

Energy Innovation Summit 2025

Real Time Fault Level Monitoring

Lara Cardoso and Kate Edwards

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Who We Are

SP Energy Networks, part of ScottishPower, owns four regulated electricity network businesses in the UK:

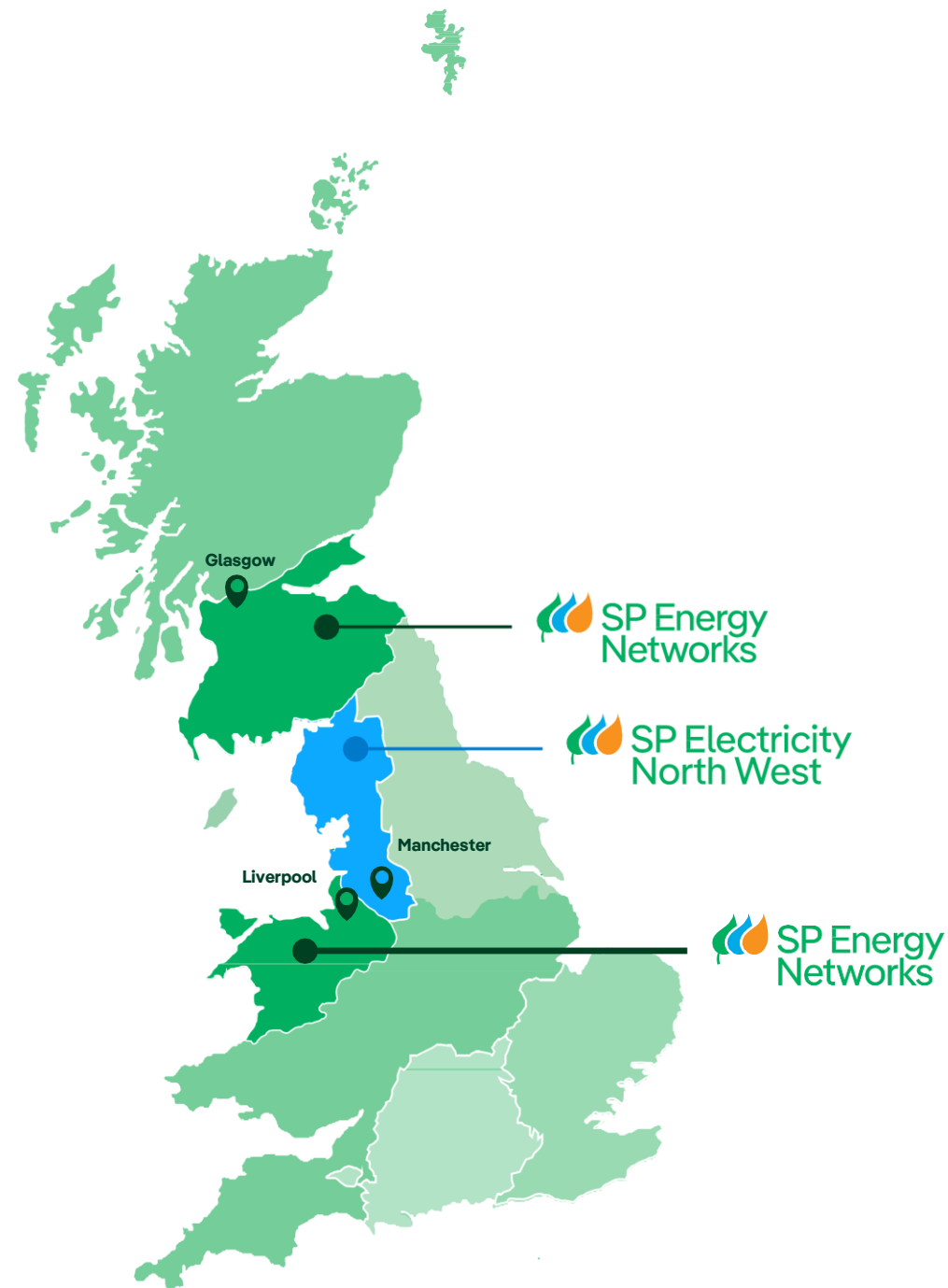
- SP Distribution plc (SPD)
- SP Transmission plc (SPT)
- SP Manweb plc (SPM)
- SP Electricity North West (SP ENW)

Together we keep electricity flowing to over **12 million** people across a network spanning more than **172,000 kilometres**.

