Scottish & Southern Electricity Networks

TRANSMISSION

# North of Beauly Dynamic Line Rating (DLR) LT000331

## Medium Sized Investment Project (MSIP) Submission

January 2025

Inveralmond House, 200 Dunkeld Road, Perth PH1 3AQ ssen.co.uk

# Contents






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# Executive Summary

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Name** | North of Beauly Dynamic Line Rating | | | | | | |
| **Project Reference** | LT000331 | | | | | | |
| **Investment Driver** | Network Capacity | | | | | | |
| **Start Year** | 2021 | | | | | | |
| **End Year** | 2025 | | | | | | |
| **Total Installed Cost Estimate (£m Nominal Price Base)** | £[redacted] | | | | | | |
| **Total Installed Cost Estimate (£m 18/19)** | £[redacted] | | | | | | |
| **Cost Estimate Accuracy (%)** | The majority of the costs are actual spend, the remainder is a Class 3 estimate with an accuracy of –5/+10% | | | | | | |
| **Projects spend to date (£m Nominal)** | £[redacted] | | | | | | |
| **Current Stage Gate** | Gate 3 | | | | | | |
| **Spend Profile** | **20/21** | **21/22** | **22/23** | **23/24** | **24/25** | **25/26** | **T3** |
| **£m, 18/19 Price Base** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| **£m, Nominal Price Base** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| **Funding request– Total spend less allocation to NZUIOLI Pot** | **20/21** | **21/22** | **22/23** | **23/24** | **24/25** | **25/26** | **T3** |
| **£m, 18/19 Price Base** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| **£m, Nominal Price Bae** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

All costs presented in this submission are presented in nominal price base, however we have converted the total cost estimate and the spend profile into 18/19 prices within the table above to ensure compliance with the Re-opener Guidance document.

In January 2022, we submitted the needs case for this project to Ofgem in our re-opener submission. Ofgem published its decision[1] to accept the need case and the preferred solution for the Beauly DLR project in September 2022. We do not consider that Ofgem need to reopen the needs case position as the drivers for the project are stronger since Ofgem approved the need in its September 2022 MSIP re-opener decision, with an increase in both connected and contracted generation in the area. The purpose of this submission is to present the costs and update Ofgem on any changes.

This application is submitted in accordance with Part C of Special Condition 3.14 (Medium Sized Investment Projects (MSIP) Re-opener) of our Licence. It presents the costs needed to develop and install a Dynamic Line Rating (DLR) system on the existing 275kV overhead line (OHL) circuits from Beauly to Loch Buidhe and Loch Buidhe to Dounreay (collectively, the 'North of Beauly DLR' project).

A significant quantity of offshore wind is contracted to connect north of Beauly, but connection is contingent on the proposed 'Spittal - Loch Buidhe – Beauly 400kV Reinforcement', which has an Earliest In-Service Date (EISD) of 2030. In addition to offshore wind, a considerable amount of onshore

[1] Decision on SHET's 2022 MSIP submissions | Ofgem

wind is contracted to connect in the Caithness area, north of the Beauly substation. Due to the volume of renewable generation seeking to connect in the mid-2020s, network constraints are expected from [redacted]. This precedes the proposed reinforcement, scheduled for 2030. In 2021 we collaborated with the (now) National Electricity System Operator (NESO)[2] to investigate a number of minimum build solutions to relieve those constraints and enable additional transport of renewable electricity prior to OHL reinforcement. We presented[3] the outputs of a Cost-Benefit Analysis (CBA) (undertaken by the NESO) which considered the value of four options: do nothing; installation of DLR; OHL reprofiling; and, DLR plus OHL reprofiling. That CBA recommended that we proceed with installing DLR on the existing 275kV OHLs from Beauly to Loch Buidhe and Loch Buidhe to Dounreay alongside OHL re-profiling.

In January 2022, we submitted the needs case for this project to Ofgem in our re-opener submission. Ofgem published its decision[4] to accept the need case for the Beauly DLR project in September 2022. In the period since that decision, we have progressed work on the recommended solution. Our original intention was to install DLR on the Skye 132kV circuit and then use insights from that work to provide technical and operational lessons learned to improve the North of Beauly DLR project. This strategy was revised following Ofgem's confirmation (September 2022) that it did not accept the need to deploy DLR on Skye. With the need for the North of Beauly DLR project accepted, we accordingly progressed that work first.

The CBA modelled the 'worst regrets' for each of the four options against a number of pre-defined scenarios. The least 'worst regret' option was to progress the full North of Beauly DLR project in conjunction with reprofiling the same overhead line corridor. We have progressed both components of the recommended option in tandem since approval. [redacted]

The DLR system which will be deployed on our network measures conductor temperature and sag to determine the maximum carrying capacity of the OHL. The system will comprise a fleet of sensors placed along the existing 275kV OHL circuits from Beauly to Loch Buidhe to Dounreay. DLR expands the carrying capacity of the OHL beyond static thermal ratings, if conditions are suitable. This enhances the capabilities of the network beyond the current capacity.

The estimated total installed cost of the project is £[redacted]. The project is expected to complete by 16 December 2025, with service charges included for the rest of the price control period. The total estimated installed costs (£[redacted]) comprise £[redacted] (Capex) and £[redacted] (associated Opex).

