Scottish & Southern Electricity Networks

TRANSMISSION

Skye Dynamic Line Rating

Medium Sized Investment Project (MSIP) Submission

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Executive Summary

In accordance with Part C of Special Condition 3.14 Medium Sized Investment Projects (MSIP) Re-opener, this application presents the case to develop and install a Dynamic Line Rating (DLR) system on the existing Skye 132kV circuit from Edinbane to Broadford. This MSIP submission is presented alongside the proposal to install DLR on the 275kV OHL circuits from Beauly – Loch Buidhe and Loch Buidhe – Dounreay (subject to a separate MSIP submission), which will be informed by the technical and operational learnings from this project.

As GB transitions to a low carbon economy, a significant quantity of renewable generation will need to connect to our network throughout the RIIO-T2 period. To enable this growth, new and innovative solutions will be required to operate and respond to the challenge. DLR can help through increasing the current carrying capacity on the overhead line (OHL) in our area, either as a retrofit or as part of new circuit builds. This has the potential to provide significant benefit to GB consumers by mitigating network constraints across the GB system and aiding the ESO in managing the system.

The Skye 132kV circuit between Fort Augustus and Ardmore currently operates on a constrained basis, with generators constrained off the system when circuit capability is expected to be exceeded. Reinforcement of the Skye 132kV circuit is proposed to be completed by December 2025. Ahead of this reinforcement, and given that the circuit is already oversubscribed, there is a unique opportunity to install and monitor DLR technology for the first time on our network.

The **primary** benefit of this DLR installation is to allow us to gain deployment experience on an existing circuit with active constraints and better understand the technology through monitoring of performance against these known constraints. Following assessment of the performance of the DLR system on the Skye circuit, the DLR system will be considered for deployment on the reinforced Skye 132kV circuits or an alternative circuit on our system that would benefit from increasing seasonal ratings. The technical and operational learnings from the project will aid in the identification of further deployment opportunities in other areas of our network where constraints are expected to occur, with the intention to identify and deploy at least a further two projects before 2027. Ultimately, expanding our knowledge and experience in the deployment and operation of DLR will allow for its introduction to the rest of the network as business as usual, delivering further benefits to the GB system and the GB consumer.

In relation to Skye, as a **secondary** benefit, the DLR system will also offer a route for the ESO to reduce the constraints costs incurred annually by [redacted] for management of the Skye 132kV circuit. However, the benefit of this project must not be assessed solely on economics. This a time-limited opportunity to study the impact of DLR on a constrained system ahead of reinforcement and will be a crucial part of providing learning ahead of the proposed deployment on North of Beauly. Any delay to progressing the project will risk missing the window of opportunity to gain valuable deployment experience and potential to mitigate constraints.

The DLR system will consist of meteorological stations placed at approximately 10 locations on the Broadford to Edinbane section of the circuits. These will relay real time environmental conditions to an Active Network Management (ANM) system to calculate the real time temperature of the conductor and in turn the OHL rating, maximising the capacity of the existing OHL to securely transport more renewable electricity.

The RIIO-T2 allowances requested for this the project is [redacted] with the works to be completed by February 2023. This overall cost constitutes [redacted] capex and [redacted] of associated opex allowance, as calculated through the Opex Escalator[1] mechanism. The full lifetime total cost of the project is [redacted]. We are requesting funding based on a Class 1 estimate. As the bulk of our funding request relates to

[1] In accordance with Scottish Hydro Electric Transmission Plc Electricity transmission licence Special Condition 3.36 Opex Escalator (OEt)

the stable cost of the DLR and ANM systems we are confident that the costs presented for these components are robust.

We propose that a regulatory decision should be made within four to six months of this submission to ensure existing project timescales can be met.

While the total cost of the project does not exceed the minimum threshold for MSIPs, this submission is being presented alongside other applications which have a cumulative value above 0.5% of ex ante average base revenue, and follows Ofgem's suggestion from discussions on our RIIO-T2 Business Plan that MSIP is the appropriate funding mechanism for DLR projects.

1 Introduction

1.1 Scope

This MSIP application sets out our plans to design and install a Dynamic Line Rating (DLR) system on the existing 132V OHL circuit on the Broadford to Edinbane section of the Fort Augustus to Ardmore 132kV circuit, as shown on the map in Figure 1.

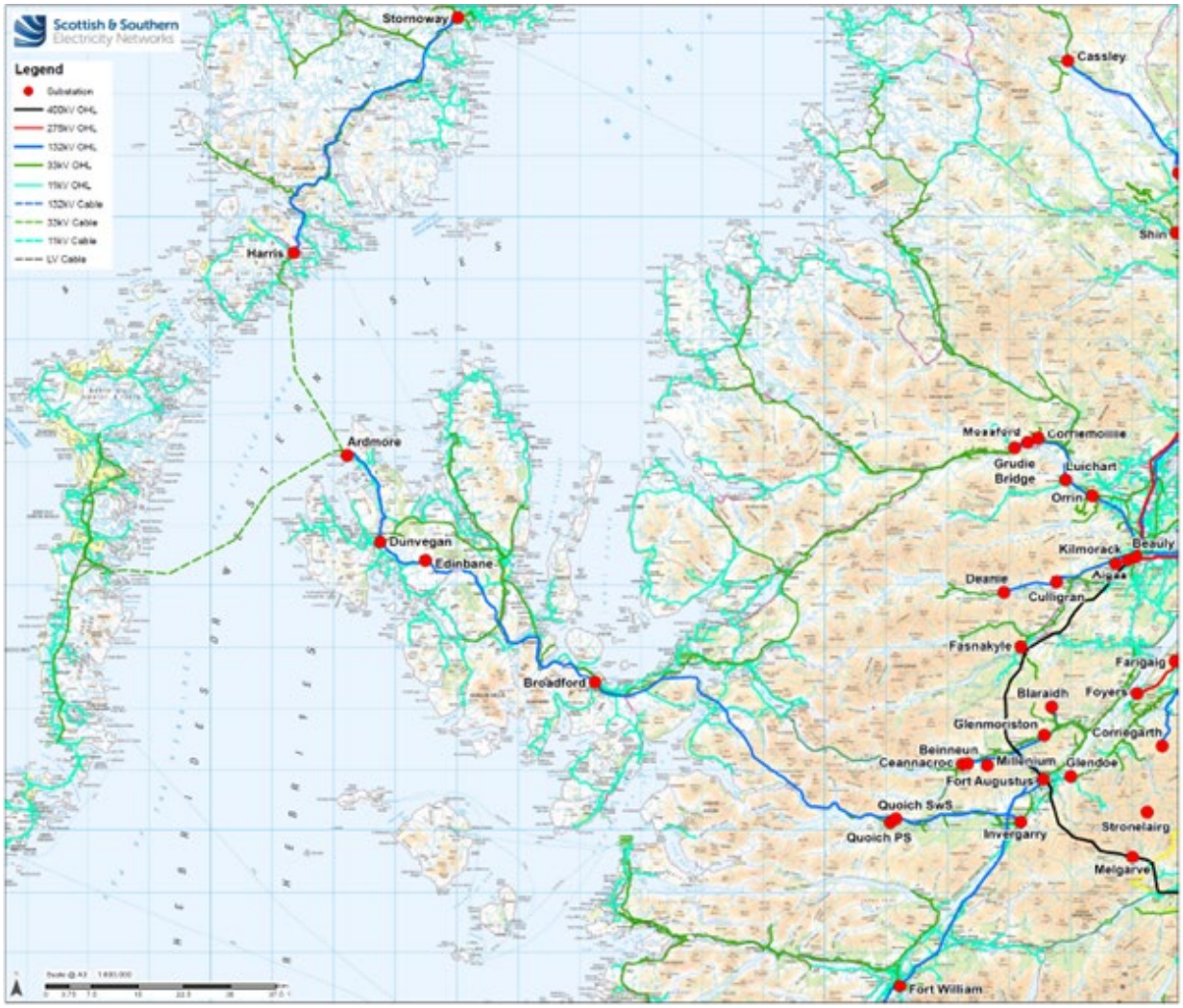


Figure 1. Map showing existing 132V OHL circuits at Broadford Edinbane

1.2 Structure and content

The MSIP submission is structured as follows:

Section 2: Need

This section provides an explanation of the need for the project. It provides evidence of the drivers for undertaking the planned works and where appropriate it provides background information and/or process outputs that generate or support the “need”.

