Fri 29/12/17	Fri 26/01/18
21	4		Review Workstreams	5 days?	Mon 29/01/18	Fri 02/02/18
22	4		Project Plan Review	5 days?	Mon 29/01/18	Fri 02/02/18
23	3	WS1	Forecasting Evaluation Phase	100 days?	Mon 05/02/18	Thu 28/06/18
24	4	WS1	Analysis	65 days?	Mon 05/02/18	Wed 09/05/18
25	4	WS1	Report Preparation	30 days?	Thu 10/05/18	Thu 21/06/18
26	4	WS1	Report Publication	5 days?	Fri 22/06/18	Thu 28/06/18
27	3	WS4	Conflict Avoidance Phase	35 days?	Thu 10/05/18	Thu 28/06/18
28	4	WS4	Report Preparation	30 days?	Thu 10/05/18	Thu 21/06/18
29	4	WS4	Report Publication	5 days?	Fri 22/06/18	Thu 28/06/18
30	3	WS4	Learning Phase 1	15 days?	Fri 29/06/18	Thu 19/07/18
31	4	WS4	Learning Dissemination	15 days?	Fri 29/06/18	Thu 19/07/18
32	3	WS1	Requirements Phase	80 days?	Fri 11/05/18	Mon 03/09/18
33	4	WS1	Determine Requirements	40 days?	Fri 11/05/18	Fri 06/07/18
34	4	WS1	ENA Output Collaboration	10 days?	Mon 11/06/18	Fri 22/06/18
35	4	WS1	Devise Trials Strategy (With SSE and SP)	10 days?	Mon 11/06/18	Fri 22/06/18
36	4	WS1	Review Common Protocols	10 days?	Mon 25/06/18	Fri 06/07/18
37	4	WS1	Detailed Project Planning	5 days?	Mon 09/07/18	Fri 13/07/18
38	4	WS1	Specify System Requirements	40 days?	Mon 09/07/18	Mon 03/09/18
39	3	WS1	Gateway Review 1	1 day?	Tue 04/09/18	Tue 04/09/18



Project: EFFS Project
Date: Fri 28/07/17

Task | Project Summary | Manual Task | Start-only | Deadline
Split | Inactive Task | Duration-only | Finish-only | Progress
Milestone | Inactive Milestone | Manual Summary Rollup | External Tasks | Manual Progress
Summary | Inactive Summary | Manual Summary | External Milestone

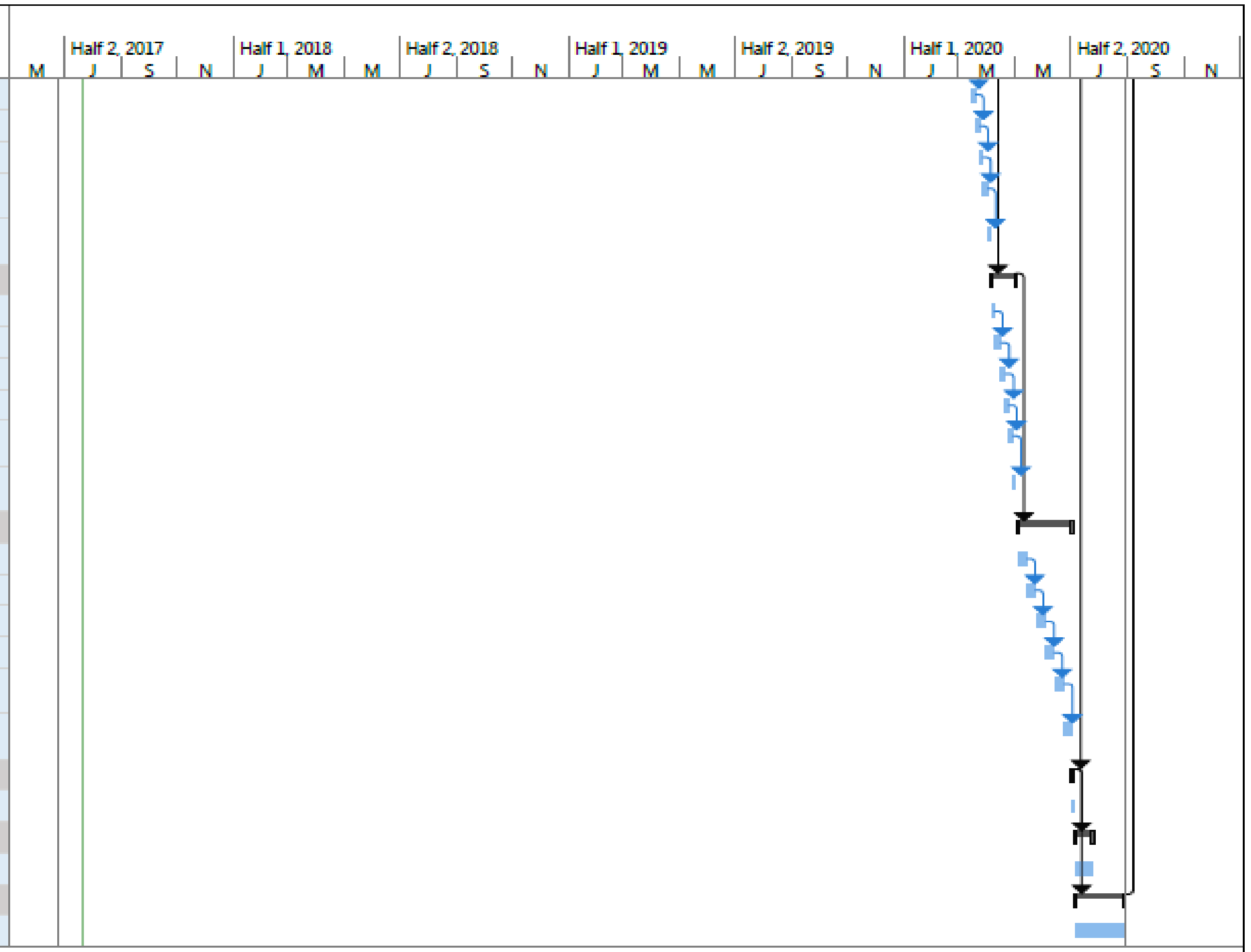
ID	Outline Level	Workstream	Task Name	Duration	Start	Finish
41	4	WS1	Gateway 1 Report	1 day?	Tue 04/09/18	Tue 04/09/18
42	3	**WS2**	**EFFS Implementation Phase**	**381 days?**	**Wed 05/09/18**	**Thu 05/03/20**
43	4	**WS2**	**Scoping Study**	**23 days?**	**Wed 05/09/18**	**Fri 05/10/18**
44	5	WS2	High-level Design / Requirements Confirmation	5 days?	Wed 05/09/18	Tue 11/09/18
45	5	WS2	Technical Architecture Proposal	12 days?	Wed 12/09/18	Thu 27/09/18
46	5	WS2	Review & Sign Off	6 days?	Fri 28/09/18	Fri 05/10/18
47	4	**WS2**	**Design**	**65 days?**	**Mon 08/10/18**	**Wed 09/01/19**
48	5	WS2	Produce Functional Specifications	55 days?	Mon 08/10/18	Fri 21/12/18
49	5	WS2	Review & Sign Off	10 days?	Mon 24/12/18	Wed 09/01/19
50	4	**WS2**	**Build**	**120 days?**	**Thu 10/01/19**	**Tue 02/07/19**
51	5	WS2	Technical Design	60 days?	Thu 10/01/19	Wed 03/04/19
52	5	WS2	System Build	90 days?	Thu 21/02/19	Tue 02/07/19
53	4	**WS2**	**System Test**	**140 days?**	**Thu 04/04/19**	**Wed 23/10/19**
54	5	WS2	Prepare System Test Plans	40 days?	Thu 04/04/19	Tue 04/06/19
55	5	WS2	System Test	100 days?	Wed 05/06/19	Wed 23/10/19
56	4	**WS2**	**Gateway Review 2**	**1 day?**	**Thu 24/10/19**	**Thu 24/10/19**
57	5	WS2	Gateway Review 2	1 day?	Thu 24/10/19	Thu 24/10/19
58	5	WS2	Gateway 2 Report	1 day?	Thu 24/10/19	Thu 24/10/19
59	4	**WS2**	**Release**	**22 days?**	**Fri 25/10/19**	**Mon 25/11/19**
60	5	WS2	Package Release	6 days?	Fri 25/10/19	Fri 01/11/19
61	5	WS2	Deploy & Configure On-Site	15 days?	Mon 04/11/19	Fri 22/11/19
62	5	WS2	System Handover	1 day?	Mon 25/11/19	Mon 25/11/19
63	4	**WS3**	**On-site Test**	**70 days?**	**Tue 26/11/19**	**Thu 05/03/20**
64	5	WS3	Integration Testing	25 days?	Tue 26/11/19	Thu 02/01/20
65	5	WS3	User Acceptance Testing	25 days?	Fri 03/01/20	Thu 06/02/20
66	5	WS3	Operational Testing	10 days?	Fri 07/02/20	Thu 20/02/20
67	5	WS3	Performance Testing	10 days?	Fri 21/02/20	Thu 05/03/20
68	4	**WS3**	**Training**	**15 days?**	**Fri 07/02/20**	**Thu 27/02/20**
69	5	WS3	User Training	15 days?	Fri 07/02/20	Thu 27/02/20
70	3	**WS3**	**EFFS Trials Phase**	**101 days?**	**Fri 07/02/20**	**Thu 02/07/20**
71	4	WS3	Review Trials Strategy	5 days?	Fri 07/02/20	Thu 13/02/20
72	4	**WS3**	**Plant Testing**	**18 days?**	**Fri 14/02/20**	**Tue 10/03/20**
73	5	WS3	Forecast accuracy for constraints & generation	3 days?	Fri 14/02/20	Tue 18/02/20
74	5	WS3	Suitability of configured forecasting horizons	3 days?	Wed 19/02/20	Fri 21/02/20
75	5	WS3	System & Asset response time	3 days?	Mon 24/02/20	Wed 26/02/20
76	5	WS3	Asset & market communication methods	3 days?	Thu 27/02/20	Mon 02/03/20
77	5	WS3	Co-ordination of service delivery between different parties	3 days?	Tue 03/03/20	Thu 05/03/20
78	5	WS3	Accuracy of reported energy delivered as part of service confirmation	3 days?	Fri 06/03/20	Tue 10/03/20
79	4	**WS3**	**System Operator Testing**	**18 days?**	**Wed 11/03/20**	**Fri 03/04/20**
80	5	WS3	Forecast accuracy for constraints & generation	3 days?	Wed 11/03/20	Fri 13/03/20