The Net Zero and re-opener Development Fund guidance allows us to use the NZ Use It or Lose It (NZ UIOLI) pot for early development work on projects we intend to bring forward under specific re-openers, including MSIP, up to the value of £2m per project. For this DLR project we are allocating £[redacted] of early development engineering and design costs of the project to the NZ UIOLI pot.

We are seeking allowances of £[redacted] (net of NZ UIOLI allocation) to support the deployment of the DLR system on the 275kV overhead line circuits from Beauly to Loch Buidhe to Dounreay. We are requesting that the Opex Escalator (OE) is not applied to any of our MSIP or VISTA applications. We have previously provided Ofgem with evidence that the mechanism is no longer appropriate in this context.

Given the anticipated connection of renewable generation in the mid-2020s, timely action is crucial. We have acted prudently and conscientiously to progress works on DLR in advance of award of

[2] Referred to throughout this submission as NESO
[3] SSENT Medium Sized Investment Project (MSIP) Submission, "North of Beauly Dynamic Line Rating / ANM" (31 January 2022).
[4] Decision on SHET's 2022 MSIP submissions | Ofgem

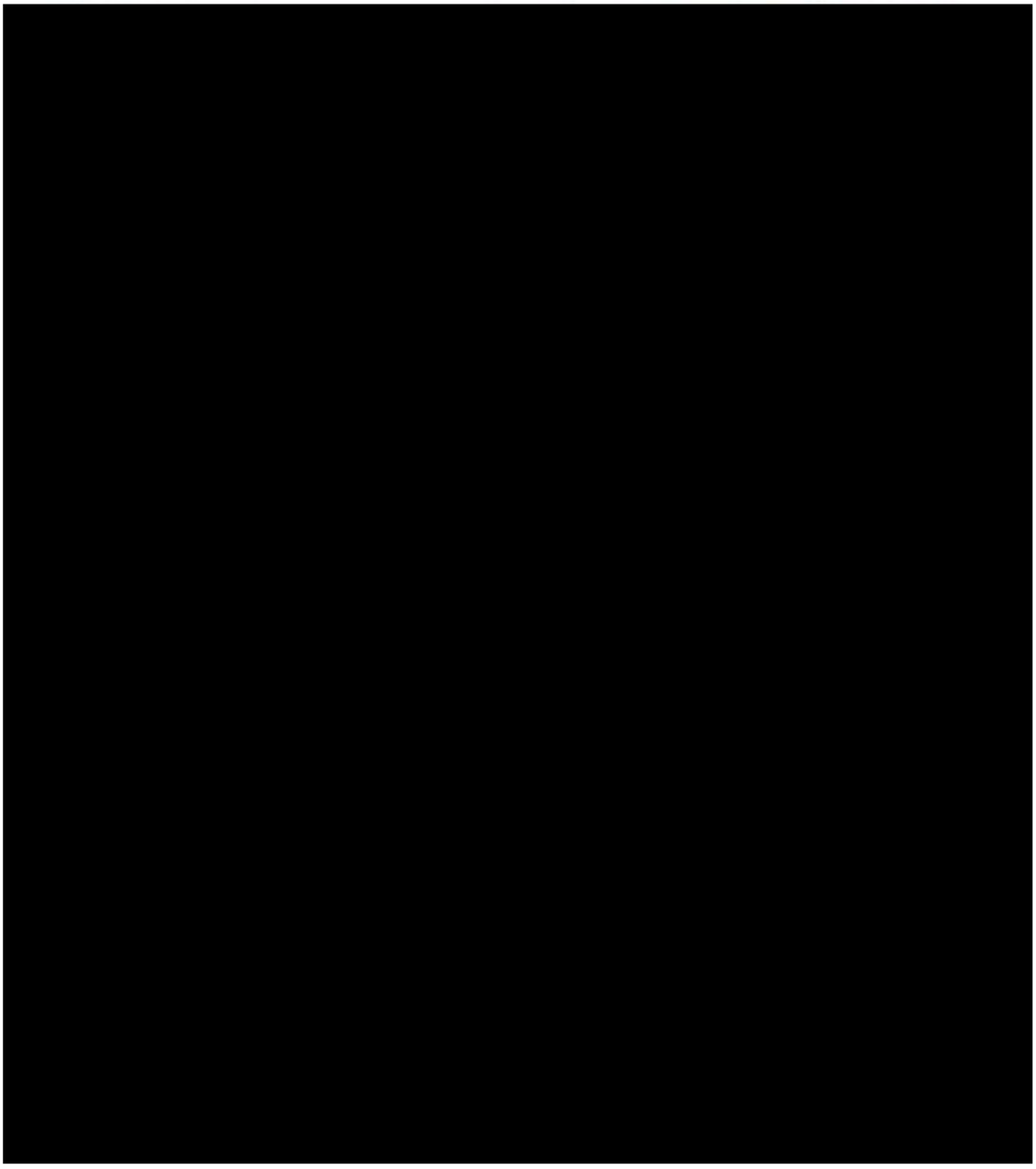
regulatory allowances. This was necessary to avoid delays which could hinder our own organisational and wider UK and Scottish Government strategic net zero ambitions. It was also required to mitigate the risks and adverse impacts associated with potential future constraint costs for consumers.

# 1 Introduction

## 1.1 Scope

In accordance with Scottish Hydro Electric Transmission Plc's Special Licence Condition '3.14 Medium Sized Investment Projects Re-opener and Price Control Deliverable (MSIPRE)' we are submitting this reopener application in line with paragraph 3.14.6 (i) "system studies by the ISOP or the licensee showing a need for dynamic line ratings".

