Light Rail (UK) Group

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Hydrogen Trams as a Service *v..21*

"The Infrastructure that Pays!"

Podcast @
https://www.railindustryconnect.co.uk/rail-industry-connected-hydrogen-trams-as-a-service-with-jim-harkins-light-rail-uk/

Light Rail UK Group believes in the proven success of current UK tramways and the alignment of the marching development of science technology in the Hydrogen field driven by Climate Change demands.

But why do Hydrogen Trams as a Service?

A summary of some significant benefits:

1. The benefits of Light Rail & VLR when combined with the emerging low cost benefits of the Hydrogen Industry point to a significant game changing outcome.
2. Within our consortium we can supply funding loan for infrastructure, vehicles, and legislation to be repaid over an agreed term, 25 years+. A H2 volume rebate is envisaged to cover the funding loan.
3. A design and build team will work with the client as in house or as DBOM type partnership.
4. A possible matched Hydrogen plant investment dowry circa £11M.
5. Establish a Tram vehicle assembly factory for domestic and European export.
6. We have a range of game changing Hydrogen Products such as Tritonex Hydrogen Barrier System, the only coating in the world that creates a 100% isolation barrier between hydrogen gas and the substrate easing transportation, storage, traction, and distribution. Tritonor.
7. A "cold process" of tip site plastic recovery and anaerobic food waste conversion and blending to high quality green Hydrogen.
8. A low cost supply of green hydrogen for either on board the tram or supplied by traditional overhead line.
9. A secure, local energy source in each city, isolated from foreign pressures and conflicts.
10. A standard vehicle pump fuelling facility for use with domestic rubber wheeled municipal vehicles including bus fleets.
11. There will be two major biproducts producing a significant source of revenue and climate change materials. :-

CO2 (carbon dioxide)
High purity premium CO2 is produced which we will then sell to the Food, Beverage. Another major and ever-growing market for CO2 is water and waste water treatment where it is used for pH control and remineralization.

Biochar
Biochar Carbon Removal falls into the category of carbon dioxide removal (CDR) technologies. This carbon dioxide is stabilised within the biochar during the production process. It is considered to be a rapidly implemented and capital-efficient negative emissions technology ideal for smaller scale installations such as farmers, local production plants. This carbon dioxide is stabilised within the biochar during the production process and can after being stored for several hundreds or thousands of years and now can be a practical climate change choice as a Carbon Sink, i.e., carbon capture and storage solution.

The profits from these two bi products will enable a percentage per kilo rebate to be given to the Municipality's "Common Good Fund" to initially pay off the Infrastructure loan and then other municipal projects.

This package is greatly enhanced when used with VLR vehicles with less than 10 tonnes axle weight. There is a widespread recognition within the UK and Internationally of the benefits and soft benefits of trams as an environmentally friendly form of sustainable mass transit outweigh most tried unsuccessfully so far.
By combining both generous benefits, we can achieve a win-win outcome.
On average there is a modal switch of 25% - 32% resulting in lower road mileage with resultant cleaner air,

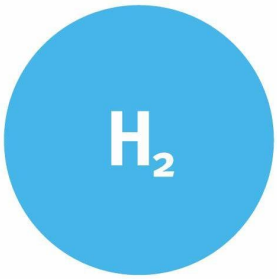
Nottingham does not need LEZs etc., along the line of tram routes.

Hydrogen Trams as a Service. ***"The Infrastructure that Pays!"***

At Light Rail (UK), we have developed a Consortium Package, "Hydrogen Trams as a Service" (HTaaS), using the Triton Family of related Hydrogen products and others as follows:-

