

RAILFUTURE FREE WEBINAR: 3 OCTOBER 2020 (see page 2)

Killing the Covid threat to rail travel



KEEP IT CLEAN: Tyne and Wear Metro staff started using a special disinfectant in June to give passengers the confidence to use its trains

Keeping trains clean will be crucial in persuading people to return to the railway. Nexus, the public body which owns and manages Tyne and Wear Metro, said it was using a new, longer-lasting cleaning agent that would provide anti-viral protection for up to 30 days, meeting the Government's Covid-secure standard. The disinfectant is being sprayed in passenger areas and drivers' cabs.

Metro operations director Chris Carson said: "We are making sure our stations and trains are cleaned to the highest standard, and that there is clear information on how to socially distance as you travel."

The new disinfectant, called Zoono Z-71, is being specifically targeted at handrails, poles, buttons and ticket machines.

Similar enhanced cleaning is taking place throughout the rail network, but there were unfortunate early reports of no soap being available in some station toilets.

Rail travellers have been required by law since 15 June 2020 to wear face coverings, and rail bosses are expecting a long-term loss of some commuter revenue as more people continue to work at home. Railfuture called on the Government in early July to get the railway system back to working productively to support economic

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recovery, after which there were signs that the “stay away from trains” message was being softened. The emphasis was on taking precautions when travelling by train with train companies publishing a “safer travel pledge”, stressing the importance of both companies and passengers playing their part in keeping everyone safe.

Read about the Railfuture initiative here:

<https://www.railfuture.org.uk/article1858-Travel-derailed>

Train companies may have to be propped up by the taxpayer until 2022. With luck though, the drop in air pollution during lockdown might encourage more people to demand sustained action by government and local authorities to enforce reductions in road traffic. In the first 30 days of lockdown there was a 9% average reduction in particulates and a 36% reduction in nitrogen dioxide levels in British cities and towns, according to the Centre for Research on Energy and Clean Air.

Hydrogen – is it the fuel of the future for railways?



Railfuture vice-president Paul Abell reviews the progress being made in using hydrogen fuel cells for rail traction.

There can be very few technologies whose fall from grace has been as spectacular as the diesel engine, but concerns about the climate change consequences of the greenhouse gases in diesel engine emissions have brought the United Kingdom to a policy of phasing out diesel-only trains by 2040, a policy formalised as a target in 2018.

This decarbonisation of rail traction has prompted the publication of a bewildering succession of reports in recent months, while the situation in England and Wales is complicated by the problems Network Rail has experienced with main line electrification schemes during the 2010s.

Clearly there is a need for significantly more routes to be electrified, but there will be some routes where the low level of traffic makes it difficult to justify the capital cost of electrification. Railfuture analysis suggests that electrification will give a benefit-cost ratio of 2:1 if a route is used by 24 vehicles per hour in each direction. However this is the break-even figure when none of the route is already electrified. The figure reduces to 12 vehicles per hour if the route is already half-electrified (as for the Midland main line out of St Pancras).

Battery or hydrogen?

Where electrification is not justified, battery traction and hydrogen fuel cells are regarded as the only technologies likely to be available for widespread adoption by



Picture: ALSTOM

Powered by hydrogen, the Alstom Coradia iLint has completed 18 months of passenger service in Lower Saxony, and ran trials in the Netherlands earlier this year

Railfuture webinar 3 October 2020

Attracting passengers back to rail after Covid-19 is the title of an online event being organised by Railfuture on 3 October 2020

You can join from 10.45, with the webinar starting at 11.00 and finishing at 12.30

We are planning to have four speakers from train operators, transport authorities, Transport Focus and employers.

Further details can be obtained on the Railfuture website or by emailing

conferences@railfuture.org.uk

Railfuture press releases

Railfuture press releases can be read in full at

[Railfuture press releases](#)

A review of other Railfuture appearances in print and broadcast media can be seen at

[Railfuture in the news](#)

2040. Battery traction for trains has been the subject of repeated trials over many years but developments in the automotive industry, such as the wider use of hybrid vehicles, suggest that it may now be a practical option.

