Project details

Application team

SP MANWEB PLC (Lead)

Organisation details

Type	Business

Team members

Full name	Email	EDI survey
Kiron Dutton	kdutton@spenergynetworks.co.uk	Complete
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Newcastle University

Organisation details

Type	Research

Team members

Full name	Email	EDI survey
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UK POWER NETWORKS (OPERATIONS) LIMITED

Organisation details

Type	Business

Team members

Full name	Email	EDI survey
Jack McKellar	jack.mckellar@UKpowernetworks.co.uk	Complete
Robert Davies	Robert.Davies@ukpowernetworks.co.uk	Complete

INTEGRATED POWERTECH LIMITED

Organisation details

Type	Business

Team members

Full name	Email	EDI survey
Glesni Pierce-Jones	Pierce-JonesG@cardiff.ac.uk	Complete
Wenlong Ming	wenlongming@gmail.com	Complete

Application details

Competition name
Ofgem Round 2: Alpha – Improving energy system resilience and robustness

Application name
D-Suite

When do you wish to start your project?
2 October 2023

Project duration in months
6 months

Public description

Public description

Due to government incentives, such as the planned rollout of 600,000 heat pumps a year from 2028, the ban on new ICE vehicles by 2030 and, ultimately, the net zero target for 2050, the LV network is expecting a large uptake of heat pumps, EV chargers and distributed generation.

The problems LV networks will experience, will mainly be voltage rise and high circuit and transformer utilisation due to LCTs, which will be compounded by large phase imbalance due to single phase connections. D-SOPs, D-STATCOMs and D-STs can mitigate these issues, at the point of connection, on the LV network.

Application questions

1. Lead Network (not scored)

Lead Network

SP Energy Networks: Manweb Plc (SPMW)

2. Problem statement

Provide a summary of the problem that you want to solve through your project.

Due to government incentives, such as the planned rollout of 600,000 heat pumps a year from 2028, the ban on new ICE vehicles by 2030 and, ultimately, the net zero target for 2050, the LV network is expecting a large uptake of heat pumps, EV chargers and distributed generation. As record numbers of electric vehicles, renewable energy sources and heat pumps are introduced to our energy system, the coming 5 years will be crucial in repurposing the existing infrastructure, recognising the scale of transformation required and the leading role networks will play in enabling that vision for decarbonisation.

The problems LV networks will experience will mainly be voltage rise and high circuit and transformer utilisation due to LCTs, which will be compounded by large phase imbalance due to single phase connections of most customers. D-SOPs., D-STATCOMs and D-STs can mitigate these issues, at the point of connection, on the LV network.

SP Energy Networks has undertaken analysis of 6 LV networks, across its two license areas, for Urban, Suburban and Rural areas and modelled the present level of LCT rollout, as well those in 2028, 2036 and 2040. This analysis has shown increasing utilisation of LV circuits and transformers, which will require intervention to facilitate the levels of LCTs required. Active Power Electronic Devices can adapt to a changing networks and defer passive reinforcement solutions, as the network changes.

The potential users of D-Suite technology are LV network design engineers, LV control room staff and, ultimately, LV connected customers, who will benefit from reduced disruption and high LCT penetration. The LV design engineers will need the control philosophies of each D-Suite device to model them in planning tools/software for customer LCT connection agreements. Control engineers will require visibility of the D-suite devices to audit their behaviour to ensure they are operating as designed.

Three completed projects, that are relevant and are contributing to this Project are: LV Engine (SPEN), FUN-LV (UKPN) and Active Response (UKPN), which

have trialled Soft Open Points and Smart Transformers respectively. The learning from these three projects have fed into the development of the D-Suite technical specification during the Discovery stage.

3. Innovation justification

How does your Project demonstrate novel and ambitious innovation in the energy networks?