Project: EFFS Project
Date: Fri 21/07/17

Task	Project Summary	Manual Task	Start-only
Split	Inactive Task	Duration-only	Finish-only
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks
Summary	Inactive Summary	Manual Summary	External Milestone
Deadline	Progress	Manual Progress	

ID	Outline Level	Workstream	Task Name	Duration	Start	Finish
81	5	WS3	Suitability of configured forecasting horizons	3 days?	Mon 16/03/20	Wed 18/03/20
82	5	WS3	System & Asset response time	3 days?	Thu 19/03/20	Mon 23/03/20
83	5	WS3	Asset & market communication methods	3 days?	Tue 24/03/20	Thu 26/03/20
84	5	WS3	Co-ordination of service delivery between different parties	3 days?	Fri 27/03/20	Tue 31/03/20
85	5	WS3	Accuracy of reported energy delivered as part of service confirmation	3 days?	Wed 01/04/20	Fri 03/04/20
86	4	**WS3**	**Supplier/Aggregator Testing**	**18 days?**	**Mon 06/04/20**	**Fri 01/05/20**
87	5	WS3	Forecast accuracy for constraints & generation	3 days?	Mon 06/04/20	Wed 08/04/20
88	5	WS3	Suitability of configured forecasting horizons	3 days?	Thu 09/04/20	Wed 15/04/20
89	5	WS3	System & Asset response time	3 days?	Thu 16/04/20	Mon 20/04/20
90	5	WS3	Asset & market communication methods	3 days?	Tue 21/04/20	Thu 23/04/20
91	5	WS3	Co-ordination of service delivery between different parties	3 days?	Fri 24/04/20	Tue 28/04/20
92	5	WS3	Accuracy of reported energy delivered as part of service confirmation	3 days?	Wed 29/04/20	Fri 01/05/20
93	4	**WS3**	**Tandem Operation Testing**	**42 days?**	**Tue 05/05/20**	**Thu 02/07/20**
94	5	WS3	Forecast accuracy for constraints & generation	7 days?	Tue 05/05/20	Wed 13/05/20
95	5	WS3	Suitability of configured forecasting horizons	7 days?	Thu 14/05/20	Fri 22/05/20
96	5	WS3	System & Asset response time	7 days?	Tue 26/05/20	Wed 03/06/20
97	5	WS3	Asset & market communication methods	7 days?	Thu 04/06/20	Fri 12/06/20
98	5	WS3	Co-ordination of service delivery between different parties	7 days?	Mon 15/06/20	Tue 23/06/20
99	5	WS3	Accuracy of reported energy delivered as part of service confirmation	7 days?	Wed 24/06/20	Thu 02/07/20
100	3	**WS3**	**Gateway Review 3**	**1 day?**	**Fri 03/07/20**	**Fri 03/07/20**
101	4	WS3	Gateway Review 3	1 day?	Fri 03/07/20	Fri 03/07/20
102	3	**WS4**	**Learning Phase 2**	**15 days?**	**Mon 06/07/20**	**Fri 24/07/20**
103	4	WS4	Learning Dissemination	15 days?	Mon 06/07/20	Fri 24/07/20
104	3	**WS4**	**Project Closedown**	**40 days?**	**Mon 06/07/20**	**Fri 28/08/20**
105	4	WS4	Project Closedown Report	40 days?	Mon 06/07/20	Fri 28/08/20



Project: EFFS Project
Date: Fri 21/07/17

Task		Project Summary		Manual Task		Start-only		Deadline	
Split		Inactive Task		Duration-only		Finish-only		Progress	
Milestone		Inactive Milestone		Manual Summary Rollup		External Tasks		Manual Progress	
Summary		Inactive Summary		Manual Summary		External Milestone			