One obvious advantage of battery traction over hydrogen fuel cells is that the trains can be recharged when running over electrified sections. Not only can hydrogen fuel cells not be recharged in this way but their power output cannot be varied quickly in response to a change in traction demand, so they have to be supplemented by batteries to store the electricity they produce.

However, the hydrogen fuel cell naturally has an advantage over battery traction when operating further away from electrified lines, leading to it being considered for low-intensity services running over longer distances (greater than 30 miles being mentioned as a yardstick).

How does it work? – the principles

You may remember the classic school experiment of electrolysis of water. You split the H₂O into its component elements of hydrogen and oxygen by passing an electric current through it. Bubbles of oxygen rose from the anode (the positive electrode), while bubbles of hydrogen rose from the cathode (the negative electrode), then the hydrogen gave a characteristic pop when the teacher waved a lighted splint at it.

The type of hydrogen fuel cell most commonly used for traction (which I am afraid rejoices in the name of the Proton Exchange Membrane Fuel Cell – PEMFC) can be thought of as using this type of process in reverse.

The hydrogen fuel is supplied to the anode, on one side of the fuel cell, while the oxygen (typically as air) is supplied to the cathode, on the other side of the fuel cell. The hydrogen at the anode is split into positive hydrogen ions (protons) and negatively charged electrons, a process which needs a platinum catalyst in order to occur.

The anode and cathode of the fuel cell are separated by a polymer electrolyte membrane. This allows the protons to pass through it only from the anode to the cathode, the negative electrons being taken along an external circuit to the cathode, and hence producing an electric current.

The protons and electrons combine with oxygen at the cathode to form water (a process which needs more platinum as a catalyst), and the water becomes the only waste product from the fuel cell, in a process which has not in itself involved any carbon emissions.

The small print

Though the amount of platinum required is being reduced as fuel cells are developed, the platinum catalyst not only requires an expensive material but is also



Unveiled at Long Marston last year by Porterbrook and the University of Birmingham Centre for Railway Research & Education, the HydroFLEX hydrogen train is based on a former four-car Thameslink class 319 electric train

The Cambrian Express Rail Link

- Cardiff, Carmarthen, Aberystwyth and Bangor

The north-south connection



Cambrian plea

The case for reopening two Welsh rail lines was put to the UK Government in June, in response to its new stations initiative. Both the Aberystwyth-Carmarthen and Bangor-Caernarfon lines are vital for improving transport in west Wales, said Welsh Government transport chief Ken Skates

He also called for new or reinstated stations at Deeside Parkway on the Borderlands line in North Wales, Carno on the Cambrian main line, St Clears on the Great Western main line in West Wales and Ely Mill on the City line in Cardiff

Oodles of cash for roads

The Highways Agency plans to spend up to £1.4 billion of taxpayers' money upgrading 10 miles of the A428 road from Black Cat roundabout, Bedfordshire, to Caxton Gibbet, Cambridgeshire. That is almost twice the amount needed to reopen the strategically important 55-mile-long Aberystwyth-Carmarthen rail line

Picture: BIRMINGHAM UNIVERSITY

one which is “poisoned” (rendered useless as a catalyst) by minute traces of carbon monoxide in the hydrogen fuel. This is a particular problem when the hydrogen is derived from an alcohol or hydrocarbon fuel, but not if the hydrogen is produced by electrolysis. PEM fuel cells have to work at relatively low temperatures (around 80°C) to prevent deterioration of the polymeric membrane, but this does at least mean that the fuel cell soon reaches its operating temperature.

On an industrial scale most hydrogen (over 90%) is produced from fossil fuels rather than by electrolysis of water, and this naturally has implications for the production of carbon emissions. The 2018 RSSB Options for Traction Energy Decarbonisation Report quotes a number of figures for CO₂ emissions per unit of power, expressed as kg CO₂e/kWh:

0.83 diesel

0.8 brown hydrogen produced by electrolysis (with 2018 UK electricity generation mix)

0.63 brown hydrogen produced by reformation of natural gas

0.62 diesel hybrid 2018

0.5 advanced diesel hybrid using techniques such as stop-start and selective engine shut-down

0.4 brown hydrogen produced by electrolysis (with anticipated 2040 UK electricity generation mix)

0 green hydrogen produced by electrolysis (using renewably generated electricity)

The last “zero” is naturally the optimum solution, but it depends on circumstances such as a low overnight demand for electricity coinciding with more electricity being generated by wind farms than is required by the grid distribution system, the extra electricity being used for the electrolytic production of hydrogen.

