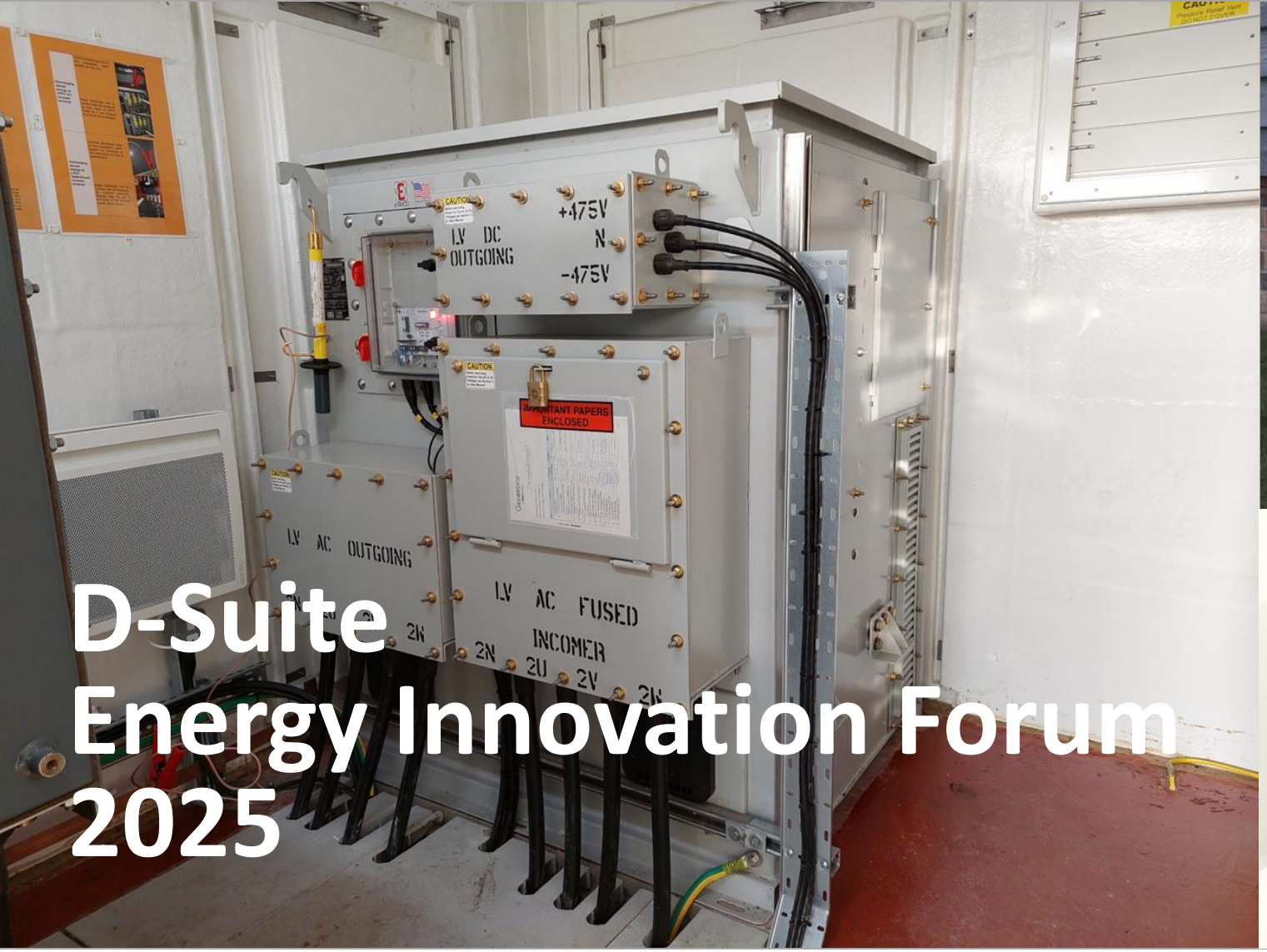

D-Suite Energy Innovation Forum 2025

SP Energy Networks

Newcastle University

IPT

UK Power Networks

Content

01 Introduction.
02 Where Have We Been?
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01 Introduction – Project and Partners

SIF Beta Round 2

Total Budget: **£8.96m**; SIF Funding Request: **£8.06m**, with the following:

- SPEN: **£6.17m**, Project Lead.
- UKPN: **£0.18m,** DNO Partner.
- Integrated Powertech: **£0.89m** Power Electronic Device (**PED**) Expert Partner.
- Newcastle University: **£0.82m** Academic Partner – LV Design tool Lead.

#	Name	Title	Representing	Email
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4	Andrew Burton	Innovation Engineer	UK Power Networks	Andrew.Burton@ukpowernetworks.co.uk

