ESB NETWORKS

Innovation 2025: Innovation To Deliver Networks For Net Zero Appendix

Issue date: February 2025

DOC-070125-ICZ

Appendix 1 - Project Updates

Project List

	Name	Impact Status	Networks for Net Zero Strategic Objective
In Development			
1.	Sustainable Backup Power Solutions	Breakthrough	Decarbonised Electricity
2.	Island Decarbonisation	Breakthrough	Decarbonised Electricity
In Progress			
1.	Plexigrid	Breakthrough	Decarbonised Electricity
2.	Development of Dynamic Line Ratings (DLR)	Incremental	Resilient Infrastructure
3.	Sidewalk Transformers	Incremental	Resilient Infrastructure
4.	Introduction of Alternatives to Creosote Wood Poles	Incremental	Resilient Infrastructure
5.	GridVision AI for Condition Assessment of Tower Corrosion	Breakthrough	Resilient Infrastructure
6.	Composite Street Light	Incremental	Empowering Customers
7.	Low Carbon Technologies Register	Incremental	Empowering Customers
8.	Neara MV/LV Pilot	Breakthrough	Resilient Infrastructure
9.	Gridguard AI -Woodpecker Mitigation	Incremental	Resilient Infrastructure
10.	Composite Core Conductors	Breakthrough	Resilient Infrastructure
11.	Flexible Demand Connections - Timed Connections	Incremental	Empowering Customers
12.	Compact 110 kV Line Design	Incremental	Resilient Infrastructure
13.	Industrial Heat Pump Network Impacts	Incremental	Empowering Customers
14.	Advanced Infrastructure Self-Serve Pilot	Incremental	Empowering Customers
15.	HV Distribution Network Development Study	Breakthrough	Resilient Infrastructure
16.	IFT (Interface Transformers) Units Refurbishment Pilot	Incremental	Decarbonised Electricity

Project List

	Name	Impact Status	Networks for Net Zero Strategic Objective
Completed			
1.	E-fleet – Decarbonisation of the Fleet	Incremental	Empowering Customers
2.	MV Planning Assist Tool	Incremental	Empowering Customers
3.	Developing 400MHz Spectrum Use for Smart Grid Applications	Breakthrough	Resilient Infrastructure
4.	AI in Smart Metering Applications	Breakthrough	Empowering Customers
5.	Innovation Feasibility Study for Uprating of Existing 38 kV Overhead Lines to 110 kV	Breakthrough	Resilient Infrastructure
6.	CSS Voltage Quality Dashboard	Incremental	Empowering Customers
7.	International Community for Local Smart Grid	Incremental	Empowering Customers
8.	Wildlife OHL Contact Prevention	Incremental	Resilient Infrastructure
9.	AI Synthetic Analyses of 110 kV Composite Insulators	Breakthrough	Resilient Infrastructure
10.	Novel Use of Drones and AI for Line Patrolling and Fault Location	Incremental	Resilient Infrastructure
11.	Inspection of OHLs Using Drones and Image Processing Analytics	Incremental	Resilient Infrastructure
12.	Investigate Statistical Contributions from Distribution Generation: F-Factors	Incremental	Decarbonised Electricity

In Development: Project Descriptions

1	Sustainable Backup Power Solutions	Timeline: Q2 '23 - Q2 '26
Scope	This project is seeking sustainable solutions to replace diesel generation used by ESB Networks for temporary and emergency backup scenarios. Diesel generation has been used over the last fifty years to provide temporary generation during substation maintenance, upgrade works and for continuity purposes during certain network outages. In addition, diesel generation is installed at over fifty ESB Networks depots to provide backup power in the event of localised network outages.	
Key partners	Consultancy and technology providers offering expertise in providing sustainable technology solutions.	
Benefits	Decarbonisation of diesel generator fleet to meet Net Zero 2040 goals.	
Impacts	Process and infrastructure changes to accommodate new technologies.	
Outputs	Comprehensive report evaluating technologies for backup and emergency generation was produced. New specifications and operating procedures will be developed for the suite of applicable use cases.	
Next steps	Obtain necessary internal approvals to proceed with contracting with pilot partner in Q1 2025. Launch pilot of mobile Battery Energy Storage System (BESS) for temporary and emergency backup scenarios in Q2 2025.	

2	Island Decarbonisation	Timeline: Q2 '23 - Q2 '26
Scope	The islands of Inishturk and Tory do not have an interconnection with the distribution network on the mainland and rely on diesel generators as their primary source of electricity. With the increasing uptake of low carbon technologies, there are challenges for such small island networks powered by diesel generators. High penetration levels of behind-the-meter solar PV can cause operational issues in small island networks with low levels of demand and innovative solutions will be needed. This project aims to reduce the use and reliance on diesel-based generation by assessing and trialling alternative sources of generation while also ensuring the proposed solutions enable and support increasing levels of behind the meter solar PV.	
Key partners	Consultancy and technology providers offering expertise in providing sustainable technology solutions.	
Benefits	Electricity generation with a lower carbon intensity whilst ensuring the continued safe and secure supply of energy for the islands. Proposed solutions should also enable and support increasing levels of behind the meter solar PV.	
Impacts	Support ESB Networks in replacement of diesel generation with decarbonised alternatives on the islands.	
Outputs	A comprehensive report evaluating technologies for decarbonising islands will be produced, outlining the evaluation and determination of the best technologies for specific use cases.	
Next steps	Further engagement with external consultancy on technical options and pathway in Q1 2025.	

In Progress: Project Descriptions

1	Plexigrid - Advanced Modelling, planning and analysis for LV Electrification - (AMP-LV)	Timeline: Q2 '23 - Q2 '25
Scope	The Plexigrid pilot seeks to implement an advanced grid management solution in ESB Networks to support better network planning, optimise capital investment in the LV network and improve data quality. The project encompasses implementation and evaluation of Plexigrid's platform over two stages. The first stage, 'Grid Planning and Analytics', focused on evaluating current grid structures and data formats, ensuring effective data integration into the Plexigrid platform. This involved collaboration between Plexigrid and ESB Networks to align on data formats and exchange methods. Once the data was exchanged, Plexigrid engaged in data cleaning and structuring to create a model of the LV Network. This stage included developing a digital twin for grid analytics and capacity assessments, detecting, and addressing any data quality issues. The second stage, 'Advanced Analytics', aims to build upon the first by incorporating smart meter data and available secondary substation monitoring data. This stage aims to leverage historical data for improved insights into grid performance, loss reduction, and power quality enhancement. It will enable ESB Networks to analyse past network issues and devise potential remedies through advanced data analytics.	
Key partners	Plexigrid	
Benefits	**Data-Driven Network Planning:** The pilot will provide insights for future network planning, particularly in accommodating new low carbon technologies and managing the growing demand for electric vehicle recharging and other emerging technologies. **Enhanced Data Quality:** The pilot will indicate the quality and reliability of LV grid data, providing ESB Networks with a more accurate and detailed understanding of the current state and future needs. **Capital Expenditure Optimization:** By utilising analytics, ESB Networks can better identify where investments are most needed, potentially reducing unnecessary capital expenditures and focusing on areas that yield the most significant benefit.	
Impacts	The Plexigrid pilot will enable ESB Networks to understand how LV asset data can be used more intelligently to make data-driven decisions for grid reinforcements and new connections. By leveraging advanced analytics and simulation, the project will facilitate better understanding and management of the network's capacity and performance.	
Outputs	Phase 1 completed in 2024 which included uploading all LV GIS (Geographic Information System) asset data from two areas to the Plexigrid digital model, allowing simulation modelling to be tested.	
Next steps	Phase 2 to commence in Q1 2025 incorporating real time MV/LV substation monitoring data.	

