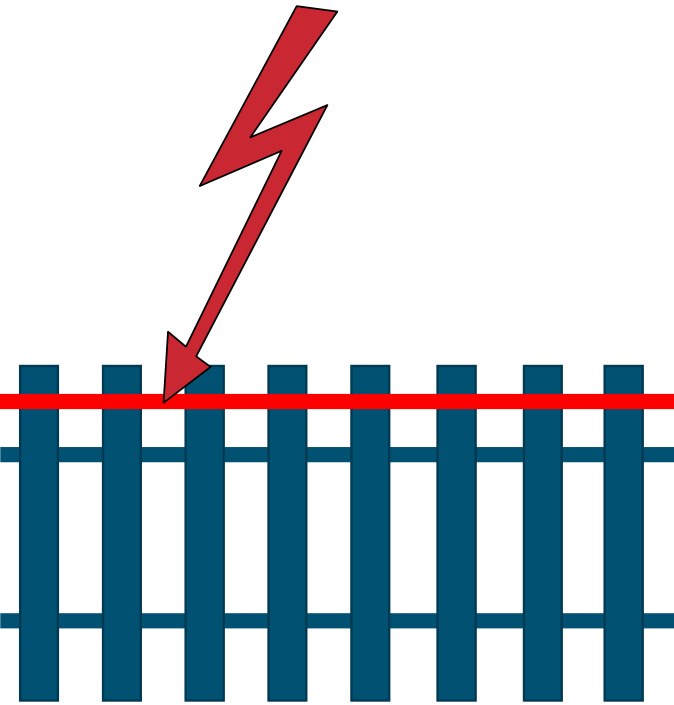
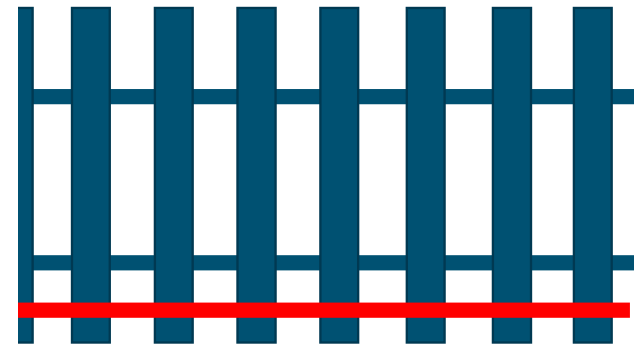




Life, the Universe and Everything – a view from a Southern Region E&P Engineer



Nigel Wheeler
Senior E&P Programme Manager
Southern Region
V1 April 2023

Don't
Panic!

An engineering journey

SR E&P RAM & Head of Engineering

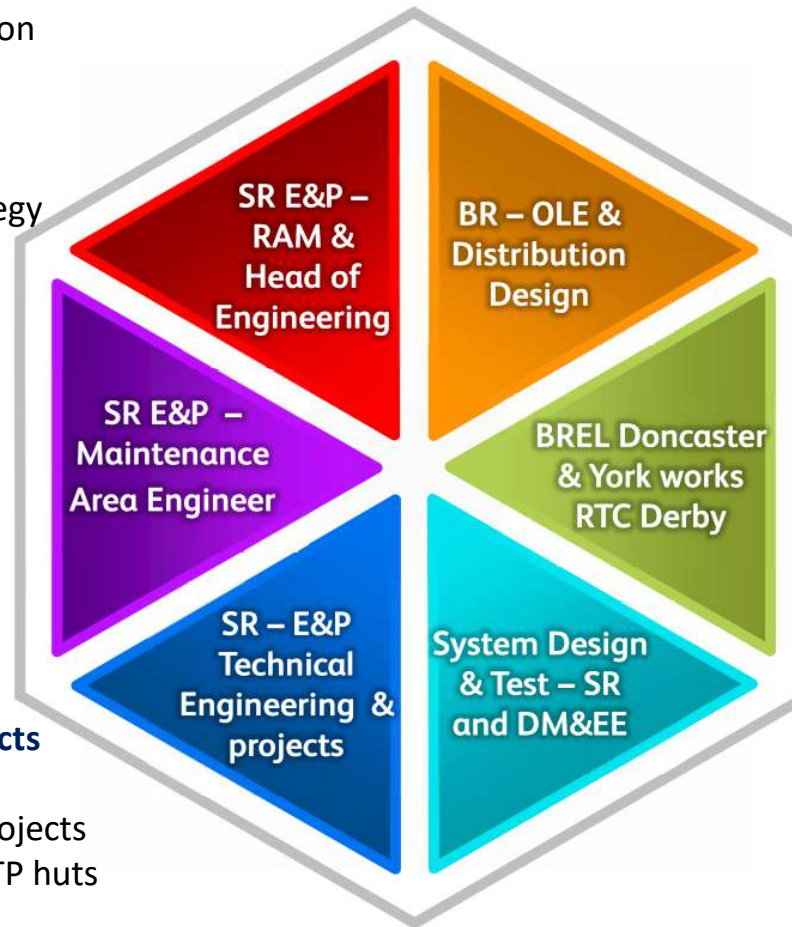
- Asset Management & Strategy
- Control period business plan submission
- Sponsorship of projects
- Support for maintenance
- Asset performance and sustainability
- Engineering leadership – vision /Strategy
- Assurance

SR E&P – Maintenance Area Engineer

- Managing front line maintenance teams and maintenance plans
- Engineering leadership
- Engineering teams and design drawing office
- Asset condition renewal strategy

