



POWER LINES

SIF Discovery



Scottish & Southern
Electricity Networks



HOUSEKEEPING

- Please feel free to ask questions throughout the session in the Teams chat.
- Today's session will be recorded and will be made available after the event. The recording will stop for the Q&A session.



Video/webcams off
Please only turn your video on for the discussion in break-out rooms



Mics on mute
Please stay on mute unless you are asking a question



Technical queries
If you have any technical questions let us know

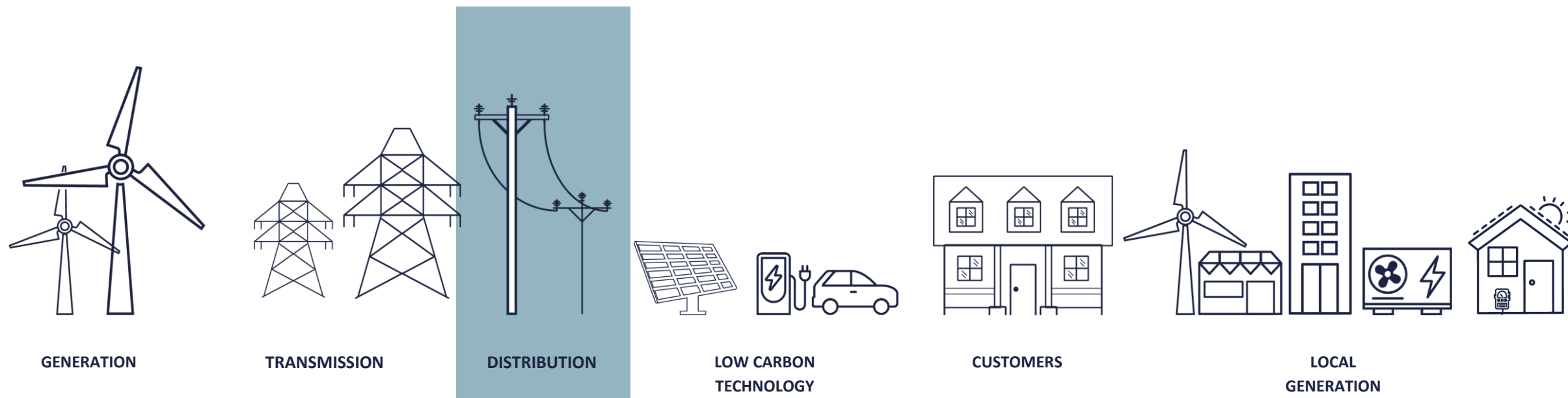




OUR ROLE IN THE ENERGY SYSTEM

As a Distribution Network Operator, our role in the energy system is to carry electricity from the high voltage transmission grid to industrial, commercial and domestic users via a network of cables and poles.