Appendix 8 – Risk Register

ID	Risk Title	Scope	Time	Cost	Quality	Resource	Risk Description ("There is a risk…")	Impact	Probability (1-5)	Impact (1-5)	Weighed Rating	Rating	Risk Mitigation	Risk Owner	Open / Closed	Risk Status
R001	Security		X	X			There is a risk of cyber attack due to potential system vulnerabilities.	This could result in the leaking of sensitive data/information.	1	5	5	L	Consider the introduction of external security audit and a penetration test phases as part of the project.	WPD	Open	G
R002	Security		X	X			There is a risk that UK security standards for a project of this nature change during the delivery of the project.	Additional cost and time to complete a redesign to ensure compliance. Also potential increase in costs if additional hardware is required.	1	5	5	L	Clearly define securty standard that are being followed at the started of the project during the Technical Architecture deliverable.	WPD	Open	G
R003	Project Contractors	X	X		X		There is a risk that project contractors are not confirmed prior to project start.	This could cause lengthy delays to the EFFS project and may reduce scope particularly regarding the trials; it may not be possible to trial all expected use cases.	2	5	10	L	To mitigate this risk, the programme will utilise parties already signed up to other projects, and utilise the selected energy suppliers' sites which are already known and capable of delivering.	WPD	Open	G
R004	Academic Partner	X	X		X		There is a risk that the programme does not secure an appropriate academic instituion for the forecasting evaluation prior to project start.	Appointment of an inappropriate academic institution could potentially delay the project due to increased time spent in design and requirements gathering.	1	4	4	L	Clearly define the scope of the academic input as part of the submission process. Consider informally approaching academic institutions prior to the approval of the submission to gain their input.	WPD	Open	G
R005	Product			X			There is a risk that the EFFS product could become redundant upon entering the market in 2020 owing to work undertaken by other market participants during project delivery.		1	2	2	L	The programme will work collaboratively with the output from ENA / SSE / SP to ensure the EFFS product is cutting edge / novel.	WPD	Open	G
R006	Resources		X			X	There is a risk that the programme may fail to obtain sufficiently flexible resources for inclusion during trials, due to lack of trial sites / data / staff with the necessary capabilities.	It may not be possible to trial all expected use cases.	2	3	6	L	WPD to pursue early engagement with potential client sites and secure early backing for resource booking.	WPD	Open	G

R007	Project facilities / technologies		X		X		There is a risk that there may be a lack of availability of work sites, data centres, project teams for the programme.	Need suitable accommodations in these areas otherwise the project delivery is at risk.	2	3	6	L	Suitable accommodations in these areas will be identified by WPD and consulted with AMT-Sybex during project mobilisation and Workstream 1.	WPD	Open	G
R008	Consensus	X	X				There is a risk that the programme may be unable to gain consensus on the role of the DNO, data interfaces and the requirements which the system must fulfil.	Project timescales will be delayed if requirements cannot be signed off in line with the project plan.	1	4	4	L	To mitigate this, a proactive mechanism of escalation to the programme board will be in place to make decisions.	WPD	Open	G
R009	Software	X			X		There is a risk that the requirements specified by the project do not align to the software solution being developed.	Extensive re-work and re-design of the software solution is required which may lead to delays in the project.	1	4	4	L	A rigorous requirements approval process at the end of Workstream 1 and a scoping study at the start of Workstream 2, as well as a strong management process.	WPD	Open	G
R010	Interface to WPD Systems	X			X		There is a risk that the software solution may not be able to interface to WPD systems.	Extensive re-work and re-design of the software solution is required which may lead to delays in the project. Other 3rd party software may be required.	1	5	5	L	A rigorous requirements approval process at the end of Workstream 1 and a scoping study at the start of Workstream 2, as well as a strong management process.	WPD	Open	G
R011	Interface to Other Third Parties	X			X		There is a risk that the software solution may not be able to interface to other third party systems.	Extensive re-work and re-design of the software solution is required which may lead to delays in the project. Other 3rd party software may be required.	1	5	5	L	A robust and proven design / solution to deliver connection to plant.	WPD	Open	G

Appendix 9 – Contingency Plan

A contingency plan has been developed for the most significant risks on the Risk Register at the bid stage. All risks will be continually monitored and were appropriate, pre-emptive actions will be implemented to prevent the risk escalating to an issue. Where prevention is not possible, mitigating actions will be deployed to reduce the impact as far as practicable.

R003: There is a risk that project contractors are not confirmed prior to project start.
Mitigation: To mitigate this risk, the programme will utilise parties already signed up to other projects, and utilise the selected energy suppliers' sites which are already known and capable of delivering.
Contingency:
R006: There is a risk that the programme may fail to obtain sufficiently flexible resources for inclusion during trials, due to lack of trial sites / data / staff with the necessary capabilities.
Mitigation: WPD to pursue early engagement with potential client sites and secure early backing for resource booking.
Contingency:
R007: There is a risk that there may be a lack of availability of work sites, data centres, project teams for the programme.
Mitigation: Suitable accommodations in these areas will be identified by WPD and consulted with AMT-Sybex during project mobilisation and Workstream 1.
Contingency: Capita office space to be used.

Appendix 10 – Lead Delivery Team

Roger Hey (Senior Management – WPD): Roger has worked in the energy industry for over 20 years. He initially trained as an operational engineer delivering networks construction and maintenance activities. Roger subsequently gained experience in Control Room and Telecommunications parts of a DNO business. More recently he spent several years managing the IT functions. In 2008 Roger was asked to bring together his varied experience and establish a Future Networks strategy and small team of specialist engineers. The department are responsible for the business's innovation strategy, delivery of demonstration projects and implementation of new solutions into core business activities. Key elements of the WPD Future Networks Programme are developing smarter local grids, leveraging value from smart meters and helping customers adopt lower carbon technologies such as electric cars, heat pumps and distributed generation.

Jenny Woodruff (Project Manager – WPD): Jenny has worked in a number of different roles for the distribution network operator covering the midlands. Most recently she has worked as an innovation and low carbon engineer project managing projects ranging from adding battery solar storage to a solar farm, creating a common information model dataset for exchange with third parties and working with Centrica to complement their Cornwall Local Energy Market with the DNO's "plug". Prior projects include managing the Strategic Investment Model within FALCON as well as the load estimation work and LV Network templates. As well as being an operational engineer, she has worked in various planning and strategic roles as well as working in the regulatory team.

Richard Holifield: (Project Director – AMT-Sybex): Richard has an extensive track record of directing large, complex projects across the utility, service and infrastructure industries. Currently responsible for a portfolio of software and business change projects with clients including Network Rail, Pennon Group and Centrica. He has been with AMT-Sybex for two years. Prior to joining AMT-Sybex Richard was with Amey PLC for 14 years bidding, mobilising and delivering complex projects for Local Authority, MoD and Government client services. Richard brings a senior level of structured governance and leadership using simple and transparent processes to maintain progress and focus.

Gordon Brown (Executive Sponsor – AMT-Sybex): Gordon is Product Development Director at AMT-Sybex responsible for a large array of successful customer engagements and bringing to market a number of industry leading solutions, particularly in the Energy Sector. Gordon has been responsible for Product strategy and product management within AMT-Sybex for over 15 years. He also has extensive experience of working in a variety of lead consulting roles in the Energy sector in England, Scotland and Ireland.

Paul Harrison (Project Manager – AMT-Sybex): Paul is a hugely experienced Programme Manager with an extensive track record of large scale IT programmes in major clients. Paul has experience across multiple industry sectors including the Energy & Utilities Sector, Rail, IT Service management, Service Outsourcing. In particular Paul has worked extensively for Npower delivering large projects and has a good knowledge of the Energy sector and its characteristics. Coupled with a strong CV of diverse and technically demanding projects, Paul brings a superb skillset of Project Management practice and methodology.

