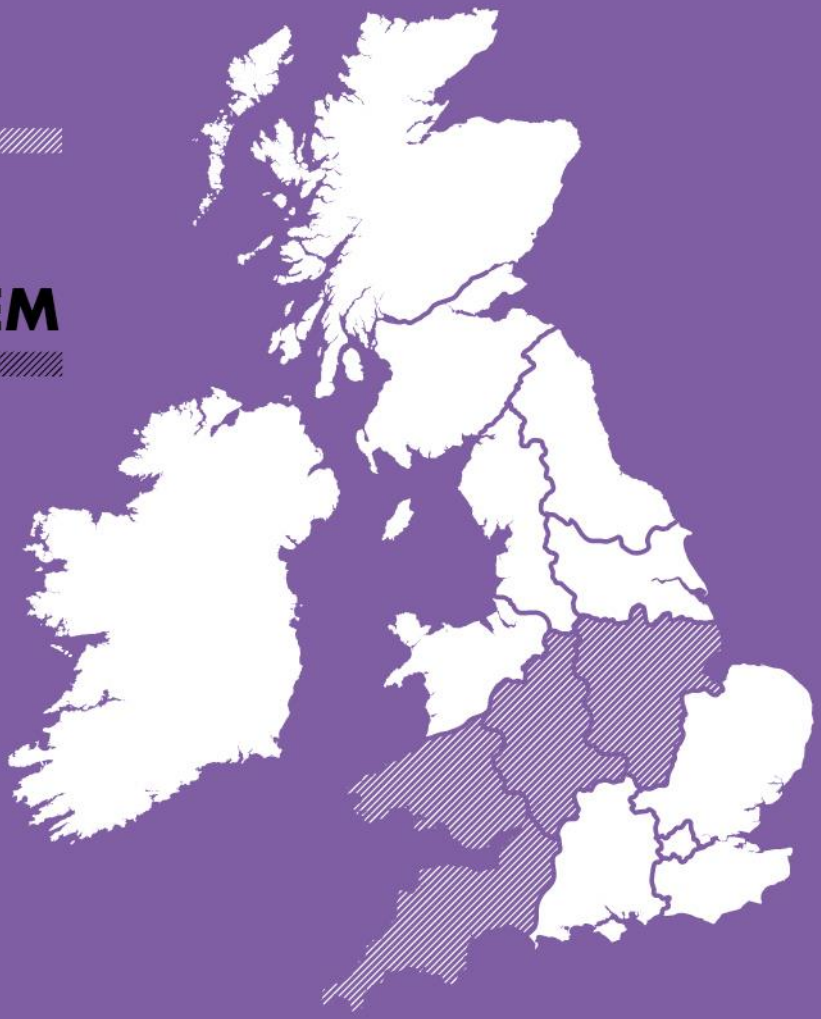
WESTERN POWER DISTRIBUTION

EFFS

ELECTRICITY FLEXIBILITY AND FORECASTING SYSTEM

EFFS
WPD_EN_NIC_003

NIC PROJECT PROGRESS REPORT
REPORTING PERIOD: APR 2019 – SEP 2019



RIIO NIC NETWORK INNOVATION COMPETITION

Report Title	:	SIX-MONTHLY PROGRESS REPORT
Report Status	:	FINAL
Project Reference	:	WPD/EN/NIC/003
Date	:	18.09.2019

Document Control

	Name	Date
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Revision History

Date	Issue	Status
19.08.2019	0.1	TEMPLATE
29.08.2019	0.2	DRAFT
10.09.2019	0.3	UPDATED
07.10.2019	1.0	ISSUED

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Glossary

Term	Definition
Background IPR	Intellectual Property Rights owned by or licensed to a Project Participant at the start of a Project.
Distribution Network Operator (DNO)	Any Electricity Distributor in whose Electricity Distribution Licence the requirements of Section B of the standard conditions of that licence have effect (whether in whole or in part).
DSO	Distribution System Operator
EFFS	Electricity Flexibility and Forecasting System
ENA	Energy Networks Association
ESO	Electricity System Operator
Foreground IPR	All Intellectual Property Rights created by or on behalf of any of the Project Participants, their sub-Licensees, agents and sub-contractors as part of, or pursuant to, the Project, including all that subsisting in the outputs of the Project.
Full Submission Pro-forma	A pro-forma which Network Licensees must complete and submit to Ofgem in order to apply for funding under the NIC.
Funding Licensee	The Network Licensee named in the Full Submission as the Funding Licensee, which receives the Approved Amount and is responsible for ensuring the Project complies with this Governance Document and the terms of the Project Direction.
GB	Great Britain
Intellectual Property Rights (IPR)	All industrial and intellectual property rights including patents, utility models, rights in inventions, registered designs, rights in design, trademarks, copyrights and neighbouring rights, database rights, moral rights, trade secrets and rights in confidential information and know-how (all whether registered or unregistered and including any renewals and extensions thereof) and all rights or forms of protection having equivalent or similar effect to any of these which may subsist anywhere in the world and the right to apply for registrations of any of the foregoing.
NIC	Network Innovation Competition
ON	Open Networks project
Project	The Development or Demonstration being proposed or undertaken.
Project Bank Account	A separate bank account opened and used solely for the purpose of all financial transactions associated with a NIC Project.

