

# **Bath & District Tram Project**

A short presentation  
to  
Bath & District Tram Conference  
24<sup>th</sup> November 2018  
Bath, Somerset  
by

**Jim Harkins FCILT MTPS.**

Light Rail (UK)

**Specialists in Affordable & Sustainable Tramways**

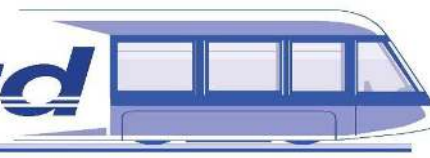
8 Beechmore, Moore, Warrington, UK

01925 740675

[www.applrguk.co.uk](http://www.applrguk.co.uk) E-mail [jimh@jimmyharkins.com](mailto:jimh@jimmyharkins.com)



***TramForward***



## **Trams for Bath & District**

**A voluntary organisation  
consisting of :-**

**Light Rail Transit Association  
Light Rail Consultants  
Transport Engineers  
Local & National Politicians,  
All Party Parliamentary Light Rail Group  
Academics & Environmentalists  
Commercial & Professionals  
Logistics**



***TramForward***



## Trams for Bath & District

### Air Quality and Congestion

**Dr. Sarah Wollaston MP, Chair of the Health Committee said**

1. "Poor air quality is affecting on the health of millions of people across the U.K. because of the impact of invisible particulates and other pollutants.  
Our joint inquiry will include an examination of the scale of the harm caused and the action necessary to tackle it."

#### **FOUR SELECT COMMITTEES LAUNCH AN UNPRECEDENTED JOINT INQUIRY ON AIR QUALITY**

MP's from four select committees have combined forces to launch an unprecedented joint inquiry on air quality to scrutinise cross-government plans to tackle urban pollution hotspots.

The Environmental Audit Committee, Environment Food and Rural Affairs, Health, and Transport

Defra instructed to hold a Public Consultation on Road, Tyre, Brake dust (Oslo Effect).  
Closed October 2018 results expected early 2019

Masks ineffective against  
PM10 & PM2.5>  
Is he at greater risk?

***TramForward***



## Trams for Bath & District



Bath & NE Somerset	Deaths 10pm Age 25+	Deaths 2,5pm Age 25+	Associated Life Years Lost
	1618	80	765
Extracts from Public Health England 2014	Page 23	Table 1	Local Mortality Air Pollution



British Thoracic Society report 1998

153,000 respiratory illness deaths, mainly young & old

Govt figures show between 25% - 40% are deaths cause by  
"Tail Pipe emissions" (38,250 – 61,100 deaths)

Then there is the "Oslo Effect"!

**TramForward**



The USC study focused on the smallest particles in air pollution, called PM2.5s. Scientists say these are the most dangerous, as they are small enough to cross from the lungs into the blood and then travel around the body, lodging in organs such as the heart, liver and brain.

## Trams for Bath & District

### *. The new evidence on pollution*

It found that those exposed to levels of air pollution above US legal limits were 81% more at risk of global cognitive decline and 92% more likely to develop dementia-related diseases including Alzheimer's.

If the scientists' findings are replicated in men and women of all ages, air pollution could also be responsible for about 21% of dementia cases, according to the study, published in the Nature Journal Translational Psychiatry.

Our study greatly strengthens the emerging evidence that the hazards of air particles extend to brain health, including the dementia risk." Dementia and Alzheimer's have overtaken heart disease as the biggest killers in England and Wales, according to ONS figures released last year.

A link between Transport emissions and age related health problems affect people 45 years +



Ella Kissi-Debrah RIP,





**Oslo Effect,  
(The Elephant in the room killer.**

## **Trams for Bath & District**



+



+



=



**A Significant cause of poor Urban Air Quality**



## Trams for Bath & District

### Rubber Dust



PM10 stands for particulate matter that is smaller than 10 microns in size.

A micron is a millionth of a metre.

Human hair is about 70 microns thick.

Non-exhaust sources account for 90% of PM10 and 85% of PM2.5 from traffic

Each time a tyre rotates, it loses a layer of rubber about a billionth of a metre thick.

A busy road with 25,000 vehicles travelling on it each day will generate around nine kilograms of tyre dust per kilometre.

In the USA, about 600,000 tonnes of tyre dust comes off vehicles every year.

Courtesy: DR Karl Kruszelnicki, ABC Science <http://www.abc.net.au/science/>

In general, the smaller the particles, the more deeply they can penetrate into your lungs.