The practicalities

As a fuel, one litre of hydrogen contains much less energy than a litre of diesel fuel, even when compressed to 350bar for storage. This is reflected in the energy density of the two fuels being quoted as 4.6MJ/litre for hydrogen and 35.8MJ/litre for diesel fuel. Hence hydrogen needs eight times the storage volume of diesel fuel, with all the implications that that brings for the size of vehicle fuel tanks, and the distribution of hydrogen fuel to depots. Each of the processes in a hydrogen fuel cell has its own efficiency. Production of hydrogen by electrolysis is quoted as 68% efficient, then compressing it for storage at 350bar takes 6% of its chemical energy, while the typical efficiency of the fuel cell itself is quoted as 52%, giving an overall cycle energy around 33%. In other words, it takes 3kW of electricity to produce 1kW of power at the wheel in a fuel cell system, compared with a straight electric system typically requiring only 1.2kW of electrical input to give the same 1kW at the wheel



Picture: EVERSCHOLT

Eversholt's Breeze hydrogen train, based on a class 321 electric multiple unit

What's on

Many rail-related events are listed on Railfuture's website:

www.railfuture.org.uk/events

Many will not now take place because of the Covid-19 lockdown

Railfuture conferences

The next Railfuture conference will be online only

www.railfuture.org.uk/conferences

– another good reason for making sure that your hydrogen fuel is produced from renewables.

Current developments

The contract between Alstom and Lower Saxony transport authority for 14 Coradia iLint hydrogen fuel cell trains was signed in November 2017. Based on the very successful Coradia Lint 54 diesel train, the first two prototypes went into passenger service the following September. Besides 18 months of successful operations between Cuxhaven, Bremerhaven, Bremervörde and Buxtehude, an iLint unit also completed 10 days of tests between Groningen and Leeuwarden in the Netherlands earlier this year. Fleet operation in Lower Saxony is due to begin in 2021-22.

The requirements of the restricted UK loading gauge mean that the bulky hydrogen fuel tanks cannot be put on the roof. Therefore the HydroFLEX hydrogen unit unveiled at Long Marston last year by Porterbrook and the University of Birmingham Centre for Railway Research & Education loses the passenger space from one of its three coaches to accommodate four hydrogen tanks, as well as two 650V traction batteries and a 100kW fuel cell. Converted from a Class 319 electric multiple unit, this three-car unit is being tested on UK main lines this year, as Eversholt develops its Breeze hydrogen train, based on a Class 321 EMU.

The future

As far as routine UK passenger operations go, the firmest proposal came in January 2020. Since more than half of UK hydrogen is manufactured in its area, the Tees Valley Combined Authority is supporting a scheme for a fleet of 10 hydrogen fuel cell trains to work the Saltburn-Bishop Auckland route. Before it lost the regional franchise, Arriva Rail North had submitted a planning application for appropriate facilities at Tees Yard and Lackenby (Lackenby being the preferred location because it has a local hydrogen supply network and suitable rail infrastructure). I hope this scheme will not have been sunk by the nationalisation of the Northern franchise.

More generally, Network Rail has a traction decarbonisation network steering group which is due to produce an interim report this July, followed by a final report in October. This work is expected to guide the Government decisions on electrification, battery and hydrogen traction.

One immediate factor in the background of such decisions is that around a thousand diesel vehicles in the Sprinter fleets will be reaching 40 years old in 2026-31. Decisions regarding their replacement need to be taken by 2024 if the procurement of new, decarbonised vehicles is to be done in an orderly manner.

We await the group's findings with considerable interest, and trust that the publication of its reports will not be delayed too long by the present Covid-19 crisis.