Term	Definition
Project Direction	A direction issued by the Authority pursuant to the NIC Governance Document setting out the terms to be followed in relation to the Eligible NIC Project as a condition of its being funded pursuant to NIC Funding Mechanism.
Project Participant	A party who is involved in a Project. A participant will be one of the following: Network Licensee, Project Partner, External Funder, Project Supplier or Project Supporter.
Project Partners	Any Network Licensee or any other Non-Network Licensee that makes a contractual commitment to contribute equity to the Project (e.g. in the form of funding, personnel, equipment etc.) the return on which is related to the success of the Network Licensee's Project.
Project Supplier	A party that makes a contractual commitment to supply a product or service to the Project according to standard commercial terms that are not related to the success of the Project.
Relevant Background IPR	Any Background IPR that is required in order to undertake the Project.
Relevant Foreground IPR	Any Foreground IPR that is required in order to undertake the Project.
SGAM	Smart Grid Architecture Model
TEF	TRANSITION, EFFS and FUSION projects
WPD	Western Power Distribution

Related documents

Ref	Document title	Version	Date issued	Prepared by	Link
1	Revised EFFS FSP Redacted	2.0	06/07/2018	EFFS	https://www.ofgem.gov.uk/system/files/docs/2018/10/effs_revised_full_sub.pdf
2	NIC 2017 Compliance Document	2.0	01/07/2018	TRANSITION, EFFS and FUSION projects	https://www.ofgem.gov.uk/system/files/docs/2018/10/nic_2017_compliance_document_v2_public_1.pdf
3	DSO Requirements Specification	1.0	24/05/2019	EFFS	https://www.westernpower.co.uk/downloads/42376
4	Six Monthly Progress Report	1.0	08/04/2019	EFFS	https://www.westernpower.co.uk/downloads-view/34480
5	Mobilisation Exit Report	1.0	26/02/2019	EFFS	Available on request
6	Gateway Review 1 Report	1.0	31/05/2019	EFFS	Available on request
7	Forecasting Evaluation Report	1.0	06/06/2019	EFFS	https://www.westernpower.co.uk/downloads/43210
8	EFFS Forecasting Validation Testing Report	1.0	17/07/2019	EFFS project	https://www.westernpower.co.uk/downloads-view/46990
9	Project Direction ref: WPD EMID / EFFS / 28 September 2018	1.0	28/09/2019	Ofgem	https://www.ofgem.gov.uk/system/files/docs/2018/10/effs_-_project_direction_amended_09_18.pdf

1 Executive Summary

The Electricity Flexibility and Forecasting Systems Project (EFFS or "the Project") is funded through Ofgem's Network Innovation Competition (NIC). EFFS was registered in October 2018 and will be complete by October 2021.

EFFS supports the Distribution System Operator (DSO) transition by developing and trialling a system design to plan and dispatch flexibility services in operational timescales. EFFS is a 3-year project split into four workstreams: 1) Forecasting Evaluation and Requirements, 2) Implementation, 3) System and Trials Testing, 4) Collaboration and Learning. The Project is working collaboratively with the Scottish and Southern Electricity Networks' TRANSITION project and Scottish Power Energy Networks' FUSION project and will share forecasting algorithms developed within EFFS. EFFS is also working with the Energy Network Association's Open Networks project[1].

1.1 Overall Project Progress

This document is the Project's second six-monthly project progress report. It covers progress from April 2019 to the end of September 2019. The first project progress report covered the period from October 2018 to March 2019 which included the bulk of the work towards the forecasting and DSO requirement specification deliverables. These were both delivered by July and brought the first phase of the project to a close. This was formalised with the production of the first gateway review document, which was approved by Ofgem allowing the project to progress to the design phase. In this phase the focus has been on expanding the processes and functions outlined in the DSO requirements specification into a set of eight design documents, each featuring a different functional area of EFFS. While the first phase of the project relied on input from a wide variety of stakeholders, the design phase has been more focussed on how to implement the required functionality within WPD. This has required more focus on understanding the WPD systems to which EFFS will interface so much of the time has been spent with WPD subject matter experts. Wider involvement has been important, though, to develop the thinking around conflict avoidance and to specify the interfaces to external market platforms for flexibility services. The design documents will be finalised in the early part of the next reporting period.

The key achievements in the first year of the project are summarised below. Progress that has been reported in the first six-monthly progress report is included in this report at a summary level where this is useful for context. Throughout the document where items relating to the first six months have been included, then these items appear in italics.
:

- *Contract close with Project Partner AMT-SYBEX*

[1] TRANSITION and FUSION are NIC funded projects that bid in the same year as EFFS that also relate to flexibility services. The projects' approval was conditional on an initial period of collaborative working to identify benefits from shared working. The projects continue to work closely to ensure that collaborative benefits are delivered and will need to demonstrate this to progress beyond a common stage gate assessment. Open Networks is an industry wide project relating to DSO transition which looks to provide shared analysis, roadmaps, models etc. and promote standardisation.

- *Contract close with Project Partner National Grid Electricity Transmission PLC*
- *Procurement, contract close and mobilisation of the Project's Forecasting Partner, awarded to Smarter Grid Solutions*
- *EDF Energy engaged for supplier input*
- *Completion of Project mobilisation*
- Delivery of the first four project deliverables:
  - *Mobilisation Exit Report*
  - DSO Requirements Specification
  - Forecasting Evaluation Report
  - Gateway Review 1
- TEF collaboration and coordination
- Dissemination of the forecasting evaluation work
- Progression to Workstream 2
- Drafting of the Project's next project deliverable, the EFFS system design specification.

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1.2 Business Case

There have been no changes to the benefits case to date. For information, the original business case benefits are included in Appendix 1.

