

LAIRG TO LOCH BUIDHE REINFORCEMENT Consultation Document

June 2014

Scottish Hydro Electric Transmission plc

Lairg to Loch Buidhe Reinforcement

Consultation Document

Published by
Scottish Hydro Electric Transmission Plc
10 Henderson Road
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GLOSSARY

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Lairg to Loch Buidhe Reinforcement Consultation Document

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Copies of this document can be found online at:

<http://www.ssepd.co.uk/Lairg/>

Copies will be placed on deposit for public viewing during normal opening hours at the following locations:

Lairg Service Point Main Street Lairg IV27 4DB	Bridgend Stores Ord Place Lairg IV27 4BA
Bonar Bridge Service Point Carnegie Building Lairg Road Bonar Bridge IV24 3EA	Lairg Library Community Centre Main Street Lairg IV27 4DD

A public consultation event detailing the proposals within this document will be held on 26th June 2014 from 3pm to 7pm at the following location:

Lairg Community Centre
Main Street
Lairg
IV27 4DB

Scottish Hydro Electric Transmission Plc request that all consultation responses are received by: 1st August 2014.

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GLOSSARY

Connection Option	One of several possible routes which a new transmission line could follow between the required electricity connection points
EIA	Environmental Impact Assessment
EIA Scoping stage	The process of seeking an 'EIA scoping opinion' from the consenting authority incorporating representations from statutory and non-statutory organisations on the proposed scope of environmental assessment required to support an application for consent
ES	Environmental Statement
GSP	Grid Supply Point. An electricity network connection point used for linking transmission voltage OHLs (132 kV or greater) with smaller voltage distribution OHLs (33 kV or lower).
GWDTE	Groundwater Dependent Terrestrial Ecosystem
kV	Kilovolt (1000 volts) - capacity of an electricity power line
Listed Building	A building that has been recognised through the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 as of special architectural or historical interest.
LOD	Limits of Deviation, an area which defines the practical limits within which micro-siting of the OHL infrastructure can occur within the terms of the s37 consents which are to be sought. The purpose of limits of deviation is to allow flexibility within a s37 consent for the final micro-siting of individual towers to respond to localised ground conditions, topography, engineering and environmental constraints
OHL	Overhead line
Preferred Corridor	The corridor option which is considered to represent the optimum balance between the various environmental, engineering and technical considerations
Preferred LOD	The LOD option which is considered to represent the optimum balance between the various environmental, engineering and technical considerations
Proposed LOD	The final LOD which will be brought forward as the basis of an application for consent under the Electricity Act 1989
Route Option	One of several possible alignments which a new transmission line could follow
Routing Study	The process of selecting a preferred LOD for a new transmission line
s37 Consent Application	An application for development consent under section 37 of the Electricity Act 1989
SAM	Scheduled Ancient Monument

SHE Transmission	Scottish Hydro Electric Transmission Plc
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
Substation	An electricity network connection point used for linking transmission voltage OHLs (132 kV or greater)
VP	Vantage Point locations overlooking the area of search for connection options from which ornithology surveys were carried out.

EXECUTIVE SUMMARY

This consultation document invites all interested parties to comment on the proposals by Scottish Hydro Electric Transmission Plc (SHE Transmission) to construct a new substation near Lairg, connected by 15 km of new double circuit 275 kV overhead line (OHL), supported by lattice steel towers, to the consented new substation at Loch Buidhe.

The proposals will provide a connection to the transmission system for new generation projects currently under development in the vicinity of Loch Shin.

This consultation document outlines the process by which the preferred substation location and preferred LOD for the OHL have been selected. Comments are now sought from relevant statutory authorities, key stakeholders, elected representatives and the general public.

In early 2014 SHE Transmission completed a routing study to select a preferred alignment for the new OHL, comprising Preferred Limits of Deviation (LOD). This was completed in association with a separate, but linked, process which identified a preferred substation location near Lairg.

The new 275 kV OHL between Lairg and Loch Buidhe will be constructed using lattice steel towers. The towers will generally be in the region of 46 m in height, with span lengths in the region of 250 - 300 m.

The proposed substation near Lairg will connect the proposed 275 kV OHL to the existing 132 kV OHL from Cassley Grid Supply Point (GSP), near the north end of Loch Shin, and from the existing Lairg GSP. The preferred substation location has been selected based on technical, economic and environmental factors and taking into account feedback received from earlier consultation undertaken in November 2013.

The Preferred LOD has been selected to provide an optimum balance of technical, economic and environmental factors. The selection of the Preferred LOD was undertaken by means of a three-stage process as follows:

- Stage 1: identification of route corridor options and selection of a preferred corridor;
- Stage 2: initial public consultation (November 2013); and
- Stage 3: development of alternative LOD in response to consultation comments and the selection of a Preferred LOD.

The design of the proposals will be informed by responses received from this consultation exercise and by continuing detailed surveys, in order to identify any as yet unknown engineering, environmental or land use constraints, which may require further modifications to the LOD before finalising the proposed LOD. A proposed LOD will then be brought forward with an application for consent in 2015.

When providing your comments and feedback, SHE Transmission would be grateful for your consideration of the questions below:

- i. Is the rationale for the project clearly set out in the consultation document?
- ii. Is the approach to the selection of the preferred connection option, identifying the optimum balance of technical feasibility, economic viability and least environmental disturbance, clearly set out?

