



Getting the most out of the Network

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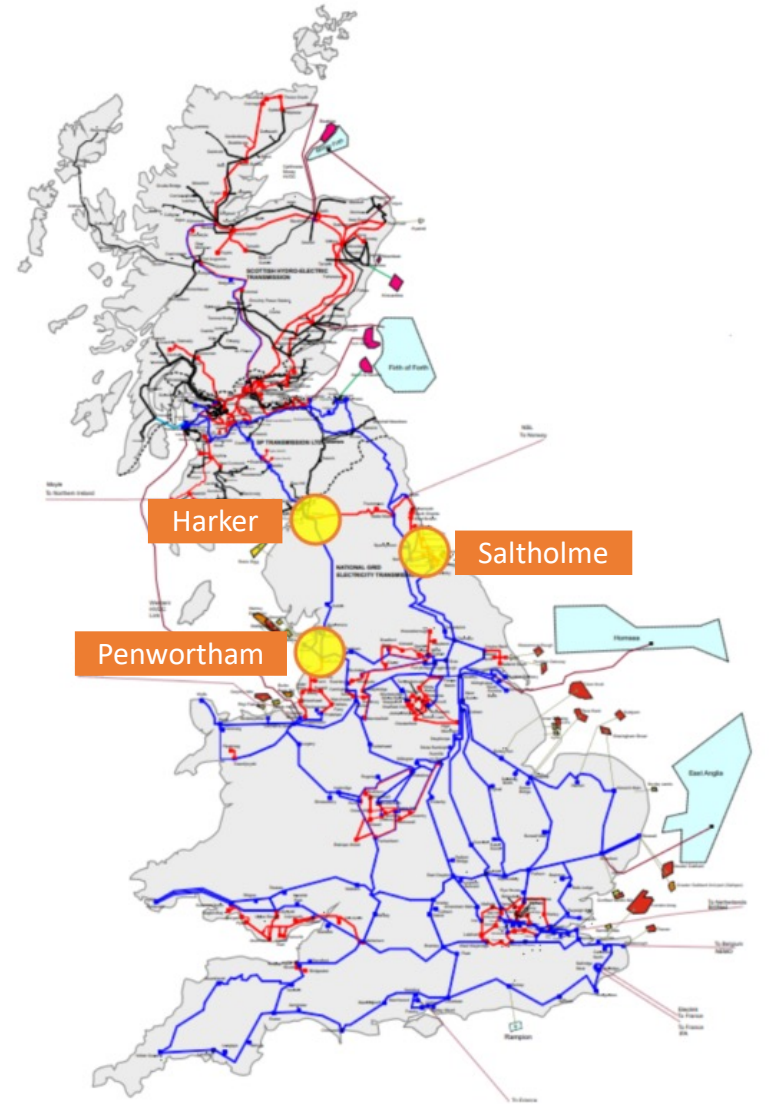
Alternatives to New Transmission

- In GB it can take up to 14 years to consent and build new transmission
- In 2025 annual curtailment costs in the region of £3bn to £4bn
- Need to find ways to increase capacity on existing network
 - ANM and intertrip schemes
 - Smart Wires
 - LIDAR
 - DER dispatch



Static Synchronous Series Compensator (SSSC) use on National Grid network

- Voltage Source Converter device
 - Injects leading or lagging voltage independent of line current
 - Similar to a series capacitor or series reactor but more flexible
- Currently installed at three sites on our transmission network
 - Penwortham
 - Harker
 - Saltholme (Lackenby to Norton)
- Initial use case
 - Post fault impedance increase to limit local circuit overload
- Further sites are planned including more advanced operating modes
 - Pre-fault operation to alter thermal flows on remote circuits
 - Assistance with voltage management
 - Co-ordinated control across number of devices to increase overall benefit



National Grid USA POCs Dynamic Line Rating (DLR)¹

Rhode Island POC with

Parameter	Line 1	Line 2
Design tension/sag @ 15.3° C	~5783 N	
Conductor in-service date	1924	1926
Conductor code name	477 ACSR Pelican	
Sag/ Clearance limit	110° C	
Max operating temperature	100/110° C	

National Grid field-tested 2 technologies (Linevision and Lindsey) to monitor overhead transmission lines

The lines identified for this project were two 115 kV lines in Rhode Island

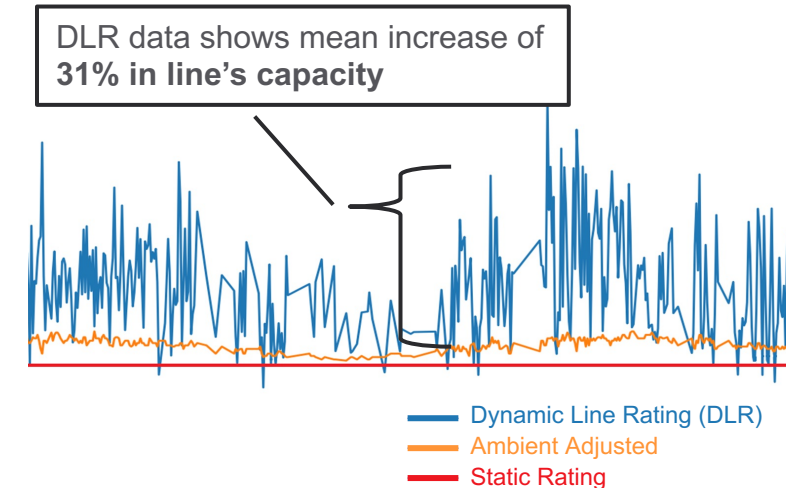
... easy installation ...