1) To eliminate leakage including under pressure up to 100 Bars, Tritonex Barrier Coating System can be applied to new or existing infrastructure and forms an impermeable seal to the surface, preventing permeation and embrittlement. ISO 17081:2014 at 0% permeation and is the final and missing piece to allow storage and transport of hydrogen gas without leakage and embrittlement.
2) A "Cold Process Plant" for extracting from tip sites materials such plastic bottles, ideal where a simple deposit system can be set up locally and extracting from food waste using Anerobic Digesters which produce Bio Methane to produce purple hydrogen.
3) There is a significant volume of CO2 as a bi product which can be sold to the drinks industry amongst others where there is a shortage of supply. The "Cold Process" (subject to NDA) hydrogen plant when operational will be able to fuel in-house hydrogen road fleet vehicles as well.
4) As part of the "Infrastructure that Pays" package there will be a social percentage dividend paid to the Municipality dependent on volumes of feed stocks supplied
5) The Hydrogen fuel costs of 1 & 2 would be approximately circa $10 per litre which can be delivered to the trams either by OHLE or to on board systems.
6) Using self-powered, battery only or battery-dominant hydrogen/electric propulsion system provides up to 20 hours per day of passenger service with no wayside power infrastructure <u>of any kind.</u>
7) Surplus products can be stored in Tritonex tanks or off site in former coal gas gasometers where available.
8) Once per day the batteries are charged and balanced and the on-board generator, if any, is refueled. Battery charging equipment is carried on-board the vehicle and each night the vehicle is simply plugged in using the supplied high-voltage charge cord.
9) Using TIG/m Hydrogen Trams which are built to standard gauge and because the tracks with the exception of points, is not electrified all aspects of its design, installation, and maintainance are simplified and are significantly less costly.
10) TIG/m trams are designed, manufactured, and tested to follow international Light Rail Standards. Passengers, owners, and Operators are protected by compliance with EN 50126,8,and 9 as well as all other applicable railway safety standards and are updated regularly.

11) It is to be noted that there are Middle East developers who will fund the Infrastructure etc., cognisant of the success of the hydrogen tram in Doha, Qatar have been involved in our proposed first two lines and have done a satisfactory "Brown Field " assessment along the line of routes with significant investment development.
12) This will be funded by an operational Hydrogen consumption rebate over 25 years +.
13) Costings from TiGM on the Doha Project came in at less than £10M per track Km.
14) Political issues that need adjusting and will make this project quicker and easier are the "Treasury's Green Book" for a level playing field of infrastructure cost spreading and the adaption of the Oil & Gas legislation to ensure continuity of skills base etc., reducing redundancy and providing a train workforce for this emerging and replacement industry.
15) The use of Very Light Rail (VLR) as developed in Coventry and BCIMO anticipate costs of <£10M per track Km.



Current Political Statement from the Labour Government

"The Rail and Urban Transport Review,"
Commissioned by the Labour Party while in opposition in December 2023, has now published its recommendations to accelerate the huge benefits that rail and urban transport infrastructure unlocks.

The independent Review is led by Juergen Maier CBE, former Siemens CEO and guided by an Expert Panel from across the industry. Secretariat support is provided by the Urban Transport Group, with expertise and thought leadership support from Arup.
Evidence from across the transport industry has been distilled into five themes with policy recommendations designed to reignite the private public sector relationship and significantly reduce project delivery timelines and costs.

Industry heavyweight Juergen Maier CBE has today announced the publication of the "Rail and Urban Transport Review," an ambitious report setting out a bold vision and plan for the future of the UK's rail and urban transport infrastructure, emphasising the need for a paradigm shift to create a more connected, affordable, and high-capacity transport network.

1. A Bold Long-term Vision and Ambition for Transport Infrastructure: An ambitious national transport strategy to increase journeys by public transport, walking, and cycling by 2035, and to double the mode share of rail within a decade.

2. Accelerating Delivery of Transport Infrastructure Across the Nation: Proposing a "Greener, Faster, Cheaper" framework, the review suggests reducing project delivery costs by 20% and timelines by 25%. Catalysing growth by building on the progress of English devolution.
3. Harnessing the Benefits of Public-Private Partnerships: Recognising the essential role of private investment, the review recommends developing an infrastructure investment playbook to facilitate public-private partnerships. A HM Treasury should support this to develop a new approach to private finance.
4. Getting the Structure Right for Delivery Now and in the Future: A clear, long-term national transport strategy aligned with the UK's industrial strategy and housing delivery. This includes reforms to planning processes and enhancing the role of local authorities in delivering transport infrastructure.
5. The Voice of Britain's Transport Users and Workforce at the Heart of Transport Plans: Emphasising the importance of user and workforce engagement, the review calls for greater involvement of trade unions and underrepresented groups to ensure inclusive and effective infrastructure development.

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Louise Haigh MP, stated:

"14 years of Conservative government left the public sick and tired of broken promises on transport infrastructure.

"This independent expert-led review provides a comprehensive assessment of the challenges and opportunities we face in delivering transport infrastructure in Britain and will help inform this new Government's thinking.