Section 3: Optioneering and preferred option

This section presents all the options considered to address the "need" described in Section 2. Each option considered here is either discounted at this Optioneering stage with supporting reasoning provided or is taken forward for further analysis.

Section 4: Stakeholder engagement

This section includes identification of relevant stakeholders and information on how this has supported development of the project

Section 5: Whole system

This section discusses our Whole System approach.

Section 6: Cost information

This section includes evidence of expenditure justification, cost drivers, forecasting and mitigation whilst identifying the costing approach and rationale for each element of the project.

Section 7: Conclusion

This section provides a summary of pertinent points from the preceding chapters, as well as providing indication of timeline and next steps.

1.3 Meeting the scope of the licence condition and reopener guidance

Table 1 details where the submission meets the minimum requirements set out in Special Condition 3.14 and associated Reopener Guidance.

Licence and Guidance Requirement	Submission Section
Statement setting out what MSIP the application relates to	Section 1
Amendments requested to outputs, delivery dates or allowances	Section 7
Clear statement on needs case	Section 2
Justification of technical need and, where relevant, the consumer benefit that the MSIP is expected to deliver	Section 2
Explanation of options assessment	Section 3
Clear description of preferred option	Section 3
Explanation of how expenditure which could be avoided as a result of the change has been accounted for	Section 3
Clear description of stakeholder engagement and whole system opportunities	Section 4 & 5
Statement that costs (incurred or expected) exceed the Materiality Threshold, but are less than £100m	Executive summary
Statement that costs are confined to those incurred or expected on or after 1st April 2021	Section 6
Explanation of the basis of the calculation any amendments requested to allowances	Section 6

Table 1: Requirement mapping

2 Need

2.1 The Need for Skye Dynamic Line Rating (DLR)

The Skye transmission network, shown in Figure 2, consists of a single radial 132kV OHL extending over 160km of challenging and environmentally sensitive terrain from the Fort Augustus 400kV substation on the mainland to Ardmore on the Isle of Skye.

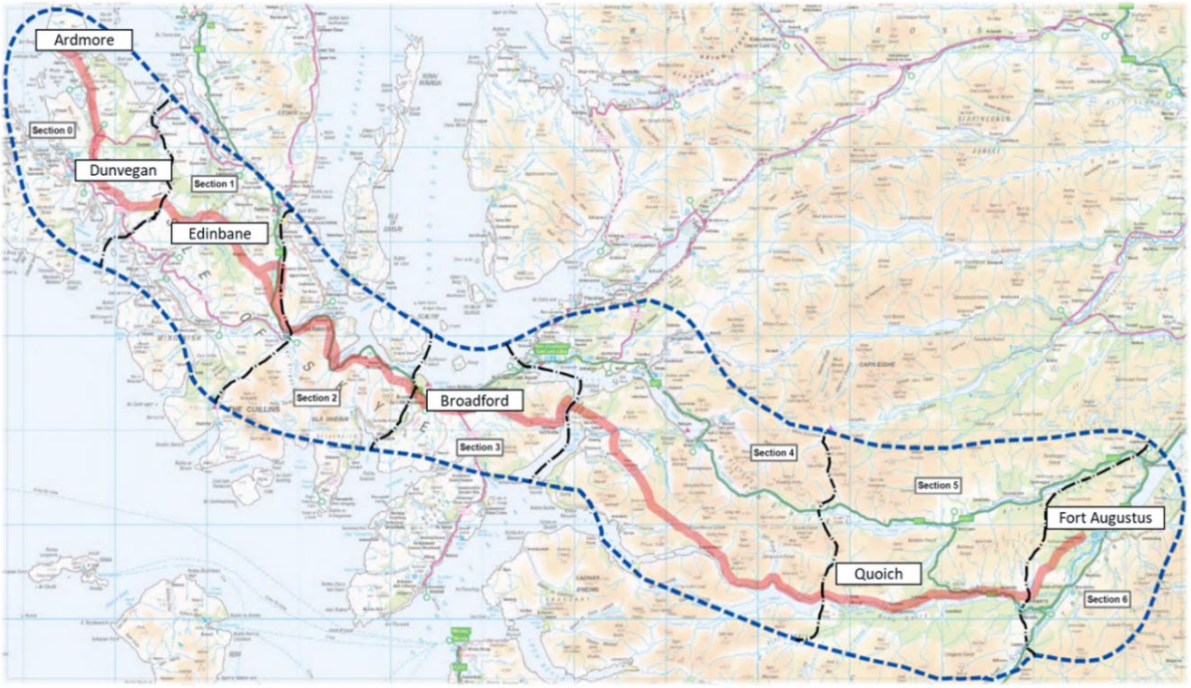


Figure 2: The Skye 132kV transmission line

We were granted a derogation by Ofgem in 2010 in relation to compliance with Section 2 of the System Quality and Security of Supply Standard (SQSS) for the Western Isles, Skye and Lochaber area. This derogation was granted due to the level of generation proposed to connect to the system exceeding the deterministic circuit capability in advance of reinforcement. It was determined that a tranche of this generation could be accommodated on an economic basis with management by the Electricity System Operator (ESO) through the Balancing Mechanism (BM)[2]. The Skye 132kV circuit between Ardmore and Fort Augustus currently operates on a constrained basis with generators constrained off the system when the ESO predicts the circuit capability will be exceeded.

The ESO provided recent constraint volumes, as shown in Table 2, on the Skye 132kV Circuit from the STEDEXV1 group, which covers Stornoway to Broadford. Costs for this constraint action were assessed from the Monthly Balancing Service Summary (MBSS). This allowed us to assess the potential value of a DLR solution to be deployed on Skye without ESO sharing confidential information.

[2] Western Isles: Derogation from standard condition D3 of the Electricity Transmission Licence (Transmission system security standard and quality of supply) (ofgem.gov.uk)

Reporting Year	Constrained Volume (MWh/annum)
Oct 2015 - Sept 2016	15,214
Oct 2016 - Sept 2017	10,823
Oct 2017 - Sept 2018	8,917
Oct 2018 - Sept 2019	14,547
Oct 2019 - Sept 2020	25,136
Oct 2020 - Sept 2021	2,309

Table 2: Annual Constraint Volumes

Constrained volume from October 2020 to September 2021 is significantly lower than average due to the impact of the failure of the Ardmore to Harris 33kV cable. This resulted in the disconnection of significant generation from the Western Isles not being able to contribute to the constraint on Skye. The cable was returned to service in September 2021, and therefore this year has been discounted from the expected average constraint.

The historic constrained volume includes generation from the Western Isles transported through the Ardmore to Harris 33kV subsea cable which was previously a limiting factor. This was rated at 23.4MVA and was replaced with a higher rated 35MVA cable due to asset failure.

Reinforcement options and the preferred long term reinforcement option for Skye were presented to Ofgem in July 2021 through the Skye 132kV Reinforcement Initial Needs Case (INC). This submission concluded that due to asset condition and load growth the appropriate long-term solution is a rebuild of the Fort Augustus to Ardmore 132kV Circuit. This reinforcement is proposed to be completed by December 2025 and therefore there is an opportunity to potentially mitigate constraints on the existing circuit over a two-year period through installing DLR technology.

While DLR would be a temporary solution, it would provide a unique opportunity to trial the first deployment of DLR on our network and provide key learnings for future projects (as covered in more detail in Section 2.2). The deployment of DLR on Skye is not proposed to directly manage constraints with connected generators but may offer a route to the ESO to reduce the constraint action it is required to take through the Balancing Mechanism. The asset life assumed for DLR is 15 years (based on the typical lifetime for operational solutions which involve IT system architecture) which means that after the two-year deployment on the Skye 132kV circuit, the DLR equipment can then be deployed on another circuit which is constrained.