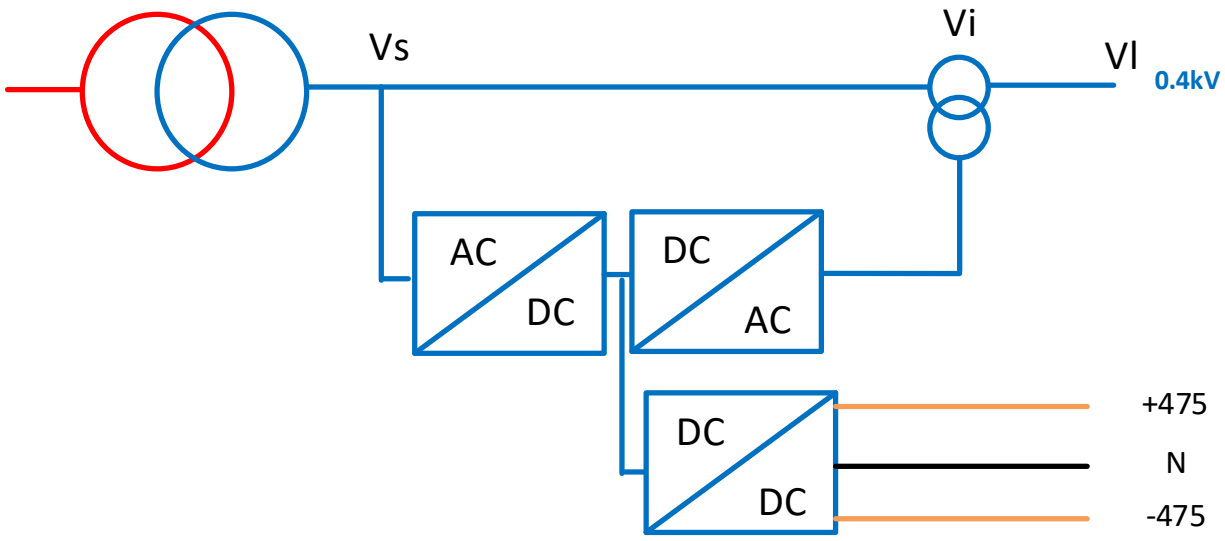
02 Where Have We Been?

LV Engine

March 2018 – Dec 2024 (completed)

Key achievements to-date:

- Manufactured all equipment.
- Established IT system integration.
- Carried out integration testing.
- Monitored performance and reported.
- 3 substations live and operational .



02 Where Have We Been?

02 Where Have We Been?

FUN-LV & Active Response (UKPN)

March 2018 – Nov 2023 (completed)

Key LV PED achievements to-date:

Manufacture and trial of 2T and 3T Soft Open Points to TRL 9.

- Improvements in several metrics including:
  - Noise reduction
  - Efficiency improvements
  - Physical size reduction
  - Improved cooling design
  - Higher current carrying capacity

Test modes to TRL 7 additional including:

- Voltage constraint mode – preventing port voltage going outside statutory limits
- Voltage balancing
- Reactive power setpoint control
- Phase balancing
- Harmonic attenuation

03 Where Are We Going?

Decarbonisation is driving unprecedented change to the LV network:

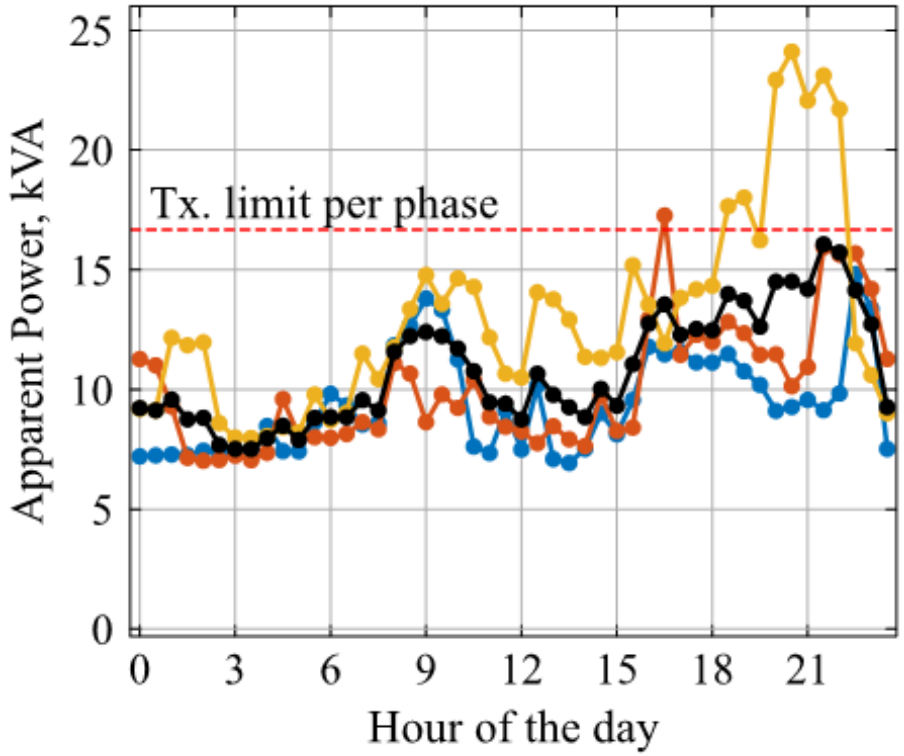
- 600,000 HP/year from 2028.
- 300,00 EV chargers by 2030.
- 85GW peak demand GB wide by 2050.

LV networks will experience:

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

LV PEDs can mitigate these issues, but:

- Are currently not cost competitive.
- Placed sub optimally on the LV network and are not optimally rated.
- Lack low-cost current balancing solutions.



04 The D-Suite Solution

Used a Suite of Distribution Power Electronic Devices

1. **D-SOP**,
2. **D-STATCOM** and
3. **D-ST**.

Reduce Cost and Optimise

- ✓ Remove DC Networks and metering from D-ST Gen2.
- ✓ Model the D-Suite PED Performance through Net-Zero.
- ✓ Optimally place and size the correct PED Type.