PM2.5 particles can be smaller than 2.5 microns, and are even more dangerous.

There are no safe minimum exposure level

# TramForward



## Trams for Bath & District

### Road Wear Abrasions

Road surface abrasion is a process whereby the surface of the road is worn away and forms loose particles, including airborne dust on our urban roads

Urban Road Vehicle type	Tyre Per Km	Brake Per Km	Road Abrasion Per Km
Car	8.7	11.7	7.5
LGV Rigid	20.7	51	38
Buses	21.2	53.56	38



4 UK Informative Inventory Report, 2017: [https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1703161205\\_GB\\_IIR\\_2017\\_Final\\_v1.0.pdf](https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1703161205_GB_IIR_2017_Final_v1.0.pdf)

# TramForward





## Trams for Bath & District

Higher Electric/Hybrid vehicle weights (24%) results in increased tyre wear and evidence shows that higher torque from an electric motor, compared to a conventional engine, contributes to increased tyre/road wear, which results in 37% greater emissions.



Road transport PM<sub>2.5</sub> Emissions by year

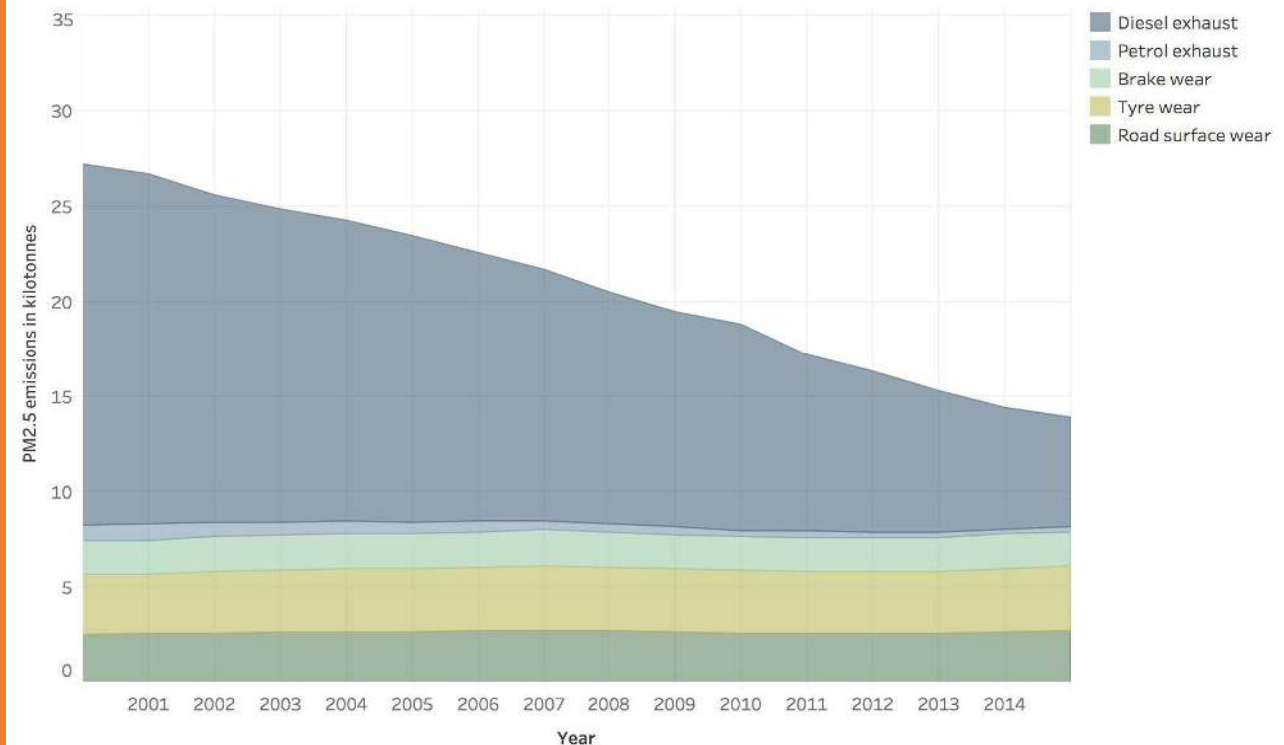


Figure 1. PM<sub>2.5</sub> emissions from road transport, 2000-2015. Source: NAEI 2015

# TramForward



## Trams for Bath & District

# The solution (s)

Re-order Road Hierarchy

Active Travel

Modal Switch .