1.3 Learning and Dissemination

The process of specifying the DSO requirements helped to clarify the functions and interfaces necessary to support the use of flexibility services. The EFFS approach excluded functions that are expected to be carried out by market platforms and focused on:

- identification of flexibility requirements via forecasting and capacity analysis;
- interfaces with markets to procure, reserve and dispatch services;
- internal processes for service management; and
- data exchanges and processes relating to conflict avoidance.

Similarly, learning from the forecasting evaluation work was published in June 2019. This took the form of a report and two dissemination events; the first an informal dissemination meeting for TEF members to understand the hardware and software arrangements used by Smarter Grid Solutions (SGS) to create the forecasts and the actions required to replicate these to enable their own forecasting; and second an industry dissemination event held via webinar to disseminate the outcomes and learnings from the forecasting evaluation.

In addition, the Project has regularly disseminated the concept of EFFS through a variety of means, including National Grid and TEF events. The Project's completed deliverables have been made available on the WPD EFFS webpage, where updates on the Project's status are also provided. A standard project overview slide set has been developed and published on the EFFS page of the innovation website as well as a short video explanation of the project. Further activities are given in section 2.8.3

1.4 Project Risks

The EFFS project risk register was formally created at project commencement. It is a live document and is updated regularly. A total of 28 risks have been raised, 7 of which have been closed, leaving a total of 21 live risks. Mitigation action plans are identified when raising a risk and the appropriate steps then taken to ensure risks do not become issues wherever possible. Of the 21 live risks none are ranked as severe, 5 are ranked major, 10 are ranked as moderate and 6 are ranked as minor.

Contained within Section 8.1 of this report are the current top risks associated with successfully delivering EFFS as captured in our risk register. Section 8.2 provides an update on the most prominent risks identified at the project bid phase.

2 Project Manager's Report

2.1 Project Background

The EFFS project was awarded funding in October 2018 under the 2017 Network Innovation Competition (NIC). It will specify and trial the additional system functionality required by a Distribution Network Operator (DNO) to help the transition to DSO by exploring forecasting, conflict avoidance and market communications requirement.

The aim of the EFFS project is to explore the new capabilities that DNOs will require in order to perform new functions as DSOs. It will trial a new system that supports several key 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 implementing suitable software and integrating hardware as required; and
4. Using and testing the technical implementation, which will involve modelling the impact of flexibility services.

The first objective has been achieved by the production of the DSO requirements specification with the input from industry stakeholders. The technical specification documents that are under development will meet the second objective with the third and fourth objectives relating the build and trial phases of the project respectively.

As well as proving the system, the trial phase will create learning relevant to forecasting the likely benefits of flexibility services and the impact of changing network planning standards. EFFS will focus on 33kV networks and above as these are the parts of the network where the use of flexibility as an alternative to reinforcement will add greatest value and is the supported by Flexible Power. The design of the EFFS functions and

processes will aim, where possible, to ensure that they could be adapted to lower voltages at a later date.

As there were three NIC projects exploring the DSO transition in the same year, Ofgem requested the TEF projects, EFFS, TRANSITION and FUSION demonstrate how they could work collaboratively before the projects were given unconditional funding approval. The main driver of this was to ensure that synergies were exploited, and duplication was avoided. This is explained in further detail in section 2.8.1, TEF Collaboration. Similarly, the ENA's Open Networks project is also working to determine the new skills and functions that DNOs will need to develop in order for the DSO transition to take place. EFFS is working closely with Open Networks contributing to and receiving information from several products across the workstreams.

The Project Partners involved in EFFS are:

1. Western Power Distribution: Project Lead/Funding DNO (licensee);
2. AMT-SYBEX: Third Party Lead Supplier ; and
3. National Grid Electricity System Operator (ESO).

Furthermore, the project has the following key stakeholders:

- Energy Network Association's Open Networks project;
- Scottish and Southern Electricity Networks, as Project Lead/Funding DNO (licensee) of the TRANSITION project;
- Scottish Power Energy Networks as Project Lead/Funding DNO (licensee) of the FUSION project;
- Capita Employee Benefits data science team as Design Authority of the Forecasting Partner; this service is provided through AMT-SYBEX
- Smarter Grid Solutions (Forecasting Partner);
- Centrica as managers of the Cornwall Local Energy Market project; and
- EDF Energy.

These relationships are depicted in Figure 1 below.