D-Suite is applying against the Improving Energy System Resilience and Robustness challenge Theme 2. SP Energy Networks partnered with Newcastle University who have expertise in Power Electronic supply chains. Newcastle University will continue to partner with SP Energy Networks in the Alpha stage.

SP Energy Networks have led two Network Innovation Competition (NIC) Funded projects, Angle-DC and LV-Engine, which have involved design, procurement, testing and deployment of novel Power Electronic (PE) systems at medium and low voltage levels respectively. Lessons learned from these projects include how to reduce the required functionality and ratings to an optimal level, to reduce unit costs as far as possible. Other lessons include operation and control, visibility in the network Energy Management System, carrying out fault and protection studies and mitigating cooling and noise issues that come with active PE technologies. UKPN is a project partner who has led two Projects, FUN-LV and Active response, funded by the Low Carbon Networks Fund and NIC respectively. UKPN gained valuable learning procuring and deploying Soft Open Point (SOP) power electronic devices.

The learning from the above projects, is informing our Project plan, which is structured to develop the D-Suite technology technical scope, seek feedback from the supplier base, identified in the discovery stage, and select appropriate trial sites to test the technology. SP Energy Networks will continue to work with the end users (network design, planning and control engineers), PED suppliers, PE consultancies, network design and standards teams, local authorities, and academic partners to ensure the D-Suite technologies are fit for purpose at the deployment stage. A deployment of a D-STATCOM, at the LV voltage level, would be a first for UK DNOs and would represent a leap forward in active LV network control using PEDs.

D-Suite alpha is scoped to progress the Project aims as far as possible within 6-months and under the allowable budget. There is no Work Package element that is not required to begin tenders with suppliers in the Beta Stage. D-Suite requires innovation funding to:

-Kickstart the LV PED market to produce innovative low-cost D-Suite designs based on modular DC- components.

-Develop D-Suite control and protection strategies to maximise benefits and equipment safety.

-Develop D-Suite design and planning tools.

-Develop operation and safety documents for novel D-Suite technologies.

The TRL levels of the D-Suite Technologies will rise from 4-5 to 6-8 based on the work undertaken in the Alpha and Beta stages of this project, should it be successful in achieving its aims.

Counterfactual alternatives to D-Suite technologies include 1) increasing the capacity of LV feeders and secondary transformers, 2) installation of three phase supplies to customers connecting high capacity LCTS (e.g., heat pumps, EVs and DER) and 3) installing passive harmonic filters. The first two options are very disruptive to customers and require a large engineering resource to deploy nationwide. The passive filter option, to mitigate harmonic emissions on LV networks, require the same connection arrangements as a D-HF, but will require period tuning and possible reinstallation, as the background harmonic spectrum changes over time.

4. Impacts and benefits selection (not scored)

Impacts and benefits selection

From initial studies for the Discovery Proposal and as part of the Discovery work package, we can realise the following benefits:

-Financial - future reductions in the cost of operating the network

-Financial - cost savings per annum on energy bills for consumers

-Financial - cost savings per annum for users of network services

-Environmental - carbon reduction -- direct CO2 savings per annum

-Environmental carbon reduction - indirect CO2 savings per annum against a business-as-usual counterfactual

The above benefit categories have not changed, since the Discovery proposal, since the discovery has not changed the benefits case. Detailed D-Suite network level control modelling will provide network specific technical benefits based on a year's worth of simulation of D-Suite technology performance.

5. Impacts and benefits description

Impacts and benefits description

Financial

The project will model the amount of capacity headroom released and the number of years reinforcement will be deferred based on LOT uptake scenario modelling on typical LV connections. The tangible benefits to the network operation can be estimated by customer minutes lost and customer interruption reduction based on historical examples.

