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Scottish & Southern Electricity Networks

TRANSMISSION

Strategic Optioneering Methodology

July 2019

Introduction

This methodology has been developed encompassing the governance and project development processes we have followed in RIIO T1 and reviewed in response to consultation feedback received on the Transmission Asset Development Process document published in September 2018.

Contents

Aims and Objectives

The aim of the Strategic Optioneering Methodology is to provide structure to the optioneering phase of a project or projects such that the synergies between scheme types and drivers can be identified across a geographical region and the overall system delivered provides a holistic benefit.

The objectives are to:

- Produce a robust regional solution
- Provide input to CBA for investment justification
- Deliver a fully developed project solution ready for delivery

Figure 1 below identifies the keys areas that drive and support the optioneering process as well as the building blocks within it.

Strategic Optioneering Methodology

Figure 1: External needs, and Internal support framework to optioneering processes

Scheme Conception and Classification

There are a wide range of scheme types included within our RIIO-T2 business plan proposal, with the application of a Strategic Optioneering Methodology we determine the best solution for each. The schemes are broadly categorised as follows:

Strategic Wider Works

Each prospective Strategic Wider Works (SWW) upgrade provides additional transmission boundary capacity across the network and is triggered by a wider system need (i.e. not by specific connections). By increasing the boundary transfer capacity, the level of network constraint payments, paid by the National Grid Electricity System Operator (ESO) to connected parties to reduce their network usage, is reduced.

The transmission network is intersected by boundaries across which power flows are analysed. Boundaries are used throughout the GB transmission network to split the system into two adjacent parts. They cross critical circuits between the areas where limitations on power flow may be encountered. The boundaries have been defined following many years of planning and operational experience in the transmission system. Both local generator boundaries and wider system boundaries can be defined. Local generator boundaries encompass a smaller geographical area, where a lack of generation diversity leads to a higher probability of stressing the local transmission system in comparison to a wider system boundary.

There are currently seven defined wider system boundaries in the SHE Transmission area known as boundary B0, B1, B1a, B2, B3, B3b and B4, as shown in Figure 2.

SWW are considered as part of the annual Network Options Assessment (NOA) process co-ordinated by the ESO. The NOA process assesses the requirement for all prospective SWW schemes against the annual GB Future Energy Scenarios (FES) and issues a recommendation on which schemes should be progressed. The FES are produced, in consultation with all Transmission Owners (TO) by the ESO. The annual FES provide a range of potential future outcomes thereby allowing the ESO to assess the optimal NOA recommendation using a Least Worst Regrets (LWR) approach to the Cost Benefit Analysis (CBA).

A more detailed overview of this process can be found on National Grid SO web site: **www.nationalgrideso.com/insights/network-options-assessment-noa**

