PARIS SESSION 2024

Towards a Digital Twin for Management of OHL Risk

Ailidh Meek & Alex Campbell

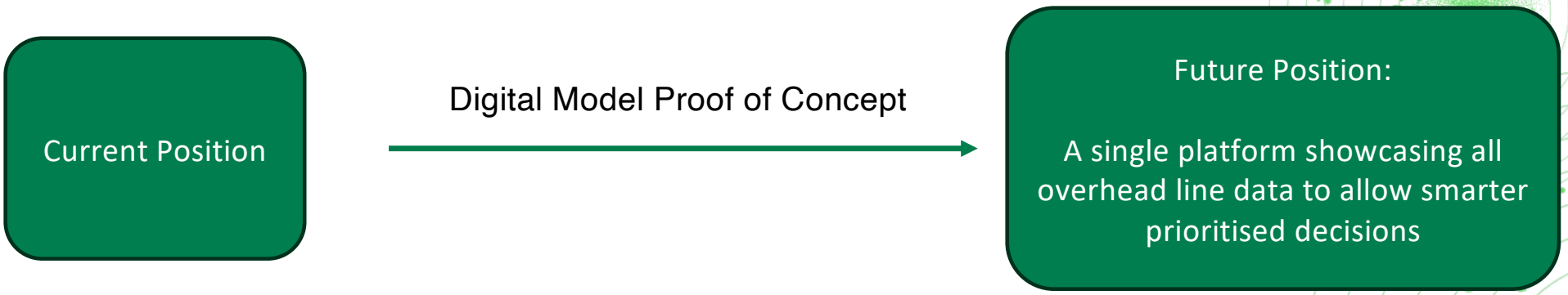
cigre
For power system expertise

Motivation

Recent severe weather emphasised areas of weakness on our 11kV OHL network

This identified the need for:

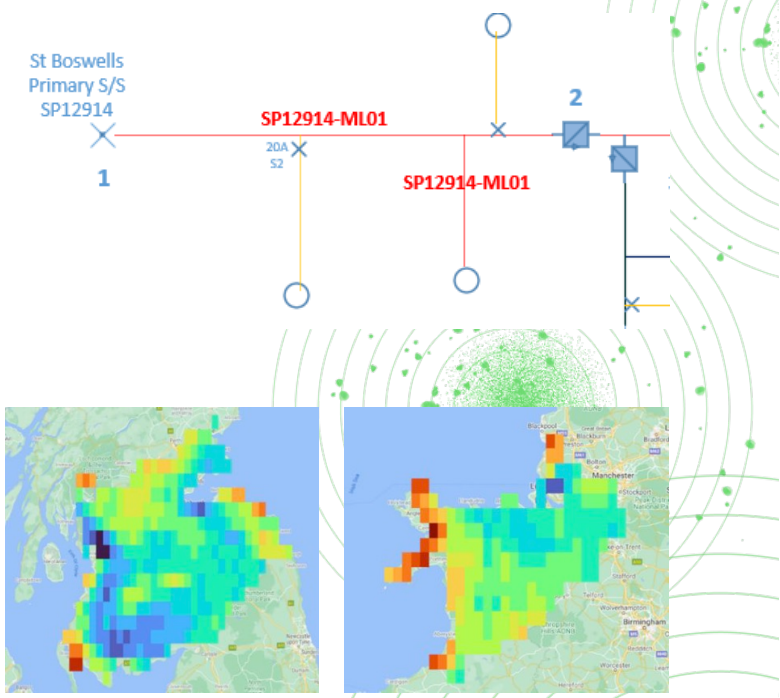
- Improved network storm resilience
- Proactive identification of remediation of most at-risk assets
- A data-driven approach to asset management
- A digital model to determine accrued risk and storm resilience of the network



Smarter asset management to avoid unnecessary disruption for customers

Inputs

OHL Data Sources	Opportunities
Lidar	• Vegetation & clearance analysis • Data alignment • Data completeness • Compliance • Asset and circuit risk assessment • Storm simulation • Investment decisions • Fault history analysis
GIS	
Specifications	
CBAs & CBRM	
Inspection Dates	
Severe Weather & Flooding	
Rurality	
Network Performance	
Protection Zones	



Single platform showcasing all overhead line data

Use Cases/Aims

Minimum Requirements

SPEN Data Assessment

- *LiDAR coverage and classification*
- *GIS / LiDAR alignment*
- *Data completeness*
- *Data alignment*

Circuit and Asset Risk Assessment

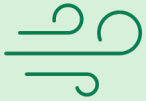
- *Health assessment*
- *Key risk drivers per circuit*
- *Fault performance*