2	Development of Dynamic Line Ratings (DLR)	Timeline: Q1 '17 - Q4 '25
Scope	This project uses innovative technology to change the way the available capacity of circuits is determined. At present, conductors on the overhead distribution and transmission network are assigned static seasonal-based ratings. The daily capacity on the network is determined by the conductor size deployed on the circuit and the current season, i.e., Autumn, Winter, Spring, Summer. The use of blanket seasonal temperatures (i.e., summer 24°C) for determining the ratings is thought to be very conservative as daily temperatures rarely meet these in summer, however in winter, due to climate change there is an elevated risk that daily temperatures can exceed the winter ratings on rare occasions. Factors such as meteorological parameters (ambient temperature, wind-speed, wind direction) and the current state of the conductor on the circuit (ground clearance, sag, conductor temperature) will be used to dynamically determine the allowable capacity on the circuit on an hourly/forecast day ahead basis.	
Key partners	EirGrid (TSO)	
Benefits	As the current seasonal capacity ratings of circuits are considered very conservative, it is expected that the circuits the technology is deployed on will realise an increase in capacity. This innovative technology also comes with the additional control that in the rare event a circuit is exceeding the allowable maximum conductor temperatures (due to high ambient temperatures and low wind speeds), it will be possible to reduce the capacity of the infrastructure to ensure optimum life of the conductors.	
Impacts	In certain cases, it is expected that this technology will provide: • An alternative solution to uprating circuits where it is expected that the increase in capacity is only required during high wind conditions. • Operational resource improvements. • Avoided outages – any consequential inconvenience or costs are avoided by not requiring a line outage to increase its capacity.	
Outputs	The Dynamic Line Rating (DLR) project, a long-term strategic initiative in partnership with the Transmission System Operator (TSO), has made significant progress. The functional specifications were completed and approved, and tender documentation was issued in 2022, leading to the selection of a successful vendor for the trial. The project has developed the necessary policies, processes, and procedures, and successfully installed 10 DLR sensors at the first trial location. The trial is currently being monitored, with learnings from the initial installation under review. A second trial line was identified, and sensor installation began in Q4 2024. In 2024, DLR devices were installed on the Cashla – Dalton 110 kV line and the busbar at Dalton 110 kV Station. Additionally, a workshop was held with EirGrid to agree on the DLR Policy Document, and lessons learned and specification improvements from the installation and operation of DLRs were collated.	
Next steps	• Trial 2nd supplier of DLR devices on the network to compare results. • Trial installation on de-energised line by drone being examined. • Update DLR Functional and Technical Specification based on field experience. • Agree DLR Policy Document between ESB Networks and EirGrid.	

3	Sidewalk Transformers	Timeline: Q3 '17 - Q2 '25
Scope	The electrification of heat and transport and the proliferation of LCT, will lead to increased demand loads and potential congestion on LV networks. The aim of the project is to develop a prototype miniature secondary substation, known as a sidewalk transformer, as an alternative to conventional reinforcement, particularly for urban centres where space to construct traditional substations is limited, and then to trial that solution.	
Key partners	Kyte Power Tech	
Benefits	The project aims to benefit customers by offering a potential network capacity solution for the anticipated increase in loads arising from electrification of heat and transport, particularly in urban settings, through trialling a viable option to uprate the network, as cost effectively as possible.	
Impacts	This solution will allow additional transformers to be located on narrow streets in densely populated city areas, where spatial restrictions limit the opportunity for construction of traditional substations with larger footprints. This will enable capacity to be increased for residential customers in urban centres where increased network load arising from LCT take-up and use is anticipated.	
Outputs	ESB Networks is conducting a trial in Ireland of these units. A 10 kV 200 kVA prototype sidewalk transformer has been designed, type tested and installed in ESB Networks' National Training Centre in Portlaoise. The sidewalk transformer has been upgraded from 200 kVA to 315 kVA and is currently in the prototype stage. Recently, it underwent type testing at KEMA (KEMA Labs is a world-renowned testing, inspections and certification organisation located at several sites across the globe) and successfully passed all scheduled tests, although the final report is still pending. Once the report is completed, the transformer will be returned to the manufacturer, Kyte Powertech, in Cavan for additional work to ensure it is fit for service.	
Next steps	Potential deployment locations have been identified for 2025.	

4	Introduction of Alternatives to Creosote Wood Poles	Timeline: Q3 '16 - Q4 '25
Scope	This materials science innovation project addresses the need for alternative structures or solutions to replace creosote wood poles. These structures must be capable of operating under Irish climatic conditions without the use of creosote which contains hazardous components. The sale of creosote has been banned to the public and although business users are entitled to continue to use it under certain conditions, the current EU-wide derogation on the use of new creosote poles is due to expire in Oct 2029. It is not presently known if an extension to this derogation will be permitted. The recommended solutions must be adaptable to and reliable in the Irish climate cognisant of the forecasted impacts of future climate change. Not only are non-hazardous products needed but replacement processes must also be introduced to store, transport, handle, install, access, maintain, operate as well as to uninstall the products. There are over 2.2 million creosote-treated wood poles installed countrywide on the LV, MV, 38 kV and HV networks. The Irish climate accelerates the decay of untreated wood poles and exacerbates the challenges, with consequential risks to safety, continuity, and reliability. Therefore, alternatives to the creosote treated pole need to be trialled and evaluated. Substitute pole preservatives have been trialled as an alternative to creosote and will continue to be assessed. Any substitute for the existing stock of wood poles must be robust and reliable to avoid or risk inconvenience for the customer and cost inefficiencies for ESB Networks.	
Key partners	ESB Networks' Network Assets team has engaged with Vattenfall (Swedish utility) who have used composite poles for nearly 15 years and is seeking opportunities to engage with other Nordic utilities who similarly use composite poles. ESB Networks has advanced technical development with Jerol (Sweden), with a substantial pole order currently in progress. Discussions are ongoing with RS (Canada), Comrod (Norway) and Creative Composites (USA). We are also exploring alternative wood types to provide diversity in supply and are continuing to research chemical alternatives that could be used in their treatment.	
Benefits	This innovation project seeks to provide viable alternatives to creosote treated wood poles. The creosote treated wood pole has been the backbone of the overhead distribution electricity network in Ireland since the Shannon Scheme in the late 1920s. Through this project, we aim to ensure that any new technologies introduced on the network have been thoroughly vetted though rigorous technical assessment, testing and trials on the network. This work will consider pole implementation in relation to several factors including safety, environment, cost, service life, resilience, work methods, handling, and storage.	

4 (continued)	Introduction of Alternatives to Creosote Wood Poles	Timeline: Q3 '16 - Q4 '25
Impacts	Composite poles will provide a solution which can replace wood poles in certain circumstances. These poles will not carry the same environmental or safety concerns posed by wood poles treated with creosote. Tooling and installation methods for these poles will be very similar to existing work practices. The service life of a composite pole may prove to be significantly greater than an equivalent treated wood pole. A cost increase is anticipated as creosote poles are retired and other pole types, such as composite poles, are introduced. These costs are mitigated by a longer lifespan, reduced crew mobilisations for pole replacements, increased storm resilience, reduced risk of wildlife damage, more agile supply chain and higher materials consistency. Research and trials on alternative wood pole treatments will identify the best performing alternatives to creosote. This work will establish if there are viable wood pole treatment options which provide a sufficient service life for the wood pole while removing environmental and safety concerns presented by creosote.	
Outputs	ESB Networks has installed approximately 20 modular composite poles (2017) and 5 singular poles (2022) across LV, MV, and 38 kV voltages on the overhead network. These installations included urgent pole replacements due to storm damage of wood poles in November 2022. These are being monitored for signs of wear, degradation, and weather effects. A 5-year audit was carried out on the poles installed in 2017, and all are performing well. During 2023 and 2024, significant progress has been made with several large deliveries of composite poles into the country. Composite poles are being supplied to each region in the country for familiarisation and installation. Composite pole installation on the network in designated situations/locations will become a business-as-usual activity. A framework tender for the supply of composite poles is being progressed, with the technical specification and tender documentation now complete. In 2024, orders of wood poles treated with creosote alternatives (Tanasote and DCOI) have been received and will be installed on the network. Additionally, significant progress was made in 2024 (Q3, Q4) with the 220 kV composite poles.	
Next steps	The timelines of this innovation project have been extended to reflect the need to monitor the trial poles for a more appropriate time (more than 10 years) to better reflect their long-term performance in the Irish context. No adverse effects are reported on the trial pole sets from initial audits in 2022, and final performance comparison stress tests will be required at the end of the trial. A construction and maintenance trial involving four foundation types was completed, and the Construction & Maintenance Trial Report is expected to be issued in Q1 2025. The procedural standards for composite poles are in development, and ESB Networks' staff will need appropriate training in relation to the correct handling, tooling, erecting, etc., of composite poles. Alternative pole solutions which are implemented on the network will be digitally recorded in a dedicated app, and the condition/performance of these poles will be tracked over time. Next steps for 2025 include the preparation of a functional specification by EirGrid for 220 kV composite poles, expected to be issued to ESB Networks for review and acceptance in Q1 2025. Following the approval of the functional specification, an ESB Networks procurement specification will be drafted. Additionally, the feasibility of an energised trial to develop construction plans is being examined.	