This MSIP application relates to the design and installation of a DLR system on the existing 275kV double circuit OHL from Beauly to Loch Buidhe to Dounreay (the red circuit on the map in Figure 1.) This corridor is in the upper north reaches of our licence area.



DLR is a technology that allows the assessment of the real-time capacity of power lines to carry electricity. Unlike traditional Static Line Rating (SLR), DLR takes into account real-time environmental



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conditions to determine the actual transmission capacity of a line. It facilitates more efficient use of existing assets; avoids congestion restrictions; and supports bringing renewable generation onto the network.

The DLR system which will be deployed on our network will comprise a fleet of sensors placed along the existing 275kV OHL circuits from Beauly to Loch Buidhe to Dounreay to measure conductor temperature and sag to determine the maximum carrying capacity of the OHL. Line-mounted sensors will measure (not calculate) the maximum conductor sag and temperature, providing *instantaneous* weather conditions (capable of a resolution / definition level down to 15-minute weather windows). This information is then fed into an algorithm which then calculates the instantaneous rating for each location.

DLR expands the carrying capacity of the OHL beyond static thermal ratings, if conditions are suitable, enhancing the capabilities of the network beyond the current capacity. The DLR system will provide a feed to our SSEN Transmission Control Room. Data will be collated and reported to the NESO in the form of a Rating Sheet, which will allow the NESO Control Room to act appropriately to manage constraints on the network. As noted above, we are working with the NESO to understand how we can further enhance this capacity in future by deploying an Active Network Management (ANM) system.

The need for the project and the preferred solution was approved by Ofgem in September 2022. This submission focuses on the costs of delivering the DLR solution.

## 1.2 Structure and content of MSIP Submission

This MSIP submission is structured as follows:

Section 2: Need
This section restates the need for the project, which has not materially changed since Ofgem decision on need in September 2022.

Section 3: Optioneering and preferred option
This section summarises the options considered to address the "need" described in Section 2. The preferred solution has not changed since Ofgem's decision in September 2022.

Section 4: Stakeholder engagement
This section identifies relevant stakeholders and provides information on how engagement with these stakeholders has supported development of the project.

Section 5: Whole system
This section discusses our 'Whole Systems' approach.

Section 6: Procurement process
This section explains our approach to procurement for the project.

Section 7: Cost information
This section includes justification for the expenditure anticipated, supported by evidence on cost drivers, forecasts, and any mitigating actions progressed to improve economic outcomes for consumers. It also sets out the approach to costing the project and the basis of calculation and justification for each individual costed element of the project.

Section 8: Conclusion

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

## 1.3 Requirement Mapping

Table 1 sets out how the submission meets the requirements set out in Special Condition 3.14 and associated guidance[5].

| 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 2, 3, 6 & 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 and 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 7 |
| Explanation of the basis of the calculation any amendments requested to allowances | Section 7 |

Table 1: Requirement mapping

[5] "Re-opener Guidance and Application Requirements Document" (Ofgem, 3 February 2023)




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# 2 Need

This chapter summarises the needs case from our MSIP re-opener submission in January 2022, including any amendments. We do not consider that Ofgem need to reopen the needs case position as the drivers for the project are stronger since Ofgem approved the need in its September 2022 MSIP re-opener decision, with an increase in both connected and contracted generation in the area.

A significant amount of renewable generation is contracted to connect north of Beauly substation, in the Caithness region of our network. At the time of our MSIP re-opener submission in January 2022 [redacted]MW of new renewable generation was contracted to connect in the area. There is now approximately [redacted]MW of new renewable generation contracted to connect in the area with a connection date prior to October 2030.

This application is submitted in accordance with Part C of Special Condition 3.14 (Medium Sized Investment Projects (MSIP) Re-opener) of our Licence[6]. This application[7] presents the costs to develop and install a Dynamic Line Rating (DLR) system on the existing 275kV overhead line (OHL) circuits from Beauly to Loch Buidhe and Loch Buidhe to Dounreay (collectively, the 'North of Beauly DLR' project). The DLR system is forecast to enter service by 16 December 2025. It is designed to alleviate connection constraints ahead of the proposed 'Spittal – Loch Buidhe – Beauly 400kV Reinforcement', a new 400kV double circuit OHL which has an EISD of 2030. We request regulatory allowances of £[redacted] to account for delivery of the work required.

Our original MSIP submission proposed a delivery date of 2024 for DLR. This date was proposed at a time when the project was in early-stage development. However, as the project entered delivery, we have had to deal with the emergence of challenging outage conditions which were not previously forecast. This has resulted in us revising our delivery date to 2025. This is not expected to have a material impact on consumers nor the economic case for delivery. Our delivery date is still anticipated during the period when constraints are expected from[redacted]

The project is aligned with our RIIO-T2 business strategy and will deliver the following outputs and benefits:

- alleviating network constraints in the north of our network in line with our RIIO-T2 goal to transport the renewable electricity that, in total, powers 10 million homes;
- alignment with our goal to provide network connections to meet our customer needs (on time and on budget); and
- alignment to our Innovation Strategy, correlating with the four focus areas – Safer, Smarter, Greener and Faster.

