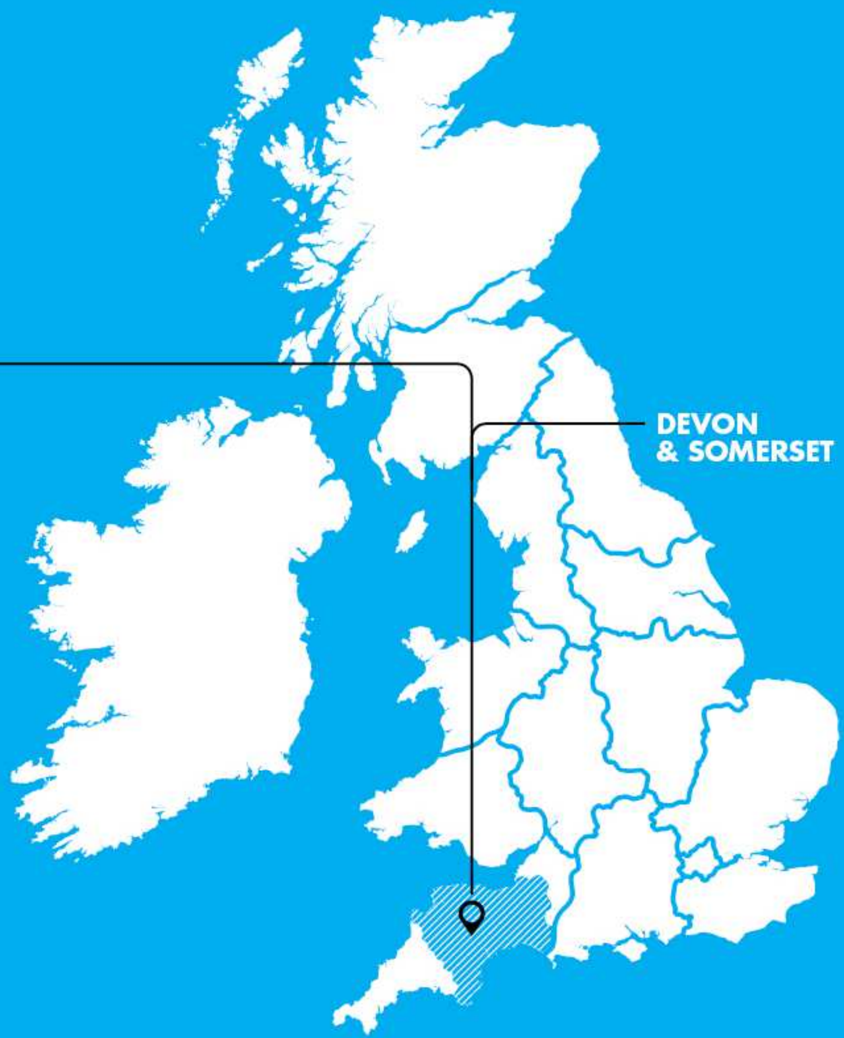
WESTERN POWER DISTRIBUTION

NETWORK EQUILIBRIUM

BALANCING GENERATION AND DEMAND



PROJECT PROGRESS REPORT

REPORTING PERIOD:
December 2018 to May 2019

LCN Fund
Low Carbon Networks

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1 Executive Summary

Network Equilibrium is funded through Ofgem's Low Carbon Networks Second Tier funding mechanism. Network Equilibrium was approved to commence in March 2015 and will be complete June 2019. Network Equilibrium aims to develop and trial an advanced voltage and power flow control solution to further improve the utilisation of Distribution Network Operators' (DNO) 11kV and 33kV electricity networks in order to facilitate cost-effective and earlier integration of customers' generation and demand connections, as well as an increase an customers' security of supply.

This report details progress of the project, focusing on the last six months, December 2018 to May 2019.

Business Case

The business case for Network Equilibrium remains unchanged. The benefit of creating additional system capacity for the connection of load and generation, as well as the increases in security of supply to all customers is still valid.

Project Progress

This is the ninth progress report. The period covered in this report has further focussed on the continued operation of the System Voltage Optimisation (SVO) system and the Flexible Power Link (FPL) and the closedown activities of the project.

Trials for SVO and the FPL have been running since February 2018 and March 2018 respectively. The benefits and outcomes of trialling all three Methods have been captured in SDRC-7 "Trialling and demonstrating the integration of the EVA, SVO and FPL Methods". The report described the detailed analysis that was under for the three Methods and highlighted that implementing the EVA and SVO on a single network could release over 350MVA system capacity. In addition, the report concluded that that each of the project's Methods could be delivered at, or lower than, the post-trial costs detailed in original bid documentation.

Throughout this reporting period there has also been a focus on identifying possible improvements to the project Methods. These improvements could be implemented during the last phase of the project trials or for use on future implementation of the Methods. The FPL Control Module (CM) is one particular area where improvements have been implemented though the deployment of optimisation within the algorithms.

