

# **Evaluation of a Low Carbon Bus**

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## Definition

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- **A Low Carbon Bus produces 30% lower Green house gas emissions than a Euro 3 Equivalent Diesel bus of the same capacity**
- **GHG will be expressed as CO<sub>2</sub> equivalent on a Well to Wheel basis measured over a standard test**
- **Includes CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O**
- **Baseline has been derived from extensive test data on Euro III UK vehicles**

## Reference points

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- **SAE J2711 – Fuel economy testing of hybrid and conventional vehicles**
- **Transport for London test protocols**
- **EC 70/220 passenger car certification methods.**
- **Millbrook Quality standards ISO 17025, ISO 9001**

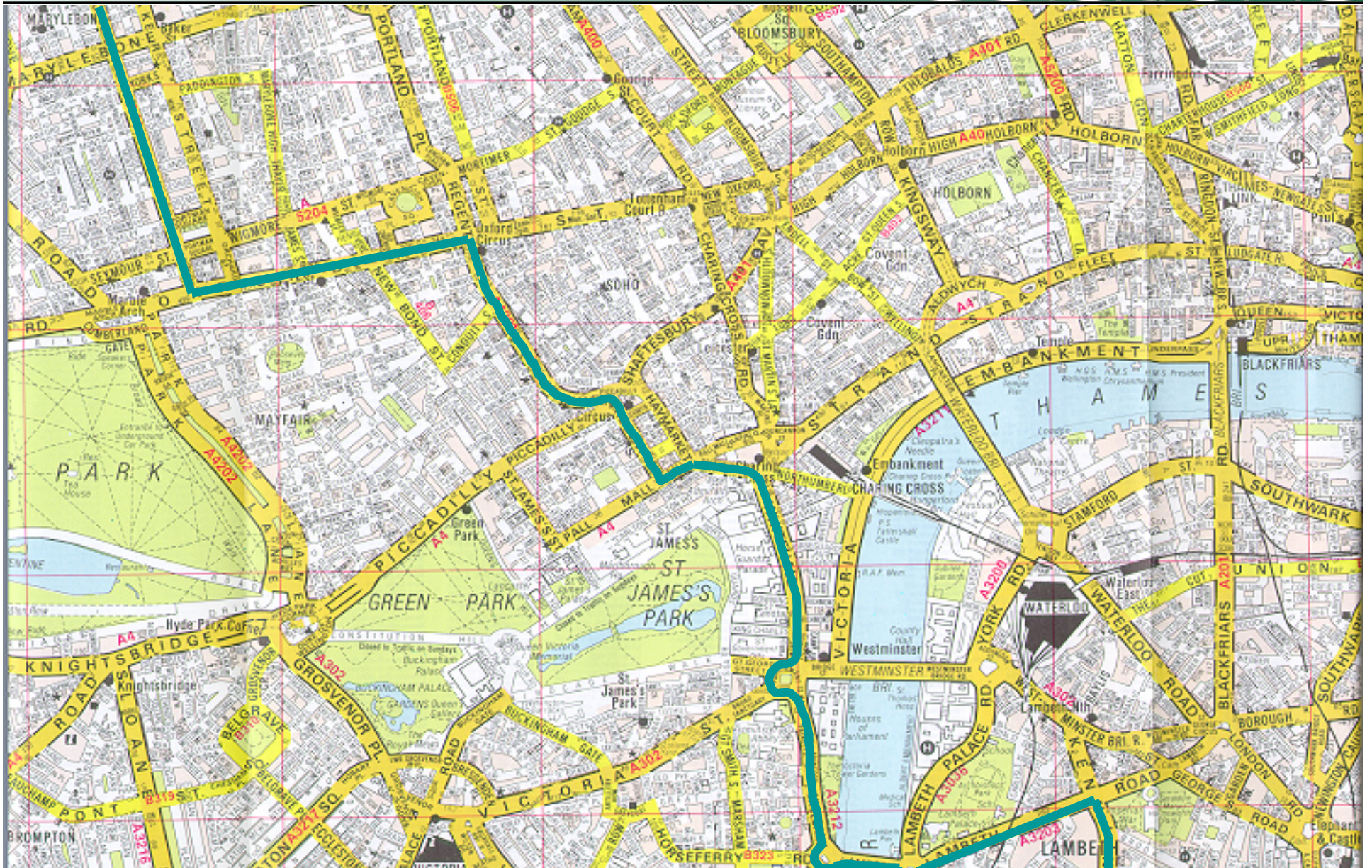
## Key aspects

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- **Standard test – MLTB drive cycle (Millbrook/LTB)**
  - Avg speed 14.1km/h, 31% idle time
- **Rated CO<sub>2</sub> v passenger loading**
- **Facility**
  - Inertia simulation to test at correct load/mass
  - Comprehensive emissions incl NO<sub>x</sub> species, CH<sub>4</sub>, PM CO<sub>2</sub>
  - Can not ignore legislated, pollutants (HC, CO, NO<sub>x</sub>)
- **WTW analysis – reference WTW studies**
- **Hybrids and Electrical systems, NEC analysis**