We will be able to use the existing assets and maximise their value by avoiding or deferring reinforcement. Increased capacity to connect DER without reinforcement:

Based on thestudies in Denmark (https://iberdrola-my.sharepoint.com/personal/a_moon_scottishpower_com/Documents/D-Suite/01%20Discovery/12%20Deliverables/05%20Alpha%20Submission/Alpha%20Submission%20v1.4%2020230627.docx#_ftn1)[1], 5% to 40% more of PV generation can be integrated without triggering reinforcement. This can be estimated to be£10k per annum per feeder (https://iberdrola-my.sharepoint.com/personal/a_moon_scottishpower_com/Documents/D-Suite/01%20Discovery/12%20Deliverables/05%20Alpha%20Submission/Alpha%20Submission%20v1.4%2020230627.docx#_ftn2)[2], providing additional income for our community, based on a 20% uplift on a LV network fed by a 100kVA secondary transformer.

D-Suite technologies will not only increase the renewable connectivity, but also contribute to loss reduction due to the optimised voltage profile and local power balancing. Thestudies (https://iberdrola-my.sharepoint.com/personal/a_moon_scottishpower_com/Documents/D-Suite/01%20Discovery/12%20Deliverables/05%20Alpha%20Submission/Alpha%20Submission%20v1.4%2020230627.docx#_ftn3)[3] for different topologies in the LV networks demonstrated 2%-6.4% reduced losses, representing a realistic saving for GB customers about£4m per annum (https://iberdrola-my.sharepoint.com/personal/a_moon_scottishpower_com/Documents/D-Suite/01%20Discovery/12%20Deliverables/05%20Alpha%20Submission/Alpha%20Submission%20v1.4%2020230627.docx#_ftn4)[4]. For the CBA, this figure SP Energy Networks has apportioned the benefits based on benefits in its license area only, rather than UK wide and overall D-Suite could provide a Net Present Value of: **£140.9M** up to 2050. When deployed UK wide, the conservative NPV value is **£1.006 bn [5]**.

(https://iberdrola-my.sharepoint.com/personal/a_moon_scottishpower_com/Documents/D-Suite/01%20Discovery/12%20Deliverables/05%20Alpha%20Submission/Alpha%20Submission%20v1.4%2020230627.docx#_ftnref1)**[1]** Voltage regulation in LV grids by coordinated volt-var control strategies, Miguel Juamperez, Guangya Yang, Soren Bakhoj KJAR, 2014, Power System Clean Energy

(https://iberdrola-my.sharepoint.com/personal/a_moon_scottishpower_com/Documents/D-Suite/01%20Discovery/12%20Deliverables/05%20Alpha%20Submission/Alpha%20Submission%20v1.4%2020230627.docx#_ftnref2)**[2]** If 100kVA 11kV/0.4kV transformer to feed the LV, it would mean 20kVA on average: 20kVA * 33% * 12hours *365days*£0.34/kwh= £10k per annum per feed, as the additional income for the community [based on electricity price: £0.34/kwh: Energy bills support factsheet - GOV.UK (www.gov.uk)

(https://www.gov.uk/government/publications/energy-bills-support/energy-bills-supportfactsheet-

8-september-2022)]

(https://iberdrola-my.sharepoint.com/personal/a_moon_scottishpower_com/Documents/D-Suite/01%20Discovery/12%20Deliverables/05%20Alpha%20Submission/Alpha%20Submission%20v1.4%2020230627.docx#_ftnref3)**[3]** [1] Voltage regulation in LV grids by coordinated volt-var control strategies, Miguel Juamperez, Guangya Yang, Soren Bakhoj KJAR, 2014, Power System Clean Energy

(https://iberdrola-my.sharepoint.com/personal/a_moon_scottishpower_com/Documents/D-Suite/01%20Discovery/12%20Deliverables/05%20Alpha%20Submission/Alpha%20Submission%20v1.4%2020230627.docx#_ftnref4)**[4]** Annual Transmission losses(L)=26GWh, Ratio of energy lost in distribution compared to transmission(R)=2, estimated price per 1 GWh(P)=£200k estimated.

