

Our Innovation Strategy

Our Innovation Strategy

Summary

This is the Innovation Strategy of Scottish Hydro Electric Transmission Limited (SHETL). SHETL's approach to innovation is common across SSE Power Distribution, which includes Scottish Hydro Electric Power Distribution plc (SHEPD) and Southern Electric Power Distribution plc (SEPD).

Innovation is a core aspect of owning a transmission network in this time of significant change. For SHETL, in particular, we face particular challenges due to the growth of renewable generation in the north of Scotland. This is distributed across a vast geographical area with relatively sparse core infrastructure. Building the required infrastructure will be a demanding task requiring considerable investment.

Our Innovation Strategy is focused on delivering real benefits to our business and our customers. Thus the current focus of much of our innovation is in accelerating the connection of renewables and the construction of the necessary assets. This is reflected in the views of our stakeholders who have told us that the challenge is not only one of capacity but also one of speed. Through our innovation strategy we tackle these challenges head on.

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Motivation and objectives

At the heart of SSE is the fundamental belief that innovation is key to our continued success as a business; without innovation organisations are overtaken and become uncompetitive. This belief permeates all parts of our business and as a result innovation comes naturally and is well supported within all SSE's businesses.

The impact of this has been demonstrated in the activities of SSE's electricity network businesses – SHETL, SHEPD and SEPD. In particular through the work we have undertaken through the Innovation Funding Initiative (IFI), Registered Power Zones scheme (RPZ) and Low Carbon Networks Fund (LCNF). Further, outwith the regulatory framework, we have initiated some extremely innovative solutions such as SHETL's Moray Firth HVDC Offshore Hub project.

We are always exploring future scenarios but, core to our values as a business, we believe that innovation is principally about delivery and implementation rather than pure theory. We believe we can demonstrate this through the innovations that have gone through our development processes and which have become 'business as usual' in recent years.

Across our electricity distribution and transmission business examples of this include:

- § Adoption of ACCC conductor in combination with Trident 132kv construction.
- § Utilisation of GAP conductor.
- § Quad Booster installation.
- § In 2003, first installation in Europe of the American Superconductor D-VAR device to manage reactive power flows on Orkney.
- § In 2009, connection of new generation to fully operational Active Network Management system to manage multiple network constraints for multiple generators on Orkney – this is believed to be a world first.
- § Trenchless techniques for underground cable replacement.

Our aim is to continue with and accelerate this successful approach and use it to address the challenges that the network faces. Our high level objectives are to:

- § Minimise the cost of providing network capacity.

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- § Maximise the use of existing assets to deliver capacity and speed connection.
- § Maintain and improve network performance.
- § Maintain and improve safety and environmental performance.
- § Provide more accurate information on the short and long term asset condition information to allow more informed decision making.
- § Accelerate network development and connections including the integration of increasing amounts of renewable generation.
- § Remain at the forefront of innovation to maintain a competitive edge.

Role of Stakeholders

Stakeholder engagement has been central to the innovative developments in SHETL.

The theme of innovation has been raised in a number of contexts and engagement itself has initiated a number of innovative approaches and ideas. Of particular note is Orkney where the period prior to justification of a transmission link and the installation of renewable generation has been bridged by the development of an Active Network Management system. Subsequent engagement with Stakeholders on Orkney has resulted in further initiatives to free capacity being initiated both by Orkney Stakeholders and within our business.

Within our formal stakeholder engagement process a number of key respondents emphasised the need for innovation stating:

“If better forecasting and therefore investments were made in transmission innovation and upgrades then more timely connection could be made.”

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“Funding for innovation is a worthwhile inclusion: in these fast changing time new low carbon more sustainable solutions are to be welcomed. It is through research that, for example, alternatives to the use of SF₆ as an insulator may be found allowing possible phasing out of this potent greenhouse gas.”

SEPA

The content of these two comments can be seen reflected in our Innovation themes described below.

A fundamental of our innovation strategy is not only to look to our own inventiveness but share our challenges with our stakeholders and allow their creativeness to help address some of our shared issues.

The Challenges

The years ahead will be challenging for the GB transmission network, and in particular those parts of the network high in renewable resources such as SHETL.