- iii. Are there any factors you consider may have been overlooked or given either insufficient or too much consideration during the selection process?
- iv. Do you have any other comments about the preferred route?

1 INTRODUCTION

- 1.1.1 This consultation document invites all interested parties to comment on the proposals by SHE Transmission to construct a new substation near Lairg and a new 15 km double circuit 275 kilovolt (kV) OHL, supported by lattice steel towers, to the consented new substation at Loch Buidhe.
- 1.1.2 This consultation document outlines the process by which both the preferred substation site and the Preferred LOD for the OHL have been selected. Comments are now sought from statutory authorities, key stakeholders, elected representatives and the public on the substation site and route selection processes and the preferred site and LOD described.
- 1.1.3 All comments received will inform further consideration of the substation site location and the OHL LOD and the eventual selection of a proposed site and LOD for which permissions will be sought.

1.1 Background and Need for the Proposed Development

- 1.1.1 SHE Transmission is the electricity transmission license holder in the north of Scotland and has a duty under Section 9 of the Electricity Act 1989 to facilitate competition in the generation and supply of electricity. The company also has obligations to offer non-discriminatory terms for connection to the transmission system, both for new generation and for new sources of electricity demand.
- 1.1.2 The area around Lairg is currently served by a single circuit 132 kV OHL which runs from Cassley Grid Supply Point (GSP) near the north end of Loch Shin to the Shin substation at Inveran, via the existing GSP at Lairg. The connection of additional renewable energy to the network in recent years means that the existing circuit is now at full capacity.
- 1.1.3 Current renewable energy generation connections to the existing infrastructure include:
- 47 MW of wind farm generation (Lairg Estate and Achany) at Lairg GSP; and
 - 11.5 MW of hydro generation at Cassley GSP which is connected to the existing single circuit 132 kV OHL.
- 1.1.4 SHE Transmission connection offers have been accepted for the Sallachy wind farm development (66 MW) to be constructed on the northwest shore of Loch Shin, near the Cassley hydro power station, Sutherland.
- 1.1.5 Several other wind farm developers currently at the scoping stage have also made enquiries to SHE Transmission. These wind farms would require connections up to a potential 314 MW, should they all be granted consent and accept connection offers in the future.
- 1.1.6 The locations of the above existing and proposed infrastructure are shown on Figure 1.1.
- 1.1.7 Given the above, SHE Transmission, as part of its duties, requires to reinforce the existing electricity transmission infrastructure between Lairg and a consented

275/132 kV substation at Loch Buidhe (due to be operational by 2017). The reinforcement is required in order to provide transmission reinforcement connections, and access to the grid for renewable energy generation projects in accordance with the National Electricity Transmission System Security and Quality of Supply Standard (NETS SQSS).

1.2 Technical Solution for the Proposed Development

1.2.1 A number of factors are considered when developing proposals for a new transmission voltage OHL (132 kV or above). The choice of conductor and tower suite in combination, are assessed at a high level. The operational voltage and required capacity of the conductor, both limit the possible choice of alternative combinations that can be employed. Assessing technical, environmental, programming, health & safety, operability, community / reputational, system interconnectivity, construction and cost elements of each combination, allows a robust, fit for purpose solution to be progressed.

1.2.2 As part of the routing assessment of new OHL's, local constraints can restrict or even prevent an overhead line solution being promoted. In such circumstances undergrounding of the proposed circuit may need to be considered. However, this increases the risk to the security of supply due to fault finding being extremely difficult, repairs take longer and can cause significant disturbance, and there is a greater risk of strikes from other uncontrolled activities (utility company work / builders / road works etc). In addition, installing circuits underground is an intrusive and time consuming activity which in no small part contributes to cost of installing underground cable being at least 5 times more expensive than an equivalent OHL solution.

1.2.3 The existing single circuit 132 kV from Lairg GSP to Shin substation is currently at capacity and due to the potential new generation in the area, an upgraded 132 kV solution would not be capable of meeting this future demand. Therefore, the Lairg to Loch Buidhe Reinforcement is the proposed technical solution to enable the additional generation to be connected into the SHE Transmission network.

1.2.4 The main elements of the proposal are as follows:

- construction of a new 275/132 kV substation near Lairg;
- construction of a new 275 kV double circuit OHL supported by steel lattice towers from the proposed new substation near Lairg to a substation which is being developed at Loch Buidhe, north of Bonar Bridge (currently being progressed under another project); and
- the removal of the existing single circuit 132 kV OHL and steel lattice towers between the existing Lairg GSP and Shin substation (which would be removed following the commissioning of the new 275 kV OHL).

1.2.5 This document consults on both the preferred location of a new substation near Lairg and the preferred LOD for the Lairg to Loch Buidhe 275 kV OHL.

1.3 Document Structure

1.3.1 This document is structured as follows:

- **Section 1 - Introduction:** describes the purpose of the consultation document, the background and need for the proposed development.
- **Section 2 - Substation Site Selection:** describes the key considerations and decisions of the substation site selection exercise. This section also confirms the location of the preferred substation site.
- **Section 3 - Route Selection:** summarises the main stages and key considerations of the route selection process. This section also summarises the findings of the routing study.
- **Section 4 - The Proposals:** provides an overview of the proposals including the anticipated general design and typical construction methods.
- **Section 5 - Consultation on the Proposals:** provides an overview of the proposed consultation process, highlighting the timescale and the key questions to consider when responding.
- **Section 6 – Next Steps:** describes the next steps in the development of the project.