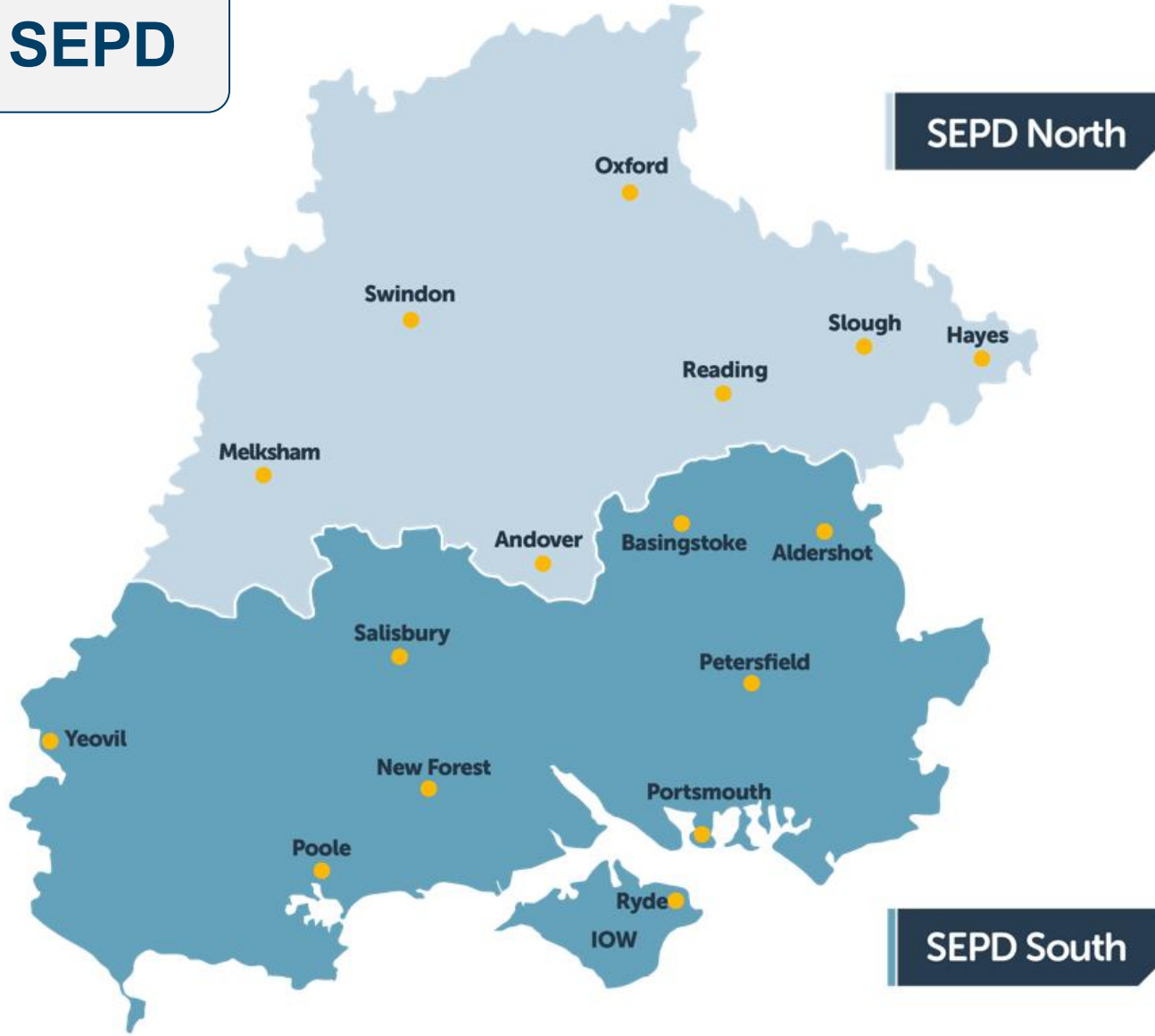
We provide this service for every home and business in the north of Scotland and central southern England regardless of who you pay your energy bills to.



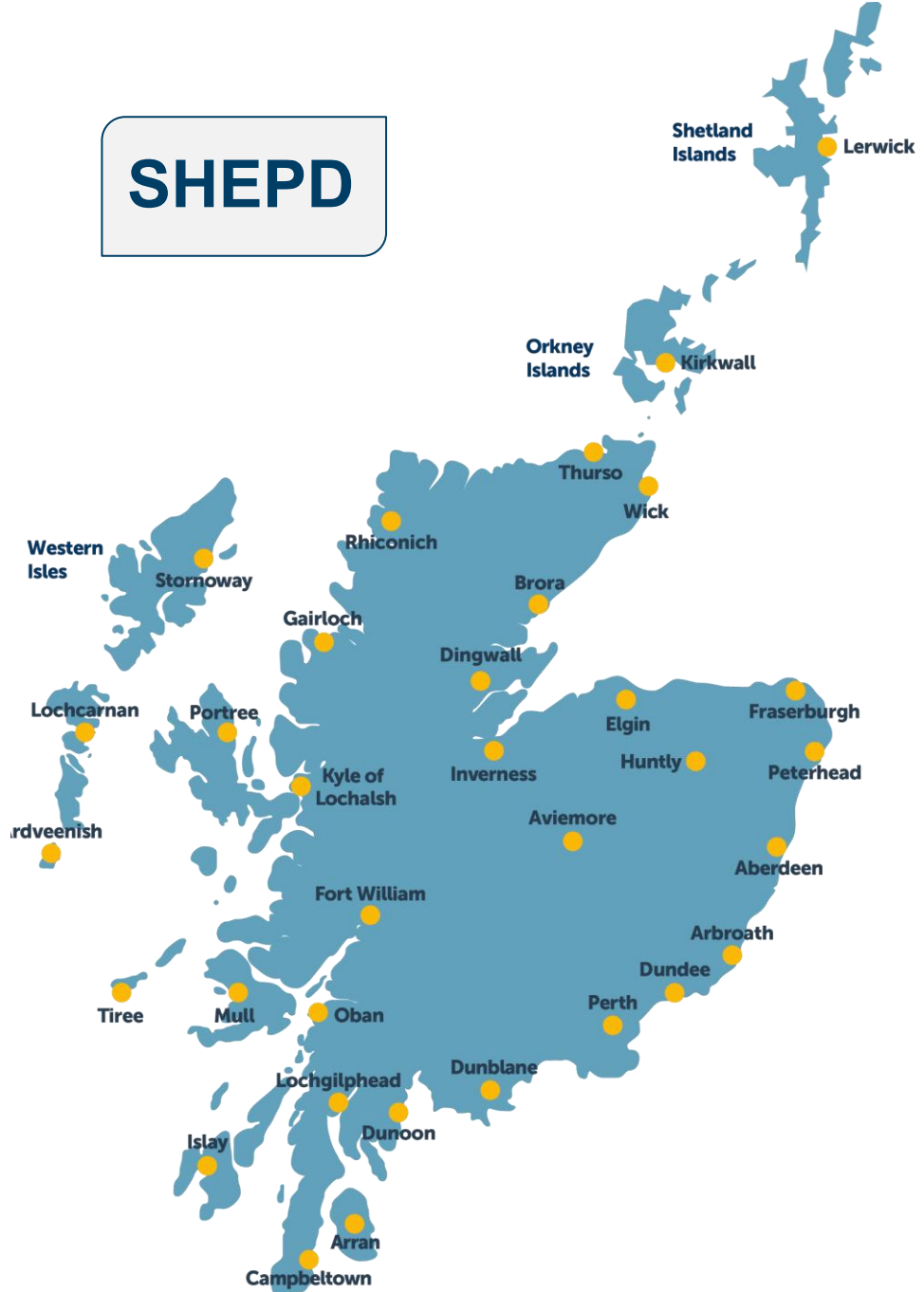
We are regulated by Ofgem, the energy regulator, through a 5-year price control cycle. Our latest business plan, for RIIO-ED2, began in April 2023 and runs until March 2028.



