

# WE WON'T HAVE TO WAIT 20 YEARS FOR ZERO CARBON

## Specifiable Technology Emerging Enabling Roll Out



A 35 passenger tram-style vehicle, PPM Car 10, pioneered net zero traction in Bristol between 1998 and 2000. This was made possible by the investment of Sustraco Ltd whose proprietors also supported the passenger operation applying Parry People Movers' patented kinetic energy IP.



20 years later at Long Marston, Sustraco's railcar is back in action as a 'First of A Kind' containing the complete driveline within the frame of a train bogie opening the way to building larger vehicles.



Photo courtesy UK Tram

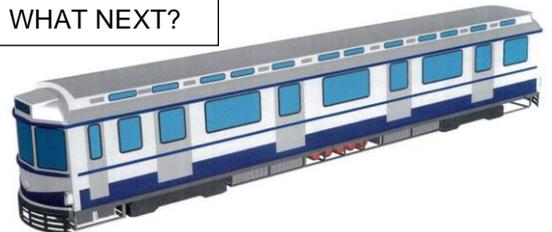


During March 2021 UK Tram, the industry trade association, launched a competition which was responded to by 16,500 members and enthusiasts to determine which example might win 'The Tram World Cup', a lighthearted popularity contest. Despite the diminutive size of the enterprise, the Stourbridge Shuttle, managed by PreMetro Operations came out the overall WINNER with 88% of the votes cast.

The UK's first award-winning hybrid light rail system was established in 2009 and connects Stourbridge Town Centre and Stourbridge Junction Railway Station.

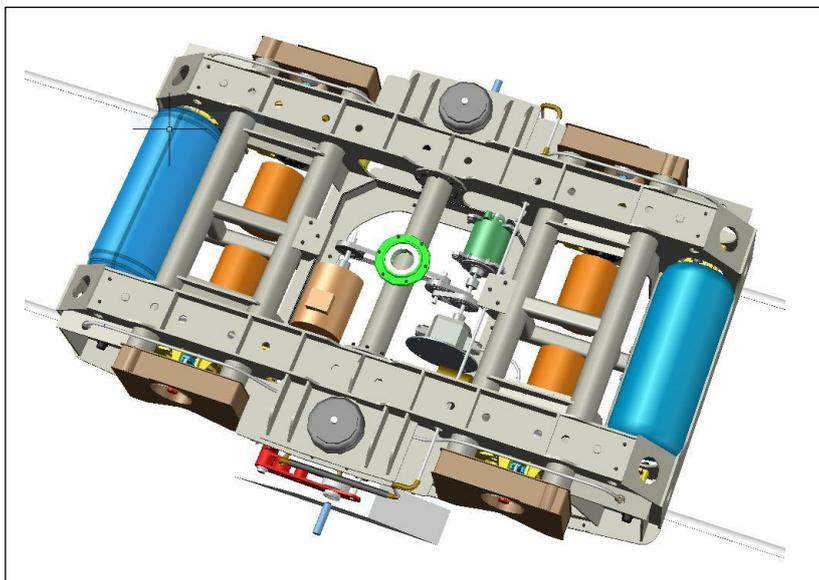
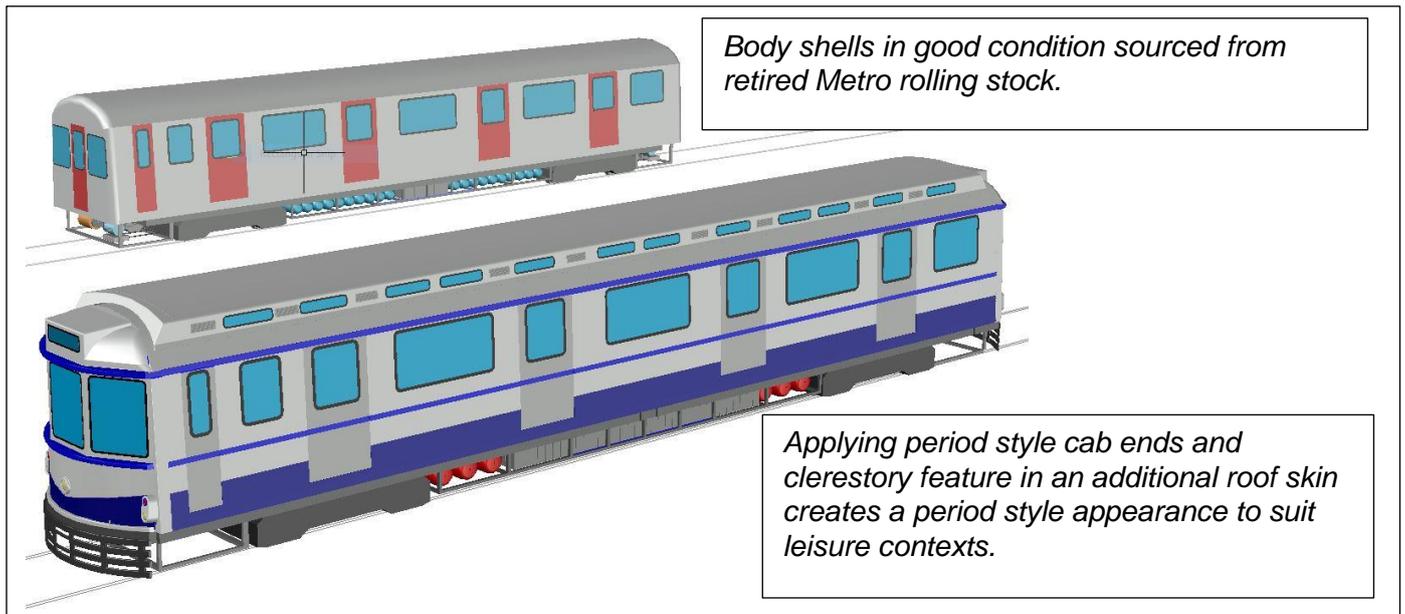
By 2021 the technology that had been step by step devised and refined by the engineering originators and the operating company over the last 11 years has consistently performed at levels of reliability between 99 and 100%. The energy efficiency of the light railcar fleet has also been outstanding due to the features of the hybrid design and regenerative braking system. 6 million passenger journeys taken so far.