2 SUBSTATION SITE SELECTION PROCESS

2.1 Background

2.1.1 The new substation is required to connect the new 275 kV OHL to the existing Cassley to Lairg 132 kV OHL, which runs between the Cassley GSP, located at the north end of Loch Shin, and the Lairg GSP. An initial substation site selection exercise was undertaken by SHE Transmission in order to identify potential sites based on basic engineering parameters. The main factors influencing site selection were the requirements for:

- a location in the vicinity of the existing Cassley to Shin 132 kV OHL, which would provide a connection for some of the proposed wind farm developments (see paragraph 1.1.5) and lie in proximity to Lairg;
- a site with reasonable access from a main road;
- a site of a sufficient size to accommodate the necessary substation equipment; and
- a site considered least likely to give rise to adverse effects on the environment, and people living and working in the area.

2.1.2 Seven possible site locations were identified, as shown on Figure 2.1.

2.2 Methodology

2.2.1 A desk-based study was undertaken to gather baseline information on the following potential constraints within the area of search for connection options:

- areas, sites and features which are designated or otherwise protected at the international, national and local level for landscape, cultural heritage and ecological sensitivity;
- known areas outside of designated areas, which support species of high or moderate conservation concern¹ (particularly in relation to ornithology);
- residential amenity (dwellings, curtilage);
- access;
- topography and gradient;
- areas prone to flooding (1:1000 year return);
- watercourses and bodies;
- private water supplies;
- agricultural land;
- wind farms (operational and proposed); and
- existing infrastructure (roads, railways, footpaths).

¹ Birds of high conservation concern include species listed in Annex 1 of the Birds Directive (2009/147/EC), and species otherwise considered under threat due to population decline, rarity or unfavourable conservation status, as defined by the red and amber list in Eaton et al (2009) Birds of Conservation Concern 3, *British Birds* 102.

2.2.2 Following initial site identification, a number of site visits were undertaken to determine the landscape character, topography, gradients and access restrictions, as well as to identify the ecological habitat types present, and to understand the likely visual amenity issues.

2.3 Substation Site Selection

2.3.1 A high level analysis of these seven sites was undertaken by SHE Transmission, according to the criteria within SHE Transmission substation site selection guidance, through a workshop and site visits. Four of the seven sites were discounted, based on cost, technical and environmental considerations.

2.3.2 Sites A, C and D were considered potentially feasible, and were taken forward for further detailed analysis in accordance with the above guidance, the results of which are detailed below:

- Site A is located adjacent to the existing Lairg GSP and requires the shortest length of new 275 kV OHL from Loch Buidhe and also allows direct connection to the existing single circuit 132 kV OHL to Cassley GSP. This makes Site A preferable in terms of capital and operational/maintenance costs as there would be fewer towers, conductors and fittings to install and maintain. Site A would require the upgrading of the existing public road to Saval, with associated potential impact on residential properties in that location. No tree felling would be required on the site. In environmental terms, the habitats within Site A comprise potentially sensitive water dependent habitats within the western part of the site, and less sensitive dwarf heath on the remainder of the site. The surrounding landscape already accommodates existing transmission and other infrastructure; however, the location of Site A in proximity to numerous individual properties may give rise to visual and noise impacts. It is located at approximately 1 km distance from the A836 and National Cycle Route 1.
- Site C is located close to the A836 and would require a short extent of new access track for construction and operation maintenance activities. It would require a greater length of new 275 kV OHL, but is located close to the existing 132 kV OHL. In technical terms, there would be minimal tree felling required to accommodate a substation at Site C, since it is located at the edge of an area of plantation forestry. In environmental terms, the habitats within Site C were considered to have the potential to support protected ecology species, with anticipated loss of habitat (tree felling) likely to cause disturbance. Site C would also be highly visible from the A836/A838 junction and from National Cycle Route 1; however, there are no residential properties located in the vicinity of Site C.
- Site D is also located close to the A836; however, it would involve the longest length of new 275 kV OHL from Loch Buidhe and is located at greatest distance from the existing 132 kV OHL. In technical terms, a greater amount of tree felling (than for Site C) would be required for the construction of a substation at Site D, as well as a short extent of new access track from the A836, since the site is enclosed within an area of plantation forestry. Therefore, Site D was least preferred on the basis of cost and technical

considerations. In environmental terms, the habitats within Site D were also considered to have the potential to support protected ecology species, with anticipated loss of habitat (tree felling) likely to cause disturbance. However, visibility would be reduced as the site would have greater opportunity to take advantage of screening from tree cover. There are no residential properties located in the vicinity of Site D.

2.3.3 From the above analysis Site A was considered the overall preferred site.

2.4 Public Consultation

2.4.1 A preliminary public consultation exercise was undertaken in November 2013 in order to seek an early understanding of public perception and key concerns. This identified the following concerns with the proposed Site A location:

- proximity to residential properties, with associated potential noise and visual amenity impacts;
- access to the substation is not suitable due to the steep gradient and tight bends in proximity to residential property; and
- possible access restrictions for local residents at Lairg Muir, Saval and Savalbeg during construction;

2.5 Substation Development

2.5.1 On further investigation of the concerns identified in section 2.4 the decision was made by SHE Transmission to eliminate Site A from further consideration.

