

March/April Newsletter

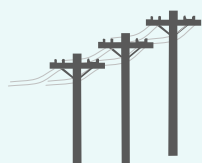
Some highlights of the last few months:

- Our 'low carbon' webinar/Q&A.
- The release of the Good Practise Guide for Electrical Energy Storage.
- The completion of Season 2 of our Commercial Demand Response trials.
- Exhibitions at the LCNI and LCRI conferences, as well as presentations at industry events.
- Our website has had a fresh lick of paint and is now sparkling!

Western Power Distribution

Delivering electricity to

7.8 million



Overhead and underground line monitoring in selected locations

40 temperature monitoring points across selected transformers



Transmitting data back to WPD at the end of each 10min monitoring period

Project FALCON – Our final year!

We are now well into 2015 and the final year for Project FALCON. Our closing year will see us complete some exciting trials and disseminate further results, as well as produce our more formal project reports later this year.

Our last newsletter looked at our energy storage results and trials. The energy storage systems (ESS) are still live as we continue to gather as much data as possible. If you want to learn more about our storage solutions please do contact us.

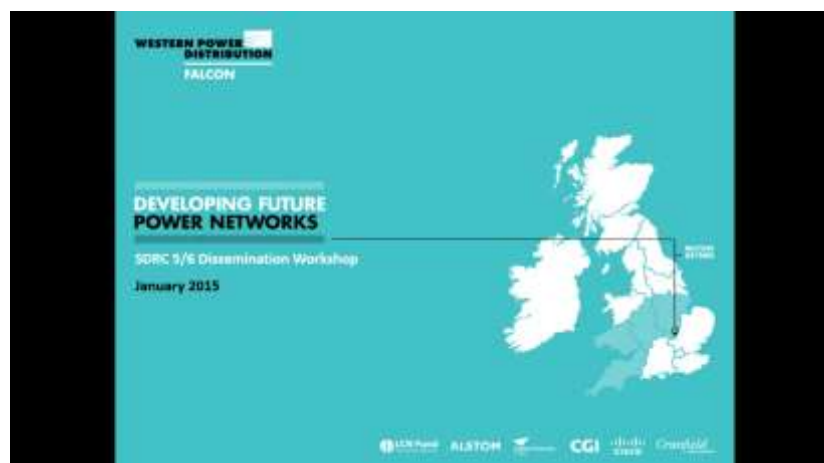
DEVELOPING FUTURE POWER NETWORKS

Project FALCON is being trialled on the 11kV network in Milton Keynes



Towards the end of 2014 we produced a set of reports relating to the year's work. We summarised these findings in a webinar and Q&A session, in order to avoid travel to a venue and remain carbon friendly. The highlights of these reports include:

- The FALCON energy model and implementing load scenarios
- Comparisons of the modelled data to actual data
- Energy models levers and uptake curves going forward
- Update on the validation of Dynamic Asset Rating thermal models
- Early indication that revision of open points could reduce losses
- Demonstrable capability for energy storage to peak shave
- Early indications across engineering trials results
- Key early learning for the SIM from initial trials



LCRI Presentation



The Low Carbon Research Institute is made up of several academic institutions and research parties, looking at collaborative programmes.

The aim is to unite and promote energy research in Wales to support the development of a lower carbon future.

Project FALCON exhibited two of our key techniques – Dynamic Asset Rating and our Commercial Demand Response models.

What is SoLa Bristol?

"B.R.I.S.T.O.L." is the Buildings, Renewables and Integrated Storage, with Tariffs to Overcome network Limitations project. It focusses on potential future LV network constraints.

- To find out more about our other Low Carbon Projects please visit: www.westernpowerinnovation.co.uk
- If you would like to see our techniques on display then visit our YouTube channel [here](#).
- To stay up to date with Project FALCON and our ongoing findings please send your details to wpdinnovation@westernpower.co.uk and we'll add you to our mailing list.

Early 2015 saw the Energy Storage Operators Forum present the Good Practice Guide for Electrical Energy Storage, which includes the work to date on FALCON. This document provides information on work to date, as well as forming a reference guide for projects so far.

During the dissemination event in London, Philip Bale from WPD Innovation, presented work on our two projects looking at storage. The first being FALCON and the second SoLa Bristol. The slides are available to view through the link below.