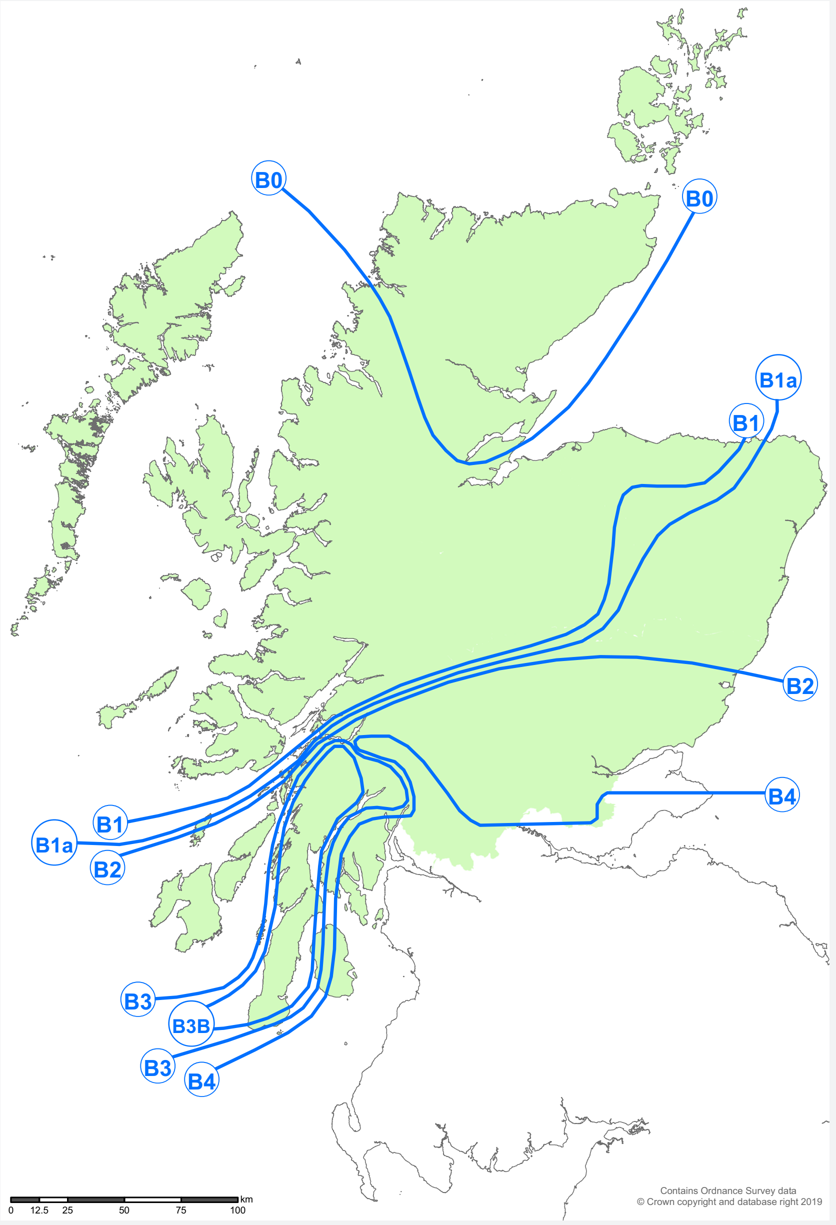


Figure 2: Map of SSEN Boundaries

Connection Infrastructure

We are obliged under the terms of our TO license to offer connections to new generation on application to the ESO. This results in the need to construct, connect or reconfigure existing infrastructure. This type of infrastructure work is specific to individual generation schemes, and the associated optioneering and project development process considers the individual connection requirements.

Depending on the connection requirements, a variety of distinct infrastructure upgrades are considered in the development process:

- **Transmission Connection Assets (TCA)** provide the final connection interface between the transmission system and the end user. Typically, this will involve the construction of a new substation comprising a transformer, switchgear, control and protection equipment and associated interface works within the generation site. The scope for these works is generally fixed with limited possibility for alternative configurations.

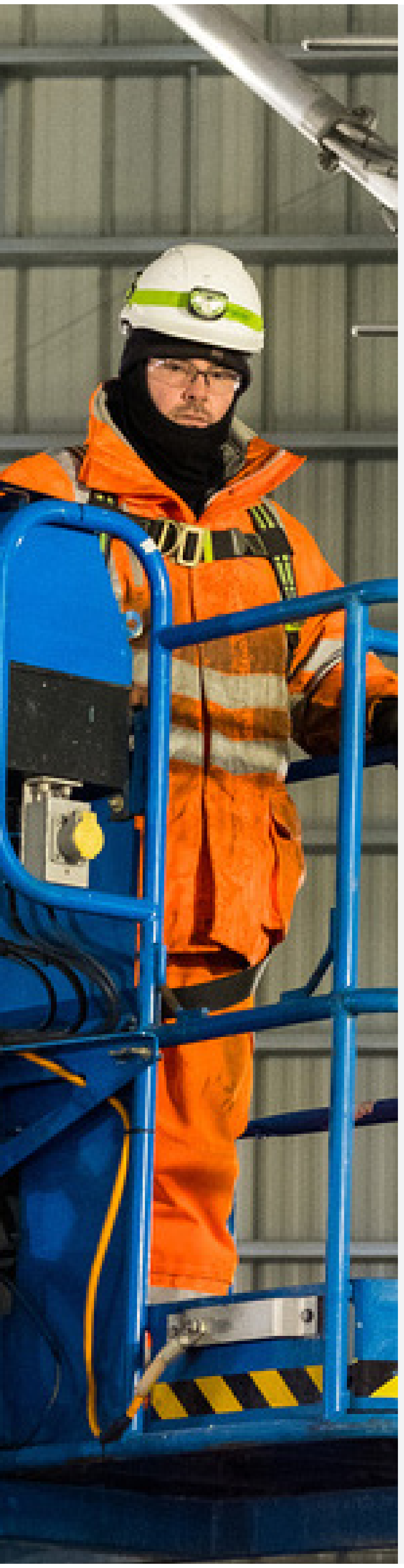
- **Sole Use Infrastructure** provides connection from the new generation sites TCA equipment to the transmission network. Typically, this will involve the construction of a new single circuit overhead line (or underground cable where applicable) which, as the name suggests, only provides connection for an individual generation scheme. The development of Sole Use infrastructure normally involves consideration of alternative technical options. System studies determine the optimal connection point on the transmission network; detailed routing assessments determine the optimal route and associated technology solution. The scope of Sole Use work is usually fixed, however there may be circumstances in which a Whole System (i.e. holistic view of the whole network) approach should be considered and the benefits of taking a wider view of the network assessed.

- **Infrastructure associated with the connection of Offshore Transmission Owners (OFTOs)** is developed in an equivalent manner to Sole Use Infrastructure. Typically, the connection of OFTO's will involve the extension of an existing substation site or construction of a new substation where this is justified as the most economic and efficient means of connection. As with Sole Use infrastructure, the scope for the new infrastructure is usually fixed, however where there are other projects in the region that can be considered in the overall economic and benefit analysis a wider assessment will be undertaken.

- **Shared Use Infrastructure** will be required where there is a need to provide additional capacity to connect several generators onto the network. Typically, this will involve the construction of significant new infrastructure on the network based on the additional capacity of the new generation looking to connect onto the network. This could involve the construction of new 132kV or 275kV circuits and associated substation; or reinforcement of existing infrastructure (uprated circuits or transformers). There are two key interrelated challenges in the development of shared use infrastructure:
  - External factors drive changes in the number and size of generation schemes, such as consents and government policy. This creates a changing network background of triggers for the new infrastructure
  - Sizing of new infrastructure to meet future unknown generation demands (i.e. anticipatory investment ahead of need)

The uncertainty associated with these issues means the determination of the optimal solution in some cases can be challenging.

