Scottish & Southern Electricity Networks
TRANSMISSION

SIF Alpha Round 4 Project Registration

Date of Submission

Mar 2026

Project Reference Number

10179178

Initial Project Details

Project Title

ODIN – Optimisation and Diagnostics for Innovative Networks

Project Contact

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Challenge Area

Accelerating towards net zero energy networks

Strategy Theme

Optimised assets and practices

Lead Sector

Electricity Transmission

Project Start Date

01/02/2026

Project Duration (Months)

6

Lead Funding Licensee

SSEN - Scottish Hydro Electric Transmission

Funding Mechanism

SIF Alpha - Round 4

Collaborating Networks

Scottish and Southern Electricity Networks Transmission

Technology Areas

Asset Management

HVDC

Maintenance & Inspections

Condition Monitoring

Electricity Transmission Networks

Project Summary

Problem and Evolution
High-voltage direct current (HVDC) converter station valve halls generate strong and hazardous electromagnetic fields (EMF), making them inaccessible to personnel while in operation. Consequently, live inspections of assets are not possible. Instead, halls are accessible once per year during a scheduled maintenance outage, limiting the ability to diagnose issues in real-time, leaving a **significant gap in monitoring of live assets**, and increasing the risk of undetected faults, unplanned outages, and inefficiencies in network operation. As HVDC infrastructure expands rapidly to connect new offshore and onshore renewable generation, this lack of continuous operational insight is becoming a major constraint on efficient network operation and planning.

Addressing this challenge, **SSEN Transmission (SSEN-T)** launched the **NIA AIM High Project**, introducing an autonomous robot to perform monitoring tasks within an HVDC valve hall. The Project demonstrated safe robotic operation in high-EMF environments, providing new capability to collect continuous data from previously inaccessible areas. Following its success, SSEN-T will deploy seven robots as part of business-as-usual (BAU) HVDC operations in July 2026.

While AIM High demonstrated robotic feasibility, it also exposed a new challenge: the vast quantity of sensor and camera data generated daily requires efficient data management and automated analysis to efficiently handle large volumes of real-time data. Manual interpretation is labour-intensive and reactive, offering limited insight into operational efficiency or emerging faults.

The **ODIN Discovery Phase**, demonstrated the feasibility of automated interpretation and diagnostics in an operational environment, utilizing the autonomous robot, deployed at the **Blackhillock HVDC converter station**. The Project proved that artificial intelligence (AI) and statistical techniques could identify equipment, extract thermal features, and visualise operational trends. This confirmed that robotic data can be used to understand component performance dynamically rather than retrospectively, **significantly reducing manual data processing.**

Building on this foundation, the **Alpha Phase** will trial integration of a condition monitoring solution, enhancing the Artificial Intelligence Data Analytics (AIDA) platform; a cloud-based system developed by Ross Robotics that integrates robotic, thermal, and operational data to provide real-time asset insights, enabling proactive detection of potential faults and data-driven maintenance decisions. The Alpha Phase will extend AIDA's capability to:

- **Detect early signs of inefficiency or stress;**
- **Quantify efficiency losses;**
- **Generate evidence to support condition-based maintenance and asset investment decisions.**

The **Beta Phase (12-18 months)** will trial a scalable, industrialised version of the solution across multiple HVDC sites, preparing for full BaU deployment.

Challenge
ODIN directly addresses **Challenge 4, Aim 2 and Theme 1** by applying AI to analyse large volumes of sensor and camera data from HVDC assets. Through pattern recognition, anomaly detection, and trend analysis, ODIN identifies early signs of degradation in HVDC infrastructure, enabling intervention before faults occur and reducing unplanned outages.

By integrating robot sensor data with AIDA analytics, ODIN advances condition-based and predictive maintenance, ensuring targeted interventions, reduced downtime, and longer asset lifespans. As low-carbon technologies expand, ODIN's continuous AI-driven monitoring helps manage increasing variability and operational stress, minimising losses and enhancing system resilience.

Users Needs

Primary users are **UK Transmission Owners (TOs)** responsible for HVDC converter systems operation and maintenance, while secondary users include Original Equipment Manufacturers (OEMS) and the engineering supply hain. Their needs have evolved from periodic inspection data toward **continuous, interpretable intelligence** that supports proactive decision-making.

ODIN provides real-time operational insight and quantified efficiency metrics, supporting data-driven asset management, enhanced workforce safety, and reduced environmental impact through fewer site visits and extended asset lifespans.

As the UK's HVDC network expands (currently approximately 65 valve halls); ODIN's scalable, interoperable approach offers significant benefits across the GB transmission system, supporting consumer value through reduced losses, improved reliability, and accelerated progress toward Net Zero.