Therefore, in accordance with Part C of Special Condition 3.14 on the MSIP Re-opener, we are applying to the authority for funding to develop and install DLR in relation to the activity 3.14.6 (i) ii. ‘system studies by the ESO or the licensee showing a need for DLR’.

2.2 Innovation and Learning for Future DLR Deployment

As GB transitions to a low carbon economy, a significant quantity of renewable generation will need to connect to our network throughout the RIIO-T2 period. To enable this growth, it is imperative that new and innovative technologies are installed and tested on the network to allow for their introduction to the rest of the network as business as usual. DLR can help through increasing the electrical current carrying capacity of the OHLs in our area, either as a retrofit or as part of new circuit

builds. This has the potential to provide significant benefit to GB consumers by mitigating network constraints across the GB system and aiding the ESO in managing the system.

This submission is presented alongside the MSIP application to deploy DLR on the Beauly to Loch Buidhe to Dounreay 275kV OHL, where the DLR system will directly manage constraints with connected generators. The deployment of DLR on the Skye 132kV circuit is primarily proposed to provide learning of how DLR may offer constraint mitigation options to the ESO for further circuits, such as North of Beauly. The project will allow us to gain deployment experience on an existing circuit with known constraints to allow performance to be monitored prior to deployment on the 275kV North of Beauly circuit that is expected to experience future constraint. There is currently [redacted]GW of renewable generation contracted to connect north of Beauly substation, with the volume expected to grow as we progress towards the UK and Scottish Government's net zero targets. The increase in year-round capability that the North of Beauly DLR system is expected to provide will be key to allowing more renewable generation on the network, supporting our ambition to deliver decarbonisation at pace, and will result in reduced constraint costs for consumers. Without gaining key learning and experience through the Skye DLR, the clear benefits of the North of Beauly DLR are put at risk through potential delays to implementation and availability of the system to ESO.

Doing so in advance of deployment on the North of Beauly, will reduce generators exposure to issues as they will have been identified and well understood on the Skye deployment. This will mean fewer constraints and a better overall customer experience. Further learning will then be applied to aid in the identification of further deployment opportunities on other areas of the network where constraints are expected to occur, with the intention to identify and deploy at least a further two projects before 2027. Ultimately, through expanding our knowledge and experience in the deployment and operation of DLR, the aim is to introduce the technology to the rest of the network as business as usual, delivering further benefits to the GB system and the GB consumer.

The Skye 132kV circuit has been selected to trial our first deployment of DLR as it comprises a radial circuit that is currently subject to constraint action by ESO and as a result incurs additional cost to the GB consumer. The DLR system and monitoring equipment is proposed to be installed from February 2023 until the planned replacement of the 132kV circuit, currently scheduled for December 2025. The key learnings we expect to obtain from completion of the project include:

- Identification of preferred system(s)
- Where best to site the monitoring equipment
- Identification of supporting ICT and analytics platform
- Define costs for applying as retrofit to inform future projects
- Transfer to business as usual for use in optioneering and update OH specification

Following assessment of the performance of the DLR system on the current Skye circuit, the DLR system will be considered for deployment on the reinforced Skye 132kV circuits or an alternative circuit on our system that would benefit from increasing seasonal ratings. This could provide an increase in capability of the new Skye circuit, particularly if combined with ANM functionality to enable direct communication with generator schemes to provide additional network access based on dynamic changes in OHL rating, in the event that the higher levels of generation predicted in the Skye 132kV Reinforcement INC materialise.

2.3 Alignment with SSEN Transmission RIIO-T2 Business Strategy

We have a duty under the Electricity Act 1989 to plan and develop the transmission system in an economic, efficient and coordinated manner. We have an obligation to investigate and implement innovative technology that will bring benefits to the consumer, maximise the transition to a net zero electricity system and facilitate the connection of low carbon generation. We have engaged with the

ESO on both asset build reinforcements and non-build or minimal build solutions that can realise system capacity or mitigate existing constraints on the network.

We presented an Engineering Justification Paper (T2BP-EJP-0050, provided for reference in Supplementary Evidence) through the RIIO-T2 Business Plan submission outlining our approach to the use of DLR across the system. At the time, Ofgem rejected the submission as costs were deemed to be uncertain and therefore contained too much risk. It was suggested that MSIP would be a more appropriate funding mechanism once cost certainty could be achieved.[3]

The application of DLR on the Skye 132kV circuit delivers the following outputs and benefits relating to the SSEN Transmission RIIO-T2 business strategy:

- increases the year-round capability in our network in line with our RIIO-T2 goal to transport the renewable electricity that, in total, powers 10 million homes;
- aligns with our Innovation strategy, correlating with the five values of the Innovation Framework: Sustainable Ambitions, Support Customers, User Driven, Deliver Efficiently and Collaboration.

[3] As set out in Ofgem's Final Determinations on 8th December 2020

3 Optioneering & Preferred Option

3.1 Options considered

The long-term options to increase circuit capacity on the Fort August to Ardmore 132kV circuit are extensively covered in the Skye 132kV Reinforcement Initial Needs Case[4], submitted to Ofgem in July 2021. These options are summarised in Appendix D.

The minimum build solutions we considered to increase capacity of the Skye 132kV circuit are detailed in Table 3, with an added explanation of why they have been rejected or progressed for further analysis below.

Option	Description	Progressed
1	Do nothing	No
2	Reconductoring, line reprofiling or increasing operating temperature of Skye 132kV circuit	No
3	Application of DLR on the Skye 132kV circuit. Involves the monitoring of weather conditions and ambient temperature in real time to determine the maximum rating of the OHL for a specified time resolution.	Yes

Table 3: Reinforcement options for the Skye 132kV circuit

The criteria for assessing the options above was to consider those which had the potential to relieve the existing system constraint which is experienced on the Skye 132kV network and that they could be delivered ahead of completion of the proposed Skye 132kV reinforcement in 2025.

Option 1: Do Nothing

Under the 'do nothing' scenario the ESO would continue to incur constraints until circuit reinforcement is completed in December 2025.

From the information provided in Section 2, the volume of constrained generation varies on an annual basis. This would result in an average annual constraint of [redacted] per annum, discounting 2020/21 which was an exceptional year due to the result of the failure of the 33kV Distribution Cable between Ardmore on Skye and Harris on the Western Isles which impacted on the constraint group. Assuming an average constraint cost of [redacted] this would incur an enduring cost for constraining this circuit of approximately [redacted] per annum in nominal terms.

Note that there is no option to delay as this would generate the same outcome as the 'do nothing' option.

Option 2: Reconductoring, reprofiling, or increasing operating temperature

These options were not considered feasible due to the requirement to rebuild sections of the circuits and timescales involved. Given that a full rebuild of the circuit is planned for December 2025, these options were not considered further.

Option 3: DLR

DLR works by going beyond the current carrying capacity defined by static thermal ratings. Static thermal ratings are defined as the maximum current carrying capacity of an OHL at a given conductor

[4] Skye LOTI Initial Needs Case 30-Jul-2021.pdf

[5] NGESO Monthly Balancing Service Summary https://data.nationalgrideso.com/balancing/mbss

temperature under defined ambient conditions, which doesn't infringe on ground clearance standards. Conductors sagging and resultant clearances are dependent on conductor design tension and temperature. While design tension doesn't vary, real time conductor temperature is influenced by many factors, such as line current, actual ambient temperature, solar emissivity, solar absorption, wind speed and direction. For the static rating conservative conditions for these factors are assumed. Using sensors that measure conductor temperature and sag will allow us to measure the resultant clearances in real time and allow the static rating to be exceeded if the conditions are right.

Deploying DLR would have the potential to mitigate constraints in the short term and provide an assessment of how increased ratings correlate to an existing constraint.

