

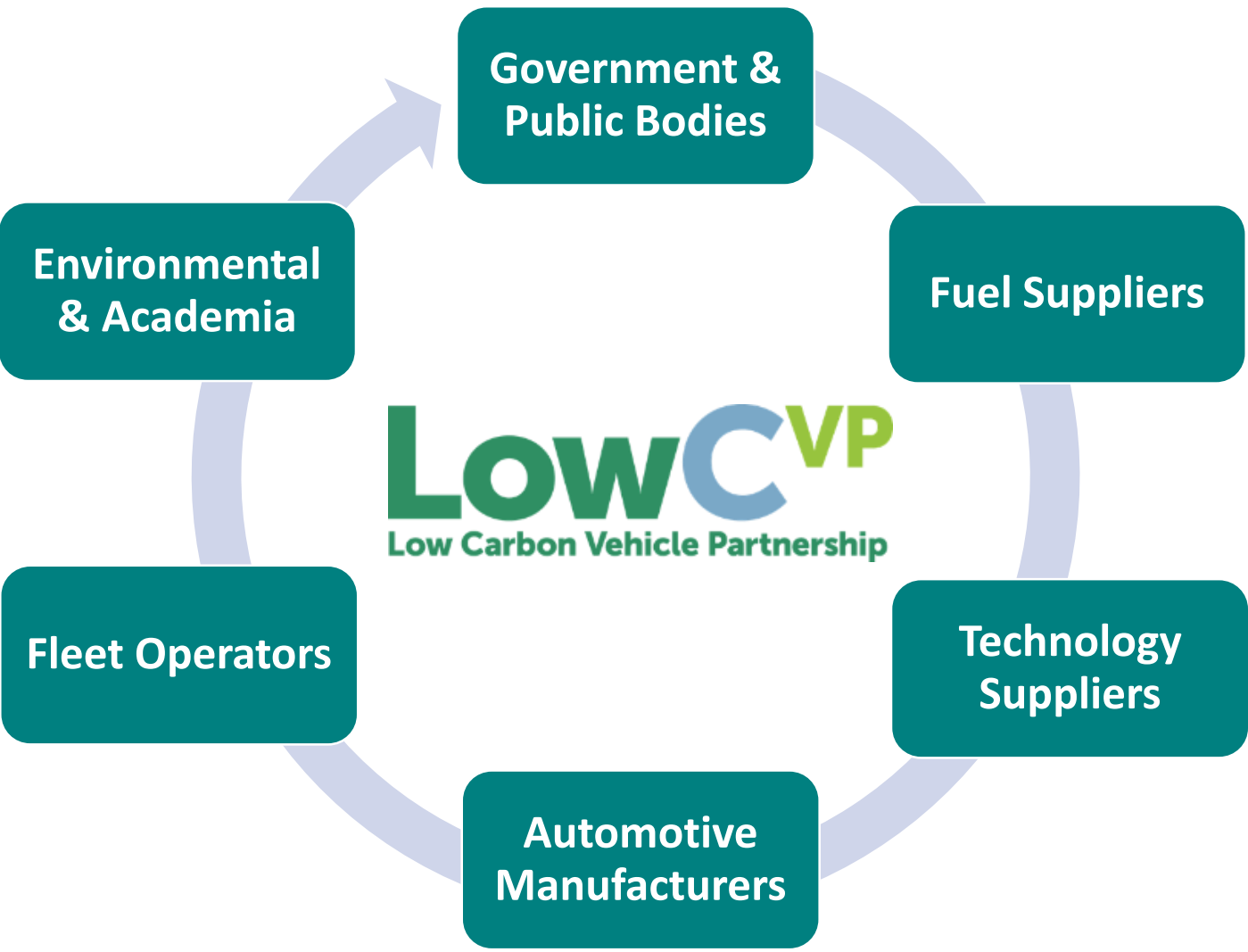
HEV – Advanced technology for real world users

