In the third of our series, Paul Clifton looks at the prospects for the UK’s rail industry. The long-term aim of overcoming pollution needs to be put back on track in the wake of the Government’s ‘avoid public transport’ mid-pandemic advice.

The future of public mass transit services: Railways

The long-term view of the railway can be summed up in one word: decarbonisation. Being efficiently and sustainably green is public transport’s trump card. But, in the medium term, a second word should be added: uncertainty. And, short-term, consider the third confusion.

The coronavirus pandemic has, temporarily at least, swept the rug from under the industry’s feet. Government advice urging workers to travel by car rather than by public transport took the industry by surprise – to put it politely. Public transport and social distancing are mutually exclusive concepts. As long as passengers feel unsafe sitting next to strangers, our railways will struggle.

The franchising programme of the past 20 years is over. With working practices changing fundamentally and more people working from homes more often, demand for the traditional season ticket may never be restored. The fares structure, already cracking and creaking, has become untenable. Reform is not just essential; it is now inevitable.

Andrew Haines, chief executive of Network Rail, reflects on the impact of the pandemic, saying: “As a country, we will be in a radically different place economically. I think the case for change on the railway becomes even more powerful, unlocking the restrictions that franchising placed on us. We have to renew the way we run our railway.”

“Otherwise, we miss the fundamental opportunity this crisis gives. Alongside a lot of challenges and some really tragic loss of life, there is an opportunity to renew our railway, and we have to seize that.”

Nobody knows with any degree of certainty what the long-term effect of the Covid-19 lockdown might be on the shape of city centre employment. Or how many people will take advantage of less frequent commuting to further separate where they live from where they work.

“We didn’t go into this crisis with the greatest of reputations, did we?” Haines admits. “We went into it with passengers satisfaction static, but with train service performance deteriorating. The Treasury believed we were inefficient.”

“We had a franchising system that was broken. We had a level of service that was way below what it should be. Coming out of this, we have to resolve those issues.”

The requirement to decarbonise public transport remains high up the agenda. Largely unnoticed due to the pandemic, in spring the Department for Transport (DfT) published a report called Decarbonising Transport: Setting the Challenge.

While the UK has declared a climate emergency and signalled a date for the end of petrol and diesel car sales, the transport industry’s response has been patchy and inconsistent. However, new diesel trains are still being built, designed for a 30-year life extending long after the sale of new diesel cars has been banned.

This appears to contradict Government aspirations in its decarbonisation strategy which points towards electrification as a primary solution.

Sir Michael Hinton, rail consultant and previous holder of a string of the industry’s primary solutions, describes the report as a “remarkable statement of intent”, adding: “I think it is one of the most positive pieces of policy for the industry in recent years. It seems serious and it will lead the way to practical change.”

**Electrification**

When the power comes from renewable sources, electricity is the cleaned form of propulsion. It is readily available, although not necessarily in the quantities required. But the UK has already taken some way behind other countries when it comes to the electrification of its railways. The average across Europe is around 60%; the UK sits at 38%.

Dr Stuart Hillmansen, reader in Railway Traction Systems at Birmingham University, says: “The best way of powering dense services with high performance is electrification. That is a given. It connects trains to what is, in effect, a limitless source of energy. And it shifts decarbonisation into a different domain, so the rail industry can piggyback the National Grid’s decarbonisation plan.”

“There is a debate on the limit of electrification. It will go up quite significantly. But a lot of route miles will not have it. There needs to be a way of filling in the gaps.”

Alan Burnows, director of the Birmingham Centre for Railway Research and Education agrees.

“To electrify the whole network is unrealistic,” he says. “Public funding could not be justified. Nor are we going to close parts of the railway. So, as we look to decarbonise the railway, we need alternatives to diesel to fill in the gaps.”

The power issue has been complicated by the decision of several franchise operators to buy in more electric-diesel trains in large quantities, including the Government-owned LNER’s much heralded new Azuma stock. Such moves make the business case to electrify harder to justify. Nevertheless, the Government’s...
you can stick enough tanks on a train to get a decent day’s duty cycle.”

Using electrolysis to create green hydrogen requires a great deal of energy and is lost creating the hydrogen. More is used to compress it. It takes energy to get it onto a train. Then electricity is needed from the hydrogen in the fuel cell, feeding it into the traction system. Estimates vary from being two to three to four times the original energy during the process from source to point of use.

“But, if we produce the hydrogen from a green source—a wind turbine—then we can produce the electricity when the renewable sources comes,” says Hillmansen.

That might be in the morning in Scotland when it really is windy. You’re making hydrogen from a source that would otherwise have been thrown away. Using the fluctuations in renewables makes a lot of sense and gives a zero carbon route to portable fuel that can run all day.”

More than four-in-five British people live in urban areas. Making transport sustainable within and between cities is the primary goal. When it comes to powering both road and rail vehicles into more isolated communities, is it reasonable for diesel to remain in operation? Batteries are going to develop incrementally over 10-15 years. The charge won’t be massive. So, it is unlikely that battery trains will be able to operate on extended routes. They won’t run to Fishguard, for example. Hydrogen takes less space. Maybe 10 times more volume is required to store it compared with diesel. But on some routes, you may need the windows to be as socially unacceptable as lighting a cigarette in public.