3.1.1 Outline of the proposed DLR system

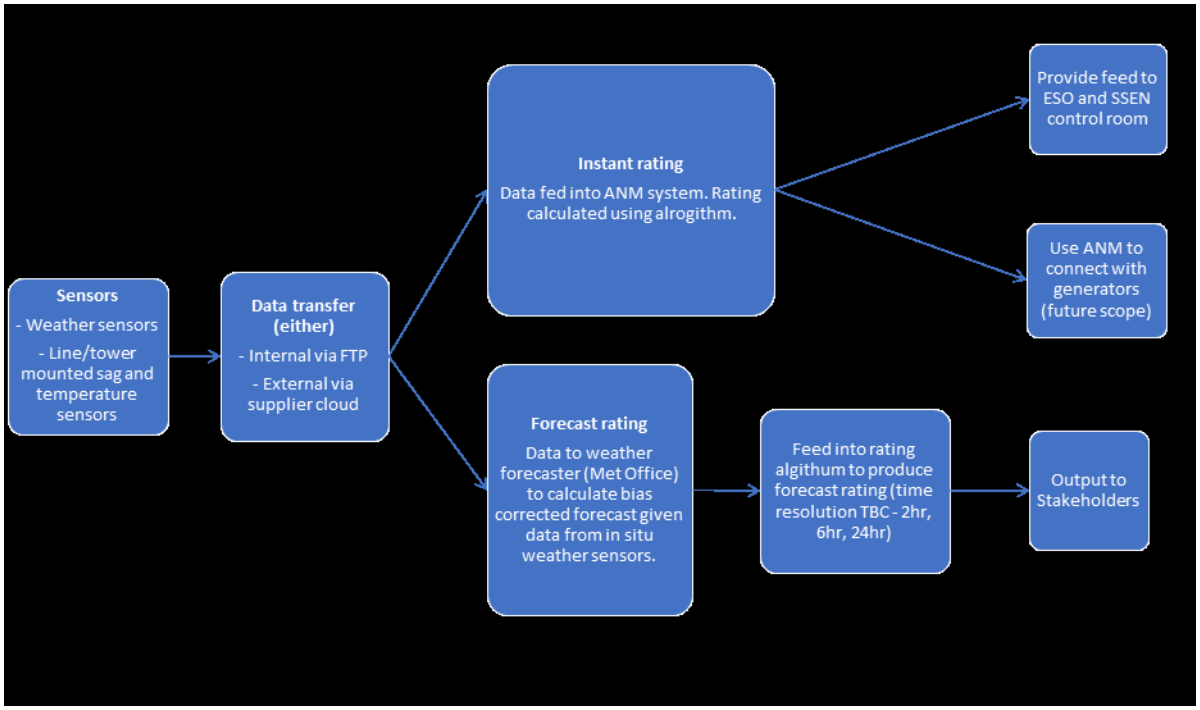


Figure 3: Overview of DLR system for Skye

An overview of the DLR system for the Skye 132kV circuit is provided in Figure 3. The DLR system is to include two fleets of sensors, the locations of which are still to be defined and will be determined through a detailed assessment of the surrounding geographical topology and orography. The likely and current assumption is that there will be 10 sensors. One fleet of sensors will consist of weather sensors and the other fleet will consist of line or tower mounted sensors. These will be used to run two parallel systems to allow corroboration in defining OHL rating.

The weather sensors serve two purposes:

- To provide instantaneous weather conditions (capable of 15-minute resolution) which are then fed into an algorithm to calculate the instantaneous rating for each location. The limiting segment of the OHL is then identified and fed into the ANM system; and
- To provide local weather data to a weather forecaster (such as the Met Office) to allow them to bias correct their forecast. This can be used to produce a rating forecast for use by various stakeholders – the granularity of which (i.e., 2hr, 6hr, 24hr and 48hr) is dependent on what is produced by the weather forecaster.

The line/tower mounted sensors (likely to be at the same locations as the weather sensors) will measure rather than calculate conductor sag and temperature, and again the limiting segment of the OHL will be identified and fed into the ANM system.

The ANM system will therefore be provided with two ratings – one calculated (from the weather sensors) and the other directly inputted (from the line/tower mounted sensors). Only one rating is needed and therefore the ANM system will have a built-in corroboration method for self-checking and to ensure only a predefined limit of divergence between the two methods occurs. The main objective is to provide learning for further deployment of DLR in the North of Beauly area and to assess the potential mitigation of network constraints, therefore enhancing the ESO's ability to manage the Fort Augustus to Skye 132kV system in advance of reinforcement in December 2025.

The DLR system will provide a feed to both the ESO and SSEN Transmission control room. The DLR system will be capable of providing an updated OHL rating every 15 minutes, however the resolution that will ultimately be used for managing the system will be determined by the ESO. We have held initial discussions with the ESO on deployment of DLR to determine what resolution is feasible for use in the ESO control room.

3.2 Detailed Analysis

Due to only a single option being determined as suitable for assessment and the limited methods to deliver this option, sensitivity analysis is not considered further in the submission.

Section 2.2, Table 2 details the constrained volume of generation on the existing circuit. The deployment of DLR on the Edinbane to Broadford 132kV section is to provide innovation and deployment experience, however it may also offer ESO a route to mitigate the existing constraint.

Analysis was undertaken to determine the potential benefits that could be realised, although it is noted that due to annual variability in weather conditions the constraint relief will change.

For DLR, where the calculated rating could change every 15 minutes, we carried out statistical analysis on an internal rating calculation model of the OHL using Met Office weather data from 2013 which was considered a typical year. This was to establish a credible seasonal rating increase to feed into the studies to determine seasonal capability uplift (as detailed in Table 4).

Option	Delivery Date	Winter Uplift (MVA)	Spring/Autumn Uplift (MVA)	Summer Uplift (MVA)
Do nothing	N/A	-	-	-
DLR	2023	+21	+21	+19

Table 4: Seasonal uplifts on the Edinbane to Broadford 132kV Circuit

Figure 4 shows an example of the statistical analysis that was undertaken using the internal rating calculation model to determine credible seasonal ratings for DLR.

For each day of Winter 2013, and Summer, Spring and Autumn in 2013 we calculated the average minimum rating (across multiple sections of the OHL) for DLR and determined different ratings for different percentiles, before deciding to use the 50th percentile rating (the median) – a rating which is neither overly optimistic nor pessimistic on the potential application and benefit of DLR. The median seasonal rating determined for DLR is 110/98/86MVA for the Winter, Spring/Autumn, and Summer seasons respectively. The outcome of this analysis is therefore a rating increase of 21/21/19MVA respectively with DLR therefore providing a higher rating increase in the Winter and Spring/Autumn seasons, but a slightly lower rating increase in the Summer.

This approach used a similar methodology to that used in the North of Beauly DLR MSIP submission.

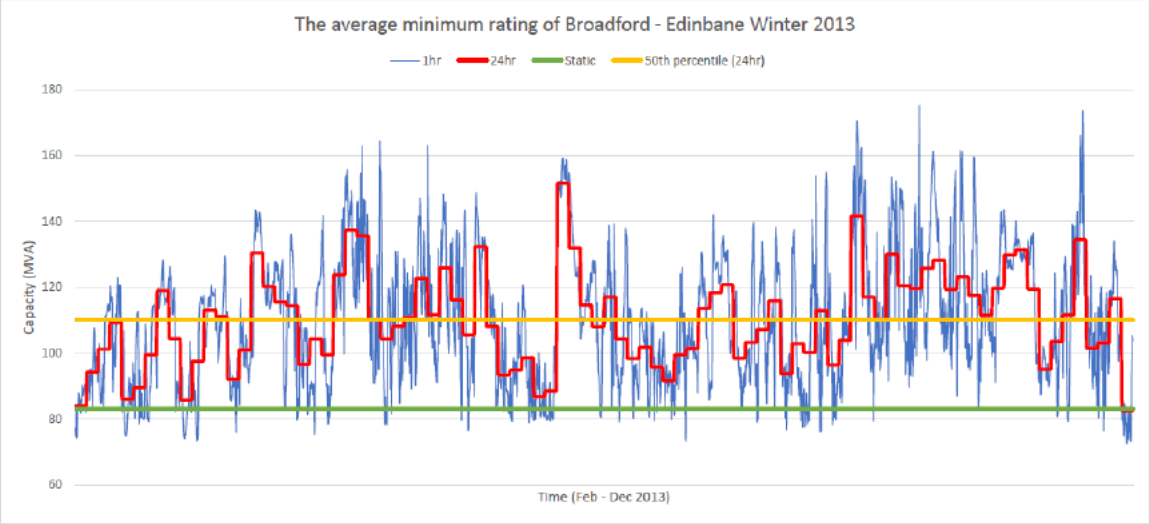


Figure 4: Example of statistical analysis undertaken to determine seasonal DLR rating

