



Risk and Resilience Day 2025

University of Birmingham

D-Suite - BETA

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About us

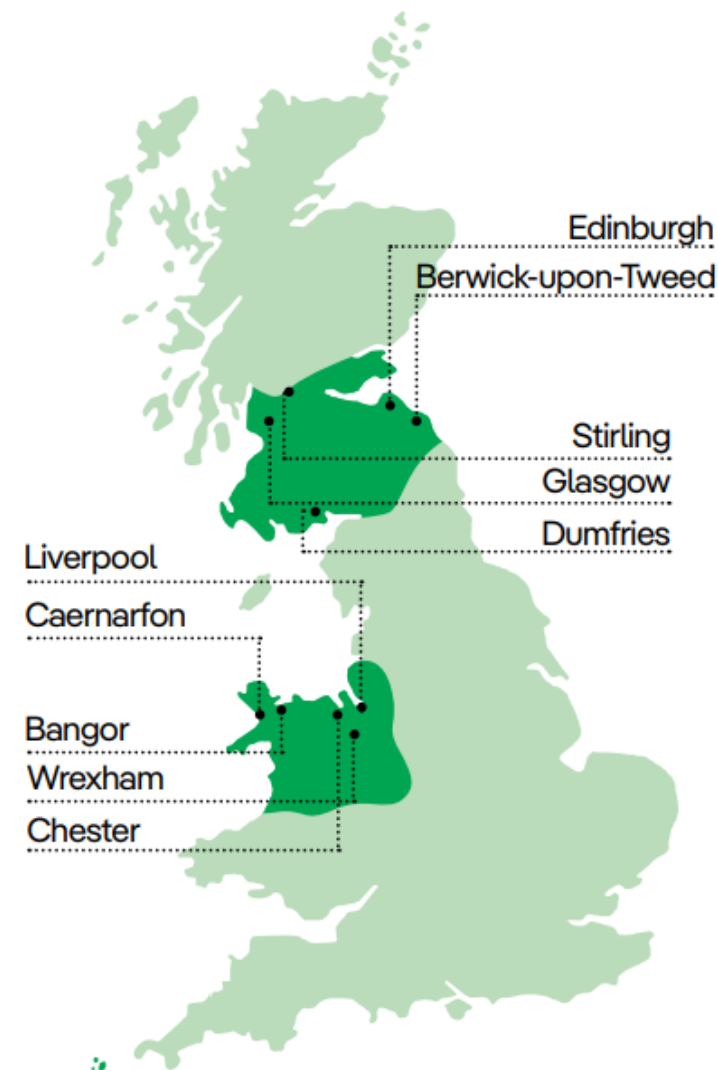
We are SP Energy Networks. As a Distribution and Transmission Network Operator we keep electricity flowing to homes and businesses throughout Central and Southern Scotland, North and Mid Wales, Merseyside, Cheshire and North Shropshire.

Our business is crucial to the delivery of the UK's Net Zero targets and the transition to a more sustainable future.

We are committed to making this happen and placing our customers and stakeholders at the heart of this journey.

Our three regulated electricity businesses are:

- SP Transmission PLC (SPT)
- SP Distribution PLC (SPD)
- SP MANWEB PLC (SPM)



Problem Statement

LV network changes are being driven by decarbonisation technologies and their impacts:

- 600,000 HP/year from 2028.
- 300,000 EV chargers by 2030.
- 85GW peak demand GB wide by 2050.

LV networks will experience:

- Increasing voltage excursions.
- High circuit and transformer utilisation.
- All compounded by large phase imbalances.