Project Delivery Structure

Project Review Group

The Network Equilibrium Project Review Group met once during this reporting period. The main focus of this meeting was to discuss the SVO and FPL systems post project, where it was determined that both the Methods had delivered significant network benefit and value and will remain on the network beyond the lifetime of the project.

Resourcing

The resourcing of the project remains as described in the previous reporting period, where the design team is led by WPD engineers and supported by consultant engineers.

Procurement

The procurement activities for Network Equilibrium focus on the SVO and FPL methods. Throughout the project supporting procurement activities will take place in order to facilitate the successful delivery of all project methods; however, there are two formal procurement activities as part of the project.

Table 1-1: Procurement Activities

Manufacturer	Technology	Applicable Substations	Anticipated Delivery Dates
Siemens	SVO System	16 Substations	Completed
ABB	FPL	Exebridge	Completed

Installation

Construction and installation activities related to the SVO and FPL have been completed in the previous reporting period:

- 16 complete SVO relay site installation; and
- FPL device installed and commissioned.

Project Risks

A proactive role in ensuring effective risk management for Network Equilibrium is taken. This ensures that processes have been put in place to review whether risks still exist, whether new risks have arisen, whether the likelihood and impact of risks have changed, reporting of significant changes that will affect risk priorities and deliver assurance of the effectiveness of control.

Contained within Section 8.1 of this report are the current top risks associated with successfully delivering Network Equilibrium as captured in our Risk Register along with an update on the risks captured in our last six monthly project report. Section 8.2 provides an update on the most prominent risks identified at the project bid phase.

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, and will be shared in lessons learned workshops at the end of the project. These are reported in Section 6 of this report.

A key aim of Network Equilibrium is to ensure that significant elements of the work carried out for network modelling, monitoring, design and installation are captured and shared within WPD and the wider DNO community. During this period the main focus has been to share the performance of the Methods as standalone systems and combined; this learning has been captured in SDRC-7, submitted 20 December 2018.

In addition the final project SDRC, 8, was submitted 8 April 2019, which documented the key learning and dissemination activities undertaken throughout the project. Further to this a DNO dissemination event was held at Exebridge Substation, the location of the FPL, where the project Methods and learning were discussed and a site visit of the FPL took place.

2 Project Manager's Report

2.1 Project Background

The focus of Network Equilibrium is to balance voltages and power flows across the distribution system, using three Methods to integrate distributed generation within electricity networks more efficiently and delivering major benefits to distribution customers.

The Problem that Network Equilibrium addresses is that electricity infrastructure in the UK was originally designed and developed for passive power distribution requirements. As a result, the integration of significant levels of low carbon technologies (LCTs) within our present electricity networks can cause voltage management and thermal issues. For business as usual (BAU) roll-out we need to develop solutions, which take a strategic engineering approach, considering the whole system and not solving constraints on a piecemeal basis. The Problem will be investigated using three Methods, and their applicability to 33kV and 11kV distribution networks assessed. Each will involve testing within South West England:

(1) Enhanced Voltage Assessment (EVA);
(2) System Voltage Optimisation (SVO); and
(3) Flexible Power Link (FPL).

The aims of Equilibrium are to:

- Increase the granularity of voltage and power flow assessments, exploring potential amendments to ENA Engineering Recommendations and statutory voltage limits, in 33kV and 11kV networks, to unlock capacity for increased levels of low carbon technologies, such as distributed generation (DG);
- Demonstrate how better planning for outage conditions can keep more customers (generation and demand) connected to the network when, for example, faults occur. This is particularly important as networks become more complex, with intermittent generation and less predictable demand profiles, and there is an increased dependence on communication and control systems;
- Develop policies, guidelines and tools, which will be ready for adoption by other GB DNOs, to optimise voltage profiles across multiple circuits and wide areas of the network;
- Improve the resilience of electricity networks through FPL technologies, which can control 33kV voltage profiles and allow power to be transferred between two, previously distinct, distribution systems; and
- Increase the firm capacity of substations, which means that the security of supply to distribution customers can be improved during outage conditions, leading to a reduction in customer interruptions (CIs) and customer minutes lost (CMLs).

2.2 Project Progress

This is the ninth and final progress report for Network Equilibrium. As the project is now in the final stages of delivery, the period covered in this report has focussed on three keys areas:

- Further analysis of data gathered during SVO and FPL trials;
- Refining the performance of SVO and the FPL Methods; and
- Extracting learning from the trials, sharing this with DNOs and generating further dissemination material for forthcoming events.

Trials for SVO and the FPL have been running since February 2018 and March 2018 respectively. The benefits and outcomes of trialling all three Methods have been captured in SDRC-7 "Trialling and demonstrating the integration of the EVA, SVO and FPL Methods". The report described the detailed analysis that was undertaken for the three Methods and highlighted that implementing the EVA and SVO on a single network could release over 350MVA system capacity. In addition, the report concluded that each of the project's Methods could be delivered at, or lower than, the post-trial costs detailed in original bid documentation.

