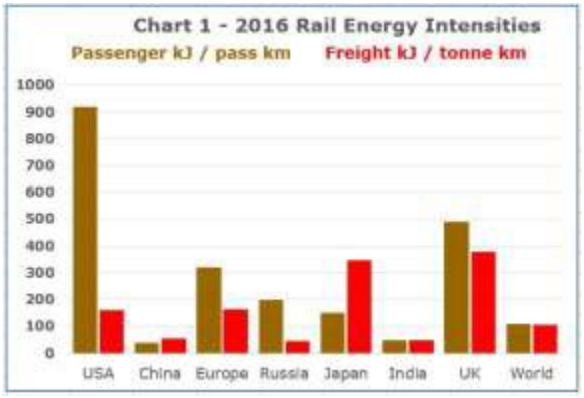
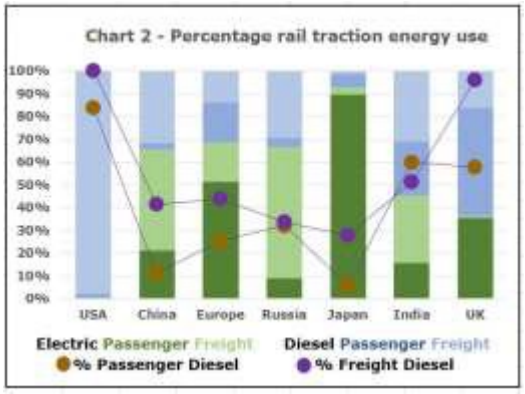
Written evidence submitted by David Shirres, Editor, Rail Engineer

International Rail Energy and Emission Comparisons

The vision of rail industry decarbonisation task force is "for the UK to have the world's leading low-carbon railway by 2040." However unfortunately data shows that Britain's railways have a very poor emissions record compared with other railways as shown by charts derived from the International Energy Agency's Future of Rail report.

Chart 1 shows that Britain's railways have a high rail energy intensity for both freight and passenger traffic. This means that, compared with other railways, they require much more energy to move a given load and so have poor emissions record.





On average UK trains requires 491 kJ of energy for each passenger kilometre. This compares with a world average of 110 kJ, 320 kJ for Europe and 40 kJ for China. On the chart the UK's figure is second only to the USA's figure of 920 kJ. These figures reflect both passenger loading and the amount of electrification which significantly reduces the energy required to run trains (A diesel train requires three times the primary energy of an electric train). Despite being an intensively used railway, Britain's passenger fleet requires a particularly large amount of energy.

For rail freight, the UK has the worst figure on the chart of 378 kJ per tonne kilometre. This compares with a world average of 105 kJ and 160kJ for Europe. Although US freight trains are entirely diesel hauled, they also average 2,000 tonnes and so have an energy density of 160 KJ per tonne kilometre. Russia has the most world's most efficient freight railway at 45 KJ per tonne kilometre with an average freight train load of 2,300 tonnes and 66 per cent of electric traction haulage.

Chart 2 shows the differing proportions of diesel and electric traction in various countries. It shows that in Britain, diesel traction energy for freight and passenger trains is respectively 96 and 58 percent. This is high by international norms and results in the UK needing more energy to move its trains than almost all other countries, except the USA. This in turn indicates that UK rail also has a poor international emissions record. The chart shows that, with extensive electrification Britain could rise up the rail decarbonisation league table. However the aspiration for UK to be a world leader in rail decarbonisation is unrealistic.

David Shirres,
Editor, Rail Engineer

Source data

International Energy Agency launched its 'Future of Railways' report in New Delhi in 2019. The report is downloadable on-line and argues that investment to encourage modal shift to rail offers significant benefits in respect of energy efficiency, reduced reliance on fossil fuels and a substantial cut in greenhouse emissions.

The report shows different energy intensity of passenger and freight transport in different regions (Future of Railways - Fig 1.28). This approximates to CO2 emission intensity as diesel traction is significantly less efficient than electric traction. The proportion of diesel traction in each of these regions is shown on a chart on the IEA website which shows the mix of diesel and electric traction. (Fig 1.23)

The charts in this feature are derived from IEA figures with comparable data derived from ORR statistics. This show that rail traffic in 2016 was 65 billion passenger kilometres and 17.1 billion tonne kilometres. They also show that in 2016/17 UK rail electric traction usage (m kWh) was passenger - 3,523 and freight – 58 and that diesel (millions litres) used was passenger – 501 and freight - 168. Conversion factors used for energy use were: 1 litre of diesel = 38 MJ and 1 kWh = 3.6 MJ.

November 2020