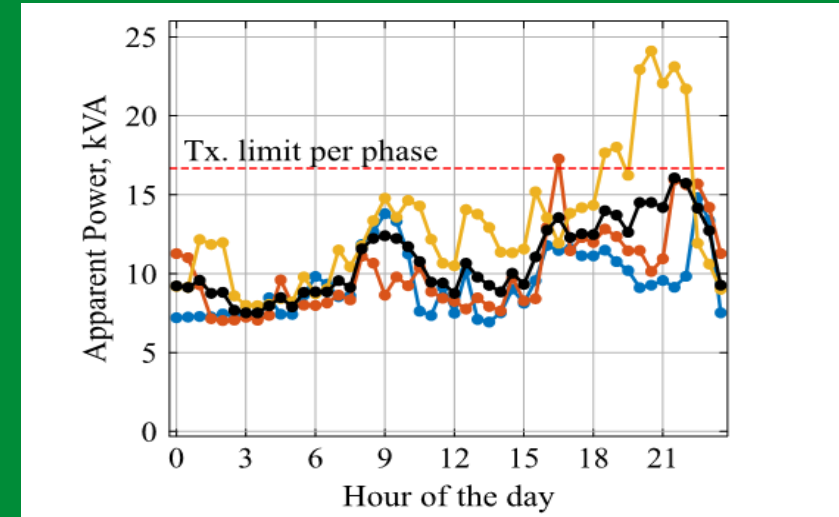


Fig. 1: Phase imbalance overloads transformer.

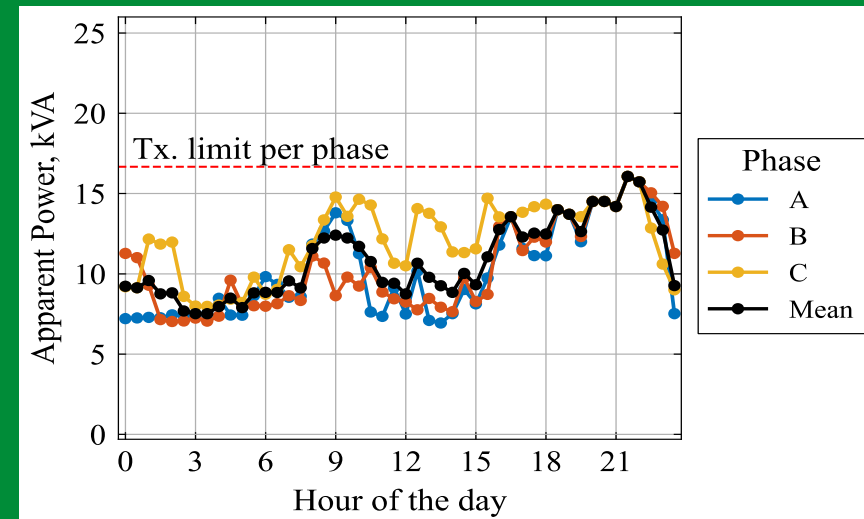


Fig. 2: D-Suite balances phase current.

Objective:

Trial of:

- Partially rated Power Electronic Devices
- LV Design Tool.

Equipment:

- Partially rated Smart Transformer (D-ST)
- Soft Open Point (D-SOP)
- STATCOM (D-STATCOM).

Testing: Conduct trials at three locations for minimum six-month period.