The cheapest alternative is grey or blue hydrogen. Globally, almost all commercial hydrogen production is from fossil fuels. - 74% comes from natural gas and 23% from coal (mainly in China). For each tonne of hydrogen from these two sources, nine-12 tonnes of CO2 are released.

A train powered by hydrogen is viable, according to the Birmingham Centre for Railway Research and Education. Working with rolling stock leasing company Porterbrook, it unveiled a converted Class 319 ‘Hydroflex’ last year. Now it is working towards trials on the main line.

“Diesel is brilliant in terms of how much energy it stores per kilogramme,” says Hillmansen. “You just need a ‘bucket’ to hold it. To carry energy as hydrogen is more complicated. But we think hydrogen fuel cells are better than batteries. If you want a battery train to do a significant mileage, you end up with a train that is mostly battery. There wouldn’t be room for much else.”

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So, freight and the supply chain are not pretending this is a privatised railway. Anyway. Just not all at once. And we can no longer need to keep making it.

Because of reduced passenger demand, the case for electrification is harder to make. The immediate future for rail is dire. Whether the Treasury will be content to give rail such a favourable deal for a year or more remains to be seen. It will be concerning the huge cost.

Beyond that, in recovery, there will be a big push for improvements in rail. Hopwood adds: “There are three reasons why people travel by train – business, commuting and leisure. I don’t think we will return to the normal of pre-COVID. On long-distance or mainline services, there will be a huge demand from the leisure market, because people want to visit friends and family. But, for commuting and business travel, there will be changes. In some ways that could benefit the railway. We may need fewer trains that only run once in the morning peak and once in the evening, and which aren’t required for the rest of the day.”

Season ticket sales had already been declining, and now half the economy is working from home with no sign of this changing in the short term. It requires, according to RDG’s Bagnall, a wholesale rethink of the regulatory system that underpins the fares structure.

“We can now create pay-as-you-go urban areas, with a weekly price cap to protect passengers,” he says. “And, on long-distance services, we can remove the artificial peak and off-peak boundary that creates crowding on the first shoulder peak-train.”

Govia Thameslink White says: “This pandemic has shown that working from home can be highly efficient. Some companies, such as Twitter, have already said they will never require staff to go back to a central place of work.”

“Public transport helps to level up society. Lots of lower-paid people do not have cars. We have seen in the post-lockdown return of traffic, the first people coming back on the trains are on the inner suburban services. People doing jobs that cannot be done from home. If you give the railway a post-Covid role to level up society, you have huge flexibility and smart ticketing solutions to a population that may now have different travel demands.”

As more people work from home the demand for season tickets is expected to decline

The country has yet to learn how to spread demand to better match capacity. There is still a rush hour, and it still causes difficulties.

“When Amazon delivers to you, it gives you a time slot,” says White. “When you go to your local supermarket, you look for a period when the queue is short. Management of demand will be important for the foreseeable future. Employers and schools need to think more flexibly about their start and finish times to avoid the saturation in the morning that was the previous norm. There is mutual benefit to the Treasury and to passengers. If we can improve demand management across the industry, will people travel less? Or will commuters take advantage of travelling only two or three days a week, and swap their small, expensive urban homes for something more leafy further afield?”

“We don’t have the data yet,” says Holden, “but there will be an argument that many lives have been saved through reduced pollution worldwide than lost through coronavirus. There will be a lot of pressure for a reduction in travel. Rail will benefit from the decarbonisation agenda. But it will take a year before people will happily travel on a crowded train. Things will get worse before they get better, and a lot of people will buy a car, instead of the season ticket.”

Asal’s Whistle strikes a more optimistic note. “There is never going to be a better time for rail than now. Coming after Covid, the mood music of the whole world is to move to a greener type of economy. If we can’t make the argument for mass transit and rail freight now, then we never will. The desire to make transport more sustainable is there.”

Bagnall adds: “A lower level of car use has given people a glimpse of a world with fewer carbon emissions, I think that could play into our strengths. The need for reform is greater than the size of the crisis than it was beforehand.”

Economic recovery will be measured not in months, but by years. Unemployment will rise and investment will fall. The changes will still where people choose to live and work. They will define decades.

“We must hope the Government will want to come out of this with a long-term strategy,” concludes Haines. “There is always risk that in 2020 we will repeat the mistakes of 1930. At that point, politically, we forgot about climate change, because we were facing a financial challenge, and we lost most of a decade of climate change mitigation. If you’re going to decarbonise the railway by 2050, the only remotely affordable or tolerable way to do that is to start sooner rather than later. If you miss out now, the opportunity cost will be massive, both in terms of supply chain efficiency and disruption to the railway. Now is the time to be demanding innovation and meaningful action.”

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Almost all commercial hydrogen is from fossil fuels – 76% comes from natural gas and 23% from coal

CONTRIBUTORS

IN-MOTION: ROB WILCOX

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