# test and development solutions

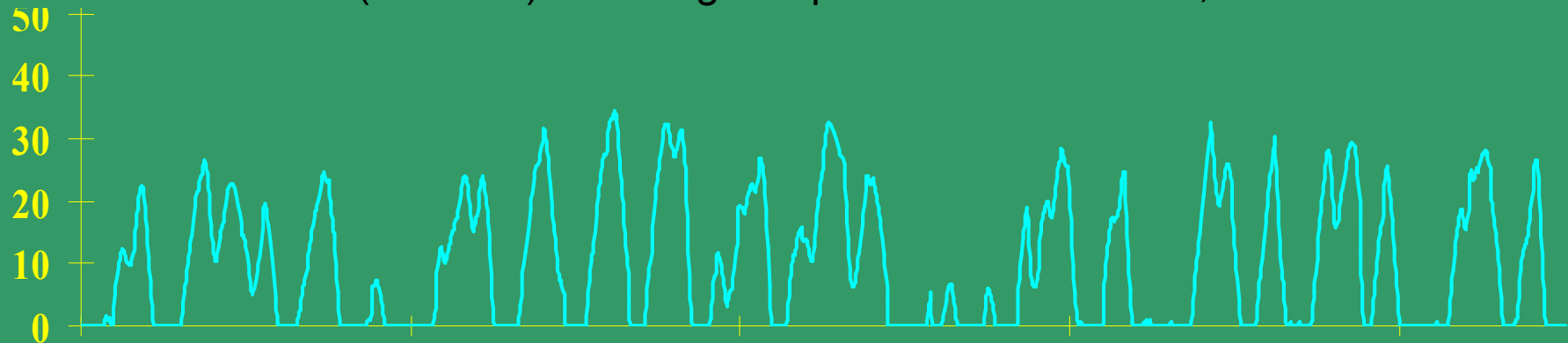


Speed (km/h)

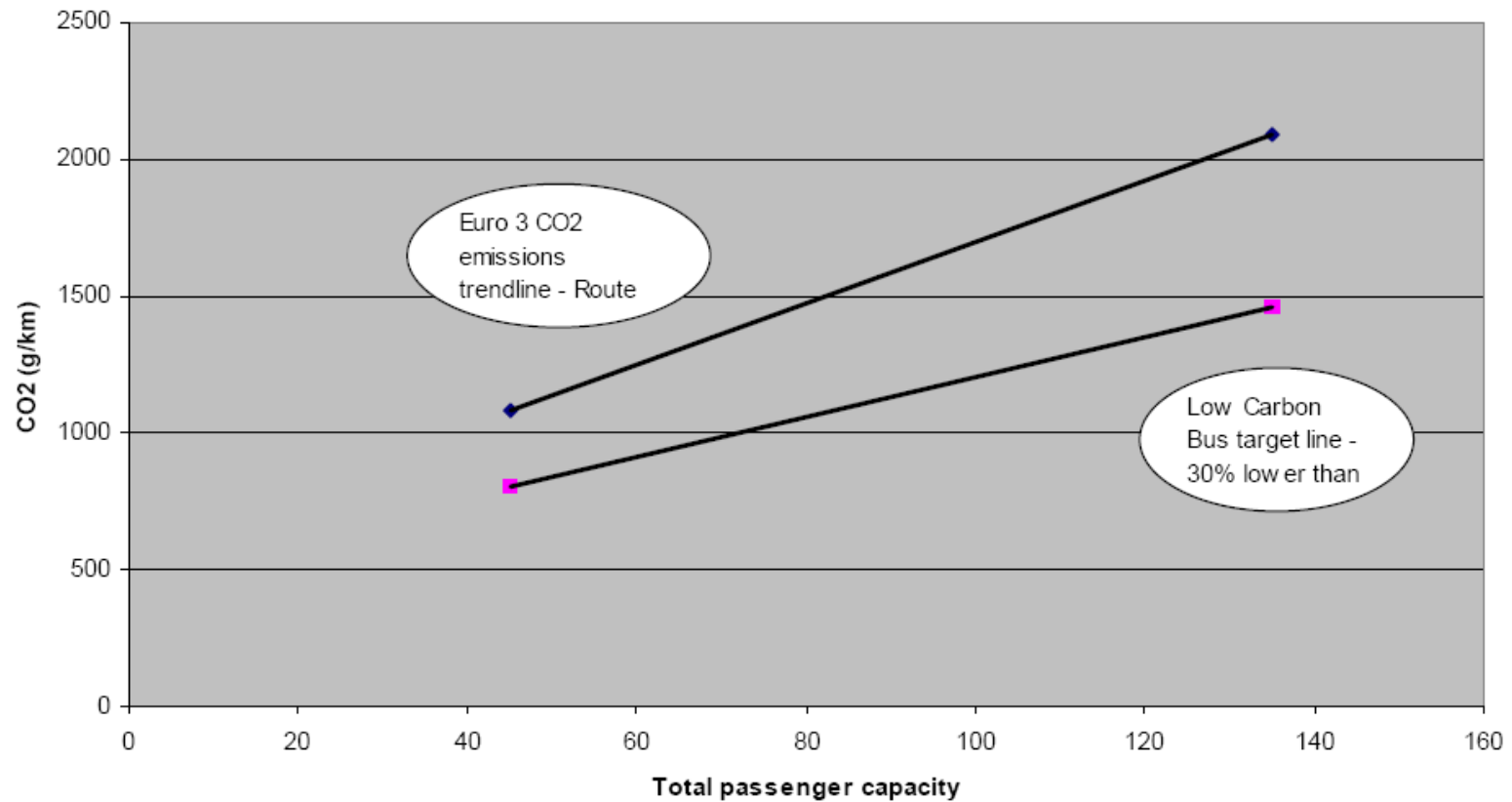
Outer London (Phase 1) - Brixton to Trafalgar Square, 6.45km 1380 secs.