Reduce Size and Rating

- ✓ From modelling, specify the most common optimum rating for developing PED products.
- ✓ Prioritise network services, avoid all at once.
- ✓ Use high temperature Power Electronics

Remove PED Complexity From Decision Making

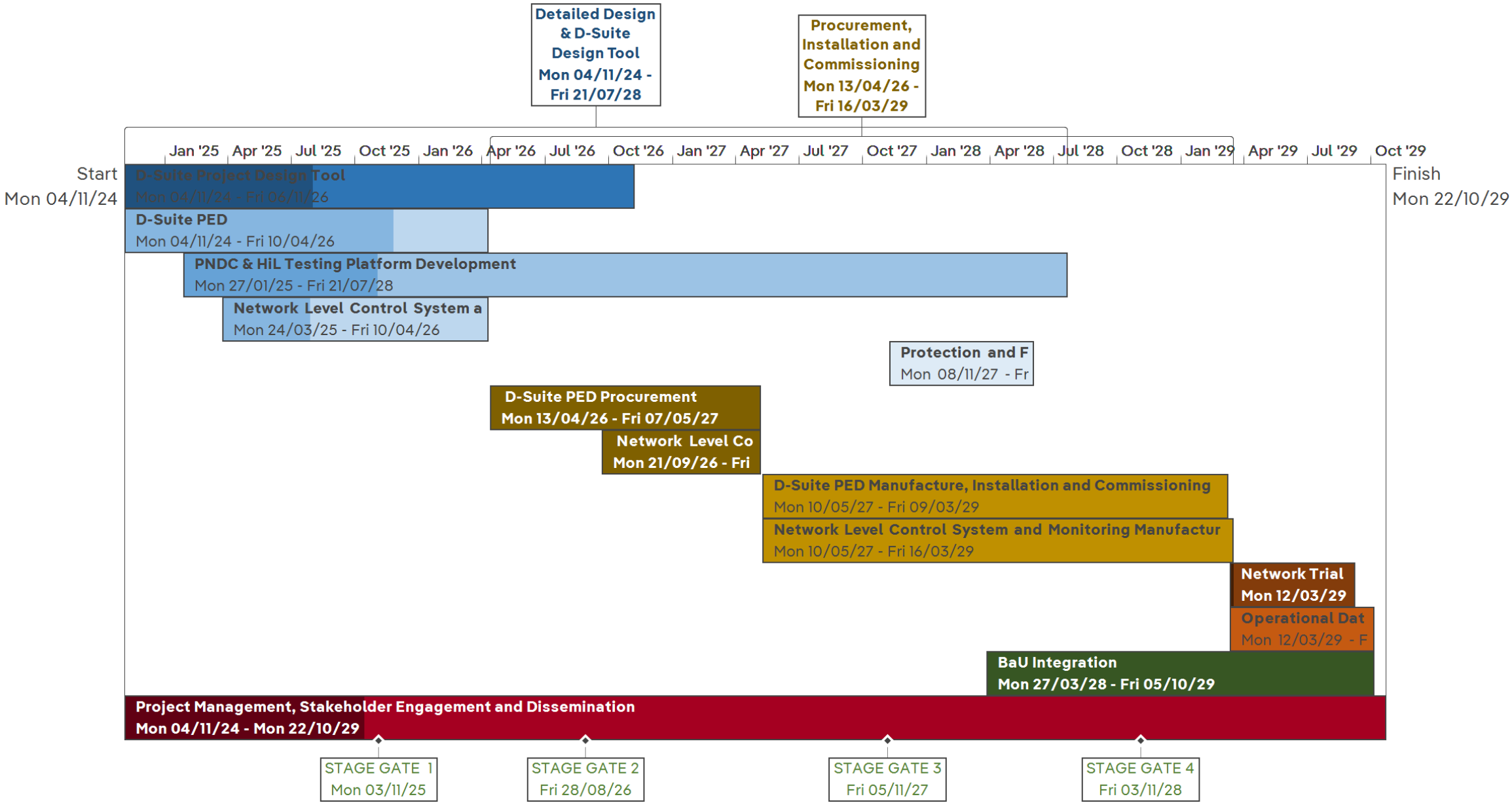
- ✓ Avoid high training requirements (LV Designers).
- ✓ Use preapproved LV design tools to aid decision making.

04 The D-Suite Solution - Who's Doing What

Project Oversight
Local Authority Council leaders and Academic Board Members
SPM Director, Trial District General Managers , Future Networks Manager and Network Planning Lead Sponsor.

