The Chartered Institute of Logistics and Transport

# CILT FREIGHT ELECTRIFICATION MAP COMMENTARY

# Summary

## Transport produces over a quarter of UK carbon emissions and moving freight over longer distances presents a particular challenge.

Electrified rail transport is a fully mature, proven green technology which has been in use for over 60 years. The UK lags behind the rest of Europe and, partly for historical reasons, only about 10% of British freight trains are hauled by electric locomotives.

Rail freight now follows the electrified main lines much more closely and around two thirds of the core c.2000-mile rail freight network is already electrified, or soon will be. **Only about 800 miles of electrification is needed to allow c.95% of rail freight to be electrically hauled**.

The Chartered Institute of Logistics and Transport (CILT) has produced the accompanying map to illustrate an electrification strategy. Trunk haulage by electric rail allied to regional and local distribution by battery HGVs would offer a multimodal solution, allowing supply chains to be almost fully decarbonised.

A handful of short unelectrified sections – shown in Red on the map – prevent freight trains being electrically hauled over very long distances. **Electrifying these 'Infill' sections, which total less than 60 miles, would allow around 2 million train miles a year to be decarbonised**. This is equivalent to taking around 80 million diesel HGV miles off Britain's roads each year.

The 60 miles of Infill electrification is estimated to **cost c.£50m p.a. over two years** – less than the cost of one road scheme – and represent **a 'no regrets' way of decarbonising key parts of the UK logistics system**. These are 'low hanging fruit' which can be readily harvested to the benefit of the UK economy and environment.

Following the Infill schemes, progressive implementation of the electrification strategy is proposed, with a rolling programme to ensure efficient delivery at lowest possible cost. Around 80% of the lines to be electrified are in – or form key routes to – the Midlands, the North, Wales or Scotland. Accordingly, the strategy makes a major contribution to levelling-up, regional equality and connectivity. It would also increase productivity in transport.

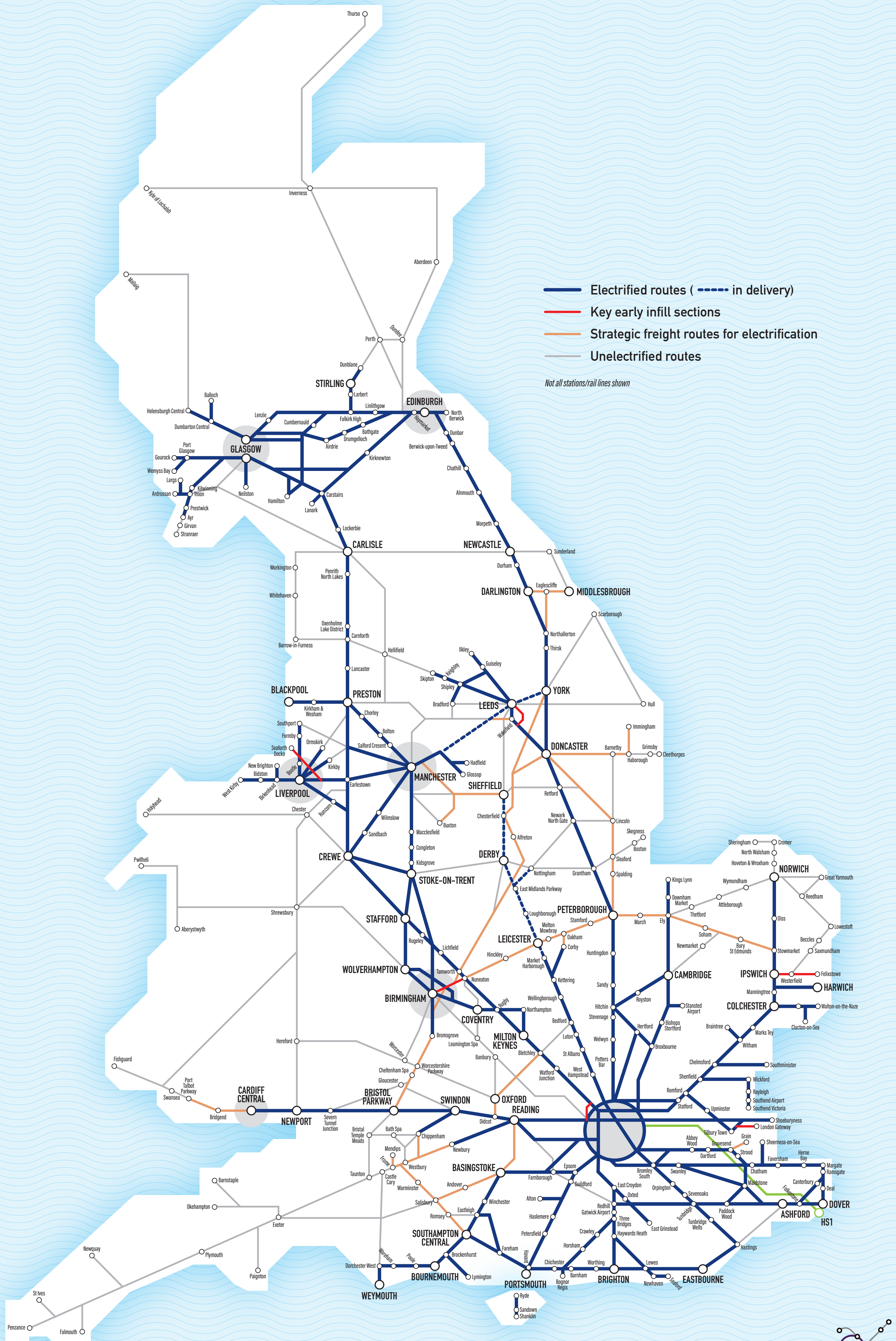
The CILT electrification strategy benefits passengers as well as freight customers. Almost all the routes involved carry passenger trains and the strategy would enable life-expired diesel trains to be replaced by modern electric units.

