

Britain's Transport Infrastructure

Rail Electrification



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Foreword



1. A modern railway system is vital to preparing Britain for the future. The Government has decided to embark on a major £1.1bn programme of rail electrification as an integral part of its rail modernisation¹ and carbon reduction² strategies. Work will begin immediately on the electrification of the Great Western Main Line between London, Reading, Oxford, Newbury, Bristol, Cardiff and Swansea, to be completed within eight years. In parallel, planning will begin immediately for the electrification of the line between Liverpool and Manchester, to be completed within four years.
2. The Great Western Main Line is the longest non-electrified intercity route in Britain, of vital national strategic importance to both England and Wales. It also includes heavily used commuter lines into London. Electrification will enable the introduction of a predominantly electric high-speed train fleet. These trains will offer faster journey times, more seats, greater reliability, improved air quality and lower carbon emissions than their diesel equivalents, as well as being cheaper to buy, operate and maintain.
3. The electrification of the line from Liverpool to Manchester will allow the introduction of a fast electric service with a journey time of around 30 minutes, compared to a fastest journey time of around 45 minutes today. It will also enable operation of electric train services from Manchester Airport and Manchester Piccadilly to Glasgow and Edinburgh along the West Coast Main Line. As on Great Western, electrification will enable the introduction of modern electric trains which provide a better service for passengers than the more expensive diesel trains which would otherwise be needed to increase capacity on these key routes.
4. The Great Western electrification project will complement the £16bn construction of Crossrail, which will extend electric train services from Essex and the new east-west tunnel through central London to Slough, Heathrow and Maidenhead on the Great Western Main Line by 2017. With electrification now to be extended to Reading, it would be possible for Crossrail to operate to Reading, rather than Maidenhead, from the outset, and this option will now be considered by the Government and Transport

1 Delivering a Sustainable Railway, July 2007, Department for Transport
<http://www.dft.gov.uk/about/strategy/whitepapers/whitepapercm7176/hitepapersustainable railway1.pdf>

2 Low Carbon Transport: A Greener Future, July 2009, Department for Transport
<http://www.dft.gov.uk/pgr/sustainable/carbonreduction/>

for London. It will also make it easier to improve rail access to Heathrow from the West. Great Western electrification will be integrated with a wider set of enhancements, including the £425m upgrade of Reading station, the installation of in-cab signalling equipment and the introduction of the new Super Express train as the successor to the diesel-powered Intercity 125. The Super Express train will now be predominantly electric powered on the London to Swansea line.

5. Further work is ongoing to assess the detailed costs and benefits of electrification on other routes. The rail industry recently published for consultation its *Network Route Utilisation Strategy: Electrification*³. The Government will carefully consider the costs and benefits of wider electrification, with particular reference to the Midland Main Line between London and Derby, Nottingham and Sheffield, as well as the routes between Manchester and Preston, and Liverpool and Preston.
6. As with other rail investments, the cost of electrification will be funded by Network Rail and supported by the Government. Over the medium term this £1.1bn investment in electrification will be self-financing, paying for itself through lower train maintenance, leasing and operating costs. This means that this investment can take place without reducing already planned infrastructure enhancement work.
7. This electrification programme radically affects the requirements for train rolling stock over the next decade. In particular, there will be far less need for diesel trains and a greater requirement for electric trains. The Government will publish a new rolling stock plan in the autumn, taking account of these changed circumstances.



Rt. Hon. Andrew Adonis
Secretary of State for Transport
July 2009

3 Network RUS: Electrification Strategy (Draft for Consultation), May 2009, Network Rail
<http://www.networkrail.co.uk/>

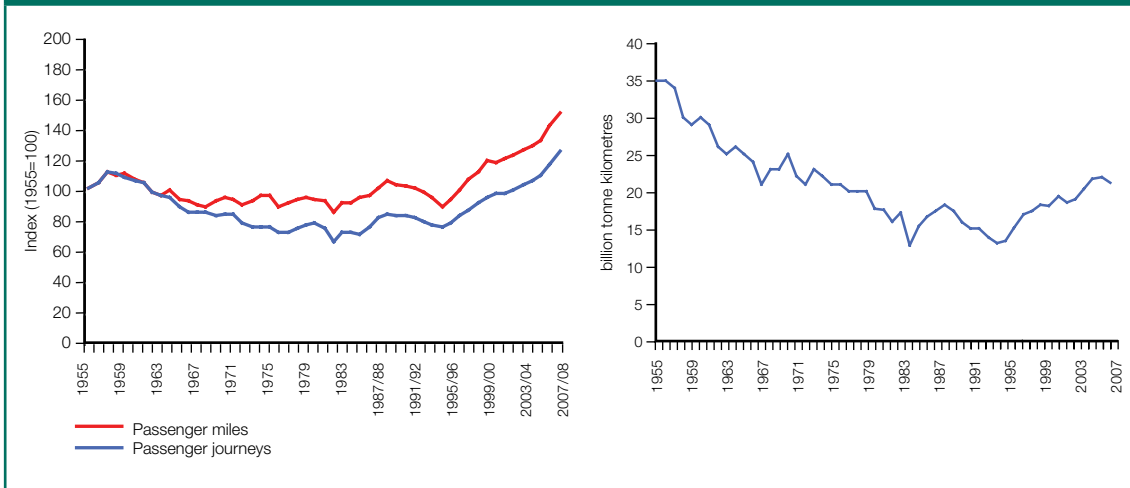
1 The case for electrification

A railway for the 21st century

8. The technology powering Britain's railways has changed significantly since the first public railway – the horse-drawn Surrey Iron Railway – opened in 1803. Coal-fired steam trains dominated for more than a century before being overtaken by diesel and electric trains. We now have a network where around 60% of passenger journeys⁴ are made on electric trains.
9. The last major electrification on the existing network was that of the East Coast Main Line in the late 1980s. While further routes were considered at the time, investment was constrained and other projects were considered to be a higher priority.
10. Rail privatisation in the 1990s wrought major upheaval in the industry, and the Hatfield accident in 2000 highlighted significant under-investment in basic infrastructure. For most of this decade our railways have focused on making good this backlog and improving the punctuality and reliability of passenger services, backed by huge Government investment (now £4bn a year, up from £2bn in 1997). As a result, performance has reached record levels. We now have a national rail network carrying more passengers than at any time since 1946. Infrastructure modernisation is also advancing, with the completion of major projects including the West Coast Main Line upgrade and High Speed One.

⁴ Measured by passenger miles.

Figure 1: National rail passenger journeys and miles, and domestic UK goods moved by rail (1955–2007/08)



Source: *Transport Statistics Great Britain 2008*.