[5] This is obtained by £140.9M/0.14, where 0.14 is the fraction of the total number of UK LV feeders within the two SP Energy Networks licence areas.

applicable circuits(C)=4%, sensitivity(S)=1%, L*R*P*C*S=£4m, [Energy Trends: UK electricity - GOV.UK (www.gov.uk) (https://www.gov.uk/government/statistics/electricity-section-5-energy-trends (https://www.gov.uk/government/statistics/electricity-section-5-energy-trends))

Environmental

Carbon reduction can be measured by the renewable electricity generated due to earlier access to the network and the reduced emissions associated with deferred/eliminated need for reinforcement. The benefits will be quantified in the Alpha stage, when the technical benefits (losses reduction, capacity uplift and reinforcement deferment) can be calculated through detailed modelling using high temporal resolution, based on customer profiles, and unbalanced LCT uptake.

6. Team and resources

Who will be involved with the delivery of the Project during the Alpha phase?

There are no changes to the project partners, but there will be additional experts within Newcastle University brought onto the Project. No new equipment or facilities will be required, as part of the Alpha stage, though additional expertise is being applied as extra resource. There will be extra parties included within the departments of Network Operators, who will be consulted on the D-Suite technical specification and design and planning tool proposals. Local authorities will be engaged early.

UK Power Networks

UK Power Networks is the Electricity distribution network owner and operator for London, the Southeast and East of England. They will also ensure that the project development is scalable and can be applied to other regions of the UK as it transitions to BaU.

Robert Davies, the UKPN project manager will be responsible for the day-to-day management of the UKPN project work package, ensuring it delivers in line with the stated objectives. Robert will be supported throughout project delivery by a team of subject matter experts in areas such as expertise in electricity networks, network planning and asset management.

Integrated PowerTech

Dr Wenlong Ming, by leveraging the EPSRC, NIA and UKRI investment and the research resources in the same research group, will lead the delivery of Work package 2: WP 2 - Hardware Design and Control of D-Suite Modules. Dr Ming's track record on hardware design will factor in the device protection and operational health & safety requirements. This work package will focus on the modular hardware design and hardware switching control. The D-Suite modular nature, as well as reducing the functionality and equipment ratings are the key focus to reduce costs for LV applications.

Newcastle University

Newcastle University has a track record in working with the energy sector. Power System Group is the UK's largest academic research group in Electrical Power.

Newcastle has state-of-the-art research laboratory facilities, with academic activities that are highly cross-disciplinary and multi-disciplinary. Newcastle University provides effective solutions in three areas of expertise:

1.Power Electronics, Drives and Control.

2.Machines.

3.Power Systems and Energy Storage.

Newcastle University's team is led by Dr Matt Deakin. His team will leverage the research investment and resources at Newcastle University to lead Work package 1: Control Detailed Design and Algorithm Performance Analysis. The work package will provide detailed network control results, which will provide the D-Suite technical benefits and fully quantified revenue streams on SP Energy Networks' networks. Newcastle University will add Dr David Greenwood and Dr Mohamed Daida to their Team.

Dr David Greenwood is a Research Fellow, at Senior Lecturer level, and has been involved in developing control schemes, e.g., for the Smarter Network Storage project with UKPN back around 2015. Dr Greenwood will contribute formally as WP Co-investigator.

Dr Mohamed Dahidah is Senior Lecturer in Power Electronics and is just starting a three-year EPSRC funded research project on Smart / Hybrid Transformers. He will lead a researcher to support the Cost Benefit Analysis of the project in the second half of the work package delivery.

Matt Deakin is a Royal Academy of Engineering Research Fellow at Newcastle University. To date, Dr Deakin has published more than 23 peer-reviewed articles, with recent outputs exploring low-cost reconfigurable AC/DC converter designs, placement of power electronics within distribution grids, and cost-benefit analysis of distribution-connected power electronics. He holds a PhD from the University of Oxford on the topic of benefits from reactive power control from distribution-connected power electronics.

