sse Renewables

viking energy
Harnessing Shetland's natural resources

Scottish & Southern Electricity Networks
TRANSMISSION

BUILDING **SHETLAND'S ENERGY FUTURE**

About SSE Renewables

SSE Renewables is a developer and operator of renewable energy across the UK and Ireland, with a portfolio of around 4GW of onshore wind, offshore wind and hydro. Part of the FTSE-listed SSE plc, its strategy is to drive the transition to a net zero future through the world class development, construction and operation of renewable energy assets.

SSE Renewables owns nearly 2GW of operational onshore wind capacity with over 1GW under development. SSE Renewables also has the largest offshore wind development pipeline in the UK and Ireland at over 6GW, of which around 3GW is in construction or consented.

About Viking Wind Farm

Viking Energy Wind Farm (VEWF) is a 103-turbine onshore wind farm set around the central Mainland of Shetland. The £580m project is owned by SSE Renewables and construction began last year.

About SSEN Transmission

SSEN Transmission, operating under licence as Scottish Hydro Electric Transmission, owns, operates and develops the high voltage electricity transmission network in the north of Scotland. Its network consists of underground and subsea cables, overhead lines on wooden poles and steel towers, and electricity substations, extending over a quarter of the UK's land mass crossing some of its most challenging terrain.

SSEN Transmission powers the communities its network serves by providing a safe and reliable supply of electricity, taking the electricity from generators and transporting it at high voltages over long distances through the transmission network for onwards distribution to homes and businesses in villages, towns and cities.

We are committed to inclusive stakeholder engagement, and conduct this at an 'Accomplished' level as assessed by AccountAbility, the international consulting and standards firm.

Keeping in touch

We are keen to hear your feedback, so if you have any questions about the newsletter or the works currently underway please contact:

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To find out more about the projects and to register for updates please visit:
www.ssen-transmission.co.uk/projects/Shetland/
www.vikingenergy.co.uk/

Cover: Spring Lambs – Dave Donaldson Photography

VIKING ENERGY **WIND FARM**

CONSTRUCTION UPDATE

Given how advanced construction work is on the ground, it's sometimes hard to believe that the Viking Energy Wind Farm (VEWF) only got underway in August of 2020. It's even more remarkable considering much of the work has had to be carefully steered through the midst of a global pandemic. By the time this newsletter comes out, the full 69km extent of the wind farm track network should be completed, the permanent bridge on the new Sandwater Road will be open, and exemplary landscaping and verge reinstatement through the road cuttings at Sandwater and Hamaragrind will be steadily advancing.

A backfilled turbine base with crane hardstanding on Mid Kame ready for cabling work and final verge reinstatement to commence. The wider area around this base is one of the designated peat restoration areas within VEWF's approved Habitat Management Plan.

Throughout 2022 there will be a constant process of capping the wind farm track network and, together with ongoing related surface drainage works, this will bring the track surfaces up to the required finished running standard by the end of the year, and well ahead of turbine component deliveries in early 2023.

In parallel with capping/finishing the established track network, cabling has now started from the different turbine arrays back to the wind farm substation at Upper Kergord. These cables will largely follow routes alongside the developed wind farm tracks, with more direct routing (e.g. to minimise disruption where cables follow the side of a public road) subject to separate routing approval by SEPA and the Shetland Islands Council. A large stock of cable reels has been slowly built up over many months at the site compound ready for this deployment to begin.

As the cables are installed, that allows road verge reinstatement, turf placement and permanent drainage works along the side of the tracks to be advanced and completed. Throughout 2022, work on verge reinstatement in situ will continue and work will continue on the wider, long-term, peat restoration initiatives which are a core part of VEWF's approved Habitat Management Plan (HMP). The HMP, and the development and implementation of environmental best practice within it, will continue to be overseen by Shetland Wind Farm Environmental Advisory Group (SWEAG) which is now well established. SWEAG brings together a wealth of environmental expertise and experience and is Chaired by Professor Joe Holden of Leeds University who is a renowned expert in peatland hydrology.

At the time of writing 24 out of 103 turbine bases have had concrete poured with a further 5 having steelwork being readied and shuttered for further pours. Backfilling of completed turbine bases is now well underway.

This work is initially focussed on Mid Kame, where the process of backfilling enables the cabling process to get underway in earnest. Once the cabling gets done on Mid Kame, it will allow the tracks to be further capped off and verging and landscaping to be advanced towards completion. This activity means Mid Kame will shortly become the first part of the overall site closest to completion of works on the ground. The landscaping of the road cuttings at Hamaragrind and the new Sandwater Road, mentioned above, is complementary to the work on Mid Kame.

At the time of writing 68 of the 103 turbine bases have been excavated and sit at different stages of completion, and 91 of the crane hard standings are at different stages of completion. Huge progress has been made overall, but there remains a lot to be done to get everything much closer to final completion, on the ground, throughout 2022.

RJ McLeod have about 200 workers on site. When SSE staff, supervisory contractors and workers building the wind farm substation at Upper Kergord are added to these, the total number of staff sits at around 290. Of these, roughly 100 are islanders and 190 are travelling rotationally.

The local supply chain continues to benefit from substantial local direct spend. At the time of writing around 60 local businesses are engaged in the wind farm supply chain and the direct spend with local contractors and suppliers sits at around £19m. Wind farm supply contracts have also helped to support vital lifeline links and services to Shetland through the pandemic. For example, Northlink, Lerwick Port Authority and Loganair have all cited wind farm related business as being pivotal in helping to steer them through, and recover from, the Covid pandemic.

The Shetland business community has embraced the project, and the wider Shetland community stands poised to benefit from, and play its full part in, delivering the global energy transition, decarbonisation and delivering on net zero as the wind farm continues to take shape for first electricity export in the autumn of 2024.

Cables deployed on Mid Kame ready for installation. Once cables are installed verge reinstatement can be completed to match the successful reinstatement shown on the right of the picture.

A fine example of Peatland restoration on Mid Kame.

PEATLAND RESTORATION

Since the recent COP26 conference, peatland restoration has risen in the political and environmental agenda. Generally in Scotland, peatland restoration has been funded by the Scottish Government through the Peatland ACTION programme, which is well represented in Shetland in the undertaking of various restoration projects. The need for, and benefit of peatland restoration was identified early in the VEWF remit and has a dedicated, stand-alone package of work incorporated into the construction phase.

Why restore peatland?