Add Preceding Project(s)

NIA_SHET_0041 - Autonomous Inspection & Monitoring of High Voltage Assets (AIM High)

SHET/ANZEN/ODIN/ Rd4_Discovery - ODIN – Optimisation and Diagnostics for Innovative Networks

Add Third Party Collaborator(s)

Ross Robotics

Project Budget

£506,056.00

SIF Funding

£455,450.00

Project Approaches and Desired Outcomes

Animal testing (not scored)

- ○ Yes
- ⊙ No

Problem statement

Problem and Evolution
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while secondary users include Original Equipment Manufacturers (OEMS) and the engineering supply hain. Their needs have evolved from periodic inspection data toward **continuous, interpretable intelligence** that supports proactive decision-making.

ODIN provides real-time operational insight and quantified efficiency metrics, supporting data-driven asset management, enhanced workforce safety, and reduced environmental impact through fewer site visits and extended asset lifespans.

As the UK's HVDC network expands (currently approximately 65 valve halls); ODIN's scalable, interoperable approach offers significant benefits across the GB transmission system, supporting consumer value through reduced losses, improved reliability, and accelerated progress toward Net Zero.

Innovation justification

ODIN delivers a transformative approach to monitoring and optimising **High Voltage Direct Current (HVDC)** converter systems, directly addressing **Challenge 4; Aim 2** (reducing efficiency loss in the context of greater network utilisation and low-carbon deployment) and **Theme 1** (innovation to improve efficiency of network operations).

Through the integration of **autonomous robotics, artificial intelligence (AI)**, and **cloud-based analytics**, ODIN provides continuous, real-time insights into converter hall conditions that are otherwise inaccessible during live operation. The Project correlates **thermal, acoustic, and optical data** from robotic sensors with operational load and ambient parameters to identify **efficiency losses** caused by thermal imbalance, electrical stress, or component degradation. These insights enable proactive maintenance and performance optimisation, reducing downtime, cost, and carbon intensity across HVDC operations.

In doing so, ODIN provides a **first-of-a-kind evidence-based link** between real-time operating conditions and measurable efficiency in live HVDC environments—a key enabler of more transparent, optimised network operation.

Previous Innovation and Learning
Discovery Phase demonstrated that inspection data from the Blackhillock converter robot could be automatically interpreted using machine-learning algorithms. Components were identified, thermal patterns analysed, and visualisations generated to support maintenance teams. This confirmed that AI can deliver consistent, repeatable diagnostics and reduce manual workloads.

The Alpha Phase now builds upon this evidence by enhancing Ross Robotics' **AIDA platform** to deliver **end-to-end condition monitoring and diagnostic capability**. This includes:

- Multi-source data integration (thermal, UV, acoustic, visual, and telemetry).
- Automated component trending and anomaly detection.
- Configurable alerting and dashboard visualisation.
- Predictive modelling of component degradation and efficiency loss.

Early prototype interfaces, shown in (***Appendix_Q6_Figures_1.2-1.5***), illustrate how operators will visualize inspection histories, component statistics and environmental status dashboards in real-time.

Lessons from **AIM High** and **ODIN Discovery** highlighted **three technical priorities**:

1. Robust data pipelines to manage continuous sensor feeds;
2. Validation methods for AI decisions to build operational trust;
3. Clear data-governance protocols to ensure compliance.

ODIN Alpha embeds these through modular architecture, standardised data schemas, and explainable AI algorithms. Network engineers will be able to interrogate AI-driven outputs directly, fostering confidence and accountability.

Stakeholder Engagement
ODIN has been developed collaboratively with HVDC operation and maintenance engineers, data-science specialists and is openly collaborating with other European Transmission System Operators (TSOs) using similar robotic systems, including **RTE, Elia, 50Hertz, and National Grid**. Feedback from these stakeholders refined ODIN's user interfaces and alert hierarchies, ensuring outputs align with operational practice. (***Appendix_Q6 Figure_2.1***) outlines milestones for prototype delivery, validation and knowledge dissemination, supporting future GB-wide learning.

Innovation and State-of-the-Art Comparison
Current practice relies on manual surveys during annual outages, capturing only static snapshots. ODIN replaces this with

continuous, intelligent analytics combining mobile robotic sensing and AI diagnostics. Compared to these reactive methods, ODIN delivers earlier fault detection, improved asset utilisation and measurable reductions in efficiency loss. No existing system integrates autonomous data acquisition and live analytics within high-EMF HVDC environments, making ODIN a **global first-of-kind innovation.**

Readiness Levels

Please refer to figure 1 attached.

SIF Funding

Integrating robotics, AI and operational-technology systems in high-EMF environments is technically risky and beyond BaU or price-control budgets. SIF funding enables shared risk, cross-network learning and independent validation of benefits that will inform future investment decisions. The Project scale is proportionate—sufficient to validate algorithms, prove interoperability and quantify efficiency gains without premature commercial roll-out.