The formal governance is in place: The project partnership agreement sets out clear responsibilities of each partner and the scope of delivery. The payment milestone is linked with the success criteria.

7. Project management and delivery

How will you manage your Project effectively?

The PM process, policies and systems fully meet the requirements of ISO9001 (quality), ISO14001 (environment), ISO27001 (information security management) and ISO45001 (occupational health and safety). Management systems are subject to regular checks by management and biannual audit by the accreditation body.

All tasks described within our project plan have been assigned to a lead organisation who will be responsible for undertaking the associated activities and ultimately report to the nominated SP Manweb Distribution Project Manager, who in turn reports to a director-level Project Sponsor and the D-Suite Steering Group, providing support, expertise, challenge, and governance.

The project plan has been broken down into six Work Packages (WPs) as detailed below, with the Alpha phase high level project plan, partner leads, Gantt chart and deliverables detailed in the Appendix.

To effectively address the technical challenges, we have created a strong partnership and a steering group (partners and engaged collaborators), providing expertise in network level control & technical benefits (Newcastle University, hardware optimisation and standards (Integrated Powertech) and experienced of Soft Open Point design and delivery (UKPN).

The partners will utilise suitably qualified and experienced personnel for delivery. The allocated resource will range from junior graduate level employees up to senior delivery managers ensuring the best value for money in the delivery of this project. Workpackage tasks are denoted by #.# below.

1.WP1: Control Detailed Design and Algorithm Performance Analysis* -- Newcastle University --

(M1.1-M1.3) (£105,600)

1.1 Network Models

1.2 Network Level Control Development and Evaluation

1.3CBA Analysis -- The results from the algorithm performance studies will provide the technical benefits for each D-Suite Technology.

2.WP2: Hardware Design and Control of D-Suite Modules -- Integrated PowerTech -

(M2.1-M2.4) (£150,100)

2.1 Modelling of D-Suite Modules for Simulations - DSTATCOM, D-ST, D-SOP, D-HF -- The electrical and thermal modelling of active switches and passive elements of the D-Suite modules, which make up the D-Suite technologies.

2.2 Optimal Design of D-Suite Modules for Cost, Size and Efficiency -- This task will involve multi objective optimisation at the hardware level.

2.3 Intelligent Hardware Control of D-Suite Modules -- In contrast to Work Package 1, the control studies at the hardware level.

2.4 Integration of D-Suite Modules with MV/LV Transformers --* This work package task will include the optimisation of hardware connections between D-Suite Modules and network interface transformers.

3.WP 3: -Techno-economic Framework and Standards Review -- UKPN

(M3.1-M3.2) (£36,540)

3.1D-Suite **Techno-economic Framework Review**. UKPN will review the use cases and benefits for D-Suite devices on their network, including size, location and capacity requirements.

3.2 Review the Technical Standards for D-Suite Technologies. UKPN will review the technical specification for the D-Suite devices for use on their network and report on the technical applicability differences between SP Energy Networks and UKPN.

4.WP 4 **Development of Supplier PQQ and Tender Pack** -- SP Energy Networks

(M4.1-M4.2) (£120,800)

4.1 Draft of PQQ - with Technical Specification for all D-Suite Technologies, Standards and Scope for Stakeholder Review

4.2PQQ Process -- held with suppliers identified in the Alpha stage.

4.3 Tender Pack Final Draft -- Ready to be issued to supplier base in the Beta stage.

5.WP4: Identification of Sites for between 2 -4 D-Suite Technologies --

(M5.1-M5.4) (£51,820)

5.1 Identification of 6 circuits.

5.2 Site Visit and Site Assessment of 6 Original Circuits for Feasibility.

5.3 Selection and Network analysis of New Sites if Needed.

5.4 Site Visit and Site Assessment of New Circuits.

6.WP5: Project Management -- SP Energy Networks --

(M6.1) (£30,150)

6.1 Dissemination

6.1.1 Webinars

6.1.2 Steering Group Meetings

6.1.3 Reports

We have developed a Risk Register with scoring pre-mitigation and an assessment of how scoring will change as a result of actions. Regular reviews will be carried out with project partners, informed by appropriate technical specialists.