[6] Special Conditions to Scottish Hydro Electric Transmission Plc's Electricity Transmission Licence (20 October 2023).

[7] While the total cost of the project does not exceed the minimum threshold for an MSIP, this submission is being presented alongside other applications which have a cumulative value above 0.5% of ex ante average base revenue. Therefore, a MSIP remains the most appropriate funding mechanism for DLR.

# 3 Optioneering and Preferred Option

The preferred solution outlined below was approved by Ofgem in its decision in September 2022. We have presented a summary of the CBA conducted, along with the preferred option for information only. We do not consider that Ofgem need to reopen the needs case and solution analysis position.

This chapter summarises the optioneering and preferred option from our MSIP re-opener submission in January 2022. Ofgem concluded in September 2022 that the installation of DLR technology together with a static line rating increase (which is also referred to as 'OHL line reprofiling') best met the network needs. [redacted]

The January 2022 MSIP submission also discussed introduction of an Active Network Management (ANM) system. ANM is designed to handle rating insights that enhance the NESO's ability to manage the system. Data collected from the DLR system will inform the nature of the future ANM system. We are continuing to collaborate with the NESO to define specifications for the ANM. At this stage, we are not seeking allowances for the ANM system.

## 3.1 Detailed analysis

The CBA conducted by the NESO[8] assessed the economic benefit of the minimum build solution proposed to mitigate network constraints for the five-year period from [redacted]. We requested that the NESO consider two contracted scenarios in their CBA:

- **Scenario 1** – All contracted generation north of Beauly; and
- **Scenario 2** – All contracted generation north of Beauly except transmission contracted generation located on Orkney ([redacted]MW) and Marine generation ([redacted]MW).

[redacted]

[redacted]

[8] We collaborated with the ESO to conduct the CBA, which was prior to the establishment of the NESO on 01 October 2024.

[redacted]

[redacted]

## 3.2 Preferred Option

The NESO relied upon the outputs of the CBA when recommending that we proceed with both installation of the North of Beauly DLR project and OHL line reprofiling of the same cable corridor. In the period since that MSIP submission was approved, we have progressed work on the recommended solution, but the following key points should be noted:

- Our original intention was to install DLR on the Skye 132kV circuit and then use insights from that work to provide technical and operational lessons learned to improve the North of Beauly DLR project. This strategy was revised following Ofgem's confirmation (September 2022) that they did not accept the need to deploy DLR on Skye. With the need for the North of Beauly DLR project accepted, we accordingly progressed that work first.

- The CBA modelled the 'worst regrets' for each of the four options against a number of pre-defined scenarios. The least 'worst regret' option was to progress the full North of Beauly DLR project in conjunction with reprofiling the same overhead line corridor[9]. We have progressed the two proposals in tandem since approval. [redacted]

For the purposes of this MSIP submission, we have concentrated solely on the DLR component of the approved solution.

[redacted]

[9] [redacted]

[10] We note that January 2022 MSIP submission also discussed introduction of an Active Network Management (ANM) system (designed to handle rating insights that enhance the NESO's ability to manage the system.) Data collected from the DLR system will inform the nature of the future ANM system. We are continuing to collaborate with the NESO to define specifications for the ANM. At this stage, we are not seeking allowances for the ANM system.

The cost of this solution will be recovered by savings made from alleviating future network constraints. Delay is not an appropriate option as this would result in the adverse outcomes modelled in the NESO's 'do nothing' counterfactual.

The project has been developed using our Large Capital Project (LCP) governance framework. This ensures that it is governed, developed, approved and executed safely, consistently and effectively. As part of this governance, a Project Programme and Project Development Plan are prepared. These tools guarantee that: sufficient resources are in place to support delivery; reporting mechanisms are present to escalate issues and monitor progress; and a clear event schedule is followed. Both documents are located in the Supplementary Evidence accompanying this submission.

A technology-based Price Control Deliverable (PCD) is appropriate for this project as the output depends on annual wind variability. We submit that the PCD could be based on our commitment to install a DLR system from Beauly to Loch Buidhe and Loch Buidhe to Dounreay, consisting of weather line-mounted sensors.

# 4 Stakeholder Engagement

## 4.1 Our Commitment to Stakeholder Engagement

We are committed to delivering sector-leading stakeholder engagement in collaboration with global consulting and standards firm AccountAbility. AccountAbility work with organisations internationally to adopt responsible business practices and transform long-term performance. Our Stakeholder Engagement Strategy outlines how we interact with and involve our stakeholders in our business activities.

We comply with AccountAbility's AA1000 'Stakeholder Engagement Standard'. This is considered the 'gold standard' in stakeholder engagement accreditation. Our most recent AA1000 Stakeholder Engagement Standard Health Check reported a total score of 88% for the 2023/24 assessment. Our score means we continue to sit within the 'Advanced' stage of the AccountAbility Stakeholder Engagement Maturity Ladder across the six pillars within it, operating at the highest level of stakeholder engagement.

## 4.2 Key Themes of our Stakeholder Engagement Activities


Figure 2: DLR Stakeholders

The DLR system will operate within the footprint of the existing OHL. Installation and maintenance will therefore cause minimal disruption.

