FUTURE FUELS

ELECTRIC ROAD SYSTEMS ERS

Determined to raise the level of debate around which fuels will power transportation in the not-too-distant future, Jorgen Pedersen (SYSTRA Transport Technologies) delves into more future fuels and asks if electric road systems can or should be used to help meet our Net Zero goals.

Find out more at www.systra.com/uk/services/future-mobility/

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Electric Road Systems ERS

My first foray into Electric Road Systems was when I was about four years old and my father came home with a huge Scalextric kit. But it wasn't until I reached the dizzying age of about twelve that I was first allowed to physically control a car, and it wasn't until much later that I realised the same technology could be used to solve some of our future transport issues.

But the questions that we need to ask are:

A.
What are real world viable Electric Road Systems?

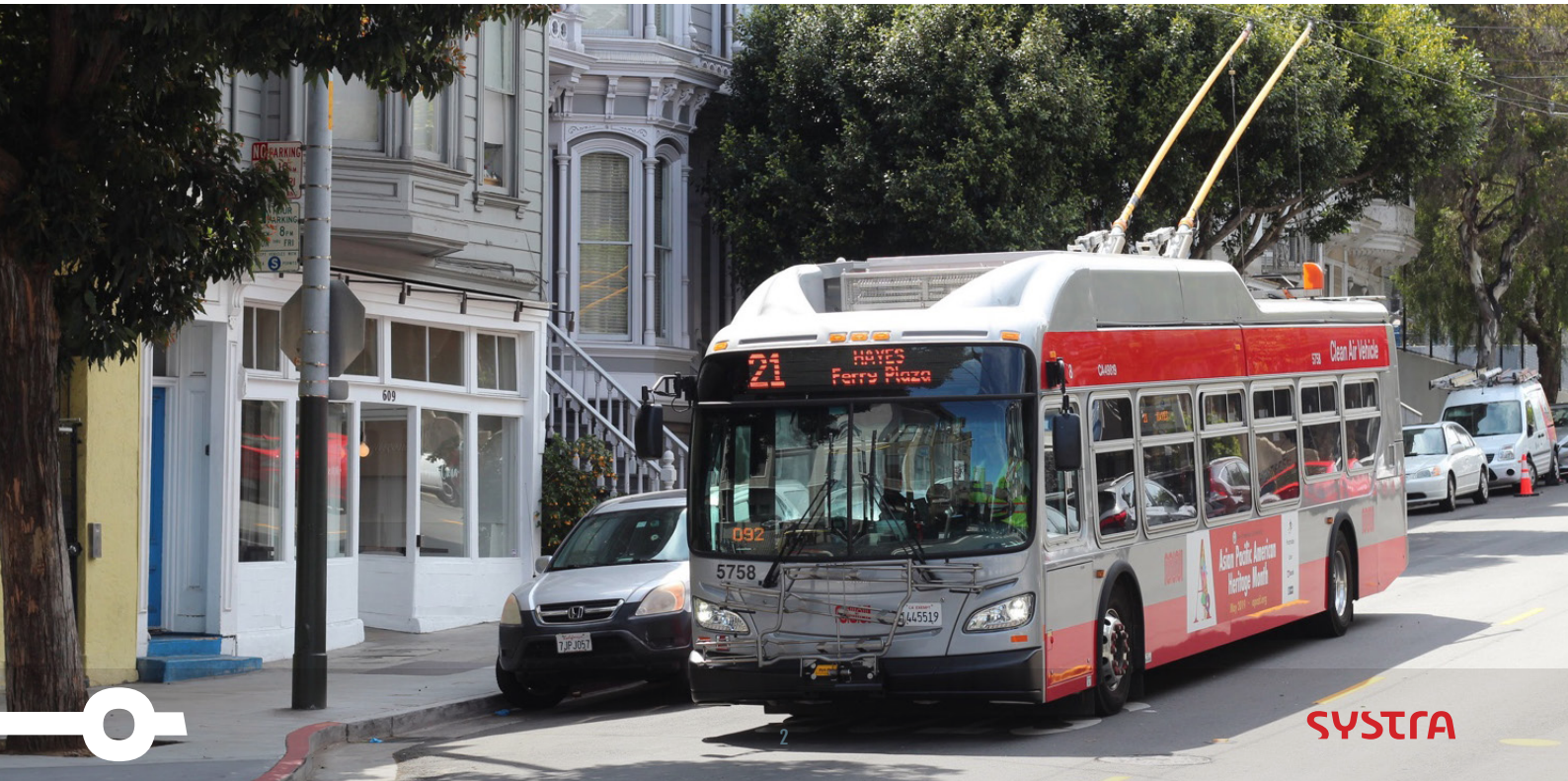
B.
Is there a place for them in the changing landscape of transport?