HEVC– 2 November 2016



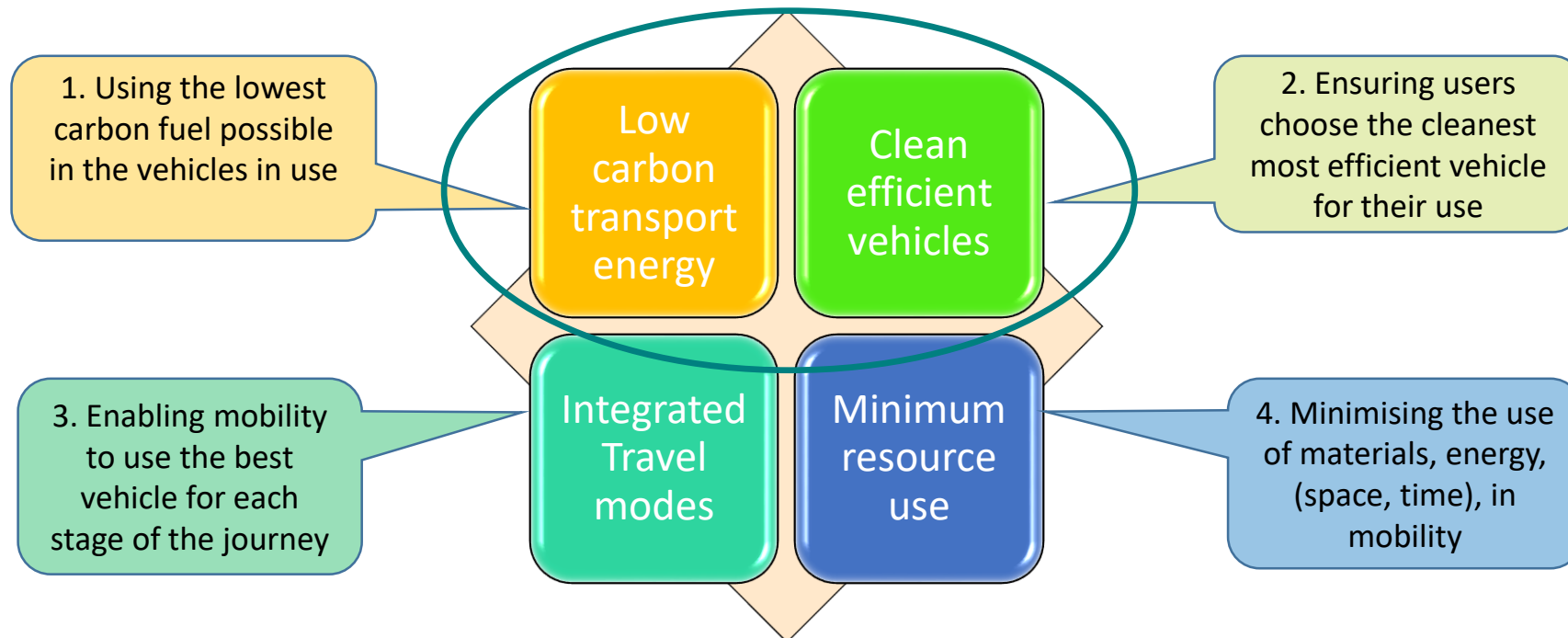
Andy Eastlake C Eng FIMechE
Managing Director

LowCVP is a unique public-private membership organisation
building evidence and creating robust policies and innovation support in UK



Our Mission:

To accelerate a **sustainable shift to low carbon vehicles and fuels** in the UK and thereby stimulate **opportunities for UK businesses**".