To determine the potential impact on constraint reduction that could be offered by the DLR system, load flow analysis was undertaken to assess the impact of the increased seasonal ratings on the Edinbane to Broadford section. This load flow used an assumed generation profile for all connected generators on Western Isles, Skye and Fort Augustus circuit. It was also considered what the benefits could be of extending the DLR scheme to the Broadford to Quioch 132kV Circuit section which is outside the scope of this submission.

While it is acknowledged that the introduction of improved seasonal static rating does not fully utilise the benefit of more frequent rating changes offered by DLR, i.e., 15 minutes, it initially offers a more practical approach to the ESO while the protocols can be developed.

Load flow analysis with ratings considered in Table 3 reduced the constraint by 17% over the full length of the circuit. This reduction is observed predominantly on the Edinbane to Broadford, however this has the effect of moving the constraint to the Broadford – Quioich section of the 132kV circuit.

Option	Total Constraint (Average) MWh	Constrained volume Reduction	Estimated annual constraint cost (£m)
Do nothing	14,925	-	[redacted]
DLR	12,387	-17%	[redacted]

Table 5: Constraint Reduction Edinbane to Broadford 132kV Circuit

It is estimated that the DLR system could reduce constraints costs by [redacted] per annum if applied to the Edinbane to Broadford section. This would provide a benefit to the consumer through reduced constraint costs.

Extension of the system to cover the Broadford to Quioich would have a greater impact with the load flow analysis showing reduction in constrained volume of ~84% which could potentially reduce

constraint costs to approximately [redacted] if similar benefits observed in the Edinbane to Broadford section can be achieved on the Broadford to Quioich section. However, given the limited timescale for deployment (approximately 2.5 years) of the DLR system ahead of wider Skye reinforcement, the variability in constrained volume over this period, and the primary purpose being to achieve innovation and learning, it is not proposed to extend the scheme to cover this circuit at this stage. We will assess throughout the project whether the circuit would benefit from reinstalling DLR system on the reinforced Skye circuit to maximise circuit capability.

3.3 Preferred Option

The Skye 132kV circuit provides a time limited opportunity to study the impact of DLR on a constrained system ahead of reinforcement. Given the valuable learning to be gained on the DLR technology ahead of the proposed deployment on North of Beauly, and the additional benefit of the potential to mitigate constraints by 17% on the Skye circuit ahead of reinforcement, our preferred option is to deploy DLR on the Skye 132kV circuit.

The DLR system will offer a route to the ESO to reduce the constraints costs incurred annually by [redacted]m for management of the Skye 132kV circuit to within the existing static seasonal ratings of the existing overhead line. This constraint reduction will offer a benefit to the GB consumer in reducing the costs paid by ESO to manage the existing 132kV system.

The system is proposed to be able to offer ESO a pathway to reduce constraints from deployment in February 2023, until such time as the 132kV circuits between Fort Augustus and Ardmore are replaced. After this time the DLR system will be assessed for redeployment elsewhere on our network. In the longer term, given potential generation scenarios on Skye, DLR may be deployed on the reinforced Skye circuit to maximise the circuit capability, however this would require a clear investment signal that generation had exceeded the capability of the Skye 132kV reinforcement.

This solution sits within the footprint of the existing OHL and there is therefore minimal work required in the installation and maintenance. DLR, although innovative in its application to our network, has already been employed through an innovation project as a real-time thermal rating (RTTR) system in SPEN's distribution network in north Wales – covering over 90km of 132kV network.

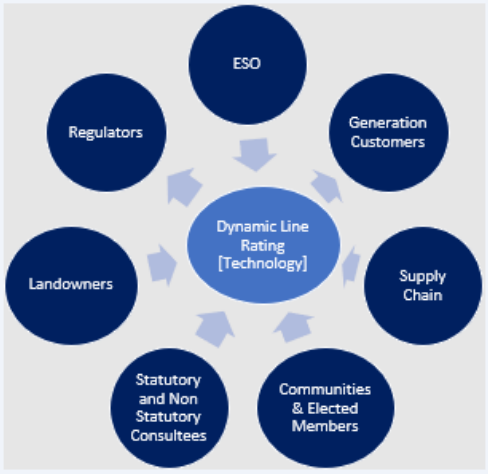
The project is managed using our Large Capital Project governance framework which ensures that project is governed, developed, approved and executed in a safe, consistent and effective manner. As part of this governance a project programme and Project Development Plan are used to guarantee sufficient resources are in place, reporting mechanisms are present and a clear event schedule is followed. Both documents are located in the Supplementary Evidence of this submission. The introduction of a technology-based Price Control Deliverable (PCD) will be most appropriate for this project as the output is dependent on the annual variability of wind. For example, we would suggest that the PCD is based on our commitment to install a DLR system from Broadford to Edinbane consisting of weather and tower/line mounted sensors and an ANM system.

4 Stakeholder Engagement

4.1 Our Commitment to Stakeholder Engagement

SSEN Transmission is a stakeholder-led business which delivers leading stakeholder engagement standards through its work with global consulting and standards firm, AccountAbility. AccountAbility works with organisations internationally to adopt responsible business practices and transform long-term performance and as committed to in its Stakeholder Engagement Strategy, we work to achieve the externally accredited AA1000 Stakeholder Engagement Standard. This is considered the 'gold standard' in stakeholder engagement accreditation. As of December 2021, following the latest AA1000 Follow-up Consultation, we have achieved a further uplift in stakeholder engagement performance, now operating at 76% within the 'Accomplished' level of Accountability's Stakeholder Engagement Maturity Ladder. We have increased our score overall by 14% since our initial 2019/20 review and we hope this strong performance provides stakeholders with confidence in the quality of our stakeholder engagement and our commitment to continuous improvement.

4.2 Key Themes of our Stakeholder Engagement Activities



Dynamic Line Rating Stakeholders

The adjacent key stakeholder groups were identified as having a direct or indirect interest, or influence, in the DLR project development; and have helped inform our approach.

We continue to review this to ensure relevant stakeholders are included across each stage of the project development, implementation, and operational lifespan.

Given that the DLR sensors will sit within the footprint of the existing OHL, it will cause minimum, if any disruption in its installation and maintenance; the main theme of engagement with communities, local landowners and environmental stakeholders as part of our wider stakeholder engagement will be to inform and promote the use of this progressive technology.

The key themes of stakeholder engagement relating to both the Skye and North of Beauly DLR projects are outlined below. As a trial project, investigating the use of a flexible operating regime, stakeholder feedback has primarily come from wider industry stakeholder themes, which support a more flexible use of the system:

4.2.1 Deliver a smarter, flexible electricity grid to help deliver Net Zero

Energy partners and stakeholders including the ESO, other TO's, generators and politicians generally agree that the evolution of a smarter, more flexible electricity grid will be required to meet the changing needs of GB as it adapts to deliver Net Zero. The Skye is one small way to trial and test the adaptability of existing infrastructure to operate more flexibly using weather and temperature data. In the ESO Future Energy Scenarios 2021 publication, it highlights the need for the grid to become more adaptable.