Scheme Conception and Classification



Non-load Related Infrastructure Upgrade

These works are triggered on a condition/performance basis and are broadly split into two categories – Lead Assets & Non Lead Assets.

Lead Assets comprise Transformers, Switchgear, Reactors, Underground Cables and Overhead Lines (Conductor, Fittings & Towers) with risk analysis carried out using a Condition Based Risk Management (CBRM) platform. A methodology has been implemented to use this CBRM platform to calculate asset risk in a monetised format that can be used to influence our decision making regarding intervention on transmission assets. Where there are credible alternatives for carrying out a proposed intervention, for example replacement of a transformer in situ or offline, a CBA will be carried out to support the selection of an optimal solution. There may be cases where Non Load interventions are assessed in conjunction with Load related upgrades as part of a wider strategic CBA in line with our approach to a holistic regional development of our network.

Non Lead Assets comprise all other assets on the network such as Protection & Control, Communications, Civil Works/Buildings, Disconnectors, Battery Systems etc. Non Lead assets also include the replacement, refurbishment or upgrade of some of the key infrastructure elements needed to operate our network. This incorporates elements such as our Central Control Room facility, Spares & Warehousing and Black Start Capability. Justification for refurbishment, replacement or upgrade of these types of assets is usually based on condition assessment along with wider system needs and drivers. Where alternative options are available for either refurbishing or replacing such assets, analysis will be carried out. As with other categories of works already discussed when synergies are identified with other scheme triggers this will be considered in the technical and economic analysis.

Other

Other, miscellaneous infrastructure upgrades may be required on our network due to operational requirements. Generally, the need for such upgrades is based on technical considerations. Any alternative solutions, if applicable, are considered using our CBA methodology.

Application of CBA

Cost Benefit Analysis is one of the tools used to determine the best option for the delivery of a scheme; regardless of the type. As discussed above in many cases the network solution is fixed and the preferred option is therefore determined by technical competence, environmental impact and least cost assessments. Where more than one viable option exists, determination of the preferred solution will be supported with the application of CBA.

The application of CBA in the development of projects can be found in our Cost Benefit Analysis Methodology document (to be published December 2019). CBA is normally carried out at the midpoint of the optioneering phase at which stage the viable options have been determined but the refinement of a preferred solution has yet to be carried out (see Figure 3). The methodology discusses our approach to the application of CBA as well as the different methods that are used depending on the complexities of the scheme proposed.

Stakeholder Engagement

The engagement of stakeholders is a continuous piece throughout a project lifecycle and forms a critical part of the optioneering phases. As discussed above there are three broad categories of system need (SWW, Connection Infrastructure, Non-load) these combine with stakeholder need to create the background against which the schemes need to be developed.

An SWW project, at concept stage is likely to require engagement with the SO and other TOs. Connection works require engagement and ongoing involvement with the contracting developer and in some cases SHEPD.

The stakeholder engagement for individual non-load driven works is generally internal as in most cases these are carried out local to existing infrastructure. However, if for an example wholesale replacement of a large asset is recommended this will require engagement with a wider stakeholder body.

As schemes move through their optioneering the range of stakeholders engaged changes and increases from those who drive the project at the start, to encompass those who are affected by the works and whose feedback is required to ensure that we are carrying out the best solution for all those impacted by the work.

Our work with stakeholders during optioneering is in line with our Stakeholder Engagement Strategy.

Support Framework

The business strategic objective is to enable the transition to a low carbon economy. In support of this the business has set out four core themes, which are upheld throughout our project optioneering:

- Stakeholder-Led Strategy
- Safe and Secure Network Operation
- Sector Leading Efficiency
- Leadership in Sustainability

Themes

Taking these themes in turn, in the context of optioneering:

Stakeholder-Led Strategy

The definition of a stakeholder changes and grows throughout the development of a project. At concept stage our stakeholder pool is quite small and may include ESO, Scottish Power for large scale reinforcements or a windfarm developer for smaller works. As a project matures the stakeholders increase and formal and informal consultation may be required with land owners, residents, interest groups and local authorities. There is a continued iterative process through the project life meaning the stakeholders and their feedback form part of the core of the decision-making process.

Any works which require Town and County Planning, or Section 37 consent, follow a statutory consultation process. For large or complex works we undertake additional consultations with both the statutory consultees as well as the local populations impacted by the works. These additional consultations take place throughout the project lifecycle: in advance of the selection of a preferred option, in advance of consent application, and in some cases on regular intervals through the refinement and execution phases. While in most cases our external stakeholders are statutory consultees and local populations, consultation with key suppliers and framework contractors is also prudent in the development of the complex projects and/or those proposing to employ novel or innovative solutions.

Our internal guidelines on circuit route selection (overhead lines, underground and subsea cables) and substation site selection provide a consistent frame work for the processes we follow in the determination of a preferred solution for these types of developments. These documents support the approach to engagement with stakeholders the timing and key hold points.

Safe and Secure Network Operation

Optioneering is a multidisciplinary task requiring the diligent application of Engineering policy and specifications as well as coordinated consultation with Operations and Control personnel.