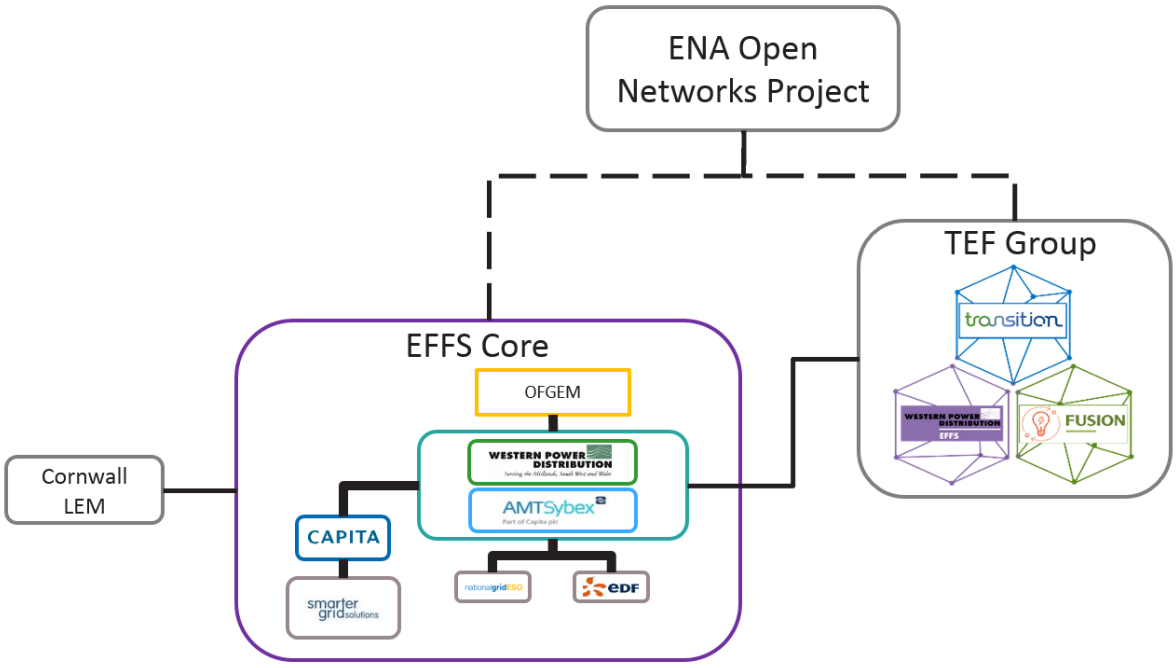

Figure 1: EFFS Key Stakeholders

The Project commenced in October 2018 and is scheduled to complete in October 2021. The Project has four workstreams as shown in Figure 2. This report details the progress of the Project over the last six months, April 2018 to September 2019. The reporting period is depicted on Figure 2 by the blue shaded box.

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

Figure 2: EFFS Timeline

The Project has progressed well over the past 12 months with four Project deliverables delivered to time and budget, as well as close collaboration with the TEF partners. Areas of focus for the purposes of this report include:

- Contracts and procurement;
- Governance;
- Mobilisation Exit Report;
- Forecasting evaluation;

- DSO requirements specification;
- Gateway Review 1; and
- Collaboration, learning and knowledge dissemination.

2.2 Contracts and procurement

For details on contracts and procurement, please refer to the Project's first 'Six Monthly Progress Report' on the WPD EFFS webpage. (https://www.westernpower.co.uk/downloads-view/34480)

2.3 Governance

For details on governance, please refer to the Project's 'Six Monthly Progress Report' on the WPD EFFS webpage.

2.4 Mobilisation Exit Report

For information relating to the Mobilisation Exit Report, please see the Project's 'Mobilisation Exit Report', available on request.

2.5 Forecasting Evaluation

The forecasting evaluation examined potential forecasting methods for predicting half-hourly average load and generation and assessed the results for different time-horizons (within day, week ahead, month ahead and six months ahead). It found that the machine learning method known as Extreme Gradient Boosting (XGBoost) provided the best balance between the accuracy of the results and the complexity of setting up the forecasts. These forecasts are to be used as an input to a capacity assessment to identify potential future network issues.

For further information relating to the Forecasting Evaluation, please see the Project's 'Forecasting Evaluation Report' on the WPD EFFS webpage(https://www.westernpower.co.uk/downloads/43210). Moreover, to view the validation testing of the forecasting models, please see 'EFFS Forecasting Validation Testing Report' on the WPD EFFS webpage.(https://www.westernpower.co.uk/downloads-view/46990)

2.6 DSO Requirements Specification

The EFFS DSO Requirements Specification records the functional requirements for a DSO that relate to the purchasing and management of flexibility services in operational timescales. While the high-level functions of a DSO have already been specified via the ENA Open Networks project, this document provides a greater level of detail as to how the processes and functions are expected to operate through the lens of Future World B, as defined by the Open Networks project (see Appendix 2: Overview of the Open Networks future worlds for details).This document forms a major part of the EFFS project's third project deliverable to Ofgem. It is being used to develop a technical specification to define the technical system to support Distribution Network Operators (DNOs) in performing the relevant new functions of a DSO.

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

For further information relating to the DSO Requirements Specification, please see the Project's 'DSO Requirements Specification' document on the WPD EFFS webpage at https://www.westernpower.co.uk/downloads/42376

2.7 Gateway review 1

The Project's gateway review 1 was held on 31/05/2019. Approval for EFFS to proceed to Workstream 2 was received from Ofgem.

For further information relating to gateway review 1, please see the Project's 'Gateway Review 1 Report', available on request.

2.8 Collaboration and Knowledge Dissemination

2.8.1 TEF Collaboration

In 2017, three projects were submitted funding requests from the NIC that supported the transition from DNO to DSO. These were:

- Our submission, Electricity Flexibility and Forecasting Systems (EFFS), ;
- TRANSITION, submitted by Scottish and Southern Electricity Networks and Electricity North West; and
- FUSION, submitted by Scottish Power Energy Networks.

The three projects look at different aspects of the DSO transition with differing aims and areas of focus. In the Project Directions issued by Ofgem for TRANSITION, EFFS and FUSION (TEF), additional conditions were included to reduce the risk of unnecessary duplication, improve delivery efficiency and ensure the projects deliver complementary learning. The principles of engagement for EFFS (and the other TEF projects) are defined in section 5 of 'nic_2017_compliance_document_appendices_v2_public.pdf'; this document can be found at the following link:

https://www.ofgem.gov.uk/system/files/docs/2018/10/nic_2017_compliance_document_appendices_v2_public.pdf.