SEPD



SHEPD





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WELCOME AND INTRODUCTIONS



BACKGROUND

Can electricity distribution infrastructure and railway electrification be planned and delivered together?

1

CO-LOCATE INFRASTRUCTURE

Combine three-phase electricity distribution with rail electrification within the same railway corridor.

2

COORDINATE DELIVERY

Reduce duplicated infrastructure, land take, construction effort, cost, and disruption by coordinating how grid and rail assets are built and located.

3

ACCELERATE CAPACITY

Accelerate network capacity delivery for both rail and wider electricity customers, supporting industrial growth and electrification.





PROJECT APPROACH

Our approach to identifying the technical, operational, commercial and regulatory challenges in adopting a Power Lines solution as the preferred approach in the future

1

Initial optioneering and identification of challenges

2

Project team workshop
Technical review by Subject Matter Experts

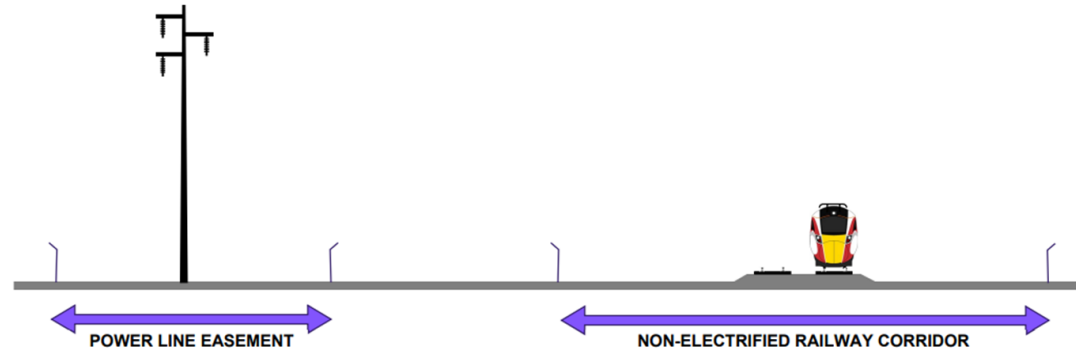
3

Revision of challenges and identification of preferred options
Horizon scanning exercise