Operating in some of the UK's largest cities as well as significant rural areas. It's our job to move electricity to and from homes and businesses over our network.

Our aim is to deliver a safe and reliable electricity supply 24 hours a day, 365 days a year whilst providing exceptional value for money.

It's a role that puts us right at the heart of the UK's Net Zero carbon emissions ambition.

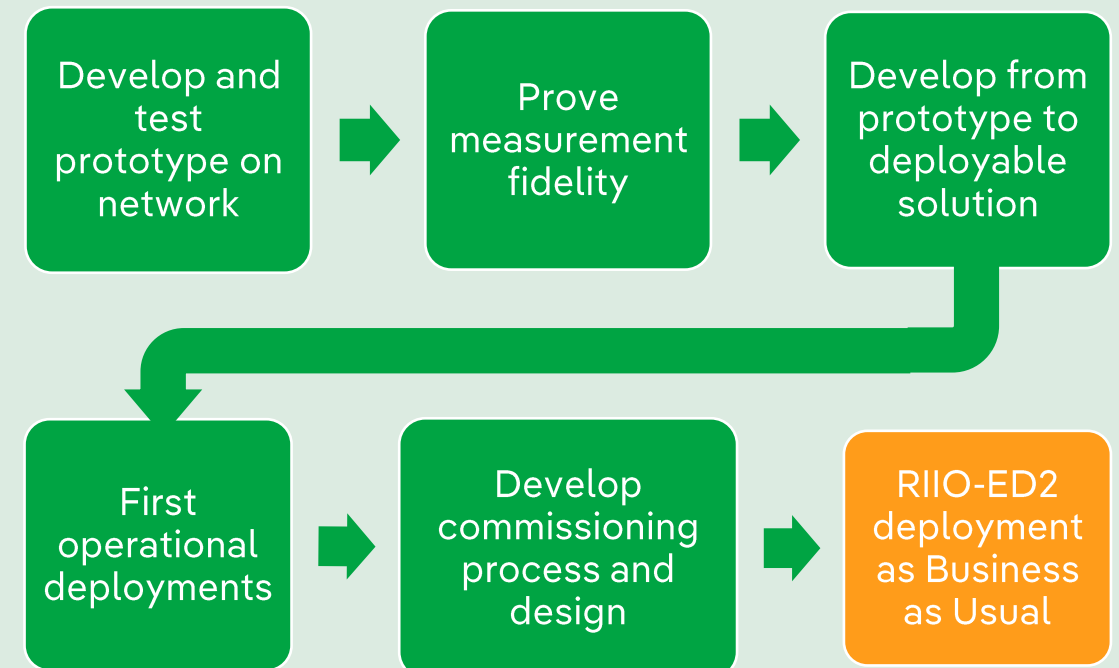


Context and background

Distributed Generation will **continue to accelerate** with decarbonisation and decentralisation to facilitate Net Zero.

- Managing Fault Level is already one of the **greatest network planning & operational challenges**.
- Fault level is currently managed through **network modelling calculations**.
- Models are **sensitive to input data quality** and are becoming more **complex** as generation technology advances.

In response, we have been partnered with Outram Research to develop a **Real Time Fault Level Monitor (RTFLM)**.



Real Time Fault Level Monitor innovation project, progress

Innovation is key to prevent fault level becoming a barrier to the low carbon transition.

Introducing the Real Time Fault Level Monitor

The devices calculate fault level by measuring very small voltage changes in response to precisely controlled electronically switched LV loads.

Simplified connection arrangements shown right:

- VT reference to target bus (e.g. 11kV, 33kV, etc)
- Inductors, controlled by power electronic switches,