### WHAT NEXT?



A new era has begun in which small lines are being promoted, but not enough segregated corridors exist. The concept of the tramtrain enables rail vehicles to share the highway alongside road traffic.

# ROUTE TO MARKET FOR THE COMPACT TRAMTRAIN

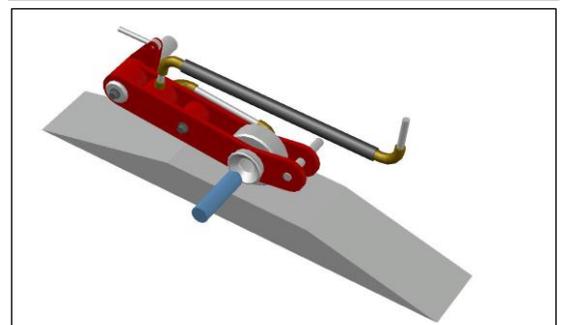


The specially-designed bogie with orthodox locomotive traction motors and running gear will also incorporate power generation from a compressed air motor with small diameter, medium-speed flywheel supplying extra acceleration.

The technique of fast, opportunity charging was perfected between 1998 and 2000 at the Bristol Harbourside Line. Car 10 Electric Railbus dwelt for 2-3 minutes at each terminus with its 'collector shoe' in contact with a 70v supply of current from transformer-rectifiers wired into the mains. In the Tribrid arrangement the tramtrain will take in energy in the form of compressed air stored under the platform. For transferring compressed air from trackside storage tanks to the vehicles a self-levelling, remote controlled connector will be activated by the tramtrain drivers.

PPM's Compact Tramtrain uses Tribrid technology in order to enable the vehicle to have all day uninterrupted operation and have good acceleration away from stops. With a pure battery-propelled vehicle neither of these would be possible. Without recharging, the batteries would run out of current part way through the shift and no surge of current would be available to deliver extra torque for rapid acceleration.

The Tribrid design uses compressed air capacity on board as a range-extender for the battery pack. Although there is a limit to the quantity of compressed air carried at any one time, unlike batteries, air can be replenished quickly and imperceptibly at any number of places along the route – notably at the passenger stops. And this happens so rapidly, there is no delay to the service.



# THE STOURBRIDGE FORMULA



Many of the smaller and most remote lines of the UK rail network have for years only received 'patch-and-mend' maintenance and still comprise of extremely old materials dating back decades. As a result of historic wear and tear, these lines have rails that have become distorted. Where the ends meet, there is often a 'drop' or 'step' causing impact damage and noise as the train wheels pass over the uneven joints.