Blanket bog is a globally important habitat and the peat within it is the largest terrestrial carbon store in the UK. Estimates for the amount of carbon stored in Scotland's peatlands range from 1.7 to 4.5 billion tonnes, with most of this in blanket bog peat. There has been a major decline in the extent of blanket bog habitat across the UK, and it may have declined by as much as 27% between the 1940s and 1980s, in large part due to afforestation on mainland forestry plantations. In Shetland, the decline is no less significant but, in the absence of trees, degradation happens for reasons such as historic heavy grazing patterns, historic drainage, peat cutting, severe weather and climate change. For peat to function as a carbon store, blanket bog must be 'active' i.e. decomposition is slower than the rate of input of dead plant material.

Degraded bog and bare peat flats are a net source of atmospheric carbon release (carbon dioxide and methane) rather than being a net sink for carbon.

Maintaining and enhancing the area and rates of peat accumulation can increase carbon sequestration (net removal of CO_2 from the atmosphere). Early calculations for the degraded areas of bog and bare peat flats within the VEWF site were originally estimated as likely to be emitting ca 36,000 tonnes of CO_2 per year, providing an indication of the effects of unchecked erosion.

In addition to arresting carbon release, the restoration of blanket bog areas increases and enhances habitats for many upland birds, especially breeding waders, as well as providing broader biodiversity.

What Is VEWF doing to address historic degradation and to offset peat displacement?

As part of the VEWF works package a separate scope of ecological enhancement is included, in keeping with planning conditions and consents. Part of this package is the commitment to undertake peatland restoration in various pockets of eroded areas across the VEWF site. At a desktop level this equated to around 260 hectares (Ha) of land and through formal surveying, ecological assessment and with consideration to construction works this has since been increased to 304Ha of land. This significantly offsets the land disturbed by the installation of infrastructure which equates to around 96Ha.

The early stage of a peat restoration site in the west of the wind farm above Aith. Note the extensive existing peat erosion.

How is peatland restoration managed?

The identified areas are made up of substandard peatland and bog and, more obviously, identifiable by the extent of bare eroded peat flats and heavily hagged areas. This erosion has occurred through hundreds of years of wind and rain erosion coupled with uncurtailed sheep grazing.

Phase One of the peatland restoration ensures that bare peat flats are infilled to restore original levels and profiles. There is an obvious source of peat through the construction works, and restoration works are planned in conjunction with construction progress, so as to minimise handling and traffic movement. All areas are within relatively easy access of the planned tracks so as not to create any additional damage, beyond that of the immediate infrastructure footprint.

Turves are stripped from construction areas and set aside for re-use. Peat is then excavated to the required construction depth, taking care that the peat does not contain the underlying mineral soil (gravels and clays). This peat is transported to the Peatland Restoration Areas where it is laid out as dug and profiled so as to be in keeping with the surrounding natural levels. Where there is a risk of slippage, then underlying bunds are formed so creating a cell structure which enhances stability. Drainage is managed such that retention and release of water is managed. The key to attaining future blanket bog conditions being the retention of water.

To complete the area, stripped turves are used to cap the area off or, where there are insufficient turves, then the area is earmarked for reseeding. Reseeding is being sourced locally. A local contractor has been engaged to harvest and sow locally grown seed which will be in keeping with local vegetation coverage.

Phase Two of the restoration works will build on Phase One, whereby remaining discrete hagged areas will be reprofiled in keeping with the surroundings. As outlined previously, the key to creating blanket bog is the retention of water. The creation of blanket bog takes time and as such it is the ongoing management of water flowing into and from the area that needs to be managed. Phase Two works will therefore also include gulley blocking to increase water retention within the defined area. Furthermore, where required, revegetation of areas will be encouraged through plug planting and the encouragement of the proliferation of blanket bog species such as sphagnum moss.

How long does this take?

Phase One works are almost complete, with Phase Two scheduled to commence later in 2022 through to 2024. However, this only provides the groundwork on which blanket bog can occur. Naturally occurring blanket bog has taken millennia to form. Our efforts on VEWF, as with all peatland restoration projects, aims to create the optimal conditions on which, through careful management, mother nature can exert her influence over time to create these new wetland environments. The immediate impact however will be in seeking to address the ongoing loss of carbon to the atmosphere which would continue unaddressed without the access and resources provided by Viking Energy Wind Farm.

THE ROLE OF THE **PLANNING MONITORING OFFICER (PMO)**

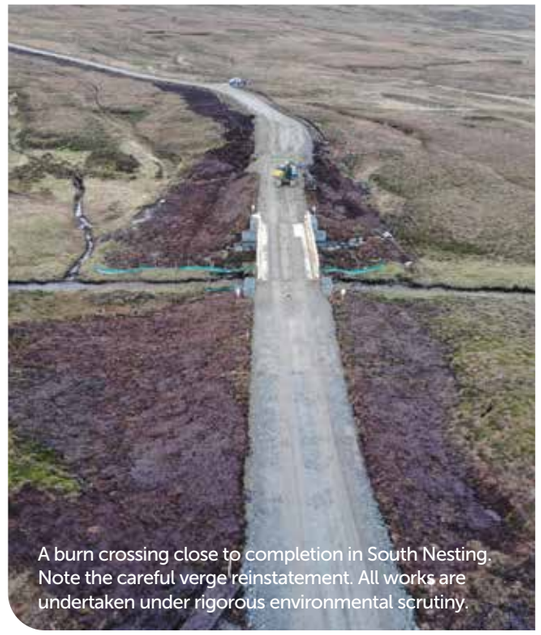
Throughout construction of the Viking Energy Wind Farm (VEWF), both SSE Renewables and RJ McLeod have had experienced, and well-respected, environmentally focussed monitoring teams in place. These teams ensure full compliance with the Construction Environmental Management Plan, the Pollution Prevention Plan and the various conditions placed on the consented development by Shetland Islands Council (SIC).

In addition, to ensure rigorous compliance, an additional condition was applied that required the SIC, as Planning Authority (PA), to appoint an independent and suitably qualified environmental consultant to assist the PA in monitoring compliance with planning and consent conditions. This appointment is the Planning Monitoring Officer (PMO) and the SIC assigned this position to Ramboll.