2.5.2 Further design development of the remaining two options was undertaken, as follows:

- Site C was moved approximately 600 m south east in order to reduce the length of the new 275 kV OHL from Loch Buidhe and to locate it on flatter ground where a lesser extent of preparatory earthworks would be required to construct the substation. In technical terms, the new location would require a lesser extent of tree felling for construction of the new 275 kV OHL. The new Site C would also be less visible from the A836/A838 junction and in the wider landscape.
- Site D was identified within the OHL route selection process (described in Section 3) as giving rise to the location of a new 275 kV OHL above tree canopy height close to Loch Beannach (a component loch of the Lairg and Strath Brora Lochs Special Protection Area (SPA)) and between Loch Beannach and Loch Shin where it is believed that divers may fly to feed. A new 275 kV OHL in this location would therefore represent a potential collision risk to these protected bird species.

2.6 The Preferred Substation Site

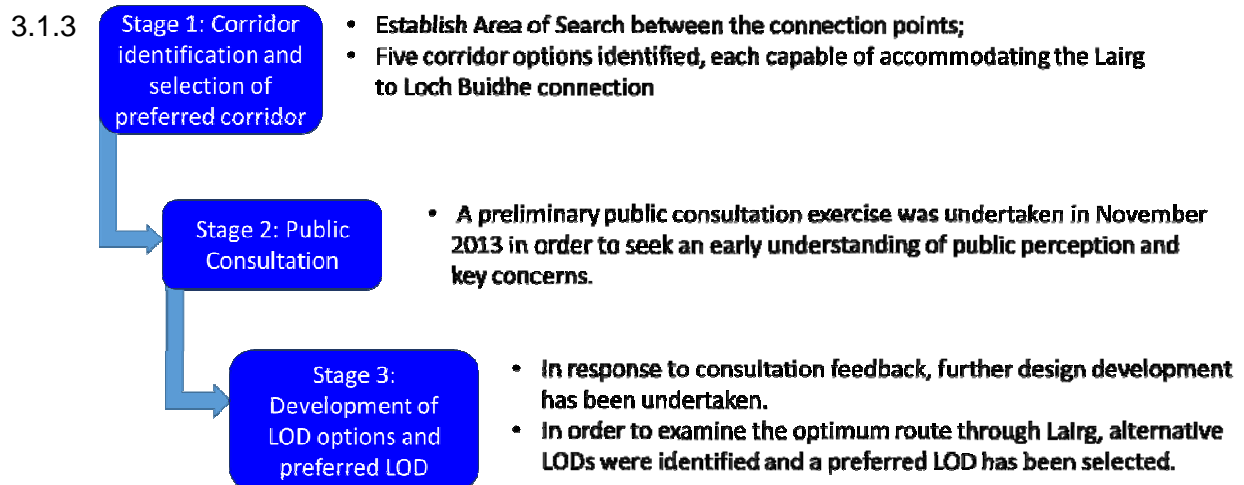
2.6.1 Site C has therefore been selected as the preferred substation site. An indicative layout of the substation site is shown on Figure 2.2.

3 OHL ROUTE SELECTION PROCESS

3.1 Background

3.1.1 The overall aim of the route selection process was to develop a Preferred LOD in a systematic manner, which is technically feasible and economically viable and which could be anticipated to cause the least disturbance to the environment; and those living in it, working in it, visiting it or using it for recreational purposes.

3.1.2 A three-stage approach was adopted as follows:



3.2 Methodology

3.2.1 A desk-based study was undertaken to gather baseline information on the following potential constraints within the area of search for connection options:

- areas, sites and features which are designated or otherwise protected at the international, national and local level for landscape, cultural heritage and ecological sensitivity;
- known areas outside of designated areas, which support species of high or moderate conservation concern² (particularly in relation to ornithology);
- residential amenity (dwellings, curtilage);
- access;
- topography and gradient;
- areas prone to flooding (1:200 year return);
- watercourses and bodies;
- private water supplies;
- agricultural land;

² Birds of high conservation concern include species listed in Annex 1 of the Birds Directive (2009/147/EC), and species otherwise considered under threat due to population decline, rarity or unfavourable conservation status, as defined by the red and amber list in Eaton et al (2009) Birds of Conservation Concern 3, *British Birds* 102.

- wind farms (operational and proposed); and
- existing infrastructure (roads, railways, footpaths).

3.2.2 Following initial corridor identification, a number of site visits were undertaken to determine the landscape character, topography, gradients and access restrictions, as well as to identify the ecological habitat types present within and outside the SPA and to understand visual amenity issues around Lairg.

3.2.3 The baseline information collected was used to compile a map of potential constraints to be considered in the route selection process. The route selection process followed a hierarchical approach to avoid, minimise and reduce negative interaction with or effects on sensitive features.

3.2.4 The potential constraints identified are shown on Figures 3.1a and 3.1b.

3.3 OHL Corridor Selection

3.3.1 Stage 1 of the route selection exercise comprised an initial strategic review of the area of search, between the potential northern substation options (substation sites A, C and D, as detailed in section 2) and Loch Buidhe substation. This was completed by SHE Transmission in autumn 2013, in order to identify broad parameters within which a 275 kV OHL could be constructed. Engineering and cost factors required the identification of the most direct corridor options possible, taking due account of major high level engineering restrictions including major water features such as Loch Shin.

3.3.2 As a result of this process, five potentially feasible corridors were identified by SHE Transmission for consideration, as shown on Figure 3.2.