Counterfactuals

Alternative approaches—manual inspection, fixed sensors, vendor-specific monitoring or reliance on SCADA alarms—were evaluated and dismissed. These methods cannot deliver comprehensive, continuous or predictive insight. ODIN uniquely provides **quantifiable reductions in efficiency loss** and establishes a replicable, data-driven operating model for HVDC networks across Great Britain.

Impact and benefits (not scored)

Financial - future reductions in the cost of operating the network

New to market - services

Impacts and benefits description

Financial - future reductions in the cost of operating the network

Under business-as-usual (BaU) conditions, HVDC converter stations are inspected during planned annual outages and maintained reactively when faults occur. This approach results in higher operational expenditure, reduced system availability, and greater exposure to unplanned outages that constrain renewable generation. Baseline metrics include **system availability (%), frequency of forced outages, mean time to repair (MTTR), and annual maintenance costs.**

ODIN introduces **condition-based maintenance (CBM)** using autonomous inspection and AI-driven analytics. Continuous monitoring enables early fault detection, targeted interventions, and optimised scheduling, reducing site visits, labour hours, and unplanned repair events while extending component lifespans. The solution also streamlines data management, replacing manual review with automated analysis through the AIDA platform.

Across SSEN Transmission's HVDC sites, implementation of ODIN's AIDA platform across seven autonomous robots is forecast to yield **cumulative net benefits of approximately £0.46 million in the first ten years**, rising to **£20.5 million over the lifetime** of the assets. There are currently an estimated 65 HVDC valve halls across the GB transmission network. Successful implementation of ODIN across these assets would deliver material operational cost reductions, reliability improvements, and indirect carbon savings at national scale.

The quantified benefits, supported by a detailed **cost-benefit analysis (CBA)**, underline ODIN's potential to deliver significant long-term savings and operational resilience.

New to Market – products, processes and services

ODIN delivers three inter-related innovations that are new to the market:

1. **Product** – the UK's first untethered autonomous robotic sensor platform capable of operating safely within live HVDC valve halls demonstration.
2. **Process** – a new methodology for data-driven, condition-based maintenance that replaces periodic manual inspection with continuous digital monitoring.
3. **Service** – the AIDA cloud analytics platform providing AI-driven diagnostics, trend visualisation, and efficiency indicators accessible to operators in real time.

Collectively these enable a step-change in asset-management practice, offering GB network operators scalable, interoperable tools for predictive maintenance and efficiency optimisation. Discovery-phase engagement with engineers and TSOs validated user requirements for explainable AI and standardised data formats, ensuring that Alpha-phase outputs will be directly applicable to future BaU adoption.

Revenues - creation of new revenue streams
ODIN provides an opportunity for UK-based Ross Robotics' long-term strategic growth and market leadership, scaling their workforce (**50+new jobs**), increasing revenue growth (**£70million**) by 2030, developing their supply chain and positioning them as a leading innovator in the autonomous robotics sector both domestically and internationally.

Environmental - carbon reduction, indirect CO2 savings per annum

The current inspection regime requires engineers to travel frequently to remote converter stations for data interrogation and investigations and depends on energy-intensive standby operation during outages. ODIN enables continuous monitoring with minimal site visits, reducing both **vehicle emissions** and **energy losses** from inefficient converter performance.

Others – not SIF specific
ODIN provides broader public and system benefits:

- **Improved reliability and network resilience**, reducing the risk of renewable curtailment.
- **Enhanced safety**, eliminating the need for personnel in high-EMF environments.
- **Skills and Supply Chain**, develops UK expertise in robotics, AI, and digitalisation, creating sustainable employment.
- **Leading Innovation world-wide**, ODIN is a global first-of-a-kind.

The Discovery Phase produced a **Cost Benefit Analysis** demonstrating a positive benefit–cost ratio for Alpha progression. The Alpha Phase will refine these metrics through live trials, with network-level consumer benefits reported using Ofgem and Innovate UK's CBA framework and verified by SSEN Transmission's asset-performance team.

Teams and resources

The **ODIN consortium** brings together proven and complementary expertise in network operation, robotics, and data analytics. The team remains unchanged from the Discovery Phase to ensure continuity, retention of learning, and efficient progression into Alpha. This partnership has already demonstrated strong collaborative delivery, technical alignment, and shared governance through previous innovation projects between **SSEN Transmission (SSEN-T)** and **Ross Robotics**.

Lead
SSEN-T will continue to lead ODIN through its established Innovation Team, supported by colleagues in Network Operations, Asset Management, and HVDC Strategic Engineering. SSEN-T has extensive experience developing, building, and operating HVDC systems, including the **Caithness-Moray** and **Shetland** interconnectors. These large-scale projects demonstrate capability in managing complex HVDC systems safely and efficiently, including technical and operational challenges associated with HVDC Valve Hall inspections.