SR – E&P Technical Engineering & Projects

- South Central - engineering leadership
- CRE Design, maintenance & renewal projects
- Refurb and commission substations & TP huts Central Routes.
- Project Delivery – CTS units and 3 year major programme HV switchgear, HV cable, rectifier and LV system renewal



BR – OLE & Distribution Design

- Ipswich Yard bespoke designs
- Plain line computer design
- 25kV Distribution
- OLE protection relay systems

BREL Doncaster & York Works, RTC Derby

- [Class 31](#)
- [Class 58](#)
- Mk2 carriages
- Class 318 emu
- Class 319 Thameslink assessment and approval – harmonic modelling
- Class 91 approvals

System Design & test, SR & DM&EE

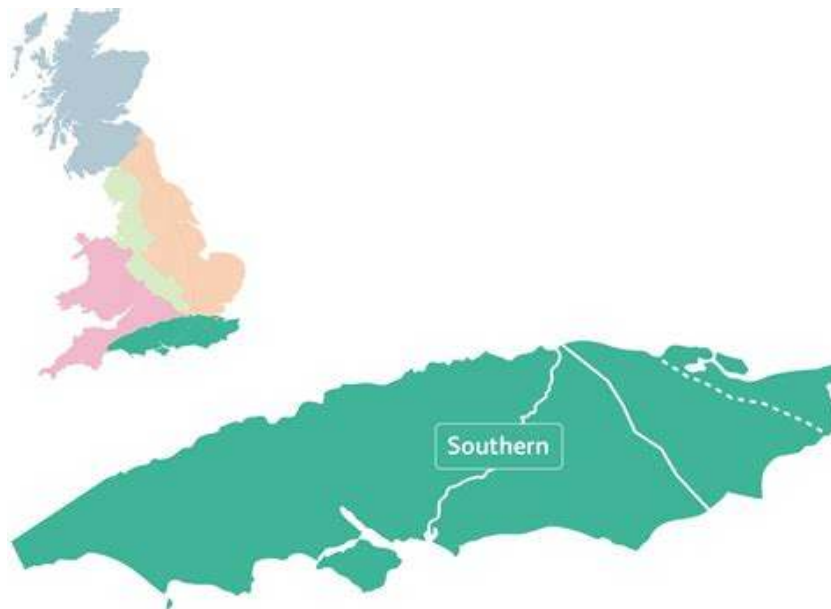
- East Grinstead line commissioning tests
- Bournemouth – Weymouth Design
- Short circuit testing equipment
- DC breaker protection systems /calcs
- System modelling OSLO
- System test – ECML commissioning & first 3 phase drive SR (Networker)

Southern Region, Network Rail



Over 7,000 passenger and freight services operate on the region every week day – more than a third of Britain's rail services.

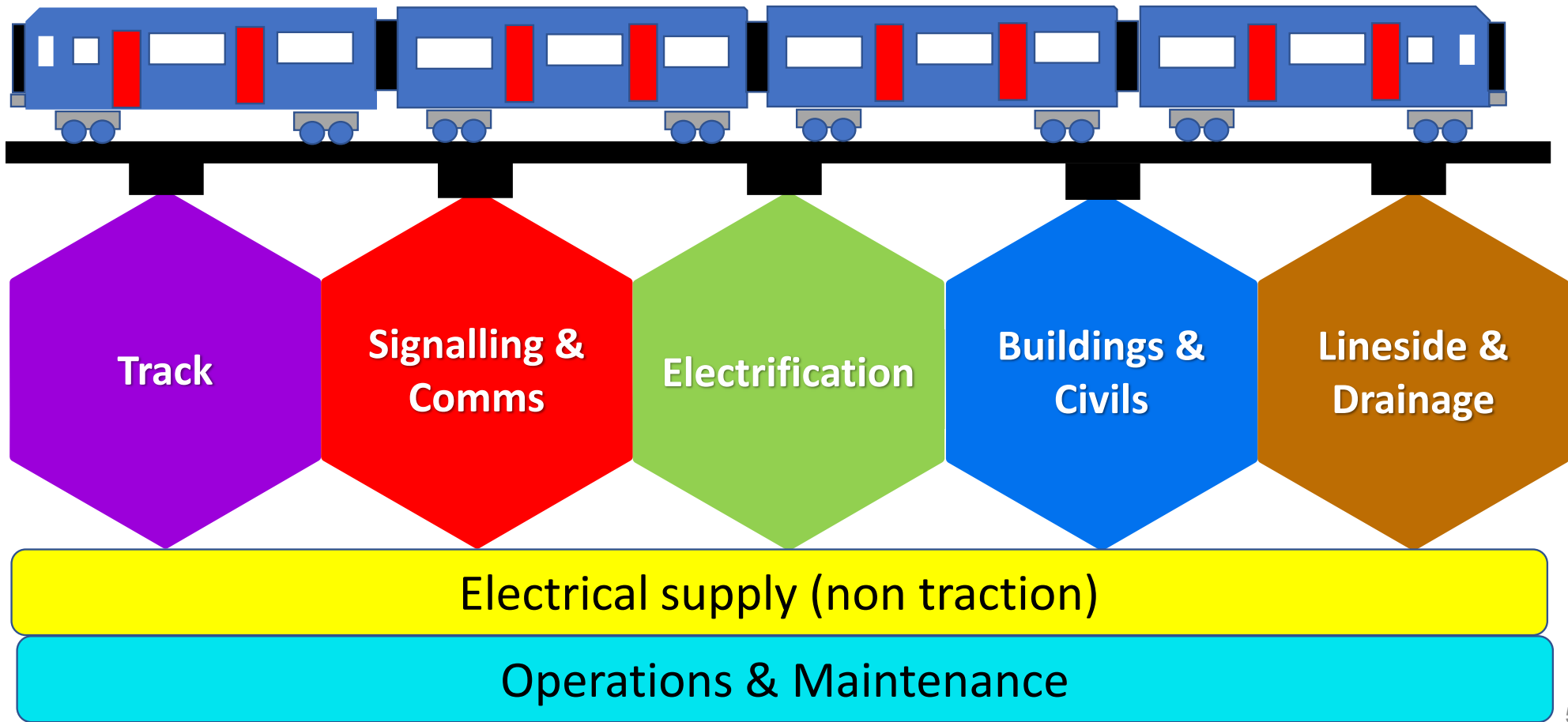
Over 266,000 tonnes of freight each week are moved in Southern Region