The PMO duties are:

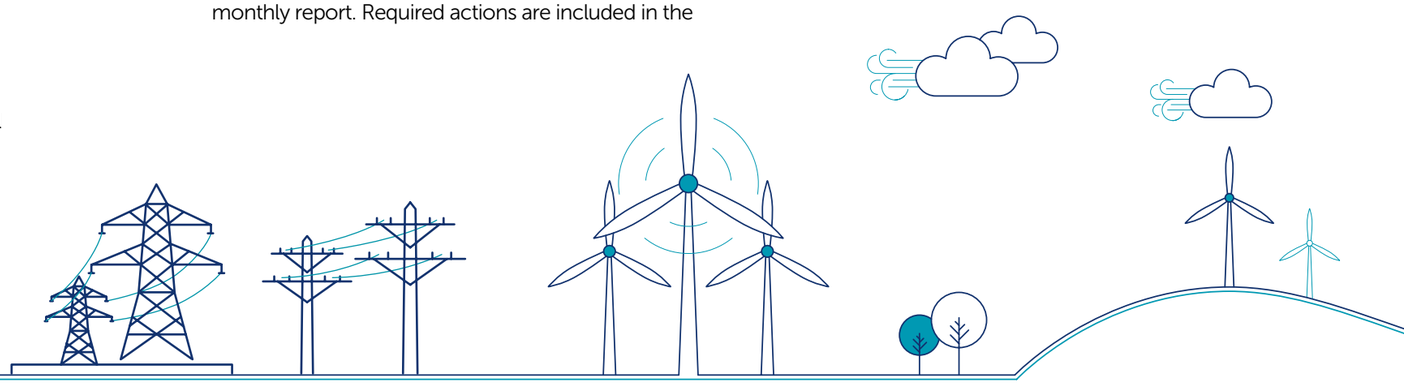
- To monitor compliance with the approved planning conditions and consents.
- To issue a monthly report to the PA summarising works undertaken.
- To report to the PA any incidences of non-compliance with the approved planning and consent conditions.

These duties are exercised through monthly site visits where work activities and environmental mitigations are assessed for compliance to the governing documents. In addition, personal interviews are undertaken with the independent clerks of works to allow an insight and evaluation of work undertaken in the intervening month between audits and, where issues are highlighted, these are included within the audit for closer investigation. Where contraventions to compliance are noted through these audits, these are reported to the SIC PA via the monthly report. Required actions are included in the report so the VEWF team can take immediate action to remedy these issues. Reported non-compliance events are specifically included for follow up assessment in the following month's audit.



A burn crossing close to completion in South Nesting. Note the careful verge reinstatement. All works are undertaken under rigorous environmental scrutiny.

This independent auditing process ensures that the project meets the stringent controls put on it by the SIC, acting in its role as Planning Authority, and above all ensures that environmental impacts are minimised and environmental disciplines are applied throughout, in keeping with conditions.



VIKING ENERGY WIND FARM
AND HOW IT WORKS

As a leading wind farm developer, SSE Renewables carries out studies in the development stage of the project to determine the optimum locations for the wind turbines to generate power at its highest potential. Various considerations will be critical to the project's success; topography (landscapes); prevailing winds etc.

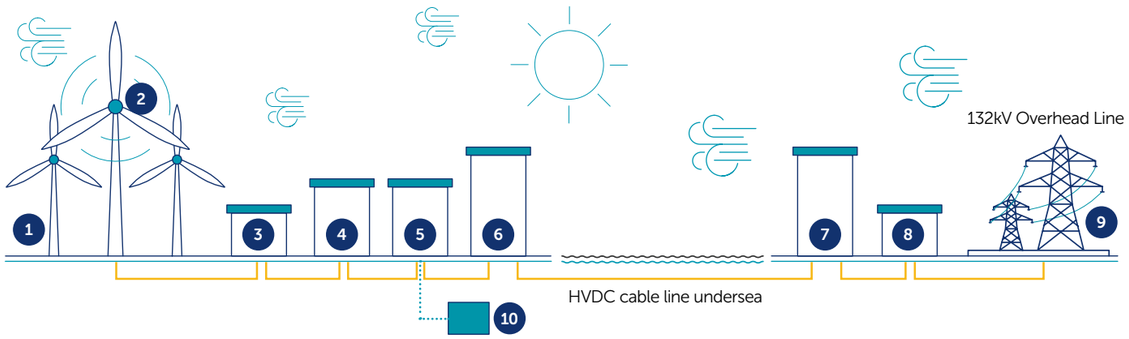
Each wind turbine is strategically designed around the entire site to capture as much wind as possible. The wind turbines are equipped with anemometers which input into the control of the turbine to position the blades in the optimum position for the greatest generation from the wind. When the wind is too strong, the wind turbines will detect this, and the blades will turn to reduce the risk of wind turbine failure or any damages. The onshore wind turbines are usually designed to withstand wind speeds of up to 25m/s (approx. 56mph) before the wind turbine will cut out. If the wind reduces, the wind turbine will resume its start-up sequence at 23m/s and return to generating. Wind speeds as low as 3-5m/s are enough for the wind turbines to generate power. Depending on the length of blades, the tip could be traveling at anything between 160 – 200mph.

The Viking wind turbines generate power at 720 volts to an internal transformer, stepping up the voltage to 33kV, then transmitting the voltage back to the SSER Substation via 33kV aluminium and copper cables, where the voltage is stepped up to 132kV and connected to the UK grid via subsea cabling for the power to be distributed on the network to consumers.

The wind farm is designed to transmit the power through three single phase cables (red, yellow and blue) known as three phases, between the substation and wind turbines which have been engineered and designed to transmit the correct rated current to generate power.

There are 16 circuits on the Viking Project which are called arrays. Each array consists of anything between 6 or 7 turbines giving a total of 103 turbines on the Viking Wind Farm. Once the cables have been installed the cables will be tested between each joint bay, and eventually between turbines, to verify no faults are in the cables that have been installed. Each joint bay is approx. 480m apart, therefore hundreds of joint bays will be required around the site. On completion of cable testing, cable jointing and backfill around the cables, the electrical sub-contractors terminate the cables into the switchgear, located in basement of wind turbine and finally complete the terminations within the Substation. The turbine supplier will conduct commissioning of the wind turbine to enable the turbine to be energised.

The final step of the project is to carry out vigorous testing of the wind farm to demonstrate that the site is compliant with the UK grid code. The wind turbines will start to generate power and ultimately supply the UK energy demand in line with SSE Renewables' ambitious targets to Net Zero.



1. Turbine
2. Transformer
3. SSER Substation 33kV
4. 33kV -132kV Transformer Hall
5. 132kV Networks GIS Substation
6. HVDC Convertor Station
7. Noss Head - Mainland Convertor Station
8. 275kV Distribution Substation
9. Network Distribution
10. Grid Supply Point - Lerwick Location TBC

Above is an easy to understand illustration of how we can generate energy by harnessing the wind


Archaeologists log the old WWII Nissen Hut near Voe.

ARCHAEOLOGICAL WORKS
AT THE VIKING WIND FARM

The wider environment that the Viking Energy Wind Farm (VEWF) site is situated in is steeped in history. People have been using the land for thousands of years; living, working, and dying here. This is why the archaeological works before and during the construction of the wind farm are vitally important.