D-Suite Alpha v0.7 20230629 - A4.pdf (opens in a new window) (/application/10086622/form/question/33917/forminput/91850/file/563380/download).

Project Management Book Template v3 - D-Suite.xlsx (opens in a new window) (/application/10086622/form/question/33917/forminput/91850/file/563587/download).

8. Key outputs and dissemination

What are the expected key outputs of your Project and your plan for disseminating them along with any lessons learned?

The purpose of the Alpha phase is to be ready for the D-Suite Technology procurement and subsequent trial of between 2- 4 D-Suite Technologies on up to 6 different LV networks. In the Beta Phase, SP Energy Networks would only wish to proceed where the Net Present Value of a D-Suite Technology is highest on either an SP Energy Networks or UKPN network selected for trial. The Alpha Phase work is required to establish what the NPV is, at the individual LV network level, to inform the Beta stage trial benefits case.

Newcastle University is responsible for the completion of a comprehensive CBA on D-Suite technologies applied to the SP energy Networks. UK Power Networks are responsible for developing a techno-economic framework which will utilise learnings from other work-packages and enable future investment decisions. Integrated PowerTech are responsible for providing the optimum designs for the D-Suite technologies to reduce costs, which will inform the tender technical specification and CBA. SP Energy Networks are responsible for going to the supplier base with Pre-Qualification Questionnaire to assess the number of eligible tenderers and receive feedback on approximate technology cost ranges. SP Energy networks are responsible for applying PQQ supplier feedback in the final draft tender specification.

Work packages 1-5 will have between 1-3 reports as deliverables, and these will be shared on the smarter Networks Portal following final review. SP Energy Networks will host a D-Suite Webinar at the end of the delivery period in March 2024, which will be recorded and hosted on the Smarter Networks Portal and SP Energy Networks innovation webpage.

M1.1Validated LV Models and LCT Profiles.

M1.2Completion of Control Philosophy Tasks.

M1.3Completion of CBA Analysis.

M2.1Electro-thermal models in simulation software i.e. (PLECS).

M2.2Completion of Optimal Designs.

M2.3Completion of Control Analysis.

M2.4Completion of Integration Analysis.

M3.1Completed Techno-Economic Framework for UKPN Networks.

M3.2Completion of Technical Standards for D-Suite Technologies Review.

M4.1Final Draft Technical Specification for Supplier Engagement.

M4.2Final Tender Pack

M5.1Site Selection Analysis Complete

M6.1Project and Dissemination Completed

9. Intellectual Property Rights, procurement and contracting (not scored)

Intellectual Property Rights, procurement and contracting

All partners will comply with the requirements set out in Chapter 9 of the SIF Governance Document. Where applicable, we will list background IP in our collaboration agreements with each partner. SP Energy Networks is using the default arrangement for the Alpha stage.

SP Energy Networks will subcontract part of its work to a Power Electronic Consultancy to develop the tender pack. None of the Project partners have stated they are intending to use subcontractors to complete their work packages.

10. Commercialisation, route to market and business as usual

How will your idea become business as usual within your network and across the other networks?

The general innovation commercialisation strategy can broken down into two constituent parts, by technology push and end-user pull:

1.Technology Push is being managed by public and private partners Newcastle University and Integrated Powertech LTD, who will optimise the design of hardware and network control philosophy, taking onboard the latest engineering developments and operational needs from DNOs SP Energy Networks and UKPN.

2.End-user Pull, is being managed by SPEN and supported by UKPN, to challenge the technology boundary with a clear purpose to improve its competitiveness and facilitate its application at LV. Network licensees, owners and operators will be the primary customer segment for this innovation, and they could own, operate, and purchase D-Suite type products following a successful beta phase delivery.