"We are clear that we will deliver value for the taxpayer while turbocharging delivery of transport projects. That's how you grow the economy in every corner of the country and deliver the transport network that modern Britain needs."

Courtesy of –

The Urban Transport Group

The Urban Transport Group is the UK's network of transport authorities with a vision for city-regions, their towns, and surrounding areas to be green, fair, healthy, and prosperous places, with public transport and active travel options that provides access for all. UTG's members serve over 30 million people across all four nations of the UK.

About the Rail and Urban Transport Review

The independent Rail and Urban Transport Review was established in December 2023 by the Labour Party while in opposition.

The Review is led by Juergen Maier CBE, former Siemens CEO, with Secretariat support from the Urban Transport Group and expertise from Arup

So, Minister Louise Haigh MP, here is the tool for the job as outlined in this Paper,
for your perusal!
(A challenge from Light Rail UK Group!)

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Hydrogen Buses

We support electric/hydrogen buses which are an integral part of a multi-modal transports system, bearing in mind that rubber wheeled vehicles of all kinds remain a source of significant local particulates & heavy metals pollution (NEE) arising from the friction between tyres and road surfaces. Steel wheels running on steel rails create zero emissions at point of use and can be refueled locally.

Warrington's Own Buses will benefit from an affordable pump style hydrogen gas from the production source, enhancing the rebate.

Trams are fully accessible to all residents and visitors including those with reduced mobility to all including Tram and shared Bus stops, Public Transport Pathways (PTP). Be mindful that we have an ageing population, and the network will be fully accessible, easy to understand and use successfully to supply the last/first mile door to door connectivity support to planned Heavy Rail upgrades.

A Tram Network will provide access to employment including industrial and logistics sites,
Provision of cleaner air to schools and hospitals Sports & leisure including several stadia Heritage and tourism. A "Rochdale Pattern" of transit behaviour, "Hop on, Hop Off" supporting the 15 minute neighbourhood concept.
Provide fixed links to other modes without building more unsuitable and unsustainable roads with new but smaller housing estates. Infilling
For public transport to become a force in dealing with urban congestion, carbon reduction, improving air quality and to be an attractive alternative to the car, it must be built quickly and run affordably.
The working life of a tram system is 145 years and rising.

Tram systems have a proven history, growing the public transport market, creating modal shift in some cases as high as 32% but no less than 20%+, high passenger satisfaction.
Supporting regeneration , renewal, and inward regeneration. Can be used to re-engineer city districts. Aiding in the creation of new urban frameworks. Re-developments include denser housing without parking spaces.

Very Light Rail (VLR) Trams are an extremely green mode of transport and support fuel security including locally produced electricity. Coventry and others with minimum utilities disturbance cost less than £10M per KM. Will drastically reduce the nations carbon footprint, reducing the need for local LEZ, CAZ, and other costly monitoring systems.
These are some of the benefits to a City which unfortunately HM Treasury's "Green Book" unlike many European Governments, disallow monetising most soft benefits included in the "Business Plan to the detriment of the national wealth generation.

The major unseen pollution and health threat from rubber wheeled transport, all modes.

Doctors writing in the International Journal of Public Health want the limits met by the end of the decade, but the European parliament wants to wait till 2035, the European Commission wants to set weaker limits for 2030 without setting a date to align with the WHO, and the European Council wants to let poorer countries wait till 2040.
"Every year of delay of reaching limit values directly translates into more death and disease," said Barbara Hoffman, the chair of the European Respiratory Society (ERS) advocacy council and head of environmental epidemiology at Heinrich Heine University in Düsseldorf. Hoffman and colleagues from several public

health institutes found that 330,000 more people would die early if EU member states with fine particulate levels greater than 10 micrograms per cubic metre were to delay bringing their pollution down to that level by a decade from 2030 to 2040. The WHO limit is 5 micrograms per cubic metre. “These numbers make it clear that allowing delays will impose a substantial, unjust and unacceptable loss of human lives in Europe,” the scientists wrote.

Doctors call poor air quality an invisible killer. Each breath a person takes draws in pollutants small enough to seep from the lungs into the bloodstream. Once in the blood, they flow through the body, damaging the internal organs particularly in the cardia/vascular systems and is known to contribute to Dementia, Alzheimer’s Disease and depression amongst others.

