Energy for generations

RD&D Strategy 2025-2028

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1 Introduction

ESB's strategy 'Driven to Make a Difference: Net Zero by 2040' commits ESB to become a net zero business by 2040. Maximising the potential of established technologies, such as wind energy (onshore and offshore), solar PV and Li-ion batteries will be critical to achieving a net zero energy system and we will also need to accelerate the Research, Development & Deployment (RD&D) of new emerging low carbon technologies to reach our goal.

There are fundamental changes already taking place in the energy sector in the way electricity is generated, distributed and consumed as society transitions to a low-carbon economy. However, the rate of change needed to achieve our decarbonisation goals whilst maintaining affordable, reliable energy needs to accelerate.

Our innovation strategy outlines our innovation priorities in support of our net zero strategy. Our RD&D activity is an integral part of our innovation strategy which will play a key role in streamlining and optimising our existing business, as well helping to shape the future of our electricity system.

We have been collaborating in research, development and deployment over many years with much success. This strategy seeks to ensure our approach continues to serve us well as we embrace the energy transformation now well underway. It reflects the significantly increased importance of effective and efficient RD&D in maintaining competitiveness, affordability and reliability whilst we transition to a zero carbon electricity system.

This strategy outlines ESB's Research Development & Deployment (RD&D) priorities in line with our Net Zero by 2040 strategy.

ESB's strategic RD&D priorities are to:

- Decarbonise our electricity by 2040
- Develop reliable, safe and resilient infrastructure that is net zero ready by 2040
- Empower customers, citizens and communities with net zero tools and services
- Lead the electrification of heating & transportation
- Optimise our existing systems and deploy enabling technologies

Our guiding principles are:

Our domain is typically Experimental Development, where proven (or near proven technologies) are optimised or demonstrated in ESB's operating environments. We do not typically engage in basic research ourselves but will collaborate with research organisations to enable this.

Our preferred mechanisms for engaging in RD&D includes optimising our existing processes and systems, working with start-up companies, multi national consortium programs such as Horizon Europe, technology developers, universities and research organisations such as Electric Power Research Institute (EPRI).

We use an objective approach to assess new technologies through Technology Readiness Levels (TRLs) to evaluate and prioritise the technologies that we engage with for demonstration projects. In general, we focus our own activities on demonstrating technologies in an operating environment that are at TRL 7 or above.

We will adopt 'best practice' principles including applying a strategic and structured approach to RD&D that is aligned with ESB's Net Zero by 2040 Strategy.

While each business unit manages their own budgets and pipeline of RD&D activities, a co-ordination group meets regularly to enable collaboration by sharing lessons learned and developing best practice across the organisation.

This group also prepares and issues an annual report outlining our RD&D activity over the previous 12 months and planned RD&D activity over the next 12 months.

In particular, the group will enhance the participation and sharing of RD&D activity to support and accelerate the transition to a safe zero carbon, affordable and reliable electricity system.

2 What does RD&D mean for ESB?

Experimental development
Experimental development draws on scientific or technical knowledge gained from research or practical experience for the purpose of achieving technological or systems advancement. It is directed at producing new or improved materials, products, devices, processes, systems or services. Experimental development is typically concerned with testing and optimising our existing systems and deploying technologies with a view to systems improvement, capability building and new technology introduction. Experimental development also involves taking innovative technologies, processes or information technology systems developed elsewhere, and examining how they might usefully be adapted, further developed, demonstrated and deployed in an ESB context.

Applied research
Applied research is work undertaken to gain technical knowledge and is directed towards a specific practical application. Applied research is usually undertaken either to determine possible uses for the findings of basic research, or to find new methods or ways of creating practical applications of basic research. This type of research is best suited to product, process and technology development companies. However, we will seek to use applied research where it helps to accelerate the transition to a net zero energy system.

Basic research
Basic research is experimental or theoretical work undertaken primarily to acquire new scientific or technical knowledge, without a specific practical application in view. This type of research is typically undertaken by publicly funded bodies and agencies such as universities and private research laboratories.

3 Objectives of RD&D Strategy

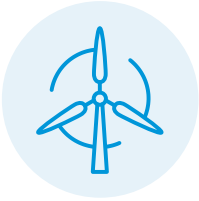
The objectives of our strategy will support the transition to a net zero, affordable and resilient electricity system.

- Establish our RD&D priorities in line with ESB's Net Zero Strategy
- Facilitate greater co-ordination and sharing of RD&D best practice
- Ensure value for money, through sharing & integrating lessons learned
- Communicate with our stakeholders our priorities and plans
- Develop our people and act as a means of talent identification
- Integrate and participate in national research initiatives that align with our strategy
- Ensure Intellectual Property (IP) is proactively managed across ESB Group

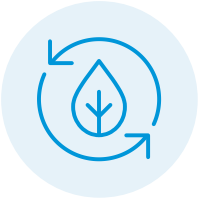
4 RD&D Strategic Priorities

We are driven to make a difference. Creating and connecting sustainable, reliable, affordable energy in a safe way and enabling our customers and the communities we serve to achieve net zero.