A Case Study: FALCON and SoLa Bristol

Philip Bale
Western Power Distribution



Our Commercial Trials have just finished their second season and already we can see some exciting early results. Having evaluated the first set of trials, we made some alterations to the scheme to explore further benefits and to explore a slightly different scheme. Some of these alterations included:

- Change of approach to a week ahead dispatch notice period
- Load reduction participants were recruited
- A new metering solution from WPD's own Smart Metering team
- A new market standard on performance measurement and billing

As the trials have finished at the end of February, we will begin to disseminate our learning in the coming months. Initial high level headline statistics however, include:

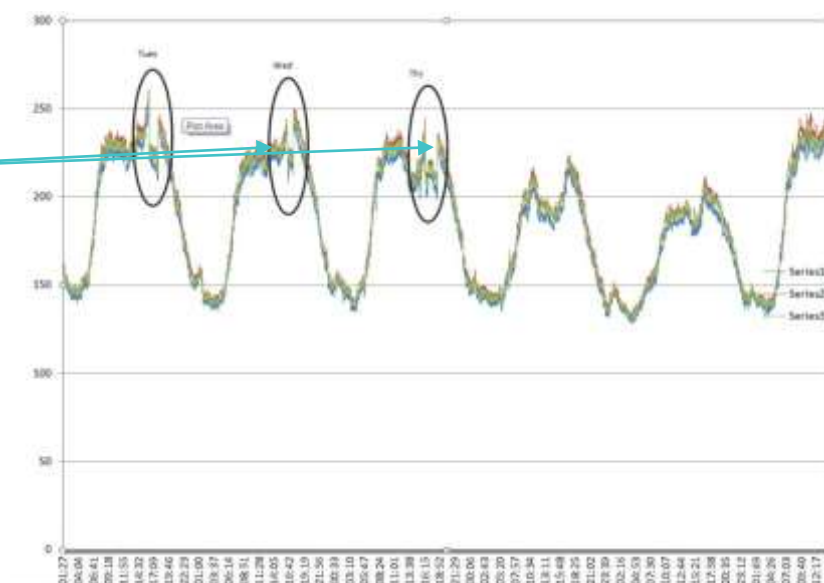
- 27 DSR events dispatched in total
- 35 hours total operating time
- Total volume of load reduced approximately 0.3GWh
- The events coincided with two of the three winter triads

There will be a great deal of further analysis necessary, particularly in relation to comparing the site event date with that we have managed to capture throughout the network during our events.

However, the initial data does provide some promising positive indications that we have seen an improvement in the reliability associated with the participating sites' performance.

COMMERCIAL DEMAND RESPONSE EARLY TRIALS DATA

- DR EVENTS SHOWN WITH 'BUCKET' EFFECT
- IMPROVED RELIABILITY
- INCLUDED LOAD SHEDDING
- COMBINATIONS OF CHP AND DIESEL GENERATION
- POSITIVE PRIMARY TRANSFORMER IMPACTS



As is clearly identifiable from the above, the dispatch of the Demand Response events has had a clear impact when measured at our primary substations, as well as an even clearer impact the closer you get to the site (i.e. 11kV feeders, local transformers and metering points).

We will continue to share information as we now begin a period of analysis and look forward to a further dissemination event this year.

DYNAMIC ASSET RATING EARLY TRIALS DATA

- ASSET MONITORING TRIAL
- INCREASE CAPACITY
- DEFER REINFORCEMENT
- MONITOR RENEWABLE IMPACT
- TRIALLED ON THE 11KV NETWORK
- ENVIRONMENTAL MONITORING
- BEST PRACTICE IN MONITORING

[SEE OUR VIDEO HERE](#)

Dynamic Asset Rating

This newsletter is going to offer some insight into one of our engineering techniques, namely, Dynamic Asset Rating, or DAR.

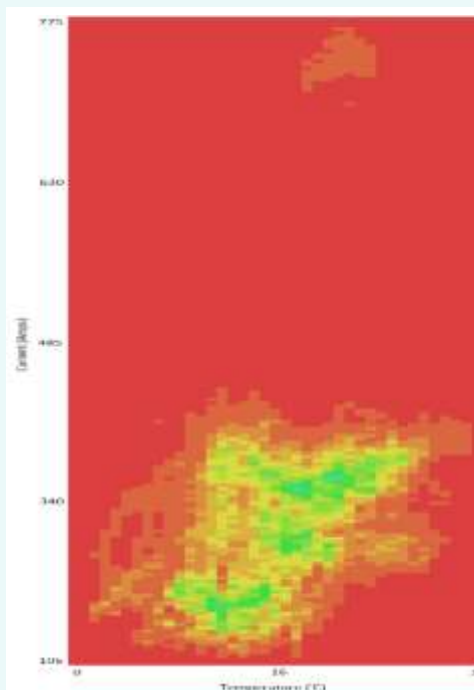
Essentially DAR is a method of freeing up capacity on our network where real conditions are more favourable than static ratings. Every asset in the network, such as a transformer, overhead line or cable, has historically been monitored considering static ratings. This means the asset operates inside set boundaries which are affected by load requirements, weather or environmental conditions and temperatures (both operating and ambient). By installing a number of monitoring solutions across the trials area, DAR is set to look at how these assets could continue to be operated inside their normal boundaries but using real data and consequently looking at additional capacity being freed up without a need for reinforcement.