John Hayling (Design Authority – AMT-Sybex): John has worked in a variety of technical and senior commercial roles within electricity supply, transmission, distribution and power generation, with over 30 years' experience. He has a proven track-record for innovation. Former employers include EDF Energy, RWE Npower, Midlands Electricity and National Grid. Most notably between 2011 - 2016, John was Investment, Policy and Low

Carbon Development Manager in the Innovations Team with UK Power Networks involved with many low carbon projects including Smarter Networks Storage. In this role, he was responsible for managing the commercial design, regulatory and policy work streams. John is a graduate engineer and began his career working for the CEGB on the ground-breaking transmission construction project building the 2000 MW interconnector DC link with France.

Andrew Hodgson (Product Owner – AMT-Sybex): Andrew has 15 years' experience with AMT-Sybex working with a variety of customers in the deregulated Energy Sector. Most recently, he has been instrumental in the solution design and delivery of market interaction solutions for EDF Energy, RWE npower, Iberdrola Scottish Power and Centrica. Andrew has also worked with a number of DNOs including Electricity North West and Northern PowerGrid and was the Solution Architect responsible for the Affinity Networkflow product design and delivery as part of the UKPN SNS Project. As well as a project delivery role, Andrew is also Functional Product owner for the Affinity Suite of products with responsibility for the functional design and roadmap of the products. Prior to joining AMT-Sybex, Andrew held operational management roles in Metering Data Collection and Customer Service Delivery for Northern Electric & Gas.

Samir Alilat (Energy Consultant – AMT-Sybex): Samir joined AMT-Sybex in 2012, following significant work as a Senior and Business Change Analyst at Npower. Samir has extensive knowledge of the Energy industry and AMT-Sybex's Affinity NetworkFlow product. Samir was responsible for the design and implementation of the Forecasting Optimisation and Scheduling System for UK Power Networks as part of the Smarter Networks Storage project. He has over 10 years' experience working with a wide variety of partners both commercial and academic across the utilities sector to deliver innovation and business as usual projects.

Appendix 11 - Details of other Low Carbon Projects, Maps and Network Diagram

Cornwall LEM (Plugs and Sockets) Project

WPD - Plugs & Socket

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.

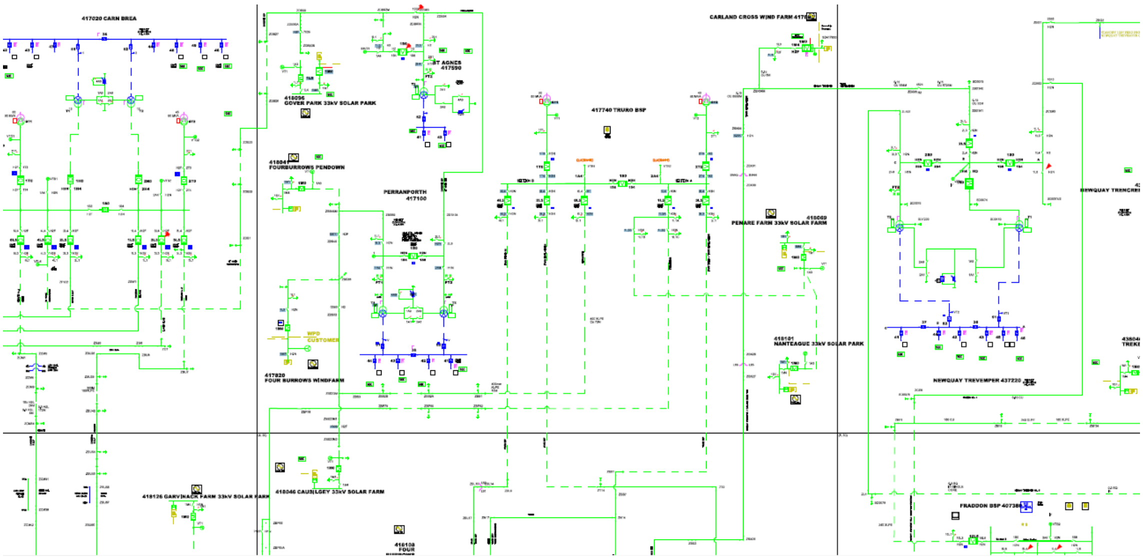
We have deliberately excluded work on determining the market rules applicable to different flexibility services from EFFS on the basis that this will most likely be delivered by Plugs and Socket. However, even if a position is reached it may still evolve over time and it is important that the systems 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.

The project is recruiting all over Cornwall, but we are hoping to utilise customers connected to specific areas of network for trials of flexibility services.

132kV Transformer	Truro BSP
33kV Transformer	Truro Shortlanesend
132kV circuit	Indian Queens to St Germans, teed to St Austell
33kV circuit	Roseland – Probus-Tregassaw

As an example, the 33kV network around Truro BSP is given below, showing the prevalence of renewables in the area.



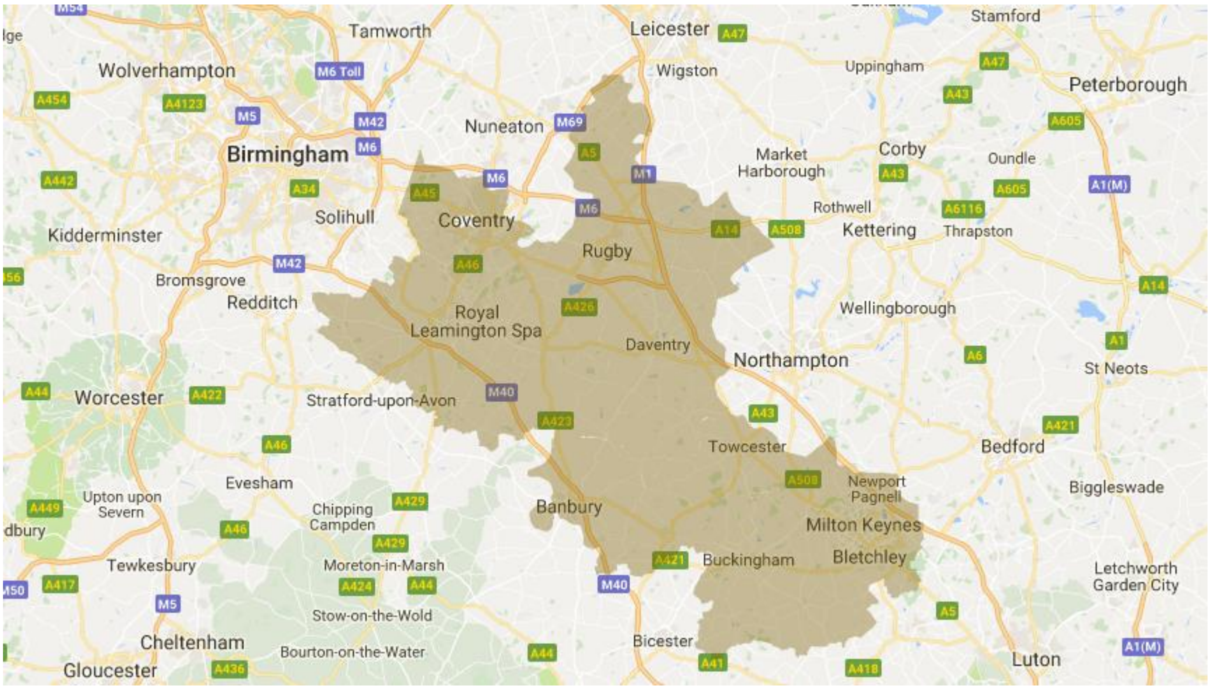
The trials phase of the project is expected to start in January 2018 and continue in various phases to September 2019.