During Alpha Phase, SSEN-T leads **Work Package 1: Project Management**, providing Project oversight, risk and financial control, and delivery assurance. SSEN-T will also support the design and validation of ODIN's performance metrics, manage stakeholder engagement, and prepare the Beta-Phase business case. Its established governance framework ensures quality, safety, and compliance. SSEN-T is best placed to lead as the **first UK Transmission Owner (TO) to perform autonomous inspections in HVDC valve halls.**

Partner
Ross Robotics is a UK-based technology company specializing in autonomous robotics and advanced data analytics for complex or hazardous environments, with expertise in electrical networks efficiency improvement. The company has a portfolio of more than 40 international patents and has successfully completed multiple commercial and Government-funded projects in **HVDC, Nuclear Decommissioning and Defence** sectors, demonstrating robust safety, cybersecurity, and software-engineering standards. In HVDC the platforms have been deployed with SSEN-T, RTE, Elia, 50 Hertz, National Grid, and Amprion. In other industries, the platforms have been deployed at CERN's Large Hadron Collider, Chernobyl Nuclear Facility and other uniquely challenging environments.

Ross Robotics will lead **WP2-Component Trending, WP3-Data Exchange, WP4-Trend Visualisation, WP5-Dashboard and WP6-Alerts**, utilising their extensive experience in deploying and maintaining autonomous systems in HVDC environments and demonstratable track record of delivering reliable secure enterprise-class software in compressed timeframes.

Its **AIDA** cloud platform underpins ODIN's AI-driven diagnostics and visualisation. The team's experience integrating robotics with asset-management systems in high-EMF environments directly supports the Alpha objective of validating automated condition monitoring for HVDC infrastructure.

Additional Resources/Equipment
The autonomous robotic platform installed at Blackhillock HVDC Converter Station remains the primary test environment for Alpha. Data from Blackhillock will be securely integrated into **AIDA cloud platform**, refined through live trials. Ross Robotics will provide cloud infrastructure and simulation tools using existing assets, ensuring efficient resource utilisation.

SSEN-T will continue collaboration with **UK Transmission Owners** (National Grid; SP Transmission) and **European TSOs** (RTE, Elia, Amprion, 50Hertz) to benchmark ODIN's analytics outputs and promote international alignment of HVDC condition-monitoring standards. Engagement with **Hitachi Energy** and other OEMs ensures results are transferable to a broad range of HVDC technologies.

Knowledge and learning from the Alpha Phase will be disseminated through Energy Networks Association, industry conferences, and SIF knowledge-sharing networks, maximising UK consumer benefit and supporting sector-wide adoption.

The ODIN consortium combines SSEN-T's operational authority and innovation governance with Ross Robotics' technical and analytical expertise. Together, the team has the capacity, infrastructure, and proven collaborative framework to deliver a **scalable, replicable solution** that advances efficiency, reliability, and resilience across the GB HVDC network.

Project Plans and Milestones

Project management and delivery

ODIN will be delivered under SSEN-T's SIF governance framework and SSE Group audit-tested standards. The Project will apply an **agile delivery framework**, allowing flexibility, rapid iteration, and transparent reporting to meet the requirements of the SIF Governance Document.

SSEN-T's internal process document **PR-NET-GOV-532** defines clear roles, responsibilities, and approval gateways for SIF projects. It incorporates robust controls for financial management, procurement, quality assurance, and reporting to ensure accountability and value for money.

A dedicated SSEN-T Innovation Project Manager will oversee progress, supported by Ross Robotics' Technical Lead and Delivery Manager. Weekly coordination meetings, monthly steering reviews, and shared Project dashboards will ensure real-time monitoring of milestones, deliverables, and financial performance.

The Project is structured into six interconnected work packages (WPs) as detailed in the Project Management Template (Appendix_PMT). The Project Plan and associated Gantt chart define linkages and milestone dependencies between WPs and milestones to ensure timely progression through each WP.