4.2.2 Reduce constraint payments ultimately paid by GB energy consumers

The GB energy market is often criticised publicly for the amount of electricity generation constrained off, due to grid constraints during periods of high wind, with these additional charges ultimately pad by GB energy consumers. Given the additional flexibility that DLR technology provides to increase the capacity of the line, this investment helps reduce GB consumer additional charges, and is provided at low cost when compared to traditional alternatives.

During our direct engagement with the Citizens Advice policy team, they have confirmed these concerns stating that they are concerned by the current size of constraint payments that are added to consumer bills because they appear to reflect system inefficiency, and adding that it is important that timely investment is made to ensure that networks can facilitate efficient constraint costs

The ESO has begun a 5-point plan to relieve increasing congestion projected on the NETS, in ways additional to what is already being recommended by the NOA process. The five points are:

- Clearer forecasts of BSUoS costs
- Inter-trip pathfinder (Constraint Management Pathfinder)
- Regional Development Programme with DNOs & TO's
- Storage (CMP)
- Network improvement targeting and acceleration

All three GB onshore transmission owners have committed to supporting this process. In relation to the fifth point, this includes the identification of year-round constraint periods at a greater resolution than is currently used by NOA with a view to providing additional network development options for congestion relief – for which DLR has been highlighted as one of the options by the ESO.

4.2.3 Flexible connection contracts for generation customers

Given the footprint of our network, there is high demand for additional connections from new windfarms, along with many non-firm connection contracts for existing generation customers. The DLR technology would increase the potential for additional capacity on the existing network, helping meet these customer needs and is therefore generally supported in principle by them. Contractual terms and conditions are at an exploratory stage and will be further developed as the projects move towards delivery.

4.2.4 Share best practice as the energy industry work towards delivering Net Zero

Energy stakeholders including regulators, industry partners and politicians increasingly encourage organisations to work together to share best practice as the world tackles climate change and focuses on the road to net zero. While the Skye DLR project would lead the investigations on our network to use this kit, we are aware that our peers at National Grid Electricity Transmission are caring out similar investigations. We are reaching out to hear more about their developments and how we can share learnings.

4.3 Stakeholder Engagement Next Steps

Given there is no need for a s37 planning application, next steps regarding stakeholder engagement on the DLR projects are primarily around:

- identifying and securing supply chain procurement
- working with the ESO to identify an adequate resolution for OHL rating change to feed to the ESO control room for management of the system in Skye

- working with generation customers to develop contractual terms which will facilitate and optimise the use of the additional capacity when it is available; and
- share learnings with other TO's developing similar projects.

5 Whole System

The Skye DLR system was discussed with ESO alongside the proposed implementation on the North of Beauly circuits. Collaboration may offer constraint reduction, however over a limited period due to the planned reinforcement of the 132kV circuits in 2025.

We concluded that a Cost Benefit Analysis (CBA) was not appropriate given the limited time window for constraint relief, proposed cost of the DLR system, and that the primary benefit of the project to provide learnings to the North of Beauly DLR installation would not be captured within a CBA.

The Deployment of DLR on the Skye 132kV Transmission circuit was also discussed with the local Distribution Network Operator, SHEPD, who are connected to the Transmission system via Grid Supply Points (GSP) at Ardmore, Dunvegan, Broadford and Quoich.

This particular deployment of DLR is not anticipated to offer new capacity to connect additional customers in advance of the longer-term reinforcement and no alternative whole system options were identified ahead of the proposed 2025 completion of the enduring solution.

It was therefore concluded that no Whole System considerations are available for this submission.

6 Cost Information

6.1 Costing Approach & Cost Breakdown

6.2 This section provides an overview of current and the next phase of the project cost status and identifies the key assumptions and exclusions. The RIIO-T2 allowances requested for this the project is [redacted] with the works to be completed by 2023. This is made up of [redacted] capex and [redacted] of associated opex allowance, as calculated through the Opex Escalator mechanism which we are seeking full recovery for as part of this MSIP submission as detailed in the Table 6 below. The total cost for the project is [redacted] which includes a [redacted] service agreement contract with the years following RIIO-T2 being funded through business as usual network operating costs. The Class 1 estimate includes all pre-construction and construction costs and has been developed and approved in full compliance with our Large Capital Project (LCP) Governance Manual (available on request).

Category	Project Class 1 Estimate Skye DLR (MSIP)	SSEN Transmission Project Cost Class	SSEN Transmission Indicative Estimate Tolerance	Supporting Documentation
Total	[redacted]	Class 1	-30% / +40%	Framework Agreement/ Contract/ Bill/ Spreadsheet/ Quotations

Table 6: Cost summary

- The Estimate has a Class 1 accuracy range from -30% / +40% based on the project status and scope maturity as identified in Chapter 2. Any material change in scope will result in the project cost estimate being updated accordingly.
- The Estimate has been produced in line with our Costing Methodology and all principles contained therein adhered to.
- A more accurate cost estimate (Class 2 accuracy -15/+25%) will be developed and approved at Gate 2 which is currently planned for April 2022.
- The final Class 3 estimate (-5/+10% accuracy) will be completed in July 2022 once all main construction contracts have been subject to competitive process and fully negotiated at Gate 3.
- Our procurement and contracting strategy is still being developed however, it will consider all potential options to drive efficiency and will deliver the most competitive prices that the current international market has to offer.

6.4 General Assumptions

The general assumptions that have been made in developing the cost estimate are listed below:

- Cost Base: All costs are based on prices deemed to be 2018/2019 cost base unless stated otherwise; and

- Due to current market volatility the cost estimate may be subject to price increases once tender returns are available from the supply chain.

The cost estimate which forms part of this submission excludes the following key items:

- Extreme weather events (meaning a worse than 1 in 10 probability for land-based activity, and equivalent provisions for marine-based activity);
- The imposition of additional terms or conditions of any statutory consent, approval or permission (including but not limited to planning consent);
- Movement of agreed outages by the System Operator;
- Changes in the project scope that could not have been reasonably anticipated during the assessment process; Foreign exchange (Fx), Metal Prices (LME) fluctuations are excluded at this time;
- Accommodation and Logistics;
- Any Public Road Improvements; and
- Distribution Network Operator (DNO) Diversions.

6.5 Cost Estimation, Regional Variations and Site-Specific Factors Driving Costs

The geographical location of Skye and the innovative nature of the works to be carried out presents significant challenges during the development, planning, construction and operational phase. At this stage we are undertaking significant review of our existing frameworks, market conditions and geographical factors to ensure we provide the best possible procurement and contracting strategy, which will enable significant progress towards UK and Scottish Government net-zero targets. The Cost Estimate has been developed in line with our Costing Methodology and in accordance with our LCP Governance process.

The basis of the current cost Estimate is a budget estimate and has been calculated, by [redacted] comprised of Subject Matter Experts (SME) in June 2020 and is based on a high-level assessment, local knowledge and experience, the scope and site-specific information available, and the assumptions listed.

6.6 Project Benchmarking & Metrics

Due to the innovative nature of the project and given that we have not embarked on a DLR project previously, we have been unable to Benchmark the current estimate against Internal or Regulator Cost Metrics.

6.7 Competition & Efficiency Procurement

This section identifies why the proposed procurement and commercial strategy to be implemented for the Skye DLR Project which will demonstrate efficiencies and the optimum economic solution for this investment in the transmission network. The chosen multi-contract strategy will ensure competition to facilitate increased innovation and drive efficiencies which will help deliver further benefit to consumers.

Our procurement and contracting strategy will consider different options to drive efficiency and demonstrate value for money. A hybrid multi-contract procurement approach which will assess various lotting / bundling options with each of the DLR projects is the current preferred solution as it will deliver the most competitive prices that the current international market has to offer following

competitive regulated tenders. The innovative nature of the DLR technology means that there are no frameworks in place for the DLR system and therefore an open market tender is the most logical solution.

Given the innovative nature of the DLR technology, the intention is to approach the market to identify a range of different DLR technologies and allow these to be tested on the network to determine which technology choice is best suited for the business's requirements. This trial is a necessary part of ensuring we select the most appropriate system for the business given that this is the first time DLR will be installed on our network. Using information gained from the completion of this trial a whole system specification will be produced stipulating the requirements of the DLR system.