Headland Archaeology have been undertaking archaeological works on behalf of SSE Renewables throughout the wind farm's construction to ensure that any archaeological sites have been recorded and/or excavated, to better understand how the land was used in the past and ensure that this information isn't lost. The need for archaeological works is determined in consultation with the county archaeologist, whose job it is to advise local councils on archaeological matters and ensure that works are carried out in accordance with standard procedure and methodology.

Several archaeological sites were surveyed and recorded prior to the construction of the wind farm. These range in age from possible prehistoric structures such as houses and cairns, to much more recent buildings and structures from the last century, which appear on OS mapping.

Three sites have been excavated in the course of the wind farm works, due to potential impact from construction. This allows archaeologists to understand more about the sites and create a permanent record of their composition and function. Reports are issued on the sites which are lodged with the county archaeologist and recorded in the local Historic Environment Record, which enables us to connect sites and landscapes across areas and ensures that records are accessible.

However, excavation isn't the only tool we can use to understand the wider archaeological landscape of the wind farm's location. Headland Archaeology's Geoarchaeology department have also been hard at work within the wind farm to carry out a different type of survey. A number of peat cores have been taken across the wind farm which are currently being analysed.


Soil core samples are a source of important archaeological information via radiocarbon dating.

Initial results from using radiocarbon dating methods to understand the age of the peat indicate that much of it formed during the Bronze Age (which is about 2,500 BC to 800 BC). However, these initial results also indicate a further period of peat formation in the Early Medieval Period (about 400AD to 900AD). This means that archaeological sites older than the Early Medieval Period are likely to be at least partially below the peat, and sites older than the Bronze Age even more so.

This is one of the reasons that a large proportion of the construction works for the wind farm must be monitored by archaeologists. It isn't enough to excavate those known sites which are potentially impacted upon – as there may also be unknown ones below the peat. Archaeologists from Headland Archaeology have been monitoring the excavation of peat during the construction of the wind farm, to ensure that any archaeology encountered during the works is also excavated and recorded.

So far, no archaeology has been encountered during the monitoring of the construction, but archaeologists will continue to ensure that any archaeology is recorded to ensure we don't lose any information about how this area of Shetland was used by people in the past.
If you'd like to see some more of the archaeology that has been surveyed and excavated during Headland's work on the Viking Wind Farm be sure to check out the interactive map! You can find it here:
bit.ly/Viking_ArchaeologyExplorer

Grid transformers similar to the four 135 MVA transformers to be installed at the VEWF sub-station.

VIKING SUB-STATION

The Viking Energy Wind Farm (VEWF) sub-station comprises of a 33kV Switchgear building, four Grid Transformer buildings, an Operations building and all associated electrical cabling, plant and equipment. There are 103 wind turbines on the wind farm that are divided into sixteen arrays, the wind turbines generate electricity at 720V AC and their internal transformers then step-up the voltage to 33kV AC for the underground high voltage cables back to the main switchgear. Cables from each array are routed to, and terminated at, the 33kV switchgear.

The switchgear is composed of electrical disconnect switches and circuit breakers used to control, protect and isolate the electrical equipment. From the switchgear, the cables will then run to each of the four Grid Transformers. The Grid Transformers are used to step-up the voltage from 33kV AC to 132kV AC before it goes to SSEN Transmission's High-Voltage Direct Current (HVDC) Converter for export to the UK mainland transmission grid. SSE Networks will also have an arrangement to send electricity generated by VEWF to a planned Grid Supply Point in Lerwick, from where it will be distributed to provide wholesale electricity supply to local Shetland customers.

HVDC System

The HVDC system will include a 320/132kV substation, an HVDC converter station, and an HVDC switching station. The use of HVDC technology allows electricity to be transmitted over long distances, whilst resulting in lower power losses in comparison to a traditional Alternating Current (AC) system.

The power generated by the Viking Energy wind farm will be fed into the wider UK electricity grid through the Shetland HVDC link, a 600MW HVDC transmission link connecting Shetland to the UK mainland via a 260km-long subsea cable.

Transformer

Transformers only work with alternating current (AC), and the input and output voltages and currents are both AC. Generally, there are two types of transformer:

- A step-up transformer which increases the voltage.
- A step-down transformer which reduces the voltage.

A basic transformer is made from two coils of wire:

- A primary coil connected to an alternating current AC supply.
- A secondary coil leading to the AC output.
- The coils are wound around an iron core.

When the transformer steps up voltage, current is stepped down. This means that the current flowing in the overhead lines or subsea cables is relatively small.

Grid Transformer Specification

- Make/Model: Siemens 135MVA Transformer Dimensions
- Approx. length 8.5 m.
- Approx. width 5.1 m.
- Approx. height 6.5 m.
- Approx. weight 94 tonnes.

Grid Transformer Transport

The grid transformers are large and heavy pieces of equipment that will need to be transported to site with great care and attention to avoid any damage. The grid transformers will be delivered by sea to the port in Lerwick and offloaded from the ship on to a large transport vehicle for delivery to site.

Due to the size and weight of the grid transformers the vehicle will require an abnormal load escort when travelling on the main roads to site. This is for health and safety reasons to minimise the risk of damage to the equipment and also for the safety of other road users. Delivery of the first two grid transformers is currently programmed for springtime, with the remaining two scheduled for early summer.

SUCCESSFUL FIRST YEAR OF GRANT SCHEME

Over 120 community groups have applied for nearly £300,000 from the Viking Community Fund, operated by Shetland Community Benefit Fund in the first year of the current grant aid scheme. The funding has helped secure projects with a total value of nearly £1.5m.

Recent schemes that have been approved include nearly £10,000 for improvements to the South Mainland Up-Helly-Aa galley shed, £5,000 for improvements at the Symbister Public Hall and a £10,000 grant for Fetlar Community Association's new website.

Approved schemes from Parent Councils include £7,000 for a new sheltered area for the Urafirth school and £4,600 for a new poly tunnel cover at the Whalsay primary school.

The Unst junior badminton, football and netball associations have all received grant aid as well as Sandwick and Scalloway boating clubs.

Community benefit fund chair, Chris Bunyan, said the first year of the advanced grant scheme, which runs during the construction of the Viking wind farm, had been very successful – but many areas still have funds available for projects.

"There's a number of areas with substantial funds waiting for groups to come forward with suitable projects. For example, Delting has already given out £51,000 in grants and still has £49,000 available for projects that qualify and are approved by the community council, and will have another £50,000 in September". He urged local groups to use the Viking Community Fund either to finance schemes or help secure funding from other sources.

"The scheme is simple to use and it's easy to apply", Mr Bunyan said. "There are few restrictions on who can apply or what funds can be used for.