WP1: Project Management (Lead – SSEN-T)

1. **Ensures on-time, within-budget Project delivery through structured reporting, financial control, and quality management. Includes Cost Benefit Analysis (CBA) updates and dissemination planning.**

(SIF funding request: £50,215)

WP2: Component Trending (Lead – Ross Robotics)

1. **Expanded and robust component detection and tracking with SSENIT aligned identification, producing reliable temperature trends for each component.**

(SIF funding request: £106,091)

WP3: Data Exchange (Lead – Ross Robotics)

1. **Standardised interface definition for importing load data and exporting inspection, telemetry, and status data for SSEN's internal use.**

(SIF funding request: £32,499)

WP4: Trend Visualisation (Lead – Ross Robotics)

1. **Interactive visual tools to compare component trends, correlate with Converter station load, and display UV discharge data.**

(SIF funding request: £111,896)

WP5: Dashboard (Lead – Ross Robotics)

1. **Centralised interface providing inspection summaries, live system status, multiIsite views, and custom trend visualisations.**

(SIF funding request: £77,505)

WP6: Alerts (Lead – Ross Robotics)

1. **Automated and configurable alerts for Thermal, Sound, UV, and operational issues with multiIchannel delivery.**

(SIF funding request: £77,242)

Risk Management

A comprehensive **Risk Register** (Appendix_PMT), identifies technical, management, and commercial risks, which will be reviewed monthly by the consortium. The key risks and mitigations include:

- **Failure of robot** - limits viability of Project as the robot must remain in the hall until the next scheduled outage or scheduling an unplanned outage to rectify. To mitigate this the robot has been deployed at Blackhillock converter station for several months with suitable performance. It also has a redundant communications system for failover communications protection and several iterative improvements since first installed.
- **Delivery delays** - Alpha Phase is a very compressed timeline - to mitigate this, partners have agreed on the start date and are resource planning to ensure timely delivery. Efficient delivery is essential and will be achieved by regular alignment between both parties, including weekly project review meetings, to ensure all risks and solutions are being identified.
- **Alpha phase deliverables** fail to meet required expectations and are not useable for their intended purpose - Robust plan of deliverables has been created to mitigate this risk. Scope has been agreed with Ross Robotics and agreed with SSEN-T subject matter experts and delivery team.

The Project involves no planned or unplanned supply interruptions for consumers and therefore will not have a detrimental effect on the consumer and will not require access to the electricity or gas network.

While ODIN does not directly interact with end consumers, it delivers indirect but significant benefits by improving network efficiency, reducing outage risks, and supporting integration of low-carbon generation. By enabling early detection of faults and efficiency loss, the Project reduces costs that would otherwise be passed to consumers through constraint payments or system charges.

Key outputs and dissemination

By the end of the Alpha Phase, **ODIN** will deliver a suite of validated technical and knowledge outputs that collectively demonstrate the feasibility of autonomous, AI-driven condition monitoring for HVDC converter assets. The **key outputs** are:

- **Validated AIDA Analytics Prototype** – a functional version of the cloud-based platform integrating robotic data, trend analysis, and condition monitoring tools. Enabling predictive maintenance decisions and performance benchmarking.
- **HVDC Component Trend Library** – a structured dataset of temperature, UV, and acoustic trends correlated with operational load. Provides empirical evidence to quantify efficiency losses and inform future models.
- **Standardised Data-Exchange Interfaces** - enabling integration with network systems.
- **Visualisation Dashboard and Alert System** - A centralised dashboard for multi-site monitoring, and automated alerts, improving situational awareness and reducing manual analysis effort.
- **Quantified Cost-Benefit Analysis (CBA).**

Responsibilities for Key Outputs

- **WP1: Project Management and CBA Development** (SSEN-T)
- **Key Outputs**: An Alpha Phase that is completed as defined in the submission documentation and that meets the Project Direction.
- **WP2: Component Trending** (Ross Robotics).
- **Key Outputs**: Expanded and robust component detection and tracking with SSEN-T aligned identification, producing reliable temperature trends for each component.
- **WP3: Data Exchange** (Ross Robotics).
- **Key Outputs**: Standardised interfaces for importing load data and exporting inspection, telemetry, and status data for SSEN-T's internal use.
- **WP4: Trend Visualisation** (Ross Robotics).
- **Key Outputs**: Interactive visual tools to compare component trends, correlate with Converter station load, and display UV discharge data.
- **WP5: Dashboard** (Ross Robotics).
- **Key Outputs**: Centralised interface providing inspection summaries, live system status, multisite views, and custom trend visualisations.
- **WP6: Alerts** (Ross Robotics).
- **Key Outputs**: Automated and configurable alerts for Thermal, Sound, UV, and operational issues with multi-channel delivery.

Dissemination

The methods for dissemination of the key outputs are:

- Each organisation has its own corporate website which is a platform for sharing the outputs of the Project.
- SSEN-T and Ross Robotics will publish reports and data compliant with SIF Governance Clauses 9.1 to 9.33 that sets out SIF Governance for IPR. Data and reports will be available according to the treatment of IPR within the SIF Governance document.
- SIF Knowledge Sharing via UKRI reviews and Project monitoring meetings.
- Energy Networks Association Portal, publicly available.
- Energy Innovation Summit Autumn 2026: to present the findings of ODIN.
- Attendance at industry and research conferences including Institution of Engineering and Technology (IET)and Conseil International des Grands Réseaux Electriques (CIGRE) conferences.
- Public Alpha 'Show and Tell' Webinar, July 2026.
- Hitachi HVDC Annual Global User Conference and various HVDC Operators Forums.