All projects are subject to the Construction Design and Management (CDM) Regulations and through these, designers ensure that they are considering the whole life cycle of an asset including asset management, maintenance, repair and removal to ensure that all risks have been removed or reduced to acceptable and manageable levels.

Other safety influencing factors which are not inherently plant based include: means of access, and the strategic importance of an asset. Where an asset is considered strategic additional security considerations may be required.

Sector Leading Efficiency

The overall goal for the optioneering of a project is to deliver the right scheme at the right time as economically as possible. To achieve this, we must satisfy ourselves and stakeholders of the need for a project and be clear about the deliverables.

The conception of a project starts with the System Planning (load driven schemes) or Asset Management (non-load driven schemes) teams depending on the need. The project development teams work very closely with System Planning and Asset Management to ensure that the needs are clearly understood and identify where there may be synergies between different scheme drivers.

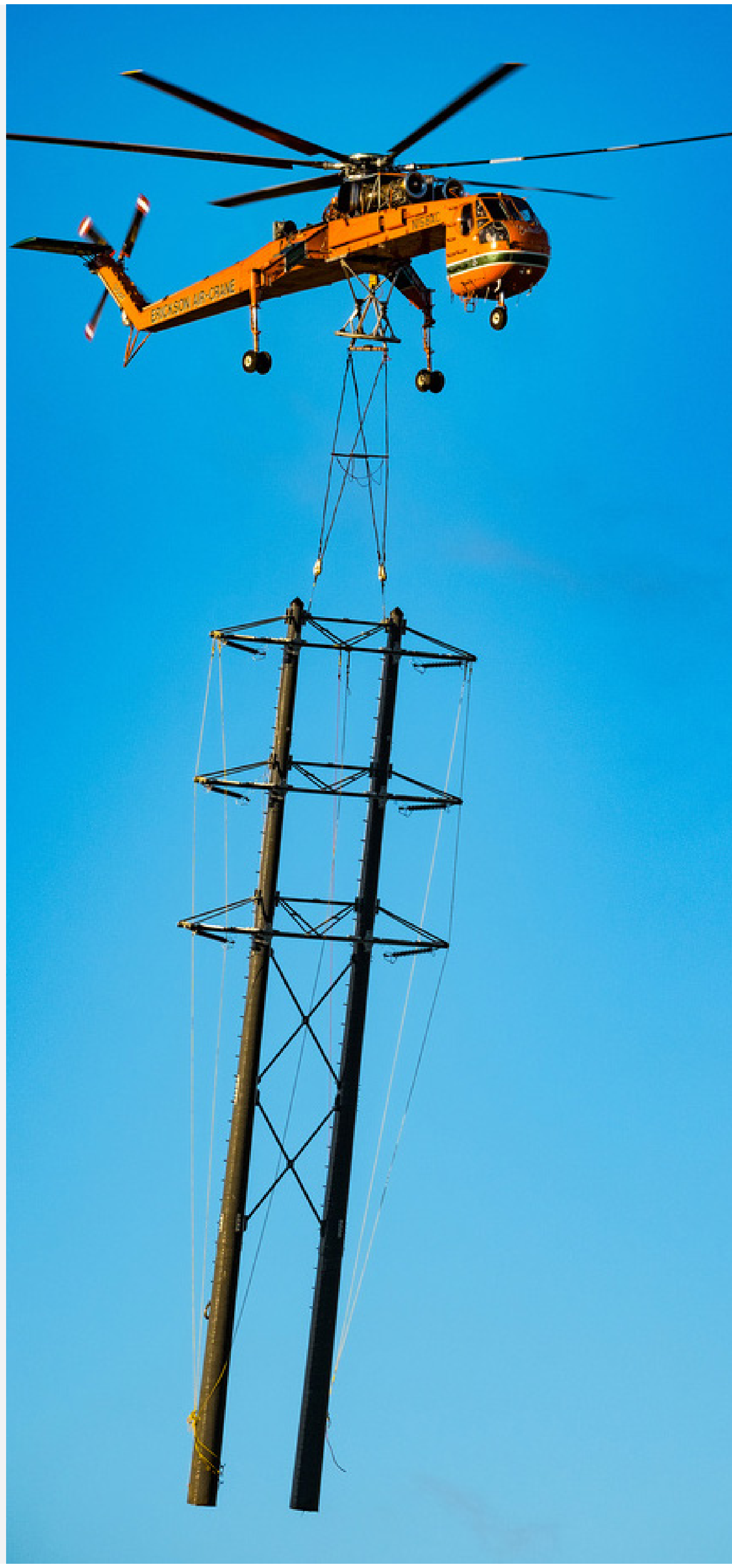
We employ a regional approach to project development with the Project Development team organisational structure supporting six regions. The regional teams have built a regional network knowledge, understand where project interdependencies are and develop relationships with key stakeholders for their area which allows the teams to build on their inherent network and geographical knowledge as well as relationships that arise from this. This knowledge means that designs and timing can be manipulated as required to ensure the most efficient delivery and design as possible. This economic analysis considers everything from plant design to outage coordination and procurement strategy and where multiple options exist CBA will be used to support the selection of the preferred option.