SDRC-8 "Knowledge capture and dissemination" was submitted in April 2019 and concluded all the SDRC submissions for Network Equilibrium. The document summarises the learning and dissemination that has taken place throughout the course of the project. In addition to the annual industry events such as the LCNI and our own Balancing Act conferences, the technical outputs and valuable learning from Network Equilibrium have been shared with an international audience at events such as CIGRE, CIRED and the IET ACDC Conference.

Throughout this reporting period there has also been a focus on identifying possible improvements to the project Methods. These improvements could be implemented during the last phase of the project trials or for use on future implementation of the Methods. The FPL Control Module (CM) is one particular area where improvements have been implemented though the deployment of optimisation within the algorithms.

Finally, work is ongoing to prepare the necessary material for the project closedown activities. The closedown activities have already commenced after a technical dissemination event for DNOs was hosted on 15 May 2019 and included a tour of the FPL installation. Further events will be held in the coming months to disseminate learning to a wider audience and gain feedback for future projects. The project Closedown Report has also been drafted will be released in July 2019.

2.3 System Voltage Optimisation

The SVO method of Network Equilibrium aims to dynamically manage the voltages in the network to maximise the level of LCTs that can be connected to network while maintaining statutory limits.

This reporting period consisted of the last phase of trials during which the trial data collection and analysis continued and the learning gained was used to further optimise the operation of the technology.

2.3.1 Automatic Restoration Improvements

In the previous reporting period, the automatic restoration procedure was developed and implemented which re-enabled the site automatically an hour after it was disabled due to a red optimisation alarm. This increased the on-time of the technology, reduced the amount of time spent by Control Engineers to manually re-enable SVO at the various sites and also provided additional learning by making it easier to see how long each site would maintain green optimisation status.

In this reporting period further trials of automatic restoration were conducted and the logic was extended to take into account failed controls. This extension to the logic was implemented as it was found that controls sent to site to enable/disable SVO could sometimes fail, mainly due to transient communication issues and would pause the operation of automatic restoration. The additional logic ensured that a check was applied to verify whether the control was successful and if not, it performed an additional two attempts of the control. The overall restoration logic is shown in Figure 2-1.

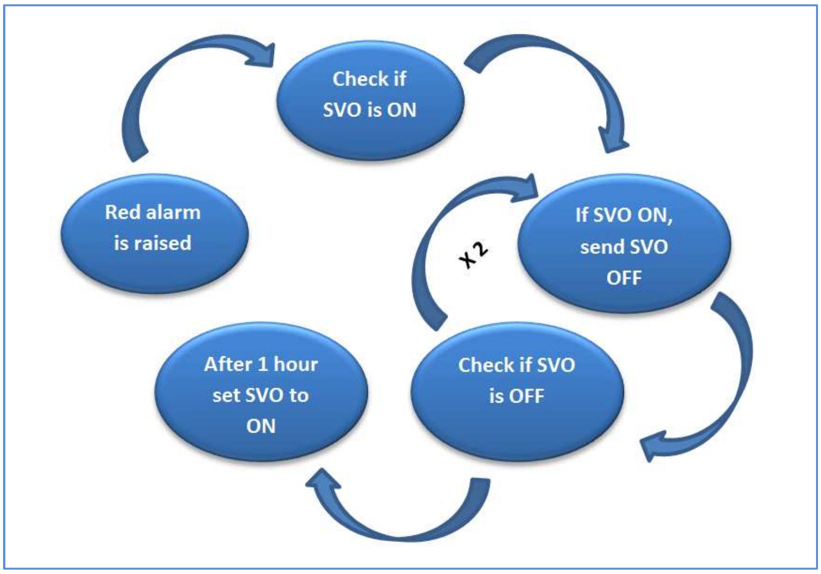


Figure 2-1 Updated Automatic Restoration Procedure

2.3.2 Trial Data Collection

Through the operation of SVO, detailed network operation data has been collected and provided learning on the transient nature of the network operation. The data that was collected was stored, creating a database of historic values which included among others tap position indicators and all instantaneous changes of voltages and power flow measurements.

In BAU operation, tap positions are not archived at all and analogues are only stored as half-hourly averages. Therefore, capturing all analogue changes by SVO provided detailed network data that were previously unavailable and enabled greater understanding of the dynamic changes in network operation. An example of the captured tap positions of GT1 at Tiverton BSP, for a week is shown in Figure 2-2.