C.
When could such technology be introduced?

We will tackle the first and last questions first. Viable ERS systems already exist and have existed for years, they have primarily been used for fixed route transit services and were developed by Dr. Siemens in the 1880's, who went on to build the Siemens AG empire. He developed the Elektromote in 1882, which went into passenger service in 1901 in Konigstein-Bad, Germany. However, this was marginally beaten by the first identified passenger service trolleybus that was made available during the 1900 Paris Exhibition and developed by Louis Lombard-Gérin.

I was lucky enough to have worked out in California for many years and spent a period of time in and around San Francisco, where since 1941 Muni has run a fleet of electric buses (Trolleybuses) powered by catenary cables. As per the picture provided these are electric powered buses with long collector poles which make it possible to navigate parked or stalled vehicles.

And of course, we are all aware that a huge proportion of our rail, Light Rail and Metro systems are electrified using catenary cables and pantographs, or through additional current-carrying rails and pickups.



At present there are three main contenders for viable ERS solutions for roads, these are:

Catenary cables and collectors

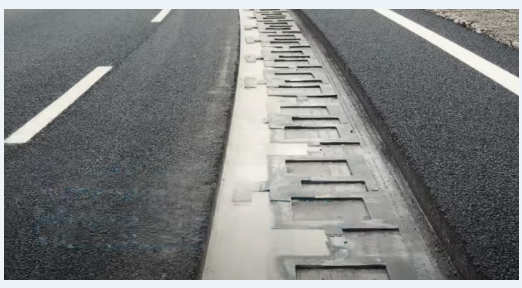
This technology is for road-based solutions and is mainly being promoted by Siemens AG and is called Siemens eHighway. The Siemens solution relies on hybrid vehicles being able to auto connect and disconnect from the catenaries and transition to alternative fuels in order to continue their onward journeys. At present there have been trials conducted in Germany, Sweden, and America as well as a green light being given for a UK based trial along a 20Km stretch of road near Scunthorpe, which was won by a Costain consortium with Siemens as a primary partner.

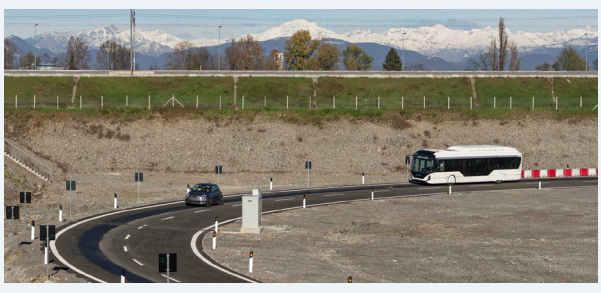
Hot rail systems

As with Catenary cables and pantographs, hot rail systems are a direct descendent of electrified railway systems, or Scalextric tracks if you prefer. In most cases they require conductive tracks to be embedded in the tarmac or concrete which act as supply and return for the electric current that is made available to vehicles by way of shoes/pick-ups, which can be easily detached as a vehicle reaches the end of the track, or to transition to alternative fuels to continue their journeys. For these type applications, in most cases the rails are positioned in such a way as to inhibit the ability to touch these rails by mistake.