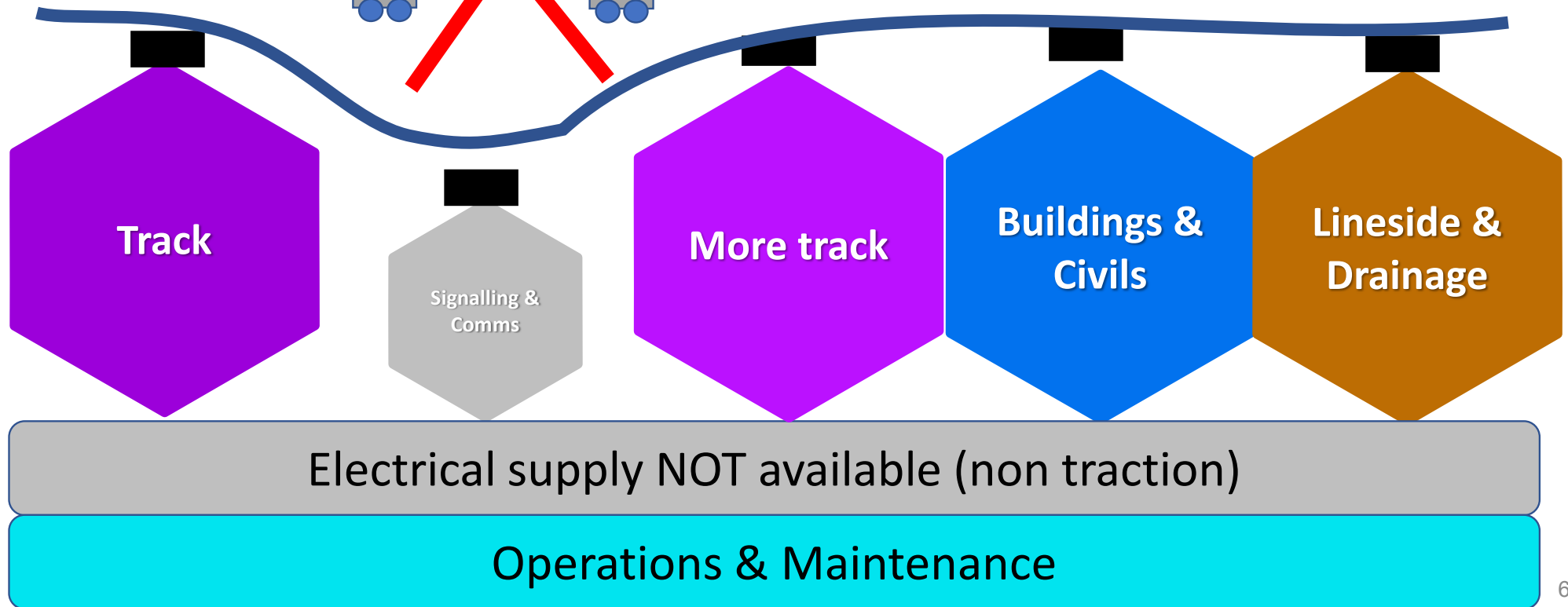
Traction type	km	
Third Rail 660/750V DC	4163	84%
Dual AC OLE/Third rail DC	13	<1%
Non-electrified	782	16%
TOTAL	4961	100%

