Using Innovation to Overcome the Challenges, Uncertainty, and Barriers for the Transmission Network

Alan Ritchie, Innovation Manager
Energy System Change

Achieving net zero will require a significant shift in the way we generate, transport, and consume energy in the UK.

A critical step will be the phasing out of high pollution, non-renewable types of electricity generation, such as gas-fired power stations.

The energy system needs to transition to put in place, new, clean low-carbon sources of energy like wind and solar.

Accommodating this means the UK power system needs significant modernisation and investment to deliver the necessary reinforcements to support this growth.

By 2050, the North of Scotland will need around 50GW of renewable energy capacity to support Net Zero. The sheer scale and pace of investment required leaves uncertainty around the feasibility of achieving this.
Pathway to Net Zero

Today our system manages 8GW of energy generation, and by the middle of the decade that will increase markedly to 14 GW and by the end of the decade 22GW.
Using Innovation to Accelerate our Net Zero Journey
Our Innovation Vision

“Our innovative thinking with responsible action, to enable the energy system transition”

Supporting Net Zero

Socio Environmental

Energy Security
Network-DC
Innovation: Using DC Breakers in the Transmission Network

**Problem**
- HVDC Circuit Breakers (DCCBs) will make possible new designs and operating strategies for High Voltage Direct Current (HVDC) links
- Without DCCBs, additional switching stations or point-to-point links will be required to support a 50GW+ ambition for offshore wind.

**New solution**
- This project will provide a pathway to making DCCBs a viable option for specification and implementation in HVDC network development projects in GB.

**Current Practice**
- Without DCCBs, additional switching stations or point-to-point links will be required to support a 50GW+ ambition for offshore wind.

**SIF Project**
- This project will provide the necessary information about the opportunities, challenges and timelines to deliver DCCBs, from a technical, regulatory and commercial perspective
- Budget estimate: £6,051,212 ; SIF Funded £ 5,446,091, SSEN Contribution £439,998 over 4 years
- Partners: Mott MacDonald, The National HVDC Centre, SuperGrid Institute, University of Edinburgh, National Grid ESO, National Grid Ventures, The Carbon Trust, and Renewable UK
- Timeline: September 2023 – December 2026
The Peterhead Use Case

SSEN-T is factoring DCCBs into current DCSS projects (future-proofing engineering)

Recommendations for Integration of DC Circuit Breakers into DC Switching Stations

Link to overseas AC network

Radial Infeeds from offshore wind farms

DC Hub at Peterhead

HVDC Converter Stations
Two at Peterhead
One in the far north of Scotland (Spittal)
Two in central England
One in another country
Multiple at offshore wind farms (or other radial infeed sources)

Additional connections made possible by use of DCCBs

Links shown as single lines but all are BIPOLE connections
Summary: £6 million of funding awarded for Beta Phase

Network-DC will build the foundation for the UK’s first High Voltage DC circuit breakers (DCCBs), enabling a more efficient and sophisticated HVDC network design.

- A DCCB hub will reduce the need for AC infrastructure and effectively isolate faults in offshore network components.
- DCCBs can save valuable space by reducing the number of transmission assets, in turn reducing impacts on local coastal communities and those who would be disrupted by expanded transmission infrastructure.
- Our approach uses the state-of-the-art HVDC Centre to simulate DCCBs within future HVDC schemes to improve the overall performance of the system, to the benefit of users and consumers alike.
- Testing and consultation with key stakeholders will establish and demonstrate DCCB performance, resulting in approved specifications that can be used for procurement.
Thank you

Any questions?
Low Profile 132kV Steel Poles
Innovation: Earthed Steel Trident Structures (EaSTS)

Problem
Within the next five years, SSEN Transmission must provide connections to multiple wind farms characterised by their large electrical capacity or high altitude. A wood OHL is unsuitable as our existing 132kV poles cannot be used above 300m and are capacity-limited.

NIA Project
- SSEN Transmission has identified a £4.8m lifetime cost saving if using the new steel pole design across 7 projects
- Project funded: £1,650,000
- Partners: PLPC, Energyline, Norpower
- Timeline: January 2022 – December 2023

New solution
- This project has researched & designed a new innovative pole for our OHLs at altitudes above 300m as a cost-effective alternative to steel lattice towers

Current Practice
- At over 250MW and 300m altitude, steel lattice and NeSTS are the proposed solutions, associated with high costs and a larger carbon footprint than traditional wooden poles.
**Future Project Identification**

**Aberarder Windfarm Connection**
- 75 MVA Wind farm connection at approx. 600m altitude approx. 5km circuit length
- It was planned for single circuit NeSTS / Steel Lattice Structures
- Low Profile structures with Upas could offer a potential saving of 55%* of project costs

*Based off per km costs of £700k/km for steel trident and £1.7m/km for steel lattice towers.

**Kergord – Yell Overhead Line**
- 220MVA 18km circuit required
- Capacity not possible with standard conductors
- Two potential options
  - Use a high novel composite conductor
  - Use underground cable
- EaSTS option is approximately 76%* cheaper than the cable option & use standard apparatus

*Based off per km costs of £700k/km for steel trident and £3m/km for steel lattice towers.