Please see our website **scbf.org.uk**, for all the details".

Chris Bunyan and Eleanor Gear (Ben Mullay Photography).

KERGORD
HVDC UPDATE

Following a well-earned break for the festive period, development on the HVDC Converter Station at Kergord recommenced in early January. This year will be the most exciting for the project to date, and together with the rapid and excellent progression with the construction of the main buildings at Kergord, the team are looking forward to working with Hitachi Energy (HE) after they mobilised to site in February to begin the installation of the HVDC equipment.

Aerial View – January 2022.

What has happened since the last newsletter?

The focus since Christmas has been to complete the main HVDC building cladding to ensure the building was wind and watertight ahead of Hitachi Energy's arrival. In addition to the external cladding, internal fireproof cladding was installed in all parts of the main building. Works have also been ongoing to install the internal elements of the building including completion of the concrete floor slabs and internal partition walls.

Fireproof internal cladding.

Internal partition walls in control building.

Reinforced concrete floors.

The Mechanical and Electrical fit-out has also started with lighting, fire alarm systems and ventilation ducting installed within the services building which will be ongoing until May.

A significant amount of electrical cable is required with approximately 35 tonnes of cable installed as part of the building services alone, with another 40 tonnes required for the Hitachi Energy equipment. To put this into context, the average house in the United Kingdom has around 50kg of cabling in it, so this building will be home to the equivalent of around 1,500 houses worth of cabling!

Containment brackets in Basement.

Power and Lighting containment.

Ventilation 1st floor Services Building.

External works have also started with the ground troughs and ducting being installed around the perimeter of the buildings. These troughs and ducts accommodate a range of cables used to transfer high voltage power, low voltage power and fibre optic communications, with work expected to be complete by April 2022. The troughs are constructed from pre-cast concrete that are manufactured off-site and delivered to site for installation. Pre-cast units are faster and easier to install and allow our Contractor to keep clear high traffic areas critical to the remaining works.

Preparations for trough bases.

Ducting being laid to connect to troughs.

Pre-cast troughs installed.

In addition to Hitachi Energy mobilising to site, the four 160 tonne electricity transformers will be delivered to Kergord, with the first delivery scheduled to take place in May. Due to their size, the transformers will be transported on specialist vehicles. In advance of the transformers arriving, works to the structure of the transformer pens where the units will be installed is ongoing and consists of cladding to the main transformer pens and installation of the blockwork and fire protection material.

Transformer Pens.

INTRODUCING **HITACHI ENERGY**

Hitachi Energy is one of the global leaders for HVDC technology in the energy industry, which is a key-enabler for a net zero energy system. HVDC is highly efficient for the transportation of large amounts of electricity over long distances, supporting the integration of renewables within the electricity grid.

Hitachi Energy, alongside our other main contractors NKT and Siemens, played a key role in the development and delivery of the Caithness-Moray HVDC Link, which was successfully energised on time and below budget and has delivered an impressive availability of over 99%, excluding planned maintenance outages, since energisation in early 2019.

Shetland Islands: The first multi-terminal HVDC interconnection in Europe

Upon completion, the Shetland HVDC link will become part of the first multi-terminal high-voltage direct current (HVDC) system in Europe using voltage-sourced converter technology, invented by Hitachi Energy, and only the second in the world.

The Shetland interconnector will connect to the existing Caithness-Moray Link to form a three-terminal HVDC network. The Shetland leg will have a power rating of 600MW; the Spittal and Blackhillock converters are rated at 800MW and 1,200MW respectively.

Hitachi Energy IGBT valves.

With HVDC technology expected to play a leading role in the transition to net zero emissions, particularly as more integrated offshore grids are built, the learnings from the Shetland-Caithness-Moray multi-terminal HVDC system will be key to support future network development and offshore grids.

Hitachi Energy Transformer.

160 tonne HVDC Transformer.

Hitachi Energy to Commence Construction

In February this year, Hitachi Energy began its construction activities at Kergord HVDC Converter Station in conjunction with their principal subcontractor, Kirby Group Engineering.

One of the more notable activities for Hitachi Energy over the coming months will be the delivery and installation of the HVDC Converter Transformers. In the coming weeks these Super Grid Transformers (SGTs) are set to make the final stage of their journey from Ludvika in Sweden, where they were manufactured, to Kergord substation.

The transformers, each weighing approximately 160 tonnes, will be delivered by sea from Sweden to Lerwick Harbour where they are due to be loaded on to multi-axle trailers by specialist haulier Allelys.

Before the transformers arrive at the Kergord access track they will be moved onto a Self-Propelled Modular Transporter (SPMT) to allow them to complete the last section of the journey.

The transformers will be delivered to site during a complex and timely operation which will be under the guidance and supervision of Police Scotland. To ensure the delivery is made safely, and with the minimum of disruption, traffic management systems will be in place with police escorts where necessary.

To minimise disruption to commuters, businesses and residents, the four deliveries are expected to take place on Sundays in May and June. When confirmation of dates is received, we will communicate the deliveries and associated traffic management plans to the local community, including via Shetland's local media. The deliveries would leave Lerwick Harbour and the convoy would not be expected to stop until they safely reach Kergord.

SSEN Transmission Project Manager, Michael Topping, said: "Every stage in the journey of these transformers has been carefully planned, going back to the earliest stages of developing plans for the new substation. Once they arrive and are installed on site, they are expected to play a key role in the network for decades to come. The arrival of these transformers represents a significant milestone in the Kergord development and the overall Shetland HVDC transmission project

"Our team will be working alongside our specialist haulier, the roads authorities and Police Scotland to make sure each delivery can be completed smoothly, safely and with minimum disruption to other traffic.

"I would like to take this opportunity to thank the local community in advance for their patience and understanding while we transport these transformers onto their final destination."

Spittal HVDC transformer being transported through Thurso.

AC SUBSTATION

Teams working on the AC Substation at Kergord, an integral part in the HVDC project development, have also been busy since returning from the festive break.

January saw the completion of the roof cladding and the reinforced internal concrete walls finished off. Work has also been ongoing to ensure that the preparation and completion of the first-floor steel decking was ready for the 180m3 concrete pour, which is the equivalent of around 30 lorry loads of concrete.

Preparation and formation of ground floor slabs is continuing and is expected to be complete for the beginning of March. There is a total of 170m3 of concrete for the ground floor slabs – that's enough concrete to fill one and a half double decker buses!

March sees drainage progressing around the building which is now 50% complete with this phase expected to be finished for the end of March.

Preparation works are also ongoing for the permanent supply to and from the SSEN Distribution network, which involves the installation of a transformer and associated cabling works. This distribution transformer provides the substation with a source of low voltage (LV) supply in the event the primary LV site supplies are lost.