The DAR trials have installed monitoring solutions such as:

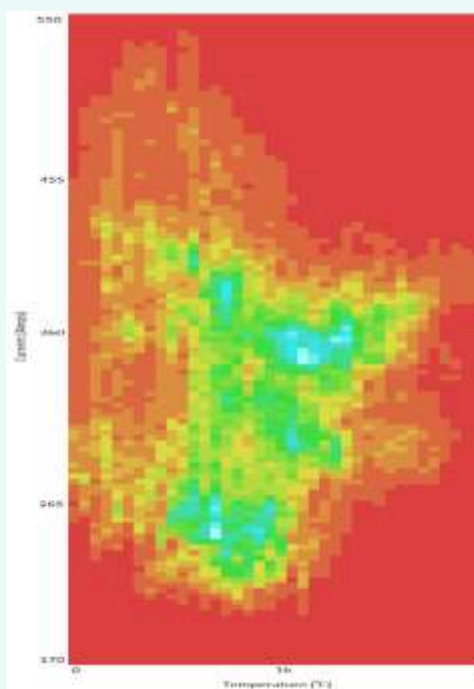
- Overhead temperature line monitoring on 11kV lines
- Underground temperature cable monitoring
- Ambient temperature at substations
- Wind speed monitoring
- Solar irradiation
- Transformer internal tank temperatures
- Transformer top and bottom oil temperatures

On the following page we go on to share some of the temperature and wind speed data results.

TECHNIQUE 1A TRANSFORMER - SUMMER



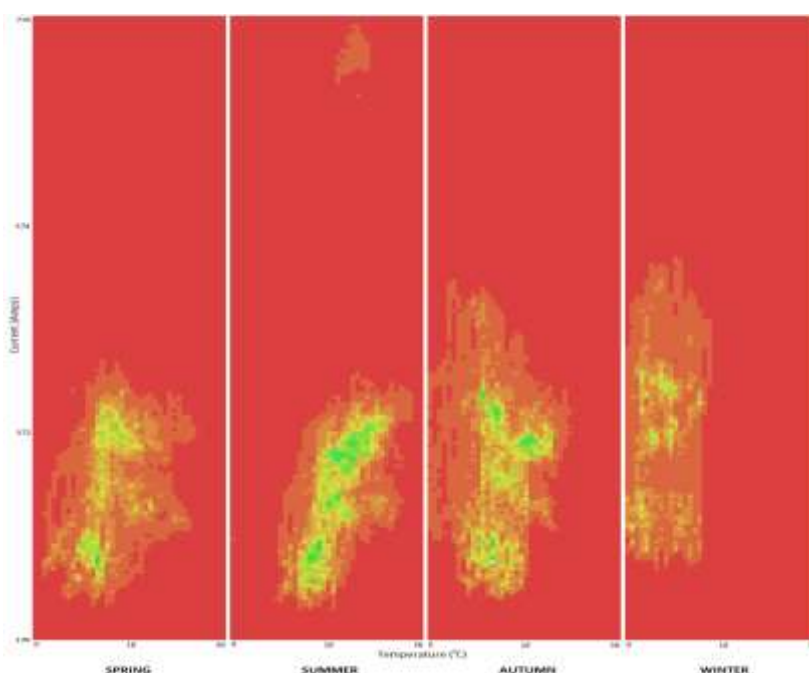
TECHNIQUE 1B TRANSFORMER - COMBINED



This page goes on to show us a number of heatmaps from the DAR trials results. All the data illustrated is taken from a primary transformer.

The heatmap representation is of an ambient condition plotted against electrical current, using data from measurements taken at the primary substations. The standard key here for illustration is red denoting regions where the load/ambient condition combination have not been experienced, with greater frequency of experiences conditions shown by the progression of colours from red (zero one minute instances), through orange, yellow, green, blue and finally white (380 one minute instances).

The diagrams are essentially a way of visually representing the variation in ambient conditions that the assets are operating under. Variation in ambient conditions is at the heart of dynamic asset rating.