ESB's Strategic Objectives



Develop and connect renewables to decarbonise the electricity system by 2040.



Provide resilient infrastructure for a reliable low carbon and safe electricity system

Empower, enable & support customers, citizens and communities to achieve net zero.

Deliver affordable energy while maintaining ESB's financial strength.

Deliver a high performance culture that supports innovation, safety and collaboration.

Our RD&D priorities define our technology roadmaps, whose purpose is to inform and challenge our approach in specific emerging areas in order to decarbonise the electricity system, provide affordable electricity and a resilient, reliable system.

ESB's Strategic Technology Roadmaps

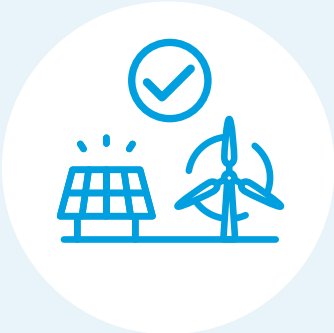
- Electrification of heating & transport
- Long duration energy storage
- Artificial Intelligence
- Sustainable materials
- Safe, reliable & resilient infrastructure
- Offshore energy
- Energy affordability
- Carbon capture
- Circular economy
- Onshore wind repowering
- Network resilience
- Hydrogen & e-fuels
- Grid enhancing technologies
- Sustainable operations
- Demand flexibility
- Data Centre growth

In line with ESB's 'Net Zero by 2040' strategy and the technology roadmaps, we have identified five priority focus areas for our RD&D activities.

ESB's Strategic Objectives

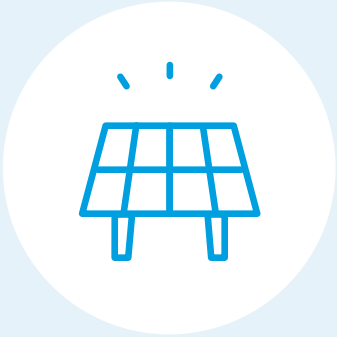
Decarbonise Our Electricity System

We will improve the efficiency and flexibility of our existing generation assets while actively seeking new sources of generation to replace existing fossil-based technologies, without impacting on affordability or security of supply. This means investing and innovating in renewable, low-carbon technologies such as offshore wind, solar, ocean, biomass, hydrogen, batteries and energy storage to manage the responsible transition from fossil fuels. We will also improve the flexibility, system responsiveness and forecasting of renewable generation output as well as develop solutions to manage the impacts of variable renewable generation on system stability.



Build Resilient Infrastructure

We will upgrade the electricity network to facilitate connecting additional amounts of renewable generation (as well as EVs, heat pumps, batteries etc) by improving network operations and network efficiency, improving communications, visibility and control of the distribution network whilst improving network performance through real-time asset condition monitoring. This will increase the safety, resilience, flexibility and reliability of the network to accommodate increasing levels of renewable and distributed energy resources and support increasing levels of electricity demand due to the electrification of heating and transport while also supporting population and economic growth. We will also facilitate energy storage and customer-side and demand-side response on the network.



Empower Customers, Citizens & Communities with New Tools and Services

We will empower our customers and the communities we serve on their journey to a low-carbon future by creating the new tools and services that put them at the centre of the energy system. This will involve the integration of technologies including solar PV, battery energy storage, EV chargers, heat pumps, assessing residential based demand response, developing digital platform offerings and trialing and testing customer appetite for adopting and using new technologies.

Lead The Electrification Of Heating and Transport Sectors

We will assess the impacts on the network from the customer adoption of technologies that enable the electrification of heating and transport. This will include examining different types of EV charging infrastructure and the potential for demand response from EVs. We will also assess the performance and optimisation of heat pump technologies, as well as examining energy system of the future.

Enable Cross Cutting Technologies

We will research and develop enabling technologies by collaborating across the energy industry and with end customers. We believe this approach will be fundamental to transitioning to a net zero energy system. We will assess and adopt new enabling technologies such as artificial intelligence, long duration energy storage, grid enhancing technologies, unmanned aerial, ground & sub-sea technologies and robotics as part of our strategy.

5 Technology Readiness Levels

The majority of ESB's internal activity is categorised as experimental development. We use Technology Readiness Levels (TRL) to define the maturity level to which a technology has been developed. This helps us mitigate the risks associated with attempting to incorporate the technology into our demonstration projects.

As a technology taker, we will typically engage in demonstration projects once technologies have reached TRL 7 level or above. Typically, demonstration projects at TRL 7 will be undertaken where we can accelerate the deployment of a new technology that aligns with our net zero strategy.

