WESTERN POWER DISTRIBUTION

FALCON

DEVELOPING FUTURE POWER NETWORKS

Second Tier Reward Application

May 2018

LCN Fund Low Carbon Networks

ALSTOM

Aston University Birmingham

CGI

CISCO

Cranfield UNIVERSITY

Document Control		
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Executive Summary

Project FALCON received funding from Ofgem's Low Carbon Network Fund in 2011 and ran from 2012 to September 2015, as scheduled.

The objective was to understand how combinations of network technologies and commercial approaches could help address the emerging challenges of designing and operating networks that are capable of supporting the growth in low carbon technologies on both the supply and the demand sides of those networks.

At the time that FALCON was developed the prevailing thinking was that the cost and limited flexibility of traditional approaches to 11kV network reinforcement would create a barrier to the uptake of low carbon technologies. Conversely, quantifying the level of the issues created for the networks and identifying the solutions that can help to mitigate those challenges would support the delivery of the goals within the Low Carbon Transition Plan, the Carbon Plan and latterly the Clean Growth Strategy and the associated Smart Systems and Flexibility Plan.

FALCON's approach was to structure around standalone workstreams to support deliverability whilst recognising the inter-dependencies between these workstreams.

FALCON trialled four engineering techniques and two commercial approaches. The trials demonstrated that energy storage delivered strong results (albeit that the costs of battery storage at the time meant that there was no business case); meshed networks delivered load changes but not on the more heavily loaded source breaker during peak; the Automated Load Transfer (ALT) algorithms did have a beneficial impact on losses and overhead minimum voltages; and Dynamic Asset Rating (DAR) showed that real time dynamic ratings are hugely variable despite the modelling.

The Commercial Trials were deemed widely successful and demonstrated the value of building on emerging learning through the project. The trials demonstrated that a 96.3% overall reliability for the use of Demand Side Response (DSR) to manage network constraints could be achieved. The Commercial Trials also established that, whilst the capacity used on the 11kV trial network was indeed useful, there were more significant benefits accruing on the higher voltage networks. The potential for DSR to move to a Business as Usual solution was, and continues to be, further explored through three subsequent projects (SYNC, ENTIRE and Visibility Plugs & Sockets), all of which built on FALCON's learning. However, the real legacy of the FALCON Commercial Trials is the Business as Usual (BAU) rollout of the use of flexibility, as evidenced by the "Flexible Power" suite of DSR products. (www.flexiblepower.co.uk)

For Load Estimation, the analysis highlighted the need to assess and, if validated, improve the quality of customer data and connectivity data, which can be a factor in estimates not being representative of the real loads.

Knowledge Capture and Dissemination was extremely successful and the learnings from FALCON have informed subsequent competition bids. More importantly though the volume and quality of learning has been extremely powerful for use internally to inform the transition into BAU through the implementation of policies or through future projects. The most powerful evidence of this has been how the data collection activities within FALCON have regularly been used within BAU activities.

Through this application under the Second Tier Reward we will focus on the areas that produced the most valuable learning and the efforts to which Western Power Distribution went in order to realise benefits for the customer.

1. Project Description

The Flexible Approaches to Low Carbon Optimised Networks project (known as FALCON) sought to address the barriers to the adoption of low carbon technologies into the electricity system created by the cost and limited flexibility of traditional approaches to 11kV network reinforcement.

Only by testing the use of alternative approaches to conventional reinforcement on actual networks would DNOs gain the confidence that: (a) the techniques worked and that (b) that they could be genuinely used as alternatives to conventional reinforcement whilst maintaining or improving customer experience.

The objectives of FALCON were closely aligned with the goals set out in the UK Low Carbon Transition Plan (2009)[1], which was the current direction at the time that FALCON was being scoped in 2010 and 2011. The Transition Plan identified the role of a smart grid in enabling the drive to supply Britain's energy needs from more renewable sources and speed up connections for that generation. The FALCON project was focused on providing an evidential base that would inform the use of smart techniques using available data to provide increased visibility of the network, identify new sources of flexibility to manage network constraints and enable customers to adopt low carbon technologies. Subsequent to FALCON receiving funding through Ofgem's Low Carbon Network Fund in 2011, the project further supported the aims of later Government policy published in The Carbon Plan (2011)[2] and The Clean Growth Strategy (2017)[3]

In addition to enabling the uptake of low carbon technologies, FALCON set out to deliver faster, cheaper 11kV connections and reduce the associated impact on DUoS charges that would be ultimately reflected in customers' bills. The learning generated through FALCON was selected so as to be applicable to all DNOs through use of a trial area comprised of six primary substations located on a mix of rural and urban networks around Milton Keynes. These were selected both as being representative of much of the national 11kV network and the identified networks were already facing some of the constraints that were expected to become common place through the progressive adoption of Low Carbon Technologies into the distribution system.

The learning was shared with the industry as it emerged and at the close down of the project through established LCNF dissemination channels and specific events, such as WPD's Balancing Act events.