The Stourbridge Town Branch was once typical of minor lines, but as an initiative from the infrastructure owner, Network Rail and the Franchise holder, West Midlands Rail Executive, the decision was made to upgrade the line with continuously welded rails. This has greatly improved the quality of the ride, now more typical of Network standards.

## Manufacturing Compressed Air, Sustainably

In every case the ideal means of storage is compressed air. Natural forms of energy can be continuously available, assuming that there has been rain or snow to feed streams and rivers which, when flowing steeply downhill, can be passed through turbines producing **hydro-electricity**. Less well known, even a slow moving river can generate energy via **run-of-stream** devices like horizontal water mills mounted between the hulls of a pontoon. In a few localities, there will be hot geo-thermal energy available which can provide a sustainable energy source, but **heat pumps** can extract energy from the surrounding locality in most places.

Very different from sourcing energy from a power station which calls for massive quantities of coal, oil or gas to keep turbines spinning, natural sustainable energy keeps coming anyway. **Tidal** energy is predictable, propelled by the moon as it rotates round the Earth. **Solar** energy becomes available as the Earth itself rotates, but in neither case does the energy arrive conveniently in time with the daily cycle of domestic and industrial demand. **Wind** energy is even more awkward; it varies with the weather. **Wave** energy derives from the wind and is equally unpredictable. A facility to store the energy is therefore vital so that it can be drawn on at any time.

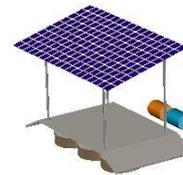
The Net Zero railway, just like the original Bristol Railbus, will top up with energy at **ACCUMULATOR PLATFORMS** along the route. Fast energy transfer to the rail vehicle can be performed electrically or pneumatically from the stores. The cost of the energy in a single use battery is £100 per kWh. The cost of energy produced by some renewables is now down to 5-10 pence per kWh (a thousand times cheaper). PPM's TRIBRID innovation provides a deep store of traction current, like in a battery locomotive and provides the means for these to recover their charge from on board generator sets driven by compressed air.

## Compressed Air Supply Points

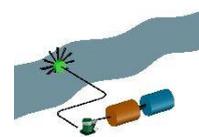
The compressed air supplied to the tramtrains from trackside storage will, with the exception of the photo-voltaic form, involve supply of power directly to compressors.



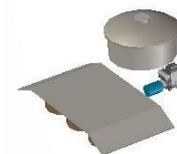
*Ground level wind energy using epicyclic gear trains to reduce the rotational speed of the turbines.*



*Photo-voltaic panels provide electricity to power the air compressor.*



*Micro-hydro energy generation from high level sources drive an air compressor.*



*Bio-methane from anaerobic digestion of agricultural waste powering i.c. engine linked to compressor*

*and multiple other sources of sustainable energy.*

# TIMES THEY ARE A CHANGING

Adopting the 'Stourbridge Formula' indicates considerable differences between this and the technology and methods which are obligatory over the majority of the National Rail Network. Complete interoperability is not practical as most main lines only ever see a limited range of trains. If, for instance, it is advantageous for freight to operate, better that the trains mainly run outside passenger hours.

Such has been the free-spending atmosphere around UK railways for almost a decade, the inevitable focus has been on larger budgets and on 'trunk' or strategic mass transit. Until the closing months of 2019 that is. In the run up to the December General Election and beyond, social, economic, environmental and even political factors came into play and themes such as 'levelling up' and lack of vital connectivity has drawn decisionmakers' attention to wasted human and physical resources in certain regions of Britain. The problem can be linked to a missing layer of transportation – small, simple railways.

## Some Prospective Passenger Routes – Generic Scenarios

- Not on the Railway Network, some of the private heritage railways have former 'town' stations between which the public would make frequent journeys if there were a means of using the line. Such instances may be examined as having potential for a shuttle.
- Several heritage railways terminate at well-served stations on the main network, clearly candidates for a 'feeder' service.
- Lightly used freight-only lines interconnect with the main passenger network. Where these are located in the proximity of clusters of dense urban activity and could connect back to a frequently served hub station, the freight line is likely to be assessed for opening passenger services.
- Major visitor attractions such as heritage museums and historic buildings are frequently located in clusters where unused rail alignments run close by. Prospects for passenger services should be examined.
- Leisure 'honey pots' such as attractive beaches and countryside of outstanding beauty bring in long stay visitors, but patronage will tend to switch depending on weather conditions; sometimes the day is best spent in a local town. A convenient rail transit amenity which is attractive in itself will facilitate weather-responsive decisions of holidaymakers where to spend the day.