Project Entire

This project will build on the learning provided from previous LCNF / NIA projects to ensure value for money is provided to electricity distribution customers:

This NIA funded project aims to develop and test a comprehensive DSR aggregation capability to manage generators and customer loads. This project will provide learning on the willingness of customers to allow direct control by DNOs given the advantages that provides of co-ordinating between DNO and SO required services. Once again, this provides a pool of customers that are willing to provide flexibility services, understand innovation projects and have the communications and control equipment already installed to allow further participation.

The recruitment area lies largely between the M40 and M1 motorways as shown in the diagram below. As shown in the table, the timescales for the trial run from 2017 to 2019, and therefore the customers from this project will have been recruited and had some practical experience before they are required by EFFS.



Task	Timescales
Project Design	**June 2016 – February 2017**
Build Phase	**February 2017 – November 2017**
Customer recruitment	**April 2017– February 2019**
Trial Phase	**November 2017 – March 2020**
Go-live for Triad	**November 2017**
Go-live for STOR	**April 2018**
Go-live for CMZ	**June 2018**
Review	**Following each year of the trial**
Report	**April 2020- June 2020**
Closedown	**June 2020**

Appendix 12 – Letters of Support

centrica

1st August 2017

Jenny Woodruff
Innovation and Low Carbon Engineer
Western Power Distribution plc
Toll End Road
Tipton
West Midlands
DY4 OHH

Centrica plc
Millstream East
Maidenhead Road
Windsor
Berkshire SL4 5GD

Telephone 01753 494000
Facsimile 01753 431010
Website: www.centrica.com

Dear Jenny,

Re: EFFS NIC bid

Centrica Distributed Energy and Power offers its qualified support for WPD's NIC bid submission for this year. This support is based on the fact that as we understand the EFFS project it does not conflict with the intent of Cornwall Local Energy Market (LEM) and its commercial arrangements and indeed offers some additional opportunities for collaborative working.

The energy industry faces a number of challenges and as the lead partner on Cornwall LEM (Plugs and Sockets) we are aware of the diverse nature of some of these challenges. In particular, the challenges faced by DNOs as they transition to DSOs, the increasing need to connect Distributed Generation and the use of flexibility within the system to deal with constraints are all areas where Cornwall LEM is focused on finding some of the answers. WPD, we believe, shares this vision as an active partner on the project. Cornwall LEM is at the heart of Centrica's strategy for a new energy market in the UK and worldwide.

The fundamental vision of the Cornwall LEM is to build a solution that proves the value proposition for all of the interested participants as far as is possible.

There are a number of key areas where we think EFFS could have the potential to enhance the outputs and learning from Cornwall LEM and vice versa.

- Creating weather adjusted forecasts for load and generation at different time-frames, to determine the nature, duration and frequency of expected constraints. This could be invaluable learning for the D Plug.

- Evaluating the suitability of flexibility services to resolve constraints in the context of the Local Energy Market and not through bilateral arrangements between customers and DNOs. We believe bilateral arrangements are not the way to enable an effective flexibility market. EFFS in parallel with Cornwall LEM has the potential to therefore prove the concepts of an effective market.

- Creation of an additional D Plug concept that could then directly integrate with the LEM Socket and testing of this as part of a parallel trial, with access to the customers on Cornwall LEM benefitting from a flexibility market

Being able to further test the principles of Cornwall LEM in the context to an additional technical trial rather than a "full" physical trial has the potential to validate the findings of our joint initiative and therefore we feel that it is worthy of our support. Further analysis of the potential of flexibility can only be positive for the industry as it tries to digest the implications and impact of these services on the energy system.

Should you wish to discuss this further please do not hesitate to contact me.

Yours sincerely,

Stuart Fowler
DNO Commercial Manager
Centrica Distributed Energy and Power

UK Power Networks
Delivering your energy

Registered Office:
Newington House
237 Southwark Bridge Road
London SE1 6NP

Registered in England and Wales No: 3870728

Company:
UK Power Networks
(Operations) Limited

Jennifer Woodruff
Innovation and Low Carbon Engineer
WPD Tipton Offices
Toll End Road, Tipton
West Midlands
DY4 0HH

01 August 2017

Dear Jennifer,

Letter of support for Electricity Flexibility and Forecasting System project

I am writing in response to the information you have provided about your NIC bid for 2017 – Electricity Flexibility and Forecasting System (EFFS).

At UK Power Networks we have seen that the update of Low Carbon Technologies is creating a strain on our networks. In order to continue to deliver value for money for our customers in a low carbon energy system we will need to understand better how these power flows are going to change, and respond accordingly.

We see the need for DNOs to improve our forecasting, as highlighted by the ENA workgroup considering DNO to DSO transition. The work in EFFS, to build on the experiences DNOs have gained from previous projects, such as Equilibrium and our Smarter Network Storage (SNS) and Kent Active System Management (KASM) projects, will be valuable to the industry as a whole. Similarly, the industry needs to standardise and formalise the DSO requirements in a way that enables implementation across the whole system. Developing the functional requirements and data interfaces is a necessary step in that direction and EFFS looks to make steps forward in that area.

From SNS and KASM we understand some of the challenges in forecasting and the need for further work in the area. This will support the DSO transition, as we are exploring in our Power Potential project – providing flexibility services from DNO connected assets to National Grid.

We therefore have great interest in EFFS and look forward to share your learning to deliver better value to customers should your bid be successful.

Yours sincerely

Ian Cooper
Innovation Lead – Opportunities and Bids
UK Power Networks

Return Address:
UK Power Networks
Energy House
Hazelwick Avenue
Crawley
West Sussex
RH10 1EX
Ian.Cooper@ukpowernetworks.co.uk