Railway type	km	
Electric railway (including signalling)	4961	100%

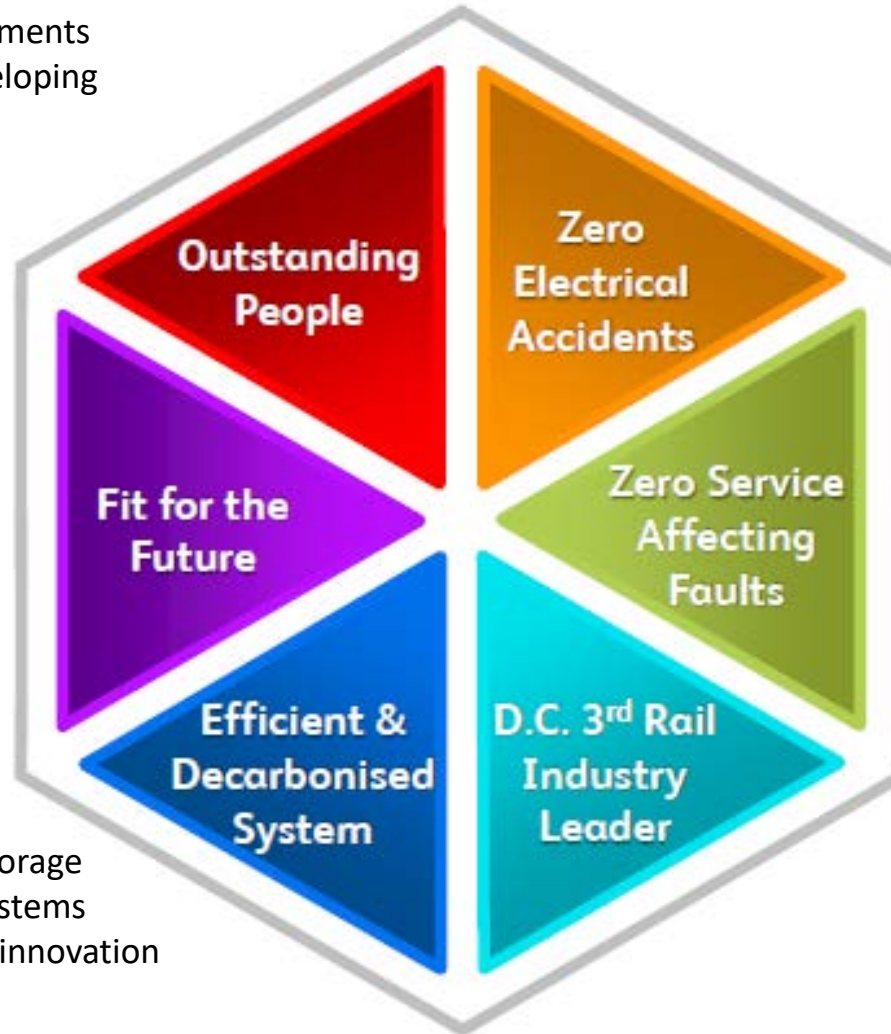
An electrified electric railway



Non electrified - still an electric railway



The Southern E&P 6-Point Vision



Outstanding People

- Cultural shift - engaged and empowered
- Training & competency improvements
- Framework for sharing and developing knowledge
- Sustainable progression plan

Fit for the Future

- Modelling of existing and future electrical capabilities of the network.
- Leading and enabling timely delivery of timetable
- SCADA
- Embracing new and innovative technologies
- New/infill 3rd rail D.C. areas

Efficient & Decarbonised System

- Power generation and energy storage innovations for traction power systems
- Hybrid and battery rolling stock innovation
- Removal of Diesel Traction

Zero Electrical Accidents

- 100% NSCD coverage with remote securing
- DC single approach / DSP
- Improving safety in traincare depot
- Removing conductor rail floaters
- Smarter Isolations

Zero Service Affecting Failures

- Maintenance Modernisation –right intervention at the right time in an efficient way.
- Train-borne monitoring
- Intelligent remote condition monitoring
- CP7 and beyond plan –renewals, refurbishments and maintenance interventions for safety, performance and efficiency

D.C. 3rd Rail Industry Leader

- Be the centre of excellence and knowledge of all DC 3rd rail systems

Electrical Safety – Negative Short Circuiting Devices

Background – protection against re-energisation

When people need to work on or around the DC conductor rail, the traction current is isolated

Additional protection against re-energisation is provided by fixing short circuiting straps between the conductor and running rails. This is to mitigate:

- ❑ Trains bridging from adjacent electrical sections
- ❑ Incorrect switching of Traction Current Circuit Breakers
- ❑ The method of applying straps requires people to be lineside to manually clamp the straps to the rails

Equipment carried to site to fit short circuit straps



Why the move to NSCDs

Why NSCDs

- The short circuit straps are replaced by fixed equipment that apply the short circuit – the Negative Short Circuit Device (NSCD). The NSCD is electrically operated from a control panel located in a place of safety and normally immediately adjacent to a suitable access point. This can be some distance from the short circuit equipment.
- By operation of a simple switch from a control panel (located at a point of safety), operatives can apply the short circuits necessary to secure an isolation, and apply padlocks to the switch without having to access the track.

Benefits

- No need to work on or near the conductor rail to apply the straps
- Reduced risks of slips, trips and falls
- Reduction in the need for manual handling along the track
- Increases time for safety critical work on the infrastructure, up to 40minutes
- Reduction in driving
- Improves compliance with EaWR as NSCD secures the DC circuit breaker (point of disconnection) through interlocking

Short Circuiting Protection and the NSCD

Isolation protection is achieved by a method called short circuiting, the rollout of NSCD removes this work force activity from the manual application of a short circuiting straps on the track, to the operation NSCDs from a local control panel away from the track.



We are moving from the manual application of straps on the track with lots of equipment.

Moving to an NSCD operator using a local control panel to apply the NSCD short circuiting protection. The local control panel is located in position of safety and the NSCDs are located at the sub station.