CILT is working with colleagues in engineering institutes to identify lower cost methods of electrifying freight routes and it is already clear that this will cost considerably less than electrification of high-speed intercity routes. Freight train speeds are much lower, meaning that a simpler form of wiring can be used, and **there are credible grounds for expecting the cost of freight electrification to be less than half the cost of higher speed passenger routes**.

An electrification programme of c.40 route miles per annum for 20 years would see the CILT electrification strategy delivered at an estimated cost of c.£100m p.a. This is a modest outlay in the context of the UK transport budget and would produce substantial decarbonisation benefits.

The CILT strategy would result in the core Freight network being electrified by the mid-2040s, with virtually zero carbon emissions from c.95% of rail freight operations, and encourage modal shift of long-distance trunk haulage from road to rail.





# Introduction

**Transport is one of the main sources of $CO_2$, producing over a quarter of UK carbon emissions. Within transport, moving freight over longer distances and hauling heavy bulk commodities presents a particular challenge.**

**In contrast to other transport modes, where decarbonisation requires development of radical new power sources and systems, electrified rail transport is a fully mature, proven green technology which has been in use for over 60 years. Renewable or nuclear energy, supplied through overhead wires (or a 3rd rail), enables electric trains to operate virtually carbon-free over longer distances without range constraints. Electrification is used extensively across Europe and a high percentage of freight trains on the continent are electrically hauled.**

**The UK lags behind and only about 10% of British freight trains are hauled by electric locomotives. Over 40% of the British rail network is electrified but, traditionally, most UK rail freight operated away from electrified routes. The replacement of coal by intermodal containers carrying consumer goods and construction materials as the main sources of rail freight have changed this pattern radically.**

**Rail freight now follows the electrified main lines much more closely and around two thirds of the core c.2000-mile rail freight network is already electrified, or soon will be. Only about 800 miles of electrification is needed to allow c.95% of rail freight to be electrically hauled.**

**As the professional institute for the sector, the Chartered Institute of Logistics and Transport (CILT) has produced the accompanying map to illustrate an electrification strategy. It shows where electrification is needed to decarbonise UK rail freight and facilitate modal shift from higher carbon modes. Trunk haulage by electric rail allied to regional and local distribution by battery trucks would allow supply chains to be almost fully decarbonised.**

**The strategy is market-led and based on detailed analysis of data on rail freight movements across the UK. The routes proposed for electrification lead from main container ports to inland distribution centres, which are key supply chain hubs, and from major quarries to urban areas that require large quantities of construction materials. Also included are routes serving other key rail freight customers such as the steel industry.**

Only about 800 miles of electrification is needed to allow c.95% of rail freight to be electrically hauled.





## First steps – short infills

A handful of short unelectrified sections – shown in Red on the map – prevent freight trains being electrically hauled over very long distances. Electrifying these 'Infill' sections, which total less than 60 miles, would allow around 2 million train miles a year to be decarbonised. This is equivalent to taking around 80 million diesel HGV miles off Britain's roads each year.

The Infills are targeted at early electrification of links between the major container ports of Felixstowe, London Gateway and Liverpool and key inland terminals in the Midlands, the North, Wales and Scotland. Electric locomotives are available to haul these intermodal trains, without new locos needing to be built.