Congestion Charging

Pollution Charging



## 3<sup>rd</sup> Generation Trams

***TramForward***



## Trams for Bath & District

The electric tram has re-emerged  
as a catalyst for:-

Clean air, No pollution at point of use

Congestion reduction by significant modal switch out of cars and buses

Connectivity in the Urban Area

Efficient in land use

Smart Cities (Attractive places to live)



***TramForward***

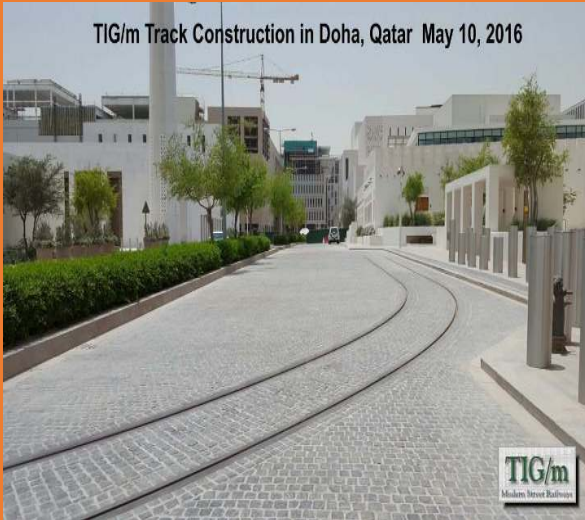


# Why Hydrogen Trams

?



TIG/m Track Construction in Doha, Qatar May 10, 2016



## Trams for Bath & District

Can be one design/build contract, and provide complete hydrogen-cycle equipment including:-

A Mixture of Hydrogen Powered Cars:-

City Cars up to 70 passengers

Electronic Coupling x 4 to 280 passengers

Tourist/Heritage Vehicles

TramTrain

This system will be an Iconic attraction in its own right





# Why Hydrogen

## Trams for Bath & District

Light weight vehicles + Trailers if required

No overhead required, robust municipal rail transit without the visual clutter of power lines, guy wires, support poles, substations, and feeder systems.

On-site hydrogen generation .Hydrogen compression and storage.

On-board fuel cell generators that charge the batteries while the tram is in passenger service

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

.  
A lifetime system maintenance picture without having to service and replace an extensive wayside power infrastructure.

