NETWORKS

ESB NETWORKS INNOVATION PIPELINE PROJECTS

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Pipeline Projects

Projects that have come through the initial assessment and are currently in ESB Networks' pipeline of possible future innovation projects are listed below. These projects have been proposed as they address the challenges identified by our Innovation Strategy and provide benefits to customers. However, they have not yet been formally evaluated or approved as innovation projects.

Pipeline Project	Project Description
Novel Use of Drone Technology and Artificial Intelligence for Line Patrolling	A pilot is being progressed in Dublin South that will use drones for quick response damage assessment during fault hunting/fault follow up, investigation of intermittent faults on overhead lines and follow-up quality checks on timber management contracts. Data (photographs) will be captured as part of the project and will be used for comparison reviews against traditional methods. The expected benefits of this trial are continuity (reduced customer minutes lost and continuity improvement), reduction in crew patrolling times and improved safety. This project will have a second phase where drones will be flown Beyond Visual Line of Sight (BVLOS) and artificial intelligence (AI) will be used to assess the data captured to optimise the patrolling process.
Identification of network configurations for Active Network Management (ANM)	Using existing infrastructure and enabling quicker connections for generation are critical in enabling the targets set in the Climate Action Plan for electricity generation from renewable resources. Active Network Management has been identified as having the potential to achieve the objectives cost-effectively with limited impact on the volume of renewable generation produced. This project will seek to understand which network configurations could be implemented through Active Network Management (ANM) so as to maximise use of available capacity for both generator and demand customers whilst maintaining appropriate levels of system security.
Development of Robust Low Voltage (LV) Models for the Future Network Planning and Operations Required to Facilitate Active Energy Citizens	ESB Networks, in common with most utilities worldwide, does not have a detailed, accurate geographical or electrical model of its LV networks. Furthermore, it has limited knowledge of customer distribution at LV other than numbers of customers per transformer. LV circuit loading data is unavailable. The challenges of decarbonising heat and domestic transport and requirements for larger quantities of microgeneration on the distribution network drive the need for access to improved LV data and development of appropriate network models. ESB Networks proposes to develop an innovative framework that will assist in the creation of LV models and assess the potential of a variety of sources of data that might be used to inform and populate the LV models.
Leveraging Enhanced LV Monitoring to Optimise Targeted Network Reinforcement	The LV system has not been designed with the level of electrified heat, transport, and microgeneration being targeted to meet our climate change targets in 2030. It is anticipated that clustering of EVs and/or heat pumps may cause constraints on the current system. ESB Networks must ensure LV network readiness for increased uptake of low-carbon technology to support the decarbonisation to enhance customer continuity. New solutions to provide additional capacity in the LV network must be developed including physical reinforcing and flexibility. Targeting deployment of enhanced monitoring equipment on LV/MV substations will reduce uncertainty on the location of constraints, and help focus reinforcing investment

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	decisions in a more cost-effective way than broad stroke application across existing infrastructure.
Flexibility Access Rights for Customers – Trials of Active Network Management	Access to the Network for Renewable Generation is limited by static network constraints, including network thermal and voltage capacity under the most limiting demand conditions. Smart management of new or existing network capacity could create the potential for renewables to securely and efficiently generate under a wider range of network conditions. The objective of the innovation project would be to pilot non-secured access arrangements for transformer capacity for an embedded generator where the existing approach would be to consider a transformer upgrade. As part of this project, ESB Networks would learn about the practical implementation of this approach prior to a more general rollout both in terms of planning processes and implementation.
Developing and Trialling Novel Approaches to Manage LV Flexibility	ESB Networks is currently collaborating with the Transmission System Operator (TSO) on planning trials for LV-connected flexibility. Significant volumes or clusters of flexibility in LV networks will trigger local congestion in these networks. An ideal system for managing LV flexibility would enable all the flexibility connected at LV to be available all the time. To enable this, two high-level options could be considered: • Reinforcement of existing LV infrastructure • Smart solutions that enable maximum use of the infrastructure Each of these options have costs and benefits associated with them. Costs are dependent on the deployment location and delivering an optimum solution in all cases is complex. In order to understand the capability of smart management solutions, trials will be carried out to assess their capability and practical implementation.
Framework for the Optimal Coordination of Network Management Systems (NMS) and Distributed Energy Resources (DER)	Network capacity is a finite resource and should be used to maximise societal benefits. The scope for innovative connection methods, demand-side response and flexibility will strongly depend on the access rights of loads/generators being optimal and delivering the greatest benefit to the overall energy system. This is a complex challenge. For example, a device which is operated for 15 minutes a year to provide a system service might risk sterilising access to the electricity network for another customer (e.g. demand/generator) operating continuously in either consuming or producing renewable generation. Similarly, 'capacity' needs to be defined in more detail. For example, does an existing customer have the right to use a network for a given load over a given period, thereby preventing other users using the same network? This project would consider these principles and what might be applied in other areas, such as in the allocation of hybrid connections or in peer-to-peer trading.
Congestion Management and Capacity Allocation using Operational Management System (OMS)	Demand-Side Units (DSUs) are aggregated market players, and they comprise a portfolio of Individual Demand Sites (IDSs), which are usually distribution connected. They use demand reduction or on-site generation, or combinations of these, to act in the wholesale markets. In 2015, it became apparent that the activation of these IDSs, as part of the market activity, had the potential to cause local congestion issues on the distribution network. To give effect to the first stages of this understanding, manual studies are carried out once a year and the output from these studies is a list of so-called "Red" sites. These