The first chart directly above shows a series of four diagrams, each being a season with data shown for that season. Autumn shows a greater spread in current than summer, as would be expected and Winter shows a similarly large spread, but further shifted up the current scale.

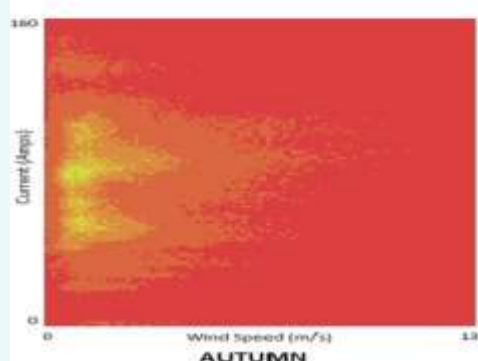
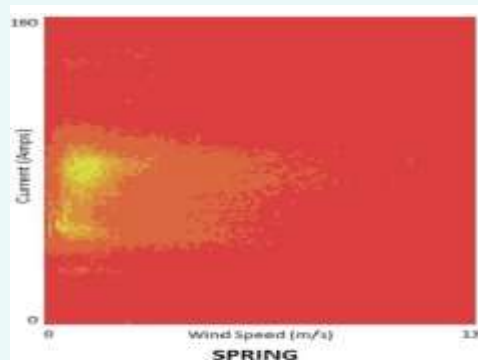
Comparably, Autumn shows a greater spread of temperatures compared to either Summer or Winter.

Image 1A on the left shows Summer temperatures only on a widened temperature scale (i.e. there are more divisions along the scale available for a temperature reading to be assigned to). It does clearly show with greater resolution the variance within the main grouping of measurements, drawing attention to three clusters.

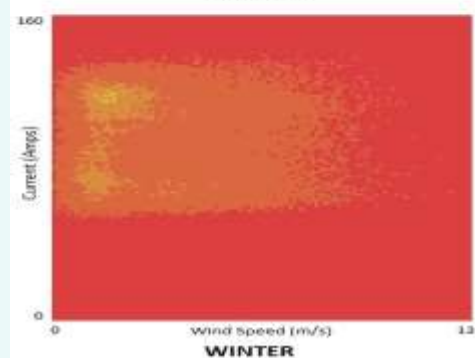
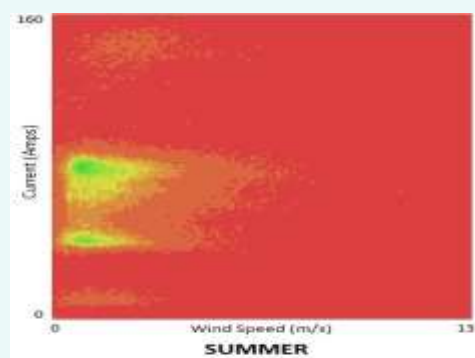
It also shows grouping of measures at the extreme end of the current scale from when the transformer was solely supplying load at the primary substation (when normally two transformers are in service).

Finally, image 1B shows a combination of all four seasons from above.