A warning

Christian Carraretto of the European Bank for Reconstruction and Development has warned: "The hydrogen that the world uses today is made from either coal or natural gas. This hydrogen is carbon-intensive, it's not a green fuel. It's called grey hydrogen if it comes from gas, while the hydrogen produced from coal is called black. Then there is blue hydrogen, an upgrade of the grey, where the CO₂ emitted is captured upstream, so the system doesn't emit CO₂ in the atmosphere."



A 1980s-built diesel Sprinter, under the Erewash valley's historic Bennerley viaduct in 2018

Picture: RAILWATCH

Glasgow gateway

Work has begun to create a regional transport hub and southern gateway to Glasgow in parallel with a plan to improve Motherwell station. Work on the £14 million project starts this year with the aim of improving interchange between bus and rail, as well as reducing road congestion. One of the key aspects of the plan is better public toilet facilities along with park-and-ride facilities in Farm Street, near the station. Unfortunately, new road building is also included in a linked Glasgow City Region city deal

£1.4m freight grant

Scottish Government awarded a £1.4 million freight facilities grant to improve rail access at Tarmac's Dunbar cement plant, next to the East Coast main line, 30 miles from Edinburgh

The £25 million fund is available to companies moving freight by rail or water rather than road

It is the first freight facilities grant for rail for years and fits in with the Scottish Government's recently published national transport strategy

Scottish high speed

Britain must develop high speed rail links between England and Scotland, according to lobby group Greengauge 21



Picture: WIKIPEDIA

Hornsea wind farm, being built by the Danish multinational company Orsted off the Yorkshire coast, is expected to become the largest offshore wind farm in the world

Wind farms' surplus electricity can make hydrogen

Surplus power from offshore wind farms can be used to run a network of electrolyzers to make hydrogen for trains and other vehicles, says the energy company Ryse. It has submitted a planning application to build an electrolyzer at Herne Bay, Kent, to supply power for London buses. It also wants to build electrolyzers in Aberdeen, Northern Ireland, Runcorn and South Wales. There are separate plans to use power from the world's largest offshore wind farm near Hornsea, Yorkshire, by another company, ITM Power, which is building a factory in Sheffield to make electrolyzers.

Hydrogen unsuitable for heavy freight trains

The Department for Transport's *Decarbonising Transport: Setting the Challenge* document published this year warns that hydrogen is not likely to be the answer for heavy freight trains. It concludes: "The challenge for rail freight is that current alternatives to overhead electrification, such as hydrogen and battery, do not have sufficient power to pull heavy freight trains."

The Railway Industry Association has also reminded the Government that while new technology can increase efficiency on branch lines, a rolling programme of electrification is the most effective solution for intensively used lines.

Can dual fuel offer a way forward?



By Graham Collett, vice-chair of Railfuture Yorkshire

Train operator Grand Central is planning a dual fuel operation – diesel plus liquefied natural gas. Grand Central managing director Richard McClean described the project at a video meeting of the Institution of Mechanical Engineers in May. Centred on Crofton depot in West Yorkshire, the project is being run jointly with the company G-volution, and is backed by the Rail Safety and Standards Board. One vehicle in a five-car class 180 diesel train has been fitted with LNG (methane) tanks next to a diesel tank.

Test results so far have shown fuel cost savings of around 20%, carbon dioxide reductions of between 25 and 40% and particulate reductions of 50% plus. A dual fuel engine is quieter and biogas is a possible future alternative to natural gas.

Grand Central's long-term preference is for a trimode – a replacement electric train with dual fuel plus battery – which can be acceptable for "last mile" operation. A 125 mph tri-mode multiple unit is not yet available, but it may appear as one of the new trains for the East Midlands franchise.

Diesel engines still power a third of all rolling stock and the engines on some diesel multiple units are based on designs from more than 30 years ago. It's a bonus that the vehicles have survived for so long compared to many road vehicles, which are consigned to the scrap heap after just a few years of operation but modern technology can bring more efficient operation.

A longer version of this article is planned to appear in the next issue of the Yorkshire Branch newsletter Yorkshire Rail Campaigner.