3.3.3 A detailed analysis of these initial corridor options was undertaken in accordance with relevant SHE Transmission OHL route selection guidance, as detailed below:

- Corridor 1 was identified as having advantages in terms of access as it was located in close proximity to the alignment of the existing 132 kV OHL between the two connection points. However, it also represented the longest OHL route, and was therefore less preferred in terms of capital and operational/maintenance costs. In technical terms, tree felling would likely be required within the woodland at Achinduich. In environmental terms, a new OHL within Corridor 1 would be highly visible from properties at Achinduich and Aulnagar. Further north, Corridor 1 included numerous individual properties within Lairg, with associated technical, wayleaves and visual amenity considerations. In addition, Corridor 1 included a greater extent of sensitive marshy grassland/peatland habitat, with the potential to support groundwater dependent terrestrial ecosystems (GWDTE), than the other corridors and crosses the largest extent of class 4.1 agricultural land (suitable for mixed agriculture).
- Corridor 2 was broadly similar to Corridor 1, but represented a shorter and straighter orientation between the northern and southern connection points, avoiding proximity to properties at Achinduich and Aulnagar. In technical terms, Corridor 2 also incorporated woodland at Achinduich and, although this could be used for screening an OHL from the residential properties, it may also require some tree felling. In environmental terms, Corridor 2

followed the same route through Lairg as Corridor 1 and included the same number of residential properties. Corridor 2 also included a similar extent of peatland, but was comprised of a lesser extent of class 4.1 agricultural land overall. North of Lairg, Corridor 2 adopted a more direct route to substation Site C, with potential visual impact from properties at Saval. The route to substation Site D was the same as for Corridor 1.

- Corridor 2A was developed as an alternative to Corridor 2, in order to potentially reduce the number of angle changes which may be required by an OHL within this corridor, with associated reductions in cost over Corridor 2. In technical terms, Corridor 2A was preferred over Corridor 2 as it avoided the woodland at Achinduich. In environmental terms, an OHL within Corridor 2A would be screened by the woodland at Achinduich. The remaining environmental considerations were similar to those described above, for Corridor 2.
- Corridor 3 was identified as a more direct option, avoiding the outskirts of Lairg and providing access only to the two northern-most substation site options. In environmental terms, Corridor 3 encompasses a greater extent of the Strath Carnaig and Strath Fleet Moors SPA and SSSI than Corridor 1, 2 or 2A. An OHL within this corridor would have greater potential for disturbance to breeding hen harrier for which the SPA / SSSI is designated. East of Lairg, Corridor 3 crosses Strath Fleet and an OHL in this location would introduce large scale elements into an area of open moorland landscape where no such features currently exist. There would be visual impact to road users on the A836 and A838, as well as to properties within Strath Fleet.
- Corridor 4 represented an alternative route to the east Lairg and the hillsides of Meall Dola and An Stoc-bheinn. A high level technical assessment was undertaken, which determined that this corridor would be the most challenging in terms civil engineering works due to the extent of new access tracks required in an area with difficult terrain and possibly poor ground conditions. Due to the extent of engineering works required this route would also be the least preferred of all options in terms of capital and operational/maintenance costs. In environmental terms this route is also the least preferred option as it encroaches to the greatest extent into the Strath Carnaig and Strath Fleet Moors SPA and SSSI, with the greatest risk of disturbance to breeding hen harrier. Corridor 4 also included the greatest extent of peatland habitat, as well as extensive habitat with the potential to support groundwater dependent terrestrial ecosystems (GWDTE). Other environmental considerations were similar to those described above, for Corridor 3.

3.3.4 Based on the above analysis, as well as the initial selection of substation Site A (as described in Section 2), Corridor 2A was identified as the preferred corridor.

3.4 Public Consultation

3.4.1 Stage 2 of the route selection process comprised initial public consultation which was undertaken by SHE Transmission in November 2013, in order to seek an early understanding of public opinions about the proposals.

3.4.2 Feedback from this consultation was collated and used to inform subsequent design refinements, particular to address concerns raised by the public relating to introduction of the proposed infrastructure into the environment around Lairg. As discussed in Section 2, the key outcome was to change the location of the preferred substation option in the vicinity of Lairg.

3.5 OHL Route Development

3.5.1 Stage 3 of the route selection exercise comprised more detailed examination of the potential route options around Lairg, in response to concerns raised during consultation in November 2013. Stage 3 was also based on the decision to eliminate substation Site A from further consideration, which meant that the connection options were no longer required to provide a connection to all of Sites A, C and D. Therefore, connection options between Loch Buidhe substation and substation options at Site C and Site D were further evaluated, and narrower alternative Limits of Deviation (LOD), rather than corridors, were developed to enable a more focussed consideration of the various technical, economic and environmental constraints identified earlier.

3.5.2 The following general factors and requirements informed the development of alternative LODs:

- limiting the number of changes in direction (angles);
- minimising the requirement to cross existing electricity infrastructure;
- minimising construction effort on-site (e.g. avoiding steep gradients and difficult ground conditions);
- ensuring a direct approach for substation entries;
- minimising crossing linear features (e.g. roads, railway lines, rivers); and
- minimising the length of new OHL and the number of towers.