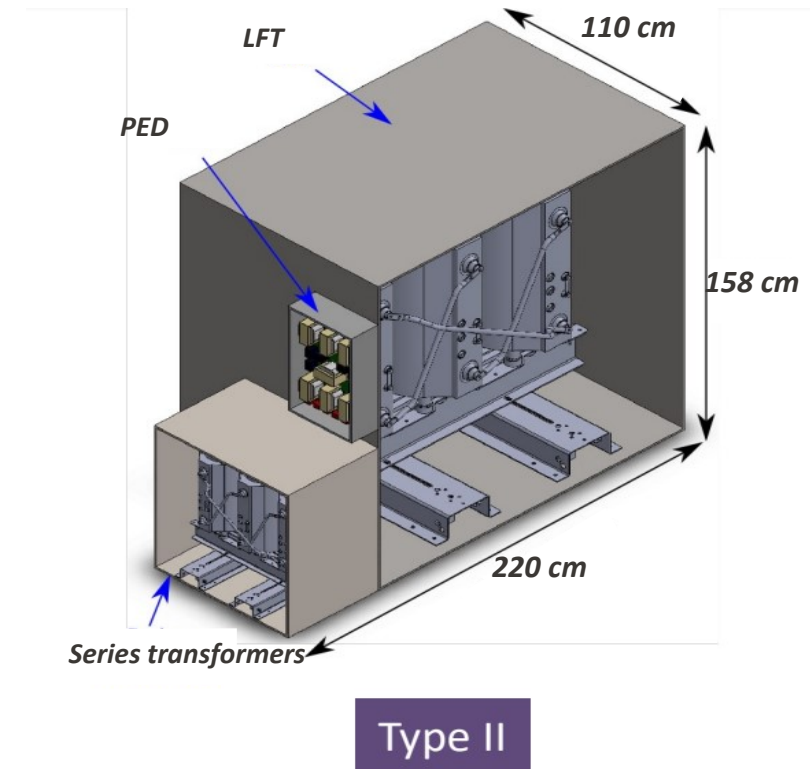


Fig. 3: Partially rated D-ST showing compact size of D-Suite Power Electronics.

LV Design Tool and Risk and Resilience



Challenges of D-Suite devices:

- Active technologies
- Device performance dependent on siting and sizing
- Cost-effectiveness dependent on high utilization

The D-Suite LV Design tool will:

- Collects the most up-to-date network models
- Assigns load profiles to customers
- Run an optimization to determine optimal type, capacity, control, and location of D-Suite devices

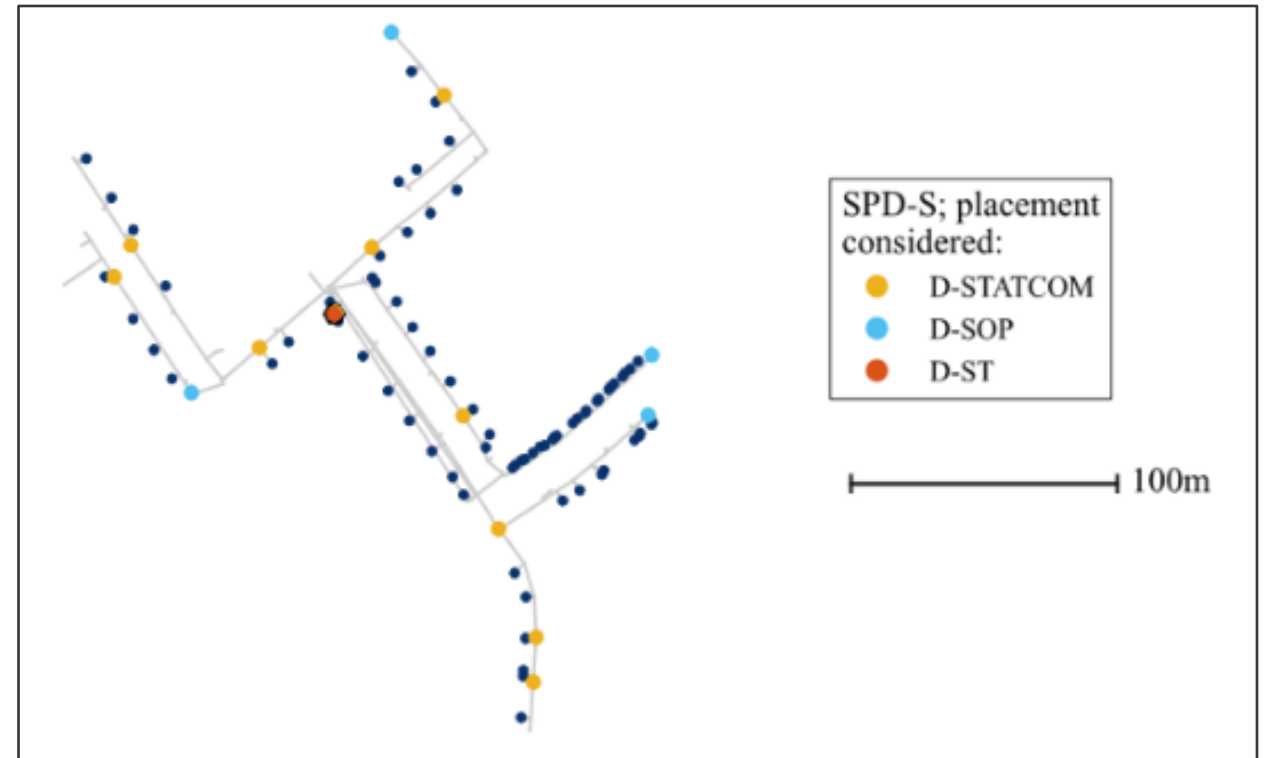


Fig. 4: D-Suite device locations which addresses both feeder level and Substation level congestions.