4

Identification of preferred use cases

BEFORE POWER LINES



Reduced construction and repair/maintenance costs



Reduced land-use, allowing land to be used for community benefit



Reduced visual impact of both network and rail infrastructure

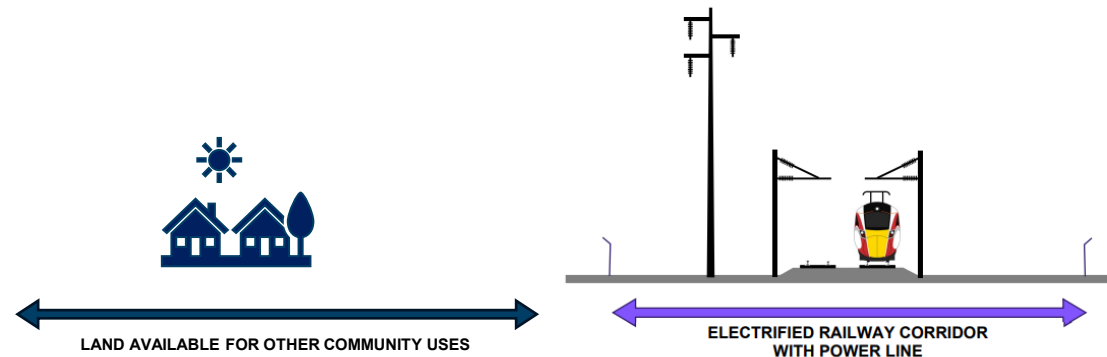


Shorter construction time



Quicker decarbonisation for rail

AFTER POWER LINES





INFRASTRUCTURE

Potential solutions and configurations of electricity and rail infrastructure were developed, to establish the 'art of the possible' for a list of solutions and configurations. The solutions were split into two categories:

Combined Infrastructure

1

Electrical distribution/transmission and railway overhead line structures

- Extensions to existing railway OHL structures
- Replacement with new combined OHL structures (innovative shape)
- Use of existing OHL at alternative voltages

2

Affix electrical distribution/transmission cables to

- Railway Structures
- Required for tunnels and bridges

3

Install cables within troughing (combined/easement)

- Combined with railway cables

Separate Infrastructure

1

Install separated new transmission/distribution pylons (at appropriate voltage)

- Traditional Structure type
- T-pylons
- Other innovative shape

2

Install underground (direct buried) cables within the rail corridor (segregated)

- Within cess (adjacent but within NR boundary)
- Within 10ft
- Within 6ft
- Within 4ft

3

Install cables within troughing (segregated)

- Separated from railway cables



CONFIGURATIONS ASSESSMENT

Several configuration combinations could be considered, and whilst each option could be assessed in its entirety, an initial sift was undertaken to identify the preferred, and more likely deliverable, configurations.



Separate Trackside Cables

Separate cable troughing or buried cable to be installed lineside or within the cess (but outside the track support zone). Rail (e.g. telecoms, signalling and traction power cables) and electrical cables installed separately.



Separate Trackside OHL

Electrical OHL to be installed in installed lineside or within the cess (but outside the track support zone), separate from the power for rail electrification, with appropriate space separation between systems.



New Combined System

Installation of new OHL/OLE on non-electrified railway lines (i.e. provide opportunity for electrification of the railway) with a new standardised combined structure for both rail and electrical systems.

Existing OLE Combined Retrofit

Combine existing railway OLE structures by retrofitting electrical OHL to existing railway OLE infrastructure, whilst ensuring separation or designing electrical system to both operate.

Please note the images contained on this slide were generated using artificial intelligence (AI) and are intended for illustrative purposes only.



COMBINED INFRASTRUCTURE

- High voltage distribution sharing structures with railway OLE is common on 16.7Hz railways (Germany, Austria, Switzerland), where rail authority is owner and operator of both elements.
- Network Rail's internal OLE design team developed a concept design to support 3 phase 132kV conductors in addition to railway OLE



