Scottish Hydro Electric Transmission plc (SHE Transmission) owns, maintains and invests in the high voltage electricity network that serves the north of Scotland.

In total, we maintain about 5,000km of overhead lines and underground cables – easily enough to stretch across the Atlantic from John O’Groats all the way to Boston in the USA.

Our network crosses some of the UK’s most challenging terrain – including some circuits which are over 750 metres above sea level and up to 250km long.

Overview of Transmission projects

- Setting infrastructure
- Under construction
- Potential development
- Advanced planning

About SHE Transmission’s role

- SHE Transmission (which is part of the SSE Group) is the transmission licence holder in the north of Scotland.
- We have a duty under Section 9 of the Electricity Act 1989 to facilitate competition in the generation and supply of electricity. We have an obligation to offer non-discriminatory terms for connection to the transmission system, both for new generation and for new sources of electricity demand.
- Our activities are closely regulated by the energy regulator, Ofgem. The regulator individually assesses the case for strategic investments in the transmission network, such as the Caithness-Moray reinforcement and the proposed Shetland connection.
Building the north’s future energy network

The north of Scotland’s electricity network is currently seeing the most sustained period of investment since the hydro development era of the 1950s.

The work is designed to accommodate new sources of renewable electricity generation and to deliver a renewed network that will meet the needs of customers right across the north and the islands for decades to come.

In Caithness, SHE Transmission has already completed work in recent years to add extra capacity to the existing 275 kilovolt overhead line which runs between Dounreay and Beauly; and to replace Dounreay substation.

We are currently delivering a £1.12 billion project centred on an underground and subsea cable between Spittal in central Caithness and Blackhillock, near Keith, in Moray. The cable at the heart of that project will run for over 160 kilometres (100 miles) and be capable of transporting up to 1200MW of electricity beneath the Moray Firth. It uses highly efficient High Voltage Direct Current (HVDC) technology and is due to be completed by 2018. The existing onshore network in Caithness will also be reinforced between Dounreay and Mybster as part of the work.

There are two further projects currently in development which build upon the strengthened network the Caithness-Moray project provides:

- A new 132 kilovolt connection between Thurso South and a new substation near Gills Bay which would enable proposed tidal generators in the area to connect to the transmission network.
- An HVDC cable which would connect Shetland to the Great Britain transmission system for the first time, allowing renewable energy to be exported from the islands. The cable would come ashore in Caithness and connect with the planned Caithness-Moray system via the proposed Switching Station which is the subject of today’s event.
Why is The Project Needed?

As part of its role, SHE Transmission is required to develop proposals to accommodate new sources of electricity generation seeking to connect to its network.

In this case, a wind farm developer in Shetland (Viking) has contracted with National Grid to connect a project with capacity of up to 412MW by 2021. As Shetland is not currently connected to the Great Britain electricity system, a new transmission cable is required to make this connection possible – allowing the export of energy from the wind farm and from other potential sources of renewable generation in the islands. The proposed cable has been designed with a capacity of up to 600MW to accommodate some potential future development and would also be capable of supplying power to the islands if required.

High Voltage Direct Current (HVDC) technology makes it possible to transmit electricity efficiently across the distances involved in connecting Shetland, which is located about 170 kilometres north of mainland Scotland. SHE Transmission has developed a proposal to provide a connection by connecting to the HVDC system that is currently being installed between Caithness and Moray. This arrangement makes use of capacity available in the Caithness-Moray subsea cable to allow onward connection to the existing onshore transmission network in Moray with minimum new infrastructure.

To connect with the Caithness-Moray system, a switching station is required in the vicinity of the planned cable landfall which is north of Staxigoe. This will allow the flow of power to be managed between 3 underground HVDC circuits – one from a converter station at Spittal in Caithness, one from a converter station at Kergord in Shetland and one to a converter station at Blackhillock in Moray.

What’s happened before?

SHE Transmission has been developing options to connect growing volumes of renewable generation in the north of Scotland and the islands for a number of years.

In the summer and autumn of 2012, we began looking for a possible site for a switching station in Caithness with capacity to connect up to 10 HVDC circuits, reflecting potential full-scale future marine and offshore generation development. A number of larger sites in the wider Sinclair’s Bay area were assessed at this time.

In 2013, the scope of our proposal reduced significantly to focus on connecting the proposed Shetland cable to the Caithness-Moray system. This change resulted in a clearer focus on site options in the vicinity of the Caithness-Moray cable corridor. The proposal includes space for a single further underground cable circuit to connect in the future should it be needed – providing flexibility under a range of possible circumstances.
What is an HVDC Switching Station?