3.5.3 The following parameters defined the alternative LODs:

- an LOD of 200 m width (100 m either side of a notional route alignment) where no overriding environmental constraints have been identified;
- an LOD of 80 m width where the route alignment passes through woodland;
- a stand-off distance of 70 m from the existing 132 kV OHL; and
- 100 m buffer distance from residential properties, scheduled monuments and listed buildings, where practicable.

3.5.4 Four alternative LODs were identified, which included variations at specific locations along the route, as illustrated on Figure 3.3.

3.5.5 A detailed analysis of these alternative LODs was undertaken, summarised below:

- Alternative LOD 1 was developed to allow consideration of a similar alignment to that of the existing 132 kV OHL and, from Site D to Site C, the route selected was considered to represent the most direct option, minimising the overall length of the OHL. From Lairg to Loch Buidhe, Alternative LOD 1 represented an LOD located within Corridor 2A (described above), which was identified as the preferred corridor on a technical, economic and environmental basis. In technical terms, it was recognised that, where Alternative LOD 1 progresses through Lairg, construction works may be disruptive and would pose greater engineering and construction challenges compared to the other alternatives due to number of temporary OHL diversions and temporary outages to the local electricity supply in Lairg which would be required. In environmental terms, the northern half of Alternative LOD 1 was considered to present a potential collision risk to black-throated diver (*Gavia arctica*) flying between Loch Beannach and Loch Shin. In addition, an OHL within Alternative LOD 1 would be highly visible from the A836 and National Cycle Route 1 and from residential properties in and around Lairg. In addition, it would cross local authority core paths within Gunn's plantation. In its southern half, Alternative LOD 1 would encounter few environmental constraints, as described for Corridor 2A.
- Alternative LOD 2 represented an LOD located entirely within Corridor 2A and it adopted the same route as Alternative LOD 1 from Lairg to Loch Buidhe, Alternative LOD 2 included two 'variations' in the northern section, variations 2(i) and 2(ii), allowing for access to either substation Site C or Site D. In technical terms, Alternative LOD 2 would require a number of angle changes near Torroble and Lairg; therefore, it was not considered preferable. In environmental terms, Alternative LOD 2 crosses extensive sensitive bog habitat north of Lairg and, north of substation Site C, would present the same diver collision risk as for Alternative LOD 1. It would also have a visual impact on the south west facing properties at Saval, although it would be less visible from the A839 than the other alternative LODs. It would also be visible from local authority core paths in Gunn's plantation and would pass in close proximity to residential properties at Torroble and in Lairg.
- Alternative LOD 3 represented a straighter alignment overall, similar to that of Corridor 3, while adopting the same route as Alternative LOD 1 from Lairg to Loch Buidhe. Alternative LOD 3 included two 'variations' in the northern section, variations 3(i) and 3(ii), to allow for access to either substation Site C or Site D. Further south, Alternative LOD 3 included three 'variations', variations 3(i), 3(iii) and 3(iv), which were developed in response to feedback from the community regarding the proximity of an OHL to properties in Lairg. In technical terms, Alternative LOD 3(i) included fewer angle changes, although topography and gradient was considered more challenging (than for Alternative LOD 1 and Alternative LOD 2) in the vicinity of Torroble and Balnadelson. Alternative LOD 3(iii) and LOD 3(iv) were considered less

preferable than Alternative LOD 3(i) on the basis of topography and access. In environmental terms, Alternative LOD 3(i) would present the same potential collision risk to black-throated diver as for Alternative LOD 1 north of substation Site C, while also increasing the potential collision risk by passing between component lochs of the Lairg and Strath Brora Lochs SPA. Further south, Alternative LOD 3(iii) and LOD 3(iv) encroach further into the Strath Carnaig and Strath Fleet Moor SPA and SSSI and would pass through a more remote area; therefore, these LOD 3 variations were considered less preferable than Alternative LOD 3(i) east of Lairg. East of Lairg, Alternative 3(i) would pass to the rear of residential properties at Culbuie and Balcharn, while passing close to properties at Balnadelson and Tomich. However, Alternative LOD 3(iii) was considered to have the potential to 'ring-fence' properties at Tomich while traversing the hillside behind these houses, and Alternative LOD 3(iv) was identified as being potentially more prominent in views looking east from properties in Lairg, due to its higher elevation. Therefore, LOD 3(i) east of Lairg was identified as being preferable on the basis of cost, technical and environmental factors, followed by Alternative 3(ii) further north, to Site C.

- Alternative LOD 4 was developed in order to allow further consideration of a route much further to the east than the other alternative LODs, representing an LOD within a combination of Corridors 3 and 4 and presenting a connection option to Site D only. However, it was recognised that this represented the longest route and the most challenging alternative technically, in terms of ground conditions, topography and access. In environmental terms, Alternative LOD 4 was considered overall to be least preferable as it crossed Strath Carnaig and Strath Fleet Moor SPA and SSSI for the longest distance, with the potential for the greatest impact on breeding hen harrier and peatland habitat. Alternative LOD 4 presented the same diver collision risk as for Alternative LOD 3(i) north of substation Site C and, further south, it crossed open moorland with high wildness value and would give rise to the introduction of industrial features into a landscape where these do not currently exist. An OHL within Alternative LOD 4 would also be highly visible from the A839 and from residential properties in Strath Fleet.

3.6 The Preferred LOD

- 3.6.1 Based on the above analysis, as well as the results of the substation site selection exercise, the Preferred LOD was identified as being Alternative LOD 3. The Preferred LOD is shown on Figure 3.4.