Appendix 13 – Expected EFFS Functionality

Flexibility Service Optimisation & Scheduling

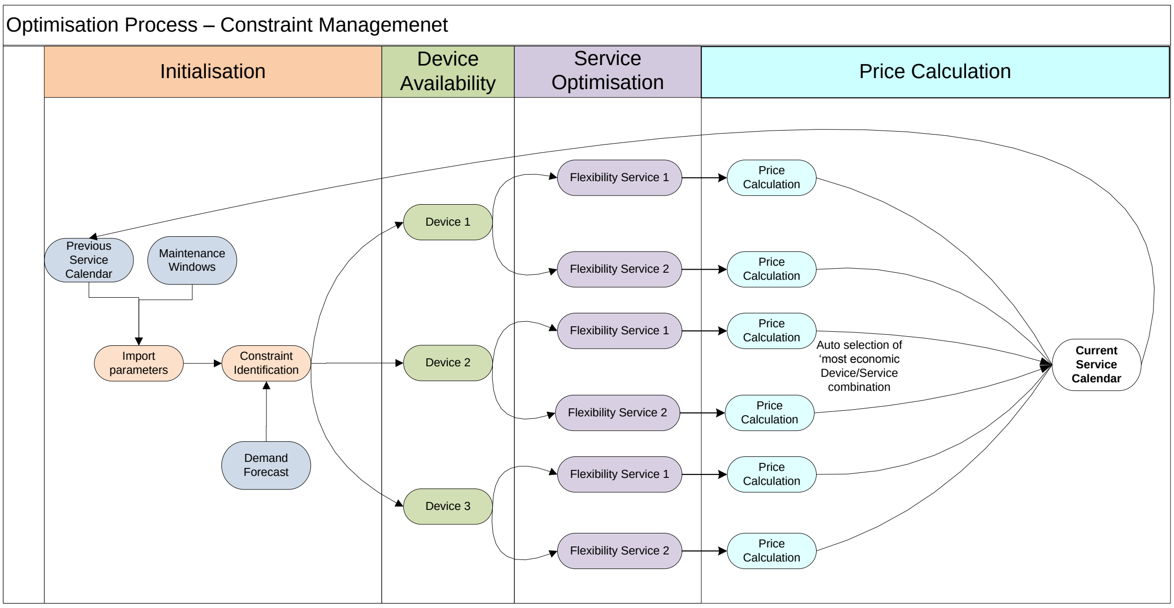


Figure 8: Optimisation Process

As part of the Smarter Network Storage project, undertaken by UK Power Networks a unique limited look ahead optimisation algorithm was developed to meet the requirement of optimising a single battery asset to support constraint management and service stacking in the National Grid ancillary services market. This has been further developed to allow for a multi device type optimisation that will support any flexibility asset and allow flexibility asset types and flexibility services to be matched.

Key features:

- Commercial optimisation will determine the most cost-effective and efficient method for meeting the constraints identified by demand forecasting in operational timescales. This may or may not reflect the optimisation criteria that are used when selecting service providers to contract with for long term reserve services. This method is used as flexibility asset type can be a driver for the type of flexibility service on offer from a particular provider. This benefits WPD by ensuring that the most competitive flexibility provider/service, with the appropriate availability and capability is selected to meet the security of supply requirement.
- Scheduling the dispatch optimisation process - Forward schedules will be created on a range of timescales. Scheduling horizons will be configurable and it will also be possible to configure further horizon points if needed. Each horizon will also have a particular optimisation mode associated to it allowing different optimisation parameters to be used for different scheduling horizons. It will also be possible to trigger an optimisation manually outside of any scheduling horizon as needed. This gives WPD a highly flexible, configurable scheduling process that will allow the optimisation process to track any changes to commercial agreements and other forecasting horizons.
- The optimisation process - This will run on an automated basis as described above. The number of services optimised will be constrained by a number of service parameters based on delivery of power, service period, asset delivery constraints & lead times. When selecting flexibility services to be optimised the start and end date of the service must fall within the specified optimisation

window. The optimisation will then consider all services that fall within those boundaries and attempt to combine these services in different ways to allow the most cost effective and efficient set of services and their associated energy exchanges to be generated to a schedule and passed to the relevant assets or flexibility markets.
- The project will investigate the impact of network scale and complexity on the optimisation process, for example the benefits of disaggregating the networks into groups which can be optimised separately rather than attempting to optimise an entire DNO area across all voltages. Similarly, the project will investigate the best means to reflect the real-time changes in network configuration within the optimisation process such that the optimisation is realistic but does not burden the control systems.

Communication of Flexibility Services

Communication of flexibility services will be achieved via an automated interface to third parties.

- Directly connected customers interfacing directly to the EFFS solution via a Hub control module
- Supply customers using a predefined market interface. Currently we are operating under the assumption that we will utilise the Common Information Model (CIM) framework however we are not tied to this and if appropriate can use other interface frameworks such as Universal Smart Energy framework (USEF) etc.
- The coordination interface as defined by workstream 1

The interface specifications will be open source such that they can be implemented within different technical solutions. If more than one of the DSO related NIC projects, Fusion or Transition is successful, then testing interfaces across different applications would form part of the trials.

Technical Description of Data Interfaces
EFFS will provide the following data interfaces that consider the ENA working group outputs and broader functional requirements:

- Data Interface to third party flexibility service markets
- Wholesale pricing interface to determine energy exchange costs
- Weather Interface
- Historical Demand Interface
- Generation Data interface
- Coordination interface with the TSO – National Grid

All interfaces will be designed to an open industry standard and consider the work already carried out by National Grid particularly in the case of the coordination interface.

Device Management
In-order to support several key processes a number of assets and equipment will need to be stored in a hierarchy within the solution. This hierarchy will conform to the Common Information Model (CIM).

Each asset will hold several key pieces of information to:

- Power Import/Export Capability
- Energy Import/Export Capability
- Response time
- Service Response rating

- Location

As well as these parameters, several other internal and device specific parameters are held to support the various internal processes that govern forecasting, optimisation and communication.