Source: "D-Suite WP1 Deliverable 1.3: Cost-Benefit Analysis", 2025.
Available from the Smarter Networks Portal.

LV Design Tool: Practical Risk and Resilience Questions

As a *Network Design* ('short term planning') problem:

- How do we ensure that the accuracy of LV network models is validated and/or appreciated within the design process when results are presented?
- How do we ensure the risk of stranded assets is minimized?

As a *Network Planning* ('medium- or long-term planning') problem:

- How do we capture the full value of these devices for DNOs and the energy system, given the disparity in expected asset lifetimes?
- How do we present the technical benefits so that they can be meaningfully incorporated into decision making (e.g., CBA)?

As a *software tool*:

- How do we ensure that tool can PED technologies, that might come to market, can easily incorporated into the tool (extensibility)?
- How do we balance trade-offs between algorithmic complexity, numerical accuracy, and usability?

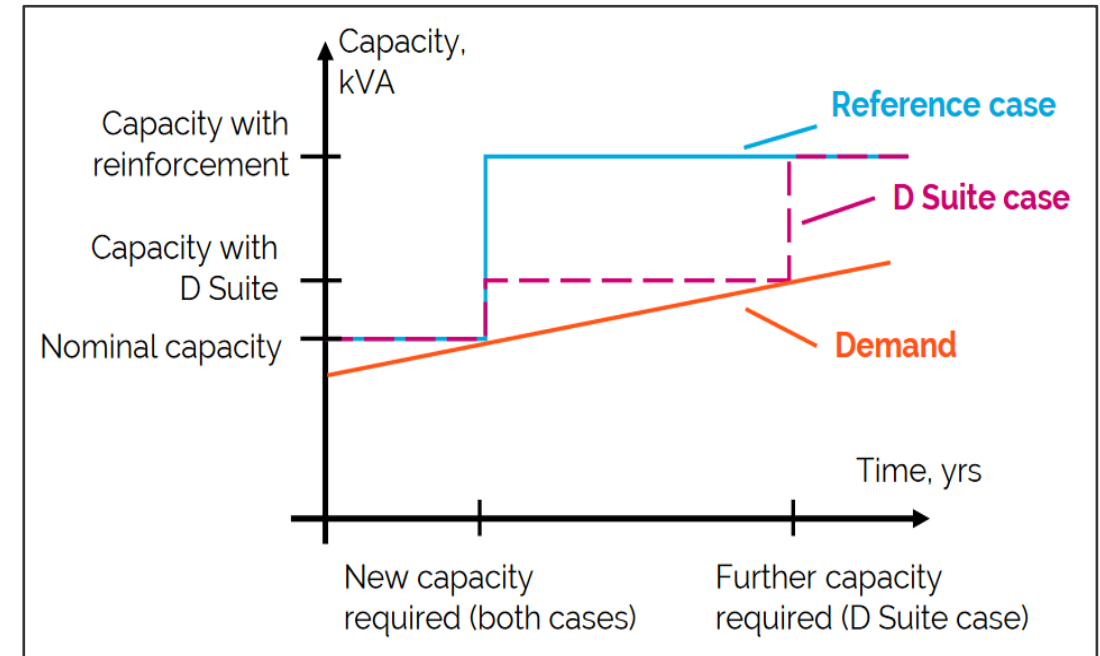


Fig 5: Deferment benefit under D-Suite case versus the Reference case.

Source: "D-Suite WP1 Deliverable 1.3: Cost-Benefit Analysis", 2025. Available from the Smarter Networks Portal.

Conclusions



Distribution networks require significant investment to reduce/prevent overutilization of LV and HV assets



D-SOP, D-STATCOM and D-ST can mitigate phase voltage and current imbalance, improve voltage profiles and reduce over utilisation.



The **LV Design Tool** aims to address critical risks of underutilized D-Suite devices or the risk of installations which only address issues for very short periods

