

Rail strategies for 2040 carbon neutral operations

Strategies to meet the vision for carbon neutral rail operations in Britain by 2040 are being developed by industry suppliers and operators. In this review FCP evaluates progress since our previous media news report “Hydrogen Powered Trains are a Reality” in May 2018.

Significant network electrification will be a key part in delivering the strategy, considering both the removal of emissions from the use of diesel-powered trains and the offset effect of regenerative braking where power can be returned to the system supplying traction current.

The business case for electrification has been greatly improved after an investigation by the Rail Industries Association (RIA) to understand the reasons for the three-fold cost over-run in wiring the Great Western Railway routes and the measures needed to prevent a recurrence.

The cost escalation resulted in the Government taking the view that electrification had become unaffordable with the work costing £3 million per single track kilometre (stk) compared to earlier projects where the price had been below £1 million per stk. As a result, plans to electrify the Midland Main Line to Nottingham / Sheffield, the Great Western Main Line through South Wales onto Swansea, the Windermere branch and the new East – West Railway were all negatively impacted and ultimately dropped (although in some cases there were other weaknesses in the business cases as well).

Suppliers of electrification systems represented by the RIA believe many of the pitfalls that caused the cost escalation can be avoided in future. For the GW routes there was a lack of clarity about whether the line speed would be 140mph or 125mph, and the factory train installation method resulted in an inability to install masts at the required rate, in part because of an unnecessary piling depth.

The specification for catenary structure clearance for multi-pantograph operation was also unclear as a result of a new European TSI and no attempt was made to identify mitigations to make clearance alterations to save money.



Electrification of the re-opened Airdrie – Bathgate route in Scotland in 2011 was achieved at a cost of £0.6 million per single track kilometre

In future there will be no necessity for Network Rail to undertake every project as the Market-Led investment initiative which FCP researched and recommended for the Department for Transport, will allow contractors to offer cheaper fixed price contracts. For example, this was proposed by Hull Trains for the installation of wiring between Hull and the East Coast Main Line at Temple Hirst Junction, where a fixed price cost was negotiated with Amey which produced a favourable return based on the elimination of diesel-powered mileage for trains operating on the route.

There could be many more projects of this type with the potential to be privately funded, where the reduced cost of operations provides the headroom to meet capital charges while maintaining the existing regulatory tariff levels for the use of traction current.

Areas of the network will remain where the density of services cannot produce an acceptable business case for electrification and for these lines the prospect of eliminating the use of diesel power is firmly focussed on new technologies, in particular the use of hydrogen cells to maintain battery power over the distances required.

Each of the leading rolling stock leasing companies are engaged in trials. As an example, Eversholt Rail is seeking to re-purpose the Class 321 rolling stock fleet by working with Alstom to apply the hydrogen cell technology that is in use on regional routes in Germany. The trains marketed as “Breeze units” are expected to be ready for service in 2021, with priority being given to use where pollution levels exceed European legal limits such as the low-level platforms at Birmingham New Street.



The proposed appearance of the converted Class 321 multiple unit. Gauge restriction in the UK means that hydrogen cells will be located within the body structure of the vehicle rather than on the roof as in Europe

Meanwhile the Porterbrook leasing company and the University of Birmingham's Centre for Railway Research and Education have announced that its prototype HydroFLEX train will be tested on the mainline railway following successful proof-of-concept trials using a test track. The project involves fitting a hydrogen powerpack to an existing Class 319 train so it can run on conventional electrified routes as well as independently. The pilot project involves a zero-carbon emission propulsion system.



Main line certification is to be progressed for the Porterbrook / Birmingham University HydroFLEX Class 319 multiple unit conversion illustrated above after a successful period of test track running

The carbon neutral haulage of heavy freight trains which typically exceed 2,000 tonnes gross trailing weight will require a significant enhancement of current plans to electrify the Strategic Freight Network. There is considerable scope for a regenerative offset to meet the carbon deficit of diesel-powered movement to terminals, but it is likely that this will need to be confined to short distance working using conventional bi-mode traction.

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