Intervention Prioritisation Analysis

- *Confidence in inspection results*
- *Rurality*
- *Single data platform*

Wider Storm Simulation

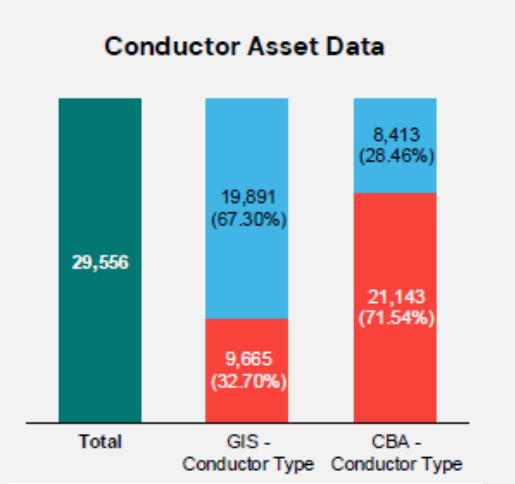
- *Finite Element Analysis*
- *Identify weakest wind direction per asset and per circuit*

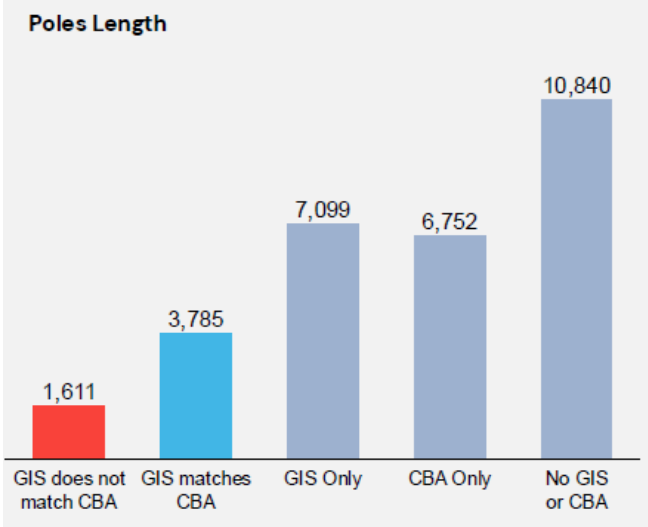


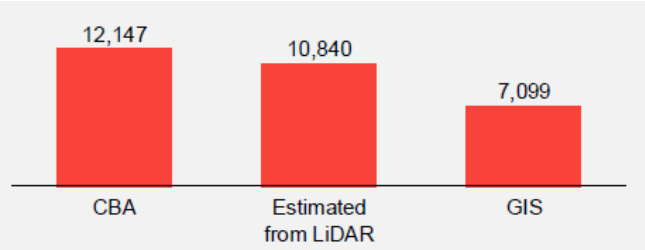
Modelling 3,000 km of HV OHL in total across Scotland, England and Wales

