SIF Discovery Round 2 Project Registration

Date of Submission

Apr 2023

Project Reference Number

UKRI10057667

Project Registration

Project Title

SECURE - Securing the future delivery of all HVDC projects by de-risking the HVDC cable supply chain

Project Reference Number

UKRI10057667

Project Licensee(s)

Scottish and Southern Electricity Networks Transmission

Project Start

Apr 2023

Project Duration

3 Months

Nominated Project Contact(s)

SIFprojects@sse.com

Project Budget

£164,344.00

Funding Mechanism

SIF Discovery - Round 2

SIF Funding

£147,909.00

Strategy Theme

Whole energy systems

Challenge Area

Improving energy system resilience and robustness

Lead Sector

Electricity Transmission

Other Related Sectors

Electricity Transmission

Funding Licensees

SSEN - Scottish Hydro Electric Transmission

Lead Funding Licensee

SSEN-T - Scottish and Southern Electricity Networks Transmission

Collaborating Networks

Scottish and Southern Electricity Networks Transmission

Technology Areas

Commercial, Conductors, Electricity Transmission Networks, High Voltage Technology, HVDC, Offshore Transmission, Resilience, System Security

Equality, Diversity And InclusionSurvey

Yes

Project Summary

SECURE is fully aligned with:

· Innovation Challenge 3: Improving energy system resilience and robustness - Strengthening whole system resilience and robustness to achieve Net Zero securely

· Scope 2: Strengthening UK's energy system robustness to support efficient roll out of new infrastructure.

SECURE aims to strengthen the UK's energy system and support efficient and timely installation of new high voltage direct current (HVDC) infrastructure to realise a Net Zero energy system.

Demand for HVDC connections is growing rapidly across Europe for grid reinforcements such as the Eastern HVDC links, interconnectors and offshore wind connections. Globally, the HVDC Cables Market size exceeded $10billion in 2021 and is anticipated to reach annual deployment of 18,000 km by 2030, with c1,300km for GB grid reinforcements.

The robustness, capability and capacity of the supply chain to support this HVDC infrastructure will be a critical factor in this growth. HVDC supply chains are a complex flow of materials and goods through a global network of suppliers and sub-suppliers. De-risking the HVDC cables supply chain will enable Transmission Owners (TOs) to successfully deliver new HVDC infrastructure whilst reducing delay and costs risks.

Energy network innovation

SECURE will utilise digital solutions that can provide TOs with greater visibility over the HVDC cable supply chain. This is expected to take the form of a Digital Supply Chain Hub (DSCH), giving real time visibility over the supply chain along with competing levels of demand. The DSCH will be developed using XLPE as a use case to bring rapid results in Alpha, extended to the full HVDC cable system in Beta and beyond that, applied to wider HVDC component parts & systems.

Experience and capability

Project SECURE blends the skills of three leading partners:

1. SSEN Transmission (SSEN-T) has practical and technical experience from the deployment of Europe's first HVDC network, the 113km Caithness-Moray-Shetland Link.

2. Digital Catapult: a Research and Technology Organisation (RTO) at the forefront of digital supply chains and implementation of advanced digital solutions.

3. Carbon Trust: a key industry partner managing joint industry programmes incorporating subsea cables innovation.

SECURE has one sub-contractor:

1 Edinburgh University: providing key expertise in HVDC cable technology.

Users

SECURE's Digital Supply Chain Hub (DSCH) will support all TO's. The solutions will be open access so will also benefit offshore wind developers. This will help all developers of new HVDC infrastructure to procure and deliver projects more efficiently.

Project Description

In order for Great Britain (GB) to hit Net Zero, significant investment is needed in offshore wind, as highlighted by the Government's Offshore Transmission Network Review. This investment will require strategic and timely development of a series of submarine HVDC cable links along the entirety of the east coast. These links will allow bulk transfer of power within the GB network and connect offshore windfarms and other countries to GB. SSEN Transmission is working collaboratively with the other Transmission Owners (TOs) (Scottish Power, National Grid), Government, Ofgem, the GB Electricity System Operator (ESO) to deliver several of these HVDC links.

Demand for HVDC connections is growing rapidly across the GB and Europe for grid reinforcements, interconnectors and offshore wind connections. Globally, the HVDC cables market value exceeded $10billion in 2021 and is anticipated to reach annual deployment of 18,000km by 2030 worth $16billion, with c1,300km in GB for grid reinforcements. Europe is the largest market for HVDC with over 50% of global subsea HVDC projects. There is a material risk that the current supply chain will be unable to satisfy growing demand, leading to delays or cost escalation of GB HVDC projects critical to meeting Net Zero targets.