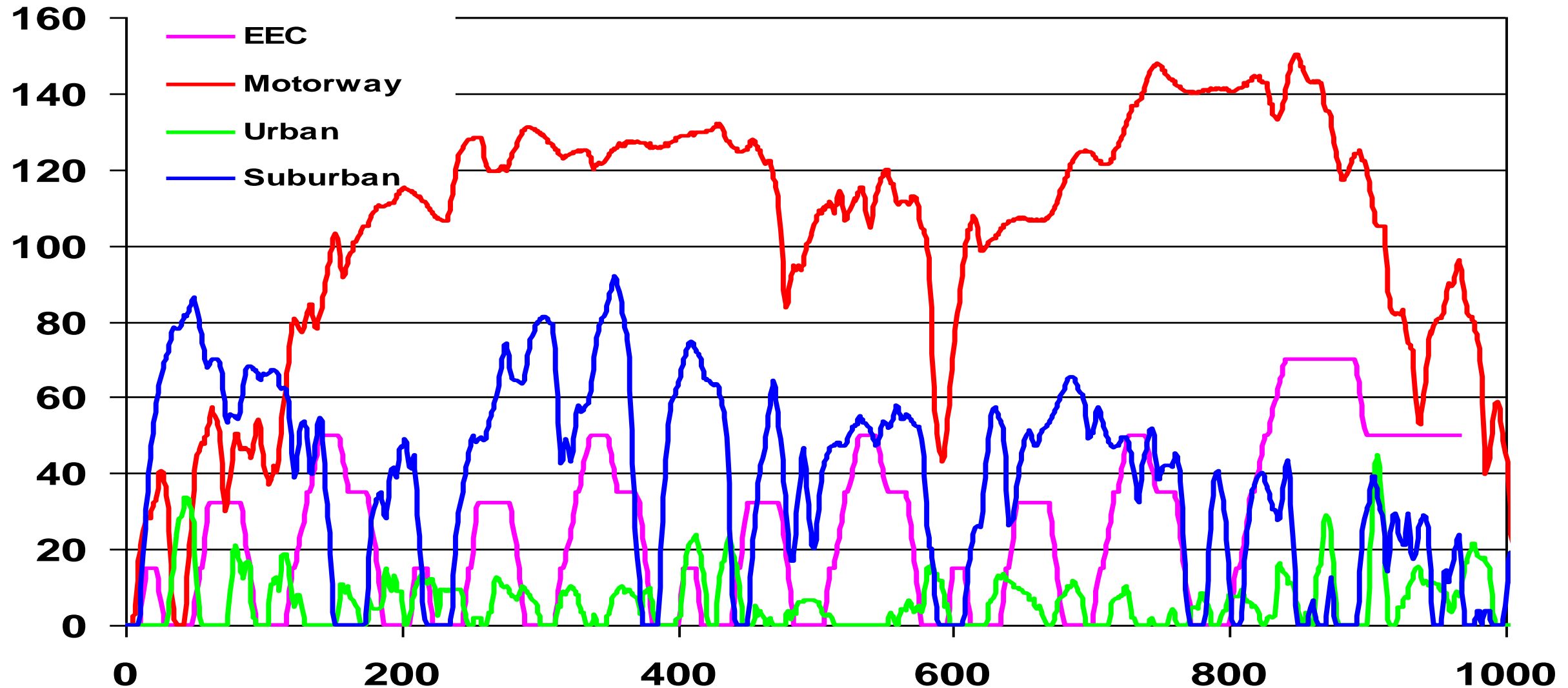
The real world user

- Is not constrained
 - Is not repeatable
 - Is not rational
 - Is not reliable
 - Is not easy to engineer!
-
- What we can do is create “representative tests” and aim to engineer flexible solutions