Initial Targets

measure fault level to within

5% threshold

15 seconds

10% step change identification

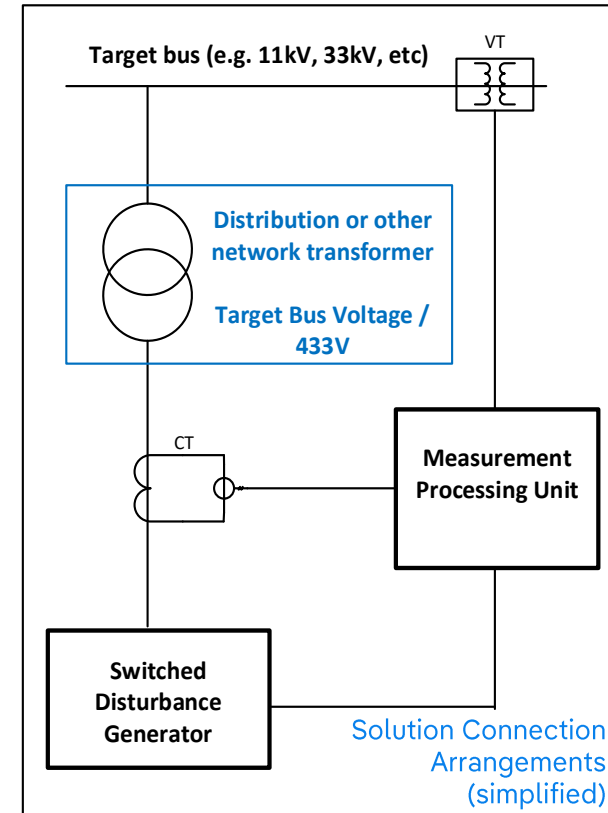
Peak performance

measurement within

1% threshold

4 seconds

10% step change identification

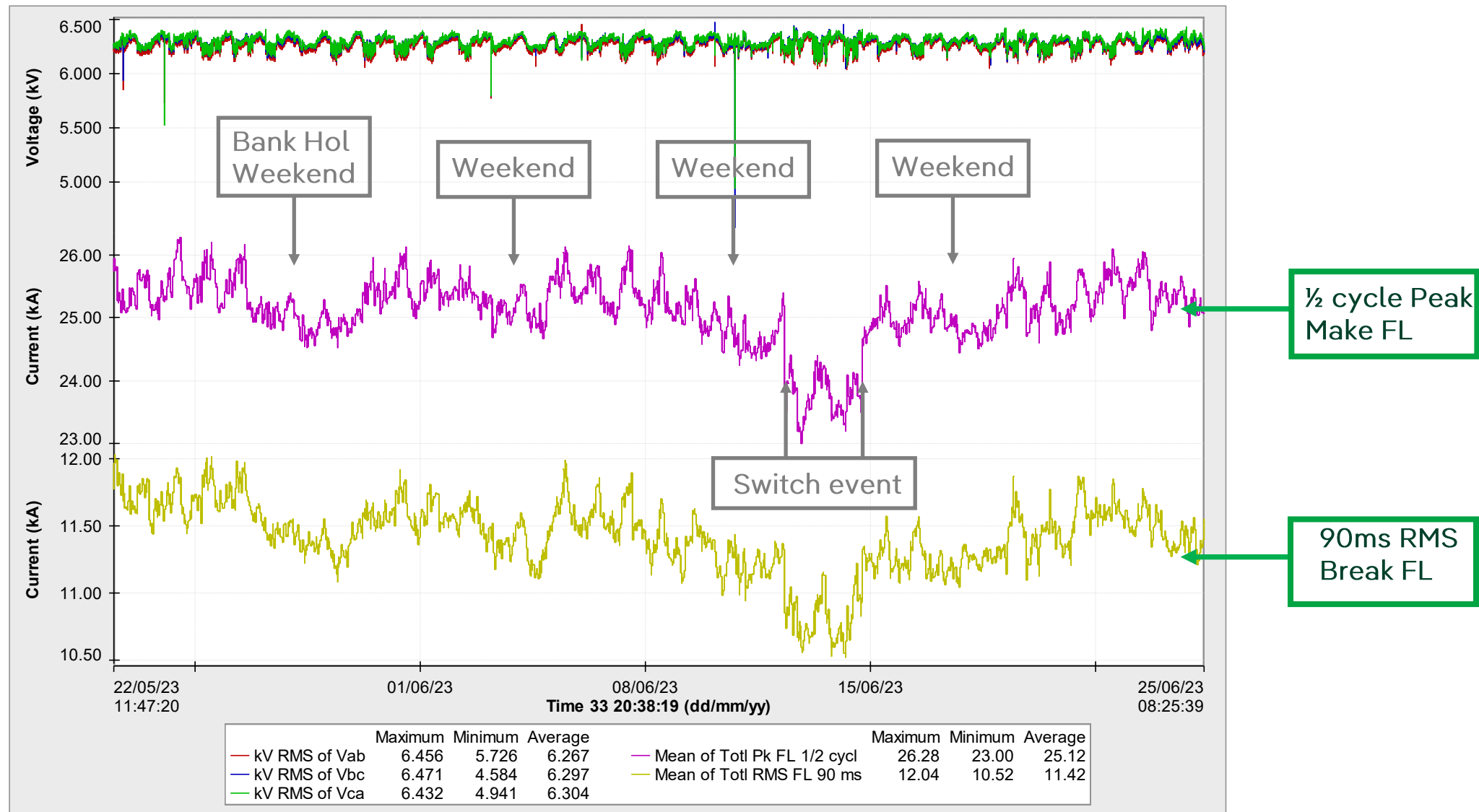


Real Time Fault Level Monitor
at Sheil Park Primary,
Liverpool, 2023

Approach has been to **prove** the technology, develop from **prototype**, then **deploy as BAU**

Continuous Monitoring: 6.3kV Primary Substation

We now have **months of continuous monitoring** data at multiple substations and multiple voltage levels (6.3kV, 11kV, 33kV).



Example is a 6.3kV substation in Liverpool.

Using RTFLM data as BAU

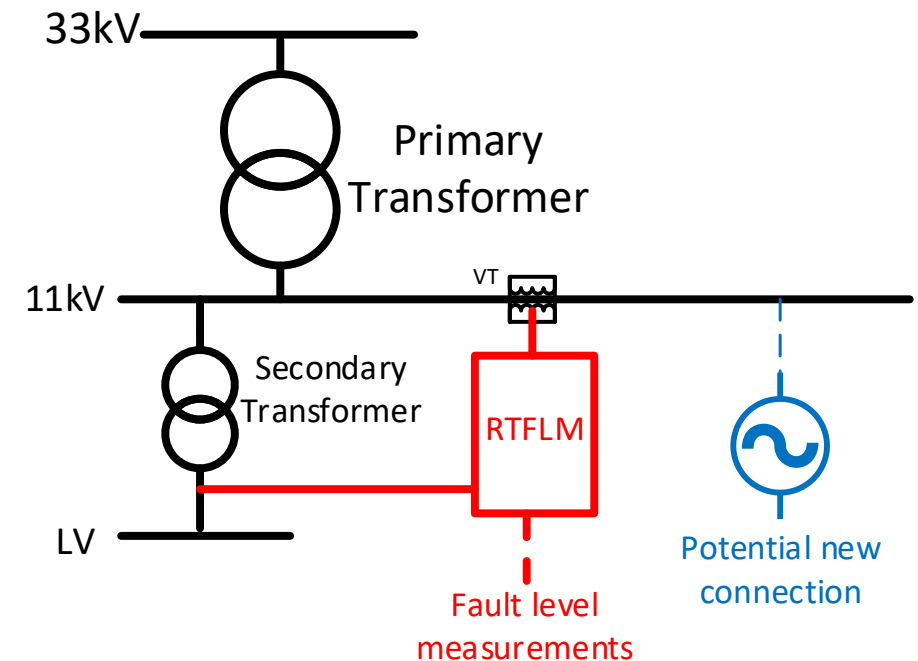
RTFLM data used to **inform two customer connection** offers in September 2025

Three phase 11kV fault level measurements compared to modelled results for various scenarios:

- Three phase peak measurements -1.39% variance
- Three phase RMS break measurements +0.74% variance

Benefits:

- Close correlation between measured and modelled results provided **additional reassurance and justification** to fault level reinforcement and mitigation recommendations.
- Site will continue to be monitored with a view to assessing **viability** of auto-changeover scheme in future.



Connection arrangements - simplified

RTFLM data provided **reassurance and additional justification** for recommendations

- Improving visibility of network fault level
- Supporting system studies
- Unlocking network capacity
- Greater confidence in network safety

SPEN estimated **£40m in cost savings** within RIIO-ED2 by deployment of RTFLM



Lara Cardoso

SP Energy Networks
Senior Innovation Engineer
lcardoso@spenergynetworks.co.uk



Kate Edwards

Outram Research
Sales and Operations Manager
kate.edwards@outramresearch.co.uk



John Outram

Outram Research
Managing Director
johnoutram@outramresearch.co.uk