We may consider experimenting with early technologies and extending further into the TRL-6 space dependent on certain factors such as low capital intensity, working with a trusted partner, working with regulatory 'sandboxes' or developing specific technology for our requirements. Software, electronics and IT solutions could be included here as these move quickly through the TRL levels. However, capital-intensive technologies will not be considered for early TRL experimental development in an operating environment.

We will collaborate with our research partners and keep a watching brief on early TRL technologies. Where early TRL technologies are aligned with our strategic priority areas, we may consider low levels of support (but not investment) for the development of these through the TRL levels. This could include engagement around utility technical specifications, perspectives around energy market opportunities, participating in the development of industry standards, or providing technical requirements for the integration of new technology. We will also explore the emerging concept of societal readiness levels as a complement to technology readiness levels.

ESB's Strategic Technology Roadmaps

TRL	EU DEFINITIONS
TRL-1	Basic principles observed
TRL-2	Technology concept formulated
TRL-3	Experimental proof of concept
TRL-4	Technology validated in laboratory
TRL-5	Technology validated in relevant environment
TRL-6	Technology demonstrated in relevant environment e.g. 'sandbox'
TRL-7	System prototype demonstration in operational environment
TRL-8	System complete and qualified
TRL-9	Actual system proven in operational environment

6 ESB Preferred RD&D Mechanisms

We collaborate in RD&D activities through a number of preferred mechanisms.

- Working collaboratively with other utilities, industry representative groups, research organisations, government agencies, universities and community groups.
- Investing in pilot and experimental demonstration projects, testing and trialling new technologies, collaborating on regulatory 'sandboxes' and developing new customer products & service offerings.
- Participating in internal and external start-up accelerator programmes to gain access to new emerging technology offerings.
- Understanding societal dimensions of the energy transition and validating customer needs and market assumptions through societal and behavioural change research.

7 RD&D Management in ESB

ESB's current RD&D activities are managed in a de-centralised fashion with central co-ordination, specialist support, safety, dissemination facilitation and delivery of pre-demonstration research from the Innovation team. This approach provides a support platform and enables ESB to be proactive in realising the benefits from emerging technologies, while also building awareness across the company of the opportunities that lie ahead.

While each business unit continues to manage their own priorities (respecting relevant license & regulatory requirements) an RD&D co-ordination group meets regularly to ensure our activities are in line with this strategy and to enable collaboration across the research eco-system. In addition, common best practice approaches are deployed to prioritise projects and ensure alignment between our RD&D activities and our net zero objectives.

8 RD&D Co-Ordination Group

ESB will enhance its management of RD&D through a company-wide co-ordination group who are responsible for the further development and delivery of this strategy. The group will meet quarterly with cross-business representation and its terms of reference include:

Communicate our RD&D Strategy across ESB

- Review and communicate this strategy to relevant teams across ESB to raise their awareness and engagement
- Set out targets and priorities aligned to Business Unit Strategies
- Communicate success stories to encourage further RD&D across ESB
- Seek feedback to ensure our research priority areas, preferred research types, mechanisms and Technology Readiness Levels are defined and are used in the selection of RD&D projects

Report on activities completed and future activities on an annual basis

- Provide a forum for sharing best practice across our RD&D eco-system.
- Ensure our research, development and demonstration activities are co-ordinated with strong collaboration and sharing of information while respecting relevant license requirements
- Facilitate a process of ideas, sharing experiences, lessons learned and a platform to explore new opportunities with colleagues from across ESB

Develop IP governance process

- Develop the systems and processes for developing and managing IP
- Promote and support the creation of IP management across the company

Engage with our external community and partners

- Discuss our priorities with our research partners including third level institutions
- Support the development of closer relationships and collaborations with external partners such as industry, academia, research institutions and government agencies
- Develop and share our knowledge and awareness of developments in the broader innovation eco-system.

Measure and report on performance and effectiveness

- Measure cost, benefit and effectiveness of our RD&D activities
- Benchmark our investment in relation to other utilities

Exploit funding opportunities and Tax Credits to support RD&D activity

- Ensure intelligence around new funding opportunities is shared e.g. EU Horizon/Innovation grants & manage funding applications where relevant
- Manage the annual RD&D Tax Credit process

9 Measures of Success

The success of this strategy will require that it is aligned with our 'Net Zero by 2040' strategy and that it is well communicated across ESB and our external stakeholders

1. RD&D activities are coordinated across ESB and best practice is embedded
2. Resources and investments are prioritised in line with our 'Net Zero by 2040' strategy
3. RD&D activities are managed safely and reported on an annual basis
4. Third party funding opportunities are exploited
5. An effective RD&D Tax Credit process is in place
6. Policies and processes for managing IP are in place

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