There is also a backup stand-by generator with 120 hours of fuel reserve which provides further resilience for the substation's LV site supplies. This ensures that in the event of a fault there is sufficient time to make any repairs

required on site at Kergord or on the local distribution network, whilst maintaining the substations LV site supplies for the duration of any fault.

Looking ahead – February to June

- Concrete first floor pours and ground floor pours planned for February
- Wall cladding
- Building Internal fit-outs
- External Infrastructure Works
- DNO Transformer Installation
- Commence Mechanical and Electrical Building services.
- Commence external troughs and completion of ducting works
- HVDC equipment installation ongoing

NOSS HEAD UPDATE

Building on from the great progress made in 2021, the team has continued to see excellent progress in early 2022 at the HVDC Switching Station in Caithness in the north of mainland Scotland. The roof cladding liner installation has been completed and the wall cladding is almost finished to make it wind and watertight.

The external HVDC cable ducting, which will be used to bring the HVDC cables into and from the Switching Station, has been completed. External works continue including external electrical ducting and building the foundations for the transformers.

The internal fit-out of the Control Building and second and third fix Mechanical and Electrical building services in the Control Building and Main Switching Hall are ongoing with completion of these elements of the works in the summer.

Looking ahead to June:

- Complete Control Building fit-out
- Complete Mechanical and Electrical Building services
- Prepare for Hitachi Energy to attend site to install HVDC equipment.

NEW TECHNOLOGY **AT KERGORD**

Since December 2021, one of our main contractors, BAM Nuttall, has introduced new technology at Kergord which aims to improve safety and efficiency with tasks such as surveying.

In January 2021, the UK Government's Department for Digital, Culture, Media and Sports (DCMS) confirmed funding of £15.2m to support nine UK projects to test and trial new ways in which 5G can improve people's lives and build back better following the pandemic. BAM Nuttall were one of the successful bidders in securing some of this funding for the trialling 5G capabilities, some of which are being trialled here in Shetland.

The Shetland HVDC project will explore and develop 5G-enabled data-rich technology solutions such as construction robotics – such as 'Spot' the dog manufactured by Boston Dynamics, BAMCAM, as well as PLINX, a live drone streaming system used in Digital construction.

5G Mast installed at Kergord.

"SPOT" THE TRIMBLE DOG

'Spot' the Trimble dog is a robotic dog that can carry out works such as intelligent scanning and photography and can be safely deployed on construction sites. The mounted X7 Trimble scanner allows for 'Spot' to carry out its predetermined works.

Assessing the progress of installed works, photo diaries for progression, bank and slope stability readings and water flow readings by scanning floats in watercourses and ponds are just some of the current functions being adopted.

Although 'Spot' currently does not need the 5G connection, the aim in collaboration with Boston Dynamics and Trimble is to achieve autonomy for 'Spot' to enable remote operation using the 5G network.

PLINX

PLINX system is an interactive device that monitors the activity of the user. A transmitter is installed at an elevated position and sends a signal wirelessly through the 4G/5G network. It has a range of 1500m and has been deployed successfully in Kergord for the project. BAM Nuttall have begun trialling the PLINX system for control and monitoring of safety exclusion zones onsite.

LAND CABLE
INSTALLATION WORKS

January and February saw the completion of the installation of the onshore cable ducts. The works were successfully undertaken by our main contractor for the subsea and land cable manufacture and installation works, NKT, who are supported in Shetland by local subcontractor Tulloch Developments Ltd.

In February, work began on constructing the landfall temporary compound at Weisdale Voe with teams expecting to complete this by the end of March, in preparation for the subsea duct installation which is due to commence in summer.

The landfall is where the subsea cable comes ashore and is joined to the land cable at the transition joint bay. The landfall will consist of two buried ducts that will be towed out by a workboat to the required location and then lowered into their designated position. The cable will be pulled through these ducts in March 2023. Cast iron shells will be used for protection on the cable between 7m and 10m water depth, where it exits the duct, after which it will be buried.

The eight cable joint bays, including the transition joint bay, commenced construction in January and are due to be completed in April 2022. A joint bay is a concrete slab buried below the ground where the sections of cable are joined together by specialist teams of cable jointers. The joint bays in Shetland are spaced 1.1km apart, which is determined by the practical size a cable drum can be easily transported without the requirement for an abnormal load.

Whilst the final section of ducting on the A971 is now complete, two of the cable joint bays have still to be constructed in the road, which will require traffic management at the joint bay locations, 1.1km apart. The traffic management will be in place for the joint bay construction, the cable pulling and then the cable jointing, currently planned from April to July 2022.

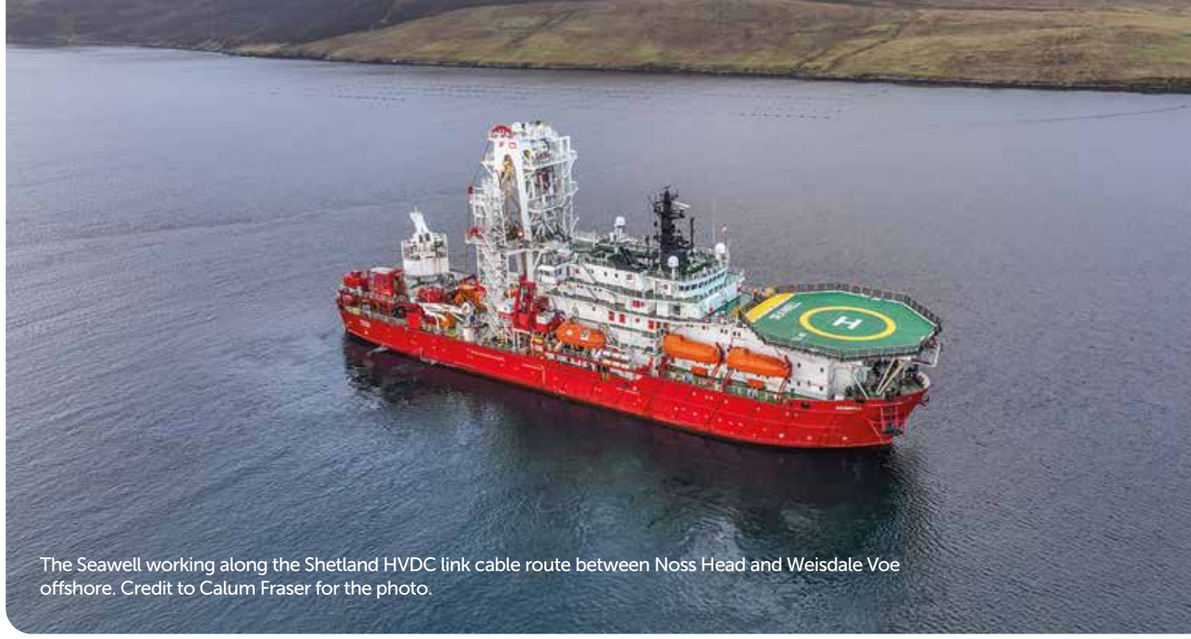


Joint bay Duct Installation works A971.