We have engaged with communities, local landowners and environmental stakeholders and focused on promoting the use of this progressive technology. The key emerging themes from our stakeholder engagement on the North of Beauly DLR project are outlined below. As a trial project, stakeholder feedback has primarily come from wider industry stakeholders, who are largely supportive of 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 NESO, other Transmission Owners (TOs), 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 North of Beauly DLR project is one small way to trial and test the adaptability of existing infrastructure to operate more

flexibly using weather and temperature data. In the NESO Future Energy Scenarios 2021 publication, it highlights the need for the grid to become more adaptable.

### 4.2.2 Reduce constraint costs ultimately paid by GB energy consumers

The GB energy market is often criticised publicly for the cost of electricity generation constrained off, due to grid constraints during periods of high wind, with these additional charges ultimately paid 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 it is important that timely investment is made to ensure that networks can facilitate efficient constraint costs.

The NESO launched a 5-point plan to relieve increasing congestion projected on the NETS. This plan focuses on additional items over-and-above those already 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 & TOs;
- Storage (CMP); and,
- Network improvement targeting and acceleration.

All three GB onshore TOs 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. This is targeted with a view to providing additional network development options for congestion relief. DLR has been highlighted as one of the options (by the NESO) which could support this ambition.

### 4.2.3 Flexible connection contracts for generation customers

Given the footprint of our network, there is high demand for additional connections from new wind farms. There are also many non-firm connection contracts for existing generation customers. The DLR technology would increase the capacity of the existing network. This could help 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 North of Beauly DLR project would lead the investigations on our network to use this equipment, we are aware that our peers at National Grid Electricity Transmission are carrying out similar investigations. We are reaching out to hear more about their developments and how we can both share learnings.

## 4.3 Stakeholder Engagement Next Steps

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

- working with our procured supply chain to achieve safe and compliant delivery by the target date;
- working with the NESO to identify an adequate resolution for OHL rating change and the preferred data sharing methods (and format) for feeding rating change information to the NESO control room (i.e. to ensure efficient management of the system north of Beauly);
- working with generation customers to develop contractual terms which will facilitate and optimise the use of the additional capacity when it is available; and
- sharing lessons learned with other ETOs to improve development of similar projects.

# 5 Whole System

We have held a number of discussions with SSEN Distribution to identify if there are any alternative reinforcement proposals north of Beauly. Most of the generation connected and contracted to connect north of Beauly is to connect to the transmission network. Considering the low cost of the minimal build solution proposed, no credible alternative solutions have been identified.

The north of Beauly DLR system was discussed with the NESO. In collaboration with us the NESO conducted the CBA which is discussed in full detail above.

# 6 Procurement

## 6.1 Procurement Strategy

The main objective of the procurement strategy for the DLR project was to deliver a high quality and reliable system in the most economic and efficient manner. Our procurement and contracting strategy considered options to drive efficiency and value for money. Competitive regulated tendering was conducted to encourage competition and offer value for money.

The strategy considers the project's innovation and remote location to ensure efficient management of costs.

## 6.2 Governance – Procurement, Insurance and Legal

All major investment projects must be managed, approved, and executed consistently and effectively to ensure safe, sustainable, and timely completion. The financial threshold (within SSEN Transmission) for use of the LCP governance framework is a project investment value greater than [redacted].

A stage gate strategy is followed for the entire project lifecycle, in line with our LCP framework. The process is phased across six gates (0 to 5), with clear consistent deliverables for each gate. The DLR project will pass Gate 3 in February 2025 and Gate 4 is scheduled in June 2025.

Our governance framework and competitive processes ensure optimal risk allocation, consumer value, and cost reduction.

## 6.3 Commercial and Contracting Strategy

At Gate 1 (November 2021) all potential options were developed and assessed, and a preferred solution was selected.

The works, goods and services will be supplied via a combination of one-off regulated tenders and framework awards. Further explanation on the main procurement activity is provided below.

| Work Package | Scope of Works | Quantities | Procurement Strategy |
|---|---|---|---|
| A | **Dynamic Line Rating (DLR) System Trial** | 1 Trial | Request for Information via Find a Tender |
| B | **DLR System** | 58 Units | Competitive Regulated Framework Agreement |

Table 4: Procurement of Works, Goods and Services

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

Given the innovative nature of DLR technology, we approached the market to identify a range of different DLR systems from two suppliers ([redacted]). These were tested on the network to determine which technology best met our requirements. Using information from the trial, we produced a system specification outlining the requirements of the DLR system. Our OHL specifications will be updated to include an option for DLR.

As per the Utilities Contracts Regulations, the trial was conducted in a manner that allows and encourages the identification of a range of acceptable solutions or options. We employed processes to ensure we did not develop relationships which could otherwise hinder a fair and open process or limit competition.

The procurement strategy was developed at Gate 1 to enable the following:

- contract strategy;
- innovation;
- maximise the scope that could be competitively tendered);
- supply chain capability to be identified;
- achieving the most cost-efficient contract price; and
- reducing and mitigating interface risk.

During the trial, DLR systems from [redacted] were evaluated to assess the different technologies employed. The results helped to inform the project team of certain technological and economic requirements that would be important in our future DLR system. Further analysis was conducted during the tender exercise in early 2024, incorporating the lessons learned from the trial. [redacted] was identified as the preferred supplier as it aligned with our technical and economic requirements.

After the trial, a regulated tender was initiated to obtain the most competitive prices available in the current international market.