5	GridVision AI for Condition Assessment of Tower Corrosion	Timeline: Q2 '22 - Q4 '25
Scope	This project aims to test and assess the Gridvision AI software tool as a proof of concept, developed to use machine learning for automated condition assessment on overhead lines. The objective is to determine if AI can be used to assess high-level corrosion across our fleet of steel towers. The scope includes the assessment of steel transmission towers, where Collaborative-AI models will identify deep rust corrosion. The goal is to eliminate the time-consuming steps in the process. An interesting aspect of this tool is its methodology to highlight and quantify corrosion levels on lattice steel tower members.	
Key partners	GridVision	
Benefits	This technology could provide an objective and rapid means of undertaking an initial assessment of the relative levels of corrosion (Grade 4+ on the UK NG Scale) on steel towers to help decide if full detailed manual steelwork inspections at individual bar-level are needed on some or all the towers on a given circuit.	
Impacts	Using automated image capture on towers provides a repeatable means of capturing identical sets of imagery over time e.g., every 5 years. A machine learning corrosion detection tool then also provides a repeatable, objective means of assessing corrosion on bars/bolts at Grade 4+ at each time point and allows for comparison of corrosion development over time.	
Outputs	Outputs from the corrosion detection system consists of a relative percentage measure of corrosion at Grade 4+ on each tower such that for towers above a set percentage e.g., greater than 2-3% (or several bars) may be selected for detailed manual image inspections and identification of individual bars and their specific corrosion levels. The project demonstrated that eSmart Systems corrosion solution was successful in identifying corrosion on ESB Networks towers with the AI models achieving a high-performance level of an average of 93% accuracy. AI performance was high, and the current solution can be used as a triage and initial assessment on towers that might need a detailed steelwork assessment.	
Next steps	The next steps of the project involve applying the Grid Vision corrosion tool to prioritize which structures require detailed steelwork assessments. Initially, an expert will conduct a conditional assessment, generating an automatic corrosion score for each tower to understand the general corrosion condition. This will be followed by aggregated reporting on all inspections, where tower corrosion scores are ranked and visualised to aid decision-makers in focusing resources effectively. Based on the AI prioritisation, actions will include detailed steelwork assessments or immediate repairs and replacements on corroded towers as necessary. Further trials of this approach are planned for the Cashla-Prospect 220 kV line in 2025.	

6	Composite Street Light	Timeline: Q2 '23 - Q2 '25
Scope	Local Authorities contacted ESB Networks to collaborate on the development and trial of an EV charging solution powered from public lighting supplies. The solution was required to accommodate simultaneous charging of 2 electric vehicles per street.	
Key partners	Electric Skyline – a public lighting maintenance contractor, Local Authorities, ZEVI, Department for Transport	
Benefits	This solution will provide a means for EV drivers without private driveways to charge their electric vehicles in the vicinity of their homes. The design of the solution will integrate the public light, the EV chargers and the ESB Networks interface cabinet all within the one column, thereby reducing street furniture. The solution design also adheres to Government's accessibility standards for mobility impaired users, by enabling 360-degree access around the device. Payment for use of the charging service will also be facilitated by "Tap & Go" charging for customers.	
Impacts	This facility can be provided at those public lighting points that are directly connected to the distribution network. The solution design will accommodate charging of 4 electric vehicles per street, double that requested by the Local Authorities.	
Outputs	A physical mock-up of the solution was used for demonstration purposes and to ensure stakeholders understood the design features of the solution. A physical mould of the solution has been developed by Electric Skyline and is being used as a basis for manufacturing. The solution design incorporates ESB Networks standard equipment such as cut-out switches, isolator devices and metering, thereby removing the need for testing of those components.	
Next steps	An Irish supplier has been commissioned recently; they have produced two viable prototypes. These prototypes need review by ESB Networks and other key stakeholders such as ZEVI in advance of a pilot site being made live in early 2025.	

7	Low Carbon Technology Register	Timeline: Q3 '23 - Q2 '25
Scope	The LCT (low carbon technology) Register is a list of devices which meet the technical standard to connect to the LV electricity distribution network. Traditionally, when applying to install inverter connected LCT generation devices to the electricity distribution network, customers must also provide copies of technical documentation sourced from the LCT manufacturers to show that the devices have been designed and tested to industry standards. This results in LCT manufacturers providing multiple copies of the same Type Test reports and Certificates of Conformance to each applicant customer and ESB Networks evaluating and storing multiple copies of this technical documentation for each installation of the same LCT devices. Establishing the LCT Register will mean that once the LCT manufacturer has secured registration of the device, then applicant customers will no longer need to provide copies of this documentation when applying to connect. The LCT Register will also provide assurance that registered LCT demand devices, i.e., EV chargers and heat pumps have been designed and tested to industry standards. The LCT Register Project involves the following: • Appointment of an LCT Compliance Agency to maintain the Register. • Establishment of the register of LCT devices compliant with industry standards. • Modification of connection application documentation and processes to reference the LCT Register and minimise the need for applicant customers to provide copies of technical documentation sourced from LCT manufacturers. • Population of an LCT Database, recording where specific LCT devices have been connected to the network.	
Key partners	Threepwood Consulting Ltd	
Benefits	The LCT Register will give rise to several benefits: • Efficiency: Including LCT Register Reference Numbers on application forms will remove the need to provide copies of technical documentation in support of connection applications, thereby reducing administration overhead for LCT manufacturers, applicant customers / electrical contractors and ESB Networks. • Compliance Assurance: By installing / connecting devices that are on the LCT Register, all parties can be confident that these devices have been designed to meet industry standards. • Visibility: The LCT Register will provide the foundation for increased and enhanced visibility of the LV network and enable new and enhanced data driven services for all customers, better supporting electrification, design of flexibility schemes and enabling prioritised uprating of the LV network.	

7 (continued)	Low Carbon Technology Register	Timeline: Q3 '23 - Q2 '25
Impacts	Implementation of the LCT Register will lead to increased efficiency in the application process for connection of LCT devices onto the LV electricity distribution network. By customers installing LCT devices which are on the LCT Register, this will provide assurance that LCT devices connecting to the network comply with industry standards.	
Outputs	ESB Networks has appointed Threepwood Consulting Ltd as LCT Compliance Agency to establish and maintain the register. The LCT Register has been published on ESB Networks website. The LCT Register will be updated over time with details of additional LCT devices, as and when LCT manufacturers provide the LCT Compliance Agency all necessary information to enable registration.	
Next steps	ESB Networks wishes to establish an LCT Database which will identify where known low carbon technologies (inverter-connected generation, electric vehicle chargers and heat pump devices) have been connected to the LV electricity distribution network.	