Reduction in the following areas related to the taking and handing back of isolations



Driving



Exposure to Infrastructure Risk



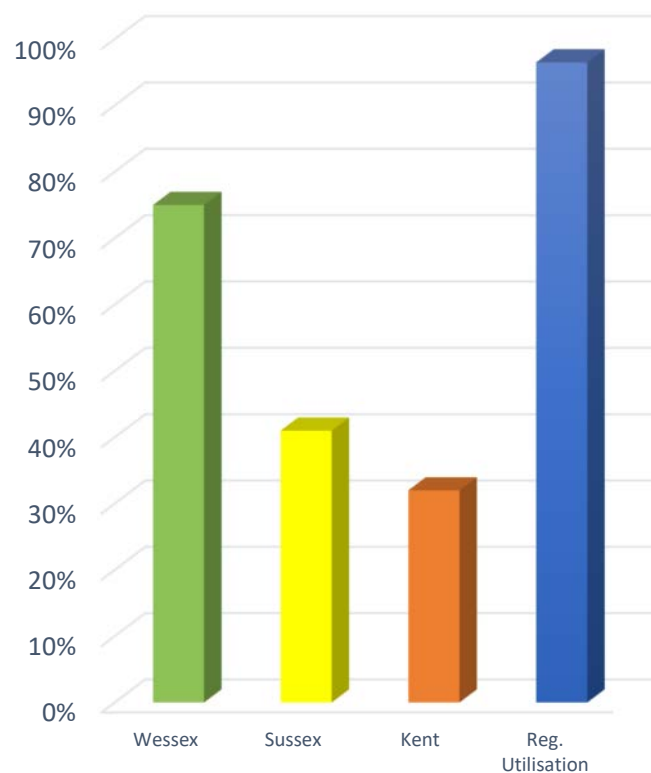
Slips, Trips and Falls



Potential Electrical Contact

NSCD coverage, utilisation and looking ahead

Current NSCD coverage and utilisation levels



CP6 Exit Position

50% coverage for NSCDs
Usage embedded in BAU utilisation.
Start remote securing workstream
PA – further development of NSCD devices

CP7

Full coverage of NSCDs at end of CP7.

CP8

Deploy Remote Securing technology which allow remote, and secure, software application based control of NSCD infrastructure.

Evolution of the CMSD Family – incremental development

Circuit NSCD - circuit main short

- NSCD fitted to every point of energisation at a substation or TP Hut, generally two NSCD at each end of electrical section
- Ultimately flexible in terms of planning and emergency
- Electrically Interlocked with associated DC circuit breaker such that ECO cannot reclose circuit breaker with NSCD closed

Busbar NSCD

- Suitable for rural two track areas with lower installation cost (fewer NSCD) but less flexible
- Electrically Interlocked with rectifier circuit breaker such that ECO cannot reclose rectifier circuit breaker with NSCD closed

Integrated Controlled Track Switch and NSCD

- Remotely controlled solutions for part sections to eliminate the use of hook switches and straps

Integrated circuit breaker and NSCD

- Solution for limited space installations
- Long term cost effective solution for renewals and new equipment