Key lessons will be documented in line with the SIF Knowledge Dissemination Plan and categorised under technical, commercial, and operational domains. Learning will focus on:

1. The technical performance of AI models and data pipelines in live operational environments.
2. Challenges in integrating robotic and cloud-based analytics.
3. Recommendations for interoperability standards and wider network application.

The Project team will work collaboratively to ensure that all dissemination materials will follow Ofgem and IUK's open-data principles, respecting commercial sensitivities while ensuring transparency and replicability across the industry, ensuring key outputs, lessons learned and knowledge is shared.

Competitive Markets

ODIN has been designed to **enable**, not constrain, future market participation. There are no activities or outputs in the Alpha Phase that will prevent other networks from procuring similar services from other parties, or allow other technology providers and network operators to build compatible tools.

By Project completion, ODIN Alpha will have delivered tangible outputs—validated tools, data standards, and lessons—that directly inform the Beta Phase and subsequent business-as-usual adoption. Dissemination will ensure the innovation's benefits extend beyond SSEN-T, supporting competitive market growth, efficiency improvement, and progress toward a low-loss, net zero electricity network.

Commercials

Intellectual Property Rights (IPR), procurement and contracting (not scored)

Intellectual Property Rights

The Intellectual Property Rights (IPR) arrangements will be defined in the **Alpha Phase Collaboration Agreement (CA)**, with the starting position being the **default Intellectual Property Rights for SIF Projects**, described in the latest **SIF Governance Document (version 3.1)** as part of Chapter 9. The CA includes a schedule where Background Intellectual Property is to be declared to help ensure there is transparency across the Partnership.

IP generated during Alpha will follow the terms in the executed CA. SSEN-T will issue the draft CA to Ross Robotics before the Ofgem funding decision, enabling early review, feedback, and negotiation to secure timely execution should the bid be successful. This proactive approach ensures that all parties understand and agree to the IP terms prior to Project commencement, reducing start-up delay and potential disputes.

Both partners understand that knowledge transfer is a key aim of the SIF and the contract's IPR arrangements will be specified to enable this. Outputs and learning will be shared through the **Energy Networks Association portal** and other Ofgem-approved channels, following the **Presumed Open and Data Best Practice** principles, with desensitisation only where justified.

Ross Robotics

Ross Robotics brings critical, proven Background IP, providing the bedrock for the High Voltage Direct Current (HVDC) asset inspection solution. This foundation is the proprietary autonomous mobile robotic platform and its extensive associated systems.

Core **Background IP** includes:

- The modular sensor suite.
- The advanced operator control unit (OCU) for centralised control and secure data handling.
- Robust cloud-based platform for fleet management.

Essential to the current capability is the concept of data enrichment, which automatically embeds specific contextual metadata (e.g., robot position, diagnostics) into all captured media. Initial algorithmic work, including component segmentation and rudimentary classification capabilities from prior R&D, forms the base AI layer.

The **Foreground IP** generated during Alpha are the development of specialised machine learning and artificial intelligence (AI) solutions, including; novel algorithms for advanced component segmentation; precise defect classification unique to HVDC assets. A major deliverable will be IP related to integrating and correlating disparate media types—acoustic, thermal, and ultraviolet data—to produce a singular, actionable defect report. Furthermore, new IP will cover specialised reporting structures, transforming raw data into essential asset management intelligence that meets strict HVDC regulatory requirements. The expansion of the data enrichment process to include dynamic, AI-derived metadata (like confidence scores) ensures full traceability and auditability. This proprietary Foreground IP represents a significant leap in capability and is the key strategic outcome justifying investment.

The general premise relating to IP ownership is that the party that completes the work retains ownership of IP. Examples of this may include:

Foreground IP:

- Machine Learning training methodology
- Bespoke Machine Learning trained models
- Novel algorithms for data analysis

There may, however, be slightly more nuanced examples such as training models and algorithms. In this scenario, Ross Robotics conducts the work but the models are trained on SSEN-T data. The likely solution is for Ross Robotics to retain the IP but grant SSEN a perpetual license for use, at no charge both during and after the Project.

These subcontractors bring specialist expertise critical to the successful delivery of ODIN. Both have pre-existing relationships with Ross Robotics, ensuring rapid mobilisation and efficient knowledge transfer.

The Project will not include any tenders, procurements or RFI's during the Alpha Phase.