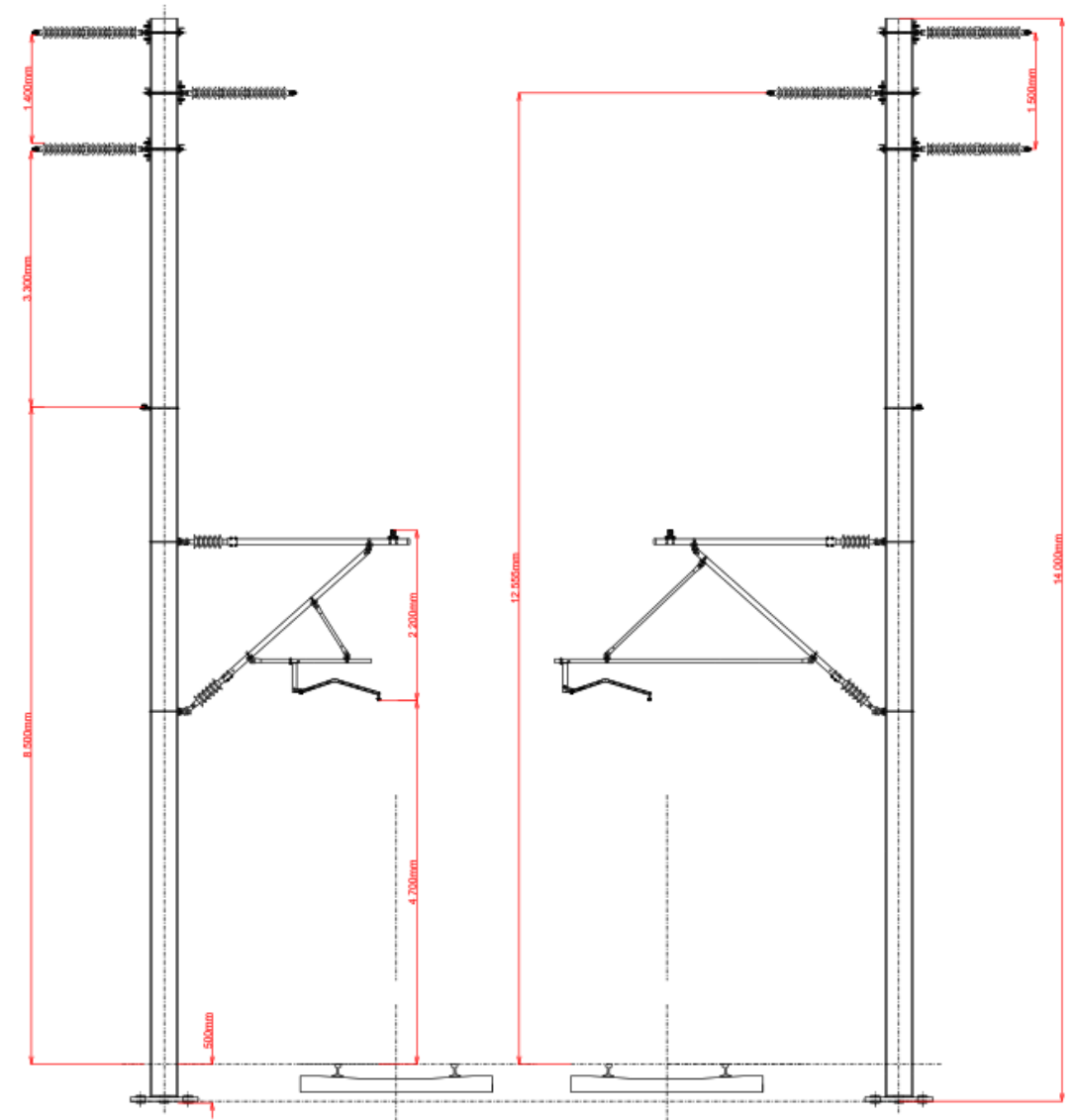
Google Maps Image, Moreillon Station, Switzerland