11. The Government is committed to a further programme of modernisation and investment, to meet projected increases in demand, to promote a shift to rail from other modes of transport, and to give Britain world-class infrastructure. The £5.5bn Thameslink project will provide extra capacity and new services to and through London from Bedfordshire, Hertfordshire, Surrey and Sussex. Work has also started on Crossrail, a £16bn project for a new east-west link across London, including a new underground tunnel, which will relieve congestion on the national railway and on the London Underground. And in January 2009 the Government commissioned High Speed Two to evaluate the case for an entirely new high-speed line from London to Scotland, starting with route planning from London to the West Midlands, which is by far the most capacity-constrained section of the West Coast Main Line.
12. Electrification has a central role to play in the next phase of rail modernisation. Electric trains have a number of significant advantages over diesel-powered trains. They have far lower running costs, far lower carbon emissions and offer better environmental performance; they can also increase capacity and reliability, and provide a better passenger experience.

Cutting costs

13. Electric trains are over 35% cheaper to operate than diesels.⁵ They require less maintenance and have considerably lower energy costs since electricity is a significantly cheaper fuel than diesel. They are lighter and so do less damage to the track. Although there are additional costs involved in maintaining electrification infrastructure, these are significantly outweighed by the train operating cost savings.

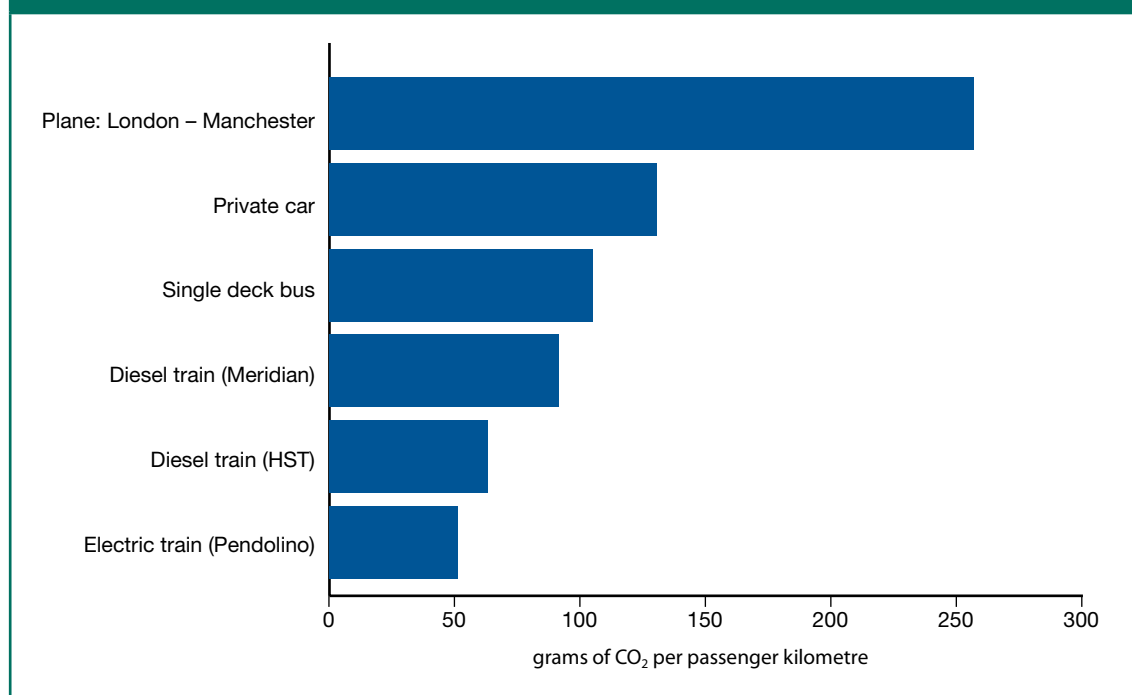
⁵ Network RUS: *Electrification Strategy (Draft for Consultation)*, May 2009, Network Rail <http://www.networkrail.co.uk/>.

14. Electric trains are generally cheaper to buy than diesel trains, reflected in lease costs which are typically around 20% lower. This relative advantage is set to increase: engines for diesel trains are likely to become more expensive following the introduction of stricter EU emissions standards from 2012. The engines required by these standards are likely to be heavier, larger and more complicated as a result of the emissions control technology required.

Reducing environmental impacts

15. Rail electrification is an important part of the Department's carbon strategy. Electric trains generally perform better than equivalent diesel vehicles even on the basis of the current electricity generation mix. Typically an electric train emits 20–35% less carbon per passenger mile than a diesel train. This advantage will increase over time as our power generation mix becomes less carbon intensive. Figure 2 compares the relative carbon performance of different modes of transport, assuming average load factors.⁶

Figure 2: Carbon emissions by transport mode



16. The roll-out of regenerative braking enables many electric trains to re-use the energy that would otherwise have been lost when braking, by converting the energy of motion back into electricity. Electric trains have zero emissions at the point of use, which is of particular benefit for air quality in pollution 'hot-spots' such as city centres and mainline stations. Electrification reduces rail's reliance on imported diesel fuel. Electric trains are quieter than diesel trains, and virtually silent when waiting at stations.

⁶ Traction Energy Metrics by Prof Roger Kemp, 2007, RSSB
www.rssb.co.uk/pdf/reports/research/T618_traction-energy-metrics_final.pdf

Increasing capacity

17. The past decade has seen sustained growth in rail travel. So an ongoing challenge for the railway is to find cost-effective ways of providing more capacity. Electric trains can provide additional carrying capacity compared to a diesel train of the same overall length. Diesel high-speed trains are unable to carry many people in the power cars at either end of the train because of the space taken up by the diesel engines. This is not the case for electric trains.

Improving reliability

18. Experience from around the world shows that a well designed, constructed and maintained electric railway will be more reliable than a diesel railway. This is because the higher reliability of electric trains more than offsets any failures from the additional electrification infrastructure. Industry figures (see Table 1) demonstrate that electric trains have a significant advantage over diesels in terms of how far they travel before a technical problem delays the train. An electric intercity train will travel more than 40% further than an equivalent diesel train before such a failure, and an electric commuter train will travel well over twice as far. This reflects the fact that electric trains are inherently simpler with fewer moving parts to go wrong.