We recognise the critical need to de-risk the supply chain, ensuring that there is adequate capacity and capability. SECURE aims to employ cutting edge digital solutions and develop an innovative Digital Supply Chain Hub (DSCH) to achieve much greater visibility and knowledge of the HVDC cable supply chain. This will yield benefits to HVDC project developers and suppliers ensuring greater supply chain resilience and strategic insight. This builds on best practices from the development of DSCHs in other sectors.

The Discovery phase will employ an AGILE development approach to explore digital solutions by considering one specific HVDC cable component, Cross-Linked PolyEthylene (XLPE) used almost exclusively as the insulation in HVDC/HVAC cables. XPLE has been selected because there is one dominant supplier across the EU therefore posing a single source supply risk. Utilising the specific XLPE use case is designed to yield early practical benefits whilst developing digital solutions applicable to the wider supply chain problem:

1. Use case provides a focused problem that allows measurement of success.
2. Allows the prototyping of tools and methodology that can be extended to other use cases in HVDC cables and beyond.

Solves a real problem sooner delivering value and an early win.

Third Party Collaborators

The Carbon Trust

Digital Catapult

Nominated Contact Email Address(es)

transmissioninnovation@sse.com

Project Description And Benefits

Applicants Location (not scored)

Inveralmond House, 200 Dunkeld Road, Perth, PH1 3AQ

Project Short Description (not scored)

SECURE - Securing the future delivery of all HVDC cable projects by de-risking the HVDC supply chain.

Video description

https://youtu.be/zz_lGajlk4I

Innovation justification

The rapid growth in demand for HVDC cables is creating supply chain pressure presenting a risk to delivery of HVDC projects and jeopardising Net Zero targets. Exemplifying this is the supply of insulation material used in HVDC cables, cross-linked polyethylene (XLPE), being limited to one dominant manufacturer in Europe presenting single source risks to delivery, timeframes, and cost.

All TOs developing HVDC projects are facing this supply chain risk. SECURE will:

1. Undertake a quantitative and qualitative assessment of risk in the HVDC cables supply chain, assessing key demands, supply factors and prioritising areas to be addressed.

2. Assess, develop and trial digital solutions to derisk the supply chain.

Digital supply chains (DSC) are an emerging solution that use collated and analysed data to provide manufacturers and customers with real-time visibility over supply chain processes, aiding competition and decision making. This is a novel application in the energy sector and is expected to de-risk project delivery, increasing supply chain robustness for TOs. SECURE will apply these novel approaches to produce a DSCH for HVDC cables by the end of the Beta phase, see AppendixQ4-Project_Approach.

Supply side knowledge of availability, costs and lead times for HVDC cables are not visible until formal procurement processes commence. A DSCH can be used to derisk the supply chain:

1. Early identification of potential future demand.

2. Identify potential new suppliers and existing capacity/capability.

3. Diversify supply chain by giving insights into the demand for new projects and stimulate new entrants.

The DSCH will collate data from various sources in real-time, eliminating large areas of uncertainty.

Economic Value

1. Decarbonisation of electricity and flexible use of renewables, by enabling grid reinforcements, can lower energy prices.

2. Stimulating investment in supply chain can benefit the economy.

3. A robust supply chain avoids costly delays.

Sustainability Value

1. Accelerates decarbonisation of energy system.

2. Potential to stimulate a local supply chain.

Funding

SIF allows for a whole system approach to tackling the supply chain and sharing results with other TOs. This is the primary reason why SIF is the most applicable funding route to securing benefits across all TOs, not just SSEN-T. RIIO-T2, NIA or BAU are unsuitable because DSC solutions are relatively immature and novel in the energy sector and the development expenditure of a holistic system are anticipated to exceed NIA cost and scalability limits.

Benefits Part 1

Environmental - carbon reduction – indirect CO2 savings per annum against a business-as-usual counterfactual
Financial - cost savings per annum on energy bills for consumers
Financial - future reductions in the cost of operating the network
Revenues - creation of new revenue streams

Benefits Part 2

The headline benefits of SECURE are the timely and cost-effective installation of HVDC cables that will:

1. Improve energy security (unlocking the potential of wind resources in the North of Britain).

2. Has the potential to reduce energy costs (or at least make energy costs more stable).

3. Decarbonise the network avoiding environmental harm and helping to achieve Net Zero targets.

4. Establish new supply chains.

Cost savings per annum on energy bills for consumers

Reduction of supply chain risk through improved delivery logistics and increased competition means grid cost savings for consumers and large-scale renewable energy. The UK can build faster its energy security with more domestic low-cost renewable energy and less reliance on imported fossil fuels where their volatile prices affect massively consumer budgets. The investigation will aim to link delays in HVDC connections with the level of curtailment to identify the impact in achieving Net Zero targets.