As per the Utilities Contracts Regulations, the trial will be conducted in a manner that allows and encourages the identification of a range of acceptable solutions or options. Processes will be in place to ensure avoidance of the development of relationships with any particular party which could hinder a fair and open process or limit competition. Any information gathered during such exercises will be shared with all interested parties at the stage of tender.

Following successful trial of the DLR technology, a contract will be awarded subsequent to a regulated tender event.

The procurement strategy will utilise the awarded Framework Agreement for the ANM System. The Framework Agreement has been procured following a compliant EU regulated tender process which demonstrates a competitive process has already been undertaken. To maximise competitiveness the ANM package will be subject to further mini-competitive process with the awarded framework contractors.

This strategy places programme and integration risk with us and consequently we have implemented a risk management strategy to safeguard consumers; allocating responsibility for risk to the party most suited to manage it and in the most efficient manner.

6.8 Procurement Strategy

The main objective of Skye DLR Systems Project procurement strategy is to deliver a high quality and reliable system in the most economic and efficient manner. The strategy considers the unique innovative and remote location factors of this project whilst ensuring an efficient outcome for all contract costs. Finally, the strategy will take cognisance of any supply chain constraints, assess methods to obtain maximum value for customers and the most appropriate allocation of risk considering different contract and construction delivery models.

6.9 Governance – Procurement, Insurance and Legal

It is critical that all major investment projects are governed, developed, approved and executed in a consistent and effective manner whilst achieving safe, sustainable and timely execution of major projects/portfolio. The financial governance threshold for LCP in SSEN Transmission is a project investment value greater than [redacted] As such, the Skye DLR Systems Project is not subject to the LCP Governance process. Despite the Skye DLR project not being required to follow the LCP process, we are still following governance set out in the process.

A stage and gate procedure structure as identified in the LCP framework governs the entire lifecycle of the project undergoing five stages to completion as illustrated within Figure 4 below. The Skye DLR Systems Project passed through Gate 1 in August 2021 and is planned to go through Gate 2 in April 2022.

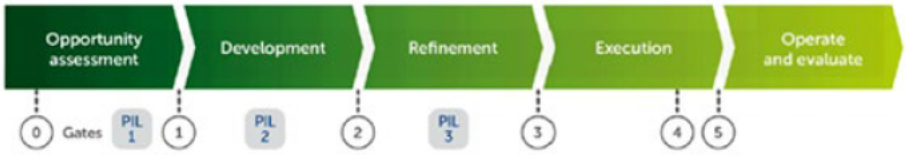


Figure 5: LCP and PIL Governance

The process is phased with six gates (0-5) at appropriate decision points, with clear consistent deliverables for each gate. This section will focus on the specific Procurement and Commercial deliverables contained therein.

6.10 Commercial and Contracting Strategy

At Gate 1 (August 2021) all potential options were developed and assessed, and a preferred solution was selected, as outlined in Section 3. A further strategy will be drafted and implemented for Gate 2 which is planned for April 2022. The strategy is finalised at Gate 3 when main approvals are sanctioned, and contract awards are executed.

Framework Agreements

SSE PLC operates a category management process as highlighted previously which is used in SSEN Transmission. This aligns procurement and commercial activities with business priorities providing a platform for effective supplier management. Performance is monitored and enhanced by using key performance indicators (KPI) and continuous improvement initiatives throughout the life of the framework agreements. The use of framework agreements provides the following key benefits:

- Enhanced quality;
- Improved safety performance;
- Superior programme management and delivery; and
- Commercial benefits i.e., continuous work programmes enable bulk discounts and promote efficiencies.

The following works, goods and services will be supplied via a combination of one-off regulated tenders and framework awards, as shown in Table 6. A further explanation of each Work Package is provided below.

Work Package	Scope of Works	Quantities	Procurement Strategy
A	Dynamic Line Rating (DLR) System Trail	1 Trial	Request for Information via Find a Tender
B	DLR System	10 Units	Regulated One Off – Competitive
C	DLR System Annual Manufacturers Service Agreement (x15 Years)	315 Months	Regulated One Off - Competitive
D	Active Network Management (ANM) System	1 Unit	ANM Framework – Mini Competition

E	Weather Data Analysis	1 Unit	Low Value, Low Risk One Off

Table 7: Work package summary

Work Package A – Pre-Market Engagement: DLR System Trial

Given the innovative nature of the Dynamic Line Rating technology, the intention is to approach the market to identify a range of different DLR technologies and allow these to be tested on the network to determine which type of technology meets the business's requirements. This trial is a necessary part of ensuring we select the most appropriate system for the business given that this is the first time DLR will be installed on our network. Using information gained from the completion of this trial a whole system specification will be produced specifying the requirements of the DLR system

As per the Utilities Contracts Regulations, the trial will be conducted in a manner that allows and encourages the identification of a range of acceptable solutions or options. Processes will be in place to ensure avoidance of the development of relationships with any particular party which could hinder a fair and open process or limit competition. Any information gathered during such exercises will be shared with all interested parties at the stage of tender.

The procurement strategy has been agreed to meet at Gate 2 to best align with the following: -

- Multi-contract strategy;
- Innovation;
- Allow for all scope items to be competitively tendered excluding direct award scope items;
- Supply chain capability;
- Provide the most cost-efficient contract price; and
- Reduce and mitigate interface risk.

The competitive process must be robust, transparent and ensure equal treatment of potential bidders and protect information appropriately. A compliant EU regulated two-stage tender process (Prequalification and Invitation to Tender (ITT) will be administered for all one-off contracts to provide the most economically advantageous solution for the consumer as it maximises the supply chain opportunities.

Work Package B – DLR System Supply, Design and Install

This section details the procurement process and scope of works associated with the Supply, Design and Installation of the DLR System in relation to the Skye project.

The proposed Package B is to supply, design and install a Dynamic Line Rating System which is capable of using local weather monitoring and conductor measurements to accurately determine the true real time rating of the conductor, therefore increasing the capacity to the circuit and alleviating the network constraints.

Item	Quantity (approx.)
DLR System	10 units

Table 8: DLR System equipment

Work Package C – DLR System Annual Manufacturers Service Agreement

Item	Quantity (approx.)
DLR equipment	15 years

Table 9: Manufacturers Service Agreement

Work Package D – AMN System

This section details the procurement process and scope of works associated with the Supply, Design and Installation of the ANM System in relation to the Skye project.

The proposed Package D is to supply, design and install an AMM System which measures the power flows at several measurement points on the network. The network is divided into zones which represent constraint points in the network and the system receives real time information from the measurement points.

Tender Evaluation Reports

We will prepare detailed Tender Evaluation Report (TER) for all key contracts which describes the entire procurement process undertaken from inception to final recommendation. The TER is a mandatory SSE PLC governance requirement and captures a number of the key requirements tabled by the Regulator to justify the procurement process undertaken.

6.11 Consistent approach to the SSEN Transmission RIIO T2 Business Plan Competition Strategy

We outline our RIIO T2 Business Plan Competition Strategy in our document titled "SSEN Transmission – Competition Strategy". We recognise that our business, together with our stakeholders, plays a key role in enabling GB's transition to a low carbon economy. The challenge to deliver Net-Zero in the timescales proposed is significant and demands a coordinated and immediate response of the energy industry. In RIIO-T1 we reshaped our business to meet the challenge of a renewable energy boom, and are on course to connect over 3GW, on-time and under agreed allowances through efficiency measures. To meet the growth in electricity demand in a sustainable way, our network must support increasing volumes of renewable generation, as well as new forms of energy interactions and ways of working across industry. We recognise this and reflect it in our Strategic Objective for RIIO-T2, which is to enable the transition to a low carbon economy.

Many of the challenges we will face during the RIIO-T2 period are similar to those we have experienced and successfully managed during the past ten years. By building upon our experience, we are well placed to manage these challenges and so deliver cost-effective outcomes that keep down the household energy bill.