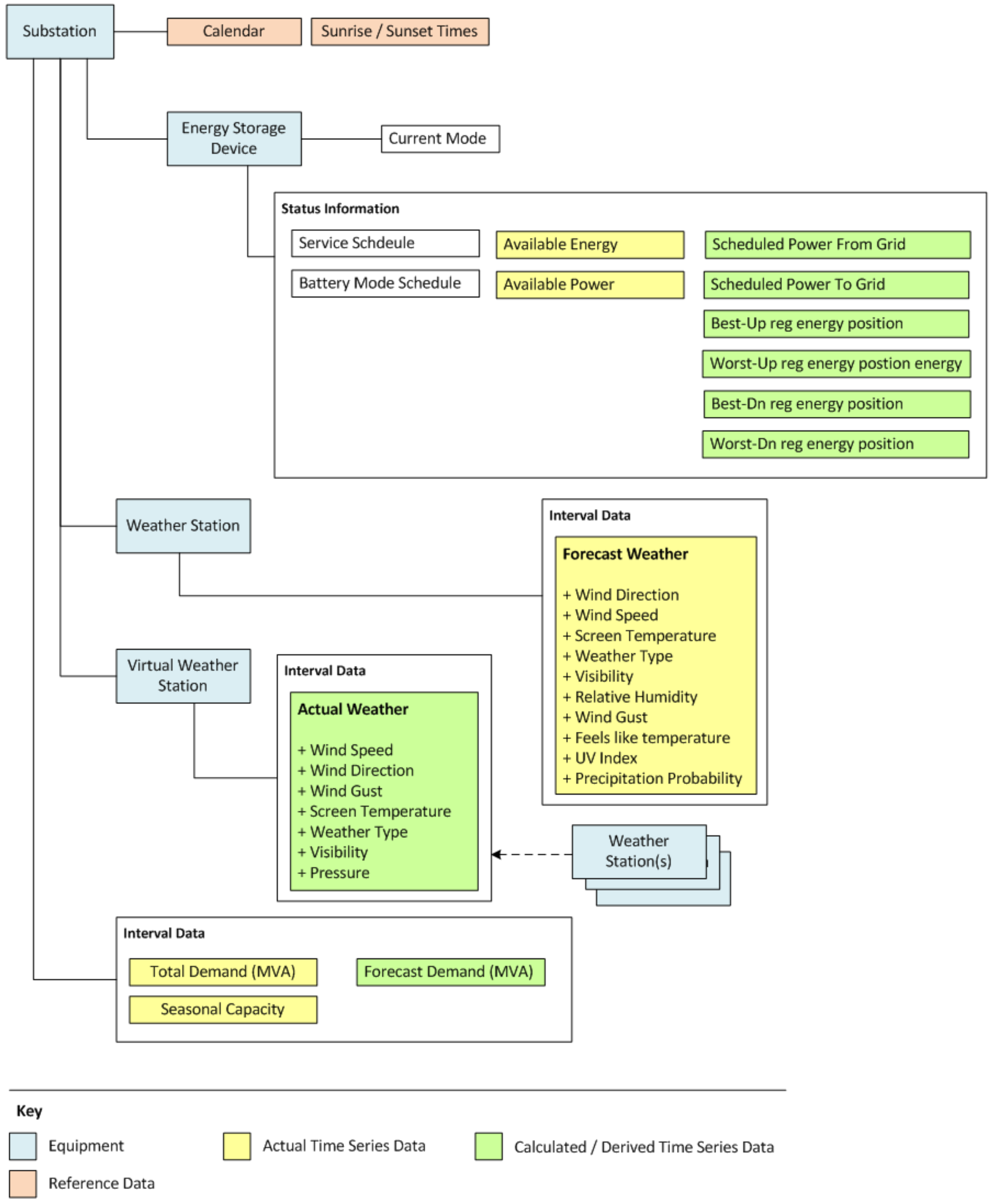


Figure 9: Example of an energy storage device hierarchy connected to a substation

Service Management

EFFS will use the Networkflow product where services are fully configurable by WPD; this flexible approach has been chosen to reflect the dynamic nature of commercial agreements and the general malleability of the fledgling flexibility market.

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 DNO 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.

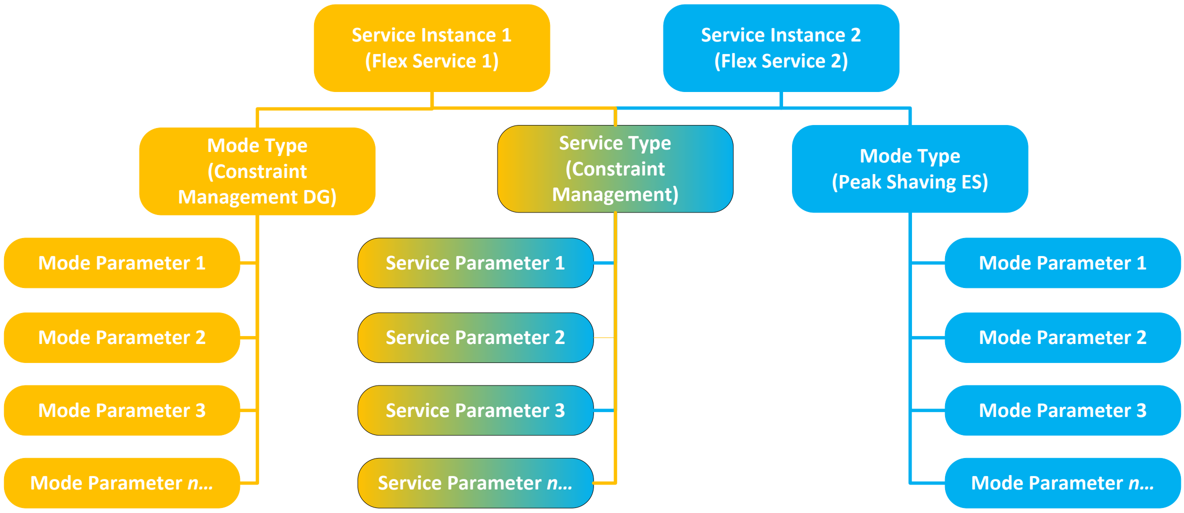


Figure 10: Two services with distinct delivery modes associated to the same service type

The definition of flexibility services is a separate activity from determining the market models that will apply to how those services are traded. Specifying market models is beyond the scope of this project; however, the systems should be able to support the market models used for DNO flexibility services to date in terms of the data used in the various interfaces.

Analytics & Reporting

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

- Demand 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
- Real time monitoring of energy exchanges of directly connected assets
- Aggregate energy exchange data in graph and numerical form with overlaid time series data

Determination of Flexibility Commercial Agreements

The determination of a Commercial flexibility framework is necessary in-order to provide commercially viable, attractive terms of provision for flexibility by third party asset operators. We have deemed it prudent to take the learnings of some previous innovation projects such as LEM as the foundation for the framework in this project. Included in this Appendix is a diagram of the arming, confirmation & stand down procedure, a table of flexibility service variables and a list of checks that would be performed as part of the on boarding process.

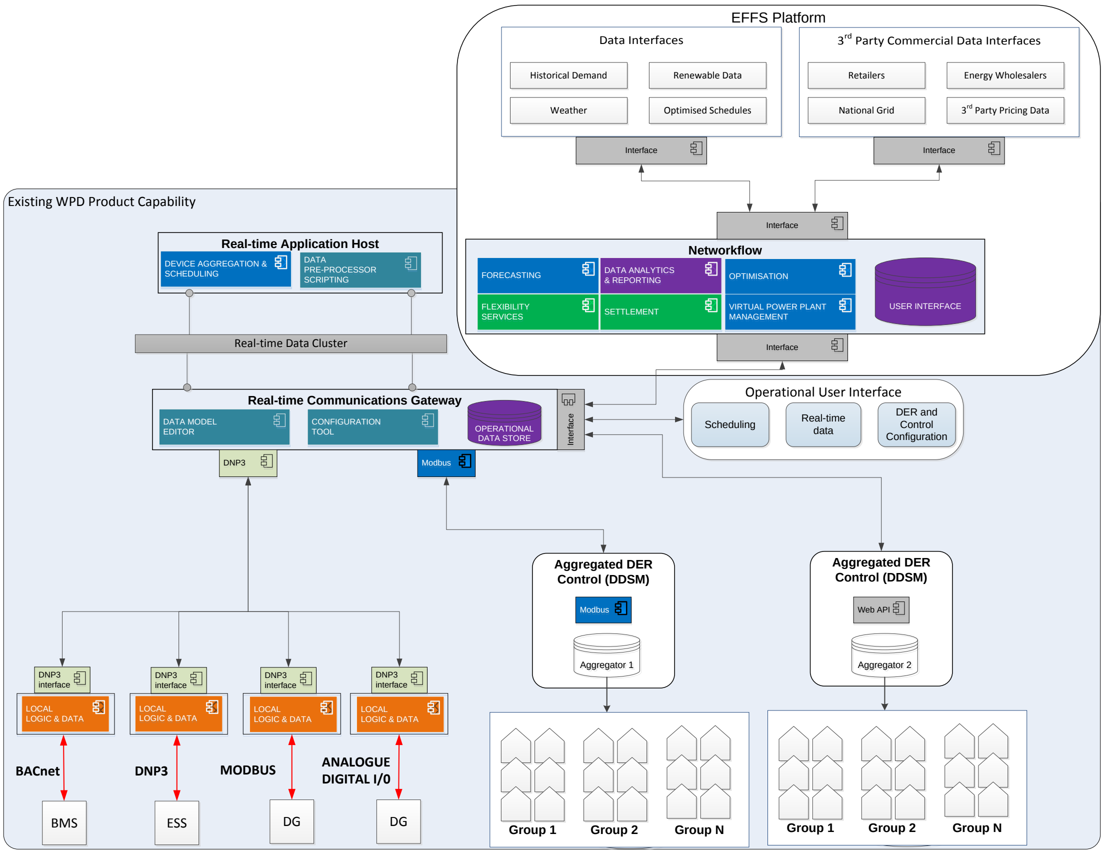
Execution of Flexibility Services

Execution of flexibility services will be determined by the local constraints of the network; a signal will be sent from the relevant network level to an armed asset or assets to ensure that the flexibility service is delivered. Part of the project will investigate the options to optimise the execution of flexibility services.