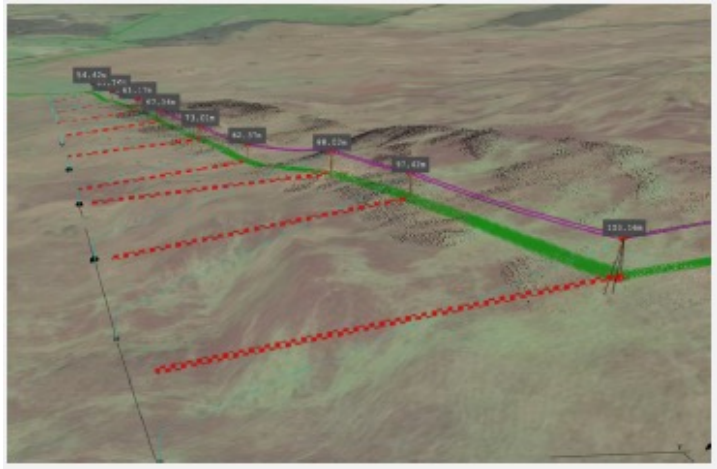
Results – Data Assessment

Assessing data completeness, accuracy and consistency







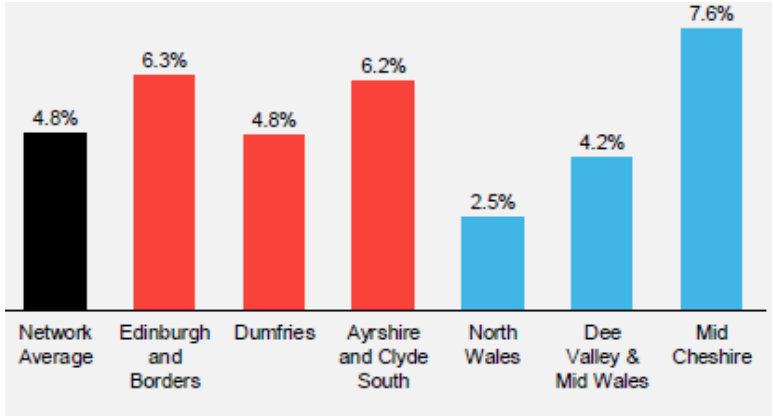


Corporate systems are missing some asset data from legacy inspections

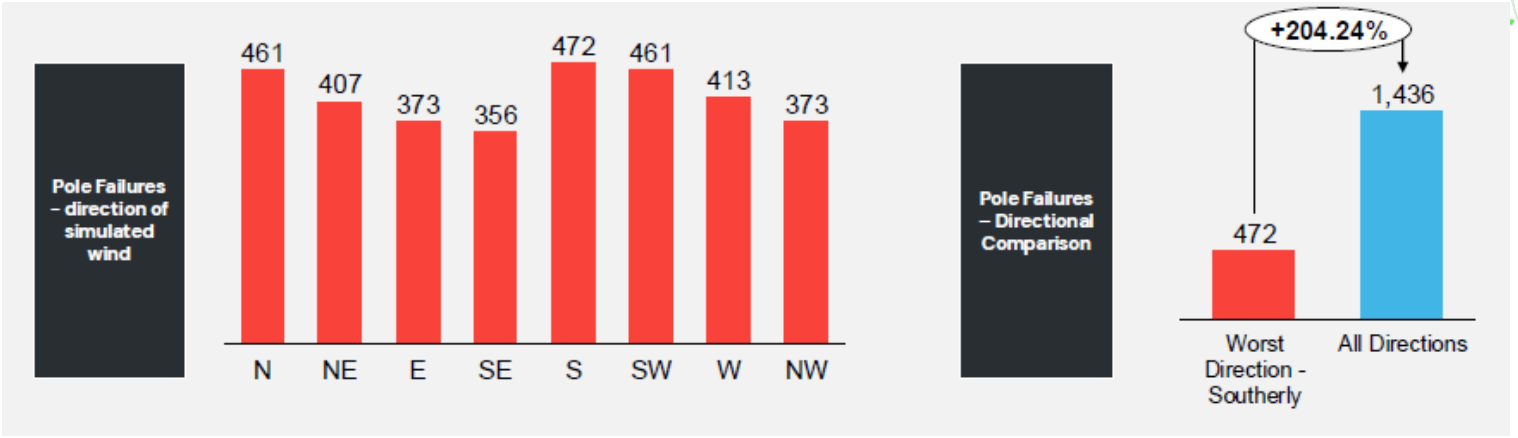
Lidar and GIS are misaligned – averaging ~8m discrepancy in GIS coordinates and precise Lidar locations

Results – Storm Simulation

Modelling Storm Arwen-like wind conditions on assets to identify likely pole failures



110 mph winds caused 1,436 of 30,055 poles to fail (4.8%)



Results – Risk Score

Developing risk score for poles going beyond UK common methodology CNAIM V2.1

Pole risk

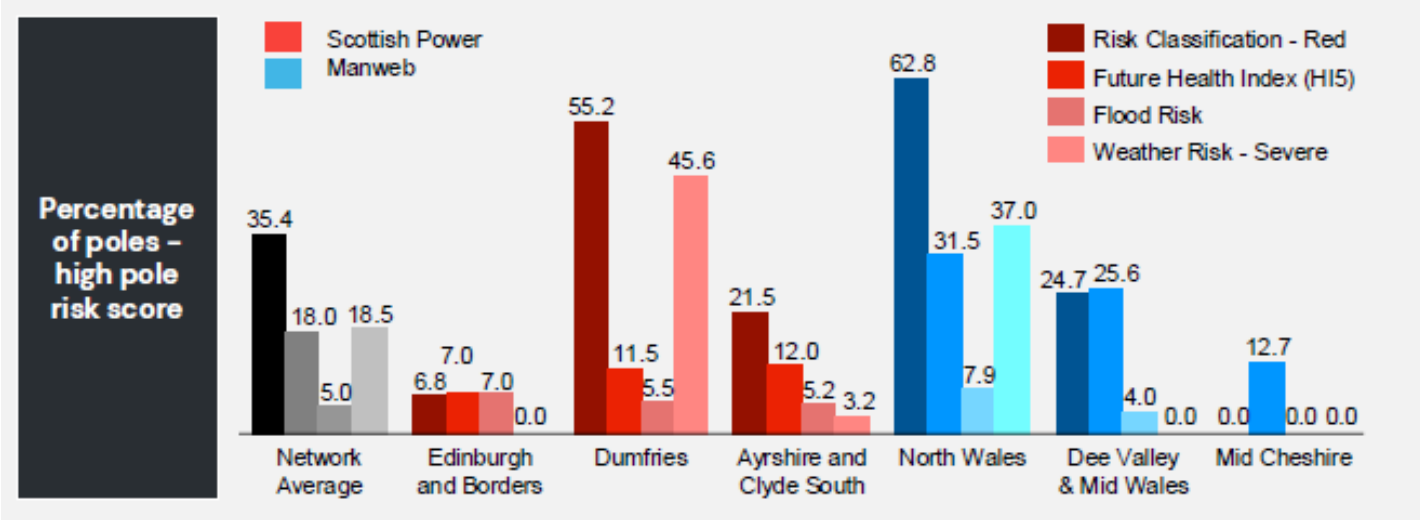
- Storm Arwen Analysis
- Future Health Index
- Weather Risk
- Flood Risk