What is the right vehicle



How will the vehicle be used



“Real World” testing since 1996



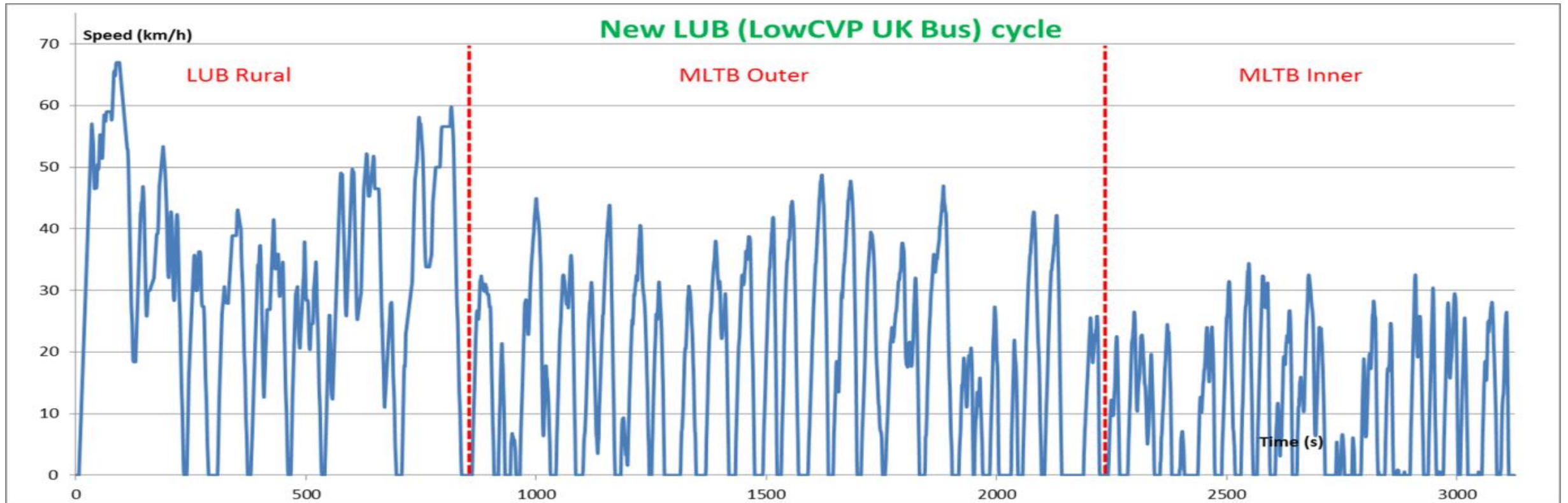
City Bus

- Start with what we want?
- Not, what will this do on my route?



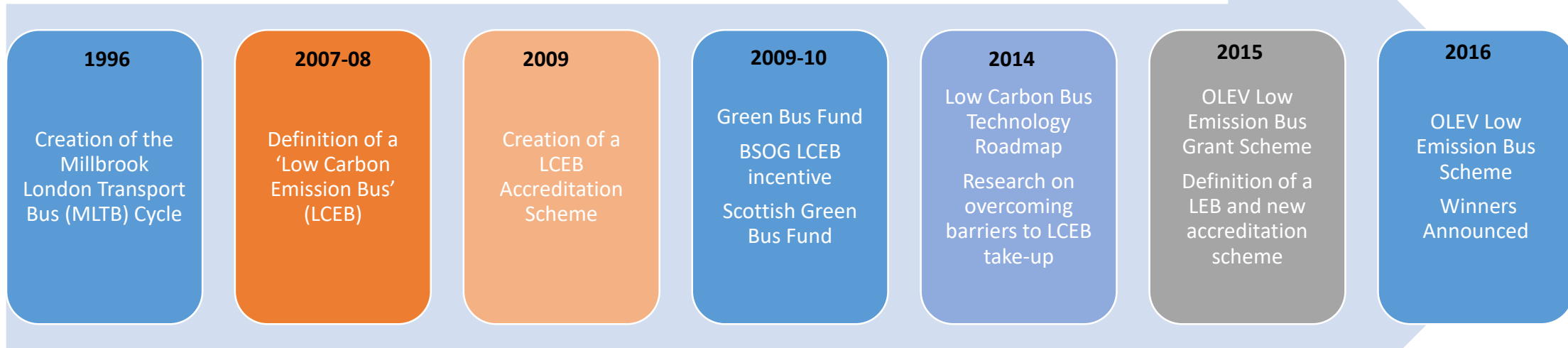
Low Emission Bus Vehicle Emission Testing Procedure

- Test procedure – Low Emission Bus Accreditation Scheme
- Real world cycle - LowCVP UK Bus (LUB) Cycle as adopted in Low Emission Bus Scheme.
- Test to be undertaken at a vehicle laboratory using a chassis dynamometer
- Test conditions: 50% of seated passenger load
- Measurements: NO, NO₂, NO_x, N₂O, CO₂, CH₄, PM, THC plus NH₃