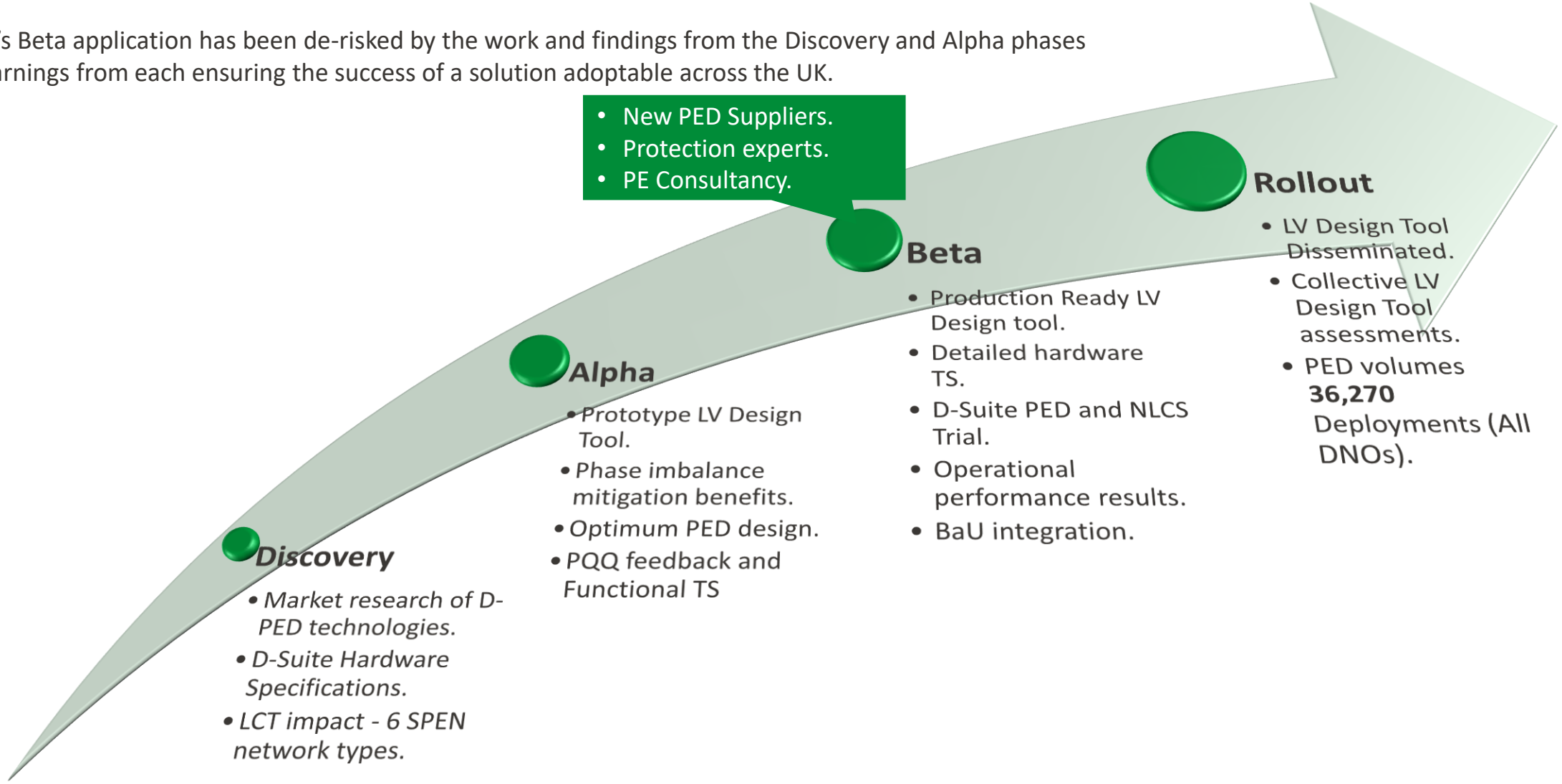
	Lead	Main Tasks	Outputs
WP1 - Detailed design & D-Suite Design Tool.	Newcastle University IPT; UK Power Networks	D-Suite **LV Design Tool**. PED Failure Mode and Effect Analysis. PED protection design a strategy. Testing specification & platform development.	D-Suite Planning Tool Module. UKPN Integration Report. PNDC & HiL TS and Platform. D-Suite PED Procurement Documents.
WP2 - Procurement, Installation and Commissioning.	SP Energy Networks; IPT	Procurement, development, full installation and commissioning of all **D-Suite PED** and **Network Level Control System (NLCS)**.	Signed Procurement Contracts. NLCS Factory Testing Report (FAT). PED FAT and Commissioning Report.
WP3 - Trial & Operational Performance.	SP Energy Networks	A **Network Trial** - 3 trial locations in SPM. Continuous data collection. Monthly result analysis.	Operational Performance Report. Report on Trial Analysis Finding for Application on UKPN Networks.
WP4 - BaU Integration.	SP Energy Networks; UK Power Networks	**LV Design Tool** verification. Drafting and review of policies	Reviewed Policy Documents.
WP5 - Project Management, Stakeholder Engagement & Dissemination.	SP Energy Networks	Webinars. National and international conferences. Regulatory Reporting.	Submitted and accepted: Conference papers Webinar videos Output reports and annual reports