A Switching Station is an electrical connection arrangement where multiple circuits meet with disconnectors (switches) to control the flow of power. They are a type of substation where no change in voltage takes place, so no transformers are required – and are widely used on the existing alternating current (AC) electricity network.

Under typical circumstances, the proposed switching station, enables two ‘input’ circuits to meet with the electricity leaving through one export circuit. The arrangement has the additional benefit that two of the circuits can continue working even while one is disconnected (switched off) for maintenance or repair.

The Switching Station does not dictate which way the power flows. This will be controlled by the Network Management Centre in Perth under instruction from National Grid, who are the transmission system operator across Great Britain. Power could flow in any direction through the system, although in this case the expectation is that renewable energy will generally be transported from both Spittal and Shetland to Moray, where it will be converted back to alternative current (AC) form for onward transmission via the existing onshore network.

A simple pictorial representation of the proposed Caithness HVDC Switching Station is shown below:

What is HVDC?
The main way the proposed switching station differs from others on the network is that the electricity flowing through it will be High Voltage Direct Current (HVDC) instead of High Voltage Alternating Current (HVAC).

In AC circuits, the current continuously changes direction at a frequency of 50 Hertz – or 50 cycles per second. By contrast in DC circuits, the current flows in a single direction all the time.

DC electricity is not new, but advancing technology has enabled its growing use across the world for transmission. It is highly efficient for carrying large volumes of power across long distances.
The search for site options

At this stage, SHE Transmission is seeking to identify the best site for the proposed Switching Station before it carries out further work to develop design proposals.

The building that would house the switching station will not need to be any larger than 100m wide by 150m long. This would be built upon a larger level platform area which would include access roads for use during construction and operation, with a security fence around the perimeter. Finally, a 50m wide area around the edge of the site has been included to allow for landscaping or planting.

A preliminary search for Switching Station sites was carried out using a combination of previous work in the area, site visits and map-based investigation, which drew upon information obtained from the statutory authorities and other recognised sources of map data. Some of the key data that informed the search for site options are presented on the maps below.

The search identified a number of potential sites, resulting in the six sites now under consideration. These are presented on the next board.
The site options

Map 1 (right) shows the 6 option sites currently under consideration. Map 2 gives a more detailed view of the area where Option Sites 1 to 4 are located.

Each site is marked as a 300 metre square (9 hectares), but it is expected that over half of this area would be used for landscaping. The building at the centre of the site would be no larger than 100 metres by 150 metres. Further detail on design and landscaping will be developed for future public consultation events.
Preliminary assessment of options

Once the initial search and appraisal process for sites had identified the six possible options shown, a preliminary assessment of each was carried out by SHE Transmission’s team. Following this assessment, three of the options are considered less preferred (coloured amber on the maps) and three are considered to have greater potential (coloured green).

At this stage no site has been ruled out and all six will be considered further in the next stage of the site selection process. Once that second stage is complete, we will present our findings and early design proposals through a further public presentation which is likely to take place in late Autumn 2015.

<table>
<thead>
<tr>
<th>Option 1: Noss Coast</th>
<th>Option 2: Low Field</th>
<th>Option 3: Airport North</th>
</tr>
</thead>
<tbody>
<tr>
<td>The site is close to the Caithness-Moray cable route and the closest option to the sea cable landing point. It is relatively elevated and the coastline generally has higher amenity value.</td>
<td>The site is again close to the Caithness-Moray cable route and relatively near to the sea cable landing point. The land is in agricultural use and occupies a lower point in the landscape.</td>
<td>This site is also close to the Caithness-Moray cable route. It is slightly further from the sea cable landing point, close to the northern perimeter of Wick Airport. The ground is higher than Option 2.</td>
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<table>
<thead>
<tr>
<th>Option 4: Airport East</th>
<th>Option 5: Skitten West</th>
<th>Option 6: Skitten Quarry</th>
</tr>
</thead>
<tbody>
<tr>
<td>This site is on Wick Airport Industrial Estate, next to the site of the National Nuclear Archive. While it has good access to infrastructure, early investigation suggests that part of the site is within the exclusion zone required by the airport operator.</td>
<td>This site was identified early in the process but is a significant distance from the Caithness-Moray cable route and from the sea cable landing point, resulting in additional cable installation and increased costs. The site is brownfield and occupies higher ground, with some woodland shelter.</td>
<td>Again, the site is a significant distance from the existing cable route and the sea cable landing point, resulting in additional cable installation and increased costs. The site is brownfield and occupies higher ground.</td>
</tr>
</tbody>
</table>
The development process

The chart below shows the main stages of the development process and the opportunities there will be for local people and others to give feedback as site selection, design and environmental work progresses. All dates are indicative at this early stage.