In scoping FALCON Western Power Distribution recognised that there would be no single solution to addressing such network constraints on the adoption of low carbon technologies. The project set out to establish the relationship between a number of techniques. FALCON's delivery structure was based on each technique being a discrete workstream that recognised their inter-dependencies with each other. These were:

- Engineering Trials
- Commercial Trials
- Scenario Investment Model
- Telecommunications
- Knowledge Capture and Dissemination
- Load Estimation

[1] Low Carbon Transition Plan (2009), pages 70 to 71
[2] The Carbon Plan (2011)
[3] The Clean Growth Strategy (2017), pages 99 to 101

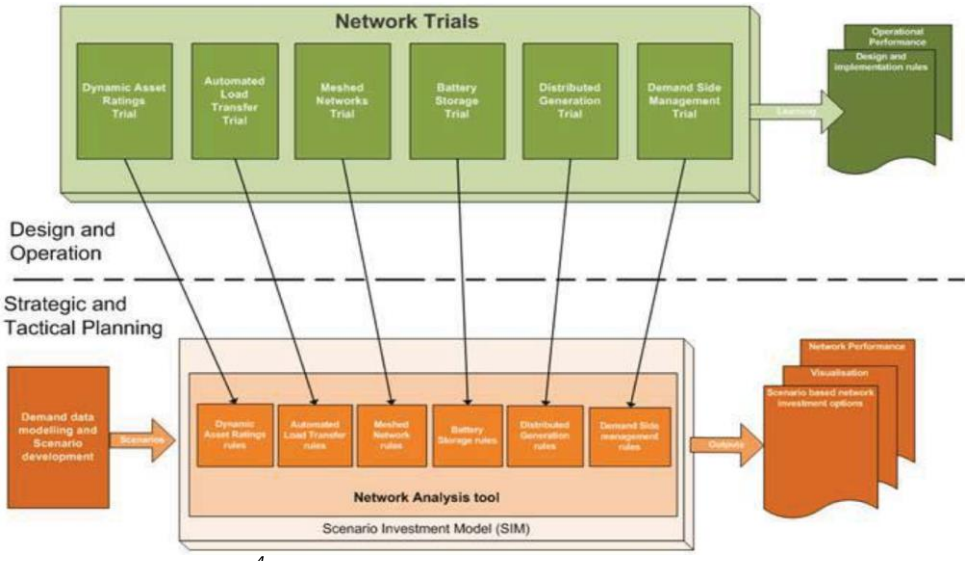


Figure 1: FALCON Structure[4]

FALCON evaluated four technical and two commercial alternatives to conventional reinforcement across the trials area with the objective of understanding the practically of these techniques for addressing the challenges created through the growth in adoption of low carbon technologies onto distribution networks.

The four technical alternatives were Dynamic Asset Rating (DAR), Automated Load Transfer (ALT), Meshed Networks and Battery Storage. The trialled commercial alternatives were designed to establish the commercial approaches for Distributed Generation (DG) and Demand Side Management (DSM). Successful trials would inform changes to Western Power Distribution's policies to enable these techniques to be adopted as Business as Usual and be applied nationally by informing changes to the relevant ENA Engineering Recommendations. The FALCON approach is captured in Figure 1.

Of the engineering techniques employed in FALCON the high level findings were that:

- Energy Storage delivered strong technical results, but was uneconomic at the time that FALCON completed in 2015; the reductions in storage costs continue to be monitored, however DNOs have subsequently been excluded from operating storage;
- Meshed Networks delivered load changes but not on the more heavily loaded source breaker during peak;
- Automated Load Transfer (ALT) algorithms had a beneficial impact on losses and overhead minimum voltages
- Dynamic Asset Rating (DAR) showed that real time dynamic ratings are hugely variable despite the modelling; and

The Commercial Trials (Distributed Generation and Demand Side Management) were deemed widely successful, proving that Demand Side Response (DSR) with commercial customers could provide a valuable network management option given the right environment.

FALCON generated significant learning about how Demand Side Response could be utilised by a DNO to address network constraints and defer or avoid the need for conventional reinforcement. FALCON established that whilst the capacity released through the use of commercial techniques to access DSR

[4] FALCON Full Submission Proforma, Page 10

on the 11kV trial network proved to be useful, there were more significant benefits accruing on higher voltage networks. This is a result of an acceptable level of confidence not being achieved on the network where the constraint and the flexible assets exist (in FALCON's case, the 11kV trial networks). This is due to their being insufficient diversity in the sources of Demand Side Response due to the limited availability of suitable participants during the FALCON trial period; in most circumstances a single third-party asset would be a single point of failure. The cumulative impact of multiple 11kV connected participants does however suggest a far more attractive proposition to manage the higher value 33kV infrastructure.

These findings are valuable as the progressive adoption of low carbon technologies onto the distribution networks results in the diversity of sources of demand side response growing on the lower voltage networks, including the electrification of transport, heat and the adoption of domestic scale storage on the LV network.

At the bid stage, the projected net financial benefit from the four year project was £1.2m and it was estimated that "a national rollout of the FALCON methods could realise a £660m financial benefit over 20 years and will save over 680 ktonnes of CO_2 by 2050 (accounting for an additional £36m of benefits)."

FALCON established the 'use case' for the application of DSR by DNOs is to manage temporary or transient constraints or to reduce risk until a more certain business case is achieved to justify an enduring solution from conventional or new smart engineering alternatives.

The area where FALCON has made an exceptional contribution to enabling a smarter energy system is in developing the understanding of the contribution of DSR and commercial arrangements that enable access to that flexibility in demand.

Therefore, this submission for the Second Tier Reward focuses on the outcomes of FALCON's Commercial Trials and demonstrates how FALCON qualifies against each of the three criteria. In summary, these are:

1.1 Criterion A: Exceptional Performance of the Project

FALCON delivered to time and under budget, returning £700k to customers. It was able to take the emerging learning from the DSR trials and build on it to significantly improve the availability of demand response when required and the reliability of it being dispatched when called. This result delivered confidence that DSR can make a significant contribution to operating the local electricity system as more low carbon technologies are adopted. FALCON has led to three further DSR projects.

1.2 Criterion B: Additional Investment of DNO's Own Money

Western Power Distribution did not put any additional contribution towards delivering FALCON. In fact, FALCON was delivered under budget, enabling £700k to be returned to customers.

1.3 Criterion C: Exceptional Efforts

Significant effort was required to change the approach to the DSR trial between 2013/2014 and 2014/2015. This effort resulted in the second round of DSR trials achieving an exceptional turn around in performance and delivering an overall reliability of 96.3%.