The Alpha stage D-Suite Project plan, Work Packages content and milestones are setup to:

1.Improve the TRL, so the D-Suite technologies are more readily available.

2.Encourage the D-Suite supplier market's participation in a tender Pre-Qualification Questionnaire, so DNOs can understand the indicative costs before full tender in the Beta stage.

3.Select several D-Suite technology trial sites within at least one UK DNO LV network.

4.Develop and verify a fully evidenced Cost Benefit Analysis through desktop study D-Suite simulation results for technical benefits and use PQQ returns for provision of indicative costs.

5.Develop training pack inputs for LV design engineers, so they can easily design LV networks with D-Suite Technologies at the network planning and investment approval stage.

6.Develop draft operational and safety policy documents inputs, within at least one DNO for each D-Suite technology, to remove licensee barriers to deployment.

Completion of the above tasks will ensure a mature tender pack to go to market and that planning engineers have sufficient confidence, training, and experience to select a D-Suite technology, when it's the optimum solution, compared with traditional design options for incorporation into the DNO investment plan.

The D-Suite Project Partners have the following strategies to support D-Suite Commercialisation:

Newcastle University: Will demonstrate the use case of the D-STATCOM, D-SOP and D-ST through network level control modelling, using real modelled networks and realistic LCT deployments, across the LV Phases, using 1-minute sampling for 1-year. Newcastle will model synthetic LCT levels, based on the SP Energy Networks Distribution Future Energy Scenarios (DFES) in 3- 6 LV networks for today, in 2028, 2036 and 2040. The results from these studies will inform the business case for BaU commercialisation.

Integrated PowerTech will model the hardware control algorithms for the D-Suite Technologies, tol show the tender technical specification for the D-Suite hardware can achieve the desired functions of each D-Suite technology. In the Beta stage, detailed models, will be simplified to be used with industry power system modelling platforms such as IPSA Power and DigSilent Power Factory , allowing LV design engineers to understand the behaviour of each D-Suite Technology for LV network planning.

Integrated PowerTech will also develop the modular design of D-Suite technologies, which will be generic building blocks that can be used to make a D-STATCOM, D-SOP, D-ST or D-HF. The modules will be optimised to minimise the required equipment ratings and amount of hardware, to reduce costs as far as possible. This specification will reduce the commercial and technical risks presented by deploying novel PEDs onto LV distribution networks.

UKPN leads a work package readying a techno-economic framework to enable future investment decisions, tailored to UKPN networks, policy, and processes for the Beta stage.

D-Suite PED suppliers will not be brought on as partners, since there are currently a significant number of suppliers with Power Electronic fabrication expertise ready to provide trial ready D-Suite products.

11. Policy, standards and regulations (not scored)

Do you consider there to be any barriers with respect to meeting the requirements of regulations, policy or standards?

For D-Suite to progress to trial and into BaU, there are no envisaged required changes to the regulations, such as the:

- Health and Safety at Work Act (1974).
- The Electricity at Work Regulations (1989).
- Electrical Equipment (Safety) Regulations (1994).
- Electricity Safety, Quality and Continuity Regulations (2002).

Work Packages 3 & 4 will help us better understand any DNO policy, standards, and regulatory barriers to allow the D-Suite devices to connect to and operate on the LV network. SP Energy Networks will review international power electronic standards, Energy Networks and DNO policy documentation and consult with internal and international experts. From this work, relevant clauses and sections from different standards and policy will be used to safely develop, procure, install, test and commission each type of D-Suite device. Additionally, these work packages are structured based on experience developing Soft Open Points, Medium Voltage DC Links and LV Smart transformers under past Low Carbon Network Fund and Network Innovation Projects:

- Fun-LV.
- Angle-DC.
- LV Engine.