The competitive process was robust and transparent to ensure equal treatment of potential bidders whilst protecting information appropriately. A compliant EU regulated two-stage tender process (Prequalification and Invitation to Tender (ITT)) was administered. This provides the most economically advantageous solution for the consumer as it maximises 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 for the North of Beauly DLR project.

Based on the considerations outlined in the section on Package A above, Package B was awarded to [redacted]. Their system uses local weather monitoring and conductor measurements to accurately determine the true real time rating of the conductor, increasing circuit capacity and alleviating network constraints.

We prepared a Tender Evaluation Report (TER) for the key contract 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 which justify the procurement process undertaken.

Work Package B was awarded to [redacted] following a regulated tender event. The Framework Agreement Contract Award Notice value was for [redacted] over a 3-year term. This allows SSEN Transmission to call-off until the end of our RIIO-T2 period.

| Item | Quantity (approx.) |
|---|---|
| DLR System | 58 units |

Table 5: DLR System equipment

# 7 Cost Information

## 7.1 Costing Approach & Cost Breakdown

This section provides an overview of cost approach and breakdown identifying the key assumptions and exclusions. The estimated total installed cost of the project is £[redacted]. This cost includes £[redacted] Capex and £[redacted] of associated Opex allowance. Installation works are due to be completed in 2025, with service charges to be incurred until 2026.

The Net Zero and re-opener Development Fund guidance[11] allows us to use the NZ Use It or Lose It (NZ UIOLI) pot for early development work on projects we intend to bring forward under specific re-openers, including MSIP, up to the value of £2m per project. For this DLR project we are allocating £[redacted] of early development engineering and design costs of the project to the NZ UIOLI pot.

We are seeking allowances of £[redacted] (net of NZ UIOLI allocation) to support the delivery of the Deployment of the DLR system on the 275kV overhead line circuits from Beauly to Loch Buidhe to Dounreay.

We are requesting that the Opex Escalator (OE) is not applied to any of our MSIP or VISTA applications. We have previously provided Ofgem with evidence that the mechanism is no longer appropriate in this context.

The total cost for the project is forecasted at £[redacted]. The years following RIIO-T2 will be funded through business-as-usual network operating costs. The Class 3 estimate covers all pre-construction and construction costs. These have been developed and approved in full compliance per our Large Capital Project (LCP) Governance Manual (available on request).

| Category | Project Class 3 Estimate north of Beauly DLR (MSIP) (Nominal Price Base) | SSEN Transmission Project Cost Class | SSEN Transmission Indicative Estimate Tolerance | Supporting Documentation |
|---|---|---|---|---|
| **Total** | [redacted] | Class 3 | -5% / +10% | Framework Agreement/ Contract/ Bill/ Spreadsheet/ Quotations |

Table 6: Project Class 3 Cost Estimate

- The Estimate has a Class 3 accuracy range from -5% / +10% based on the project status and scope maturity. 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.

We have acted prudently and conscientiously to progress works on DLR in advance of award of regulatory allowances. The preparatory activities include performing sensor trials, supplier evaluations, detailed line assessments, and outage requests. This was necessary to avoid delays which could hinder our own organisational and wider UK and Scottish Government strategic net zero ambitions. It was also required to mitigate the risks and adverse impacts associated with potential future constraint costs for consumers. Given the anticipated connection of renewable generation in the mid-2020s, timely action is crucial.

[11] Net Zero Re-opener Development UIOLI Allowance Governance Document

## 7.2 General Assumptions

- All costs are based on prices deemed to be 2024/2025 (nominal) cost base. We note them in 2018/19 prices in the Executive Summary table.

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

The geographical location of Beauly and the innovative nature of the works to be carried out presents significant challenges for the development, planning, construction and operational phases. We have undertaken a significant review of our existing frameworks, market conditions and geographical factors to ensure an effective procurement and contracting strategy is progressed.

The Cost Estimate was developed in line with our Costing Methodology and LCP Governance process. The estimate is based on an expert assessment of the scope and any project-specific information plus relevant assumptions.

A detailed breakdown of the Class 3 cost estimates for the project are presented in the table below.

| Area | Cost Estimates (£m Nominal) | % of Project Costs |
|---|---|---|
| 01 SSENT Staff Costs | [redacted] | [redacted] |
| 02 Regulatory and Consent | [redacted] | [redacted] |
| 03 Engineering | [redacted] | [redacted] |
| 04 Equipment and Procurement | [redacted] | [redacted] |
| 05 Construction | [redacted] | [redacted] |
| 06 Commissioning | [redacted] | [redacted] |
| 07 Operations | [redacted] | [redacted] |
| 08 Risk | [redacted] | [redacted] |
| Total Execution | [redacted] | [redacted] |

Table 7: Class 3 Cost Estimates Breakdown

SSENT staff costs were calculated using staff hours and RIIO-T2 day rates converted to hourly figures. Preconstruction activities are complete, and project management and site work are currently underway. Contracts for engineering and equipment are awarded, and servicing costs are set.