04 The D-Suite Solution – How Long Wil It Take?



05 Journey So Far

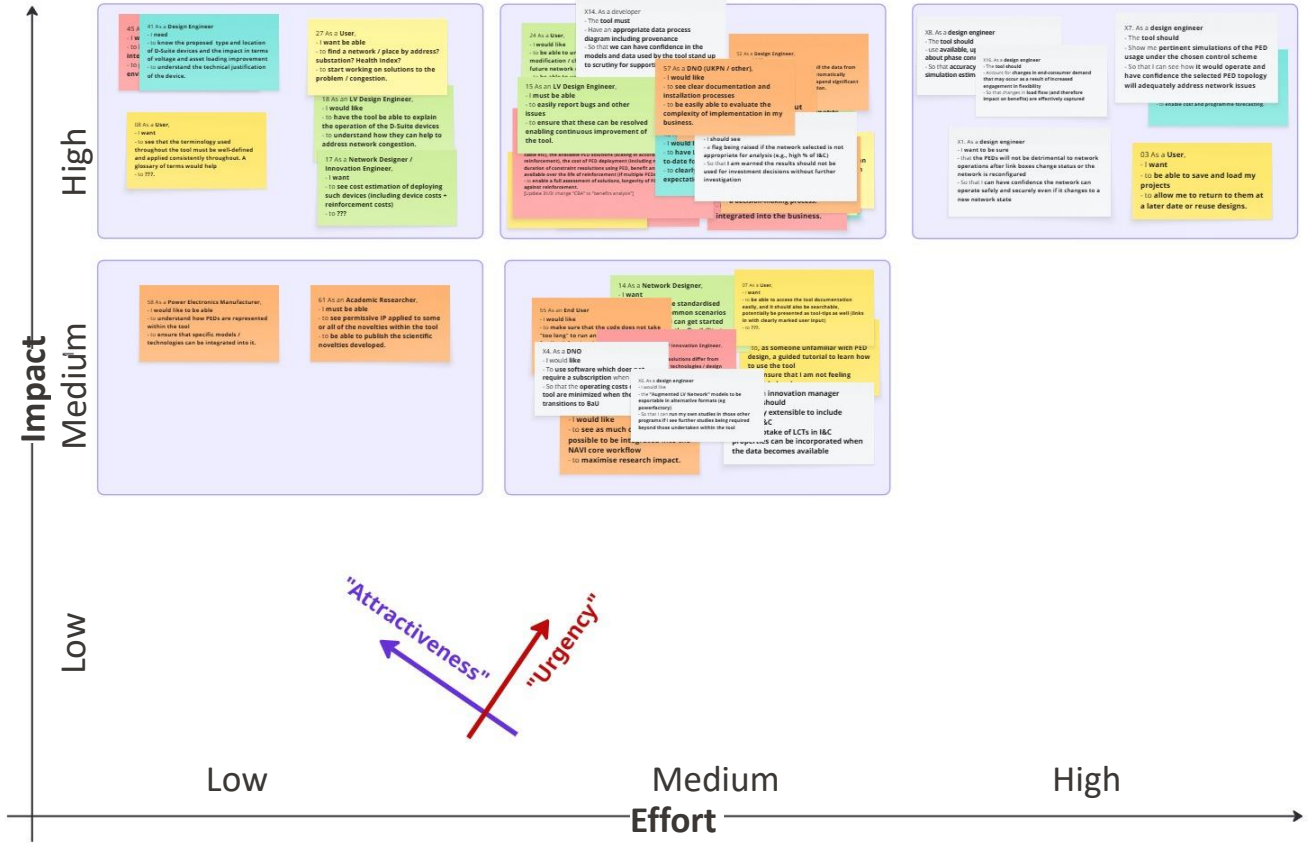
D-Suite's Beta application has been de-risked by the work and findings from the Discovery and Alpha phases with learnings from each ensuring the success of a solution adoptable across the UK.