If this effort had not been made, then the results from the first season may have led to DSR being dismissed as a viable technique for managing network constraints. If that had remained the case, then the Smart Systems and Flexibility Plan may be quite different.

Tier 2 Project Name	Licensee	Project summary (2 Sentences)	Tier 2 funding £k (nominal prices)	Licensee compulsory contribution £k (nominal prices)	Other contributions £k (nominal prices)	Link to Close-Down Report
FALCON	Western Power Distribution (East Midlands)	FALCON sought to trial a combination of technical and commercial interventions to increase capacity on the network. WPD planned to use the data from these 'smart' interventions to develop a novel network investment model for the 11kV network.	12,399[5] 12,397[6]	1,413	(700)[7]	https://www.ofgem.gov.uk/system/files/docs/2016/04/wpdt2002_falcon_close_down_report_final_v2.0_resubmission_0.pdf

Table 1: Summary of Tier 2 Project FALCON

[5] 2011 Project Direction
[6] 2015 variance to original project direction
[7] For the avoidance of doubt, FALCON was delivered under budget and £700k was returned to customers

2. Reward Criterion A: Exceptional Performance of the Project

2.1 Aspects of the Carbon Plan and/or Clean Growth Strategy that have been facilitated

In the scoping of the FALCON project in 2010 and 2011, it was designed to inform a number of the areas detailed in the Low Carbon Transition Plan (2009). The importance of these areas was reinforced in the subsequent publication of the Carbon Plan at the end of 2011, which was after FALCON received funding. FALCON provided a testbed to establish the value of techniques that had the potential to enable the move towards smart grids and "which could limit the need for more reinforcement of the grid [distribution networks]". Specifically, FALCON provided the platform for a large scale demonstration of technologies operating in combination, such as demand side management, grid connected storage, advanced communication solutions combined with the deployment of sensors to provide data on network performance.[8]

Many of the outcomes from FALCON relate directly to Clean Growth Strategy[9] and to a number of the actions specified in the associated Smart Systems and Flexibility Plan (July 2017)[10]. These include:

- 2.1 Encouraging participation of large non-domestic consumers in demand-side response (DSR)
- 2.11 Testing of innovative approaches to DSR for domestic and non-domestic consumers
- 2.12 Domestic and smaller non-domestic consumers must be informed and engaged to participate at scale in a smart energy system
- 3.6 trialling ways in which energy markets may evolve
- 3.8 maximise our stakeholder engagement on smart energy systems

FALCON's Commercial Trials directly address these actions within the Smart Systems and Flexibility Plan for non-domestic customers.

In the broader context of the Carbon Plan and the Clean Growth Strategy, FALCON's trials of engineering techniques evaluated ways of releasing network capacity and limiting the need for network reinforcement that could present an economic barrier to customers being able to adopt low carbon technologies.

The outcomes from FALCON relevant to the Low Carbon Transition Plan, Carbon Plan and the Clean Growth Strategy are:

1. FALCON successfully demonstrated the two commercial techniques on the trial networks in Milton Keynes, proving that Demand Side Response (DSR) with commercial customers can make a valuable contribution to managing network constraints where appropriate. Western Power Distribution is continuing to move this area forwards through Project SYNC, Project ENTIRE and the Visibility Plugs & Socket project to ensure that this can be moved into Business as Usual in line with our DSO strategy.

[8] Low Carbon Transition Plan, Page 70, Box 10
[9] Clean Growth Strategy, Page 9, clause 7
[10] Smart Systems and Flexibility Plan, Actions 2.1, p24; 2.11, p26; 2.12, p27; 3.6, p30; and 3.8, p30

2. Four engineering techniques were successfully trialled on the Milton Keynes FALCON networks. These technique trials provided insight on the suitability of grid connected battery storage, meshed networks, automatic load transfer and dynamic asset rating, for use in different scenarios. The learning gathered informed the development of the Scenario Investment Model (SIM).
3. FALCON enabled new methods of load estimation to be developed and validated through comparison with measurements of substation loads in the Milton Keynes FALCON trial area. These load estimation methods were then successfully used as the basis for modelling network load to inform network investment scenario planning using the SIM.
4. A new, advanced, dedicated communications network was installed at project-specific sites around Milton Keynes. This network satisfactorily supported the load estimation and technique trials work packages of FALCON and supported the acquisition of network data. This workstream delivered a wide range of valuable learning about the deployment and operation of telecommunications equipment and technologies.

The commercial trials were operated across two winter seasons, with the learning from the first season informing the approach in the second season.

The first season established DSR contracts for the target of 10MW of capacity at £300/MW from embedded generation. This was called 18 times over the 2013/2014 winter dispatching approximately 250MWhs of energy. FALCON identified a number of conflicts in the use of DSR by Western Power Distribution and National Grid's use of its Balancing Services. The understanding of these conflicts gained through FALCON is helping inform the work of the Open Networks Project on market models and resolving such conflicts.

With some parties declaring themselves unavailable in the windows, there was only a 66.3% availability reliability. Failure to dispatch by some parties who did not declare themselves unavailable meant that the event reliability was 76.1%. This led to the overall reliability of dispatch being 50.5% against the contracted DSR volume.

Building on the learning from season 1, during season 2 (winter 2014/2015) availability increased from 66.3% to 100% and the event reliability across 27 events increased from 76.1% to 96.3%.

By taking the learning from the first season and demonstrating that an overall reliability of 96.3% could be achieved provided confidence that Demand Side Response presents a useful technique to increase resilience and mitigate transient issues, enabling reinforcement to be deferred rather than avoided over the long term. Western Power Distribution believes that the way in which the lessons from the winter 2013/2014 trials were captured and used to adapt the approach for winter 2014/2015 to achieve a near doubling in overall reliability demonstrates exceptional commitment in an area that is being increasingly recognised as vital for the future energy system.