Hydrogen fuel dispensing.  
Revenue earning



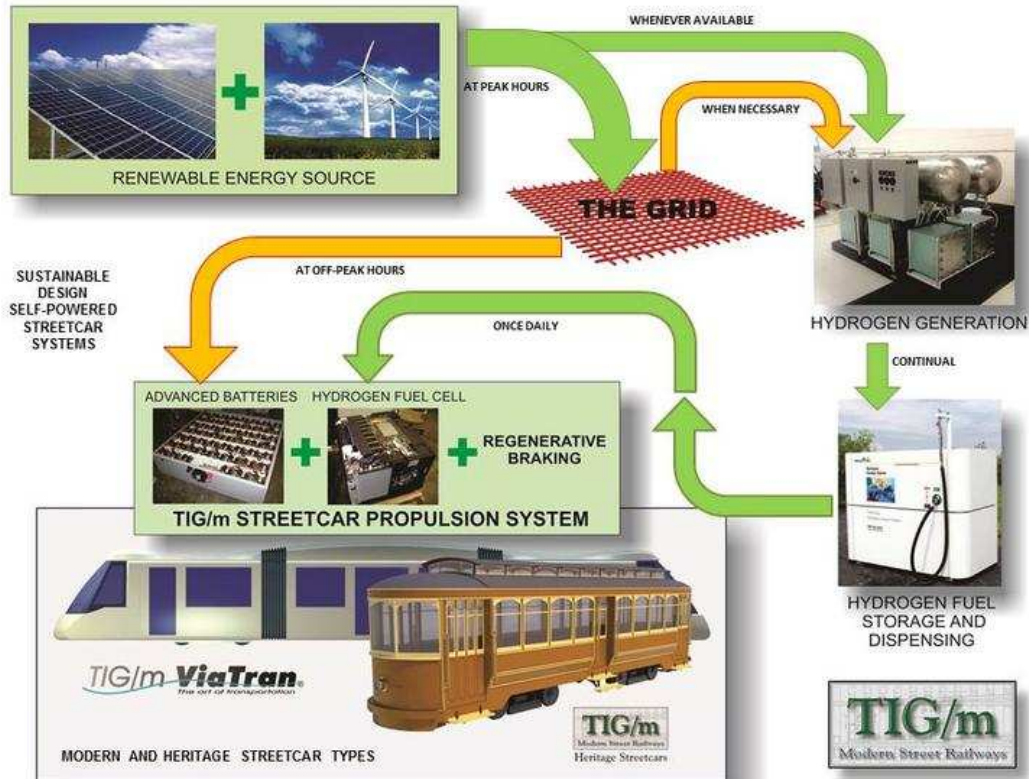
On-board fuel cell generator



# TramForward



## How it Works



## Trams for Bath & District

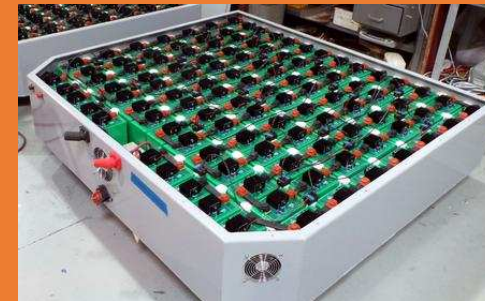
### On-board electricity storage:

•VR-AGM batteries, LiFePO4 Batteries, 200Ah

•400Ah On-board electricity generation:

•Hydrogen, CNG, LPG, Bio-diesel

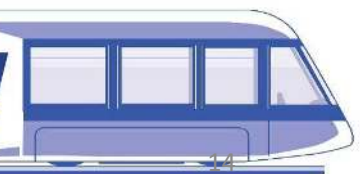
•Liquid petroleum fuels are available but not recommended



$$ESS + OBG + RB = TP + AP + 25\%S$$

On-board electricity storage + on-board electricity generation + regenerative braking = traction power + ancillary power + 25% surplus power.

# TramForward





## Trams for Bath & District

*City Cars  
Doha Qatar  
June 2018*



*Modern:*  
•Articulated 20 metre,  
•Rigid body 15 metre,  
Closed car, Convertible car

*Can be fitted for Pantograph use*





## Trams for Bath & District

A selection of  
Hydrogen Tourist Trams



**Heritage:**  
**Open car, Closed car, Convertible car**  
**Double-deck, Single-deck,**  
**11 metre, 12 metre, DPTAC Compliant.**

**Oranjestad running successfully from 2013**





## Trams for Bath & District



*Route length –*

*Single track loop 2.4 km, double track link  
to Depot 1km TOTAL 4.4 track km*

*Track installation:  
Maintenance Facility:  
4 Streetcars:  
Power supply:*

*Allowance for extra street works 15%  
of sub total = £2.2M*

**Total** **£23.6M**

*Includes UK Govt Optimism bias allowance of 60% total*

***TramForward***



## Trams for Bath & District

### Funding

Clean Air Zone Class D, Congestion Charge, Pollution Charge  
Expenditure from Government /Matched Funding £32M

Budget 2018 mobility Zones,  
WECA, Housing Infrastructure Fund

Funds from specialist Government funds, trusts and charities

Revenue Support, Farebox Revenue, Prudential Borrowing, Local  
Government Bonds, Public Private Partnership (PPP)  
Non-profit distributing public private partnership model (NPD).  
English & Local Tourist Boards, On board WiFi

Private Funding for a 35 year operational lease

This not an exhaustive list and will change  
as schemes are introduced, ended, replaced etc.,



**TramForward**



## Trams for Bath & District



- The Development of this modest first tram line will form the basis of extensions and new lines to the rest of Bath and District incrementally line by line

As growth in Bath picks up, the tramway should be extended

It is suggested that between four and ten trams could be acquired  
tramway could be constructed  
Incrementally expand using TramTrain technology



# Trams for Bath & District

Getting started in Bath you need:-

Feasibility & Business Case Studies.

Get good advisors – challenge them, stick with them

- Start public consultation early
- Get a well known local Public Face for the project
- Be willing to revise the route to support developments
  - Get the bus, rail and highway authorities on side
  - Think of it as a ‘Starter Line’
- Inexpensive does not have to mean cheap-and-nasty
- Think of the added “X” factor for subsequent “UK City of Culture” type bids

- Ridership estimate

Estimates of potential redevelopment and revenue generation

Retail Footfalls

- Assessment of impact on utilities

Assessment on impact on parking

Outline alignment with stop, depot facility locations etc.

- To capture “Soft Benefits

***TramForward***





## Trams for Bath & District

Thank You  
for  
Listening



***TramForward***