France backs trains

A £6 billion post-Covid package for Air France is conditional on limiting competition with rail services. Air France must not carry domestic passengers on flights lasting less than 2.5 hours where there is a rail alternative, said Finance Minister Bruno Le Maire

Flight shame

In 2003, there were 12 flights a day between Frankfurt and Cologne. Then a high speed line opened cutting train times from two hours to one. Now there are 0 flights. In 2019, there were 12 flights a day between Manchester and London

£20 to the Med

Regiojet has launched a £20 single ticket for its 450 mile rail service from Prague to the Croatian Mediterranean resort of Rijeka

£30m a day saving

California saved £32 million a day in the first weeks of its Covid-19 lockdown, because the number of car crashes and injuries was cut by half, according to a report by the Road Ecology Center at the University of California, Davis



Picture: SCOTRAIL

Bike carriage debuts on West Highland line

As more and more people switch to riding bikes, ScotRail is converting five of its single-car class 153 trains to carry bikes on the Glasgow to Fort William, Oban and Mallaig (West Highland) line. Each "active travel carriage" can carry up to 20 bikes, as well as skis, snowboards and large rucksacks. The livery, designed by Scottish artist Peter McDermott, includes Glenfinnan monument and viaduct, the Cuillin mountains on Skye, Ben Lomond, and the castle on Loch Awe. The artist said: "I hope the trains contribute to the very landscape we've all sought to interpret." The 153s will be coupled on to normal service trains and ScotRail managing director Alex Hynes said: "If the trial is successful, it could be emulated in other parts of the network." One campaigner commented: "Welcome back – the guard's van."

Cyclists using the new Hitachi inter-city trains on Great Western and London North Eastern have been less impressed. One said: "It's hell on earth. One bike does not fit in the bike space, never mind two. It feels like whoever designed it had never seen a bike before."

Greater Anglia has given more than 100 bikes abandoned at its stations to Colchester-based Re-Cycle, which repairs the bikes and sends them to rural communities in Zambia and Ghana. Many of the bikes come from Cambridge where the station's cycle point has parking space for 2,850 bikes.

The season ticket refund conundrum

Railfuture vice-president Paul Abell explores the small print of season ticket refunds

All credit to the railway industry for being so quick to announce that season ticket holders could apply for a refund of the unused portion of their tickets from 17 March, at the start of lockdown.

But unfortunately there is a sting in the tail, perhaps best illustrated by considering a Swindon-Paddington season ticket passenger expecting to claim back the unused two months on their annual ticket.

Such a person might well start off thinking that they would be refunded the remaining two-twelfths of the sum they paid in the first place (which would be £9,272 at current fares, but this includes the January increase).

10 months = Game Over

Sadly they are not going to see the £1,545.33 which results from this calculation (or even the £1,535.33 which remains after deducting the £10 administration fee). The Great Western Railway website explains that the refundable value is calculated over 40 weeks instead of 52 "because annual tickets offer significant savings compared to paying weekly or monthly".

At this point you should probably become resigned to not getting any refund at all, since the 10 months for which you have used your ticket exceeds the 40 weeks mentioned. The National Rail website confirms: "Because of the discounts on longer



Picture: SCOTRAIL

Good: Plenty of room on ScotRail's class 153s



Picture: RAY KING

Bad: Too tight on GWR's class 800

Chinese investment

Work has started on a new 220-mile-long high speed line, largely financed by the Chinese Exim bank, from Budapest to Belgrade. Much of the material for building the line will be coming on "silk road" freight trains from China



Map: M1AGG10N3

China buys Vossloh

The Vossloh Locomotive company, based in Kiel, was taken over in May by the Chinese company CRRC. Earlier Vossloh sold another part of its empire to Stadler

Heart of Wales hit

Through services on the Heart of Wales line were suspended in early July because of damage to a bridge which may take eight weeks to repair. Replacement buses were operating over the 65 miles from Llanelli to Llandrindod Wells

Russia lifts ban

More China-Europe freight trains are expected to operate after Russia lifted its ban on European food and agriculture products. Beef and salmon exporters are likely to benefit

term season tickets, refunds are not made pro rata to the periods before/after surrender and annual season tickets have no refund value after approximately 10 months."