The growth of renewable generation in the north of Scotland is distributed across a vast geographical area with relatively sparse core infrastructure. Building the required infrastructure will be a demanding task requiring considerable investment. More information on our plans for facilitating the connection of new renewable generation can be found in our supporting document [Information to support our proposed growth capital expenditure programme](#).

Although there is little in the way of technology that can eliminate the need for capital investment to meet the requirements of new generation in the north of Scotland, the challenge is not only one of capacity but also one of speed. As a consequence, the current focus of much of our innovation is in accelerating the connection of renewables and the construction of the necessary assets. A good example of this is the development of the methodologies and infrastructure for the active network management systems required

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to support the “Connect and Manage” access arrangements.

The key challenges are:

- § Finding quicker, cheaper ways to construct network.
- § Finding ways to increase the utilisation of our existing assets.
- § Maintaining and improving safety and environmental performance.
- § Improving and adapting equipment design to take advantage of advances in materials and control.
- § Taking advantage of advances in sensors and telemetry to improve our awareness of asset condition and utilisation to better manage assets.
- § Identify new commercial arrangements to facilitate flexible and novel solutions.
- § Overcoming skills shortfalls associate with the rapid change in the networks.

If innovation were not to occur a number of consequences would be felt:

- § Significant connection delays and impact on UK renewable target.
- § Overhead line consenting process would not be robust, with a lack of innovation being cited as the reason for the assets being constructed without alternatives being considered.
- § Capital cost would be significantly higher.
- § Significant resource constraints would be felt as a result of concurrency on the construction programmes.
- § Network security would be compromised by the high volume of construction work occurring concurrently.
- § Ultimately aspects of our programme would not be physically achievable.

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Priorities and risks

The prioritisation of innovation can result in a complex multi-dimensional matrix; however the short term focus for us is clear.

Our current priority centres round the implementation and further development of Active Network Management (ANM). This emphasis on ANM is based its success to date, technology readiness, proven low risk approach and the ability to significantly accelerate the connection of renewables.

The cost of ANM bears no comparison with the cost of conventional connections, customer impact is measurable and positive, in particular reducing connection delay. The business risk involved in accepting a constrained connection is mitigated by the provision of best estimates of the likely level of constraint which will be experienced by the developer. In practice, we have found that the developers are accustomed to managing risk and readily incorporate this information into their project planning.

Deliverables

The deliverables associated with innovation projects are diverse and identified in detail as projects are initiated.

Deliverables range from research papers to fully implemented and evaluated solutions at full scale. Some examples from deliverables in our current programme are listed below:

- § A quantification of network resilience to weather in the context of climate change through collaborative work with the Met Office.
- § An evaluation of a full scale operational transmission driven Active Network Management system.
- § An evaluation of a full scale operational Dynamic Line Rating (DLR) systems to realise the additional capacity available from DLR.
- § An evaluation of a full scale implementation of real time Distribution State Estimation to improve the robustness of monitoring systems and improve observability at least cost.

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- § An evaluation of the full scale integration of demand side management in the distribution system for the management of transmission constraints.
- § Delivery of a new lower cost tower designs including retrofit designs which will maximise the use of the existing infrastructure and deliver a reduction in Emergency Return to Service (ERTS) times.
- § Innovative alternative methods of tower construction to lower cost and environmental impact.
- § Full scale evaluation of a system integrating communications infrastructure with transmission infrastructure.
- § Development and application of techniques to detect partial discharge.
- § Utilisation of fibre infrastructure for network physical security and monitoring.
- § Utilisation of new materials in particular conductors and fittings.
- § New asset management monitoring techniques.

- § Understanding the ageing of composite EPDM insulators used at 132kV.
- § Application of Met Office Rating Enhancement (MORE) system.

In light of the breadth of potentially valuable innovation available within SHETL we are increasing our expenditure on innovation in the business. This process has been started by the expansion of our Future Networks team, a group of specialist ICT, network engineering, commercial and regulatory specialists and projects managers. We see our Future Networks team as a long term investment feeding into the supply chain for the network engineers and managers of the future as the network becomes more complex. To this end we have a mix of graduates along with experienced project managers to ensure a group with a strong creative and delivery focus.