COMBINED INFRASTRUCTURE CONCEPT

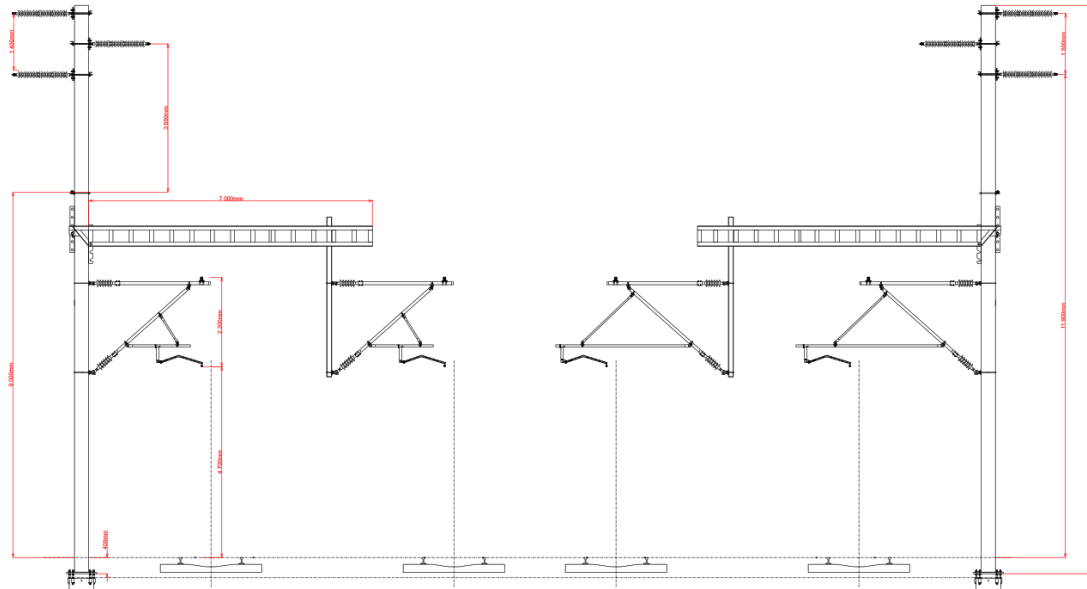
Initial design concepts incorporating “classic” 25kV electrification and 132kV conductors developed for:
Single Track Cantilevers
Twin Track Cantilevers
4 Track Portal Structure

Uses standard UKMS rail overhead line components, supports 400mm² Stranded Aluminium 132kV conductors



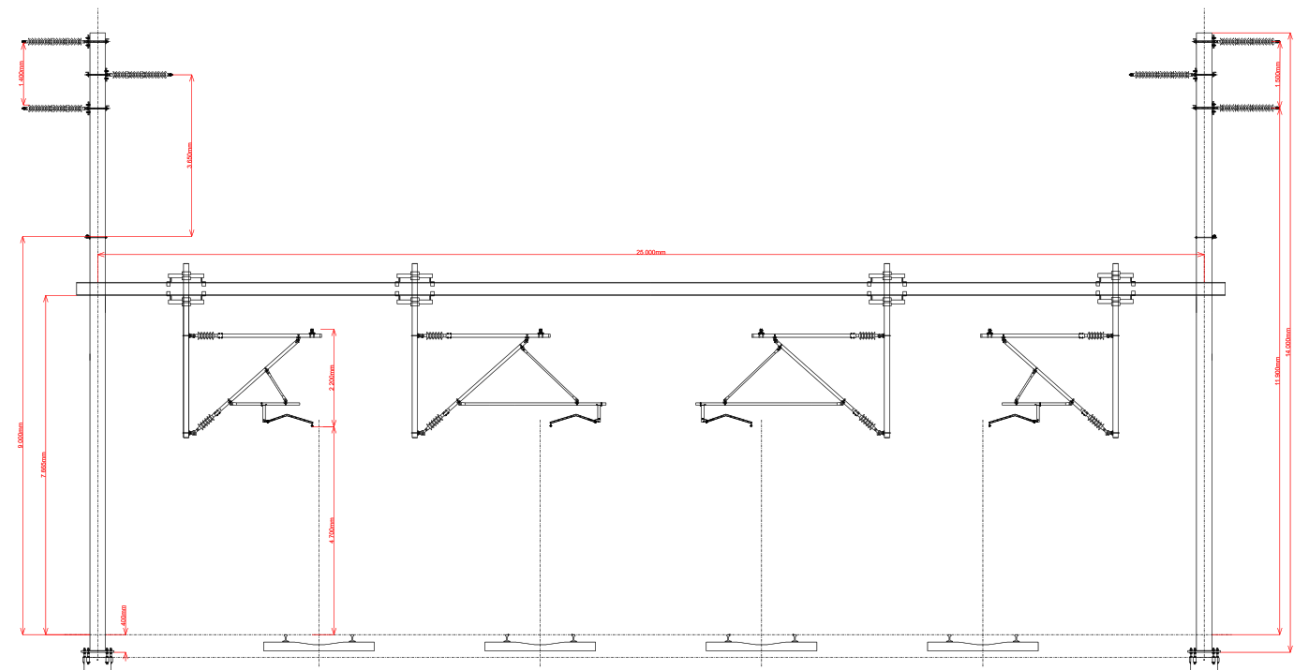


COMBINED INFRASTRUCTURE CONCEPT



ESDD Combined Infrastructure Concept, Twin Track Cantilevers

Initial analysis shows that the concept is worth further investigation to confirm feasibility.