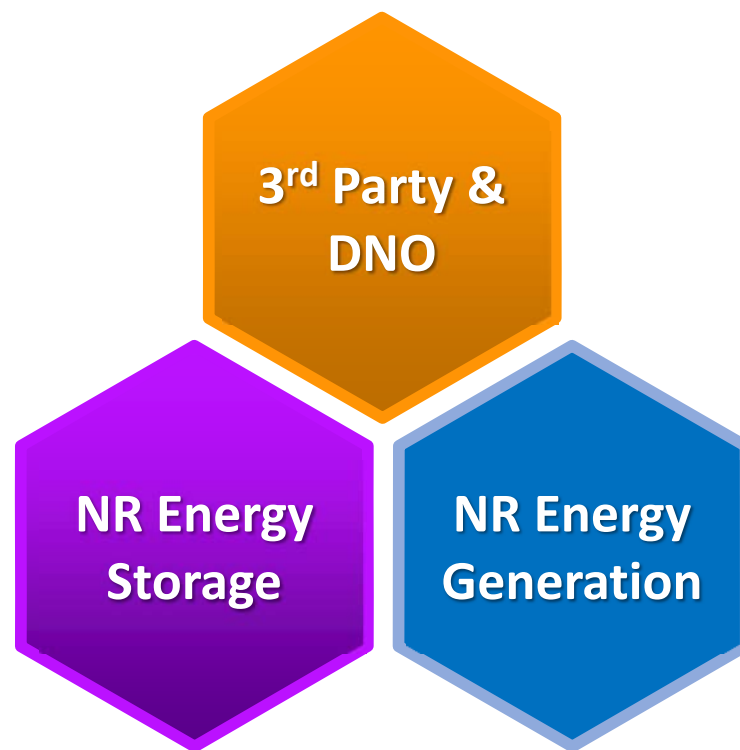
Consolidated Control Panel

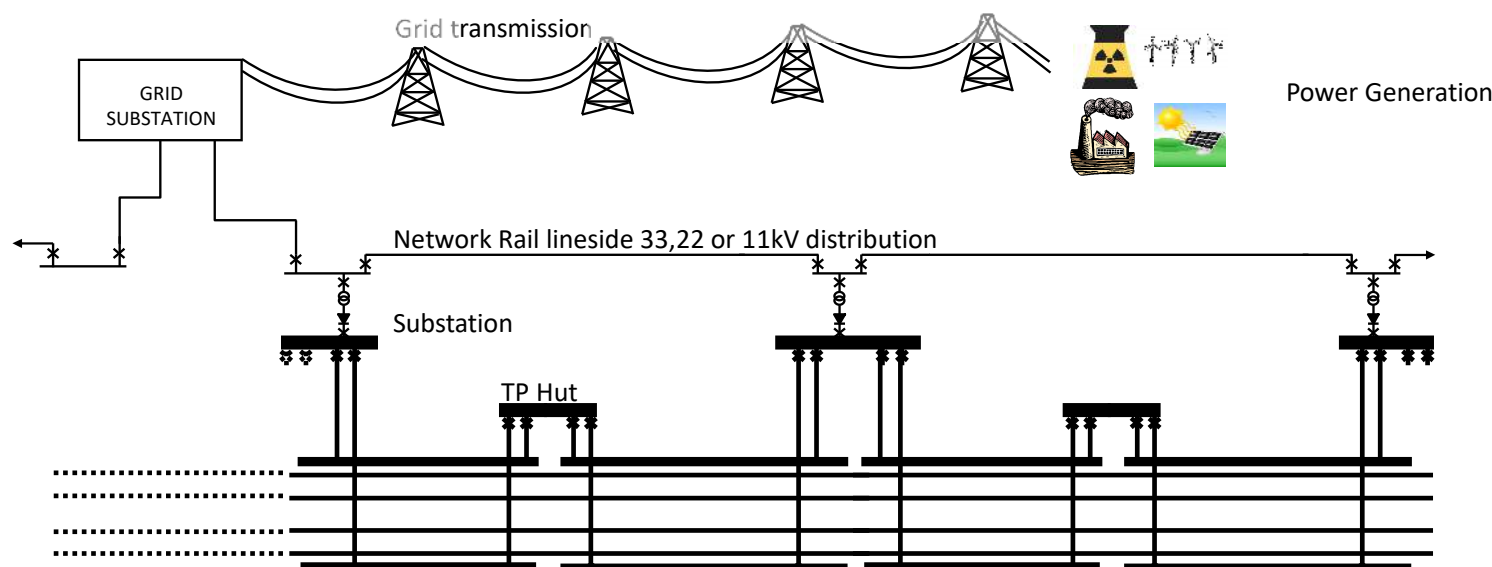
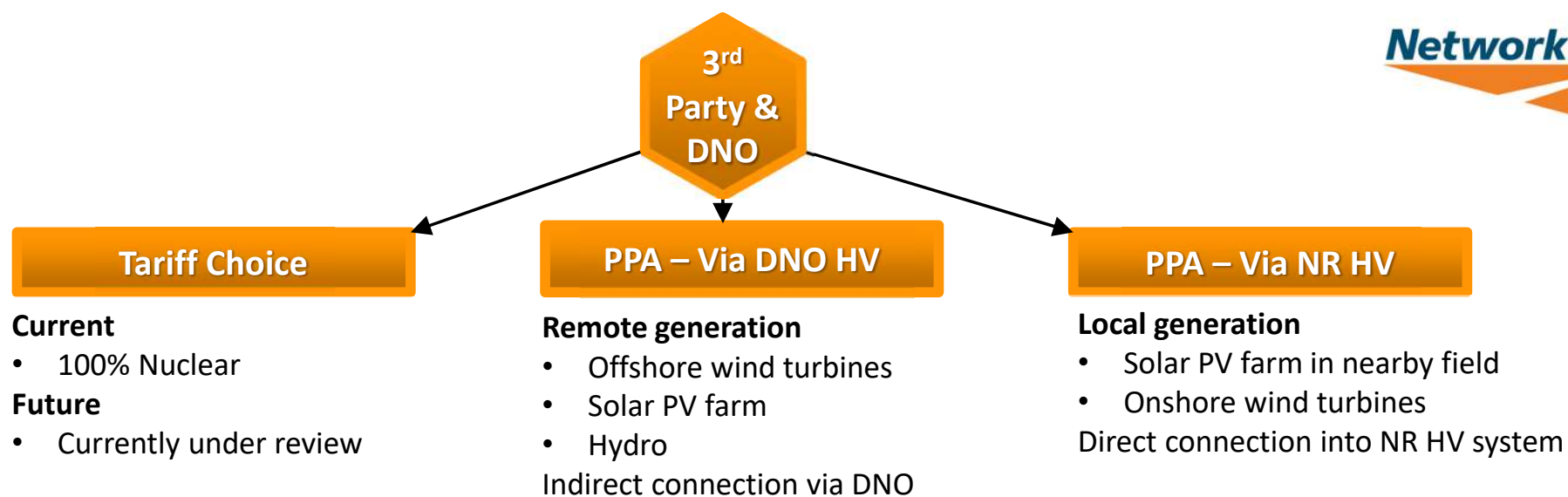
Allows a NSCD at multiple sites to be controlled from one location reducing number (and cost) of LCP and reduces number of people travelling to Local Control Panels

Remote Control and Securing

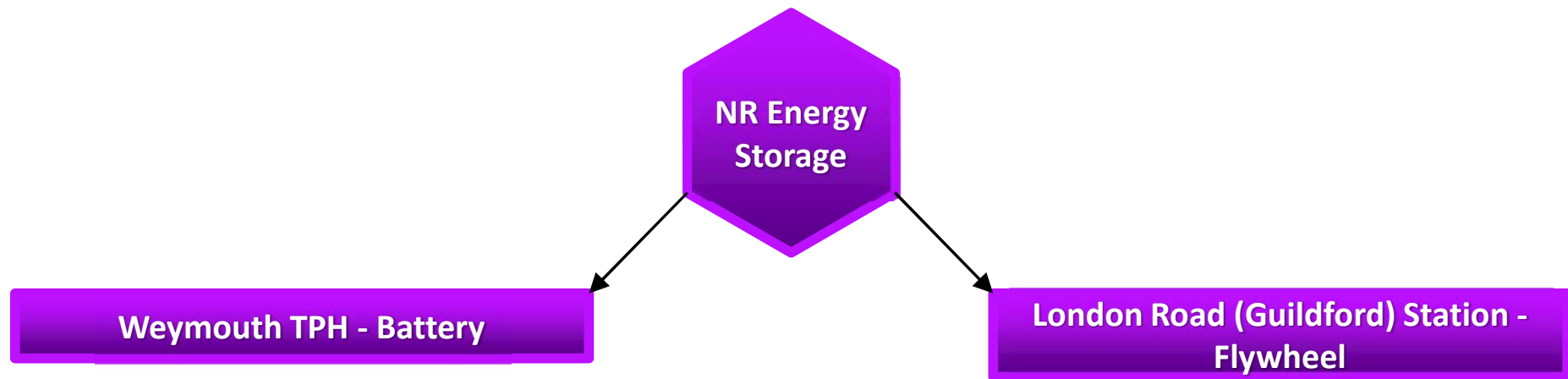
Medium/longer term development to enable fully remote operation through SCADA and securing using smart phone app from site - eliminates the need to travel to a local or consolidated control panel