Leadership in Sustainability

Leadership in Sustainability: By ensuring that we are doing the right thing at the right time we are building sustainability into our designs and assets. At a practical level, through the application of engineering policy and standards we achieve the addition of assets onto our network which have a positive contribution to our Operation and Maintenance cycles.

With the application of innovation policy we take advantage of technological improvements in plant and material design to get more for less, improve life cycle performance, or reduce carbon footprints. The application of CBA is used as appropriate to ensure we consider and account for the benefits and costs that our efficient and forward looking design process provides.

The preferred option is refined with engagement of key contracting parties as appropriate to ensure that the scope of work is well defined, and any risks are eliminated or reduced.



Support Framework

Governance

Our approach to development of new infrastructure is governed by our Large Capital Projects (LCP) Governance process. The LCP process has five Gate stages. The optioneering process comprises the first three phases from Gate 0 through to Gate 3 as shown below in Figure 3:

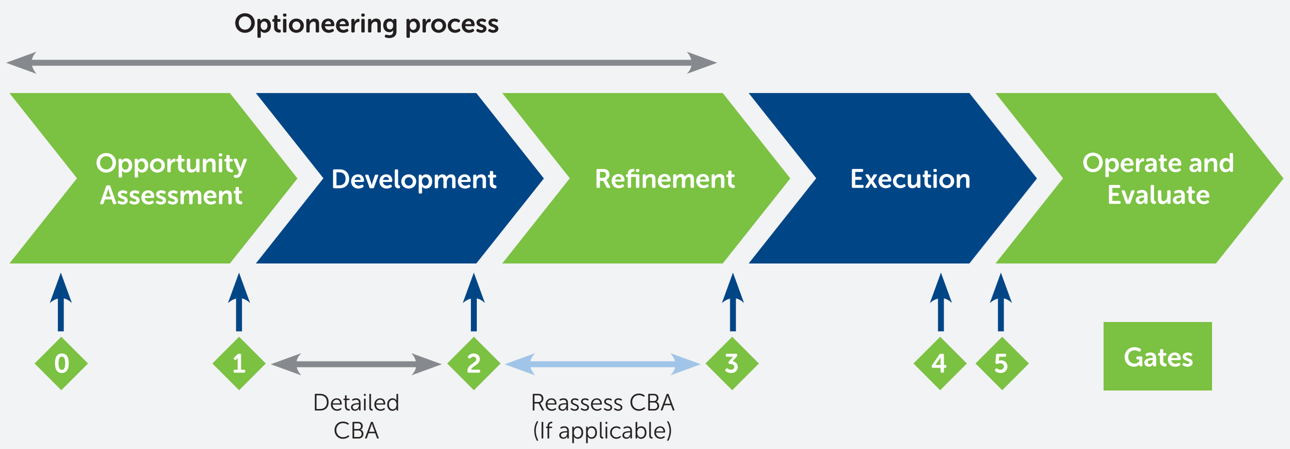


Figure 3: LCP governance and Gate stages, with optioneering phase highlighted

Gate 0-1

Opportunity Assessment; where the need for investment is identified and initial options are considered. At this stage the application of any innovations that could allow the delivery of a more efficient solution are considered in line with the Innovation Strategy (to be published December 2019). The outputs from this phase are initial preferred options identified based on an initial optioneering process involving consideration of Cost (Totex), Environmental and Technical factors.

For Load Related infrastructure investments, this will usually involve identifying a preferred route corridor for the new infrastructure along with preferred substation site locations. It should be noted that in cases where there are alternative credible options (e.g. upgrading of existing infrastructure, alternative Distribution type solutions), further work may be required in the next phase to determine the optimal solution. This is particularly relevant where the investment is being developed against a changing background need (e.g. changing background generation driver).

For Non Load Related investments, this phase will usually involve the identification of potential refurbishment or upgrades along with associated costings and benefits.

Gate 1-2

Development; where further refinement is undertaken on the preferred options with more detailed costing, design refinement including routing assessments and environmental studies. During this stage, detailed CBA (where applicable) is carried out to determine the preferred option.

For some Load Related schemes, the timeframe between Gate 0-2 may be more than two or three years meaning the background drivers for the investment may have changed during the development period. It's therefore important that the CBA is carried out considering the latest information on the investment driver, this is usually completed in advance of the scheme being approved to proceed through Gate 2.

For Non Load Related schemes, the timeframe between Gate 0-2 is much shorter and typically less than 3 months. The approach during Gate 1-2 is to further refine the option costings before completing the CBA to determine the preferred option where several credible alternatives are being considered (for example comparing on-line and off-line build).

Gate 2-3

Refinement; where the preferred option is further developed with detailed design completed along with consent application where applicable. Further verification of the CBA may be required within this phase if the background drivers for the investment have changed (e.g. generation drivers, asset condition changes etc) On approval to proceed through Gate 3, a scheme is deemed to be approved for construction and therefore the scope of the scheme is fixed.

Gate Deliverables

The Gate stages as set out above ensure that there are governance hold and check points at key stages throughout the optioneering phase and the need and efficacy of a scheme is still valid and clear.

Policy

The optioneering phase of a project is underpinned by numerous policies and strategies.

These inform the project development decisions on circuit routing, choice of technology and environmental considerations as well as wider project impacts on sustainability and stakeholder relationships.