We seek to ensure that we operate a comprehensive tender process that is fit for purpose for each project or portfolio of projects (described below). Whilst retaining these key principles, we have sought to simplify our procurement processes where practicable, to both reduce the programme timescales, and the cost burden for consumers.

6.12 Procurement Process Conclusion

This section has clearly demonstrated that our high quality and robust approach to governance, strategy selection and implementation, comprehensive competitive tender events and negotiation

processes and the most appropriate allocation of contractual risk will all contribute to a very competitive cost which will deliver added value and reduced costs.

6.13 Risk Strategy

The Skye DLR Project is managing risk in accordance with ISO31000, the International Standard on Risk Management, and the agreed SSE LCP Governance Manual and requirements therein.

The Project has a Risk Management Plan that sets out the approach and process the Project will use to manage risk (threats and opportunities) over the lifetime of the Project.

Within the Risk Management Plan are the key risks (threats and opportunities) the project faces, the risk process that the project will follow to manage risk, project teams roles and responsibilities in respect of managing risk, and that the Project is using KERIS, the SSE LCP Risk Management Information System (RMIS) for managing risk on the project.

KERIS will act as the repository for all project risks (threats and opportunities) as it allows the users to create and assess all risks, impact assess these risks and track mitigating risk actions through to successful closure. All risks and actions are assigned owners who are then accountable for updating the KERIS system. Risk owners can simultaneously access the RMIS, that is an ongoing project activity to ensure that risk data is captured, up to date and can be used to support project decision making. To supplement the ongoing updates to the RMIS, the Skye DLR Project team hold strategically timed risk workshops to collectively review and challenge the Project Risk Register ahead of each key gate stage.

The development of the project risk register follows the LCP Governance Gated Process in the Manual, and the risk register is a live document that evolves through continuous updates and contributions from the project team over the life of the project.

Risk will be reviewed by the Project Manager with:

- Updated reports detailing the status of Risks and Actions to highlight risks/ actions requiring attention, and
- Monthly report, showing risk progress (new risks, opportunities, new actions, and closed items); risk gaps, usage, quality of the information being recorded and where the risk focus needs to be going forward for the Project.

7 Conclusion

As GB transitions to a low carbon economy, a significant quantity of renewable generation will need to connect to our network throughout the RIIO-T2 period. To enable this growth, new and innovative solutions will be required to operate and respond to the challenge. DLR can help through increasing the current carrying capacity on the overhead line (OHL) in our area, either as a retrofit or as part of new circuit builds. This has the potential to provide significant benefit to GB consumers by mitigating network constraints across the GB system and aiding the ESO in managing the system.

The Skye 132kV circuit between Fort Augustus and Ardmore currently operates on a constrained basis, with generators constrained off the system when circuit capability is expected to be exceeded. The needs case shows that the anticipated average constraint by 2024 will be approximately [redacted] per year on the Western Isles to Broadford area. Reinforcement of the Skye 132kV circuit is proposed to be completed by December 2025 and therefore there is an opportunity to install and monitor DLR technology for the first time on our network, whilst also offering the ESO a route to reduce the existing constraint, over a two-year period.

While this would be a short-term solution, it would provide a unique opportunity to trial the first deployment of DLR on our network and provide key learnings for future projects. The deployment of DLR on this circuit will allow practical assessment of how this constraint could be managed by the ESO and provide technical and operational learning that will be key for deployment of DLR on the North of Beauly 275kV circuits, where a constraint is predicted to occur in the medium term. In deploying on the Skye 132kV circuit ahead of North of Beauly, where the DLR system will directly manage constraints with connected generators, will allow any potential issues to be identified early and well understood ahead of generators being connected to the DLR system. This in turn will result in reduced constraints and a better overall customer experience.

To enable the industry to keep pace with the projected growth of renewable generation, it is imperative that innovative technologies are installed and tested on the network to allow for introduction to the rest of the network as business as usual. Following assessment of its performance on the Skye circuit, the DLR system will be considered for deployment on the reinforced Skye 132kV circuits or an alternative circuit on our system that would benefit from increasing seasonal ratings. The learnings from the project will aid in the identification of further deployment opportunities in other areas of our network where constraints are expected to occur, with the intention to identify and deploy at least a further two projects before 2027. Ultimately, expanding our knowledge and experience in the deployment and operation of DLR will allow for its introduction to the rest of the network as business as usual, allowing increased capability from existing transmission assets.

The secondary benefit of the project is that the DLR system will offer a route to the ESO to reduce the constraints costs incurred annually by approximately [redacted] for management of the Skye 132kV circuit to within the existing static seasonal ratings of the existing overhead line. This constraint reduction will offer a benefit to the GB consumer in reducing the costs paid by the ESO to manage the existing 132kV system.

The RIIO-T2 allowances requested for this the project is [redacted] with the works to be completed by February 2023. This overall cost constitutes [redacted] capex and [redacted] of associated opex allowance, as calculated through the Opex Escalator[6] mechanism.

Next Steps

Following submission of the MSIP application, we anticipate a decision from Ofgem within four to six months. During this time, we will further collaborate with Met Office to define optimal locations for

[6] In accordance with Scottish Hydro Electric Transmission Plc Electricity transmission licence Special Condition 3.36 Opex Escalator (OEt)

the DLR equipment installation to gain an understanding of appropriate locations within the geography and weather conditions experience over the length of the circuit. Further collaboration will be undertaken with the ESO to explore if dynamic line rating capability provided by the system from installation in 2023 to completion of the Skye 132kV Reinforcement can provide an option to mitigate the existing constraint.

Appendix A Glossary of terms

Acronym	Definition
ANM	Active Network Management
BM	Balancing mechanism
CBA	Cost Benefit Analysis
DLR	Dynamic Line Rating
ESO	Electricity System Operator
FES	Future Energy Scenarios
INC	Initial Needs Case
LCP	Large Capital Project
MBSS	Monthly Balancing Service Summary
MSIP	Medium Sized Investment Project
NETS SQSS	National Electricity Transmission System Security and Quality of Supply Standard
OHL	Overhead Line
TO	Transmission Owner

Appendix B List of supplementary documents and evidence

Title	Description
T2BP-EJP-0050 Dynamic Line Rating	Engineering justification paper submitted as part of RIIO-T2 Business Plan
LT320 Skye DLR Programme	Project programme for Skye DLR
LT000320-DT-PDP-G1-0000-00	Project Development Plan (PDP) outlining the strategy for the Skye DLR
LT000320 Skye DLR – KERIS Risk Register	Risk register for Skye DLR

Appendix C Single Line Diagram

Appendix D Long-term Skye 132kV reinforcement options

As outlined in the Skye 132kV Initial Needs Case, the following primary options were assessed which after Cost Benefit Analysis (CBA) concluded that Option 4 was the preferred option.

Option	Description	Capex* (£m)	EISD[7]
0	Baseline - Single Circuit Trident 132kV wood pole from Fort Augustus to Ardmore	193.4	2025
1	Two 132kV wood pole single circuits from Fort Augustus to Broadford and a 132kV wood pole single circuit from Broadford to Ardmore.	239.8	2025
2	132kV steel tower double circuit from Fort Augustus to Broadford and a 132kV wood pole single circuit from Broadford to Ardmore.	340.4	2025
3	Two 132 kV wood pole single circuits from Fort Augustus to Invergarry, 132kV steel tower double circuit from Invergarry to Broadford and a 132kV wood pole single circuit from Broadford to Ardmore.	363.1	2025
4	Double Circuit 132kV steel tower from Fort Augustus to Edinbane with single 132kV trident to Ardmore	400.4	2025
5	Double Circuit 275 kV from Fort Augustus to Edinbane with single trident 132kV to Ardmore	519.9	2027

* **Price base of 2019/20, Class 0 Cost Estimates (-50% to +100%)**

[7] The Earliest In-Service Date (EISD) is based on the completion date, with the first year of full operation being the following year.

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