8	Neara MV/LV Pilot	Timeline: Q3 '24 - Q2 '25
Scope	A digital twin is being developed and trialled on an area of LV/MV network (~400 km) located in the central region of the country. This trial has been progressed based on evidence that the platform provides value in relation to HV vegetation management. This pilot is focussed on several medium and low voltage use cases including: • Vegetation management • Asset location/GIS (Geographic Information System) correction • Data unification • Phase tracing • Hazard identification • Design of new or upgraded overhead lines. • Resilience assessment of network • Thermal rating/capacity assessment of existing overhead lines • Network design.	
Key partners	Neara	
Benefits	The use cases being examined could provide significant enhancements in terms of network reliability and resilience. The potential benefits being explored include: • Targeted vegetation management (ability to prioritise based on proximity to network, predict future growth). • Improved continuity performance – identify immediate risks to network from vegetation, conductor clashing, inadequate jumper clearance. • Data unification for assets – reconciliation of various independent data sets • Network/asset identification and GIS (Geographic Information System) correction. • Increased capacity using thermal rating analysis. • Resilience assessment of network – analyse overhead network for different storm conditions. • Manual processes completed digitally (e.g. phase tracing)	
Impacts	The impact of this technology is yet to be established. There are many potential benefits and the trial being completed will determine whether the proposed use cases are viable and would provide sufficient benefit to pursue this technology.	
Outputs	The output from this trial will be a digital twin model on c.400 km of LV-MV network. This model will be analysed for actionable data with input from several areas of ESB Networks. The findings of the trial will be documented highlighting the use cases examined and will inform future investment decisions. LiDAR and aerial imagery have been captured for the trial area in Q3 2024.	
Next steps	The build of the digital twin is now on-going with the use cases for the trial being implemented in the model. The pilot is due to conclude in Q2 2025.	

9	Gridguard AI -Woodpecker Mitigation	Timeline: Q2 '24 - Q2 '26
Scope	ESB Networks overhead line (OHL) Asset Management team has been completing trials to determine the vulnerability of various wood pole types to attack and damage from woodpeckers. Various innovations are being explored to mitigate against damage from woodpeckers and methods to repair damaged poles. This work has also incorporated testing of non-destructive testing equipment to assess the condition and remaining strength of wood poles which has value beyond woodpecker challenges. The great spotted woodpecker species first arrived in Ireland circa 2005. Since then, the population of this bird has been steadily increasing. The woodpecker is a protected species under the Wildlife Acts. Trending analysis sightings data suggests a 30% increase per annum in the population growth of these birds. Woodpeckers can cause significant damage to the wood poles on the overhead network, which can be categorized as direct or indirect.	
Key partners	Gridguard AI	
Benefits	This pilot has the potential to deliver a preventative solution to woodpecker damage, reducing the need to identify and remediate damaged poles and reduce the likelihood of secondary decay ensuring existing poles can remain in service.	
Impacts	The innovations trialled will be critical to managing the growing challenge posed by woodpecker damage on the overhead electricity network.	
Outputs	The output from this trial will be a report on the product's performance, as well as its environmental and ecological impacts.	
Next steps	Three independent trials using Gridguard AI, are to commence Q1 2025, where 114 units will be deployed on three sections of network, which are severely prone to woodpecker interference.	

10	Composite Core Conductors	Timeline: Q2 '24 - Q4 '26
Scope	ESB Networks has progressed trials for the use of composite core conductors on the network. These new and innovative conductors are also known as aluminium composite fibre reinforced (ACFR) conductors, or aluminium composite core conductors (ACCC). This conductor is a type of high temperature low sag (HTLS) conductor; however, it can be installed at much lower tensions than an equivalent aluminium conductor steel reinforced (ACSR) or traditional GAP type HTLS conductor which use a steel core – while not exceeding sag limits to maintain safety clearances. This conductor can double capacity in some instances while not increasing the mechanical loads on structures. This novel conductor could be used extensively to increase capacity on the network while retaining existing structures. The scope of the work to be completed includes a construction trial and live trial installation for the composite core conductor. These trials will inform ESB Networks regarding on the construction practices needed to work with this conductor type and will provide a limited live installation from which the performance of the conductor can be monitored.	
Key partners	Various industry suppliers	
Benefits	Innovative new conductor type which could provide for capacity increases on existing overhead line while retaining existing structures.	
Impacts	This technology could become a leading means of uprating overhead lines to deliver additional capacity.	
Outputs	This trial will conclude if the conductor type is viable for implementation. There are several significant projects identified which could benefit from this technology.	
Next steps	Conductor for the trials is in the process of being sourced. It is envisaged that the pre-work and live installation trial will be completed in 2025.	

11	Flexible Demand Connections - Timed Connections	Timeline: Q3 '23 - Q2 '26
Scope	ESB Networks is currently exploring innovative ways to manage capacity on the distribution network, including the use of flexible demand connections. The simplest form of a flexible demand connection is a timed connection, where a customer is offered a connection on the condition that they remain within their Maximum Import Capacity (MIC), which may be curtailed at particular times. Eligible customers will typically have a demand profile that aligns with times when capacity is available on the electricity network, allowing any increases in MIC to be accommodated with the existing network capacity. Meeting these conditions would enable ESB Networks to offer a timed connection, allowing customers to connect more quickly on a timed basis. Meanwhile, ESB Networks will analyse the effectiveness of the timed connection and other solutions, and plan and deliver the appropriate long-term network reinforcements for that location to provide a 24/7 firm connection. Customers offering timed flexibility would have a specific time window in which they could utilize their full MIC but would be restricted to operating at significantly lower demand at other times. This Timed Connection pilot will contribute to the development of fully flexible demand solutions by providing evidence and insights into the practical implications of flexible solutions, as well as key customer drivers and benefits.	
Key partners	Key partners for the initiative will be confirmed following acceptance of connection offers as part of the pilot.	
Benefits	The learnings from this pilot have the potential to accelerate electrification by enabling ESB Networks to offer faster demand connections for suitable applicants where capacity is available at particular times, while planning and delivering the long-term reinforcement works.	
Impacts	This project will enable ESB Networks to pilot an innovative approach to managing the growing electricity demand within the capacity of the existing infrastructure. It will deliver valuable insights on any impacts to existing commercial policy and planning standards.	
Outputs	This project will deliver a comprehensive pilot report detailing the learnings from the pilot, including the operational, planning, commercial, and asset management impacts of timed connections on the distribution network and the benefits to availing customers.	
Next steps	Finalisation of the assessments and issuing of the first connection offer with timed connection conditions in Q1 2025, followed by implementation and monitoring of the pilot site if the connection offer is accepted by the customer.	

12	Compact 110 kV Line Design	Timeline: Q3 '24 - Q4 '28
Scope	An Innovative desktop Feasibility Study was completed in Q3 2024 for Uprating of Existing 38 kV Overhead Lines to 110 kV. The study's Conceptual Design Report proposed the introduction of a new Distribution System Operator (DSO) standard compact 110 kV overhead line design. The objective of this follow-on project is to develop the new Distribution System Operator (DSO) standard compact 110 kV overhead line design that could be employed to uprate ESB Networks' 38 kV overhead line corridors to operate at 110 kV voltage; this would provide the improved capacity and voltage reach needed to meet 2040 electricity network capacity forecasts. The design is intended to enable the uprating/conversion of existing 38 kV lines to 110 kV using a similar line profile to the existing circuit (i.e. the same height structures in same locations, same span lengths). The design could also be used for new lines at 110 kV or when re-conductoring/refurbishing existing 38 kV lines so they would be '110 kV ready'.	
Key partners	ESB Engineering and Major Projects	
Benefits	The project is expected to deliver the following benefits: • **Enhanced Capacity:** The proposed compact 110 kV overhead line will have a rating of 100 MVA, representing a circ. four-fold increase in capacity along these corridors. This substantial capacity upgrade is expected to be deliverable within a 5-year timeframe. • **Minimal Community Impact:** By using existing route corridors and structure positions and an innovative compact design, the solution will significantly reduce the impact on local communities. • **Unlocking Value from Existing Corridors:** This innovative approach unlocks additional capacity from existing line corridors, accelerating the delivery of new hard capacity and addressing the significant challenges associated with building new overhead lines.	
Impacts	The proposed compact 110 kV overhead line solution will deliver a circa four-fold increase in capacity along the corridors where it is utilised. It is expected that this will also deliver associated resilience and continuity benefits.	
Outputs	To develop a Distribution System Operator (DSO) Compact 110 kV design that: • Can be used to uprate existing 38 kV overhead line corridors to provide a sub-transmission capacity of at least 100 MVA summer rating. • Will be used to uprate existing 38 kV overhead lines and delivered in a 3 to 5-year timescale (which is quicker than building new 110 kV overhead line infrastructure) and which better meets landowner and stakeholder expectations than the standard 110 kV overhead line design. • Provides adequate resilience, reliability, and performance for a sub-transmission network, meeting current international technical standards.	
Next steps	It is planned that designs for a pilot project will commence in 2025 and specifications for new materials (e.g. post insulators) will be developed to enable procurement of the required materials. Construction and maintenance trialling of the new designs will be progressed as required to validate the designs and expedite the construction of the pilot project.	