FALCON also established the principle that Demand Side Response has the greatest value at voltages above the network to which the flexible demand is connected[11].

The engineering techniques were proved to deliver the following benefits in the context of the Carbon Plan and Clean Growth Strategy:

[11] Project FALCON Closedown Dissemination Event, 10 Nov 2015, slides 47-64

- Grid connected energy storage, employing a 50kW / 100kWh battery, was demonstrated as delivering reliable peak shaving of 11kV feeder load and for individual sites[12].
- Dynamic Asset Rating was demonstrated to have the potential to increase primary transformer ratings by up to 10% over the winter period, which is currently typically coincidence with higher demands[13].
- Automatic Load Transfer demonstrated the potential to reduce network losses, and so increase capacity headroom, through the periodic revision of network open points. This could result in an increase in capacity headroom of 4% to 12% for overhead lines and 8% on most heavily loaded underground cables[14].

By increasing headroom on capacity constrained networks the FALCON techniques facilitate the adoption of low carbon technologies at the distribution level, aligning with the objectives in the Clean Growth Strategy and previously in the Carbon Plan.

2.2 Releasing network capacity

For the purposes of this Second Tier Reward submission, Western Power Distribution is focusing on the Commercial Trials within FALCON as the area that delivered the most immediate and quantifiable benefits. The benefits accrue from releasing network capacity as a means of deferring or avoiding network reinforcement that is required to support the adoption of low carbon technologies into the distribution system.

FALCON successfully demonstrated both of the commercial techniques on the trial networks in Milton Keynes. The project put in place contracts for 10MW of Demand Side Response (DSR) with commercial customers. By the end of the commercial trials, and building on the emerging learning throughout FALCON, it had been proved that DSR contracts could be used to release network capacity where required on constrained networks with an overall reliability of 96.3%.

During the Winter 2014/2015 trial period no parties to the DSR contracts declared themselves unavailable, giving a 100% capacity availability. Across the 27 times DSR was called to be used it was dispatched with 96.3% reliability, leading to an overall reliability of 96.3% for the contracted DSR.

At this level of reliability, FALCON demonstrated, through real use, that Demand Side Response can make a valuable contribution to managing distribution network constraints where appropriate, and that DSR provides a useful technique to increase resilience and mitigate transient issues, enabling reinforcement to be deferred rather than avoided over the long term.

[12] Project FALCON Closedown Dissemination Event, 10 Nov 2015, slide 43
[13] Project FALCON Closedown Dissemination Event, 10 Nov 2015, slide 25
[14] Project FALCON Closedown Dissemination Event, 10 Nov 2015, slides 31-32

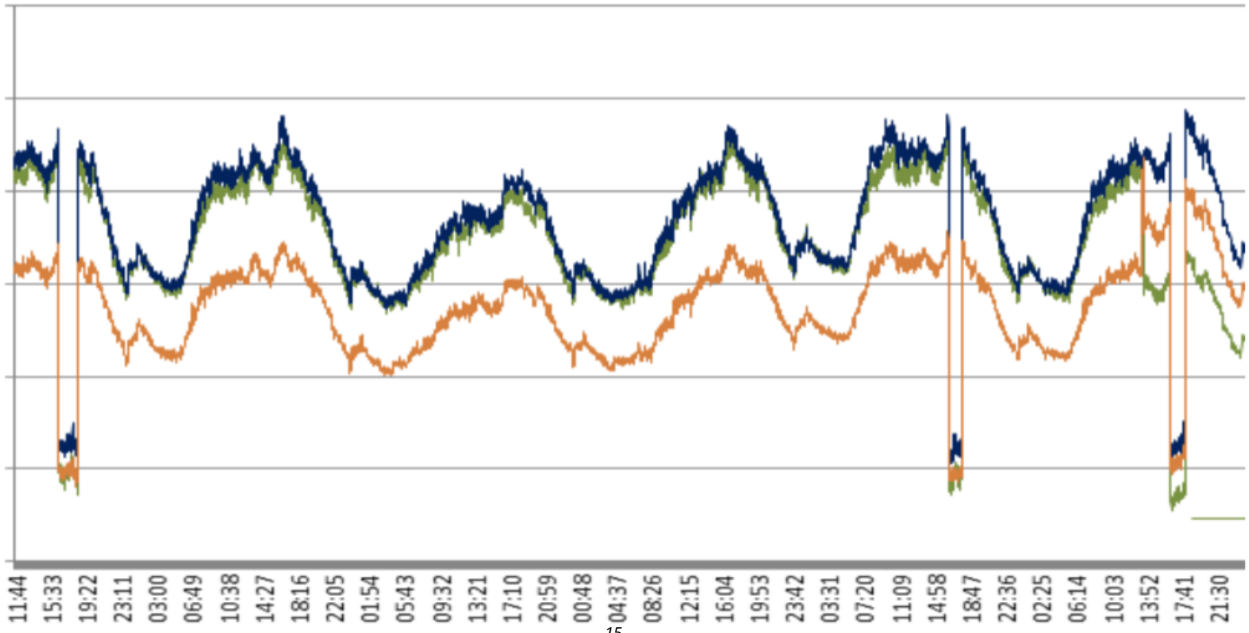


Figure 2: DSR Dispatch on 11kV networks, Winter 2014/2015[15]