De-carbonisation - Renewable Traction Power





Renewable Traction Power – Southern Update



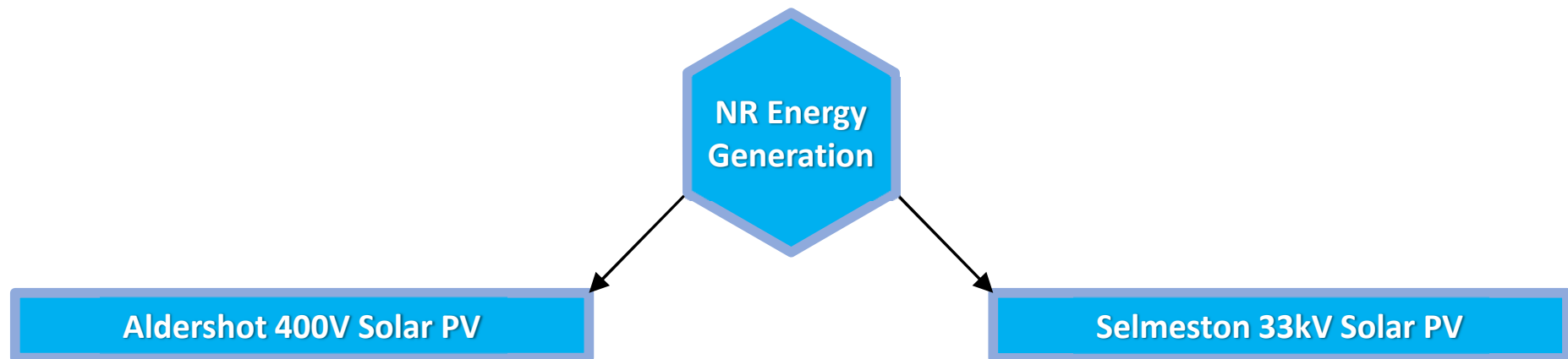
Trial Site (NR lead – R&D)

- Proof of concept trial, based on recovery of unused regen from trains
- Store and provide supplementary energy back to trains when accelerating
- Circa 100 kWh storage capacity (TBC)
- PACE 1 – Option selection stage
- Other future uses: peak lopping, increasing train service without requiring DNO supply changes, asset life extensions, solving local voltage issues...

Trial Site (TOC lead)

- Proof of concept to recover unused regen from trains
- Store and provide supplementary energy to station domestics
- 5kWh storage capacity
- Outline design Stage

Renewable Traction Power – Southern Update



LV Trial Site (NR + 3rd Party)

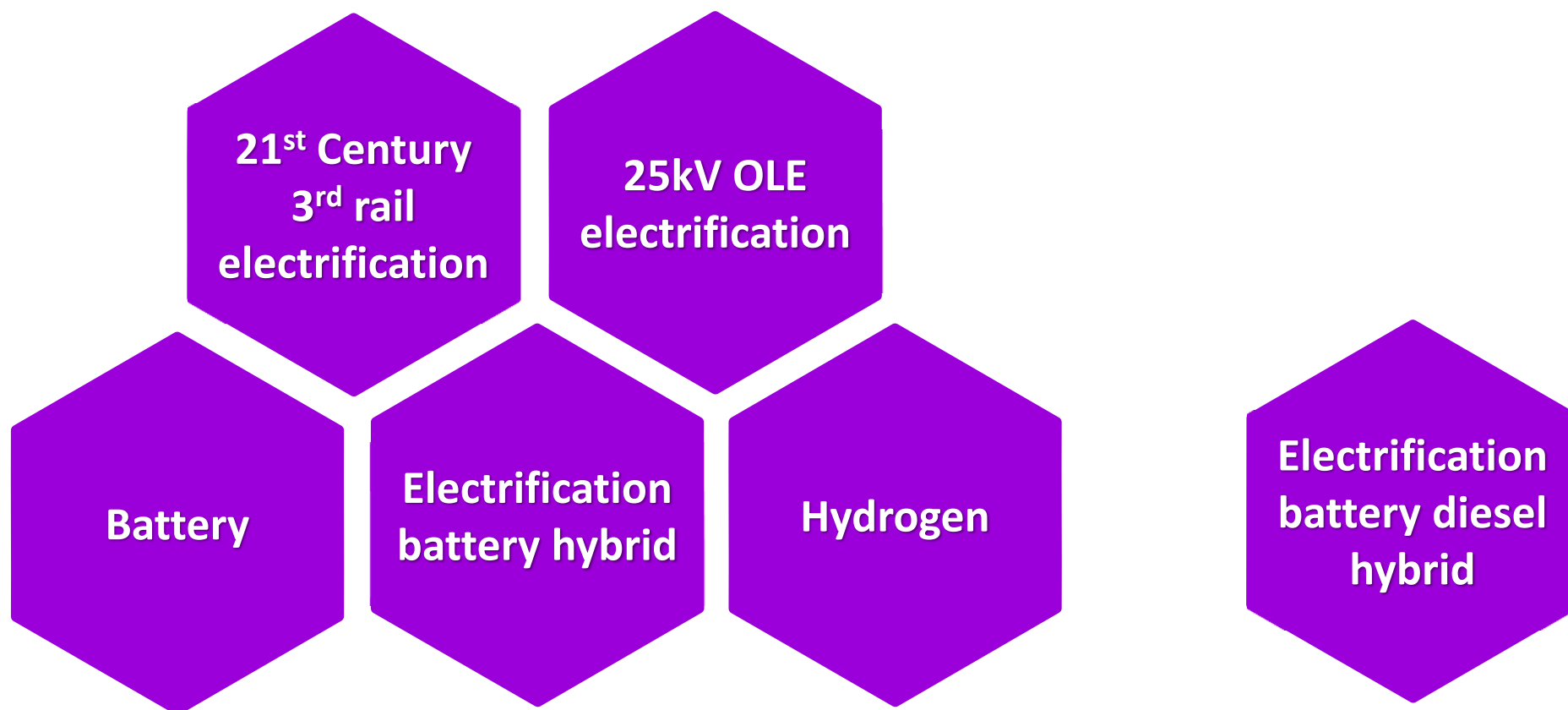
- Generated energy fed into the LVAC panel at 400V
- Energy can be used for domestics (via LVAC) and traction power (via AT)
- 30kW maximum generation capacity - no energy is exported to DNO at this power range
- Commissioned