05 Journey So Far – LV Design Tool

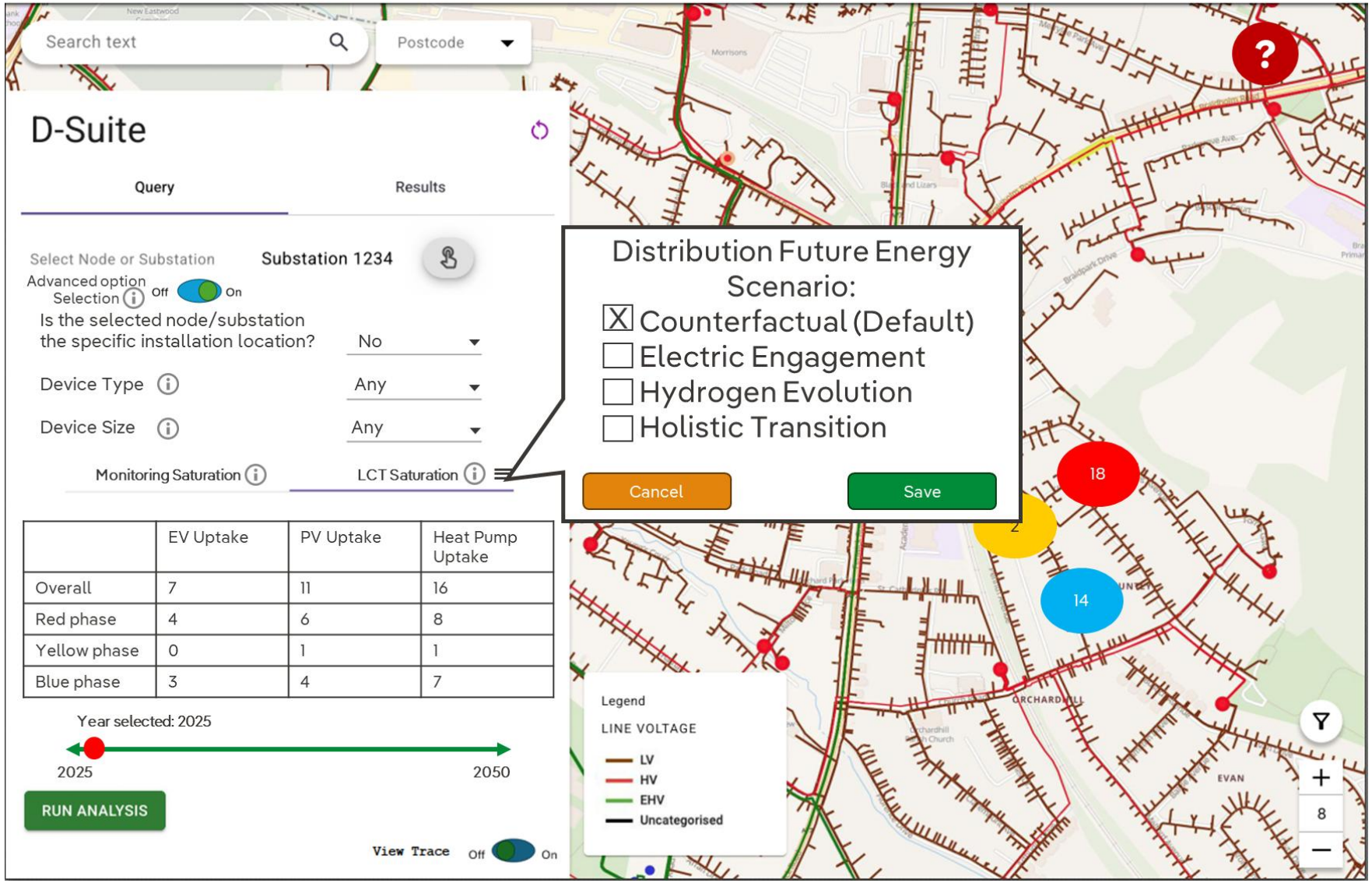
Main Progress

1. Newcastle University Control Response modelling code developed and installed into SPEN NCEWS 2 Platform (NAVI).
2. NU-NAVI team workshop to propose user journey based on outputs of User Requirements workshop.



05 Journey So Far – LV Design Tool

The User Experience – The Most Important Part



	EV Uptake	PV Uptake	Heat Pump Uptake
Overall	7	11	16
Red phase	4	6	8
Yellow phase	0	1	1
Blue phase	3	4	7

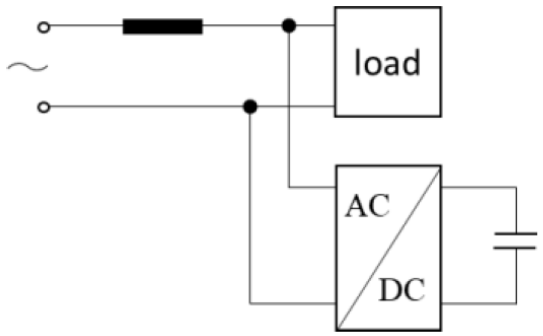
05 Journey So Far – Testing Platform Development

Hardware prototyping of D-suite modules

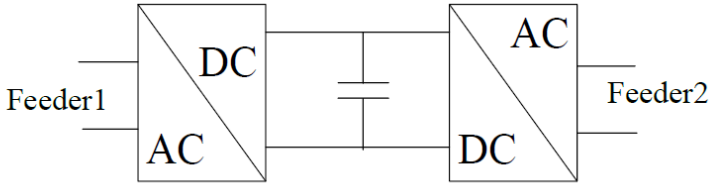
1. Completed simulation models for two key D-Suite devices: D-STATCOM and D-SOP.
2. Completed open-loop hardware testing of a modular D-Suite unit in the lab.
3. Prepared next steps for closed-loop testing to replicate real-world operation of D-Suite devices.
4. Maintained alignment with SPEN to ensure all work directly supports technical specifications.

Contribution to Success

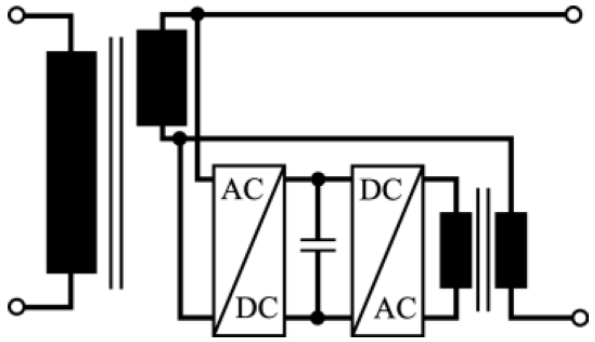
- ✓ Expands the simulation and testing toolkit needed for safe, scalable deployment of D-Suite devices.
- ✓ Confirms modular designs work as expected in real-world lab conditions, reducing the risk of later-stage failures.
- ✓ Strengthens readiness for future acceptance testing and supports long-term business-as-usual rollout