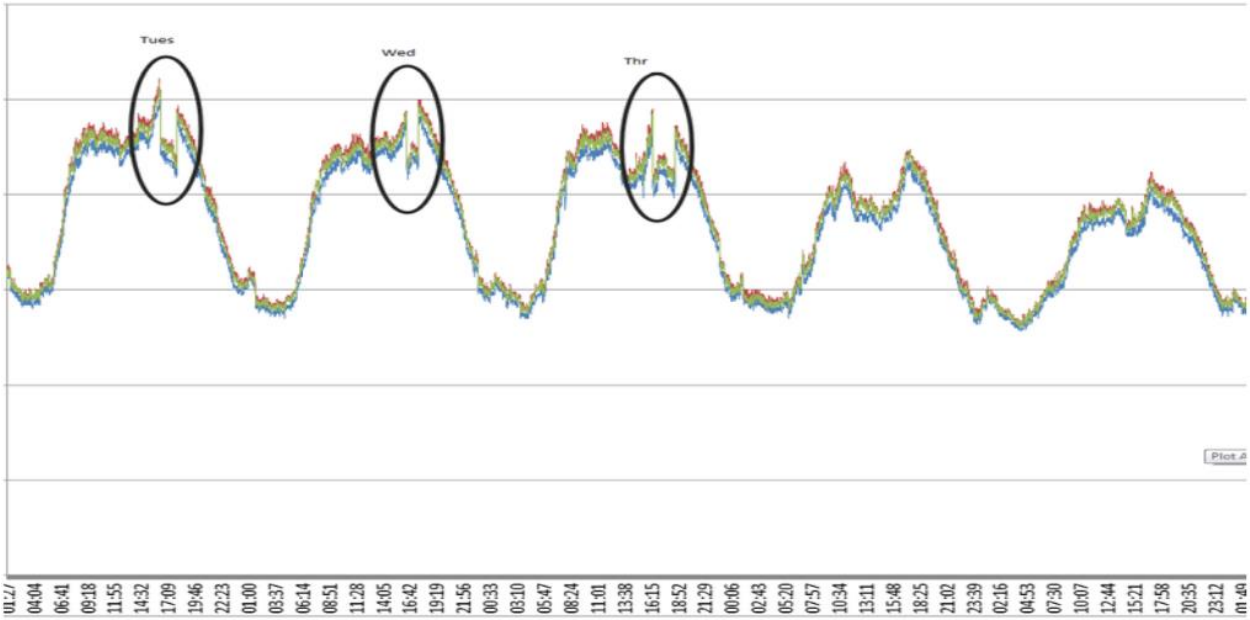


Figure 3: DSR Dispatch on 33kV Network Winter 2014/2015[16]

Western Power Distribution believes that the way in which the lessons from the winter 2013/2014 trials were captured and used to adapt the approach for winter 2014/2015 to achieve a near doubling in overall reliability demonstrates exceptional commitment in an area that is being increasingly recognised as vital for the future energy system.

Indeed if Western Power Distribution had not made the effort to identify how the approach to securing DSR could be improved then the results from the first season may have led to DSR being dismissed as a

[15] Project FALCON Closedown Dissemination Event, 10 Nov 2015, slide 62
[16] Project FALCON Closedown Dissemination Event, 10 Nov 2015, slide 63

viable technique for managing network constraints. If that had remained the case, then the Smart Systems and Flexibility Plan may be quite different.

As a result of the success of the FALCON commercial trials Western Power Distribution is incrementally contracting for DSR services under the Flexible Power[17] initiative. The learning from FALCON has directly informed both the commercial approach and the customer engagement for Flexible Power. The first round secured 60MW of capacity within the 14 target zones. The opportunity to participate will be opened up in a further 26 zones in June 2018.

Western Power Distribution is continuing to move this area forwards through Project SYNC, Project ENTIRE and the Visibility Plugs & Socket project to ensure that this can be moved into Business as Usual in line with our DSO strategy.

2.3 Delivering Financial Benefits

It was identified early within FALCON that there would be no significant direct benefits (either carbon or financial) during the course of the project trials. FALCON was about identifying the potential for the different technical and commercial trials to help manage network constraints and so enable the adoption of greater levels of low carbon technologies onto the distribution networks whilst deferring the need for reinforcement for a period of time.

At the start of the project the expected opportunities for net investment financial benefit was £1.2m after the trial period. This accruing from delayed or invested reinforcement to the network.

The Scenario Investment Model developed and validated by FALCON was used to run scenarios using all the techniques trialled vs a conventional reinforcement scenario over the five primaries within the Milton Keynes area. This identified there were some net financial benefits where utilising the smart techniques. These savings were in the order of up to 30% in Totex, equating to up to £2.4m[18].

With Flexible Power now being incrementally opened up the to address network constraints financial benefits will start to accrue for customers through the deferral of the need to reinforce those networks.

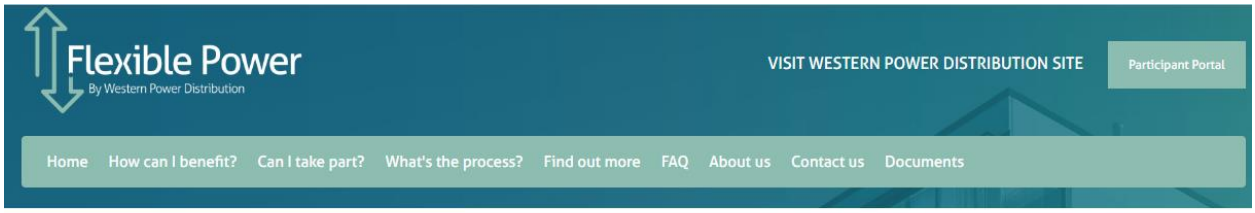
2.4 Rollout across the DNO's system and across GB

This submission focuses solely on the additional benefits accruing from what Western Power Distribution considers to be exceptional and the efforts that we are undertaking to realise the benefits for our customers.

2.4.1 Current implementation of learning within Western Power Distribution

FALCON has given Western Power Distribution the confidence to begin moving DSR to a Business as Usual solution. This is evidenced by the "Flexible Power" suite of DSR products.