4 THE PROPOSALS

4.1 Overview

4.1.1 The proposals comprise both the construction of a new substation, as indicated on Figure 2.2, and the construction of a new OHL within a defined LOD is shown on Figure 3.4.

4.2 Proposed Substation Design and Construction

4.2.1 A new substation is required in the vicinity of Lairg in order to enable the consented and/or contracted³ new generation to connect into the transmission network. SHE Transmission will seek planning consent under the Town and Country Planning (Scotland) Act 1997 (as amended) for the new substation.

4.2.2 The new substation requires an area of generally level ground in the order of 245m x 280m, with access to the local road network and in proximity to existing OHL. Discounting any overhead line terminal towers, 275/132 kV substation plant would generally be less than 10m high. The substation would contain a single storey building to house the substation control equipment, an office and welfare facilities. The site would be surrounded by a 2.5m high security fence of palisade construction.

4.2.3 The substation will not generally be illuminated as it will be an unmanned facility with access only required for operations and maintenance. Floodlights would be used during maintenance works or in the event of a fault during the hours of darkness.

Construction Activities

4.2.4 Construction of a substation typically follows a standard sequence of events:

- complete pre-construction surveys, as required by a construction environmental management plan;
- establish temporary or permanent accesses (including any necessary vegetation management);
- install temporary site drainage (if required);
- install site compounds / laydown areas and site services (water, power and telecoms);
- complete cut and fill earthworks to create a level platform;
- install permanent drainage, including SuDS;
- construct the control building and other civil engineering works;
- install substation electrical infrastructure;
- Connect overhead lines;
- commission electrical infrastructure;

³ SHE Transmission is contractually obliged to provide a connection to its network for any developer who has applied (and subsequently accepted) a connection offer. The developer has to obtain the necessary planning permission from the local planning authority and/or a Section 36 consent under the Electricity Act 1989 from the Scottish government.

- dismantle and remove temporary works; and
- undertake landscaping works, and reinstate / restore temporary works areas.

Construction Access Arrangements

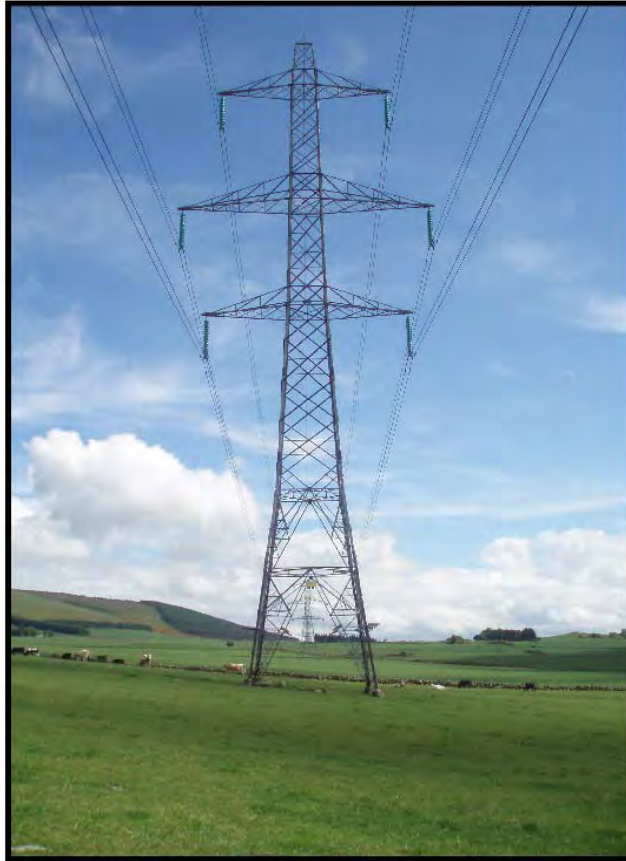
- 4.2.5 In constructing substations, access requirements for long and heavy loads must be taken into account. In some instances improvements to the local road network, such as localised widening at bends in the road, or strengthening of roads or bridges, will be required in advance of the construction works commencing. The largest plant item in a substation is usually the transformer. A 275/132kV transformer is likely to weigh around 190 tonnes when arranged for transport.
- 4.2.6 The substation access road, including the bellmouth with public roads, would form part of the Proposed Development for which SHE Transmission will seek planning consent under the Town and Country Planning (Scotland) Act 1997 (as amended).
- 4.2.7 Consultation with the local authority roads department and Transport Scotland will be required in due course once the transport requirements for the project have been confirmed and detailed assessments have been undertaken.

Operations and Maintenance

- 4.2.8 Substation plant requires maintenance and inspection at regular intervals. Most substations have a monthly inspection. Maintenance is completed about once every four to six years on each circuit. As the substation would have several circuits, it is likely that some maintenance would be completed most years. This is likely to involve a site presence for about one week with light vehicles. There would be other visits as required for operational duties.

4.3 Proposed OHL Design and Construction

- 4.3.1 The OHL proposals are anticipated to comprise the installation of two circuits, each with three wire conductors supported from glass or porcelain insulators attached to the horizontal cross arms on both sides of lattice steel towers. An earth wire with a fibre optic core would be suspended between tower peaks, above the conductors.
- 4.3.2 The standard tower height is expected to be in region of 46 m although this would vary to accommodate changes in topography and where the line crosses roads and watercourses. Photograph 1 shows the type of tower likely to be used.
- 4.3.3 The spacing between towers would vary depending on topography and land usage. The height and distance between towers will be determined later in the design process; however an average spacing of 250 - 300 m is typical.
- 4.3.4 SHE Transmission shall apply for consent under section 37 of the Electricity Act 1989 for the new 275 kV OHL.