13	Industrial Heat Pump Network Impacts	Timeline: Q2 '23 - Q2 '25
Scope	The NEXSYS Heat Pump project aims to comprehensively analyse the implications of incorporating an industrial heat pump into the electricity network. The scope includes a detailed assessment of the impact on the electricity network, considering factors such as load curves, peak demand, power losses, voltage drop, power quality, and reactive power requirements. The broader analysis encompasses the examination of the industrial heat pump, its size, industry applicability, and interactions with other systems like storage, supplementary heating, and waste-heat systems. Additionally, the project involves a review of relevant industry standards and an in-depth analysis of heat pump performance and load capacity scheduling.	
Key partners	NEXSYS partners.	
Benefits	This project will help to build understanding of the implications of industrial heat pumps on the electricity network to enhance network planning and maintain power quality. This would optimise heat pump utilisation without compromising the stability of the electricity distribution system. It will also ensure compliance with industry standards, mitigate potential issues related to power quality, harmonics, and technical considerations.	
Impacts	Identification of early adopters and insights into the scale of installations. Consideration of on-site integration solutions and its impact on the electricity network. Addressing concerns such as voltage drop, power quality, power factor correction, and cleaning cycle management.	
Outputs	Comprehensive analysis report will be developed detailing the impact of industrial heat pumps on the electricity network, heat pump performance and load capacity scheduling insights. A key element of this analysis on the electricity network will be understanding power quality impacts.	
Next steps	Finalisation and publication of project reports.	

14	Advanced Infrastructure Self-Serve Pilot	Timeline: Q4 '24 - Q4 '25
Scope	This pilot proposed for 2025 aims to develop and demonstrate an interactive web user interface that will enable customers considering demand connections at medium voltage level to access tailored network capacity information, high-level estimated costs, and potential timelines for their desired connection. It is hoped that a self-serve capacity screening tool could provide an enhanced pre-application service for customers, while also leading to a reduction in applications that are not progressed by customers. This pilot aims to build on the existing capacity heatmap data already published on our website.	
Key partners	Advanced Infrastructure Technology Ltd.	
Benefits	As part of our Networks for Net Zero strategy, there is an action on ESB Networks to develop a pre-screening process for public EV recharging infrastructure and furthermore to extend it to all demand customers. A simple manual screening service has been established for EV charge point developers and we are committed to expanding this pre-screening facility out to all demand customers with digital self-serve capability central to delivering on this commitment. This pilot is intended to provide greater insight into available network capacity, high-level connections costs and projected connection timelines.	
Impacts	A substantial number of demand applications are let lapse or are withdrawn by the applicants and this is inefficient from a network planning perspective. It is hoped that greater insight to available network capacity, high level costs and potential delivery timelines will reduce this and result in greater numbers of applications progressing to live connections. The outputs and learnings of this pilot are intended to inform a technical specification for the development of an enduring self-serve solution.	
Outputs	The Advanced Infrastructure platform will deliver a web-based capacity screening tool that is hoped will provide customers with greater insight into available network capacity, high-level connections costs and projected connection timelines.	
Next steps	The project is scheduled to be delivered within a year, with completion expected by the end Q4 2025.	

15	HV Distribution Network Development Study	Timeline: Q2 '24 - Q3 '25
Scope	This HV Distribution Network Development Study aims to develop innovative approaches for enhancing the 38 kV HV distribution network outside major urban areas to meet the capacity requirements for a Net Zero ready network by 2040. This project addresses the increasing load on the 38 kV electricity distribution system due to increased renewable energy generation and the electrification of heat and transport. It builds on a previous feasibility study to identify future HV distribution network voltage levels and recommend the direction for voltage conversion. CAP24 targets for renewable energy generation and the electrification of heat and transport will significantly increase the load on the 38 kV electricity distribution system, requiring widespread uprating of substations and overhead lines with higher capacity installations. The 38 kV network also faces asset replacement and supply chain challenges.	
Key partners	ESB Engineering and Major Projects	
Benefits	The project is expected to deliver several benefits, including confirming the appropriate voltage levels for the HV distribution network and providing a basis for stakeholder consultation. It will recommend an innovative and integrated approach to network development that ensures the required capacity for a cost-effective, Net-Zero ready distribution network by 2040. Additionally, it will provide a methodology that can be translated into policies and procedures for network planners to apply consistently across the country, excluding the Dublin urban area.	
Impacts	The final HV network development approach adopted will inform future investment decisions by ESB Networks in its network reinforcement and customer connection decisions.	
Outputs	A comprehensive report will be developed that outlines international practices by comparable utilities in relation to voltage conversion and rationalisation to address capacity growth requirements. Further reports will be produced on the screening of network development approaches and studies on implementing these approaches in specific scenarios and situations. The key deliverables from the study are: 1. Identify the future HV distribution network voltage level(s) to be employed and recommend the direction of travel in relation to voltage conversion. 2. Propose an optimum HV network development approach for 2040 based on sample area case studies. 3. Undertake specific studies on voltage uprating approaches to understand the optimal reach of 110 kV and 20 kV networks and the optimal voltage uprate approaches in specific scenarios	
Next steps	A report on future network voltages and international practice will be completed in Q1 2025. This will be followed by a screening assessment of network development approaches and detailed studies of specific situations in Q2 and Q3 2025.	

16	IFT (Interface Transformer) Units Refurbishment Pilot	Timeline: Q2'24 - Q2'25
Scope	This project aims to refurbish and upgrade Interface Transformers (IFTs) to enhance their functionality and extend their operational life. This initiative aims to reduce waste, extend asset life, and provide cost savings, aligning with ESB Networks' circular economy approach. ESB Networks is committed to minimising waste and promoting sustainability by refurbishing existing equipment, significantly reducing the amount of waste that would otherwise be scrapped, and recycling and reusing materials to reduce the need for new procurement. These efforts contribute to a reduced carbon footprint, substantial cost savings, and support ESB Networks' commitment to environmental sustainability.	
Key partners	Internal project.	
Benefits	• Reduces ESB Networks carbon footprint by reducing waste and recycling existing material. • Provides substantial savings on the cost of replacing existing IFT Subs. • Is in keeping with the circular economy approach taken by ESB Networks. • Significantly reduced lead in time compared to a new purchase.	
Impacts	The units are stripped down, degreased, cleaned, and painted. A new zinc-coated floor and brackets are installed to support the two reclosers and controllers. Additionally, a new control panel with a protection relay is fitted to each unit, allowing the IFT (Interface Transformer) to be fully automated.	
Outputs	An IFT (Interface Transformer) refurbishment workshop was set up focusing on upgrading and automating IFTs to support the 20 kV project team.	
Next steps	Agree and formalise the IFT (Interface Transformer) refurbishment process. Implement pilot projects to emulate this refurbishment process for other electrical equipment, leveraging the success and learnings from this pilot.	

Completed: Project Descriptions

1	E-Fleet – Decarbonising and Electrification of our Fleet	Timeline: Q2 '22 - Q4 '24
Scope	ESB Networks is trialling and developing innovative solutions to decarbonise and electrify our transport fleet in line with our Networks for Net Zero Strategy. We operate an extensive fleet of vehicles to maintain and operate the network. As well as the day-to-day operations and maintenance of the network, our experienced Network Technicians (NT's) and teams leverage the fleet when restoring the network following adverse weather conditions and storms. Delivering solutions that work for our experienced NT's is at the core of this project. In line with our Networks for Net Zero strategy, for vehicles that an electrification option is not yet available we will electrify systems that can be electrified. The aim of the project is to meet our targets to decarbonise our fleet and transport in line with our 2030 targets and beyond to achieve Net Zero by 2040.	
Key partners	The end user experience is at the heart of this project, and we are working with technology partners to trial charging and payment methods which are efficient and easy for the end user.	
Benefits	As well as decarbonising our fleet, we will deliver a modularised fit out for our yellow van fleet which can support lower carbon emissions from our existing fleet. This modular fit out can be re-used on our new fleet of electric vans as they are delivered to ESB Networks in line with our circular economy goals.	
Impacts	The implementation of the home charging solutions for NTs is helping with the adoption of new electric vans by NTs by ensuring the energy costs associated with charging are reimbursed.	
Outputs	Ideas developed to date include a home-charging solution and modular van fit-out that are now deployed as BAU for new EV van users.	
Next steps	Continued roll out of electric vans over the coming years.	