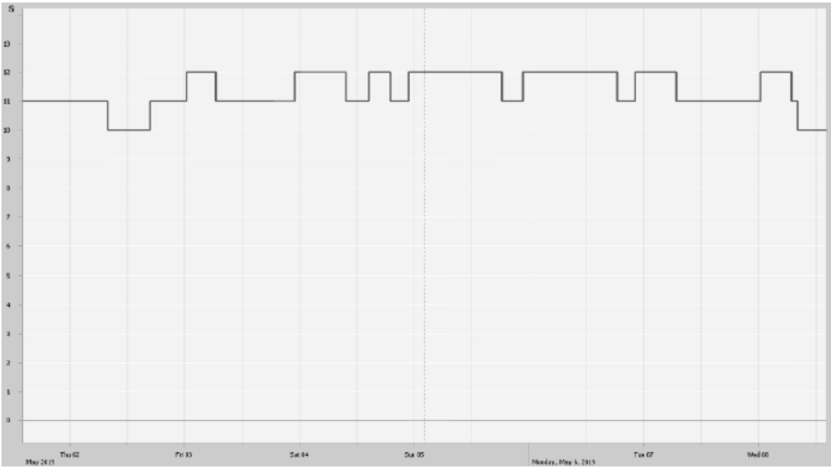


Figure 2-2 Historic Tap Positions of GT1 at Tiverton BSP during a week in May 2019

2.3.3 Trial Data Analysis

The analysis of the trial data provided useful further learning on the operation of the technology and enabled comparisons to be made with the expected SVO operation in the studies that were performed during the site selection process at the beginning of the project.

The results have consistently shown that the voltages in both 33kV and 11kV networks can be shifted both up and down during real-time network operation. More specifically, SVO has demonstrated that in practice, the capability to amend the target voltage set-point at both BSP and primary substations is much larger than can be estimated from traditional power system studies. For example, the actual target voltage amendment window at a primary for a week was 57% wider in reality compared with the estimated value through power flow studies, and 88% wider for a BSP.

2.4 Flexible Power Link

In the previous reporting period there was considerable effort to understand the operational performance of the FPL. The device was operated in both real (P) and reactive (Q) power modes to manage thermal and voltage limits on the network.
In this reporting period the trial of the FPL and analysis of the operational performance data has continued. The following sections provide further information on the activities that have been carried out in the final reporting period of the project.

2.4.1 Performance

In the last reporting period the FPL was mainly operated in P control mode as this is the predominant mechanism to transfer the excess generation seen at Barnstaple BSP to the load centre at Taunton BSP. In this reporting period, the operational range of the device has been extended to include trials of the Q control mode used for voltage control purposes which proved to be successful. Following this, subsequent trials were conducted to test simultaneous P and Q control modes. The FPL has operated without any issues over the six months and the behaviour of the device in the new control modes was as expected.
Figure 2-3 shows the FPL providing real-time voltage regulation over a two week period in March 2019 by absorbing reactive power on the Barnstaple BSP side of the device. There is a high level of DG connected to this BSP and it is therefore susceptible to voltage rise violations. The FPL can be seen to manage the voltage thus avoiding the network exceeding statutory voltage limits. Voltage regulation on the 33kV network would normally be performed by tap changer operation on the BSP 132/33kV transformers. However, voltage can be difficult to manage on parts of the 33kV network that are remote from the BSP and have DG connected to it. The main benefit of integrating an FPL is that it can provide local voltage control to manage the fluctuations that occur due to circuit impedance and DG. A secondary benefit, therefore, is that the FPL acts to reduce these tap changer operations.

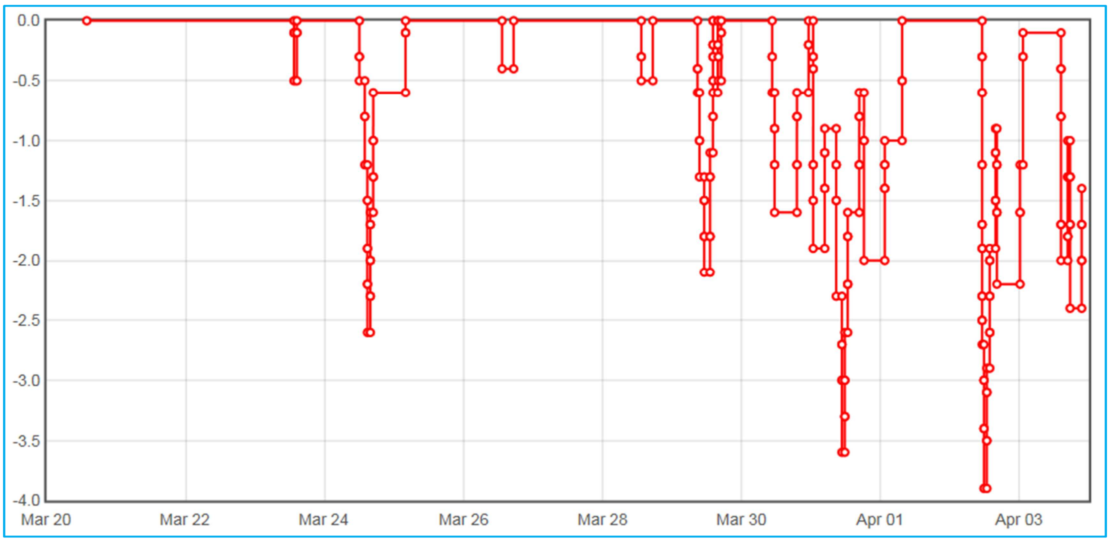


Figure 2-3: Reactive power (MVar) absorption by the FPL on Barnstaple side over a two week period

2.4.2 Optimisation

In this reporting period there was further development of the FPL CM to deliver improved optimisation of the set-point calculation logic. The FPL CM design that was implemented for the initial energisation of the FPL involved calculating and applying an FPL set-point when a network violation was detected. If the violation remained unchanged, the FPL would continue to operate at this set-point.