Table 1: Reliability of diesel and electric intercity and commuter trains, expressed as the average distance (miles) between failures which delay the train by at least 5 minutes.⁷

	Diesel	Electric	Improvement factor
Intercity trains	11,800	16,571	1.4
Commuter/regional trains	12,880	30,209	2.3

The passenger experience

19. From a passenger perspective, electric trains offer improved comfort through reduced cabin noise and vibration. Although modern diesel multiple units are better in this respect than older designs, there is still a significant difference. Under-floor diesel engines can need high floors which result in a cramped passenger cabin.
20. Electric trains can offer a higher power to weight ratio than diesels, resulting in better acceleration and reduced journey times.

⁷ NFRIP Period 9 2008/09 report.

The way forward

21. For all these reasons, the Government has decided to pursue a major programme of rail electrification.
22. Inevitably electrification makes most sense on busier routes where the cost of installing new infrastructure can be offset by large ongoing savings from running electric trains. Network Rail's draft *Network Route Utilisation Strategy: Electrification* was published in May 2009. We have carefully studied Network Rail's proposals, alongside our own detailed analysis. It is this work which has led us to prioritise two routes – Liverpool to Manchester and the Great Western Main Line.
23. Electrification of a key Liverpool to Manchester route will significantly reduce operating costs, cut journey times between the two cities and allow the operation of electric trains from Manchester to Scotland. It will also provide a diversionary route for electric trains on the West Coast Main Line to and from Liverpool and Manchester, reducing disruption and increasing service resilience. Electric train services will be able to operate within four years.
24. The case for electrifying the Great Western Main Line is founded not only on financial efficiencies from running electric trains, but also the potential to integrate electrification with other important projects already planned. The north-south London Thameslink project relies on the purchase of new electric rolling stock with uniform operating characteristics to enable 24 trains per hour to pass in rapid succession through the central London section. A large pool of good-quality existing electric rolling stock will therefore become surplus by 2016. Fully modernised, some of these electric commuter trains can be cost-effectively deployed on commuter services on an electrified Great Western Main Line, as well as on services between Liverpool and Manchester once that route has been electrified, rather than standing idle. The Super Express Programme, which is already underway, will provide the necessary new electric trains for intercity services.
25. In addition to these rolling stock considerations, important infrastructure works are scheduled on the Great Western Main Line itself. Crossrail will provide electrification from London to Maidenhead. Network Rail is currently planning a number of signalling renewal projects, linked to the plan to install in-cab signalling (the European Rail Traffic Management System) on the route. And the £425m Reading Station Area Redevelopment Project is designed to provide additional train capacity to enable better train performance and a reduction in delays.
26. Taking all of these factors into account, our analysis shows that electrifying to Oxford, Newbury, Bristol, Cardiff and Swansea will deliver high value for money. Detailed planning will start straight away. Early works can take place between 2012 and 2014, with the bulk of the construction between 2014

and 2016. Subject to detailed planning work, electric services will be introduced progressively: London to Oxford, Newbury and Bristol by the end of 2016, and London to Swansea by the end of 2017.

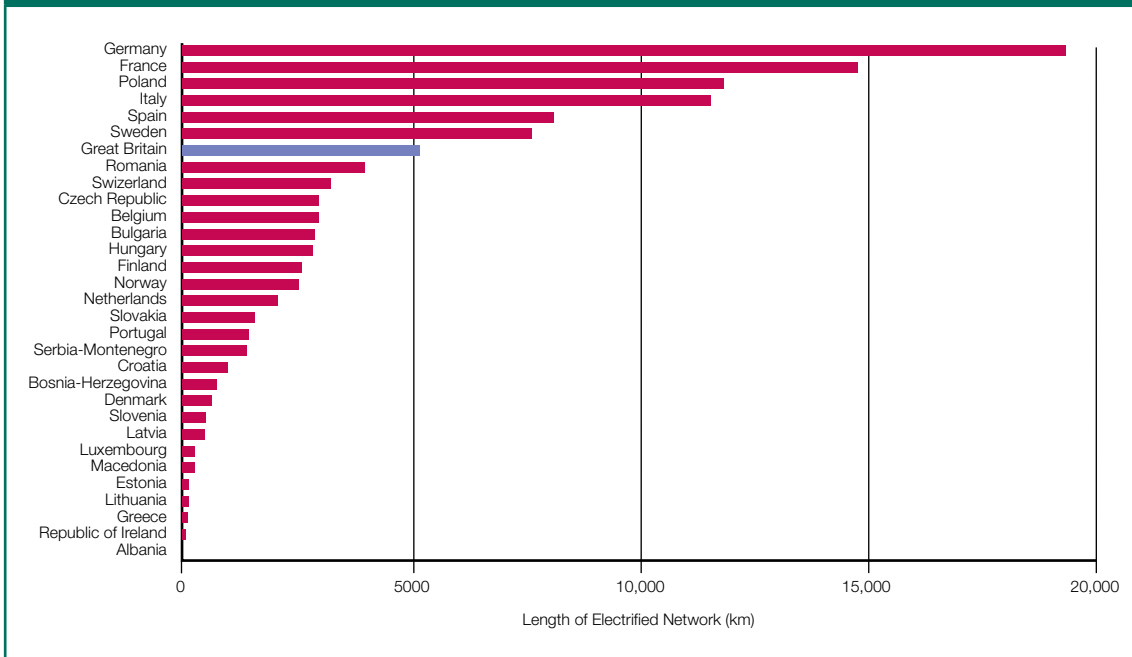
- 27.** This electrification programme radically affects the requirements for rolling stock over the next decade. There will be far less need for diesel trains and a greater requirement for electric trains. In particular, the previously-planned procurement by the Government of new diesel trains has now been superseded. We will accordingly publish a new rolling stock plan in the autumn, taking account of the changed circumstances.