[17] http://www.flexiblepower.co.uk/
[18] Project FALCON Final Report, P121



How can I benefit?

Flexible Power aims to help you generate revenue from your existing electrical flexibility. By adjusting your electrical consumption or generation at key times you can provide services that benefit you, the local network and the wider electricity system.

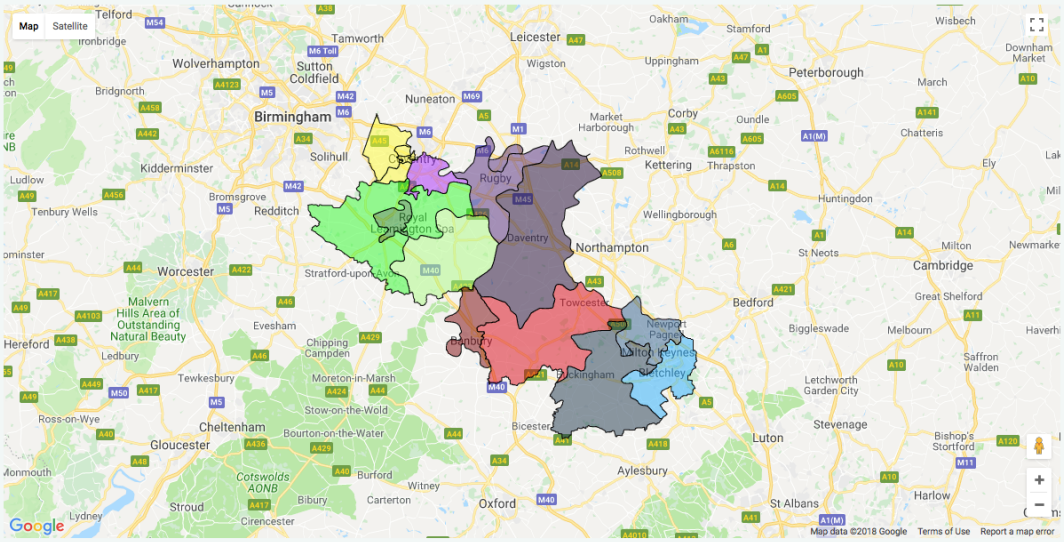
Flexible Power offers access to Constraint Managed Zone (CMZ) services in the midlands.
These are the Secure, Dynamic and Restore services. The process uses simple automated technology that enables you to focus on your main business priorities.

This is all delivered by Western Power Distribution; the UK's leading Distribution Network Operator with a proven track record for customer service.

Figure 4: Flexible Power Website

Title	Version	Release date	Summary
Service Overview	1.0	13/10/2018	A summary of the CMZ services available.
EoI results	1.1	17/01/2018	A summary of the EoI responses and the zones taken forward.
CMZ Contract	1.1	08/01/2018	The framework contract for participants. A tracked changes version is available here.
CMZ Payment and Assistance Notes	1.1	21/03/2018	Explanatory notes accompanying the contract. The latest changes update the baselining methodology
Participation Requirements Form	1.0	08/01/2018	The form required for the proof of technical compliance.
Participation Requirements Assistance document	1.0	08/01/2018	Explanatory notes accompanying the form.
API Guide	1.2	10/04/2018	A guide to the API interface.
Outstation Interface Manual	1.0	21/03/2018	A guide to the Outstation interface.
Baselining principles	1.0	21/03/2018	An overview of the baselining principles
Billing guide	1.0	21/03/2018	A guide to the billing process
Billing details form	1.0	21/03/2018	The form for the provision of billing details
Commissioning and Testing Guide	1.0	21/03/2018	A guide to the commissioning process
Commissioning and Testing Checklist	1.0	21/03/2018	A checklist of the commissioning requirements
Availability Declaration Guidance	1.0	21/03/2018	A guide on how participants can declare their capacity
Service Partner Agreement	1.1	08/01/2018	The agreement required to be a Flexible Power Service Partner
Service Partner Guidelines	1.0	08/01/2018	A guide on being a Flexible Power Service Partner

Figure 5: Flexible Power suite of documents openly available to potential participants



Colour	Zone	Name	Services	Arming Fee (£/MW/h)	Availability Fee (£/MW/h)	Utilisation Fee (£/MWh)	Restore Fee (£/MWh)
	1.1	Coventry Interconnector	Secure & Restore	75	N/A	150	600
	2.1	Harbury	Dynamic & Restore	N/A	5	300	600
	2.2	Warwick 33kV	Dynamic & Restore	N/A	5	300	600
	2.3	Warwick 11kV	Dynamic & Restore	N/A	5	300	600
	3.1	Brackley	Dynamic & Restore	N/A	5	300	600
	3.2	Banbury	Dynamic & Restore	N/A	5	300	600
	4.1	Whitley	Secure & Restore	118	N/A	150	600
	4.2	Rugby	Secure & Restore	118	N/A	150	600
	4.4	Daventry	Secure & Restore	118	N/A	150	600
	5.1	Bletchley	Secure & Restore	118	N/A	150	600
	5.2	Bradwell Abbey	Secure & Restore	118	N/A	150	600
	5.3	Stony Stratford	Secure & Restore	118	N/A	150	600

To register your interest please email WPDflexiblepower@westernpower.co.uk.

Figure 6: Flexible Power zones

The learning from FALCON's commercial trials about the use of Demand Side Response as a technique to create additional capacity headroom on constrained networks and defer the need for network reinforcement is being taken forward through three projects.

As part of **Project SYNC** Western Power Distribution tested a range of Demand Side Response (DSR) techniques to help address many of the different challenges being posed by PV generation. Through engagement with industrial and commercial (I&C) customers, the possibility of releasing additional capacity and the potential to improve power quality was evaluated. SYNC still relied upon manual dispatch of the DSR signals.