2	MV Planning Assist Tool	Timeline: Q1 '23 - Q1 '24
Scope	Medium Voltage (MV) network planners in ESB Networks rely on many sources of data to complete network studies when assessing the impacts of new demand and renewable generation connections. The setup and completion of these studies take time and many applications do not proceed. This project was established with the objective of designing a software tool that would gather GIS network data and MV feeder capacity data into a single interface. The tool was intended to be a ready reckoner for users to be able to make faster, high-level assessments of new demand connections including the estimated connection cost for a customer based on their location and required connection capacity.	
Key partners	Internal ESB Networks Project	
Benefits	The tool could be used as a ready reckoner to enable users make faster, high-level assessments for new demand connections including an estimated connection cost for the customer based on their location and required connection capacity. It provides additional benefits for training and onboarding of new staff.	
Impacts	Assists the network planner in determining estimated network capacity.	
Outputs	A proof of concept has been completed in 2023 with data from two ESB Networks areas. Various internal workshops have been completed to gather user feedback.	
Next steps	The project has been successfully completed, and the insights gained have been integrated into the development of the Advanced Infrastructure Self-Serve Pilot.	

3	**Developing 400MHz Spectrum Use for Smart Grid Applications**	**Timeline: Q1 '21 - Q4 '24**
Scope	The aim of this project is to enhance the telecommunications infrastructure of ESB Networks. ESB Networks' existing telecoms infrastructure is fully managed and maintained by ESB Networks Telecoms. ESB Networks Telecoms supports connectivity to 400 kV substations down to 38 kV substations. Connectivity beyond the 38 kV substation is currently supported by third-party mobile networks. Third party networks are not suitable to meet predicted growth in sensors and line equipment on MV feeders and substations primarily due to coverage, availability, and insufficient power backup. Services at an MV level will become increasingly critical to the operation of the electrical grid. ESB Networks Telecoms is developing a private LTE network to deliver a dedicated, secure, and robust solution that is appropriate to the scale of new connections. ESB Networks acquired a radio spectrum licence from ComReg in November 2019 to deploy a Smart Grid telecommunications network.	
Key partners	This radio network is being procured, designed, and rolled out by ESB Networks Telecoms for use by ESB Networks. Sigma Wireless and Nokia are the primary delivery partners.	
Benefits	This Smart Grid network will deliver a wide range of benefits for ESB Networks and wider society, including integrating more renewable energy, enabling electrification of heat and transport, and reducing electrical outages with faster fault resolution times. This network will be used to deliver services essential to the grid with the potential to be upgraded and leveraged for emerging smart grid services.	
Impacts	The electricity industry is undergoing unprecedented change, and the methods by which electricity is produced and consumed are fundamentally changing. Secure telecommunications are fundamental to this change and to the safe and efficient operation of the electrical grid. Having a private mobile network to meet predicted growth in sensors and line equipment on MV network that also has the coverage, availability and necessary cyber resilience is a key enabler to delivering of ESB Networks' Networks for Net Zero strategy.	
Outputs	The pilot phase of this project has now been successfully completed, and the initiative has transitioned into the delivery phase. The BAU rollout is currently underway, with multi-year infrastructure development in progress.	
Next steps	First services will begin to transition onto the new network during late 2025 and into 2026, marking a significant milestone in leveraging the 400MHz spectrum for smart grid applications and other BAU services.	

4	AI in Smart Metering Applications	Timeline: Q1 '21 - Q4 '24
Scope	This project involves the use of artificial intelligence (AI) to review images of smart metering installations to maintain high quality standards. On-going auditing of smart metering installations is carried out to ensure quality and standards are maintained and to improve safety.	
Key partners	Internal project	
Benefits	The use of AI has brought significant benefits to the Quality Assurance Audit function of the smart meter programme. By performing five key audit checks on every smart meter installation, the AI tool supports ESB Networks in maintaining its high-quality standards with smart meter installers and contractor staff.	
Impacts	The auditing process is resource intensive and involves the review of images taken at every install. The smart metering programme involves the installation of over 2.5m smart meters, with more than 10 million images to be checked and reviewed over the duration of the programme. The use of AI enables ESB Networks to do this with significant efficiency and cost savings. Integrated use of AI within the auditing process is a key safety and quality anchor of the Smart Metering programme, which alerts ESB Networks to 40% of quality assurance issues, thereby helping to ensure that quality standards are kept high with staff and contractors maintaining a >99% pass rate.	
Outputs	Auditing time per installation has been reduced by up to 10% with associated cost savings. In the absence of AI, it is anticipated that the audit budget would have to increase by 400% with a larger team performing the assessments.	
Next steps	As the roll-out of 3-phase smart meters commences, the opportunity to integrate other QA / auditing tests will be explored. Learning will be applied into the 3 phase meters.	

5	**Innovation Feasibility Study for Uprating of Existing 38 kV Overhead Lines to 110 kV**	**Timeline: Q3 '23 - Q3 '24**
Scope	This project addressed the evolving capacity requirements of the 38 kV overhead line network. The 38 kV overhead line network is a key element of the distribution system comprising some 5,600 km overhead network and is similar in length to the full transmission network. Much of the existing 38 kV network is comprised of relatively small conductors, a proportion of which has been installed for several decades. The 38 kV network did not undergo the significant upgrades during the MV Network Renewal Programme, nor has it seen the level of upgrades/uprates completed in the past decade on the 110 kV network. To accommodate the anticipated growth in demand for capacity driven by the electrification of heat and transport, distributed generation and economic growth, the capacity of the 38 kV network needs to be reviewed. This project will seek to do a desktop feasibility study for the uprating the voltage of existing 38 kV overhead network to 110 kV to support the increased capacity requirements for our network. Additionally, a software platform is also being evaluated to assess the benefits of LiDAR processing software to quantify the impact on vegetation and ground clearances associated with upgrading a 38 kV circuit to 110 kV.	
Key partners	ESB Engineering and Major Projects, Neara	
Benefits	The benefit of this pilot is the evaluation of methods to assess future line upgrades and to better understand the role and value of using LiDAR data and associated digital twin software platforms to perform this analysis at scale.	
Impacts	The impact of a successful outcome of this pilot study will result in ESB Networks taking the next steps to develop the tools, standards, and designs to enable follow on technical and physical trials that will implement the solutions to deliver a significant increase in network capacity along the existing 38 kV line corridors.	
Outputs	It is expected that the output of this study will help to shape the strategy to transform and upgrade the existing 38 kV network in line with ESB Networks' Networks for Net Zero strategy and its principle of 'build once for 2040'. Outputs shall include the following main elements: • Proposed design solution including suite of structures for voltages up to 110 kV to replace existing 38 kV structures on any given line. • Line rating and conductor solutions (conventional and composite core HTLS for min. 100 MVA capacity) • Sample line design assessments for 3 x 38 kV lines (40 km total) to assess planning and clearance requirements to vegetation and buildings. • Constructability and Cost Review of proposed solution based on sample line assessments. • Recommendations for further studies to support implementation phase including indicative costs and programme. • Evaluation of Neara LiDAR processing software platform providing learnings for ESB Networks regarding the use of such data and technologies • Development of new materials needed to implement the solution.	
Next steps	The feasibility study is completed, and work is due to progress on an insulation coordination study. The learnings will go into the Compact 110 kV line design project.	