En-Route Inducted loop Technology

This is the latest type of technology being proposed, where essentially a sequence of conductive loops are embedded in the road surface to supply energy. One such organisation Stellantis, parent company of Fiat, Chrysler, Dodge, Chrysler, Jeep, Opel, Peugeot, Ram, Maserati etc, is pioneering a direct drive solution conductive loop solution. A 1Km test track has been developed just outside of Milan that has demonstrated this technology – see pictures below.





UNDER THE ASPHALT, THE DWPT SYSTEM HAS A SERIES OF INDUCTIVE CHARGING COILS – STELLANTIS

The arguments for and against

While the rest of Western Europe has largely responded much faster, Electrification of the UK rail system has been slow by comparison, to date only 38% of the national network has been electrified equating to about 3800 miles. England's SRN (Strategic Road Network) is approximately 4550 miles long and equates to just 2.4% of the road network, if we increased this to also include A classification roads which equates to 9.6% of the nation's network that would add a further 18,200 miles of road, all of which may need electrification. However, perhaps an alternative approach could be to concentrate on high-volume freight trunk routes, such as the A14 (serving Felixstowe), the M6 and the M42 (serving the midlands) just these routes could significantly improve our collective carbon footprint, and with government commitment these could be implemented relatively quickly. The benefit is that with dual fuelled vehicles the network could continuously be expanded as time, money, and freight transport requirements evolved.

The case of hot rail systems

At least to me seems problematic from a health and safety point of view. I'd expect that any embedded rail might be subject to environmental conditions such as rain, snow, ice etc, and therefore maintenance might also be problematic. That said I'm sure that those considerations could be overcome with technology such as in-ground pavement heaters, and even technology to clear the rails from debris using in-vehicle compressed air etc. but that's very theoretical, but this will also add to implementation and operations costs not to mention the possible carbon impact..

Inductive loop technology

This perhaps the less obviously invasive, it also offers the least mature technology. The question is can it be made financially viable? Even Stellantis when they installed this technology at their test track alluded to the high installation costs, but as with anything those costs would likely reduce as demand increases. However, the idea of 1000's of miles worth of energy emitting coils doesn't exactly fill me with excitement, and one has to wonder if this would become a health issue over time, or even in the short term to those who have pacemakers, or implanted cardioverter-defibrillators, or other such medical devices. But it does provide probably the least obtrusive, and possibly the easiest to install and maintain option that is currently available.

How much energy would such systems need

And what would be the impact of any of these technologies on our national grid needs? What would be the carbon impact of needing to build a number of new power stations to accommodate these types of systems, and the impact of building and maintaining +10,000 miles of additional infrastructure, just at a time when the UK needs to reduce our large-scale infrastructure budgets?

I think it is fair to say from the examples provided, with the possible exception of inductive loop technology, the technology for these systems and therefore the implementation path for these technologies is already available and could be implemented at any time. Induction loop technology clearly works, in my view, and depending on the lifespan of a coil, it would be better if there was a way of being able to remove a faulty coil quickly without the need for major road works, but I'm confident a solution could be found to enable this.

In conclusion

I am a bit of a sceptic for the large-scale roll-out of these technologies but do fully believe such systems do have a place in our future transport landscape, particularly where there is a high volume of freight movement for example port to Distribution hub movements. However, in the UK, we are apparently struggling to make the case to electrify the more obviously areas of the network, such as lines and links to key freight hubs. So, its puzzling to me how we could make a more compelling case for electrification of any significant amount of our road network prior to achieving these even quicker wins.

Therefore, I need a little more persuading that the cost (financial and carbon) to implement these types of systems needs a little more scrutiny before we jump in.

"My objective in writing this series is to stimulate a healthy debate on how we should approach future fuels and technologies, and perhaps be a little more open minded to the opportunity for alternative options to those that are currently being presented to us. I welcome your views, including those which are at odds to mine, it is only through healthy debate and scientific investigation that we will make the right decisions to reach net zero."

SYSTRA

Find out how SYSTRA can assist you in Future Fuels:

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