TECHNIQUE 1C WIND SPEED



TECHNIQUE 1D WIND SPEED



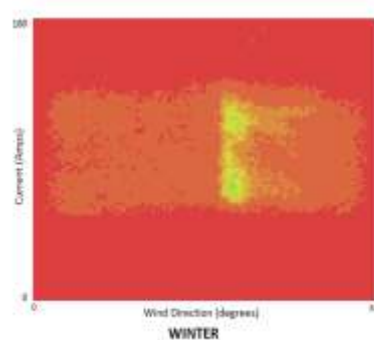
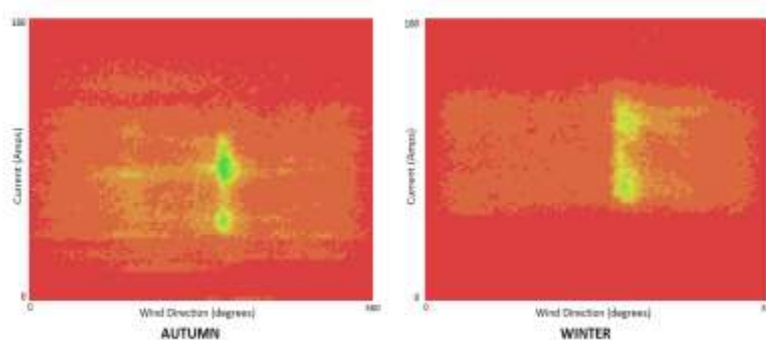
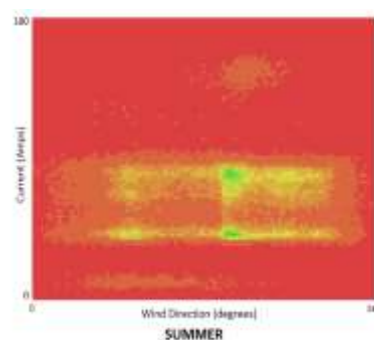
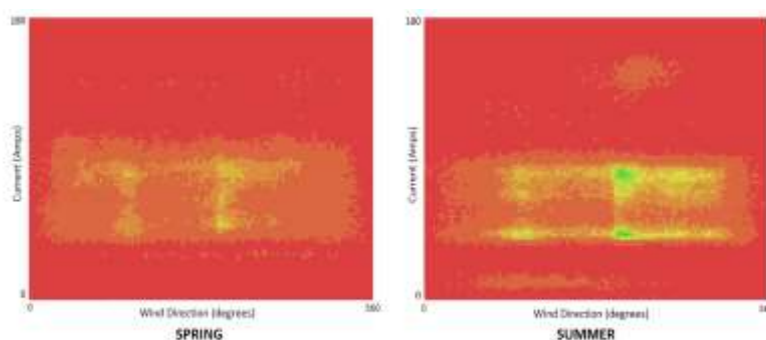
This page goes on to show us further similar heatmaps, this time based on wind speed and wind direction patterns.

Current/amps is shown in each diagram on the y-axis, with speed or direction shown on the x-axis.

The first chart below shows wind direction patterns across the four seasons. As with the temperature diagrams, Autumn shows a greater spread in current than Summer or Winter, with Summer and Winter shifted further down and further up the current scale respectively (as expected).

Whilst wind direction is spread over most compass bearings, a large portion of the time the wind comes from between 190° - 240°, the south-west (as expected from prevailing winds in the UK).

The wind also seems to come frequently from between 85° - 120°, east-south-east, shown most obviously by groupings of readings between these bearings in Spring, Summer and Autumn but absent from Winter (so far).



The wind speed charts in the adjacent columns show the data we have for all four seasons. As is elsewhere, the seasonal variation in current is seen.

Summer shows a smaller spread in speeds than both Autumn and Winter, with the latter seasons exhibiting stronger winds. It is suspected that Spring will appear more similar to Autumn once further data is included as we had limitations in data collection for wind speed during the last Spring season.

Our final reports will offer wider data collected in the DAR trials.



**TOLLGRADE DAR OVERHEAD LINE
MONITORS SHOWN ABOVE**



**LINK TO THE TOLLGRADE CASE STUDY
ATTACHED ABOVE**

Dissemination

As part of our ongoing dissemination, we have continued to be actively involved in various events, some already mentioned previously. 2015 is likely to be a busy year as we embark on further periods of consultation with our colleagues in the industry and begin to formalise outputs.

FALCON Appearances and Conferences



● Demand Response & Future Networks – UK

Future Networks Manager, Roger Hey, recently presented our early Season 2 findings at Utility Week's event, also looking at how networks will cope with future demands, the role of active network management and future network development.

● Utility Week Live 2015 – NEC, Birmingham, UK

The WPD Future Networks Team will be featuring at Utility Week, with Project FALCON on show. With supporting speaking slots, we will be sharing our latest findings.

● Smart Energy Analytics – London, UK

Jenny Woodruff will be speaking at this industry event about WPD's Smart Grid Project findings in relation to data and analytics.

● GEODE Workshop – European Industry Event

Project FALCON will be discussed with our European DNO/TSO colleagues at the GEODE Workshop in Brussels next month.

Low Carbon Hub

2015 has also seen the closure of one of our other key projects – The Lincolnshire Low Carbon Hub (LCH). The LCH was designed to test a variety of new and innovative techniques for integrating significant amounts of low carbon generation on to electricity networks, in an effort to avoid the costs that would normally be associated with more conventional methods.

The LCH explored six main techniques to allow more generation to connect to an existing network. These techniques were used together in the LCH, however different permutations were explored to see how connecting generation could be supported.

As part of our overall commitment to knowledge sharing and industry best practice, LCH is hosting a Knowledge Dissemination Event on Tuesday 2nd June 2015 at The Hallam Conference Centre in London. This event will share how the six techniques have been used together along with an evaluation for future roll out throughout the UK based on our learning to date.

For an invitation please email wpdinnovation@westernpower.co.uk.

FALCON partners