Commercialisation, route to market and business as usual

The long-term vision of ODIN is to enable full integration of autonomous inspection robotics and AI-driven analytics into **business-as-usual (BaU) HVDC operations** across the **GB Transmission networks**. The **Alpha Phase** will validate the **Artificial Intelligence Data Analytics (AIDA)** platform's predictive capability and user interfaces. The subsequent Beta Phase will scale the system to deployment at multiple converter stations, demonstrating secure, cloud-enabled performance under real operational conditions.

Following successful Beta demonstration, **SSEN Transmission (SSEN-T)** intends to adopt ODIN within its HVDC operations, beginning with the **Caithness–Moray–Shetland (CMS) multi-terminal system**, before extending deployment to its full HVDC fleet through **RIIO-T3**. Integration of the AIDA platform and autonomous robots will enable continuous condition monitoring, predictive maintenance, and performance optimisation across converter halls.

This approach aligns directly with **SSEN-T's Accelerated Strategic Transmission Investment (ASTI)** programme and major joint-venture infrastructure projects such as **Eastern Green Link,** embedding robotic analytics into the design and operation of new HVDC infrastructure. ODIN will inform technical specifications, digitalisation strategies, and procurement frameworks for future converter builds, supporting consistent rollout across GB networks.

Commercialisation Readiness

For **Ross Robotics**, ODIN represents a pivotal commercialisation opportunity. The Alpha and Beta Phases will de-risk the technology, validate performance in live HVDC environments, and provide independent evidence of efficiency gains.

Ross Robotics' **modular robotic platform** and **AIDA analytics framework** are transferable to the broader high-voltage, substation, and industrial inspection markets. The current **global HVDC market** comprises **over 850 converter stations** operated by approximately 215 Transmission System Operators (TSOs). Ross Robotics estimates an initial addressable market of **$890 million**, expected to grow to **$1.8 billion by 2035**, with associated high-voltage markets exceeding $5.9 billion.

Ross Robotics forecasts **revenue growth** of approximately **£70 million by 2030**, supported by expansion of its UK workforce by **50+ skilled roles** in AI engineering, cloud systems, and manufacturing. SIF funding is therefore essential to de-risk the technology and establish market confidence before attracting commercial investment for full deployment.

The commercialisation model is deliberately **non-exclusive** and **designed to stimulate competition**. By adopting **open-data interfaces** and **shared learning** through the SIF knowledge-sharing framework, the Project will enable other suppliers to innovate complementary analytics, robotics, and digital-twin tools, thereby strengthening the wider UK innovation ecosystem.

BaU Deployment

Within SSEN-T, adoption will follow a staged process aligned to internal innovation governance. Upon successful Beta completion, AIDA will transition to the operational technology (OT) environment through a managed handover to the Asset Management and HVDC Operations teams. A supporting training and change-management programme will be implemented to ensure system integration, cyber-security compliance, and user readiness. The BaU implementation plan will include KPIs on system availability, outage reduction, and maintenance efficiency to evidence consumer value.

Senior Sponsorship

ODIN is endorsed by **SSEN-T's Transmission Executive Committee**, providing executive oversight, resource commitment, and alignment with regulatory priorities. The **Senior Sponsor** ensures cross-functional engagement across operations, engineering, and finance and will continue to champion ODIN's transition through Beta and into BaU. The Project has formal approval from SSEN-T's **Innovation Governance Board** and is embedded within the company's strategic roadmap for digitalisation and net-zero delivery.

Summary

ODIN presents a clear, deliverable pathway from innovation to adoption once developed and demonstrated sufficiently to meet the needs of users. The Alpha Phase validates the technical and commercial case; Beta demonstrates scalability and interoperability; and BaU deployment integrates robotics and AI analytics into routine HVDC operations. This creates sustained consumer benefit through cost reduction, improved reliability, and carbon savings while enabling **Ross Robotics** to scale within a global market. The Project's **open, non-exclusive model** ensures fair competition, supports supplier diversity, and positions the UK as a leader in intelligent energy-network operations.

Policy, standards and regulations (not scored)

ODIN operates within High Voltage Direct Current (HVDC) converter stations that are governed by well-established UK regulatory frameworks, including the **Electricity Safety, Quality and Continuity Regulations (ESQCR)** and **Health and Safety Executive (HSE)** standards.

All Alpha activities will take place within SSEN Transmission (SSEN-T) controlled facilities under existing site safety rules. The robotic platform operates autonomously in designated areas, fully segregated from live HVDC equipment, and does not interact with the transmission system. As such, **no derogations, exemptions, or policy changes are required** to deliver or operationalise ODIN within the Alpha or Beta Phases.