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	are communicated to the relevant DSUs and they are instructed to refrain from activating these sites for the summer months. However, this approach results in some Individual Demand Sites (IDSs) being unavailable for long periods during the summer months. To reduce these periods of unavailability, a new assessment approach is being evaluated to address the limitations. ESB Networks and NIE Networks have agreed a joint use case and are collaborating with an OMS vendor. There would be a trial programme involving the procurement and testing of the Distributed Energy Resource Management System (DERMS) module, together with a phased transition from the current connectivity model, to a fully populated electrical model with load flow and state estimation.
Development of Optimised LV Design Framework to Enable a Unified Mobile Support Application	To best deliver designs, ESB Networks staff use a number of tools and applications to extract data from the organisation's databases and make assessments of key planning metrics such as voltage drop and transformer capacity. Providing an application that unifies and simplifies these processes should ensure consistency of approach and enable them to complete the design more efficiently and accurately. Providing this support to ESB Networks staff will become more critical in the future as the challenges in LV design become more varied (electrification of heat and transport, microgeneration and flexibility) and the solutions become more numerous and complex (both physical and flexibility solutions such as new transformer options, DSR, new connection options etc.).
Developing 400MHz Spectrum Use for Smart Grid Applications	ESB Networks has acquired licence for the use of the 400MHz spectrum to deploy private, secure, resilient communications at a national level, using cost-effective radio equipment to facilitate the rollout of Smart Grids. As a result, ESB Networks can now leverage benefits from the use of this secure spectrum in terms of standardised communications interfaces and modules on ESB Networks' infrastructure. An earlier innovation project provided learnings as to how this enabling infrastructure might support Smart Grids. This project aims to investigate this further and develop solutions for implementation, including power quality monitoring, non-secure network access, active network management, MV/LV substation load and generation monitoring, active coordination of EV charging, and microgeneration.
Network Flexibility – Non-Wires Solution to Replace Conventional Network Reinforcement	This project will trial a non-wires solution to replace conventional network reinforcement using flexibility solutions. An assessment of locations which require conventional reinforcement will be carried out as part of the project, and the approach proposed in the Smarter HV and MV Customer Connections project will be trialled. This will consider what will be required across the business to implement this new approach to reinforcement including procurement, economic assessment, and operational requirements.
Electrification Uptake Data Analytics Forecasting Tool	By analysing the demographic data from the CSO database, and if appropriate, other public sources of data, along with ESB Networks GIS data, the project aims to develop a forecasting tool for the uptake of EVs and heat pumps in order to predict future network upgrade requirements and better target investment for LV networks with large concentrations of electrified heat and transport.

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Novel Protection for Public Lighting LED Programme	To reduce the electricity usage and light pollution from public street lighting, local authorities have initiated a programme to replace 480,000 lamps across the country with efficient LED lamps. 140,000 of these street lights are mounted on ESB Networks' LV overhead network poles without fuses. An agreement has been reached with Local Authorities (LA) to install a new electrical box with isolators and connectors which permits the LA contractor to effect isolations without the need for an ESB Networks technician to be in attendance. This solution is not suitable for 4,500 lights and requires an alternative solution. For this project a novel alternative solution has been proposed to use an in-line enclosed, weather-proof fuse-disconnect for each light. This will enable LA contractors to carry out the upgrades with increased safety and efficiency, and without the need for an ESB Network Technician to attend.
Develop a Novel Slim Unit Substation to Replace Magnefix Substations >200kVA	To facilitate the electrification of heat and transport, this project aims to develop a newly designed slim unit substation that can be retrofitted into the existing LV Magnefix footprint. This will avoid the impact to the customer and environment of installing a standard unit substation, which is a larger size, in a new open space location.
Development of Modularised Metering and Control for RES Connections	ESB Networks will consider a number of possible designs for the provision of modularised arrangements at Renewable Energy Sources (RES) in which necessary metering equipment can be accommodated. Locating metering in prefabricated modules may have a number of advantages in terms of costs and speed of delivery.
Provision of Enhanced Levels of Reactive Power	A previous innovation project (Nodal controller) sought to use centralised and automated intelligence to allow as much reactive power support as possible to be delivered from specific type of wind generators to the TSO-DSO interface, while at the same time respecting voltage and thermal limits on the distribution network. This project looks to further develop the benefits of the Nodal controller and the provision of reactive power from other types of wind generators (other type B windfarms and potentially type C windfarms) and examine operational issues raised in the original trial.
Optimised Design for 38kV Arc Suppression Coil (ASC) to Support RES Connections	This project aims to investigate different modifications to the design of the Arc Suppression Coils and the changeover switch for wind farm connections in order to facilitate a reduced cost of connection and improve system protection for our generation customers.