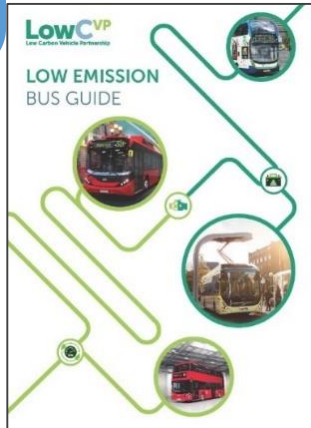
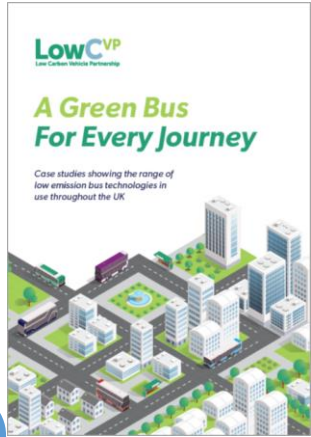


Success takes time, *and perseverance and funding!*

Key milestones in the evolution of green bus policy in the UK



20 years of collaborative development of products, performance and policy



The UK Bus market success

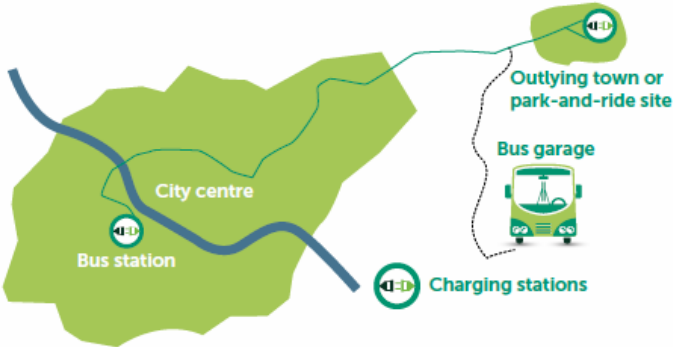
- 40% of new Buses sold in 2015 classed as “Low Carbon”
- All technology options represented - CNG, Hydrogen, Hybrid, Plug in, Full Electric, Mild hybrid, Biofuel
- Government support
 - Grant for Vehicles
 - Grant to support infrastructure
 - Operating incentives
- OEM support – Full range of products
- Robust assessment – full carbon impact, Air Quality, Cost
- Operator support and engagement, collaboration with OEM

Electric buses and infrastructure

LEB Certificate Performance Data

	Electric Bus Models	Energy Consumption and Electric Range	WTW GHG and Air Pollution Emissions
	Volvo 7900 Electric Single Decker Length: 12m Passenger capacity: 83 GVW: 18,000 kg	84.7 kWh/100km Up to 39.3 km	WTW GHG Emissions: 447.3 gCO ₂ e /km 5.3 gCO ₂ e/passenger km WTW GHG savings: 65% Zero emission
	Optare Solo EV Single Decker Length: 9.2-9.9m Passenger capacity: 55 GVW: 11,300 kg	51.0 kWh/100 Up to 208km	WTW GHG Emissions: 307 gCO ₂ e/km 5.6 gCO ₂ e/passenger km WTW GHG savings: 69% Zero emission
	BYD eBus Single Decker Length: 12m Passenger capacity: 70 GVW: 18,700 kg	83.1 kWh/100km Up to 452.7 km	WTW GHG Emissions: 429.6 gCO ₂ e/km 6.1 gCO ₂ e/passenger km WTW GHG savings: 62% Zero emission
	BYD-ADL Enviro200EV Single Decker Length: 12m Passenger Capacity: 90 GVW: 18,600 kg	83.1 kWh/100km Up to 425.1 km	WTW GHG Emissions: 429.6 gCO ₂ e/km 4.8 gCO ₂ e/passenger km WTW GHG Savings: 68% Zero emission

Overview of different charging strategies and what to consider regarding installation