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Our innovation themes

We have embarked on a number of focussed innovation themes aiming to assist us achieve some of the key challenges of the coming period and focus our investment. These themes are applicable to commercial, regulatory and technical solutions.

Our innovation themes are illustrated in **Figure 1** and expanded on in Appendix A.

Evaluating innovation

Our innovation assessment process is designed to encourage free flowing innovation balanced with the need to ensure that innovation provides a benefit. To this end we have deployed a number of “Gates” in the innovation process.

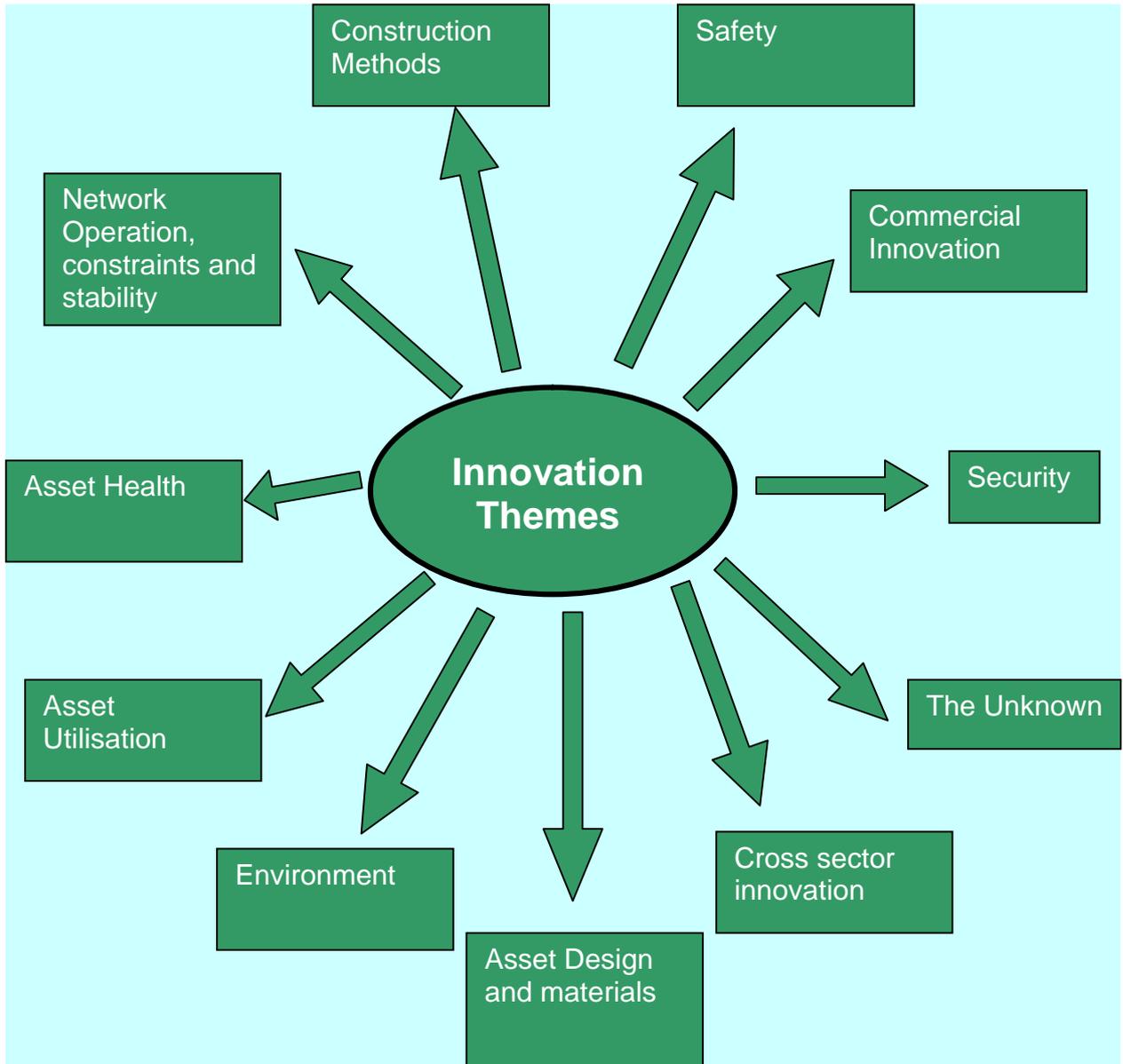
These Gates apply to projects identified through internal and external processes.

