

Battery train experience building

Analysis of Hitachi's experimental replacement of one of the MTU diesel Generator Units (GU) on a TransPennine Express Class 802 bi-mode with a battery, meant that I had to get up to speed on issues like battery capacity, weight, range and charging techniques. How this involved finding out the electricity consumption of a typical house is explained in the column.

Anyway, after a lot of back of the envelope design, I got a range for an all-battery-powered Class 80x Battery Electric Multiple Unit (BEMU) a little over the figure quoted by Hitachi, and I expect they were being a bit conservative.

However, this also explained why Hitachi's previous deal, announced in November 2021, for a similar trial replacing one of the GUs on a Great Western 5-car Class 802, was binned. As GW Managing Director Mark Hopwood explained to Modern Railways in August 2023, it transpired that battery traction 'would not be useful to GWR' – hence the transfer of the trial to TransPennine.

Once away from the wires, the multiple station stops en route to Penzance, each requiring acceleration back to linespeed, could have drained the battery before journey's end. The shorter TransPennine route will provide a much more practical, and less mission critical, test route.

But, overall maximum kudos to Hitachi for investing £15m in doing something practical with batteries rather than talking a good game. There are lots of 'battery trains' around, but nothing on the scale of the Class 802, where the battery is going to have to cope with very high discharge rates for prolonged periods.

Hitachi tell me that the vehicle will be able to regenerate, braking energy into the battery and also recharge when running under the wires – although this is likely to be more of a trickle compared with the 2 MegaWatts from the static battery banks which provide power for GWR's Vivarail fast charge BEMU.

At first sight, charging the traction battery in a BEMU from the 25kV Overhead Line Equipment (OLE) seems such a simple concept as to not need further consideration. But when Eversholt was looking to convert the Class 321 Renatus to a BEMU, it emerged that recharging on the move would be restricted to when the train was coasting, because of the limit on current through the pantograph and transformer.

Of course, you would design a new train with the necessary capacity to handle recharging while under power, including a bigger and heavier transformer. But would the OLE power supply be able to cope? Even the simplest things can be difficult. But, see later.

Meanwhile, on Sunday 30 June, the GWR Fast Charge battery train, ran an all-day trial on the Greenford Branch – a total of 28 round trips. The aim was to see how the performance of the train and the fast charger at West Ealing Station Platform 5 compared with the computer modelled/predicted behaviour. The system performed as expected, with the charging system filling the train with the same energy used for the return trip. According to Informed Sources it was all 'boringly reliable'.

Siemens goes full discontinuous

Perhaps feeling left out of the emerging battery bubble, Siemens opened a new front in June, offering reduced-cost rail decarbonisation through a combination of BEMUs and discontinuous electrification.

Personally, I regard promotion of discontinuous electrification as handing the Department of Transport a new strain of bionic duckweed. When electrification has already lost momentum, discontinuous electrification gives DfT civil servants and their Ministers, not to mention the Treasury, an attractive way out of facing up to the need for a rolling programme.

It was, in retrospect, clearly a mistake for the industry to jump on Rail Minister Jo Johnson's off-the-cuff

challenge to remove diesel-only traction from 2040 as an opportunity to promote an electrification programme. The resulting 2019 response on 'how the rail industry will decarbonise', put electrification in a box of options labelled 'decarbonisation' rather than 'better railway'.

Since then, the mood music has changed and, at industry electrification conferences, this column's mantra 'an electric railway is a better railway however you define 'better', is quoted regularly. Reduced emissions are, of course just one of the 'betters', but some way down the list.

Having established where I am coming from, in the column I analyse Siemens' proposal that, away from the wires, BEMUs, would recharge their batteries at intervals from 'small sections' of OLE at key points on route. These would be fed by fast-charging sub-stations supplied from the domestic grid via Siemens' innovative Rail Charging Converters (RCCs).

Potential operators of this BEMU/discontinuous electrification combo 'within the next decade' are listed as Chiltern, Great Western, Northern, ScotRail, TransPennine Express, Transport for Wales plus East-West Rail.

My standard route when it comes to getting rid of diesel traction is the Far North Line from Inverness to Wick. As with Hitachi, Siemens also claims commercial confidentiality when it comes to the capacity of their battery.

Working round this, I reckon two sections of OLE would be needed for the Inverness-Wick line, representing 18% of the route. This is bang in the middle of Siemens quoted typical '15-20%' of route miles for its proposal.

Clearly, the concept is both deliverable and doable. But is it realistic? Well, in the case of the Far North Line I estimate you are looking at spending over £50 million to save 5 tonnes of CO2 from the current four diesel trains a day each-way.

That much money spent as part of a rolling electrification programme – Julian Worth's freight in-fills, for example, would give a far greater benefit, including decarbonisation.

Of course, the Far North Line is an extreme example, and in the column I look at some the other potential operators mentioned by Siemens.

As reported last month, Chiltern's new train aspirations include BEMUs. Some quick sums suggest that a single length of discontinuous electrification would probably make Marylebone-Moore Street a feasible application.

But, 20 minutes charging time at 75 mile/h, increases the length of OLE required to 80 single track km. While writing this piece, the thought 'business case' kept nagging away in the background.

That, plus the likelihood that Government would ever provide funding for both a mainline electrification programme and discontinuous electrification at the same time. It may be heretical, but while you are rolling out the wires on the un-electrified main trunk routes, the emissions from DMUs on secondary lines will be insignificant both in global terms and when compared with the much greater reduction from more electric passenger and freight traction replacing main-line diesel mileage.

Discontinuous electrification's time will come when main line electrification reaches the limits of affordability. Then BEMUs could ensure that those travelling beyond the electrified network can enjoy all the 'betters' of the electric railway.

Roger Ford