Opportunity Charging



Plug-in Charging

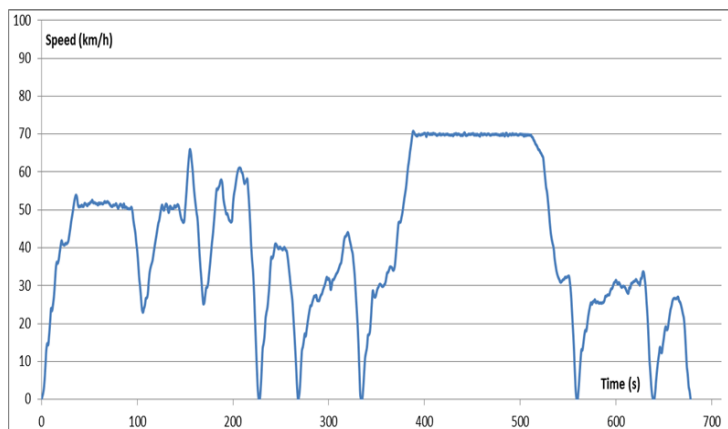


Truck vehicle emissions testing procedure

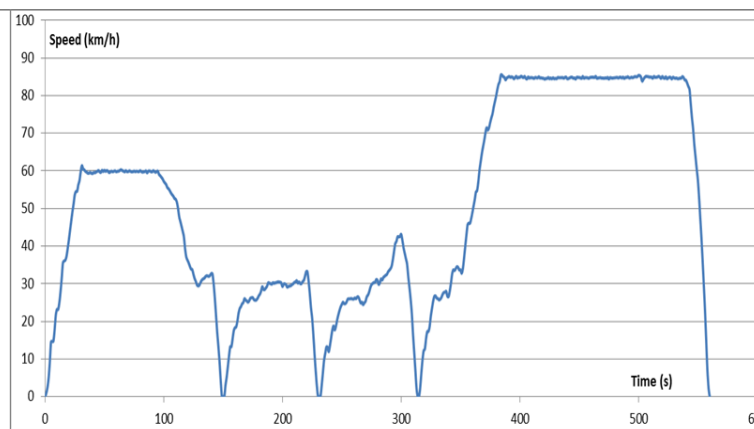
- Test procedure – HGV Technology Accreditation Scheme
- Real world test cycles – derived from VECTO applied to UK.
- Test to be undertaken on test track with PEMS with chassis dynamometer option
- Test conditions: 50-60% payload,
- Measurements: NO_x, NO₂, CO₂, THC, (PM, NH₃, N₂O not available on PEMS)

VECTO based Truck Cycles (Millbrook Versions)