Teams began land cable installation works at the end of February. The cable drums were transported from Lerwick Harbour to the various joint bay locations along the route late in February and early March using a low-loader lorry. The cable drums were placed on specialist trailers, which were then pulled through the ducts using winches and then merged at the joint bay locations by the team of jointers. After jointing, the joint bays are backfilled and the existing road surface reinstated. Once the cables are pulled in to the Kergord Convertor Station, they are terminated (connected) to the specialist HVDC equipment. Cable installation works, including the terminations at Kergord Convertor Station, are planned to be complete by July 2022. The general sequence of cable installation will be to commence at the Convertor Station and work towards the landfall.

After the land cable installation is complete, the full width of the northbound carriageway of the A971 from Scord of Sound to Stenswell will be re-surfaced, which is currently planned for August and September. Traffic management will be in place during the resurfacing works to keep road users as well as construction teams safe during this phase of the project.

We and our contractors would like to thank the Shetland community for their support and patience during the installation works to date.



The Seawell working along the Shetland HVDC link cable route between Noss Head and Weisdale Voe offshore. Credit to Calum Fraser for the photo.

SUBSEA WORKS

The Seawell, a custom designed light well intervention and saturation diving vessel, has just completed its scope relocating boulders for installation campaigns one and two along the Shetland HVDC link cable route between Noss Head in Caithness and Weisdale Voe in Shetland. The Seawell is utilising a specialized boulder grab tool to relocate the boulders within the consented cable corridor so the seabed is clear for the safe installation of the cables.

The relocation works began in November 2021, with teams successfully clearing the areas associated with campaigns one and two in February.

Vessell MV SIMA.

Trenched Cable close up.

Planned works for March to July 2022

The MV SIMA, a versatile multipurpose offshore installation vessel, is preparing for the pre lay grapnel run which is due to mobilise at the end of March from Thyboron quay in Denmark. These works are expected to last about 12 days. The MV Sima will dredge a grapnel to clear any obstacle that could obstruct the cable lay operation, such as fishing nets, ropes etc. prior to this phase getting started.

Back on Shetland, landfall preparation works will commence in April in Weisdale Voe. A High Density Polyethylene (HDPE) Pipe will be installed in preparation to receive the cable in 2023. The cables will then be installed from a purpose-built cable laying vessel (Victoria) at the Weisdale Voe landfall via the HDPE duct to the transition joint bay. Following the installation of the cables, they will be trenched and backfilled where possible and protected by a rock berm where trenching cannot be achieved.

SECURING SHETLAND'S **FUTURE SECURITY OF SUPPLY: GREMISTA TO KERGORD**

In early March, we submitted to the Scottish Government a Section 37 planning application for the 132kV electricity transmission network overhead line infrastructure that will connect Shetland to the GB energy system.

Two 22km circuits, which will be a combination of overhead line and underground cabling, will provide a connection between the proposed Gremista GSP and Kergord substation, which is currently in construction as part of the Shetland HVDC link. Upon completion, this will provide a connection to Shetland's local electricity distribution network, connecting the islands to the GB energy system for the first time, helping secure Shetland's future security of supply.

The Kergord-Gremista connection follows extensive local consultation which has helped shape the project's design.

At the Kergord end of the two circuits, the 132kV infrastructure will be undergrounded for around 5.8km, with another 900m section of one of the circuits to be undergrounded at Sweenister. As the transmission circuits approach and connect to Gremista GSP, the two circuits will be undergrounded covering a distance of 4.1km in total.

We have also committed to underground around 11km of existing 33kV electricity distribution overhead network infrastructure running in parallel with the proposed 132kV overhead lines and 500m of existing electricity 11kV distribution overhead network infrastructure, reducing the cumulative visual impact of overhead network infrastructure on Shetland's landscape.

In total, around half of the proposed 132kV connection is to be undergrounded which when coupled with the undergrounding of existing electricity distribution infrastructure, strikes a balance between minimising visual impacts on Shetland's landscape; mitigating potential environmental impacts, particularly on protected species of birds; and protecting electricity consumers from the high costs associated with undergrounding.

In April we will undertake ground investigation works on the proposed route between Kergord and Gremista as well as the proposed route from Kergord north to Yell. These works, which are required to assess ground conditions, are expected to continue for up to eight weeks and will consist of bore holes and trial pits along proposed routes.

Scottish & Southern Electricity Networks
TRANSMISSION

GREMISTA GSP SUBSTATION

In December last year, SSEN Distribution, who we are working closely with as part of the connection from Kergord to Shetland's existing distribution network, submitted a planning application to Shetland Islands Council for Gremista GSP.

The proposed site, which has been identified as a suitable area for development in Shetland Island Council's Local Development Plan, has been carefully selected due to its close proximity to the existing industrial infrastructure in the Black Hill Industrial Estate, with the GSP proportionate to existing buildings; and where the GSP will connect to Shetland's existing electricity distribution network.

Ground Investigation site works have been completed by Raeburn Drilling and Geotechnical at Gremista, Lerwick in preparation for the start of the construction of the Grid Supply Point (GSP) substation.
The ground investigation work comprised rotary boreholes and machine excavated trial pits being undertaken to assess ground conditions and enable optimisation of the re-use of soils and rock from the future excavation of the GSP platform. The landowner, Lerwick Port Authority, helped to establish a suitable access route for the plant and equipment undertaking the investigation to help minimise the impact of the works.

Although the specialised drilling rig was required to be brought to Shetland, the excavator for the trial pitting was locally supplied by Tulloch Developments Limited, with Mott MacDonald provided geotechnical support from their Lerwick office.

We are working closely with HIE to keep the local supply chain informed of the opportunities that the development project offers. A webinar is planned for June 2022 to introduce the scope of the project and drill down into the specific requirements. A follow-up face to face event will be held in October to introduce the successful tier 1 contractor to the local supply chain later in the year. This will give the opportunity for the local supply chain to see where they fit into the overall scope and engage directly with the tier 1 contractors.

MSIP FUNDING APPLICATION

In January we submitted to the GB energy regulator, Ofgem, a funding request under its Medium Sized Investment Projects (MSIP) for Gremista GSP and the associated 132kV network infrastructure connecting Gremista GSP to Kergord substation.