2 Britain's electrified railway today

The European context

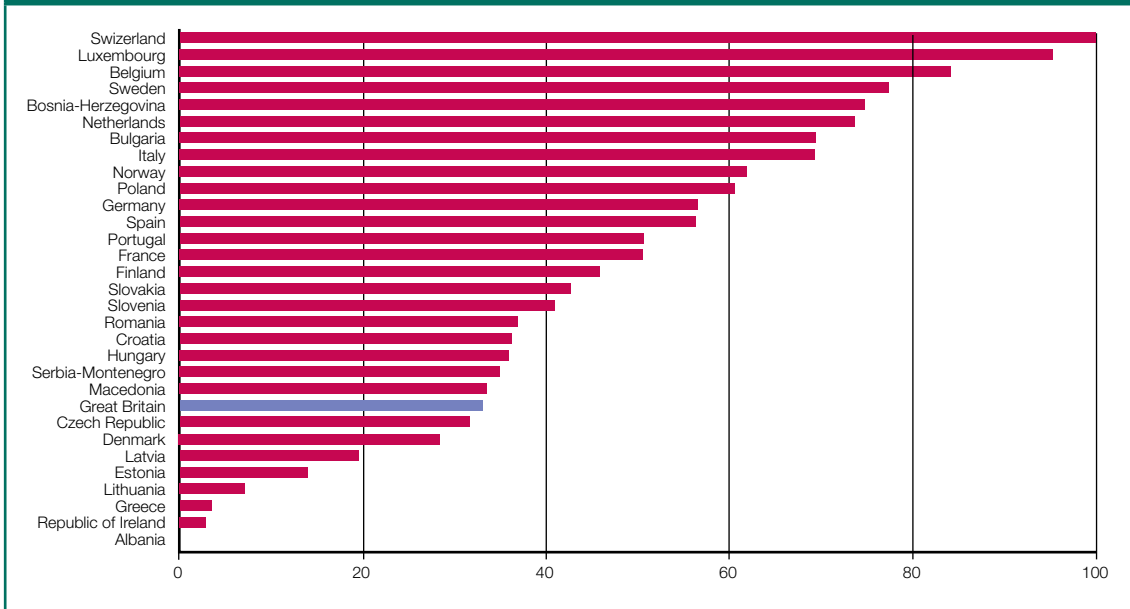
28. Britain significantly under-invested in rail electrification in the post-war decades. Figure 3 shows the total length of the electrified rail network for European countries. Great Britain currently lies in seventh place, far behind Germany, France, Poland and Italy. Moreover, as a proportion of the total network, the electrified network in Britain is far smaller than that of most European countries, as shown in Figure 4.

Figure 3: Length of the electrified rail network (route km) for various European countries



Source: UIC.

Figure 4: Rail electrification in Europe in 2005 showing percentage of network (by route km) which is electrified



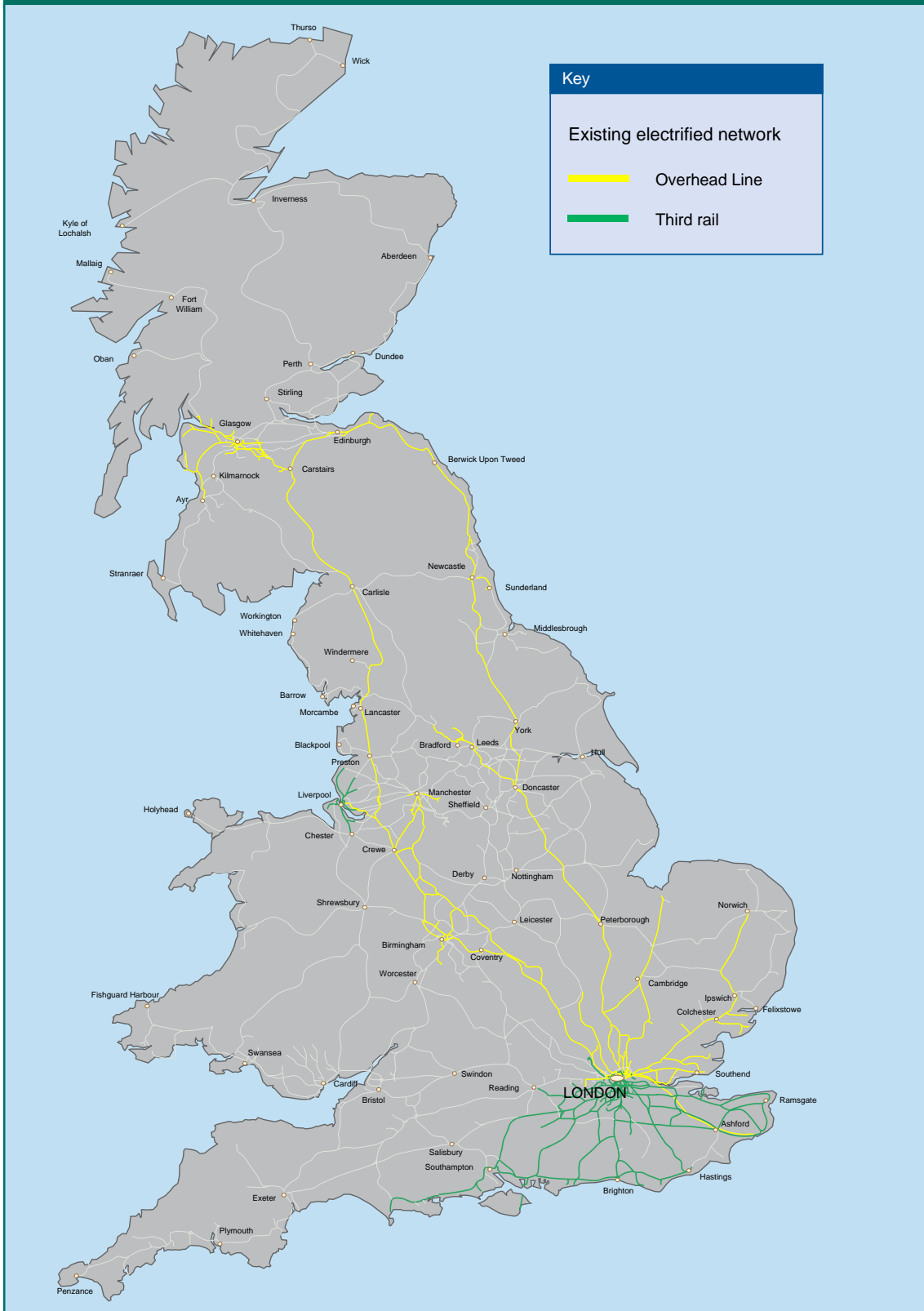
Source: UIC.

Existing GB rail electrification

29. Approximately 33% of the British rail network is currently electrified. Of this, two thirds is equipped with overhead line electrification, while the remainder is mainly 'third rail' electrification. Figure 5 illustrates the extent of the electrified network.

30. The West Coast Main Line, East Coast Main Line, Great Eastern Main Line and part of the Midland Main Line are electrified with an overhead line system. Overhead line electrification is also provided on much of the London suburban network north of the River Thames, and on parts of the suburban networks of Birmingham, Glasgow, Leeds and Manchester. The route from Newcastle to Sunderland is electrified for Tyne and Wear metro trains, which share the route. Third rail electrification operates on London suburban routes south of the River Thames and on routes between London and the south coast, as well as between Euston and Watford, on parts of the North London Line and on the Merseyrail suburban network.