Internal innovation screening

Internal innovation is filtered through our “Licence to Innovate” (L2I) initiative. L2I is used for all internal innovation within SSE and is a simple, low overhead process allowing individuals and internal groups to present their idea to a panel of open minded managers. These managers and specialists assess the relevance and probability of a particular idea delivering benefits.

22% of ideas raised through the L2I receive a licence, and a subsequent 17% proceed to implementation. A percentage of these feed into our IFI and LCNF programmes.

Figure 1: Our Innovation Themes



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External innovation screening

Energy Innovation Centre

The Energy Innovation Centre is a spin out of EA Technology Ltd. and takes the form of a “Dragons Den” with support. It is aimed at developing ideas from SMEs, academics and individuals from out-with the industry.

The Centre ensures that ideas are given support and can be developed in a way that is aligned with the needs of the business. It also ensures that other forms of funding are being leveraged prior to specifically seeking IFI funding.

Ultimately the Centre aims to consider and develop ideas and steer these, where possible, through development to a point where there is a business case.

Equipment and Service Supplier engagement

Suppliers are one of the biggest and most rapid producers of innovation. To tap into this, we have undertaken a number of workshops with key manufacturers and suppliers to ensure that they understand the challenges that we face and similarly that we understand their full capabilities. This

approach has been particularly helpful in recent years with strong relationships being built on the back of an open, two way relationship with equipment suppliers.

We have adopted the same approach in procurement. Our intention is to ensure, where appropriate, that the procurement process allows the supplier to present innovative solutions.

Corporate partnerships

SSE has a number of global interests allowing for strong links to be established between businesses across the continents. This has been a source of innovation and should continue to be, in particular as a result of our links to Japan, China and the United States.

Final Evaluation

All research, developments and demonstrations are subject to regular reviews through the Gate process. Final implementation of larger innovations is subject to a business proposal and business justification in the same way as capital investments are considered.

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Maintaining Flexibility

Continuous Engagement and Exploration

Change is continuous, we do not believe that we can have an awareness of all the changes, threats and opportunities that we will face in the medium to long term. As a result, an integral part of our approach is continuous structured horizon scanning.

We use horizon scanning not simply to identify new technologies but also to assess new commercial arrangements and new best practices. We undertake this process through a number of mechanisms:

- § Extensive and action focussed stakeholder engagement with developers, local authorities and statutory bodies.
- § Trade reports and conferences.
- § European engagement, including with ENTSO E.
- § Relationships with key suppliers and leading edge companies within and out-with our sector.
- § Relationships and linkages with non UK utilities.
- § Membership of ENA.

- § Active participation in the Strategic Technology Programme at EA Technology.

- § Specific commissioned pieces of work.

- § Extensive academic engagement.

- § Engagement with Government and Regulators.

The output of this work influences our innovation themes providing new solutions for evaluation, identifying new threats and opportunities and introducing innovation to the business at all technology readiness levels. Importantly this process is also important for identifying when a particular line of innovation should be stopped due to new developments or evolving challenges.

Continuous innovation stimulation

In addition to horizon scanning, we also actively stimulate innovation through a number of mechanisms.

This is done by sponsorship of organisations like the Energy Innovation Centre. In addition our direct engagement and sponsorship of activity in a number of UK universities through the likes of the SSE

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Research Partnership and the EPSRC SuperGen programme focus some of the best minds in the UK on the development of technologies, processes and commercial arrangements aimed at our networks business. We also actively support the IET Power Networks Research Academy which covers a range of topics as the subject of PhD research including work at Imperial College on HVDC.

Conclusion

Innovation is a core aspect of owning a transmission network in this time of significant and revolutionary change.

SHETL has a proven record of innovation brought about historically by the challenging nature of the environment we operate in and, more recently, encouraged and promoted by SSE plc's core values. This places us in a strong position to translate innovation expenditure into real benefits effectively.

Appendix A Our Innovation Themes