D-STATCOM



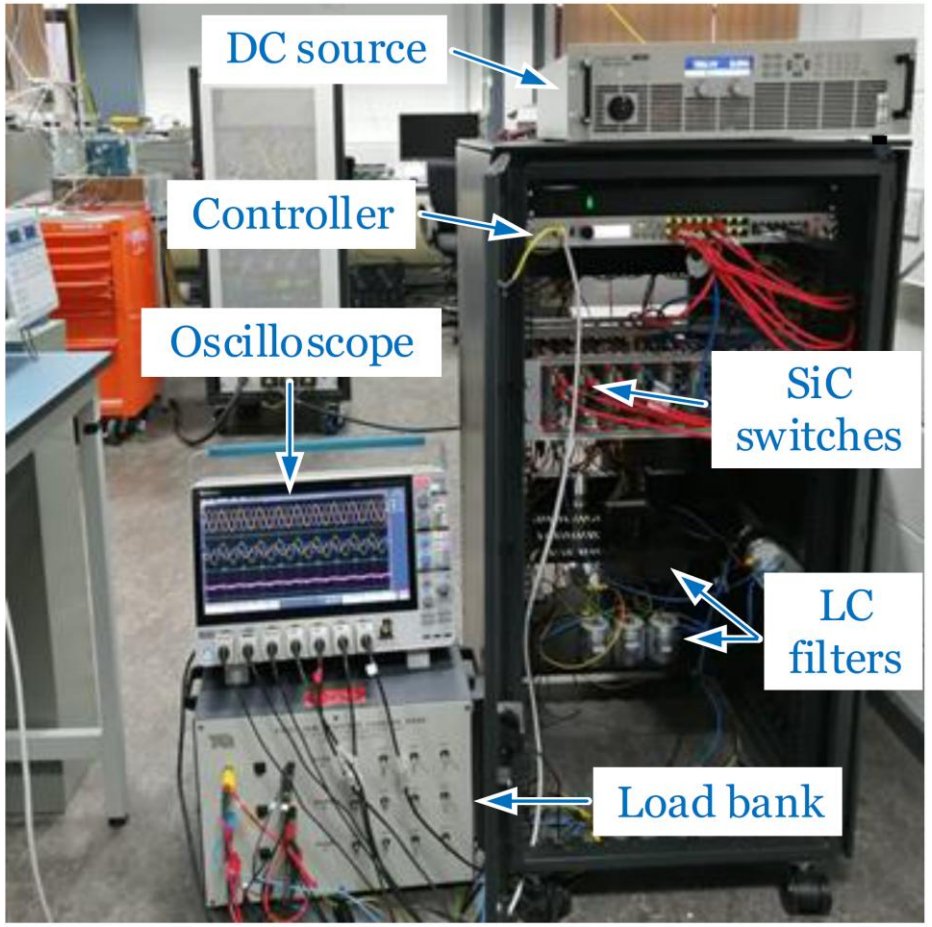
D-Soft Open Point



D-Smart Transformer

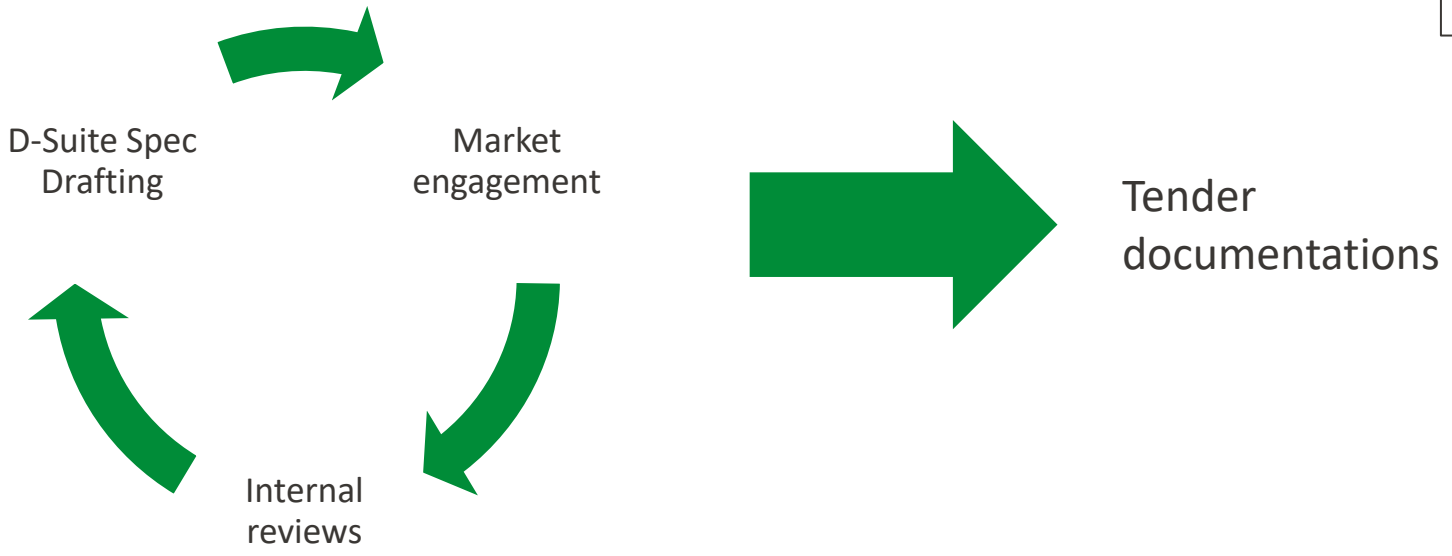
05 Journey So Far – Testing Platform Development