Figure 5: Existing electrification on Britain's railways



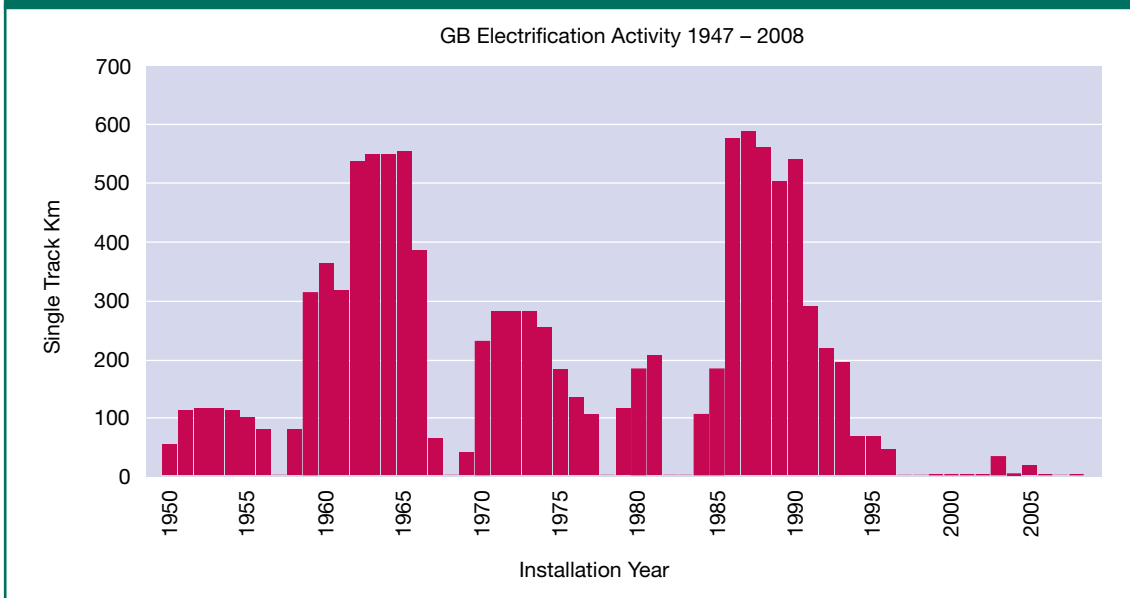
Source: Network Rail.

- 31. These existing electrified lines serve many of the busiest parts of the network and consequently carry a greater density of traffic than the non-electrified parts of the network.
- 32. In the period up to 2014, Network Rail is funded to deliver electrification from Barnt Green to Bromsgrove in the West Midlands. The Government has announced that the Great Western Main Line between Airport Junction (near Heathrow Airport) and Maidenhead will be electrified as part of the Crossrail project.
- 33. There are also plans for further electrification in Scotland. But with certain exceptions, such as safety, rail strategy is a devolved matter in Scotland. The geographical scope of this document is therefore primarily limited to England and Wales, recognising the implications of further rail electrification for cross-border services to Scotland.

Historic electrification

- 34. The British Transport Commission's seminal 1955 report *Modernisation and Re-Equipment of British Railways* recognised the benefits of electrification, stating: "*In many ways electricity is the ideal, since it meets the requirements of reliability, good acceleration, cleanliness and (where traffic is sufficiently heavy) economy in operation.*" As for the costs of electrification, it went on to say that: "*It is not so much a question of whether the nation can afford to undertake the new investment in its railway system here proposed, as whether it can afford not to do so and thereby continue to carry the economic burden of a public transport system that lags far behind the standard of efficiency technically possible.*"
- 35. This followed the successful electrification of the Southern Railway's commuter routes into London in the 1930s. However, only partial electrification, even of the intercity network, took place thereafter (see Figure 6). The routes from London to East Anglia were electrified progressively from the 1950s, the West Coast Main Line from London Euston to Glasgow in the 1960s and 1970s, the southern section of the Midland Main Line from London St Pancras to Bedford in the early 1980s, and the East Coast Main Line from London King's Cross to Edinburgh in the late 1980s. But the majority of the network, including busy intercity routes such as the Great Western Main Line and the Midland Main Line north of Bedford to Sheffield, was neglected.

Figure 6: Number of single track km of electrification delivered in each year since 1947



Source: Network Rail.

36. For the past 15 years, making good the effects of privatisation and clearing the backlog of essential infrastructure work have been the priorities for investment. Now that the essential network infrastructure is in fairly good shape, the Government and Network Rail are addressing the imperative for further electrification. Detailed joint analysis has been underway since the establishment of the National Networks Strategy Group by DfT last October. The completion of the first stage of this work has led the Government to conclude that the Great Western Main Line and the Liverpool to Manchester line should be electrified immediately.

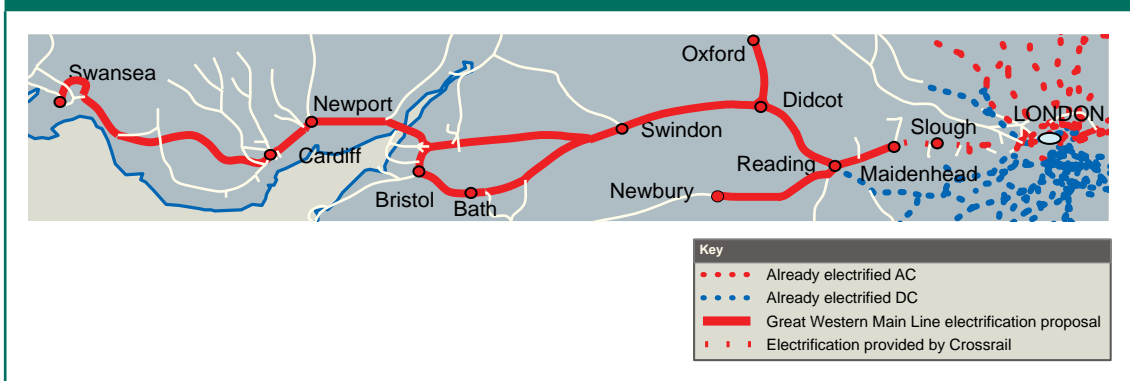
3 The Great Western Main Line

37. The backbone of the Great Western Main Line is Brunel's historic route from London through Reading and Swindon to Bristol, most of it now equipped for high-speed running, and the South Wales main line through the Severn Tunnel and on to Newport, Cardiff and Swansea. These routes provide fast intercity links between the English and Welsh capital cities and the West of England regional capital.
38. The line has seen significant increases in passenger demand, with the Thames Valley and Greater Bristol both being key growth areas. Between 2000 and 2006 there was 20% growth in passenger numbers between the Bristol urban area and London. The 2007 White Paper anticipated significant growth continuing on the route.