Within this, the following approach for post 2018 engagement was defined:

"Presently Open Networks (ON) have only committed to their workplan for 2018. In subsequent years, the TEF Project Delivery Board shall review the ON Project Initiation

Document (PID) and liaise with relevant Product Leads during the scoping phase to feed in cross project learning and facilitate alignment of key inputs and outputs. This will be approved by the TEF Steering Board and ON Steering Group as required on an annual basis."

The principles of engagement for TEF were also formally agreed in the TEF collaboration document referenced above, which was submitted to Ofgem in June 2018.

Coordination activities between TEF are in progress, which to date include:

- *Establishment of the TEF project steering group;*
- *Set up of a shared TEF SharePoint set up by SSEN. Key project documents uploaded to, and are being actively managed by, the TEF group;*
- EFFS updates provided at TEF project delivery board meetings. Ten face-to-face meetings complete to date;
- Review and identification of further areas of collaboration;
- Combined TEF support for individual and combined project events;
- Forecasting Evaluation Q&A session with TEF on 19/03/2019 to enable better understand of the WPD EFFS forecasting evaluation and its outputs;
- DSO Requirements Specification issued to TEF and relevant industry parties for review on 25/04/2019;
- DSO Requirements Specification Q&A webinar held on 02/05/2019; and
- Forecasting dissemination webinar held on 27/06/2019 to disseminate the learnings and outputs to TEF as well as other relevant industry stakeholders.

2.8.2 ENA ON Collaboration

Coordination activities between the ENA Open Networks and EFFS are in progress, which to date include:

- *ENA Open Networks Consultations – 2018 future worlds consultation attended and 2019 PID consultation response provided;*
- *Ongoing engagement as part of the TEF group via the TEF Open Networks representative;*
- *Attendance at ENA Future Worlds Stakeholder Event 03/09/2018 in London;*
- *Attendance at ENA policy framework discussion 01/02/2019 in London;*
- DSO Requirements Specification issued for review on 25/04/2019;
- DSO Requirements Specification Q&A webinar held on 02/05/2019; and
- EFFS DSO Requirements Specification and Forecasting Evaluation Report shared with ENA Open Networks Workstream 5 – Communications on 09/08/2019.

2.8.3 Project Learning and Dissemination

Project lessons learned and what worked well are captured throughout the project lifecycle. These are captured through a series of on-going reviews with stakeholders and project team members. These are reported in Section 6 of this report.

Key dissemination activities within the reporting period are as follows:

- *A press release for the EFFS project was released by WPD and AMT-SYBEX in October 2018;*
- *EFFS project information were uploaded to the WPD website in October 2018;*
- *The EFFS project was represented by the WPD and AMT-SYBEX project team at the Low Carbon Networks & Innovation event in October 2018;*
- *TEF project overview at ENTSO-E National Grid event in December 2018;*
- *Ofgem Deliverable 1, the Mobilisation Exit Report, received sign off on 20/02/2019 and was formally issued to Ofgem on 27/02/2019;*
- *EFFS introductory slide pack and voiceover were uploaded to YouTube and the EFFS project webpage on the WPD website in March 2019;*
- *Forecasting Evaluation Q&A session with TEF on 19/03/2019;*
- EFFS updates provided at TEF project delivery board meetings. See section 2.8.1for further details.
- Collaboration between SGS and National Grid to share best practice in terms of forecasting approaches and methodologies;
- DSO Requirements Specification issued to TEF and relevant industry parties for review on 25/04/2019;
- DSO Requirements Specification Q&A webinar held on 02/05/2019;
- EFFS project overview and early learnings from forecasting evaluation disseminated at AMT-SYBEX's Forecasting the Future event on 15/05/2019;
- Forecasting dissemination webinar on 27/06/2019; and
- EFFS DSO Requirements Specification and Forecasting Evaluation Report shared with ENA Open Networks Workstream 5 – Communications on 09/08/2019.

3 Business Case

At the time of writing, there have been no changes to the anticipated benefits to be gained by the Project. For information, the original business case benefits have been included in this document as Appendix 1.

4 Progress against Budget

Spend Area	Budget (£k)	Expected Spend to Date (£k)	Actual Spend to Date (£k)	Variance to expected (£k)	Variance to expected %
Labour	397.4	163.9	120.4	43.5	27%
Equipment	58.0	2.7	0.0	2.7	100%
Contractors	2,029.7	629.6	608.2	21.4	3%
IT	630.1	500.0	500.0	0.0	0%
IPR Costs	0.0	0.0	0.0	0.0	0%
Travel & Expenses	39.7	16.4	13.4	3.0	18%
Payments to users & Contingency	101.8	41.3	0.0	41.3	100%
Decommissioning	0.0	41.3	0.0	0.0	0%
Other	82.0	0.0	0.0	0.0	0%
TOTAL	3,338.8	1353.9	1242.0	111.9	8%

4.1 Comments around variance

[1] Labour - this underspend reflects the assumption that during the mobilisation and specification phases greater WPD resource time would be available for use on the project with lower requirements during the build phase. A flatter resource profile is now expected.

[2] Payments to users & contingency – this underspend relates to contingency values being allocated on a pro-rata basis. No payments to users are scheduled until the trial phase in 2020.

[3] Equipment - this underspend relates to switching to webinars rather than events held in conference facilities for the DSO requirements specification & forecasting results.

5 Deliverables

Progress against the Project's deliverables has been as expected with the first four deliverables delivered by the close of this reporting period to time and budget. These were:

- *Mobilisation Exit Report;*
- Forecasting Evaluation Report;
- DSO Requirements Specification; and
- Gateway Review 1.