While the list of policies and strategies that are applied in any scheme are individual to that scheme and its scope of work, the ones which are at the core of the optioneering process are:

- Engineering
- Environment
- Land
- Asset Management
- Procurement and Commercial
- Protection, Control and Telecoms
- Stakeholder Engagement
- Innovation

The application of the polices and strategies in project development under the LCP governance framework ensures that we are consistent in approach and achieve the overriding need to do the right thing at the right time.

Optioneering

Regional Approach

The LCP process as described above is based on individual schemes passing through the gate process. Practically we approach the development of infrastructure across our network on a regional basis, which provides significant benefits including:

- Holistic regional approach that considers multiple drivers across each of the regions. This may include both Load and Non Load investment drivers covering multiple schemes, in such cases this may require the use of CBA in the decision making process on a regional basis.
- A clearer understanding of wider factors that may impact the decision-making process, for example deliverability factors including impacts of system outages.

The SSEN network, for the purposes of scheme development is segregated in six regions (Figure 4):

- Argyll & West
- Caithness & Orkney
- Eastern & North East
- Central
- Western Isles
- Shetland

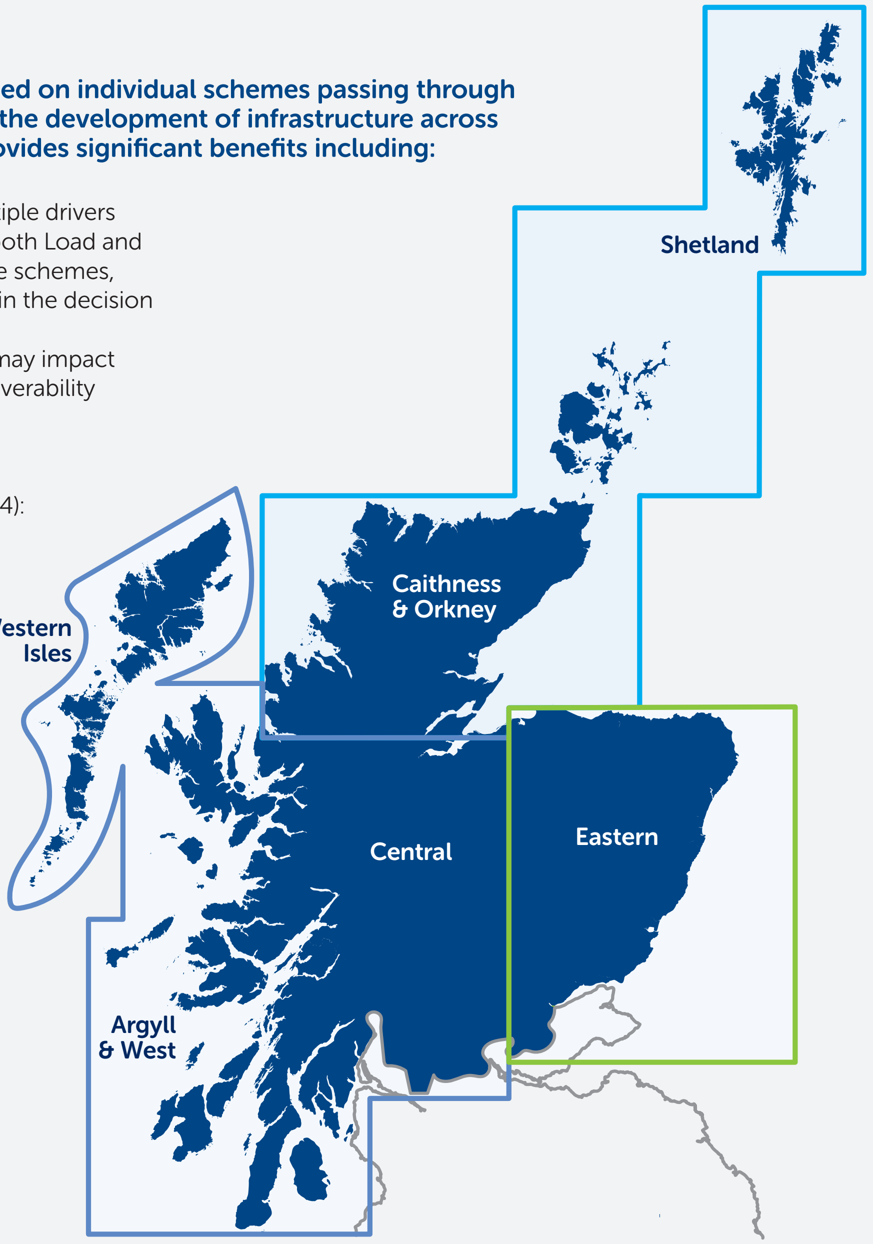


Figure 4:
Map of regions as applied in the Project Development team

The management and progress reporting of the project portfolio across a region is facilitated using a Regional Dashboard.

The Dashboard captures the status of live projects to ensure the efficient use of personnel and contracting resource. Other information captured includes project cost estimates compared to allowances and a regional map showing the geographical relationships between works.