Project ENTIRE builds on the learning from the FALCON DSR trials with the objective of identifying and addressing many of the key challenges a DNO is presented with as they develop DSR and other commercial service capabilities within what is essentially a traditional engineering and asset management organisation. Through ENTIRE, Western Power Distribution will create a roadmap for WPD's other regions, as well as for other DNOs, to assist development of a commercial service capability and deliver increased value to their customers.

The functional control requirements delivered by FALCON directly informed the specification for ENTIRE.

By carrying out ENTIRE we will ensure that the underlying assumptions regarding our networks are correct and that we have increased visibility of those customers that have both flexible demand and are willing to allow it to be available to the electricity system. This will inform operational decisions as we transition to become a DSO and we move towards more decentralised, local system operation.

The **Visibility Plugs & Socket** project is WPD's NIA funded contribution to a much larger EU funded initiative – the Cornwall Local Energy Market - led by Centrica. The objective is to establish a local energy market in Cornwall and test the use of flexible demand, generation and storage across both domestic and business sectors. The Cornwall Local Energy market project also involves National Grid and Exeter University.

The expertise from these projects is being combined to develop a platform for flexibility services to put buyers and sellers in touch with each other. This central 'socket' is a hub to which many different parties can connect using their 'plugs'. This infrastructure and the knowledge of how electricity demand and generation is likely to change as a result of flexibility services allows for greater visibility.

2.4.2 Take up across GB

Over recent months a number of DNOs have signalled their intent to make greater use of DSR services.

2.4.3 Alternative approaches

The alternatives to contracting for Demand Side Response services on constrained networks would be conventional reinforcement as the counterfactual or, if the constraint would be created by a new connection, then an Alternative Connection agreement can be offered. Note that Alternative Connections has been adopted into Business as Usual as a result of another Western Power Distribution innovation project, Low Carbon Hub, and will be implemented across all of our licence areas by 2021.

2.4.4 Dissemination

Western Power Distribution's commitment to dissemination and enabling other DNOs to fully understand the learning from our innovation projects has been significantly beyond the approach set out in the Final Submission Proforma[19] and Project Direction[20]. A full list of dissemination activity related to FALCON can be found in the project close down report[21].

On top of our standard approach to dissemination, the data set produced through FALCON has been shared. Several universities (Bath, Manchester, Imperial College) are making use of the data for activities as varied as tariff design.

2.5 Value for money to Customers

Western Power Distribution was able to deliver FALCON under budget and return £700k to customers.

Through the incremental implementation of Flexible Power, Western Power Distribution's customers are starting to benefit from FALCON through the ability to defer network reinforcement through the use of DSR.

[19] FALCON Full Submission Proforma
[20] FALCON Project Direction
[21] Project Falcon Close Down Report (2016), Section 13

2.5.1 Efficient Use of Funding

FALCON received £12.4m of funding through Tier 2 of the Low Carbon Network Fund in its second round, 2011. The scale of the project, whilst ambitious in terms of the number of workstreams and the mix of technical and commercial deliverables, was appropriate to produce meaningful learning, whilst delivering value for money for consumers.

The approach to addressing the challenge of network constraints that are being created through the progressive adoption of low carbon technologies was to identify trial networks that were already facing these challenges and had some degree of constraint. This approach focused on procuring low Technology Readiness Level network technologies and establishing commercial contracts to enable access to demand side response. FALCON enabled statistically robust quantitative data to be acquired about the performance of networks that were already suffering the expected stresses from the progressive adoption of low carbon technologies and the impact that the four technical and two commercial techniques could have on managing those stresses. In this way, representative results in which the whole DNO sector could have confidence were produced.

FALCON also negotiated successfully with the Ministry of Defence for free access to the radio spectrum required for the Wi-Max telecommunications network that provided the backbone for collection of the high resolution data acquired as part of the project.

2.5.2 Minimising the Cost of Resources

In 2.5.1 Efficient Use of Funding we have articulated how we were able to achieve more at no additional cost. The saving of £700k on the original budget that was returned to customers was achieved through strong project governance and our delivery approach.

Our process for selecting partners included what they brought to the project in terms of contribution (for instance, reductions to rate cards or involvement at cost). Further, by using resources from project partners and contractors the project only bore the costs of the time they were involved on the project and not the full time equivalent rate of someone assigned to the project.

Costs were also driven out of the IT budget by sourcing alternative solutions that were still able to deliver the capabilities required by the project.

2.6 Relevance and timing of project

FALCON was one of the earliest innovation programmes to receive funding through the Low Carbon Network Fund in 2011. Its focus was at the heart of the challenges outlined in the Low Carbon Transition Plan[22]. FALCON provided a testbed to establish the value of techniques that had the potential to enable the move towards smart grids and "which could limit the need for more reinforcement of the grid [distribution networks]". Specifically, FALCON was the first project to focus on providing a platform for a large scale demonstration of network technologies operating in combination, such as demand side management, grid connected storage, advanced communication solutions combined with the deployment of sensors to provide data on network performance.

As an early stage innovation project, FALCON faced many challenges that required significant effort to resolve and presented significant opportunities for learning, which was captured and disseminated.

[22] Low Carbon Transition Plan (2009), pages 70

Western Power Distribution, today, considers dissemination to be part of the normal progress of an innovation project of this type. FALCON helped to define our approach to dissemination.

The two commercial demand side response trials required significant effort to secure trial participants. Between the two seasons there was significant effort to identify the lessons from the 2013/2014 trials and adapt the approach for the 2014/2015 period. The results of these efforts can be seen in the improvement in the performance during the winter 2014/2015 trials, which delivered an exceptional outcome.