Photograph 1: Typical 275 kV Overhead Line Tower

Construction Activities

4.3.5 High voltage OHL construction typically follows a standard sequence of events:

- complete pre-construction surveys, as required by a construction environmental management plan;
- establish temporary or permanent accesses (including any necessary vegetation management);
- install tower foundations;
- assemble and erect towers;
- erect temporary scaffolds and install temporary scaffolds to protect roads, railways and rivers;
- string conductors (wires);
- dismantle and remove temporary scaffolds;
- re-instate tower sites and remove temporary access tracks; and
- dismantling and removal of redundant infrastructure, where required.

Construction Access Arrangements

4.3.6 Access tracks, including the bellmouths at junctions with public roads, would form part of the associated works for which SHE Transmission will seek deemed planning

consent under the Town and Country Planning (Scotland) Act 1997 in the SHE Transmission application under s37 of the Electricity Act 1989.

4.3.7 Further information relating to proposed access arrangements will be developed as the project progresses.

Foundation Installation

4.3.8 A tower compound would be established at each tower location, within which foundation installation and subsequent tower erection would take place. Each compound would be fenced for safety.

4.3.9 There are three main types of tower foundation, which are:

- Mass Gravity;
- Piled; and
- Rock Anchor.

4.3.10 Foundation types and designs for each tower would be confirmed following detailed geotechnical investigation at each tower position. The extent of ground works would vary according to the foundation design, however good practice construction methods would ensure environmental impacts are minimised.

4.3.11 Photograph 2 shows a typical mass gravity foundation under construction. An excavation is made (sides supported by sheet piles), followed by the pouring of a reinforced concrete base.



Photograph 2: Conventional Foundation Construction

Tower Assembly and Erection

4.3.12 Tower steelwork is generally delivered to site either as individual steel members or as prefabricated panels, dependent on the method of erection for the tower.

4.3.13 The preferred method of assembly and erection would use a crane (as shown in photograph 3).



Photograph 3: Tower Assembly and Erection

Conductor Stringing

4.3.14 Prior to stringing the conductors, temporary protection measures (normally netted scaffolds), would be erected if necessary for features such as roads, railways and existing transmission infrastructure is to be crossed.

4.3.15 Conductor stringing is carried out using winch and tensioner (as shown in photograph 4). Pilot wires are pulled through the section to be strung first, which are connected to the conductor at the tensioner end. The conductor is pulled via the pilot wires through the section and under controlled tension to avoid contact with the ground and any under-running obstacles including protection scaffolds. Once the conductor has been strung between the ends of the section it is then tensioned to provide the necessary sag and then permanently clamped at each tower.



Photograph 4: Tower with Rollers and Winch, Ready for Stringing

4.4 Project Construction Programme

- 4.4.1 It is anticipated that the construction programme would last approximately 36 months and that construction will commence in 2016 (subject to consents and approvals being granted), which would allow completion in 2019. Final commissioning and ground restoration/reinstatement works would be completed in 2019-2020.
- 4.4.2 The detailed construction phasing and programme would be subject to change as the design progresses and also due to necessary consents and wayleaves being agreed.

5 CONSULTATION ON THE PROPOSALS

- 5.1.1 As indicated in Section 1, SHE Transmission is inviting comments on the reinforcement proposals described in this document. You may comment in person, at the forthcoming public exhibition, detailed below, by post or by email. When providing comments, SHE Transmission would be grateful for your consideration of the following questions:
- 5.1.2 When providing comment and feedback, SHE Transmission would be grateful for your consideration of the questions below:
- Is the rationale for the project clearly set out in the consultation document?
 - Is the approach to the selection of the preferred connection option, identifying the optimum balance of technical feasibility, economic viability and least environmental disturbance, clearly set out?
 - Are there any factors you consider may have been overlooked or given either insufficient or too much consideration during the selection process?
 - Do you have any other comments about the preferred route of the overhead line, or the proposed substation location?
- 5.1.3 The public exhibition will be held in Lairg Community Centre on the 26th June. The event will be advertised in the local press, and in the local community.
- 5.1.4 Comments forms will be available at the public exhibition or will be available to download at www.ssepd.co.uk/Lairg. Comments can be posted or emailed to the SHE Transmission Project Liaison Manager, at the address below:
- Lisa Marchi
SHE Transmission
10 Henderson Road
Inverness
IV1 1SN
- 5.1.5 The consultation process will close on **Friday 1st August 2014**.

6 NEXT STEPS

- 6.1.1 All comments received will inform further consideration of the route and the eventual selection of a proposed LOD and proposed substation location. Depending on the issues arising from this consultation SHE Transmission may consult further.
- 6.1.2 A Report on Consultation will be produced, which will document the above considerations and the decisions made. This document will provide details of the proposals that we will take forward for detailed engineering design, environmental assessment, and agreement with landowners.
- 6.1.3 SHE Transmission shall apply for consent under section 37 of the Electricity Act 1989 for the new 275 kV OHL, and apply for planning consent under the Town and Country Planning (Scotland) Act 1997 (as amended) for the new substation. These applications will be developed for submission in 2015.