The electrified route

39. Electrification will bring important benefits for people making both long and short journeys. From 2016, commuters travelling between London, Slough, Reading, Newbury, Didcot, Oxford, and Swindon and intermediate stations will benefit from the reliability and comfort of electric trains. Figure 7 shows the route proposed for electrification.

Figure 7: The Great Western Main Line between London and Swansea, showing the planned electrified route



Source: Network Rail.

Intercity services

40. The replacement of a whole fleet of trains operating over a route creates an opportunity to reconsider the power source for those trains. Rolling stock fleets tend to last 30 to 40 years, so the replacement of the Intercity 125 High Speed Train (HST) fleet over the next decade creates a 'once in a generation' opportunity to electrify the route at the same time as replacing its rolling stock. The Government has decided to seize the opportunity to bring together the planning for the replacement of the HST fleet with a programme of electrification, rather than embarking on a sub-optimal replacement of the HST with another diesel-only fleet.
41. The proposed fleet for an electrified Great Western Main Line to Swansea will include a proportion of 'bi-mode' trains, so that destinations including Worcester, Gloucester, Cheltenham, Carmarthen and the South West beyond Bristol continue to enjoy through trains while also gaining the benefits of electrification. These bi-mode trains have a diesel generator vehicle at one end and an electric transformer vehicle at the other end. This allows bi-mode trains to operate 'off the wires' to maintain through services and provide diversionary services. They may also assist during the latter part of the construction period by allowing some new trains to be used as they are introduced but before the electrification programme reaches Swansea. Table 2 sets out some potential journey time savings from using Super Express trains compared to the existing HST fleet.

Table 2: Anticipated journey time savings following the introduction of Super Express trains, compared to existing Intercity 125 High Speed Train (HST) services

	Estimated journey time saving to/from London with Super Express trains (minutes)
Reading	4
Oxford	6
Swindon	8
Bristol	12
Cardiff	15
Swansea	19

42. In addition to the journey time savings, it is expected that the introduction of Super Express trains will provide at least 15% extra capacity on intercity services during the morning peak hour, and much more extra capacity across the day and during the evening peak.

Suburban services in the Thames Valley

43. Electrification will enable the current suburban services into London Paddington to be operated by electric trains instead of diesel trains.
44. The Thameslink Project is a major investment in additional capacity linking areas to the north and south of London. In order to operate a high-frequency service of 24 trains per hour in the peak period, a new fleet of around 1,200 vehicles is being procured. These new trains will replace the existing electric trains on the current Thameslink routes from 2013 to 2015.
45. It will then be possible to transfer the current Thameslink four-carriage electric trains onto the Great Western Main Line, replacing the current three-carriage diesel trains. These 100 mph vehicles will be completely modernised, including the installation of air-conditioning, and will offer quieter journeys and additional capacity. It is planned that suburban services between Oxford, Reading and London will be operated with such vehicles from the end of 2016.
46. From 2017, inner suburban services currently running into and out of London Paddington will operate through the new Crossrail tunnel to central London and destinations to the East of London. The Crossrail project will be procuring new rolling stock for these services. Outer suburban services will continue to operate to London Paddington.
47. Existing modern diesel trains that operate the suburban services into London Paddington can then be transferred to provide additional capacity on services in the Bristol area and the South West as well as releasing vehicles that can then be deployed to deliver additional capacity in key Northern cities.

Freight

48. Rail freight operators will be able to take the opportunity to lower costs by using electric locomotives to haul freight trains on the Great Western Main Line where possible.

Crossrail

49. The £16bn Crossrail project involves the construction of a new, cross-London railway connecting Heathrow Airport, the West End, the City and Canary Wharf to areas east and west of the capital. Crossrail will offer high-frequency, convenient and accessible services, with up to 24 trains per hour in the peak period over the core section. It will replace some of the current suburban services into London Paddington as well as some of the existing suburban services into London Liverpool Street. A fleet of around 600 new electric vehicles will be procured to operate these services.

50. The project involves electrifying the Great Western Main Line from Airport Junction (near Heathrow Airport) to Maidenhead. Close co-ordination between the electrification teams and the Crossrail project teams will be necessary to ensure dovetailing with the wider programme of electrification on the Great Western Main Line. This co-ordination could lead to savings in procurement costs and reductions in overall disruption of the railway. The potential savings will be discussed in detail with Transport for London, as co-Sponsor of the Crossrail project, and with Crossrail Limited.
51. Electrification west of Maidenhead also makes it possible to extend Crossrail services through to Reading. This could bring significant benefits, giving Reading and the wider Thames Valley direct rail access to London and the City, while also creating extra capacity in the existing Paddington terminus for longer distance services. The costs and benefits of this option will be considered by the Government and its project partners in Crossrail.

Rail access to Heathrow Airport

52. Heathrow Airport already benefits from an electrified railway link to London, but passengers from the West are required to change trains or use coach links in order to access the airport. A recent study commissioned by local authorities in the Thames Valley identified a potential case for direct rail access to the airport from the West, particularly from Slough, Maidenhead and Reading.
53. One of the constraints identified by the study was the lack of electrification of the Great Western Main Line to support services from Heathrow – which must be electrically operated to use the railway beneath the airport. The commitment now being made to electrification will have a positive impact on the case for Western rail access to Heathrow, and we look forward to the local authorities and BAA taking this into account in their further assessments of airport surface access requirements.

Reading Station Area Redevelopment Project

54. The growth in rail traffic on the Great Western Main Line has meant that, operationally, Reading station has become a serious bottleneck. Trains frequently come to a standstill, waiting before they can enter the station, causing delays to passengers. The Reading Station Area Redevelopment Project is designed to provide additional train capacity for the Great Western Main Line and other routes converging on Reading. These improvements – effectively a doubling in train capacity – will also enable better train performance and a reduction in delays.
55. The project is due to be completed in 2015. Early work has already made passive provision for electrification, with preliminary designs including locations for overhead line equipment and masts. Work will now be

undertaken to explore further synergies in order to minimise disruption to passengers and keep down overall costs.

Wales

56. The Government and Network Rail will work closely with the Welsh Assembly Government so that plans for electrification of the Great Western Main Line are co-ordinated with the Welsh Assembly Government's own rail plans.