The cost estimate and costing approach for each element of the DLR system is detailed in the table below. The following sections explain how these costs were calculated.

| Project Activity | Cost Estimates (£m Nominal) | Costing Approach |
|---|---|---|
| Project Management | [redacted] | Actual to date & forecast to completion |
| DLR Sensor Trial | [redacted] | Actual Incurred Costs & Forecast Remaining |
| DLR System | [redacted] | Internal estimate informed by DLR Trial RFI |
| Installation | [redacted] | Internal estimate provided by Transmission Operations team and DLR annual costs. |
| Risk | [redacted] | RIIO-T2 Project Risk Allocation ([redacted] of capex) |

Table 8: Project Activity Cost Breakdown

**DLR Sensor Trial**

There are two main types of technology available for DLR sensors: conductor-mounted sensors (installed directly on the OHL conductor) and tower/pole-mounted sensors (installed on a transmission tower or wood pole). The primary measurements of a conductor-mounted sensor include conductor temperature, vibration, angle of the conductor, and Light Detection and Ranging (LIDAR) measurement to ground. The primary focus of a tower-mounted device is typically on the position of the conductor in space.

As outlined in our 2022 submission, our plan was to trial various DLR technologies and test them on the network to determine which technology best meets the project's requirements. This approach ensured that the technology and capabilities of the units deliver the needed outputs for our network.

The technology trial was initially scheduled to commence in September 2022. However, due to delays in obtaining the necessary information from the supply chain and the subsequent rescheduling of outages to install the sensors, the trial was conducted in January 2023 on sensors from [redacted]. Prior to the January 2023 trial, we conducted bench testing of the sensors to better understand the different types of technology. The bench trial allowed us to make an initial assessment of the devices' suitability for our network and provided an opportunity to train operational staff in the fitting of the devices.

In January 2023, the sensors were installed on a live circuit, allowing us to test them in a real-world scenario and draw conclusions on their accuracy, durability, reliability, and maintainability. This provided us with the knowledge to produce a specification for the DLR sensor device required for tender.

**DLR system**

Initial bench testing indicated that the conductor-mounted sensor technology was the most appropriate for the North of Beauly system and deployment environment. Consequently, our cost estimate is based on conductor-mounted DLR sensors.

The sensors from [redacted] were evaluated and monitored during the trial period. We issued an ITT to ensure a fair and open process, as noted in Section 6.3. The results informed the project team about the technological and economic requirements for the future DLR system, leading to [redacted] being identified as the preferred supplier.

Weather station specifications were provided by the [redacted], and the appropriate equipment was identified. The costs were estimated based on a quote from OTT Hydrometer for this project.

The table below summarises the average unit cost of each DLR system component and the total cost for the bulk order discount for purchasing 58 units. DLR sensor unit costs are based on the [redacted] conductor-mounted sensor.

| Equipment | Average Unit Cost | Number of Units | Total Cost |
|---|---|---|---|
| DLR Sensor Units (Supplier: [redacted]) | [redacted] | 58 | [redacted] |
| Weather Station | [redacted] | 4 | [redacted] |

Table 9: Summary of DLR system costs

**Installation**

The installation of the DLR equipment will be executed internally by our Transmission Operations team. The cost estimate for this activity was prepared considering the location of the towers, the number and type of field personnel required, necessary equipment, transportation needs, and the duration of outages. This detailed knowledge allows for greater accuracy and confidence in the cost estimate, as regional and site-specific factors are incorporated.

The labour costs associated with the installation are derived from our approved charging statement, which outlines the day rate for specific roles within SSEN Transmission. The DLR installation works will be completed over [redacted] planned outages by [redacted] teams, each consisting of [redacted] linespeople, [redacted] Site Foreman, and [redacted] Engineer, as well as [redacted] additional outages involving [redacted] Engineer, [redacted] Foremen, and [redacted] linespeople. We have provided a detailed estimate as part of the supplementary information, offering a comprehensive breakdown of the costs.

| Circuit Section | Duration | Labour Cost | Plant Cost | Total |
|---|---|---|---|---|
| BYL-FYL | 5 Days | [redacted] | [redacted] | [redacted] |
| DNG1 | 5 Days | [redacted] | [redacted] | [redacted] |
| LT1 | 4 Days | [redacted] | [redacted] | [redacted] |
| NGU1 | 3 Days | [redacted] | [redacted] | [redacted] |
| TD1 | 3 Days | [redacted] | [redacted] | [redacted] |
| Total | 20 Days | [redacted] | [redacted] | [redacted] |

Table 10: Summary of installation costs

It should be noted that the estimate includes overtime provision for anti-social hours required to minimise outage disruption to customers when delivering this project.

## 7.4 Project Benchmarking & Metrics

Due to the innovative nature of the project, we have not previously embarked on a DLR project. Therefore, we could not benchmark the cost estimate for the DLR system against Internal or Regulator Cost Metrics. However, cost estimates for the DLR system were based on the competitive tender process described in Section 6, ensuring an economic and efficient cost for consumers. The result was the selection of the most economically advantageous tender (MEAT), which also presented the most efficient (lowest) commercial price offer.

## 7.5 Risk Strategy

The north of Beauly DLR Project is managing risk in accordance with ISO31000 (the International Standard on Risk Management) and our SSE LCP Governance framework.

The key risks that the project faces are set out in the project delivery plan. This plan sets out the process that the project will follow to manage risk. It establishes project team roles and responsibilities in respect of managing risk. It outlines the SSE LCP Risk Management Information System (RMIS) for managing risk on the project (i.e. KERIS or Knowledge Exchange Risk Information System).

KERIS will act as the repository for all project risks (both threats and opportunities) as it allows the users to create risks, impact assess them and then 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. It is an ongoing project activity to ensure that risk data is captured, up to date and can be used to support project decision-making. The North of Beauly DLR Project team holds 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 framework. The risk register is a live document that evolves through continuous updates and contributions from the project team over the life of the project.