Inner London (Phase 2) - Trafalgar Square to Baker Street, 2.47km 901 secs.

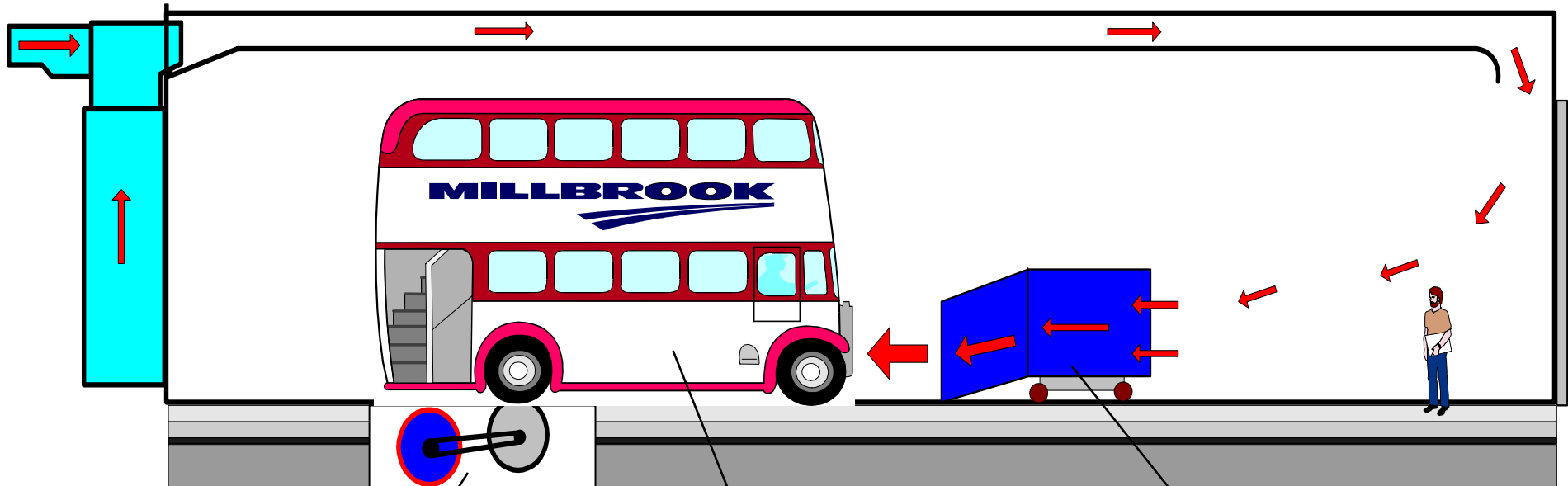


### Appendix 2 - Low Carbon Bus CO2 emissions target line



**Variable Temperature Emissions Chamber (-30 to +50°C)**

26m long x 5.5 m high



**Unique 48" Electric Dyno with Heavy Duty Vehicle Inertia Set (insulated and heated pit)**

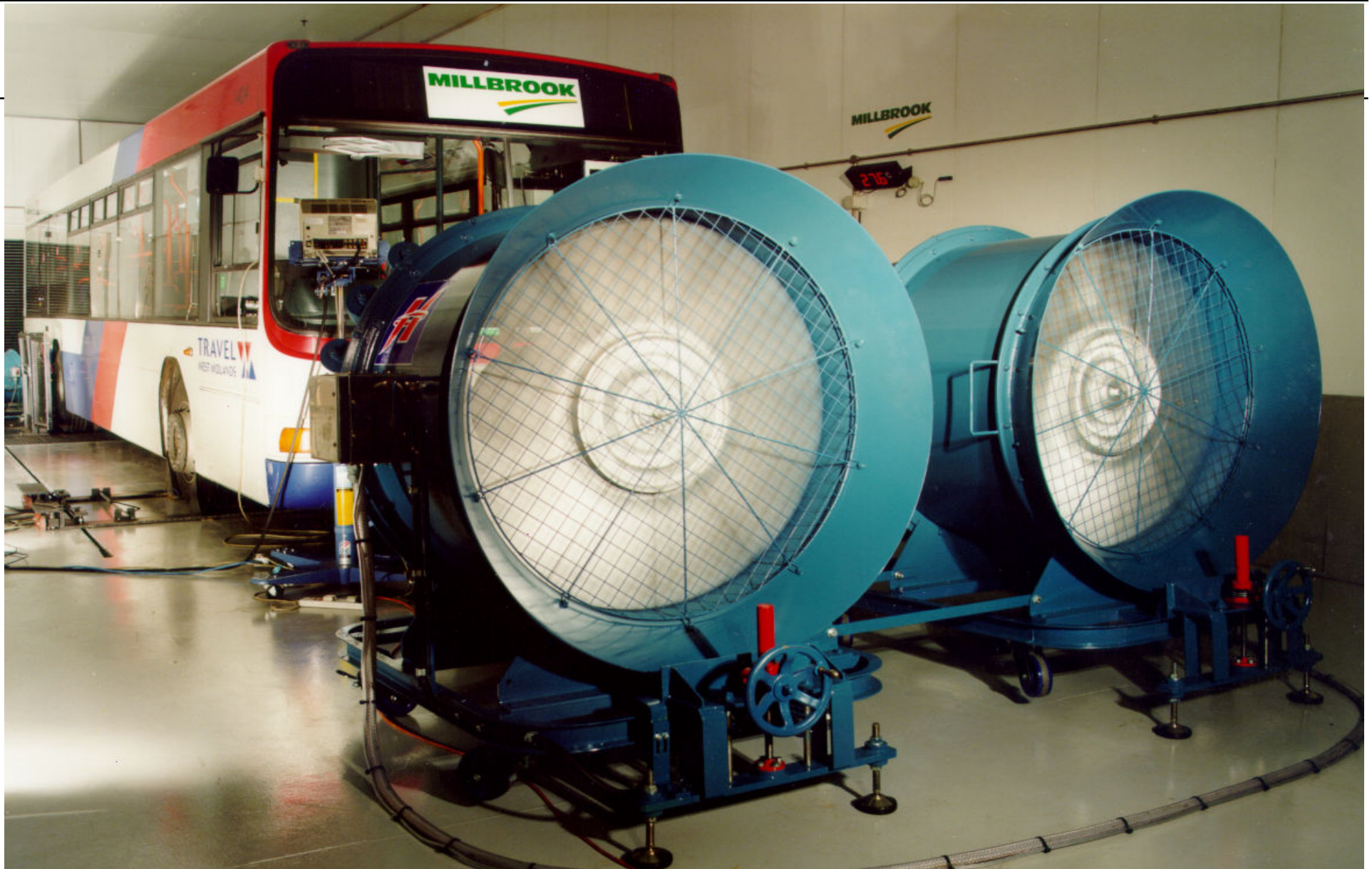
**Complete vehicle, engine Exhaust, Trans. and Driver!**

**Ultra-high volume speed tracking fans**





test and development  
solutions



# Routes to Low Carbon

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- **Fuel**
  - Alternative
  - Biofuel
- **Weight reduction (or increased payload)**
- **Aerodynamics**
- **Engine technology**
  - Hybrid
  - Advanced conventional
- **Combinations**

## **LCVP – comprehensive approach**

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- **The physical test confirms**
  - TTW CO<sub>2</sub>, NO<sub>x</sub>, PM etc
  - Demonstrates benefits from vehicle technologies
- **The LCVP Fuels group**
  - Confirm WTT carbon
  - Verifies fuel supplier contribution

## Out of Scope

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- **Driver improvements**
- **Route/traffic management systems**

## Success stories

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- **Wrightbus Hybrid**
- **ADL Hybrid**
- **Eneco**
- **Some other technologies look promising**