Super Express Programme

57. The Super Express Programme was launched in 2005 to examine how the current Intercity 125 High-Speed Trains (HSTs), introduced by British Rail between 1976 and 1982, could be replaced. In 2006 and 2007, the rail industry, co-ordinated by the Department for Transport, developed a specification and a deployment strategy for the new trains, which led to the announcement of Agility Trains as preferred bidder earlier this year.
58. In developing the deployment plan, flexibility of power source was a major objective. The Super Express train can operate as a diesel train (self powered), an electric train or a combination of both (bi-mode).
59. The deployment plan for Great Western did not assume any electrification and so was based on using diesel Super Express trains. As these trains have a 30-year life-span, this would have meant the continued use of diesel-only trains on Great Western for the next generation. Electrification of the Great Western Main Line will now enable the Super Express procurement process to focus on electric and bi-mode options for Great Western. The contract with Agility Trains will be conditional upon their delivery of significant savings and expected capacity increases from the deployment of electric and bi-mode trains.
60. Deployment of electric and bi-mode Super Express trains will dramatically reduce the environmental impact of diesel operations within Paddington station and at other major covered stations like Bristol Temple Meads.

Re-signalling

61. Network Rail is currently planning to re-signal sections of the Great Western Main Line linked to the plan to install in-cab signalling, the European Rail Traffic Management System, on the route. This will provide 'immunised signalling' which does not suffer interference from overhead line equipment, and is therefore an essential prerequisite to electrification. The Department anticipates that careful co-ordination of the re-signalling work with the electrification work will minimise any disruption and keep overall costs down.

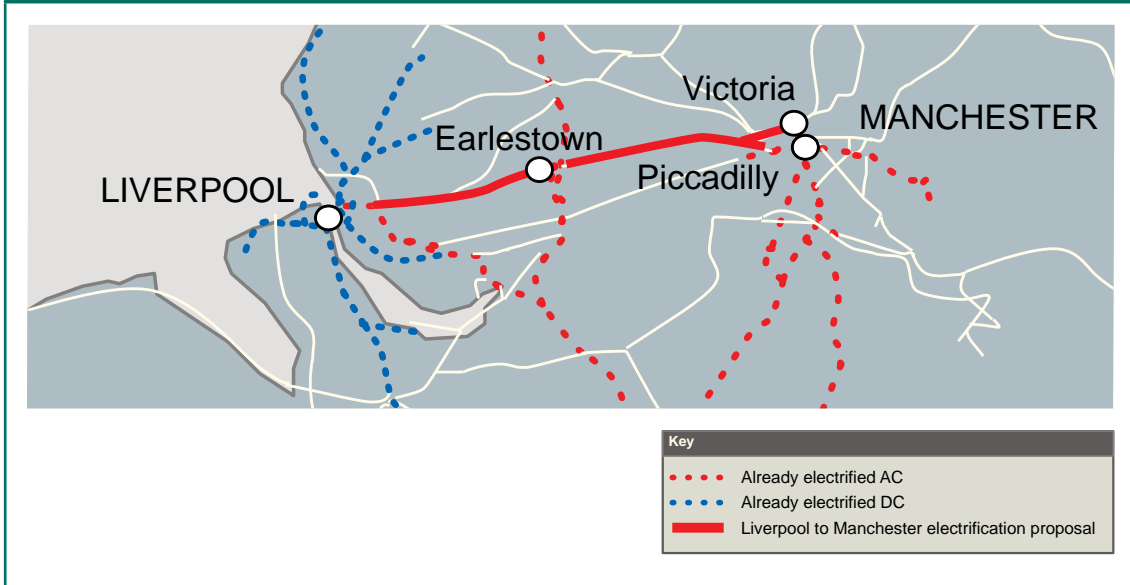
4 Liverpool – Manchester

- 62.** The route to be electrified is one of three between Liverpool and Manchester. It was the first railway in Britain built with passengers as well as freight traffic explicitly in mind from its inception, and was the scene of early pioneering engineering achievements. George Stephenson met the challenge of building a stable route over Chat Moss, and his steam locomotive “Rocket” triumphed in the Rainhill trials of 1829.
- 63.** The double-track route, 32 miles long, runs from Liverpool Lime Street station to Manchester Victoria station via Huyton and Newton-le-Willows. Four miles of the route, Lime Street to Bootle Branch junction, and between Earlestown East and Newton-le-Willows junctions, is already electrified. The route currently has a maximum permitted speed of 75 mph.

The case for electrification

- 64.** Significant investment on the route is already planned. The maximum line speed will be raised to 90 mph, to achieve a target journey time between Liverpool and Manchester of 30 minutes (compared with 44 minutes today). Signalling renewals are planned in the Huyton and St Helens Junction areas.
- 65.** Electrification will unlock further major benefits, both for intercity and for regional services. In particular, it will enable the Government and the rail industry to make the best use of electric rolling stock.

Figure 8: The Liverpool – Manchester route, showing the planned electrification



Source: Network Rail.

Services between Manchester and Scotland

- 66.** The existing TransPennine Express services between Manchester Airport and Glasgow/Edinburgh are operated by diesel trains, running under the overhead wires for more than 85% of their journey. Completion of the first phase of electrification, between Manchester and Newton-le-Willows, will allow through-train electric operation between Manchester and Scotland via the West Coast main line. This new service will use modern, air-conditioned trains which are currently used on West Coast Main Line services from London Euston. These high-powered, four-carriage electric multiple units have greater capacity than the existing trains, relieving crowding in key sections of the route.
- 67.** Electrification will enable diesel trains to be transferred onto other TransPennine Express routes, delivering much-needed additional capacity with many trains able to operate as six-carriage trains instead of three-carriage trains today.

Regional services

- 68.** Completion of the second phase between Newton-le-Willows and Liverpool will provide a fully electrified route between Liverpool and Manchester. Like the Thames Valley suburban services on the Great Western Main Line, regional services will be operated from 2013 by four-carriage electric trains transferred from the cross-London Thameslink route. These trains will be completely modernised before they are transferred, including the installation of air conditioning.

69. As with the Manchester to Scotland services, these electric trains will provide a better service for passengers compared to the diesel rolling stock which would otherwise have to be ordered to increase capacity and relieve overcrowding on this key regional route.

Freight

70. Electrification of this route will offer electric haulage options for freight. There will be an alternative route to Liverpool docks for electrically-operated freight trains, and better opportunities of electrified access to the proposed freight terminal at Parkside near Newton-le-Willows.