The risk status is regularly reviewed by the Project Manager to produce the following outputs:

- Updated reports detailing the status of risks and actions (to highlight those requiring attention);

- A monthly report is prepared detailing: overall risk progress; new risks and actions, opportunities, and closed items; risk gaps; and areas where risk focus needs to be concentrated for the project; and,
- A risk value which is calculated by the same methodology as detailed and substantiated in our RIIO-T2 Business Plan Submission. A risk register for the DLR project has been provided in the supplementary evidence justifying the risk allowance for the project.

The current project Risk Register has been generated in line with the requirements above, this allows us to generate a cost for the project risks at the current position before construction starts, predicting a mean cost for the risks noted within the risk register. The value of the risks that have been priced at this stage against the probability allocated to each risk generates a risk cost of £[redacted] to the works included within this MSIP.

The key project risks are summarised in Table 11 below. These risks were identified and raised at various stages in the project. Consequently, these risks have influenced various phases of the project lifecycle. For further detail, refer to the risk register attached to this submission.

[redacted]

# 8 Conclusion

A significant amount of renewable generation is contracted to connect north of Beauly but connection is contingent on the proposed 'Spittal – Loch Buidhe – Beauly 400kV Reinforcement', which has an EISD of 2030. A number of minimum build solutions were identified to alleviate network constraints prior to OHL reinforcement. The CBA recommended that we proceed with installing DLR on the existing 275kV OHLs from Beauly to Loch Buidhe and Loch Buidhe to Dounreay alongside OHL re-profiling. We have progressed both components of the recommended option in tandem, as separate projects, since approval. [redacted]

The DLR technology expands the carrying capacity of the OHL beyond static thermal ratings, if conditions are suitable. The technology sits within the footprint of the existing OHL, requiring minimal installation and maintenance works. Installation of the DLR system is expected to be finalised in 2025.

Within this submission we have outlined the requested costings and funding requirements, supporting our request for an allowance of £[redacted].

We are requesting that Ofgem provide us with the funding needed to deliver the proposed price control deliverable summarised out in the table below.

| Scheme Name | Output | PCD Delivery Date | Allowance (£m) (Nominal Price Base) |
|---|---|---|---|
| North of Beauly DLR (Project Number: LT000331) | Deployment of the DLR system on the 275kV overhead line circuits from Beauly to Loch Buidhe to Dounreay has been completed. | 31 March 2026 | [redacted] |

Table 10 – Requested Price Control Deliverable (PCD)

## Next Steps

Following submission of the MSIP application, we anticipate a decision from Ofgem within four to six months. In the meantime, we will continue with installation of the DLR system on the identified circuits. Continued collaboration will also be undertaken with NESO to ensure that DLR rating is appropriately and accurately communicated, allowing NESO to employ the new ratings on the network.

When the DLR system is fully operational, and all parties are comfortable with the dynamic ratings, it is expected that some level of automation will be introduced to allow a more efficient use of DLR across our network. We will continue to assess future uses of DLR technology on other areas of the network.

[12] We note that January 2022 MSIP submission also discussed introduction of an ANM system (designed to handle rating insights that enhance the NESO's ability to manage the system.) Data collected from the DLR system will inform the nature of the future ANM system. We are continuing to collaborate with the NESO to define specifications for the ANM. At this stage, we are not seeking allowances for the ANM system.

We will continue to collaborate with the NESO and other interested TO's to develop ANM functionality designed to handle rating insights that enhance the NESO's ability to manage the system. Data collected from the DLR system will inform the nature of any future ANM system.

# Appendix A Glossary of Terms

| Acronym | Definition |
|---|---|
| ANM | Active Network Management |
| CBA | Cost Benefit Analysis |
| CfD | Contracts for Difference |
| CM HVDC | Caithness-Moray High Voltage Direct Current link |
| CUSC | Connection and Use of System Code |
| DLR | Dynamic Line Rating |
| EISD | Earliest In-Service Date |
| ENA | Energy Networks Association |
| ESO | Electricity System Operator |
| FES | Future Energy Scenarios |
| ITT | Invitation to Tender |
| LCP | Large Capital Project |
| LIDAR survey | Light Imaging, Detection And Ranging survey |
| MEAT | Most Economically Advantageous Tender |
| MSIP | Medium Sized Investment Project |
| NESO | National Energy System Operator |
| NETS SQSS | National Electricity Transmission System Security and Quality of Supply Standard |
| NOA | Networks Options Assessment |
| NPV | Net Present Value |
| NZ UIOLI | Net Zero Use-it-or-lose-it |
| OE | Opex Escalator |
| OHL | Overhead Line |
| PSTs | Phase shifting transformers |
| RTTR | Real-time thermal rating |
| SLR | Static Line Rating |
| STC | System Operator Transmission Owner Code |
| TO | Transmission Owner |
| TOCA | Transmission Owner Construction Agreement |

# Appendix B List of supplementary documents and evidence

| Title | Description |
|---|---|
| LT00031_North of Beauly DLR Programme | Project programme for North of Beauly DLR |
| Class 3 Cost Estimate | Estimate document identifying the project estimate at completion cost at Gate 3 |
| LT331 NofB DLR – KERIS Risk Register | Risk register for North of Beauly DLR |