No outage required for LineVision installation (devices install near the base of the transmission tower)

Installation was easy / straightforward for line crews

enabling clean power



Data showed mean **increase of 31%** in capacity vs. Ambient Adjusted Ratings; increase was 47% vs. Static Rating

National Grid poised to deploy on 2 lines in NY that carry a lot of wind generation

Rationale for POC: SSHARN constraint / costs

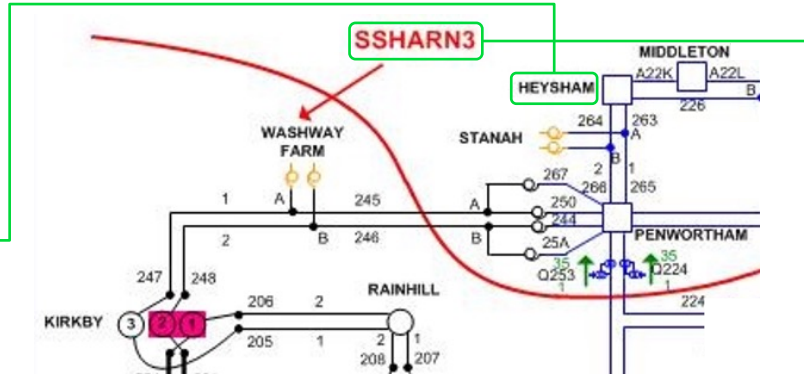
Wind¹ + nuclear ...



Multiple offshore wind locations (Walney 1, 2 + Extension & Barrow) bring generation onshore at Heysham

The Heysham nuclear power station also connects at this location

...connect @ Heysham...

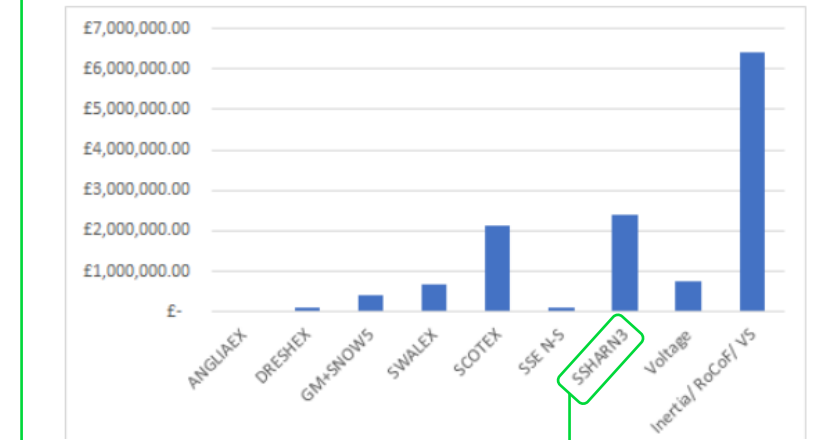


Inflexible generation connected at Heysham crosses SSHARN3 in 2 locations, including Kirby-Penwortham-Washway

In total, SSHARN crosses the grid ~6 times i.e. ~16% of thermal constraint costs could be estimated/attributed to a single line

... & cross SSHARN3

Constraint costs, Oct. 5th - 11th, 2020¹



SSHARN3 #2 driver of constraint costs, with ~£2.5m for October 5th - 11th, 2020²

Total thermal constraint costs for SSHARN constraint group, for fiscal 2020, ~£245m³

National Grid

1. Photo from Orsted website. 2. ESO Operational Transparency Forum, 14th October 2020 (<https://data.nationalgrideso.com/backend/dataset/b3c55e31-7819-4dc7-bf01-3950dccbe3c5/resource/958f2745-755c-4a1a-9c1a-089668eb0e12/download/ngeso-transparency-forum-14-10-vfinal.pdf>) 3. Thermal Constraint Costs 20-21 (<https://data.nationalgrideso.com/constraint-management/thermal-constraint-costs>)

Dispatch of DER

- The MW Dispatch Service will support the management of transmission network constraints, by enabling Distribution Network generators and batteries to play an active role in local constraint management.
- Capacity reallocation using the technology enabled by MW Dispatch will enable the acceleration of over 7.3GW and 500 connections in the Southwest, South Wales and the Midlands
- A more inclusive and potentially cheaper to implement service than the Balancing Mechanism, MW Dispatch Service will extend the options available to the ESO's control room



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