6	CSS Voltage Quality Dashboard	Timeline: Q1 '23 - Q4 '24
Scope	The scope of this project is to develop a Power BI dashboard to enable Customer Service Supervisors (CSS) to validate customer reported voltage issues without site visits. Site visits are required to install and uninstall voltage recorders. This project aims to give CSSs access to suitable smart meter data to facilitate remote validation of issues and fast tracking of rectification order creation.	
Key partners	ESB Networks Customer Delivery, Powering Ahead Programme, Smart Metering	
Benefits	This project will Improve efficiencies in dealing with voltage complaints. This product will enable faster assessment of voltage issues, local area teams will be able to articulate issues to customers and initiate the system improvements more effectively. The project will also empower CSSs and wider teams with enhanced visibility of customers voltage quality. This will also support and enhance investment and system improvements. It will also enable efficient use of constrained resources, including staff and voltage recorder devices.	
Impacts	• Shortening of duration of customer journeys from original phone call to construction. • Reduction in number of site visits required by Network Technicians. • Increased access to voltage recorder equipment due to reduction in number of site visits.	
Outputs	A data engineering solution was implemented, including database architecture and data pipelines to extract, transform, and load (ETL) data from various sources to a suitable central datahub. A data analytics reporting tool was developed in Power BI to visualize data and apply fast-tracking logic to automatically validate confirmed issues to CSS.	
Next steps	The dashboard has been successfully completed and transitioned to Business as Usual (BAU). It has been rolled out to users in ESB Networks Customer Delivery, enhancing the efficiency of resolving customer voltage issues.	

7	**International Community for Local Smart Grids (ICLSG)**	**Timeline: Q4 '22 - Q3 '24**
Scope	This project was intended as a 5-year knowledge sharing programme to promote, support and advance the critical role of smart grids in securing a fair transition to Net Zero. The project was a partnership of electricity distribution network operators, community groups and research partners. Convened by the University of Oxford. The project held regular meetings and workshops over three years which leveraged the knowledge and experience of the international partners by bringing together the learnings from smart grid trials run by the project partners. Of particular interest was lessons from projects in Japan, New Zealand, and Australia.	
Key partners	Oxford University; Ausgrid, Australia; Corena, Enel Foundation, Italy; Low Carbon Hub, UK; SSE Networks, UK; TEPCO Power Grid, Japan; WEL Networks, New Zealand	
Benefits	The research addresses the intersecting themes of community, planning, and operation and is addressed through the following four lenses: current state of play, a just transition, community opportunities, policy, and regulation. The aim of the partnership is to promote the critical relationship between communities and smart grids in securing a fair transition to Net Zero that share ideas, innovations, and opportunities that a low carbon future creates. The themes of the project partnership are: • A fair transition to Net Zero - ensuring that as we take action to decarbonise, people and communities are not left behind and the policy environment supports this transition. • A resilient transition - undertaking adaptation and mitigation measures to continue delivering a secure supply of electricity. • A smart and local transition - exploring innovative ways to support engagement between communities and smart grids and the lessons that can be learnt from the partners projects.	
Impacts	ESB Networks has presented to the group based on our Dingle project, and the community impact that it had. The partners will take this experience and apply to their own innovation endeavours, just as ESB Networks will do for the projects it learns about from the partners.	
Outputs	The network resilient report was published in 2023 and made available to project partners and stakeholders. The project partners are carrying out research focused on Distributed Energy Resources (DER) and the network in 2023 in the Distribution System Operator (DSO) regions, to share insights and learnings into the technical, behavioural, and regulatory challenges in the different partner regions.	
Next steps	In 2024, due to changes in circumstances with the lead partner, the ICLSG project could no longer continue and the proposed 3-year extension to the project was not progressed. Key contacts will be maintained with other utility partners.	

8	Wildlife OHL Contact Prevention	Timeline: Q1 '19 - Q1 '24
Scope	The project seeks to identify and trial novel measures to prevent wildlife from encountering live conductors and overhead line (OHL) network equipment in general. It uses technology to allow technicians to report bird strikes and other issues caused by wildlife, and the use of mobile technology can allow workable solutions to be shared. The project aims to bring about a reduction in bird strikes to the network to reduce Customer Interruptions (CIs) and Customer Minutes Lost (CMLs). The success of the project is in delivering and fielding of deterrents (diverters) that can be shown to be reliable and effective to protect wildlife and the Networks.	
Key partners	Lancaster University, EA Technology	
Benefits	The benefit to the customer will be an improved service (reduced Customer Minutes Lost) through a reduction in wildlife-caused interruptions to supply, while the primary benefit will be to wildlife, who will be deterred from harming themselves.	
Impacts	The project reports positive results from a particular design of 'diverter' which has been trialled in ESB Networks' Northern Region to deter contact between birds and overhead lines.	
Outputs	Project outputs will feed into line design incorporating any measures at the outset, informing upgrades and alterations to account for local conditions. Another project benefit relates to how existing standard materials can be cost-effectively modified to potentially incorporate deterrents during manufacture. Collaboration with Lancaster University has yielded a better understanding of how birds visually detect obstacles and which colours and shapes work best to highlight them. ESB Networks' aerial warning devices specification has now been updated to include a variety of solutions intended to reduce wildlife interaction with overhead network, these devices include anti-perching devices, bushing guards, larger spiral diverters, and dynamic bird flight diverters.	
Next steps	Feedback from the trial has been obtained and will be implemented in business-as-usual activities.	

9	AI Synthetic Analyses of 110 kV Composite Insulators	Timeline: Q4 '22 - Q4 '24
Scope	This project selected from the 2022 Free Electrons portfolio will assess the capabilities and use cases for Simerse AI. The project is developing a significant number (100K+) of synthetic images of two types of 110 kV composite insulators from different manufacturers to see whether synthetic imagery can be used to train an AI algorithm to accurately identify several types of insulators. It is also intended to further develop synthetic imagery of typical defects that can arise on composite insulators with a view to using the tool to automate defect detection. Additionally, this tool aims to detect any visible difference between insulator supply batches.	
Key partners	Simerse AI	
Benefits	This project would provide efficiencies by automating defect detection. It is hoped that this tool may be able to detect visible differences between insulator supply batches. For example, crimping patterns	
Impacts	The tool is intended to provide a system that can be utilised for automated identification of insulator type differences (Stage 1), within type batch differences (Stage 2a) and defect identification (Stage 2b) based on Unmanned Arial Vehicle (UAV) imagery provided by any vendor on the current ESB Networks CON 819 UAV Inspection framework.	
Outputs	The project tested Simerse AI with three challenges: identifying composite insulators, recognizing crimping patterns on end fittings, and assessing nearly 200 towers for batch identification. The AI successfully identified insulators and crimping patterns but struggled with tower assessments due to lighting and image quality issues. Modelling and detecting flashover damage proved too variable for AI, indicating that there is still a need for human assessment.	
Next steps	This project has concluded, and the main recommendation from this study is to consider undertaking further work to define and implement a library of synthetic imagery for all insulator types and configurations on the transmission and distribution systems. This would then allow for insulator type identification and inventories to be automatically determined from the UAV imagery sets collected by contractors for any given transmission line.	