Significant progress is being made towards the next project deliverable which is the System Design Specification document.

A full list of EFFS deliverables is given in section 5.1.

5.1 EFFS Project Deliverables

Below are the Project's deliverables in line with the Project Direction (see Project Direction ref: WPD EMID / EFFS / 28 September 2018' for further details). Note: the Project's deadlines were revised part way through the TEF signoff process which continued for a further three months. As it was not possible to revise the deadlines to reflect this additional time, the deadlines being worked to are stated separately in the 'Deadline' column as agreed with Ofgem.

Ref.	Project Deliverable	Deadline	Evidence	NIC funding request (100%)	Status
1	Mobilisation Exit Report	Project Direction 17/12/18 WPD plan 18/03/19	A mobilisation exit report will be produced, including evidence of: • Forecasting partner tender accepted • Collaboration agreements signed • Detailed plan with breakdown by project work stream 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%	Complete
2	Output from the forecasting	Project Direction 08/04/19 WPD plan 05/07/19	Publication of report showing forecasting options evaluated and selected options. Presentations at conferences and workshops to disseminate output.	6%	Complete
3	Development of requirements specification for DSO functionality	Project Direction 15/04/19 WPD plan 12/07/19	Production of requirements specification document outlining for DSO functionality, common protocols and approach to supporting these functionalities. Electricity Networks Association (ENA) and stakeholder collaboration strategy document (delivered a fixed period of time following publishing of ENA workshop output). Letters of support from key	9%	Complete

Ref.	Project Deliverable	Deadline	Evidence	NIC funding request (100%)	Status
			stakeholders (e.g. ENA Working Group) outlining agreement with specification document.		
4	Development of EFFS Design Specification document	Project Direction 15/07/19 WPD plan 16/10/19	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%	In progress
5	Implementation and System Delivery	Project Direction 20/07/20 WPD plan 19/10/20	Build and delivery of the completed EFFS system, including technical design package release, deployment and configuration and system handover.	3%	On track
6	Completion of on-site system testing	Project Direction 02/11/20 WPD plan 01/02/21	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%	On track
7	Trials design and preparation	Project Direction 30/11/20 WPD plan 01/03/21	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%	On track
8	Trials – execution and knowledge capture	Project Direction 01/06/21 WPD plan 31/08/21	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%	On track

Ref.	Project Deliverable	Deadline	Evidence	NIC funding request (100%)	Status
9	Gateway reviews	Project Direction 26/03/19 20/05/20 07/06/21 WPD plan 25/06/19 19/08/20 06/09/21	Delivery of gateway report at the end of Workstream 1, Workstream 2 and Workstream 3, detailing progress against the project benefits and costs.	2%	Gateway review 1 – complete On track
Common Project Deliverable					
N/A	Comply with knowledge transfer requirements of the NIC Governance Document.	End of Project	1. Annual Project Progress Reports that comply with the requirements of the Governance Document. 2. Completed Close Down Report which complies with the requirements of the Governance Document. 3. Evidence of attendance and participation in the Annual Conference as described in the Governance Document.	N/A	In progress

6 Learning Outcomes

The following learning outcomes have been recorded in the Project's Learning Log in the last six months

Project requirements evaluation

The project kicked off with a series of workshops designed to capture the full detailed requirements for DSO operation. However, it has not been possible to set out and agree a solution in the level of detail originally envisaged, since the EFFS project has progressed ahead of the majority of compatriot work in this field. The result being that some areas are having to be revised by rerunning follow-up work-shops when the necessary and external thinking has progressed to a sufficient level of detail. In retrospect, acknowledging that much of the work and necessary process is highly innovative and very new in nature, a two-part requirement gathering process might have been beneficial. This might have worked on an initial phase of developing a greater understanding for participants. Then running a second stage for actually capturing requirements. With participants having had more time to consolidate their understanding of how DSO might impact their business areas, the final workshops - which would have run later in the programme - would have been able to pick up a greater level of detail.

Forecasting evaluation results

Three forecasting methods were investigated as part of the forecasting evaluation phase; Auto-Regressive Integrated Moving Average (ARIMA) – A classic statistical modelling approach for building time-series forecasting models. Long Short Term Memory Artificial Neural Networks – A specific type of deep learning neural network for learning patterns in time-series data. Extreme Gradient Boosting (XGBoost) – A machine-learning technique based on decision trees that has performed well in recent machine learning and forecasting competitions. The key outcomes from the forecasting delivered within this part of the EFFS project include the following:

- **Model performance**: For the majority of test cases, Extreme Gradient Boosting outperformed the other methods tested (ARIMA and Long Short Term Memory).
- **Forecasting at different voltage levels and substation types**: EFFS applied a series of techniques to Grid Supply Point (GSP), Bulk Supply Point (BSP), Primary, Load and Generation customers across multiple time horizons. The high-level results include:
    - Techniques based on historical data work best on short time horizons (hour ahead and day ahead). This result is seen across most of the voltage levels, including load and generation customers.
    - For the Primary and BSP cases with low penetration of wind and solar, relative to yearly demand, a feature set containing only temporal trends will provide predictions with acceptable levels of accuracy; for higher penetrations of renewables, predictions benefit from the addition of weather features to meet accuracy requirements.
    - For the GSP case, a GSP including connected solar and wind generation capacities comparable to that of its total demand were selected. The stochastic nature of the renewable generation made it more challenging to identify trends/patterns from historical data for the net real and reactive power flows at the GSP. By forecasting on an individual transformer basis and then aggregating the forecasts yielded better results. Although the results were only for a limited number of substations, this suggests DSOs may look build a large number of specific models to aggregate up to the GSP level to achieve the desired accuracy.