Cost savings per annum for users of network services

The introduction of more competitive suppliers in the market offering alternative options is expected to drop prices and so allow more HVDC connections to materialise at less cost. According to published analysis by the Electricity Systems Operator, the impact of a one-year delay on the Eastern HVDC link projects may lead to a detriment of approximately £400m and 2-year delay may lead to circa £800m due to increased constraints cost. The project will explore price sensitivities on HVDC cables and the cost impact of delays on the delivery of HVDC cable connections by 2030.

Indirect CO2 savings per annum against a business-as-usual counterfactual

Less delays on delivery of renewable connections could speed up the decarbonisation of the energy sector. The investigation will look to identify the potential of carbon saving from the reduction of delays.

Creation of new revenue streams

Establishing a digital supply chain may also stimulate new entrants and existing companies to grow HVDC cables capacity and capability through increased visibility of demand. This is key to accelerating business growth, supporting the local economy, contributing to gross value added and creating jobs. It can also encourage the commercial development of more innovative and sustainable products by making key risks visible. The methodology is planned to assist the creation of partnerships between suppliers, manufacturers and TOs. It is replicable in other supply chain areas if applicable so benefits could be realised more widely in due course.

Project Plans And Milestones

Project Plan and Milestones

SECURE comprises five work packages (WP) detailed in AppendixQ3-Project_Management_Book.

WP0: Project Management (SSEN-T, SIF funding request: £6,025)

WP0 will provide oversight and project management using an AGILE process approach. Partners will meet weekly to update on progress, risks, and insights.

WP1: HVDC Cables Market Landscaping (Carbon Trust & Edinburgh University, SIF funding request: £24,102)

The HVDC cables study will deliver a high-level technical, market and commercial understanding of the HVDC cables supply chain including supply side and demand side forecasting.

WP2: XLPE Supply Chain Detailed Assessment (Carbon Trust & Edinburgh University, SIF funding request: £29,948)

The XLPE supply chain eco-system will be assessed in detail as a first use case having been identified as a critical component with vulnerabilities and include technical requirements (testing, certification etc), market assessments, key suppliers, commercial aspects, sustainability factors.

WP3: Stakeholder Engagement (Carbon Trust & SSEN-T, SIF funding request: £29,360)

Extensive internal and external stakeholder engagement will inform the needs of end-users so a best-in-class digital supply chain can be developed by producing key inputs for WP4.

WP4: Digital supply chain opportunities (Digital Catapult, SIF funding request: £58,476)

The digital supply chain scope, feasibility and benefits for HVDC Cables will be assessed and identify areas such as possible data sharing barriers to be addressed in the implementation. This will lay the foundations for the DSCH to be created in ALPHA for the XLPE use case. Suitable existing digital tools will be identified as potential platforms to build upon to deliver the DSCH.

Project milestones, success criteria and deliverables are detailed in AppendixQ3-Project_Management_Book.

Risks

The risk register is in AppendixQ3-Project_Management_Book. Risks will be reviewed weekly, managed between the SECURE team WP Managers. The key project specific risks:

· Availability of suitable, existing digital software tools – This will be mitigated by Digital Catapult delivering an ecosystem review of existing digital tools mapping feasibility/ benefits to be realised in HVDC cables supply chain.

· Open sharing of commercially valuable market data – This will be mitigated by a commercial assessment in Discovery to outline barriers which need to be overcome in Alpha.

We do not envisage any major constraints to the delivery of SECURE or adoption as BaU. Relevant security measures are used to

minimise the risk to our IT systems and the data they contain. We choose high quality capable partners and suppliers so consequently we foresee no commercial or technical constraints. Any regulatory constraints are discussed in Q8.

Regulatory Barriers (not scored)

Regulatory barriers

There are two potential regulatory barriers identified that could impact the later stages of this project:

1. Open sharing of commercially valuable market data may have competition implications that will need to be assessed.

Mitigation: A regulatory assessment will be made to ensure that all information shared on the Digital Supply Chain Hub is not anti-competitive or market distorting.

2. On the specific XLPE use case there is a risk that the project appears to interfere with the XLPE market.

Mitigation: This will be mitigated by early stakeholder engagement and supply chain mapping in the discovery phase.

Derogations

This project is not expected to require any derogations.

Commercials

Route To Market

ANSWER (400 words max) Words: 385 words

Business as usual adoption and competitive markets

SECURE will follow the SIF three stage process integrated with the innovation governance processes within SSEN-T. The number one ambition of SECURE is to de-risk the HVDC supply chain and create a more competitive supply chain.