The dashboards are updated on a quarterly basis and the output shared with supporting teams to allow them to manage priorities and workloads. The dashboard captures the changes in project status in terms of consent, change in contractual commitments and how this may have moved since last quarter. This analysis and review on a regional basis allow us to maintain an efficient method of work and ensures we capture any interfaces at the earliest opportunity.

Development Team

The conceptual phase of a project is influenced by our approach to whole system planning and this mind set is continued as projects move from the System Planning and Asset Management teams on to the Development team.

In support of the Regional Approach the Development teams is organised as shown in Figure 5

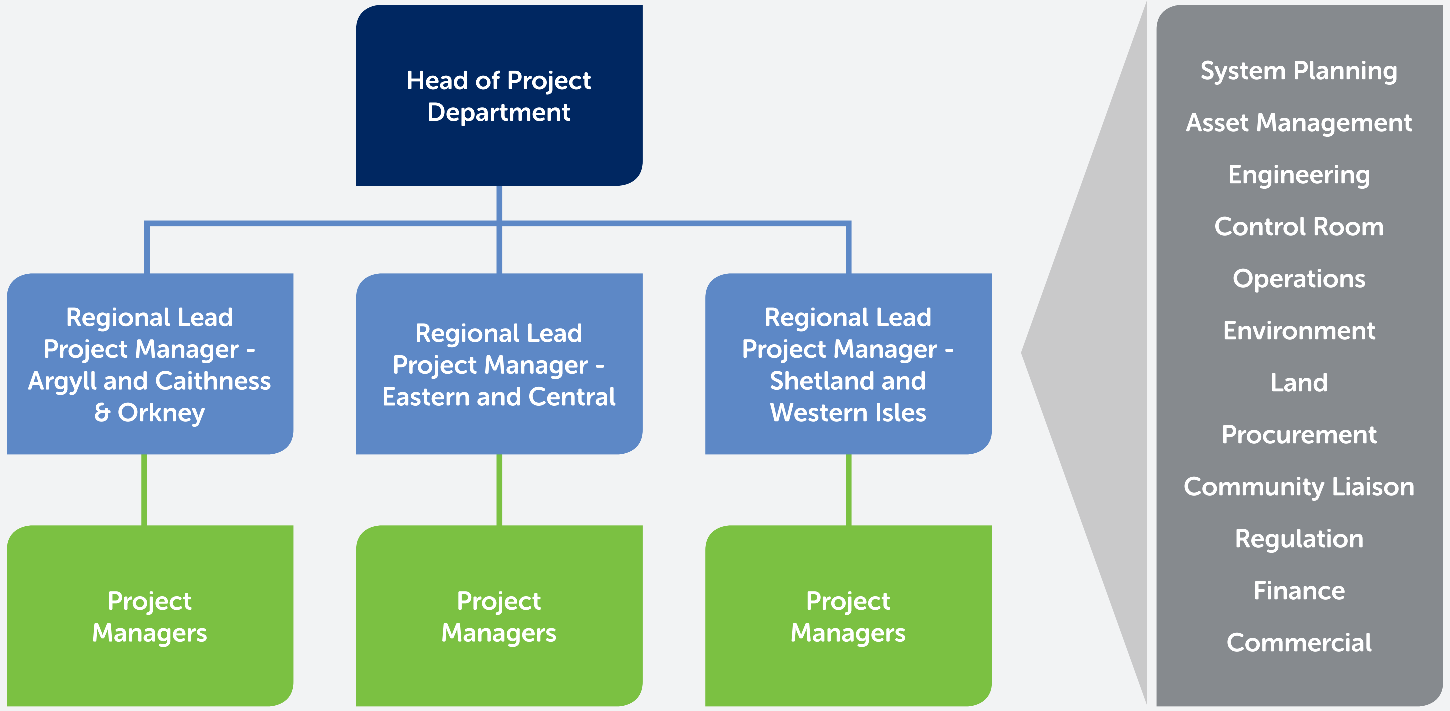


Figure 5: Project Development team structure and supporting functions

The Development team own a project from acceptance of a conceptual design and will consider how an individual project interfaces, interacts and impacts other pieces of work in development or construction within their region.

In addition to this the parameters set out in engineering standards are applied to define the envelope within which a project is to deliver its needs and requirements.

This organisational structure allows interfacing and dependant projects to be identified and considered together taking account of plant design and layout, outage coordination, coordination of surveys and investigations. Supporting documents such as the Overhead Line Routing Guidelines and Substation Site Selection are married with policies through the optioneering process. The iterative and interlinking nature of project development is shown in Figure 6 demonstrating how we manage the optioneering process against the changing landscape of project drivers.

Optioneering

At the key decision-making points in the optioneering process stakeholders are engaged, as well as throughout the project life cycle. This could be through early consultation with local residents, with local planning authorities or with generation customers and the SO. The level of consultation is commensurate with the complexity and impact of a project.