ESDD Combined Infrastructure Concept, 4 Track Portal



FEASIBILITY

Challenges were identified that could impact on the infrastructure configurations identified. The challenges were split into four main categories; Technical / Engineering, Operational, Commercial and Legal / Regulatory.

Barriers to an integrated solution include:

Technical

1

EMC

Interference between parallel runs of HV

3

Interference

With signalling and telecom systems on railway

5

Space

Trackside space and corridor size is limited

7

Construction

Space and timeframes for construction

2

Earthing

Complex earthing and bonding between systems

4

Civils

Bridges, stations, tunnels all cause issues for routing

6

Geotechnics

Working in track support zone. Additional earthworks

Operational

1

Safety

Different environments requires additional safety measures

3

Railway operations

With signalling and telecom systems on railway

2

Maintenance

Reactionary very difficult to undertake

4

Access

Difficult to gain and plan access on rail network



CONFIGURATION ASSESSMENT

Each of the preferred configurations were then compared utilising a red, amber, green (RAG) rating for each of the challenges. This aided the team to narrow down the preferred configurations.

The ratings are defined as:

- **Red: Critical challenge** – Identifying a solution should be a priority for Alpha Phase
- **Amber: Potential challenge** – Requires addressing, although potential solutions are already identified or not anticipated to be showstopping
- **Green: Minor challenge** – Unlikely to pose a barrier to development

At this point it is proposed that the below options are investigated in the Alpha Phase:

- **Option A** – separate trackside cables
- **Option B** – separate OHL structures

Challenge	Separate Trackside Cables	Separate Trackside OHL	New Combined System	Existing OLE Combined Retrofit
Technical – Electrical – EMC				
Technical – Electrical – Earthing				
Technical – Signalling and Telecoms				
Technical – Civil – Spatial Provision				
Technical – Civil – Geotechnics				
Technical – Civil – Track and Track Crossings				
Technical – Civil – Existing civil infrastructure				
Operational – Training				
Operational – Access – Maintenance (planned)				
Operational – Access – Maintenance (reactive)				
Operational – Access – Emergency				
Operational – Access – Construction				
Legal / Regulatory – Planning				
Legal / Regulatory – Relative cost impacts				



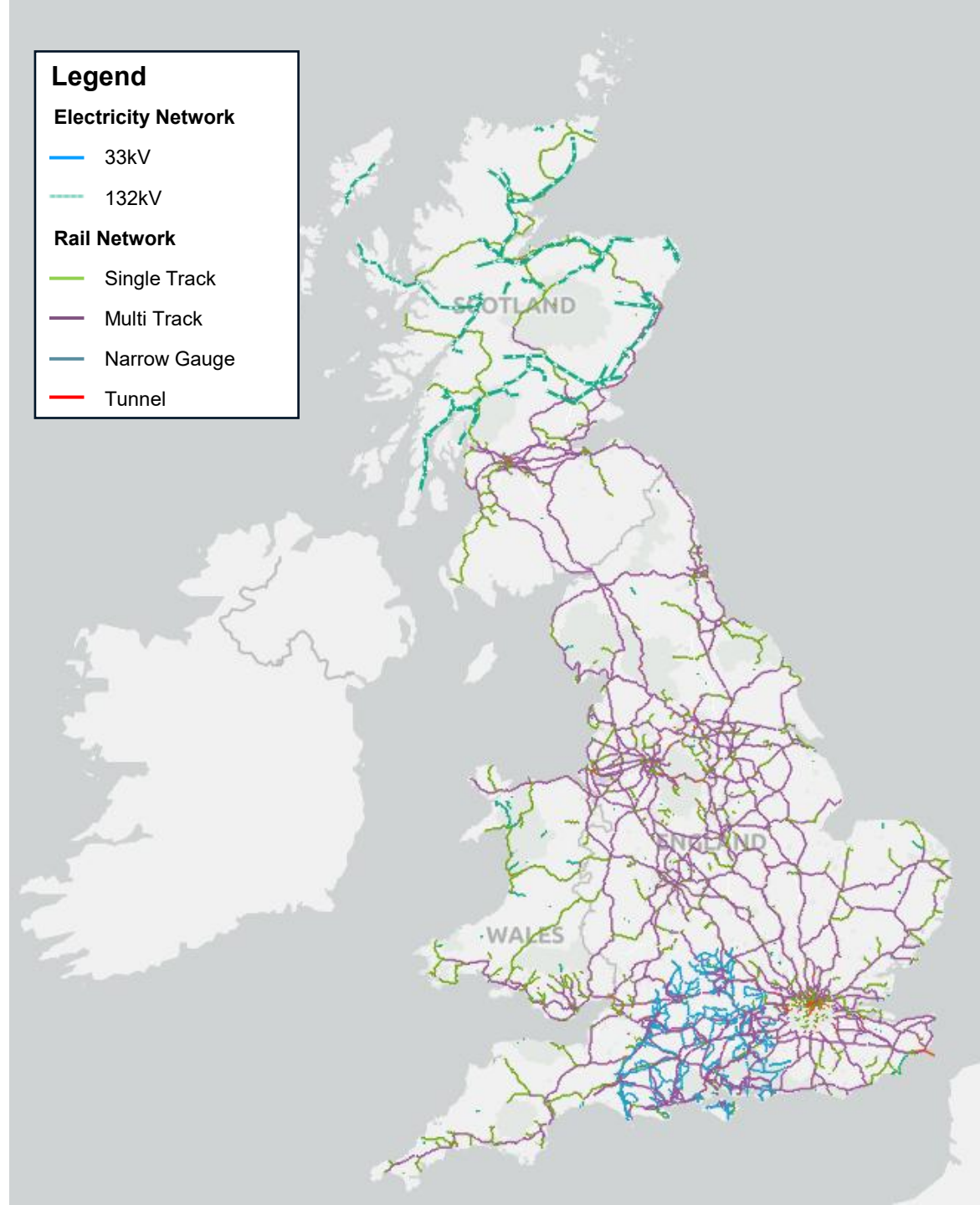
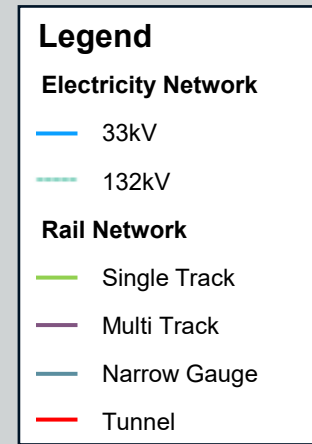
HORIZON SCANNING