The 60 miles of Infill electrification is estimated to cost c.£50m p.a. over two years – less than the cost of one road scheme – and represent a 'no regrets' way of decarbonising key parts of the UK logistics system. These are 'low hanging fruit' which can be readily harvested to the benefit of the UK economy and environment.

## Wider benefits

Following the Infill schemes, progressive implementation of the electrification strategy is proposed, with a rolling programme to ensure efficient delivery at lowest possible cost. Rail freight investments typically produce good or very good Benefit Cost Ratios – BCRs of 3 or 4 are common and 5 is by no means rare, so the direct economic logic is sound. In addition, as well as decarbonisation, the strategy contributes to many other policy imperatives

Around 80% of the lines to be electrified are in – or form key routes to – the Midlands, the North, Wales or Scotland. Accordingly, the strategy makes a major contribution to levelling-up, regional equality and connectivity. Businesses in these areas need efficient zero-carbon routes to market, which is facilitated by the CILT strategy. Particularly important is the much-improved connectivity to Freeports: good inland transport links are essential if maximum advantage is to be taken of Freeport status.

Productivity is promoted by modal shift – one train driver replaces around 50 HGV drivers on trunk hauls, freeing them to work on essential local and regional deliveries. The HGV driver shortage has abated for now, but will inevitably return given the average age of drivers and the reluctance of young people to take HGV driving jobs. This is particularly true when 'tramping' is involved – living in the cab for several days at a time on trunk hauls.

The UK economy will need many more people with electrical skills as the country decarbonises. The rolling programme of electrification will offer significant opportunities for training and developing staff in the appropriate skills. The majority of these jobs and apprenticeships will be in the Midlands and North, where more people are seeking work, thereby avoiding pressure on the South East labour market.

As well as addressing global warming, the CILT electrification strategy reduces particulate and other pollution. Improved air quality, particularly in towns and cities, will reduce health problems, especially amongst children, and relieve pressure on the NHS.

## Rolling out the strategy

The main priority is electrification of the key cross-country route from Felixstowe to the Midlands and North avoiding London (the 'F2MN' route). It provides a direct link to the West Coast Main Line at Nuneaton for the North West and Scotland and, along with the line from Peterborough via Lincoln to Doncaster, a direct link to Yorkshire and the North East. It would allow zero-carbon electric trains to replace diesel trunk HGVs on the A14, M6, and A1.

The next phase would electrify the link from Britain's third largest container port at Southampton to inland markets. The first stage involves electrification from Basingstoke to Reading and from Didcot, via East West Rail, to Bletchley on the West Coast Main Line. A second stage would see the route from Southampton to Basingstoke via Andover being wired, to create an overhead AC electrified route. This would complement the existing 3rd rail DC route via Winchester, which has operational and technical constraints. Diesel trunk HGVs on the A34, A43 and M40 could be replaced by zero-carbon electric rail services.

The third phase of the CILT electrification strategy involves routes from major quarries and cement works in the Peak District and the Mendips. This would allow electric haulage of millions of tonnes a year of heavy construction materials to Manchester, Leeds, Birmingham and the South East. Roads such as the A6 and A38 in the Midlands and North, plus the A36, A303, M3 and M4 in the South, would be relieved of diesel HGVs.

New heavy-haul electric locomotives will be needed for this traffic, which has different characteristics to moving intermodal containers. The private sector Freight Operating Companies are keen to develop and procure new locomotives – but only if there is an electrified infrastructure on which they can operate: the investment is only financially viable if this is available.

Fourthly, routes serving the steel industry – which is particularly keen to decarbonise its supply chains – would be electrified. This involves wiring the South Wales Main Line west of Cardiff to connect the UK's biggest steelworks at Port Talbot, as well as from Bristol to Bromsgrove on the line to Birmingham. This would provide an electrified route from South Wales to the Midlands and North, allowing diesel HGVs on the M4, M50 and M5 to be substituted by electrically-hauled freight trains.

Similarly in the North, electrification of the routes from Immingham via Scunthorpe to Doncaster and from Middlesborough to Northallerton and Darlington would link the steel industry to the East Coast Main Line and Trans Pennine routes. Wiring the connecting lines from York and Doncaster to Sheffield would in turn provide an electrified route to the Midlands and South Wales. As well as decarbonising steel movements, electrifying these northern routes would also allow zero-carbon movements of containers from East Coast ports, replacing diesel HGVs on the M18, M62, M1 and A1(M).