Figure 2-4 shows the additional logic that was developed to provide the FPL control module with optimisation functionality. The optimisation has now been implemented in this reporting period and involves the CM continually evaluating the set-point. If a violation is now no longer present, or has reduced in severity, the CM will adjust the set-point to ensure that the FPL is not transferring more real or reactive power than necessary. This significantly improved the FPL efficiency.

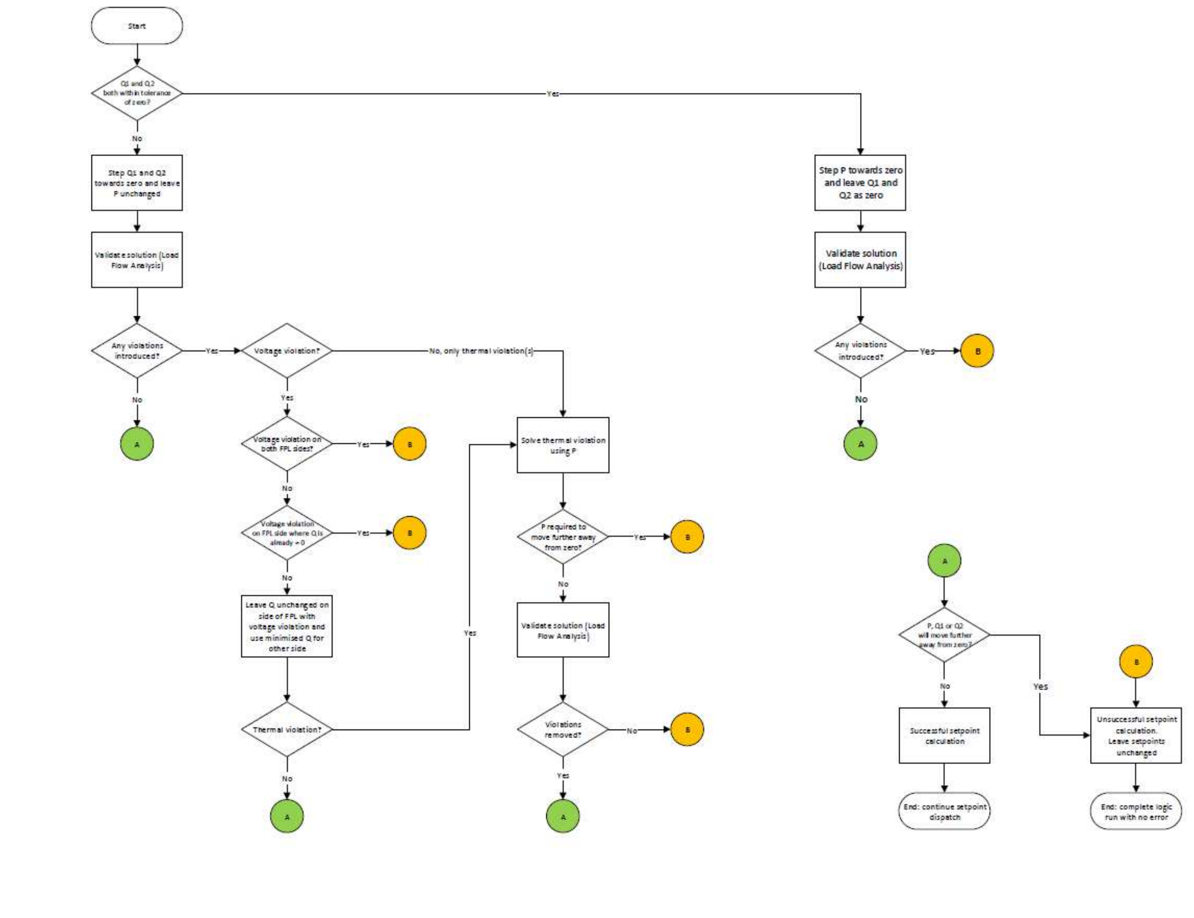


Figure 2-4: FPL optimisation logic

2.4.3 Dissemination of FPL Documentation

Developing new policies and procedures is a critical part of connecting new technologies to the distribution network. They ensure the new technology is integrated effectively into the main business and allow other DNOs to replicate the Method without duplication of effort. The following documents were reviewed and approved in a previous reporting period. The documents have now been disseminated to other DNOs during this reporting period:

- **ST:OC1AC – "Operation and Control of ABB 33kV Flexible Power Link installed at Exebridge Primary Substation for use on the Network Equilibrium project"** – describes how to operate and control the ABB FPL on the 33kV network. It goes on to describe how to safely energise and de-energise the FPL as well as the conditions required to ensure the safe operation of the device. The document also instructs operators on the action to take should an alarm or fault occur related to the device.
- **ST:SP2CAD – "Inspection and Maintenance of ABB 33kV Flexible Power Link installed at Exebridge Primary Substation for use on the Network Equilibrium project"** – covers WPD's requirements for the inspection and maintenance of the ABB 33kV FPL. This document was produced in collaboration with the manufacturer to describe the routine inspection and maintenance activities that WPD must undertake to ensure the device operates reliably and safely in service.
- **FPL Control Module Update Guide** – describes the process to be followed to ensure that the electrical models within the FPL CM are kept up to date, accurate and manageable.

These documents incorporate important learning on the technology and will improve the replicability of the Method across GB.

2.4.4 Project Closedown

The project will be closed down in June 2019 and therefore there has been significant effort in this reporting period to compile and document the body of learning associated with the FPL and its control system. This body of learning will be captured and disseminated in two documents that will be published later this year; the Network Equilibrium Closedown Report and the FPL Development and Improvement Report.

As part of the closedown activities, a technical dissemination event was delivered to other UK DNOs in this reporting period. The event was held at Exebridge and focussed on disseminating the technical knowledge that has been developed as part of the FPL Method. The event included a site visit to the FPL installation at Exebridge primary substation. Figure 2-5 and Figure 2-6 below show other DNO staff members attending the project closedown technical dissemination event and FPL site visit on 15 May 2019.

Figure 2-5: DNO technical dissemination

Figure 2-6: DNO technical dissemination FPL site visit

3 Business Case Update

There is no change to the business case. The business case to further facilitate the connection of low carbon loads and generation in the project area, on both the 11kV and 33kV are still applicable.

4 Progress against Budget

Table 4-1: Progress against budget

	Total Budget	Expected Spend to Date May 2019	Actual Spend to date	Variance £	Variance %
Labour	**1262**	**889**	**852**	**-38**	**-4%**
WPD Project Management & Programme office	510	420	404	-36	-4%
Project Kick Off & Partner / Supplier Selection	33	33	33	0	0%
Detailed design & modelling	101	101	92	-9	-9%[1]
Installation of Equipment - 11kV & 33kV	290	56	55	-1	-1%
FPL Technologies - Substation Installation 33kV	241	220	221	1	0%
Capture, analyse & verify data for EVA, SVO & FPL	58	35	33	-2	-6%
Dissemination of lessons learnt	29	24	13	-11	-44%[2]
Equipment	**6691**	**6691**	**6273**	**-417**	**-6%**
Project Kick Off & Partner / Supplier Selection	2	2	2	0	0%
Procurement of SVO Equipment	1540	1540	1223	-317	-21%[2]
Procurement of FPL Technologies 33kV	4550	4550	4432	-118	-3%
FPL Technologies - Substation equipment 33kV	599	599	616	17	3%
Contractors	**3339**	**2572**	**2457**	**-115**	**-4%**
Detailed design & modelling	804	804	804	0	0%
Delivery of SVO Technique - 11kV & 33kV	392	320	318	-2	-1%
Installation of Equipment - 11kV & 33kV	650	125	121	-4	-4%
Implementation of Solution	46	46	46	0	0%
Implementation of Solution	139	110	105	-5	-4%
FPL Technologies - Substation	740	715	678	-37	-5%

Installation 33kV					
Capture, analyse & verify data for EVA, SVO & FPL	445	400	336	-64	-16%[2]
Dissemination of lessons learnt	123	52	50	-2	-4%
IT	**396**	**330**	**317**	**-14**	**-4%**
1. WPD - Advanced Network Modelling and Data Recovery	130	125	114	-11	-9%[3]
1. WPD - Procurement of SVO Equipment	60	50	48	-2	-5%
Installation of Equipment - 11kV & 33kV	60	9	9	0	-5%
6. WPD - Implementation of Solution	46	46	46	0	0%
FPL Technologies - Substation Installation 33kV	100	100	100	0	0%
Travel & Expenses	**159**	**130**	**129**	**-1**	**-1%**
Contingency	**1190**	**-**	**-**	**-**	**0%**
Other	**53**	**25**	**25**	**0**	**0%**
TOTAL	**13090**	**10637**	**10053**	**-585**	**-5%**

Notes on line item changes and variations

1 – Efficiencies in detailed design and the production of standard designs enabled savings.

2 – Costs realised against planned is focussed on work being completed, however invoicing being carried out on a net monthly basis.

3 – Cost savings were enabled through the use of an existing advanced network modelling methodology created as part of the previous FlexDGrid project.

5 Successful Delivery Reward Criteria (SDRC)

In this reporting period the final two SDRCs, 7 and 8, have been completed, these focussed on the Trialling and Demonstrating the Integration of the EVA, SVO and FPL Methods and Knowledge Capture and Dissemination, respectively.