It is clear that a combinations of tighter environmental legislation such as “Ella Law” and the recent Horse Hill Court ruling that the council breached environmental law owing to its failure to consider the inevitable greenhouse gas emissions from burning the oil (its end use, likely to be in transport) ie particulates etc., will make Urban Bus in particular with its end-use emissions as a Mass Transit option, a restricted mode of operation.

This has serious legal and cost implementation for Local Authorities and Operators etc. and as we appear to be losing the battle for Climate Change and Net Zero, legislation will only get more draconian with negative effects on non-steel-on-steel transport modes.

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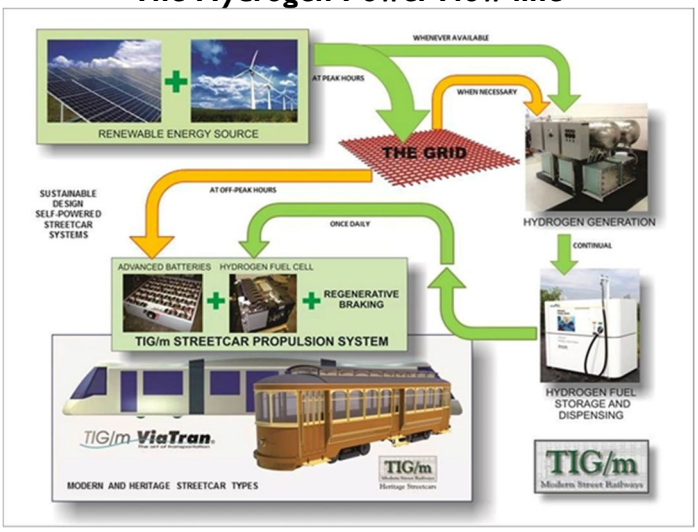
Hydrogen Tram vehicles available today

Possible Vehicles from TIG/m

The Hydrogen Power Flow line



MRV-3 City Car single car body and is rated to carry 100 pax and can be coupled autonomously as above to a maximum of three as shown above and using suitable, safe sidings and unneeded cars 2 or 3 can be parked off peaked eliminating unnecessary dead milage and wear and tear.

MRV-3 City Car

This vehicle can be operated for 20 hours per day of passenger service leaving 4 hours each night for preventative maintenance, battery balancing, and cosmetic cleaning. this schedule will consume approximately 1 kg of hydrogen from the fuel cell to charge the batteries while in passenger service (approximately 3.5 hours of fuel cell use during the 20 hours).

MRV-4 SERIES City Runner

An articulated multi-body trams is rated to carry 300 pax and can be coupled autonomously to a maximum two cars giving a maximum of 600 passenger

If you enter service with a fully charged battery system and 2.5 kg of hydrogen and run the tram until the batteries and the hydrogen supply are depleted, you would be able to operate for approximately 35 hours in extremis. However, this is not recommended, best practice overall is to work 20 hrs. daily and recharge nightly.

And for when the sun shines??

HRT-1AC SERIES

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New build, old design, a modern vehicle!
Used as a tourist cruise line shuttle in Aruba since 2013.

H2 Trams in Tourist mode, New build, old design

single body Double-Deck all weather convertible car 85 x passenger heritage tram

Traction - History Repeats itself ? .

In the late nineteen hundreds, many horse trams companies were looking for an alternative form of traction to increase payload and more importantly, to find a fuel that wasn't as polluting as horse traction and cheaper to operate.

It also coincided with the end of the gas lit era with a new but unfamiliar fuel to most people at the time called Electricity. In the 1890s people thought electricity had the potential to replace gas as a fuel source; that it was deadly dangerous.

However, It was now becoming clear that there was much more to electricity than the ancients had realised. In 1733/4, a French physicist named Charles du Fay (1698–1739) made the next important breakthrough when his experiments revealed that static electricity could come in two different (opposite) flavours, which he named "vitreous" and "resinous."
Englishman Sir William Watson (1715–1787) thought there was just one kind of electricity, with an ingenious explanation much more like our modern view: if we have too much electric charge, it seems like one kind of electricity; if too little, the other kind. He was also one of the first to show that electricity could zip down very long wires, and his other experiments included passing electricity through lines of several people to give them surprising electric shocks sometimes with fatal consequences.