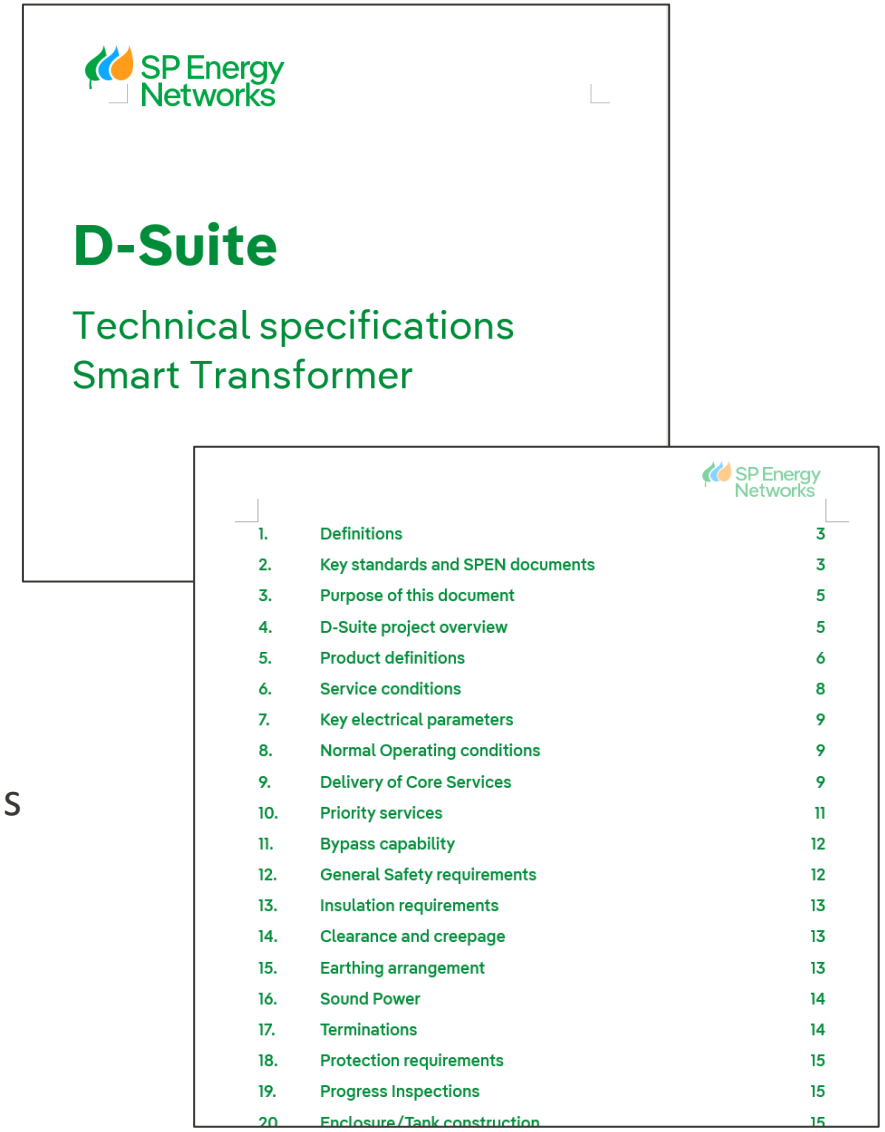
IPT



05 Journey So Far – PED Technical Specification

- The technical specifications of the D-Suite devices are progressing as planned. Expected an initial draft of D-ST technical specification issued August 2025.
- Market engagement continues in terms of identifying more potential supplier
- Carrying out factory visits for those manufacturers with no relationship with SPEN before.
- Approval committee appointment scoping and market engagement is ongoing

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D-Suite

Technical specifications
Smart Transformer

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06 Why It Matters

By the year **2040**,

- Planned works instead of reactive works– LCT Rollout.
- Fast Installation and recovery of units under approved planning method.
- Up to **10%** of the reinforcement volume could be D-Suite PED.

Financial

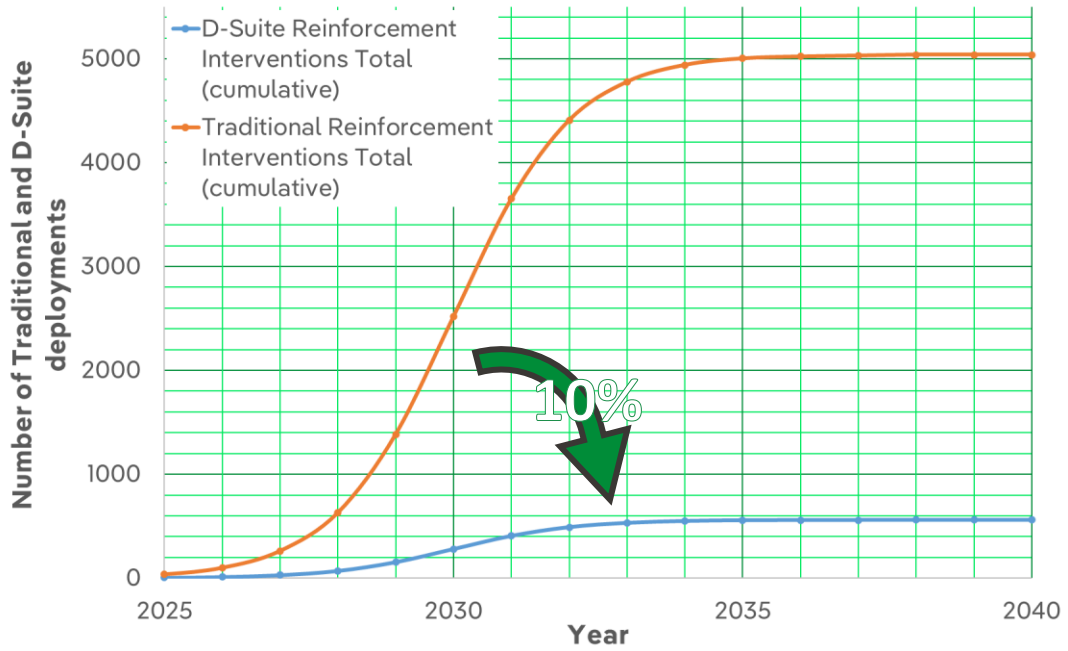
- Traditional Reinforcement - average cost of all types.
- **1.5%** annual inflation rate applied to traditional reinforcement cost.
- D-Suite PED OPEX **2%** of CAPEX.
- D-Suite PED volume cost reduction £250/kVA to £62/kVA by 2040.

Societal

- **£9.8 k** per feeder due to DER hosting capacity uplift.
- Traditional solutions marginal capacity uplift.

Environmental

- CO2 savings PV capacity uplift:
- 162gCO2/kWh - PV panel lifecycle emissions: 41gCO2/kWh = Δ = - **121gCO2/kWh**



Questions?

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