To understand the scale of replicability of this solution across the UK and assist in identifying future use cases, a project-specific GIS map was developed using Mott MacDonald's propriety visualisation software Moata.

The following parameters were considered to narrow down the initial long list of areas across GB for further exploration:

- Existing 33 kV / 132 kV electrical infrastructure which may require reinforcement
- Unelectrified rail corridors
- Large-scale demands: airports, ports, freeports, new development (townships)
- Large-scale generation: solar, wind
- Interconnectors
- Nuclear (N/A for Scotland)

An initial list of possible use cases was developed, with input sought from Network Rail and SSEN on broader considerations which may impact feasibility.





FUTURE USE CASES

The factors influencing deployment in urban environments are substantially different from those encountered in rural settings.

Given the differences in how the identified challenges propagate and manifest in different situations, three distinct contexts were explored:

- 1 Rural [e.g. Scotland]
- 2 Rural* [e.g. Cairngorms, New Forest]
- 3 Urban [e.g. Southampton, Reading]





REGULATION

Railway operations take priority, and DNO land rights are likely to require ORR consent.

1

Railways Act

The proposal must not restrict operation, maintenance, renewal or development of the railway.

2

Land disposal

DNO rights are likely to count as a land disposal under Network Rail License Condition 17.

3

Railway use

Consent may be withheld if the rights affect current or future railway use.

4

Tenure terms

Short-notice termination or relocation rights under Network Rail License Condition 17 are unlikely to be acceptable to DNOs.

Devolved rules - Requirements differ across England, Wales and Scotland, so the route must be confirmed by location

(eg Town and Country Planning Act 1990 and Planning Scotland Act 2019)



REGULATION

The model is viable when asset responsibilities, access and safety interfaces are clearly defined.

1

DNO responsibility

Own and operate the distribution and transmission assets.

2

Network Rail responsibility

Manage the land and protect the railway corridor.

3

Safety interface

Each system must meet ESQCR and EAWR; any departure from normal standards must be agreed

4

Access risk

Unplanned work may create conflict over access to assets on railway land.



ACCESS

- Network Rail regulates access to the network, with 12-week lead times for normal access requiring disruption to train services.
- DNOs require fast access to repair faults which impact customers.
- Network Rail also requires fast access to equipment to recover or prevent disruption to train services.
- These requirements create potential for conflict over access to equipment.





THANK YOU



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