5 Implementation

71. Electrification necessarily involves engineering work on and near the railway. But it is important to minimise disruption to passengers and freight while these works are carried out. Passenger Focus, the statutory body which acts on behalf of passengers, is well placed to ensure that the passenger voice is heard in the planning of major engineering works.
72. Network Rail has developed proposals for an electrification process to minimise disruption. These proposals involve construction techniques which make extensive use of overnight closures of not more than eight hours. The application of modular techniques and the deployment of rapid delivery systems to improve the rate of production will be of key importance. The proposed methodology is designed to operate within normal 'rules of the route' possessions. To achieve this it is expected that construction techniques which are capable of working with the adjacent line open to traffic will be required.
73. On the Great Western Main Line, for straightforward stretches of line between major junctions and complex stations Network Rail's work suggests the use of 'factory trains'. This will enable standardisation as far as possible. The factory trains will be flexible units, capable of working individually or in combination, and as such, could play a useful on-going role in the efficient maintenance of the electrified network.
74. For the works necessary to provide clearances for overhead wires there may be some need for more extensive temporary closures for demolition and erection of new structures. But even these can usually be planned to coincide with other works. Close co-ordination with the electricity supply industry will be crucial to ensuring a mutual understanding of expected electrical demand and supply points.

Financing

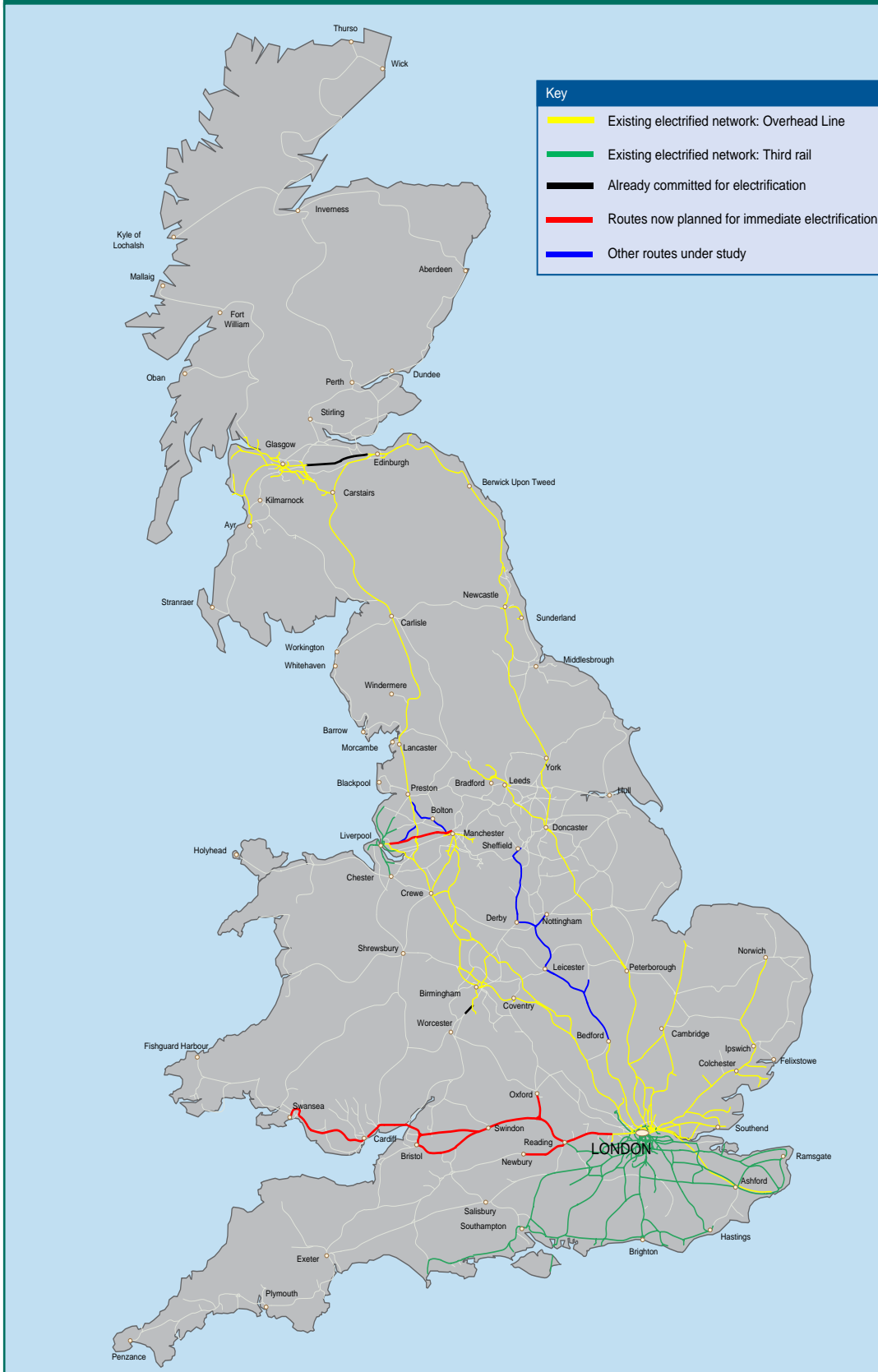
75. The capital cost of electrifying the Great Western Main Line from London to Swansea is estimated at around £1bn. It is estimated that electrifying the line from Liverpool to Manchester will cost around £100m. As part of implementing the proposals, Network Rail will be seeking the maximum efficiencies in the infrastructure work required.

- 76.** As with other rail investments, the cost of electrification will be funded by Network Rail and supported by the Government. Over the medium term this £1.1bn investment in electrification will be self-financing, paying for itself through lower train maintenance, leasing and operating costs. This means that this investment can take place without reducing already planned infrastructure enhancement work.

6 Next steps

- 77.** Detailed planning to take forward this electrification programme is now underway by Network Rail. It is expected that Liverpool – Manchester electrification will be carried out in two phases, to be completed within four years. On the Great Western Main Line, the programme will be co-ordinated with Crossrail’s electrification work to Maidenhead. As planning proceeds, Network Rail plans to start securing resources and ordering items of equipment which have long lead times (such as construction plant). It is currently expected that early works will take place between 2012 and 2014, with the bulk of the construction between 2014 and 2016. Electric services will be introduced progressively: London to Oxford, Newbury and Bristol by the end of 2016, and London to Swansea by the end of 2017.
- 78.** Network Rail recently published for consultation its *Network Route Utilisation Strategy: Electrification*. This draft strategy was the result of work by a cross-industry working group. It concluded that there was a good case for electrification of a number of sections of the network.
- 79.** Reflecting its remit, the study did not consider in any detail several key issues which affect the implementation of any electrification programme. These include the age of existing diesel rolling stock, the availability of electric rolling stock, affordability and phasing of delivery.
- 80.** Further detailed analysis is now ongoing on the other routes identified by Network Rail, and we are looking intensively at the costs and benefits of electrifying the Midland Main Line between London and Derby, Nottingham and Sheffield, as well as the routes between Manchester and Preston, and Liverpool and Preston, as shown in Figure 9. The Department will continue to work with stakeholders to review these schemes.

Figure 9: Electrification on Britain's railways



Source: Network Rail.

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