9 months = Refund

Happily there is more hope for passengers who have only used their annual ticket for only nine months, explained in Section 40.3 in the National Rail Conditions of Travel (as amended from 4 December 2019): "The amount refunded will be based on the price paid for your season ticket less the cost of any season ticket(s) and additional tickets required to cover one return journey for each weekday that your season ticket was actually held for, and an administration charge (not to exceed £10)."

Nine months of travel between Swindon and Paddington would presumably be covered by a combination of a six months ticket (£5,340.70 at current fares) and a three-months ticket (£2,670.40). Deducting the combined £8,011.10 from the £9,272 paid would leave you expecting (hoping for?) a refund of around £1,260.90, though the actual sum would be slightly smaller because of the January fares increase and the £10 administration fee.

Do Swindon commuters get longer holidays?

Researching this article did raise an unexpected question for me. The Swindon annual ticket fare of £9,272 is 35.2 times the seven days fare of £263.50, while a passenger using an annual ticket to travel into Paddington from Reading pays a fare of £4,736, 39.9 times the seven days fare of £118.60. On the face of it, this suggests that the yield-pricing wizards who set fares think that Reading commuters will be travelling for nearly five weeks longer during the year than passengers from Swindon. To add insult to injury, we can expect that Reading passengers boarding a Paddington train in the morning will have significantly less chance of getting a seat

Anglo-Scottish agreement on need for Waverley line

The High Speed Rail Group has recommended that a new Anglo-Scottish line be built to solve capacity problems on the East and West Coast main lines. The report High-Speed Rail and Scotland suggests completing the Borders Railway from Galashiels to Carlisle. Campaign for Borders Rail chair Simon Walton said rebuilding the line all the way to Carlisle was more important than ever, and MSP for South Scotland Paul Wheelhouse (pictured) is looking forward to getting agreement from Scottish Government ministers on a feasibility study into reopening. Tweedbank to Carlisle is "unfinished business" which will bring great benefit to northern England, said Henri Murison, director of the Northern Powerhouse Partnership.

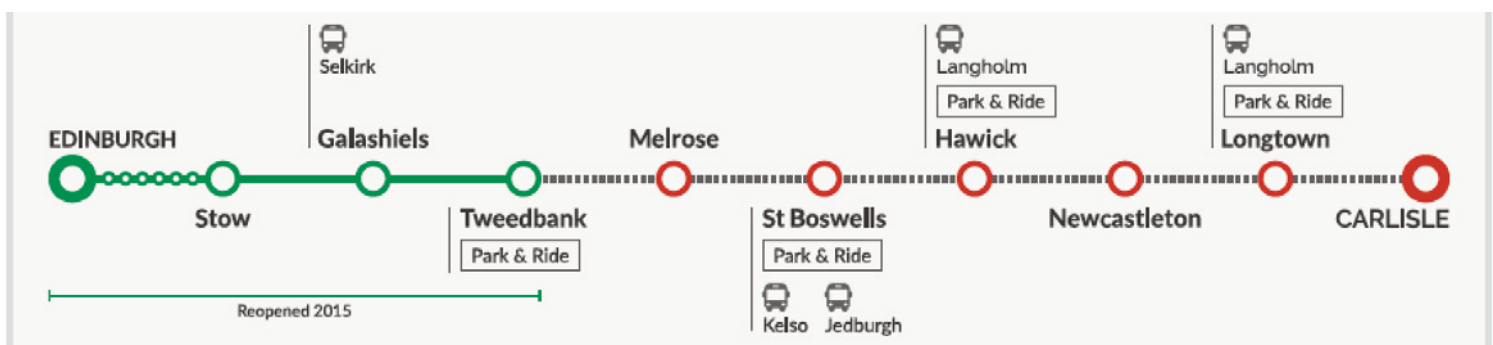


Railfuture's book gives details of the 400 stations and over 950km of new routes which have opened to passengers since 1960

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www.railfuture.org.uk/shop/books.php



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