HV Trial site (NR + 3rd Party)

- Generated energy fed into the 33kV HV system via new breaker
- Energy can be used for domestics and traction power
- 3-6MW generation capacity - energy is likely to be exported to DNO at this power range
- Outline Design Complete – Project Cancelled



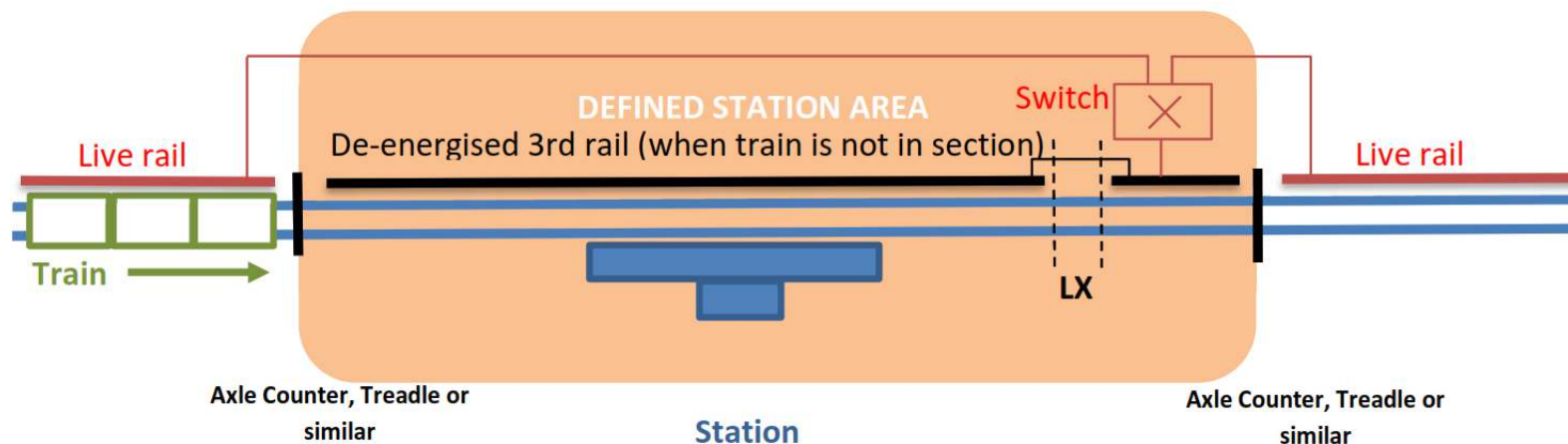
Decarbonisation – replacement of diesel traction.



Business case, safety justification report, whole life costing assessment

21st Century 3rd rail electrification

- Protecting the workforce
 - Safer, Smarter Isolations
 - NSCD
 - Remote secure
 - Remotely controlled mid section switches and disconnectors
- Protecting Passengers and Public
 - Simple conductor rail switching in platforms for lines with low frequency of trains (see below)
 - Small traction batteries (short distance) on trains.
 - Allowing Conductor Rail to be cut back further, having larger gaps around S&C.
 - reducing conductor rail from key areas – level crossings, depots, stations...



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Summary

We will continue to develop and enhance our 3rd rail electrification system to meet the requirements of our stakeholders, including where there is a strong business case and safety justification new 3rd rail electrification. We will continue incremental developments to introduce new products, equipment and processes to improve safety, efficiency and performance .

The future is exciting and full of innovative development of new products and equipment.

Thank You.

[End](#)



[Back](#)



Photo: Thanks to Richard Allen



[BACK](#)

Photo: Thanks to Richard Allen