Since the above Power Electronics projects have either been delivered, or are in the advanced stages, SP Energy Networks does not envisage any required conversations with policy makers or regulation oversight agencies to remove barriers for implementation. Experience from future projects also informs us that no derogation or exemption will be required for the Project.

12. Value for money

What are the Alpha Phase Project costs and how are they proportionate to the Project delivery?

The total project costs is £550,224. The total SIF funding requested is £495,010, which comprises of £202,770 for SCOTTISH POWER ENERGY NETWORKS HOLDINGS LIMITED, £36,540 for UK POWER NETWORKS (OPERATIONS) LTD, £150,100 for INTEGRATED POWERTECH LIMITED and £105,600 for Newcastle University.

Each partner is contributing just over 10% of the Benefit in Kind (BiK) contribution, with Newcastle Contributing most of Dr Matt Deakin research time through a grant, which has been factored into the Benefit in Kind contribution. The remaining partner BiK figures are derived through addition contributions through Project labour provision from the general overhead of their teams,

Due to the accelerated delivery requirements of SIF projects in Alpha stage, the most efficient and cost-effective method of providing 6 -- months resource is through consultancy, specialising in the PED technology and PED CBA analysis. These skills will be critical to delivery of the Alpha work packages. There will be no immediate requirement for these skill sets 'in house', when the Alpha stage has closed. There is no innovation funding from other sources supporting this project.

13. Associated Innovation Projects (not scored)

Associated Innovation Projects

NIC £8.3mLV EngineLV Engine is a flagship £8.3m innovation project funded via Ofgem's Network Innovation Competition (NIC). The project will carry out a globally innovative network trial of Smart Transformers to facilitate the connection of LCTs whilst representing value for money for our customers.

LCNF £8m FUN-LVFlexible Urban Networks -- Low Voltage (FUN-LV) demonstrated the potential of power electronics devices to help defer network reinforcement.

The finances of all project partners are included in the milestones summary (/application/10086622/milestones-summary).

	Total costs (£)	Funding sought (£)	Contribution to project (%)	Contribution to project (£)	Contributions in kind (£)
SP MANWEB PLC Lead organisation	**225,480**	202,770	10.07%	22,710	22,710
Newcastle University Partner	**117,344**	105,600	10.01%	11,744	11,744
UK POWER NETWORKS	**40,600**	36,540	10.00%	4,060	4,060

	Total costs (£)	Funding sought (£)	Contribution to project (%)	Contribution to project (£)	Contributions in kind (£)
(OPERATIONS) LIMITED Partner					
INTEGRATED POWERTECH LIMITED Partner	**166,800**	150,100	10.01%	16,700	16,700
Total	**£550,224**	495,010		55,214	55,214

Funding breakdown

	Total	Labour (£)	Materials (£)	Subcontracting (£)	Travel and subsistence (£)	Other costs (£)
SP MANWEB PLC Lead organisation View finances (/application/10086622/form/FINANCE)	**£225,480**	90,191	22,542	67,644	11,275	33,828
Newcastle University Partner	**£117,344**	113,744	0	0	3,600	0
UK POWER NETWORKS (OPERATIONS) LIMITED Partner	**£40,600**	40,600	0	0	0	0
INTEGRATED POWERTECH LIMITED Partner	**£166,800**	159,000	0	0	7,800	0
Total	**£550,224**	403,535	22,542	67,644	22,675	33,828

SIF Governance Document

SIF Governance Document

Partner	SIF Governance Document
SP MANWEB PLC (Lead)	Third Party (/application/10086622/form/terms-and-conditions/organisation/51136/question/33852)
Newcastle University	Third Party (/application/10086622/form/terms-and-conditions/organisation/118/question/33852)
UK POWER NETWORKS (OPERATIONS) LIMITED	Third Party (/application/10086622/form/terms-and-conditions/organisation/19843/question/33852)
INTEGRATED POWERTECH LIMITED	Third Party (/application/10086622/form/terms-and-conditions/organisation/73734/question/33852)