Further detail on both these SDRCs can be found at the following links:

SDRC 7 – Trialling and Demonstrating the Integration of the EVA, SVO and FPL Methods; and
SDRC 8 – Knowledge Capture and Dissemination.

Table 5-1: List of SDRCs

SDRC	Status	Due Date	Comments
1 - Detailed design of the Enhanced Voltage Assessment (EVA) Method	Complete	29/01/2016	Submitted on time
2 - Detailed design of the System Voltage Optimisation (SVO) Method	Complete	26/02/2016	Submitted on time
3 - Detailed design of the Flexible Power Link (FPL) Method	Complete	25/03/2016	Submitted on time
4 - Trialling and demonstrating the EVA Method	Complete	27/01/2017	Submitted on time
5 - Trialling and demonstrating the SVO Method	Complete	20/04/2018	Submitted on time
6 - Trialling and demonstrating the FPL Method;	Complete	5/10/2018	Submitted on time
7 - Trialling and demonstrating the integration of the EVA, SVO and FPL Methods	Complete	28/12/2018	Submitted on time
8 - Knowledge capture and dissemination	Complete	12/04/2019	Submitted on time

6 Learning Outcomes

Significant learning has been generated and captured in this reporting period, specifically relating to the information documented in SDRC-7 regarding the additional network benefit of employing multiple Methods to a single network area. Table 6-1 illustrates the capacity release by project Method and the additional benefit of employing complimentary Methods to a specific network area.

Table 6-1: Capacity Release by Method(s)

Technology	Average Maximum BSP Capacity Release (MW)	Average Maximum Primary Capacity Release (MW)
EVA	43	4.81
SVO	17.7	8.69
FPL	20	N/A
EVA and FPL	9 (additional to just using EVA)	FPL only applied at BSP level
EVA and SVO	12.43 (additional to using just EVA)	6 (additional to using just EVA)

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 relevant foreground IP has been identified and recorded 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
- ✓ Monitoring and updating of risks and the risk controls

8.1 Current Risks

The Network Equilibrium risk register is a live document and is updated regularly. There are currently 4 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 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.

For all remaining risks the risk level is minor, however, the nature of the technology installs as part of the Methods, these inherent risks remain for a period greater than the project.

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

Details of the Risk	Risk Rating	Mitigation Action Plan	Progress
Optimal FPL violation limits for operation cannot be determined	MINOR	Carry out detailed analysis of data retrieved during trial phase of the FPL / FPL CM to establish credible violation limits that can be implemented after trial phase	The FPL is operating efficiently and effectively, however, a longer operational period as planned post project will enable increased optimised values for voltage, power and losses to be further developed
Voltage complaints	MINOR	Thorough testing and trialling of system	No voltage complaints have been received to date, either low or high, however, this risk can only be removed once a further number of operational conditions have been demonstrated
FPL has reliability issues resulting in an unacceptable availability	MINOR	1. De-risk the method by engaging with manufacturers through issuing a detailed RFI to manufacturers. 2. Select a established and proven Power Electronics technology 3. Include availability in the functional specification 4. Trial another FPL in a separately funded project, if required 5. Look at including availability targets in the contract	The FPL has been operational for over 12 months, however is expected to last a minimum of 15 years, therefore this risk remains until further operational experience of the technology on the network has been observed
SVO relays lose control visibility	MINOR	Thorough testing of comms failure system	No issues have been observed to date but this is the first time WPD has communicated with relays over DNP3.0 and the residual, minor risk, remains

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

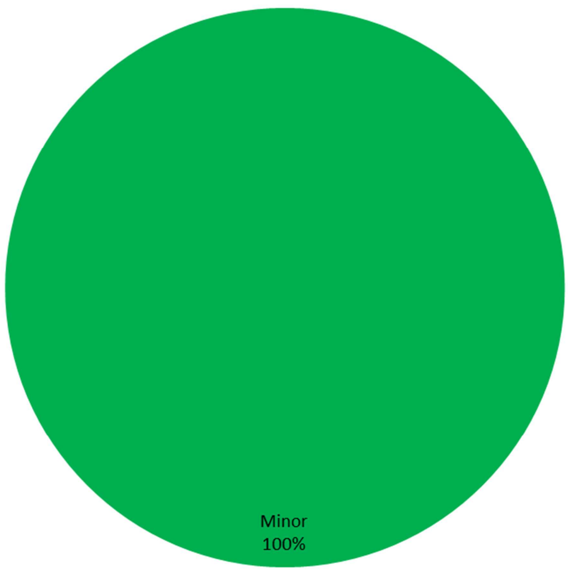
Table 8-2 - Graphical view of Risk Register

Likelihood = Probability x Proximity						
	Certain/Imminent (21-25)	0	0	0	0	0
	More likely to occur than not/Likely to be near future (16-20)	0	0	0	0	0
	50/50 chance of occuring/ Mid to short term (11-15)	0	0	0	0	0
	Less likely to occur/Mid to long term (6-10)	0	0	0	0	0
	Very unlikely to occur/Far in the future (1-5)	0	0	4	0	0
		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
		Impact				

	Minor	Moderate	Major	Severe	
Legend	4	0	0	0	No of instances
Total	4				No of live risks

Table 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.