## Passenger benefits

It is important to note that the CILT electrification strategy benefits passengers as well as freight customers. Almost all the routes involved carry passenger trains and the strategy would enable life-expired diesel trains to be replaced by modern electric units. Significant numbers of these are available due to the reduction in long distance commuting and business travel following Covid. Passenger services could be electrified on the following routes:

*Edinburgh-Newcastle-Birmingham-Bristol*

*Manchester-Birmingham-Bristol*

*Birmingham-Leicester-Cambridge-Stansted Airport*

*Manchester-Sheffield-Doncaster-Scunthorpe*

*Manchester-Leeds-York-Middlesborough*

*Darlington-Middlesborough*

*Nottingham-Birmingham-Bristol-Cardiff*

*Doncaster-Lincoln-Peterborough*

*Peterborough-Ely-Ipswich*

*Ipswich-Felixstowe*

*Oxford-Bicester-Milton Keynes (East West Rail)*

*London-Didcot-Oxford*

*Reading-Basingstoke*

*London-Basingstoke-Salisbury*

*Swindon-Salisbury-Southampton*

Note that short sections of wiring into a passenger station would be required in a few locations, where freight trains follow a different route through the area.

In addition, GWR bi-mode trains would be able to run further on electric power, with reduced carbon emissions, on the following routes:

*London-Exeter-Plymouth-Penzance*

*London-Cardiff-Swansea*

*London-Worcester-Hereford*

## Delivery and cost

CILT is working with colleagues in engineering institutes to identify lower cost methods of electrifying freight routes and it is already clear that this will cost considerably less than electrification of high-speed intercity routes. Freight train speeds are much lower, meaning that a simpler form of wiring can be used, reducing costs substantially.

Early indications are that, based on a rolling programme, the cost per single track kilometre (stk) will be substantially lower than recent main line electrification in England and Wales, which has cost around £2.5m per stk. It is also likely to be significantly lower than recent costs of wiring passenger lines in Scotland of around £1.5m per stk. On slower speed routes, there are credible grounds for expecting the cost of freight electrification to be less than half the latter figure.

Crucially, of the 800 miles to be electrified, around 70% is already cleared for high cube containers. This means that most of the bridges, which would otherwise need to be rebuilt before overhead wires can be installed, have already been raised. This reduces the cost of electrifying a route significantly.

The remaining 30% serves quarries and steelworks which do not see container traffic and where bridges have not been raised. Heavy-haul trains (weighing up to c.5000 tonnes) carrying aggregates and steel will need new electric locomotives, which will very probably be equipped with batteries for working in terminals and sidings. On-board batteries are likely to mean that wires will not need to be installed under every bridge and, by avoiding bridge rebuilding, such 'discontinuous electrification' produces substantial cost savings.

Taking advantage of such innovative techniques, an electrification programme of c.40 route miles per annum for 20 years would see the CILT electrification strategy delivered at an estimated cost of c.£100m p.a. This is a modest outlay in the context of the UK transport budget and would produce substantial decarbonisation benefits.

The strategy would see the core Freight network electrified by the mid-2040s, with virtually zero carbon emissions from c.95% of rail freight operations. This aligns with life expiry of the existing diesel locomotive fleet, which will need replacement through the 2030s and 2040s. Faster delivery could be achieved given a higher spend rate and would accelerate decarbonisation. This may be considered desirable in the light of the IPCC's 'Code Red' warning about limiting global warming to 1.5°C.

# Conclusion

The CILT electrification strategy would allow around 95% of UK freight trains to be hauled by electric locomotives by the mid-2040s, saving considerable amounts of carbon every year. It would also facilitate modal switch of long-haul freight from diesel HGVs to zero carbon rail. Allied to the use of short-range battery trucks for local and regional distribution, this could decarbonise a significant part of the UK supply chain system.

The strategy also strongly supports other policy imperatives, notably levelling-up and union connectivity – around 80% of the routes to be electrified are in, or provide links to, the Midlands, the North, Wales or Scotland.

Freeport connectivity would be much improved and significant productivity improvements could be achieved with one train driver replacing up to 50 HGV drivers, where modal switch occurs.

Passengers would also benefit from clean, modern electric trains replacing life-expired diesel units on services into cities such as Birmingham, Manchester and Sheffield in the Midlands and North, plus Cardiff, Oxford and Salisbury in Wales and the South. This would result in cleaner air with fewer particulates in these and other cities, generating significant health benefits and reduced healthcare costs.

The CILT electrification strategy would allow around 95% of UK freight trains to be hauled by electric locomotives by the mid-2040s, saving considerable amounts of carbon every year.

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