1. Spring–Summer 2015
   - Search to identify multiple potential sites and carry out preliminary assessments
   - First Pre-Application Consultation: Carry out consultation with the statutory authorities and public on the multiple sites

2. September 2015
   - Consider the feedback from consultation and identify a preferred site

3. October 2015
   - Develop an outline design for the preferred site, including landscaping proposals
   - Second Pre-Application Consultation: Carry out consultation with the statutory authorities and public on the outline design

4. Autumn 2015
   - Consider the feedback from consultation and further develop design

5. Late Autumn 2015
   - Winter 2015/2016
     - Submit Needs Case for consideration by the energy regulator Ofgem
   - Winter 2015/2016
     - Submit Proposal of Application Notice to the Highland Council
   - Spring 2016
     - Carry out detailed environmental surveys and assessments to inform planning application
     - Final Pre-Application Consultation: Carry out final pre-application consultation with the statutory authorities and public on the detailed design and environmental assessments

   - Consider any final feedback on detailed proposals

7. Winter 2016/2017
   - Winter 2016/2017
     - Submit planning application to the Highland Council
     - Statutory Consultation: Highland Council will carry out a statutory consultation following submission during which representations can be made directly to the planning authority
   - Early 2017
     - Determination of planning application
   - 2017
     - Subject to consents, pre-construction works begin on site
     - Completion of Switching Station Construction

Indicative timescale of 2 years from the start of construction
Developing an outline design

Once a preferred site has been identified, more detailed work will begin to develop a suitable design for the switching station building and the surrounding area.

A site significantly larger than the building itself is being sought to allow for a significant area which could be landscaped and planted to make the building as sympathetic as possible to its surroundings.

Below are some of the considerations that will inform the design and landscaping process. Comments would be very welcome on these design principles and ideas:

Design principles

- The switching station is expected to be housed within a building to protect equipment from corrosion due to the coastal environment
- The design will need to allow for necessary clearances around the electrical equipment and for safe access during operation and maintenance
- Consideration will be given to ways in which the height of the building above the existing ground level can be reduced to a minimum
- An architect has been engaged to consider the design of the building which could include features such as a curved roof to blend better with the existing landscape
- The building could also be designed to provide a feature of interest in the landscape or to resemble an agricultural or airport-related structure

Landscaping

A 50 metre wide belt has been provided within the total site footprint to allow for a landscaped area outside the secure perimeter fence. This area could include carefully designed earth mounds, planted with grasses, to reduce further the apparent height of the building. Depending on management arrangements, the landscaped area could provide valuable habitat for native flora and fauna.

An example is shown below of landscaping at an existing substation site on SHE Transmission’s network.

By the time of the next public consultation, outline plans and visualisations will be available showing the initial design work that has taken place. There will be an opportunity for members of the public to provide comments and make suggestions.

Images showing the completed Knocknagael substation, south of Inverness, where earth mounds and planting have been used to reduce visual impact on the surrounding area. Unlike Knocknagael, the main equipment for the HVDC switching station would be housed within a building, but landscaping and building design could be used in a similar way. (The connections into the Knocknagael substation are via overhead lines, whereas at the proposed switching station they would be via underground cables.)
How you can have your say

Today’s event is part of the first of three stages of public consultation that we intend to carry out while we develop detailed proposals to form the basis of a planning application. Please feel free to speak to members of our project team, who are here to answer any questions you may have and to explain the information presented on the boards.

How can I give feedback on the options?
At this stage, we are particularly keen to receive feedback on the option sites we are assessing to inform the site selection process. We would also be pleased to receive any wider comments, questions or suggestions about the development process.

Comments can be submitted as follows:

1. **At the exhibition today** – complete a Comments Form and place it in the box provided.

2. **By post** – complete a Comments Form and post it to our Liaison Manager (details below).

3. **By email** – complete a Comments Form and email it to our Liaison Manager (details below).

Comments forms and all the information from today’s event will also be available to download from the project website at [www.ssepd.co.uk/CaithnessHVDC](http://www.ssepd.co.uk/CaithnessHVDC). Information can also be posted out to you by our Liaison Manager upon request.

Please make your comments as specific as possible in order to help us consider them in relation to our proposal. The closing date for feedback as part of the site selection process is **Friday 9 October 2015**.

Feedback submitted to SHE Transmission as part of the pre-application consultation process is not part of the statutory consultation which will be carried out by the consenting authorities. Once an application for consent has been submitted, there will be an opportunity to make formal representations to the Highland Council before it takes a decision.

Get in touch with our Liaison Manager at any time with questions or comments

**Lisa Marchi-Grey**  
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