Table 8-3 - Percentage of Risk by category



8.2 Update for risks previously identified

Descriptions of the most significant risks, identified in the previous six monthly progress report are provided in Table 8-4 with updates on their current risk status.

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

Details of the Risk	Previous Risk Rating	Current Risk Rating	Mitigation Action Plan	Progress
Optimal FPL violation limits for operation cannot be determined	MODERATE	MINOR	Robust cold-commissioning and testing of the system and its suitability	The FPL is operating efficiently and effectively, however, a longer operational period as planned post project will enable increased optimised values for voltage, power and losses to be further developed
Required data from several WPD systems in to the Siemens SVO system to enable it to function is unmanageable and non-updatable	MODERATE	CLOSED	Develop a team structure and a process to enable the required timely updates to be carried out	Risk now closed due to operational performance to date of the system
Analogue data is not suitable to support the SVO and FPL real-time system decisions	MODERATE	CLOSED	Ensure that quality and quantity of analogue data is suitable for the project	Risk now closed due to operational performance to date of the systems
Correct level of network data can't be gathered to benchmark SVO and FPL performance	MODERATE	CLOSED	Carry out detailed analysis of data retrieved during trial phase of the FPL / FPL CM to establish credible violation limits that can be implemented after trial phase.	Risk now closed due to operational performance to date of the systems and SDRC output
Voltage complaints	MODERATE	MINOR	Carry out detailed analysis of data retrieved during trial phase of the FPL / FPL CM to establish credible violation limits that can be implemented after trial phase.	No voltage complaints have been received to date, either low or high, however, this risk can only be removed once a further number of operational conditions have been demonstrated

Descriptions of the most prominent risks, identified at the project bid phase, are provided in Table 8-5 with updates on their current risk status.

Table 8-5 - Risks identified at the Bid Phase

Risk	Previous Risk Rating	Current Risk Rating	Comments
Project team does not have the knowledge required to deliver the project	Closed	Closed	All Methods are now live and operating as expected with learning captured and disseminated
No SVO available from the contracted supplier	Closed	Closed	The SVO system procurement activity is now complete
Project cost of high cost items are significantly higher than expected	Minor	Closed	All major items are now procured
No FPL available from the contracted supplier	Minor	Closed	FPL is now live and operational
Selected sites for technology installations become unavailable	Minor	Closed	Construction activities on all sites are now complete

9 Consistency with Full Submission

During this reporting period the final delivery and SDRC activities have been completed as per the original project Full Submission Proforma (FSP) and Project Direction. The scale of the project has remained consistent for all three methods throughout the project:

- **EVA** – Develop and demonstrate an Advanced Planning and Operational tool for 33kV and 11kV networks;
- **SVO** – Install and trial advanced voltage control schemes at 16 substations; and
- **FPL** – Install and trial a Flexible Power Link at a 33kV substation.

10 Accuracy Assurance Statement

This report has been prepared by the Equilibrium Project Manager (Yiango Mavrocostanti), reviewed by the Innovation Team Manager (Jonathan Berry) and approved by the DSO Systems and Projects Manager (Roger Hey).

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.

Glossary

Term	Definition
ABSD	Air Break Switch Disconnector
AC	Alternating Current
AIS	Air Insulated Switchgear
APT	Advanced Planning Tool
AVC	Automatic Voltage Control
BAU	Business as usual
BSP	Bulk Supply Point
CB	Circuit Breaker
CT	Current Transformer
DC	Direct Current
DG	Distributed Generation
DNO	Distribution Network Operator
EHV	Extra High Voltage
ENA	Energy Networks Association
ER	Engineering Recommendation
EU	European Union
EVA	Enhanced Voltage Assessment
FPL	Flexible Power Link
FTP	File Transfer Protocol
GB	Great Britain
GIS	Gas Insulated Switchgear
HSOC	High Set Overcurrent
HV	High Voltage
IDMT	Inverse Definite Minimum Time
IPR	Intellectual Property Register
ITT	Invitation to Tender
LCT	Low Carbon Technologies
LV	Low Voltage
LVAC	Low Voltage Auto Changeover
NMS	Network Management System
NOP	Normal Open Point
OCEF	Overcurrent Earth Fault
OHL	Overhead Line
OLTC	On Load Tap Changer
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition

SDRC	Successful Delivery Reward Criteria
SLD	Single Line Diagram
SVO	System Voltage Optimisation
TSDS	Time Series Data Store
UK	United Kingdom
VLA	Voltage Level Assessment
VT	Voltage Transformer
WG	Working Group
WPD	Western Power Distribution