Span risk

- Vegetation clearances
- Terrain clearances

Compliance

- Pole compliance
- Span compliance



The strongest factor leading to high risk poles varies by region, but on average the Future Health Score and Severe Weather Score affected the accrued risk classification more significantly than Flood Score

Learnings

Difficulties that arose when sharing key information for modelling

External Delays

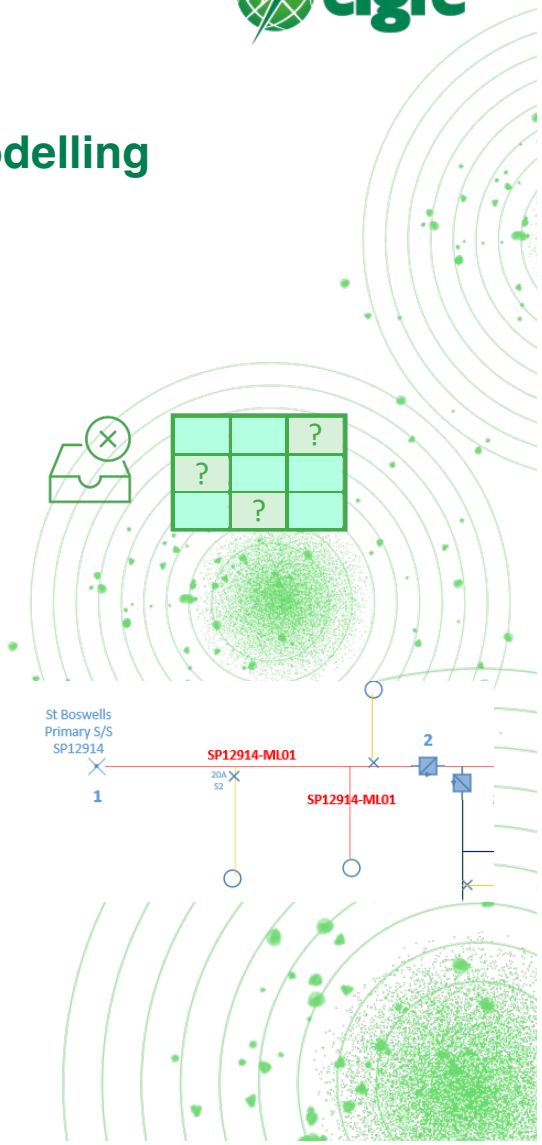
- *Extraction of Lidar was slow, difficult and inconsistent*

Data Issues

- *Inconsistent data layouts caused manual work to import all data*
- *Incomplete data required significant assumptions to fill in gaps*

Missed Opportunities

- *Protection zones methodology was delayed meaning limited dashboard design*



Next Steps

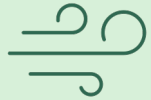
Full HV network roll-out across 20,000km

Intervention Prioritisation Analysis

- *Optimal time for next inspection*
- *Moving towards real-time system*
- *Multiple data source integration*

Weather Simulation

- *Consider degraded failure*
- *Integration of complementary data layers e.g. soil, satellite*



Fault History Assessment

- *CI/CML summary*
- *Key risk drivers per protection zone*
- *Comparison with actual fault categories*

Network Design

- *Visual & accessible data quality assessment*
- *Line re-rating assessment for additional capacity (availability on network)*

Developing a BAU tool aligned with OHL strategy and existing data models