Additional forecasting requirements

Following completion of the forecasting evaluation work by SGS in June 2019, a number of additional forecasting requirements not originally envisaged came to light. Had these requirements been identified at the outset when the forecasting requirements were specified, they could clearly have been included for in the tender. However, innovation projects such as EFFS by their very nature are exploring new requirements and therefore it should not be expected that a definitive set of requirements can be known at the start of any piece of work. Future innovation projects might look to mitigate this by including added budget or specifically hold back a small additional requirements budget to support the inclusion of additional requirements in a future tender if required.

DSO requirements specification: industry review cycle

Reviewing long technical documents in a short timescale can be challenging. To reduce the potential issues with this industry reviewers were provided multiple, advance notifications of the DSO requirements document review cycle timescales and purpose and additionally an introductory webinar was held so that reviewers already had a chance to clarify key concepts before reviewing the document. However, some reviewers still found the required 5 working-day turnaround to be challenging. In future, the Project will try to extend the review periods and provide an indication of the anticipated document size and corresponding reviewing effort. This will enable reviewers to better schedule a sufficient amount of time during review cycles (or push back in advance if it is not feasible), which will improve engagement and the quality of the associated deliverables.

DSO requirements specification: direct dispatch of assets

At project commencement, EFFS team initially assumed that EFFS would have direct control of assets and would trigger services via flexibility platforms. However, an exploration of the concept of neutral market facilitation during WS1 led to the decision that EFFS will not have direct control of assets. Instead, there will be one single method to dispatch flexibility regardless of whether the asset is owned by a third-party or WPD, and this will be via whichever of the multiple flexibility platforms EFFS has procured the service from. This decision was made to ensure fair, equal and consistent interaction with flexibility platforms and to avoid any specific technology provider, or flexibility platform(s), being treated preferentially. EFFS will be agnostic to these factors; all flexibility service providers will be treated equally as long as they can fulfil the service requirements and provide value for money.

DSO requirements flexibility service requirement data exchange

Although the Smart Grid Architecture Model (SGAM) defined by the ENA Open Networks project give a high-level view of the types of data exchanges required to support the procurement and dispatch of flexibility services, this had not previously been defined to the level of agreeing data items. Through the WS1 workshops we have defined a proposed set of data items (based on the 4 service types defined by the ENA Open Networks) and drilled into the next level of detail which have been reviewed and agreed by various industry stakeholders as part of the DSO requirements document review cycle. This view may evolve further during the technical design of the EFFS system, however it has provided an additional level of detail and understanding to how the data exchange related to flexibility services will work in practice and therefore enhanced the learning of the SGAM.

7 Intellectual Property Rights

A complete list of all background IPR from all project partners has been compiled. The IP register is reviewed on a quarterly basis. No additional foreground IP has been identified and registered in this reporting period.

8 Risk Management

Our risk management objectives are 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; and
- Anticipate and respond to changing project requirements.

These objectives will be achieved by:

- ✓ Defining the roles, responsibilities and reporting lines within the Project Delivery 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;
- ✓ Preparing contingency action plans; and
- ✓ Monitoring and updating of risks and the risk controls.

8.1 Current Risks

The EFFS risk register is a live document and is updated regularly. There are currently 21 live project-related risks. Mitigation action plans are identified when raising a risk and the appropriate steps then taken to ensure risks do not become issues wherever possible. In Table 8-1**Error! Reference source not found.**, we give details of our top five current risks by category. For each of these risks, a mitigation action plan has been identified and the progress of these are tracked and reported.

The most significant risk to the project is that EFFS is working to faster timescales than TRANSITION, FUSION and the Open Networks project. This results in EFFS having to take the lead in defining DSO functionality while still achieving engagement from stakeholders that had not expected to consider these issues until later in the year. Some stakeholders have accepted that this is a shift in timescales rather than additional workload. The workshops have been generally well received and have identified future collaborative opportunities. Therefore, the mitigation of this risk lies chiefly with demonstrating useful outputs to the stakeholders to ensure continued participation, and to ensure that the outputs from EFFS are sufficiently accepted by stakeholders such that the risk of Open Networks reaching significantly different conclusions is minimal.

Details of the Risk	Risk Rating	Mitigation Action Plan	Progress
Lack of availability of project teams to support the project.	Major	Alternative approach to WS2 system design deliverable that is less resource intensive for WPD staff has been adopted. Technical SME / PM engaged from WPD perspective	Ongoing
National Grid ESO participation in the EFFS project (to support technical requirements and trials).	Major	Continue to work with and communicate project requirements to National Grid ESO.	Ongoing
Cornwall LEM cannot support the EFFS interfacing requirements.	Major	Continue to work and communicate requirements with CLEM. Promote simple options that can be implemented.	Ongoing
There is a risk that the requirements specified by the project are too complex to be delivered within the time and budget of the project.	Major	Understand build requirements early during system design phase with SMEs. Escalate early to the Project Review Group for decision on scope.	Ongoing
Market platforms that EFFS interacts with are not interoperable (e.g. timelines, data items, API, service definitions)	Major	Continue to encourage EDF platform development to reflect Flexible Power platform features. Risk/expectations of EFFS project to be managed actively.	Ongoing

Table 8-1: Top five current risks (by rating)

Table 8-2 provides a snapshot of the risk register, detailed graphically, to provide an on-going understanding of the projects' risks.