10	Novel Use of Drones and AI for Line Patrolling and Fault Location	Timeline: Q1 '21 - Q4 '24
Scope	ESB Networks has 150,000 km of overhead distribution lines on its network. To manage and maintain the reliability and resilience of the network we carry out preventative maintenance including vegetation management and line patrols (where Network Technicians walk the route to identify potential faults or issues on the distribution network through often challenging rural and forest terrain). The aim of this project is to create a scalable pilot training programme, to deliver drone patrols of overhead network by our staff. The ambition will be to train operatives to operate drone flights Beyond Visual Line of Sight (BVLOS) and to develop AI capability to enable assessment and cataloguing of the data captured. This will optimise the overhead network patrolling process and drive business efficiency. ESB Networks was granted authorisation to operate at an Extended Visual Line of Site (EVLOS) licence from the Irish Aviation Authority to trial and operate the drones. In July 2024, new European Aviation Safety Agency (EASA) drone operational rules were introduced across all EU States. These rules have been adopted by the Irish Aviation Authority (IAA). To ensure compliance with these updated UAS Operational requirements, ESB Networks has revised our Company Standard in respect of UAS Operation and Training and this will be implemented in January 2025. A new pilot training program will commence in 2025 across ESB Networks. New UAS aircraft will also be purchased, with the intention for UAS aircraft to be dispersed throughout regions. Trained and certified pilots with UAS aircrafts within the regions will facilitate a more self-sufficient storm response, fault response and proactive approach to network maintenance.	
Key partners	IAA, FlyRyte	
Benefits	The project has successfully used drones to patrol lines, undertake vegetation audits and assess vegetation encroachment on overhead lines. The drones have proven to reduce patrol times by 80% with one drone able to assess as much as 60 km of lines in one day. The drones can also patrol inaccessible lines due to flooding or inaccessible ground. The project plans to further develop the use of drones and image capture capabilities to audit and assess our network under different use cases.	
Impacts	The use of AI can further enhance the use of this data across a range of use cases from vegetation management audits to line patrols following storms or issues relating to intermittent faults on our network.	
Outputs	In 2022 the project undertook a trial demonstration on our network in conjunction with University of Limerick (UL) to assess the capabilities of larger drones with higher payload capacity for use with LiDAR and advanced cameras on our network and to share learnings from the advanced image analysis features which University of Limerick (UL) are working on as part of their research. During 2023, documentation was updated in line with new European standards and ESB Networks. During 2023, ESB Networks shared learnings with UKPN in relation to the development of internal process, procedures, training, and approvals and certification.	
Next steps	This project has transitioned to BAU. For 2025, the focus will be to complete further training with existing pilots and new additional pilot resources. A quarterly Continuing Professional Development (CPD) will be established for all ESB Networks pilots. Our Beyond Visual Line of Sight (BVLOS) pilot capability will be further developed in 2025.	

11	**Inspection of OHLs Using Drones and Image Processing Analytics**	**Timeline: Q3 '16 - Q4 '24**
Scope	Line inspections on ESB Networks' overhead transmission lines (OHL) and towers are currently carried out manually. To carry out these inspections, the HV lines need to be switched out before inspectors are deployed to carry out visual inspections on all structures and equipment associated with the HV line by climbing its structures. Information on the condition of the HV line is then manually transcribed onto line assessment sheets which are then compiled into an overall report. Disadvantages associated with this approach include: • limited range of ability to undertake inspections due to outages. • dependence on accessible locations on the structures. • data collected can vary in quality and be subject to error. By using new drone and AI systems, this project seeks to develop an innovative alternative to traditional line inspection methods. This will reduce time and resources spent on overhead line inspections, improve safety, reduce, or eliminate the need for outages and optimise the use of materials and resources. A specification has been developed and procurement is in progress to inspect transmission lines using drones. The drone provider will collect visual and location data through visual inspection of structures, insulators, hardware, and conductor. The AI service provider will assess the data through automation, at a basic level to produce an automated report detailing the necessary requirements for line refurbishment. Once procured the project will move into the capture and data analysis phase of the project using AI and comparing systems and solutions. The key objective of the project and trials will be to: • Demonstrate a saving over the current average line patrol. • Evaluate the risks associated with the interaction of drones and network components such as insulators and to establish clearance distances and no-fly zones, if necessary, around live and/or delicate equipment.	
Key partners	TSO (Transmission System Operator)	
Benefits	The use of new drone and AI systems is expected to enable time and resources savings on overhead line inspections, improve safety, reduce, or eliminate the need for outages and optimise the use of materials and resources. Certain inspections would no longer need lines to be switched out, thus improving system security and customer continuity. Additionally, physical line maintenance can be scheduled for regular maintenance outages when works identified by data analyses/AI software can also be conducted. In the event the project proves successful, significant saving may be realised over several years from avoided market adjustments and customer inconvenience that result from scheduled line outages. The potential to reduce exposure of personnel to working-at-height hazard is also of significant benefit.	

11 (continued)	Inspection of OHLs Using Drones and Image Processing Analytics	Timeline: Q3 '16 - Q4 '24
Impacts	The use of AI/machine learning to routinely screen collected inspection images for anomalies, could also allow human experts to focus on high-value-adding analysis of identified anomalies, such as installation/design anomalies. AI can aid in the development of network models that can be used for asset health assessment, asset recording, maintenance planning and future analysis. The technology trialled in this innovation project supports that ambition by potentially reducing scheduled outages and providing a reliable means to identify asset faults before they result in unscheduled outages.	
Outputs	The project has developed and delivered a new Unmanned Arial Vehicle (UAV) inspection framework for programmed UAV inspection and condition assessment of hardware and steelwork on overhead line transmission network. This framework should reduce requirement for costly, higher risk, outage-depending climbing inspections while providing high quality, verifiable asset condition imagery and data/indicators. This framework includes options for additional innovative proposals in the areas of asset health and AI inspection tools. The framework was awarded in early 2023 and is currently being utilised for image capture as business as usual and as part of further pilot projects.	
Next steps	The project is currently being implemented on a business-as-usual basis for HV line assessments under capital projects. This technology is now being examined for value on distribution voltage network (10/20 kV).	

12	**Investigate Statistical Contributions from Distribution Generation: F-Factors**	**Timeline: Q1 '22 - Q1 '24**
Scope	The project aims to research the use of F-factors to account for the potential contribution of connected Distributed Generation (DG) to the Security of Supply (SoS) for ESB Networks. This involves analysing Load Indices 4 (LI4) stations to assess available generation that can contribute to the network during transformer outages (N-1). The project will adopt a fast follower approach, considering methodologies from other jurisdictions to enhance ESB Networks' security of supply standards by including contributions from embedded generation. The goal is to explore F-factors as a method to defer station uprates.	
Key partners	Azorom	
Benefits	The project aims to determine an appropriate contribution of MWs' available from the different types of generation to be considered when analysing the potential benefits to Security of Supply (SoS) and the potential benefits to defer station uprate for LI4 stations (by 2 or more years).	
Impacts	This pilot project has the potential to significantly impact the way ESB Networks approaches distribution network security. By exploring the use of non-network assets, such as connected Distributed Generation (DG), the project aims to enhance cost efficiency and increase the security of supply. The current deterministic standard, which relies on conventional network assets like transformers and circuits, ensures network redundancy and timely recovery of supply during peak demand conditions. However, incorporating DG into the security of supply standard could provide additional flexibility and resilience, potentially deferring the need for costly station uprates and improving overall network performance. This innovative approach could lead to a more robust and adaptable energy distribution system for ESB Networks.	
Outputs	The first stage of the analysis evaluated the potential benefits of F-Factor as observed in UK Distribution Network Operators (DNOs) and considered how ESB Networks could implement it. After investigating network topology and generator connections, it was proposed that F-Factor could benefit ESB Networks by deferring station upgrades. Two approaches were developed to evaluate F-Factor's contribution. The 2021 Load Indices report identified 47 LI4 stations, with generation available at 17 of them. However, two of these did not meet the criteria set out in ENA Engineering Report 130 (EREP 130). ESB Networks, along with AZOROM, analysed the remaining 15 stations using both approaches. The analysis showed limited benefits from applying F-Factor to substation upgrades. Only three out of 47 LI4 substations saw a deferral of upgrades by two years or more due to generation contributions calculated using F-Factor. The limited benefits are due to restrictions like de-minimis (ignoring small DGs) and capping (limiting large DGs' contributions), which significantly reduce the calculated generation contribution. High projected growth rates on the distribution network mean that even when DGs contribute, the deferral period is often not significant in the planning timescale. Non-intermittent generation provies increased security of supply, but is currently rare on the distribution network. Solar generation offers no F-Factor contribution in winter and can be ignored for winter peak loads.	
Next steps	It is recommended that further analysis on F Factor contribution is completed in the future when more distributed generation is connected on the network. It is recommended the findings are considered for inclusion in the Distribution System Security and Planning Standards (DSS&PS) and that the benefits to including F Factors into the SLR's and Load Indices reports is investigated.	

ESB NETWORKS
Three Gateway,
East Wall Road,
Dublin 3,
DO3 R583

Tel 1800 372 757 or +353 21 2386555
Email esbnetworks@esb.ie

esbnetworks.ie