When connected, the GSP will remove Shetland's dependence on diesel generation as the primary source of generation from Lerwick Power Station, which will then transition to a standby mode of operation to provide a backup supply in the event of an outage on the Shetland HVDC link.

Grant Smith, Lead Project Manager, said:

"The submission of our Section 37 planning application for the Kergord to Gremista 132kV transmission circuit which follows last year's planning application for Gremista Grid Supply Point, alongside our recent funding request to Ofgem, marks a major milestone in helping secure Shetland's future security of supply.

"Upon completion, these projects will connect Shetland to the GB energy system for the first time and will enable the supply of clean power to homes and businesses, even at times when local generation on Shetland's electricity distribution network does not meet demand.

"Our proposals have been carefully developed to minimise the impact on Shetland homes, businesses and the local landscape as we have sought to balance a range of economic, environmental and technical factors.

"We look forward to the outcome of our planning applications and remain committed to working closely with Shetland Islands Council, the local community and wider stakeholders to deliver this critical infrastructure to support Shetland's future energy needs."

ENVIRONMENT

Kergord HVDC Convertor Station – protecting and enhancing biodiversity

We are committed to protecting and enhancing the environment in which we operate by minimising the potential impacts from our construction and operational activities as part of our commitment to deliver biodiversity net gain on all future transmission projects across the north of Scotland. Our teams and contractors at Kergord HVDC Convertor Station are committed to ensuring caring for and protecting natural environments is included at every stage of the project's development.

Teams have been actively seeking to identify opportunities throughout design, construction and reinstatement of the project to enhance the biodiversity value of the site post construction. Prior to the construction, a habitat survey was undertaken for the site to determine the type and extent of plant communities and species present. Data gained from the survey has been used to inform the reinstatement proposed, as well as provide long-term targets for the site through our long-term landscape management plans for the site. The site selected for the development was primarily under agricultural use, consisting mainly of semi-improved grassland with some areas of degraded blanket bog, and small wetland areas. Overall, it was considered to have a relatively low biodiversity value.

In line with the UK's good practice principles for biodiversity, the landscape proposals that have been

developed at Kergord seek to improve on the existing site conditions. Proposals include the creation of areas of neutral grassland, along with woodland and scrub to improve the habitat diversity on the site. The development has also diverted a number of small watercourses around the site via the creation of two newly constructed naturalised channels.

Where possible turfs from existing wetland areas within the site boundary will be re-used along the realigned watercourses. All seed mixes to be used on the site are being agreed with Shetland Amenity Trust.

We are developing a long-term monitoring and maintenance plan for the site to ensure that the habitats created achieve their target condition.

A SAFETY PERFORMANCE **TO BE PROUD OF**

Imagine the entire adult population of Shetland working a full week, in a high-risk environment, in some extreme weather conditions during a global pandemic. Now imagine that scenario and not a single person suffers an injury that requires any medical attention. That is the equivalent of what the Shetland HVDC Link Project has delivered – together, teams have achieved one million working hours since the last recordable injury.

At SSEN Transmission, safety is not just about statistics. But when the Project recently surpassed that milestone, it reminded teams of the importance of celebrating success and giving those working on the project the recognition that they deserve.

Day to day, project teams and contractors work tirelessly to reduce risk and prevent incidents from occurring. From Risk Assessments, Toolbox Talks and Engagements to PPE, Communications and Safety Observations, there are a number of steps taken to keep SSEN Transmission sites and teams safe.

SSEN Transmission Occupational Safety Manager, Stuart Clannachan said, "Reaching one million working hours without a recordable injury is a fantastic achievement. There has been an incredible effort from the leadership teams and workforces both within SSEN Transmission and our Contractors to keep each other safe and it is something which everyone involved in should be extremely proud of. We still have a long way to go on the Project and it only takes one injury to change this. It is important that we recognise this moment, celebrate the success and use it as motivation to work safely until the very end of the Project."

MEET THE TEAM

We're shining the spotlight on team members working to help power change on Shetland. This month we caught up with Assistant Project Manager Jared Deeney to find out more about his role and how he helps to deliver a network for net zero.

How long have you worked in SSEN Transmission?
Six months with SSEN Transmission and 13.5 years with SSEN Distribution.

How did you get started in your career – what did you do before joining SSEN Transmission?
I started working for SSEN Distribution in 2007 as a trainee LV jointer/linesman. I went through training and then onto college in Inverness to do a modern apprenticeship. I did 8 years on the tools, carrying out new connections work, maintenance/inspections and fault/storm work as a craftsman and HV switcher. In 2014 I became a Senior Authorised Person (SAP) and in 2015 I was promoted to New Connection Manager for Shetland. I spent 6 years planning and delivering projects (involved in design then planning, organising, outage planning and carrying out outages) all over Shetland on the Low Voltage Network, 11KV Network and 33kV Network. Also carrying out standby duties.

What inspired you to join SSEN Transmission?
The project in Shetland is something that has never been experienced here in Shetland before. This is a fantastic time for SSE and a huge opportunity to learn new skills, get involved, gain new experiences and see the project being built from the ground up.

What qualifications do you need for your role?
LV, HV Switching and SAP Authorisations, City and Guilds but most importantly, experience. I'm also currently learning new HVDC Authorisations and will be starting Project Management courses shortly.

Talk us through a brief typical day in your job:
Generally my day consists of working with the Project team, meetings via Microsoft Teams and visiting Kergord site. Engaging with contractors is a big part of my job too. As things return to a bit more normality, I'm looking forward to more travelling for work. I'll likely be making regular visits to Sweden, Austria and Germany which is very exciting for quality assurance purposes to witness Factory Acceptance Tests on key equipment.

What is the best part of your role?
I was very lucky to have the opportunity to travel to Sweden to see the convertor transformers and valves being made in the factories. That was amazing to see I'm really grateful for the experience. That's a definite highlight for me so far.

What is your proudest achievement so far at SSEN Transmission?
I think I've achieved a fair amount in my short time here, but looking forward, the completion of Kergord will be a huge achievement for SSEN Transmission and I'm proud to be a part of that.

How do you help power change?
The Shetland HVDC link is providing not only a conduit for delivering renewable energy to the UK grid but also providing power for Shetland's everyday needs. Therefore, greatly reducing the dependence on Diesel Generation. By working on this project, I feel I/we are helping to make this change happen.

sse Renewables

viking energy
Harnessing Shetland's natural resources

Scottish & Southern Electricity Networks
TRANSMISSION

Lang Ayre

To find out more about the projects and to register for updates please visit:
www.ssen-transmission.co.uk/projects/Shetland/
www.vikingenergy.co.uk/