Likelihood = Probability x Proximity	1. Insignificant changes, re-planning may be required	2. Small Delay, small increased cost but absorbable	3. Delay, increased cost in excess of tolerance	4. Substantial Delay, key deliverables not met, significant increase in time/cost	5. Inability to deliver, business case/objective not viable
Certain/Imminent (21-25)	0	0	0	0	0
More likely to occur than not/Likely to be near future (16-20)	0	1	0	0	0
50/50 chance of occuring/ Mid to short term (11-15)	2	0	1	1	0
Less likely to occur/Mid to long term (6-10)	1	1	4	2	0
Very unlikely to occur/Far in the future (1-5)	0	1	1	1	5
	Impact				

	Minor	Moderate	Major	Severe	
Legend	6	10	5	0	No of instances
Total	21				No of live risks

Table 8-2: Graphical view of Risk Register

Chart 8-3 provides an overview of the risks by category, minor, moderate, major and severe. This information is used to understand the complete risk level of the project.

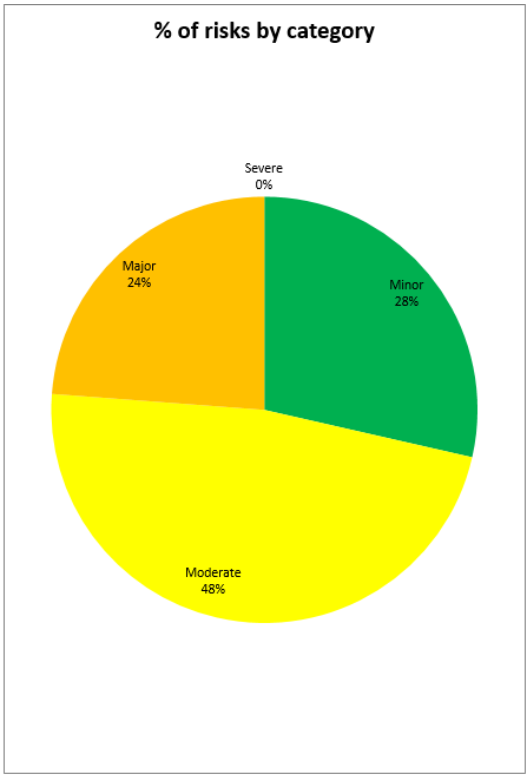

Chart 8-3: Percentage of Risk by category

8.2 Update for risks previously identified

An update on the most significant risks from the previous six-monthly report is given below.

Details of the Risk	Previous Risk Rating	Current Risk Rating	Mitigation Action Plan	Progress
ON output not sufficiently detailed or received in project timelines in order to inform development work.	Major	Moderate	Engagement with ON continues via T.E.F. to ensure that while ON is too late to contribute to EFFS design, EFFS can contribute to ON to ensure alignment of approach.	Ongoing
There is a risk that the programme may be unable to gain consensus on the role of a DSO, data interfaces and the requirements, which the system must fulfil.	Major	Moderate	To mitigate this, a proactive mechanism of escalation to the programme board will be in place to make decisions.	Risk reduced following industry review of DSO requirements specification
The DSO requirements specification cannot be completed in time to achieve WPD sign off by 21/05/19.	Major	Closed		.
Unable to support links to market platforms that are too diverse in their services, definitions, data items, process flows etc.	Major	Major	Continue to work with market platforms to promote simple options that can be implemented	Some alignment between EDF PowerShift and Flexible Power. Cornwall Local Energy Market will have different approach.
There is a risk that there may be a lack of availability of WPD work sites, data centres, project teams to support the project.	Moderate	Major	Alternative approach to WS2 system design deliverable that is less resource intensive for WPD staff has been adopted. Technical SME / PM engaged from WPD perspective	Work site access no longer a risk however obtaining WPD project team time continues to be high risk.

Table 8-4: Risks identified in the previous progress report

9 Consistency with Project Direction

The scale, cost and timeframe of the project has remained consistent with the registration document, a copy of which can be found here:

https://www.westernpower.co.uk/projects/effs

10 Accuracy Assurance Statement

This report has been prepared by the WPD EFFS Delivery Manager (Elliot Warburton of AMT-SYBEX), reviewed by the WPD EFFS Project Manager (Jennifer Woodruff) and approved by the Innovation Team Manager (Jonathan Berry).

All efforts have been made to ensure that the information contained within this report is accurate. WPD confirms that this report has been produced, reviewed and approved following our quality assurance process for external documents and reports.

Appendix 1 – Project benefits

Benefit 1 – Deferral or avoidance of conventional reinforcement for a period of time

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 Great Britain (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 provided 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.

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.

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.

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.

Appendix 2: Overview of the Open Networks future worlds

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

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

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

World A: DSO Coordinates

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

World B: Coordinated DSO-ESO Procurement and Dispatch

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

World C: Price Driven Flexibility

World B considered a World based on enhanced contracted flexibility arrangements. In World C, changes are made to price flexibility arrangements such that active parties vary their demand or generation in response to either or both energy price and network signals, such as time and location. World C has been developed cognisant of Ofgem's reform of electricity network access and forward-looking charges programme and considers potential changes to future charging and access arrangements. Given the relatively early stage of this programme and the nature of the SGAM modelling it has not been possible to define a detailed option. World C does consider high level principles for

changes to charging and access arrangements that are consistent with the work of Charging Futures including:

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

World D: ESO Coordinate(s)

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

World E: Flexibility Coordinator(s)

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