Although we now know this idea is correct, back in the 18th century, such a convoluted explanation of multiple variation of this power source sounded wrong to some people. As a consequence of the adoption of this new power source, many Municipalities built their own electrical power generation plants to serve their new electric tramways and supply electricity ,initially for street lighting, manufacturing and eventually for domestic lighting.

The trams contribution to the municipal Common Good Funds enabled much of the infrastructure that we have inherited today to be expanded and built in our cities. Unfortunately, from this bonanza cash cow, very little was set aside for its own renewal.

The efficiency of the electric tram led to its expansion so that no respectably sized city or town did not have a tram system significantly contributing to the growth and wealth of cities and nation until superseded oil based vehicles especially in the aftermath of the first world war and the first generation of electric tram ended with its demise in Glasgow, Blackpool the only survivor.

Present 2024

There is now a second generation of trams rebranded as Light Rail (8 systems) running in the UK carrying,
Pre Covid 181.7 million passenger journeys (DfT March 2021). Passenger numbers have recovered and are slightly above this number. Passenger satisfaction stays high with this mode in its variants. With the escalating high costs of electricity and installation costs denying the positive transport, economic, social benefits, and a significant tool in the fight for Climate Change
One of the effects of the Russian invasion of Ukraine and insecurity and high prices experienced in the aftermath of the war was to remind us that we are no longer secure or independent from negative fluctuations outside our control.

There are a number of traction issues parallel with the late 1900s but with current and emerging hydrogen technologies enables the modern role of Hydrogen in "Trams as a Service" (HTaaS) which may replace OLE in favour of on-board powering, especially with the extreme high cost of copper and it's unguarded vulnerability.

There are a rising number of new and mature tram systems using Hydrogen in the simple role of a Tourist shipside shuttle to an Urban Mass Transit system now running in Gorlitz, Chemnitz, and several very large Chinese Cities with severe air quality issues.

Hydrogen, often hailed as the fuel of the future, presents an enticing alternative to fossil fuels in the global pursuit of clean energy. With its high energy density and zero-emission potential, hydrogen has gained traction as a viable candidate for decarbonising various sectors, including transportation, industry, and power generation. However, despite its promise, the widespread adoption of hydrogen faces a number of formidable challenges, particularly in its distribution.

Hydrogen, the most abundant element in the universe, holds immense potential as a clean energy carrier. When burned, it produces only water vapor, making it an extremely clean fuel option. Furthermore, hydrogen can be produced through a variety of methods, including electrolysis powered by renewable energy sources, natural gas reforming with carbon capture and storage (CCS), and biomass gasification. This versatility in production methods lends itself to a wide range of applications
To date, effective storage and distribution of hydrogen have been two of the main constraints on its development as a green fuel for decarbonisation of the economy.

However, a multinational UK based company called Triton Hydrogen Ltd, has developed a simple coating product, nanotechnology which provides a quantum leap forward in the delivery of hydrogen as the green fuel of the future. Tritonex Barrier Coating System is the only coating to be certified to the ISO 17081:2014 hydrogen permeation test standard with 0.000% penetration of hydrogen and can be applied to new or existing infrastructure and forms an impermeable seal to the surface, preventing permeation and embrittlement and has recently passed container trials up to and including 100Bars. The coating can be applied to new products by OEMs or just as easily retrofitted to existing infrastructure to convert it for hydrogen usage, and it can be used for pipelines, storage, valves and event transport applications.
"We now need to change our mindset in the hydrogen industry to realise that we now can treat hydrogen gas as any other fuel, utilising buffer storage and long transport lines," said Triton Hydrogen CEO Henning Syversen.

TramTrain

About Tram Train
The UK Government funded Tram Train programme is a partnership between SYMCA, Network Rail, Stagecoach Supertram and Northern Rail piloting pioneering technology which allows passengers to make a single continuous journey connecting street tram stops and conventional rail stations.

Passengers in South Yorkshire are the first in the country to receive help from pioneering, award winning, Tram Trains that will provide a direct service from Sheffield city centre to Rotherham Central and Parkgate, travelling on street tramlines and the national rail network.

Stadler TramTrains operate successfully in Sheffield and TfW South Wales.

NB. A Hydrogen version is under development with several manufacturers which will be compatible with our proposed infrastructure package.

Construction

Light Rail (UK) Group

Steconfer is a global rail infrastructure specialist, with a large permanent team of multiple rail systems specialists and managers, proud to be "firsthand" delivering Metro, MRT, Light Rail and Heavy Rail fixed installations construction and maintenance services worldwide.