Validation of Service & Payment (Directly controlled assets)
Validation of service delivery for directly connected assets will be provided by the real-time control systems which will provide details of response time, second by second energy exchange data aggregated to a half hour resolution where appropriate. This data will be provided to and associated with the specific scheduled service in the schedule.

Validation of service delivery (Third party controlled assets)
For third party supplier/aggregator services, service delivery will be confirmed by the third-party data interface. The methodology used to validate service delivery with customers that do not have direct real-time monitoring data is expected to build on the findings from the Plugs and Socket NIA project.

Control and directly connected interfaces
The control and directly connected interfaces supported by EFFS will be further enhanced by integration to an existing WPD product, ANM strata. AMT-Sybex has already undertaken detailed discussions with the providers of the product Smarter Grid Solutions as part of our wider strategy to provide a one solution offering for flexibility management.



Appendix 14 – Costs

NIC Funding Request										
		2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	**Total**		
Cost	*From Project Cost Summary sheet*									
	Labour	21.53	126.72	151.53	97.64	-	-	397.42		
	Equipment	-	12.00	40.00	16.00	-	-	68.00		
	Contractors	163.27	1,000.90	979.43	714.26	-	-	2,857.85		
	IT	562.50	92.80	90.85	18.67	-	-	764.82		
	IPR Costs	-	-	-	-	-	-	-		
	Travel & Expenses	2.15	12.67	15.15	9.76	-	-	39.74		
Payments to users & Contigency		2.15	43.00	36.33	20.37	-	-	101.86		
	Decommissioning	-	-	-	-	-	-	-		
	Other	-	-	-	81.96	-	-	81.96		
	Total	751.60	1,288.09	1,313.29	958.67	-	-	4,311.65		
External funding	*Any funding that will be received from Project Partners and/or External Funders - from Project Cost Summary sheet*									
	Labour	-	-	-	-	-	-	-		
	Equipment	-	-	-	-	-	-	-		
	Contractors	27.15	171.20	165.14	123.22	-	-	486.71		
	IT	421.88	-	54.14	-	-	-	476.02		
	IPR Costs	-	-	-	-	-	-	-		
	Travel & Expenses	-	-	-	-	-	-	-		
Payments to users & Contigency		-	-	-	-	-	-	-		
	Decommissioning	-	-	-	-	-	-	-		
	Other	-	-	-	-	-	-	-		
	Total	449.03	171.20	219.29	123.22	-	-	962.73		
Licensee extra contribution	*Any funding from the Licensee which is in excess of the Licensee Compulsory Contribution - from Project Cost Summary sheet*									
	Labour	2.15	12.67	15.15	9.76	-	-	39.74		
	Equipment	-	-	-	-	-	-	-		
	Contractors	-	-	-	-	-	-	-		
	IT	-	-	-	-	-	-	-		
	IPR Costs	-	-	-	-	-	-	-		
	Travel & Expenses	0.22	1.27	1.52	0.98	-	-	3.97		
Payments to users & Contigency		0.22	0.50	1.52	0.98	-	-	3.21		
	Decommissioning	-	-	-	-	-	-	-		
	Other	-	-	-	-	-	-	-		
	Total	2.58	14.44	18.18	11.72	-	-	46.93		
Initial Net Funding Required		*calculated from the tables above*								
	Labour	19.38	114.05	136.37	87.88	-	-	357.68		
	Equipment	-	12.00	40.00	16.00	-	-	68.00		
	Contractors	136.12	829.69	814.29	591.04	-	-	2,371.14		
	IT	140.63	92.80	36.71	18.67	-	-	288.80		
	IPR Costs	-	-	-	-	-	-	-		
	Travel & Expenses	1.94	11.40	13.64	8.79	-	-	35.77		
Payments to users & Contigency		1.94	42.50	34.81	19.40	-	-	98.65		
	Decommissioning	-	-	-	-	-	-	-	Check Total = to Initial Net Funding request	
	Other	-	-	-	81.96	-	-	81.96	in Project Cost Summary	
	Total	299.99	1,102.45	1,075.82	823.73	-	-	3,301.99	**OK**	
Direct Benefit	*from Direct Benefits sheet*									
	Total	-	-	-	-	-	-	-		
Licensee Compulsory Contribution / Direct Benefits	*from Project Cost Summary sheet*									
	Labour	1.94	11.40	13.64	8.79	-	-	35.77		
	Equipment	-	1.20	4.00	1.60	-	-	6.80		
	Contractors	13.61	82.97	81.43	59.10	-	-	237.11		
	IT	14.06	9.28	3.67	1.87	-	-	28.88		
	IPR Costs	-	-	-	-	-	-	-		
	Travel & Expenses	0.19	1.14	1.36	0.88	-	-	3.58		
Payments to users & Contigency		0.19	4.25	3.48	1.94	-	-	9.86		
	Decommissioning	-	-	-	-	-	-	-	of Total Initial Net Funding Required	
	Other	-	-	-	8.20	-	-	8.20	**OK**	
	Total	30.00	110.24	107.58	82.37	-	-	330.20	Check that **Total** is = or > than Total Direct Benefits	
									OK	
Outstanding Funding required		*calculated from the tables above*								
	Labour	17.44	102.64	122.74	79.09	-	-	321.91		
	Equipment	-	10.80	36.00	14.40	-	-	61.20		
	Contractors	122.50	746.73	732.86	531.94	-	-	2,134.03		
	IT	126.56	83.52	33.04	16.80	-	-	259.92		
	IPR Costs	-	-	-	-	-	-	-		
	Travel & Expenses	1.74	10.26	12.27	7.91	-	-	32.19		
Payments to users & Contigency		1.74	38.25	31.33	17.46	-	-	88.78		
	Decommissioning	-	-	-	-	-	-	-	Check that Total is =to	
	Other	-	-	-	73.76	-	-	73.76	Total Outstanding Funding required	
	Total	269.99	992.20	968.24	741.36	-	-	2,971.80	**OK**	
balance	2,942.70	0.00	1,680.51	729.61	(2.72)	0.01	(0.00)	2,942.70		
interest		0.00	17.34	9.04	2.73	(0.01)	0.00	29.09		
								2,971.80	-	click this button to calculate the NIC funding request
Bank of England interest rate			0.3%		**NIC FUNDING REQUEST £**			**2,942.70**		
interest rate used in calculation			0.8%							
	RPI adjustment	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
	Index	265.0	273.2	281.7	290.4	299.4	308.7	318.3	328.1	338.3
	Annual inflation	3.10%	3.10%	3.10%	3.10%	3.10%	3.10%	3.10%	3.10%	3.10%

n.b the NIC Funding Request calculation should use the Bank of England Base rate plus 0.5% on 31 June of the year in which the Full Submission is made.