Within Discovery, we are investigating HVDC cables long-term supply chain and the digital solutions that can increase visibility of critical supply and demand factors. SECURE will utilise Digital Catapult's expertise in their existing UKRI project "Made Smarter" and allow for knowledge exchange and experience from this and their digital field labs to be brought directly into the project to build confidence and de-risk adoption.

To ensure the solutions can be readily adopted into BAU the approach being taken has two main strengths.

1. A significant stakeholder engagement process involving SSEN-T internal stakeholders, other HVDC developers and suppliers. This will ensure the innovation is both tailored for the users and the market.

2. SECURE will run in parallel with SSEN-T teams developing and delivering several new HVDC projects. SECURE will be developed and trialled seamlessly with these real-world projects and benefit from this exposure, bringing early wins to those projects and making the solution highly tuned to user needs.

Customers and value proposition

SSEN-T will gain significant value from SECURE as it builds out the Eastern HVDC links and will be a critical tool for the SSEN-T HVDC cable engineering and SSEN-T procurement teams. The added visibility and understanding of the market, commercial and technical variables impacting the planned developments will enhance decision making helping to accelerate, derisk and reduce the costs of these projects.

Any HVDC project across the world would benefit from a de-risked HVDC cable supply chain helping to enhance competition in this market. The primary customers are all HVDC developers including TOs, interconnector operators, offshore wind developers and suppliers of HVDC electrical components.

Funding

SECURE is intended to be a supply chain hub for all industry. The Digital Catapult are experts in rolling out new digital solutions including how these are commercialised to ensure that they are sustainable and maintained. An outline business model for SECURE will be developed in Discovery. As an end user, SSEN-T's long-term funding of SECURE is expected to be part of the BAU budget following the beta phase, likely RIIO-T3 along with other subscribers.

Intellectual property rights (not scored)

To ensure clarity is provided to the project partners, UKRI, and Ofgem, regarding the IP landscape of the project, the project is using an IP register to track the Background IP provided to the project, the Foreground IP the project generates, and the use and access rights to all this IP.

The main contract governing the project (the Collaboration Agreement) will include detailed, mutually agreed terms governing IP that are in line with the SIF Governance Document.

For the Discovery phase, all the IPR arrangements will follow the default recommendations of Chapter 9 SIF Governance Document.

Costs and value for money

Costs Summary

The total project cost for the Discovery phase is £164,344.

The project is requesting £147,909 of funding (90% of the total cost), with the remaining £16,435 (10%) being provided by SSEN-T as the Project Lead. This level of funding will lead to outcomes that provide value to the consumer.

The £16,435 (10%) of the total cost being contributed to the project by private funds satisfies the minimum 10% compulsory contribution giving excellent leverage of SIF funds.

SSEN-T costs are £42,967 to lead this project and manage the delivery of work and one sub-contract, detailed below. SSEN-T is requesting £26,533 (62%) of funding and will contribute £16,435 (38%) from internal funds. The SECURE project proposal has been developed to compliment and be additional to SSEN-T BaU activity.

The Digital Catapult and Carbon Trust business models do not allow them to contribute financially to the project at this stage.

The University of Edinburgh will be employed as a sub-contractor under SSEN-T, with costs of £24,417. They are a sub-contractor for the Discovery phase as their work is non-IP generating and therefore university policy dictates that this is carried out under a consultancy contract with associated rates. In future IP generating phases, the University may become a partner with associated value benefits.

Value for money

SECURE is an ambitious project and will bring together a consortium of leaders in their fields. The consortium has carefully prepared the Discovery phase project plan and the resources used are necessary to fulfil the scope and to deliver a quality output. We are confident that the likely benefits of the project significantly outweigh the initial cost of launching the project through Discovery and then developing it through later phases. As this is a digital solution, the future Alpha and Beta phases can be rapidly grown cost-effectively utilising a range of existing software tools and AGILE development processes delivering value for money.

Having Digital Catapult as project partner will be very timely with their current UKRI project Made Smarter Innovation project. This project was borne out of an industry-led review exploring how UK manufacturing industries can prosper via integration of digital technology tools and innovation. All learnings can be shared through digital field labs allowing for best insight and value for money in the solution developed for project SECURE.

Document Upload

Documents Uploaded Where Applicable

Yes

Documents:

SIF Discovery Round 2 Project Registration 2023-04-12 1_28

Discovery R2 End of Phase Report SECURE 2023-06.pdf

SECURE SIF Discovery Show and Tell 2023-06-21 Submitted.pdf

SECURE SIF Discovery End of Phase 2023-06-30.pdf (2)

This project has been approved by a senior member of staff

☑ Yes