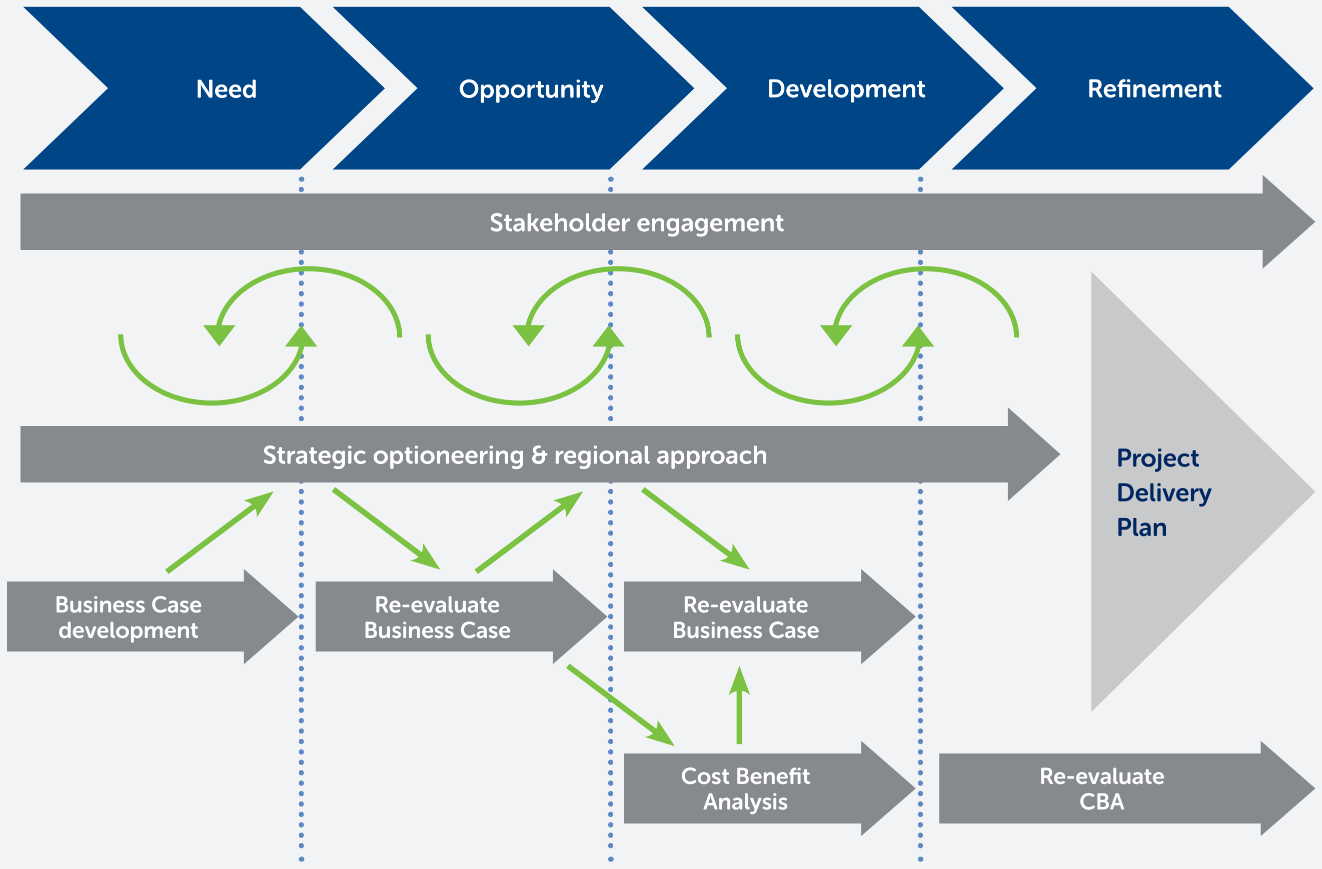


Figure 6: Iterative assessment of scheme need and options

Business Case

At each Gate stage of the LCP process a suite of documentation is produced for assurance and approval to proceed to the next stage.

The optioneering phase demonstrates that the system need is well defined and understood, the drivers are well articulated, and these elements documented in the Business Case. The Business Case also states the preferred option to be delivered and its costs. Other supporting governance documentation detail the selection of the preferred option and define the scope of work and the key deliverables required.

The programme and costs are well developed as well as a pathway to consenting the scheme and its safe and timely delivery with any risks and mitigation measures well defined.

The product is a defined project scope of work which supports our policies, the regional considerations and stakeholder engagement thereby arriving at fully justified project need and cost, supported by CBA.

Conclusion

The methods used in optioneering projects supports the business aim and strategic themes by ensuring that:

- Renewable connections are made in a considered manner: developed in partnership with developers and in consultation with communities; considering network reinforcements in view of the wider system need and ensuring any economies of scale and delivery strategy are realised
- We consult with and respect the responses of our external stakeholders: engaging with our local and national audience in a tailored manner to ensure the best outcome for the project and those affected by it
- Engineering, operational and asset management policy are considered: in the development of the designs best practise is embedded in the optioneering to ensure that we are applying a consistency to our technical approach as well as considering the ongoing operational and maintenance requirements of infrastructure designed with a lifespan of more than forty years.
- Whole system planning and regional approaches are applied: a holistic approach is taken to the development of the network taking into account the interactivity of the Transmission and Distribution network and overlaying the regional characteristics in terms of geography, commercial background and asset condition.
- The application of sustainability, environmental and innovation policy: making sure the option pursued is the most efficient use of resources and that all viable alternatives have been considered in the journey to a fully justified package or work.

In combination, all the above contribute to a sustainable future network, developed in a measured and efficient manner where the whole life cycle of the infrastructure has been considered.