The winter 2013/2014 trials established DSR contracts for the target of 10MW of capacity at £300/MW from embedded generation. This was called 18 times over the 2013/2014 winter, dispatching approximately 250MWhs of energy.

The potential for conflicts between a DNO's use of demand side response for network balancing and the transmission system operator's use of its Balancing Services were not understood at the time. FALCON identified a number of conflicts in the use of DSR between a DNO and the system operator and helped inform the sector's understanding or these.

FALCON established, ahead of need, an approach to contracting for DSR and engaging with providers that resulted in an overall reliability of 96.3% following the completion of the 2014/2015 trials.

Through the efforts associated with taking the learning from the first season and building it into the winter 2014/2015 trials, FALCON demonstrated that an overall reliability of 96.3% could be achieved. This provided confidence that Demand Side Response presents a useful technique to increase resilience and mitigate transient issues, enabling reinforcement to be deferred rather than avoided over the long term. Western Power Distribution believes that the way in which the lessons from the winter 2013/2014 trials were captured and used to adapt the approach for winter 2014/2015 to achieve a near doubling in overall reliability demonstrates exceptional commitment in the area of DSR, which is being increasingly recognised as vital for the future energy system.

Indeed if Western Power Distribution had not made the effort to identify how the approach to securing DSR could be improved following the results from the first season, then this may have led to DSR being dismissed as a viable technique for managing network constraints. If that had remained the case, then the Smart Systems and Flexibility Plan may be quite different.

FALCON also established the principle that Demand Side response has the greatest value at voltages above the network to which the flexible demand is connected.

Western Power Distribution has continued to develop in this area through Project SYNC, Project ENTIRE and the Visibility Plugs & Socket project to ensure that this can be moved into Business as Usual in line with our DSO strategy.

2.7 Methodology robustness and project readiness

FALCON was funded in 2011, the second year of the Low Carbon Network Fund, and was at a significantly larger scale that the other innovation projects that Western Power Distribution was managing. The understanding of how to manage an innovation programme of FALCON's scale, involving multiple stakeholders, some of whom were new to being considered DNO stakeholders, presented some new challenges.

As such, FALCON became the 'foundation project' for Western Power Distribution's approach to delivering innovation programmes. This does not just cover the delivery of the projects themselves, but also the approach taken to implementing the learning into business as usual, engaging across the sector to embed the learning in national approaches or identifying and scoping areas of further research to achieve the confidence threshold to move to business as usual.

Being an early innovation project, FALCON delivered significant additional learning around engaging with different stakeholder and community groups. This insight, along with learning from other projects, has informed Western Power Distribution's approaches to customer engagement. We believe that this is evidenced by Western Power Distribution consistently being ranked to the top of Ofgem's Stakeholder Engagement and Customer Vulnerability Incentive.

Ultimately, the strength of the programme controls is evidenced by the identification of opportunities to reduce costs and return £700k to customers.

3. Reward Criterion B: Additional Investment of DNO's Own Money

FALCON did not require Western Power Distribution to make additional investments in its delivery.

3.1 Details and significance of DNOs additional contribution

Not applicable

3.2 Issues that justified the additional contribution

Not applicable

3.3 Demonstrable benefits to customers

Not applicable.

4. Reward Criterion C: Exceptional Efforts

4.1 Demonstrate where the project has delivered more learning than was expected

Given that this criterion is about exceptional learning and exceptional efforts, the response focusses on the area of learning that demonstrated the greatest shift in performance through the duration of FALCON.

Based on the poor results from the first season in 2013/2014, the easy option would have been to conclude that DSR was not a viable technique for managing network constraints. However, the significant learning that emerged enabled the approach to the trails in the second season to be redesigned. This effort resulted in delivery of a near doubling of the overall reliability of the contracted DSR being available when required and dispatched when requested.

4.2 Additional learning as a result of exceptional effort of the DNO

As already articulated in this submission, the analysis of the outcomes of the 2013/2014 DSR trials identified vital learning that enabled the second round of DSR trials over the 2014/1015 winter period to achieve an exceptional turn around in performance and deliver an overall reliability of 96.3%.

This required significant efforts in terms of changing the approach for the second season. If this effort had not been made, then the results from the first season may have led to DSR being dismissed as a viable technique for managing network constraints. If this had remained the case, then the Smart Systems and Flexibility Plan may be quite different.

This effort provided confidence that Demand Side Response presents a useful technique to increase resilience and mitigate transient issues, enabling reinforcement to be deferred rather than avoided over the long term.

Western Power Distribution is continuing to build of FALCON's legacy in DSR through Project SYNC, Project ENTIRE and the Visibility Plugs & Socket project to ensure that this can be moved into Business as Usual in line with our DSO strategy.

FALCON also provided us with the necessary confidence to launch Flexible Power[23]. Learning from FALCON has directly informed both the commercial offer and the approach to customer engagement for this initiative. The first round secured 60MW of capacity within the 14 target zones. The opportunity to participate will be opened up in a further 26 zones in June 2018.

4.3 Exceptional capture and dissemination of learning in a way that maximises value for all customers

As with all our innovation projects, Western Power Distribution goes beyond the specified level of dissemination within the SDRCs. A full list of the FALCON dissemination activities is in the close down report[24]

A list of dissemination events that go being the SDRCs includes:

- University of Bath, July 2012

[23] http://www.flexiblepower.co.uk/
[24] Project Falcon Close Down Report (2016), Section 13

- GE's digital energy summit, presentation on the storage solution.
- European Utility Week, October 2013
- Energy Storage World Forum, held in London.
- EuroScience Open Forum

Western Power Distribution has also made the data set generated by FALCON available. This data set includes 5 minute data on over 200 LV-ways across Milton Keynes. Bath, Manchester and Imperial College have all taken advantage of access to this data set.