Relevant Standards and Future Evolution
Although ODIN is fully compliant with existing legislation, the Project anticipates that widespread future deployment of autonomous robotics and AI analytics across live HVDC installations may benefit from clearer guidance and industry alignment in several areas:

1. **Autonomous operation in high-voltage environments** – alignment with **IEC 61508** (Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems) and **HSE safety management systems**, ensuring robots can safely coexist with energised plant.
2. **AI transparency and data integrity** – ensuring compliance with **Ofgem's Digitalisation Strategy, Data Best Practice guidance**, and emerging **AI governance frameworks** (e.g., ISO/IEC 42001).
3. **Cyber-security and cloud resilience** – ensuring that ODIN's cloud-based analytics platform conforms to **National Cyber Security Centre (NCSC)** principles and **ISO/IEC 27001** information-security standards, providing assurance for integration into Operational Technology (OT) systems.

While no formal changes are necessary to proceed, ODIN's findings may inform future refinements to these standards through open and transparent knowledge-sharing with relevant regulatory and industry bodies; **Energy Networks Association (ENA), HSE**, and **Ofgem's Digitalisation and Data teams**, ensuring alignment with broader policy frameworks supporting a digital, secure, and Net Zero-aligned grid. All Project documents will be publicly available on the Energy Networks Smarter Portal, and knowledge-sharing will be conducted at the Annual Innovation Summit, CIGRE and other industry conferences, Public Alpha 'Show and Tell' Webinar and regular engagement with UKRI.

The Lead Network **does not anticipate any requirement for a regulatory derogation or licence exemption** during Alpha, Beta, or future BAU phases. The Project's activities are non-intrusive, observational, and conducted within existing site-safety and regulatory frameworks.

ODIN is fully compliant with all existing policy, regulatory, and standards frameworks. No barriers or derogations are expected. Instead, ODIN provides a **safe testbed** for informing future guidance on AI, robotics, and digital resilience in critical infrastructure —strengthening the UK's leadership in safe, data-driven network operations and supporting Ofgem's strategic innovation and digitalisation objectives.

Value for money

Project Costs
The total cost for the **ODIN Alpha Phase** is **£506,056**, of which **£455,451 (90%)** is requested from **SIF funding** and **£50,606 (10%)** is provided as **partner contributions**, meeting the compulsory private funding requirement. The overall budget is proportionate to the Project's scope, duration, and deliverables, representing strong value for money for consumers to de-risk a high-value innovation.

Cost Balance and Justification
Project costs are distributed between SSEN Transmission (SSEN-T) and Ross Robotics in alignment with their responsibilities and expertise.

- **SSEN Transmission**: £56,796 total (£51,116 SIF Funding, £5,680 contribution). SSEN-T will lead Project Management (WP1), governance, risk management, and stakeholder engagement. The cost covers Project oversight and coordination, quality assurance, reporting, stakeholder engagement, management of the collaboration agreement, development of the CBA and financial compliance.

- Ross Robotics: £449,261 total (£404,335 SIF Funding, £44,926 contribution). Ross Robotics will deliver the technical work packages (WP2–WP6), including software development, AI model training, and data visualisation. These activities require significant technical resources and cloud infrastructure to advance the Artificial Intelligence Data Analytics (AIDA) platform.

The balance of costs reflects the **technical intensity** of Ross Robotics' scope relative to SSEN-T's management and oversight functions. Costs are benchmarked against prior SIF and NIA projects of similar complexity and deliver a strong return relative to outputs: by enabling predictive analytics, ODIN is expected to reduce unplanned outages, extend HVDC asset lifespans, and lower consumer costs through improved reliability.

Additional Funding and Asset Reuse

No additional funding from other innovation programmes will be used for this Project. ODIN Alpha leverages **existing assets** to avoid duplication and reduce costs:

- The Ross Robotics' **autonomous robot platform** already deployed at **Blackhillock HVDC Converter Station** will continue as the live test environment.
- Existing **data pipelines, control permissions, and cloud infrastructure** are reused to minimise capital expenditure.

Value for Money and Consumer Benefit

The total SIF funding investment of **£455,451** represents a **cost-efficient route** to developing an **innovative global first-of-a-kind solution** capable of reducing forced outages, improving network efficiency, and preventing costly system failures. If implemented across SSEN-T and the GB HVDC fleet, benefits could exceed several million pounds in avoided outage costs, lower operational and maintenance costs and renewable curtailment savings annually.

SIF funding provides a high-leverage return. The Project aims to improve system reliability, extend asset life, and reduce operational expenditure. ODIN reuses existing assets, offers competitive rates and delivers new-to-market systems, products and processes, while lowering carbon emissions (fewer site visits), delivering long-term consumer benefits and value for money.

Associated Innovation Projects

- (●) Yes (please remember to upload all required documentation)
- ( ) No (please upload your approved ANIP form as an appendix)

Supporting documents

File Upload

SIF Alpha Round 4 Project Registration 2026-03-06 4_12 - 158.8 KB
Figure 1.pdf - 31.6 KB

Documents uploaded where applicable?

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