Luas Dublin, Cross City Line

Lund Sweden

An example of Track Infrastructure VLR project costings done recently for the pre-feasibility Gloucester Road, Bristol Project by the builders of the Doha Very Light Rail Tram System.

STECONFER is a global railway construction company with a skilled and experienced workforce and a plant equipment fleet for Trackwork, Overhead Catenary (and Light rail), Signaling and other rail-based systems. The company's 20+ years' experience is consistently based on core values of: - Safety for our team, our customers, partners, and clients. - Client focused value propositions. - Technical competence and high-quality standards. - Adaptability to local cultures, customs, and social responsibility. - Passion for Equality and Diversity. - Environmentally conscious and caring.

STECONFER are qualified, willing, and able to provide comprehensive solutions to the market and all its clients regarding the system installation and maintenance of: - Tramway and LRT - Metro and MRT - Heavy Rail Infrastructures Local Company Although part of a larger Global Group based in Lisbon, Portugal, Steconfer has a fully registered (11146299) standalone company in the UK.

Steconfer Rail Ltd has been registered since 2018, with its own Quality & Management System compliant to and verified by RISQS (registration no. 6683) with its registered office at International House, Mosley Street, Manchester, M2 3HZ.

What We Can Do for ***"The Infrastructure that Pays!" VLR***

Whereas we can provide trackwork, power distribution, and signaling systems we believe that the concept for **"The Infrastructure that Pays!"** Bristol is to have and benefit from the environmental sustainability and technical advantage of a 21st-century Ultra Light Self Powered Tram System. This means that Bristol would not need a lineside traction power supply system in the form of a Third Rail, or Overhead Line System.

Although our area of expertise does include Overhead Line installation, we do have experience in delivering this type of forward-looking transit solution having worked with, partnered with, and built a successful relationship with the Global Leader in terms of Self Powered Tram Systems. It therefore would be our privilege to limit our potential scope of supply to the installation of the trackwork, including the preparation and construction of the track bed.

Trackwork Concept Proposal for Bristol Revision 00 The slab is set at a depth of 500mm from finished rail level with allowance for a 150mm C8/10 blinding layer as a working platform.

The choice of structural concrete for blinding is made to allow for construction traffic after an appropriate curing time and to provide sufficient strength for anchoring the props required to guarantee rail alignment. As with most light rail systems the rail can be encapsulated to counteract the effects of stray current. Sophisticated rail setting jigs allow for a top down method of construction whereby the rails are suspended at their finished alignment to very exacting tolerances.

A live quote for the Gloucester Road (A38), Bristol Tram Project
"Using Very Light Rail (VLR) technology, we can install a double track tramway at less than £10M per track kilometre."

In Conclusion

This outline draft document briefly shows that using Hydrogen Technology, VLR technology, it is definitely possible for Metro and other operations including smaller cities and towns, to afford more steel on steel lines including compatibility with heavier TramTrain operation which we think that this technology outlined above would be a more affordable, quicker build and greater street option where your customers are option on many of the proposed Strathclyde Metro Routes for Heavy Rail vehicles.

Yours aye

James Harkins FCILT MTPS,
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Light Rail (UK) Group. Warrington, Cheshire, United Kingdom, WA4 6UE.
" A not for profit organisation promoting steel on steel sustainable Public Transport."

Member: of The Scottish Cross Party Parliamentary Group for Sustainable Transport
Secretariat &Technical Advisors: The (UK) All Party (Parliamentary) Light Rail Group,

Further video details can be found on

https://www.youtube.com/watch?v=1VkuFUD3fc4

1. A modern hydrogen tram in a light density environment

2. https://www.youtube.com/watch?v=o1BTuHUwTwM
   A mixture of street running and former railway line

3. https://www.youtube.com/watch?v=GYGZxE8KGDY

TIG/m Streetcar in Santa Cruz! Clean, Quiet, Just right

4. https://www.youtube.com/watch?v=-A4QxeWsXpw&list=PLa-lo2y-lMWI9Kgkp2iqPKFLG_v2Q9rvb
   TIG/m City Car Street running in Doha.

5. https://applrguk.co.uk/media/files/LR-UK-Let-Glasgow-flourish-AGAIN-Mar-2021-V5apdf
   Original PowerPoint why Glasgow needs this type of tram.