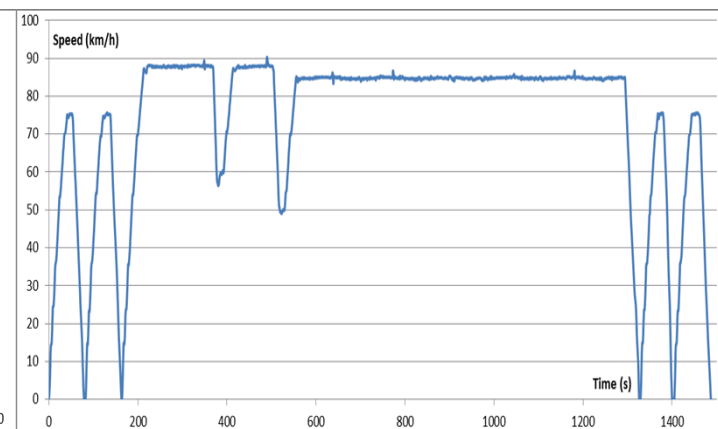
Urban



Regional

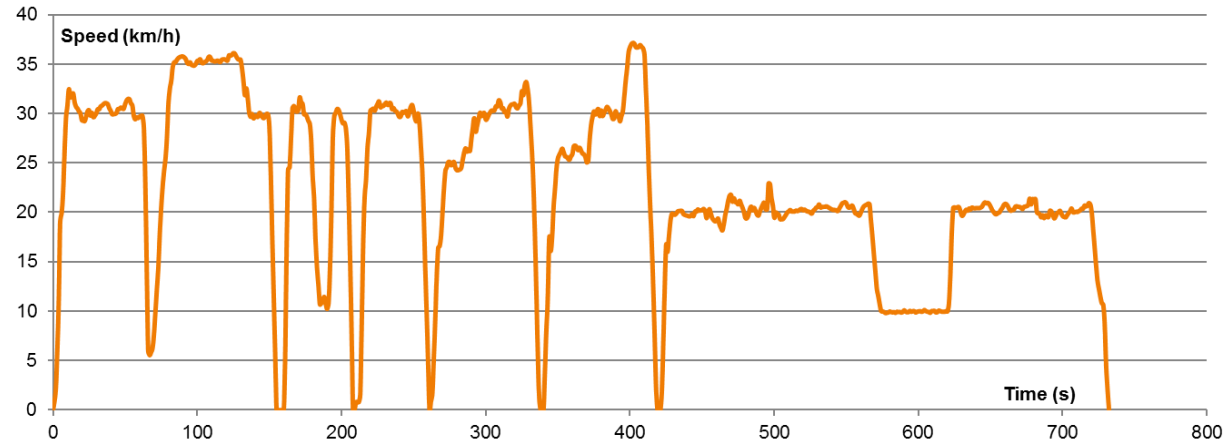


Long Haul



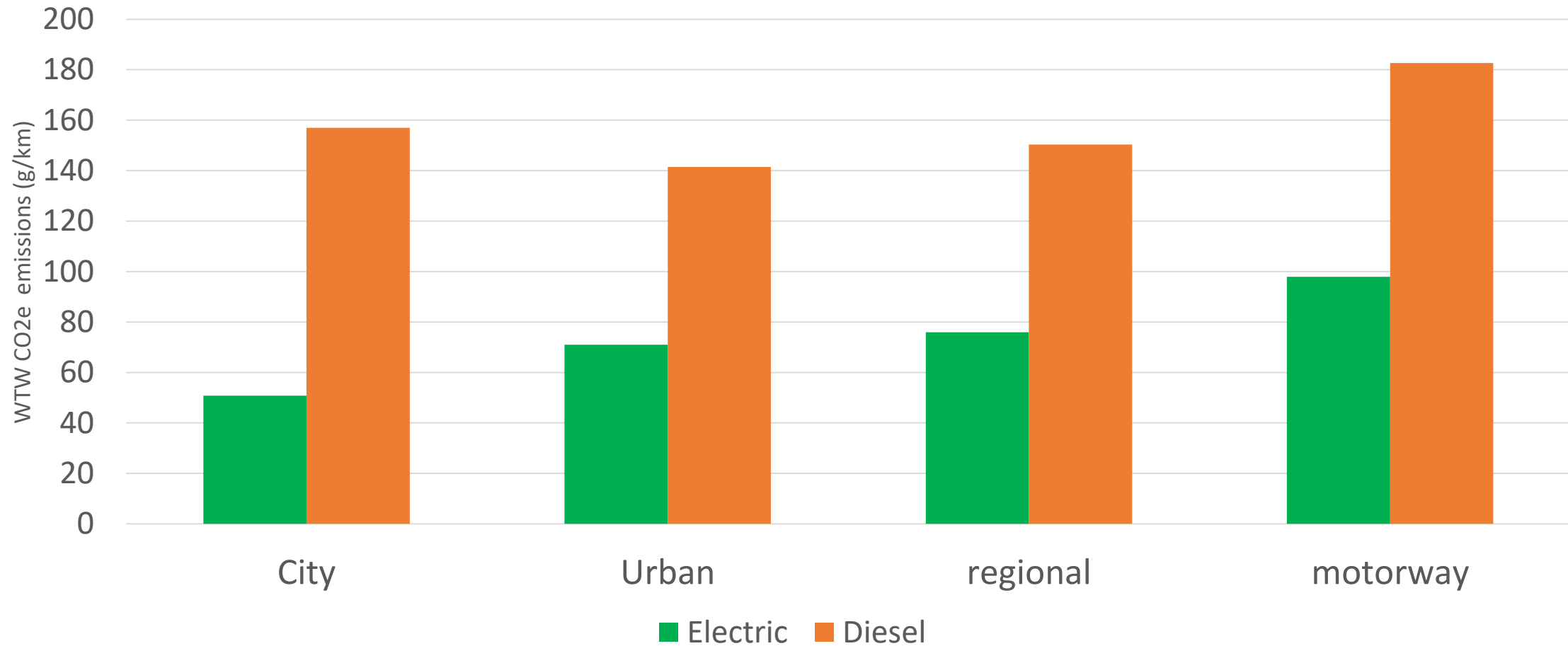
LoCITY city centre challenge

- City Centre Operation – low speed, start/stop (22km/h)
- Van focussed
- Correlated
- 60% load

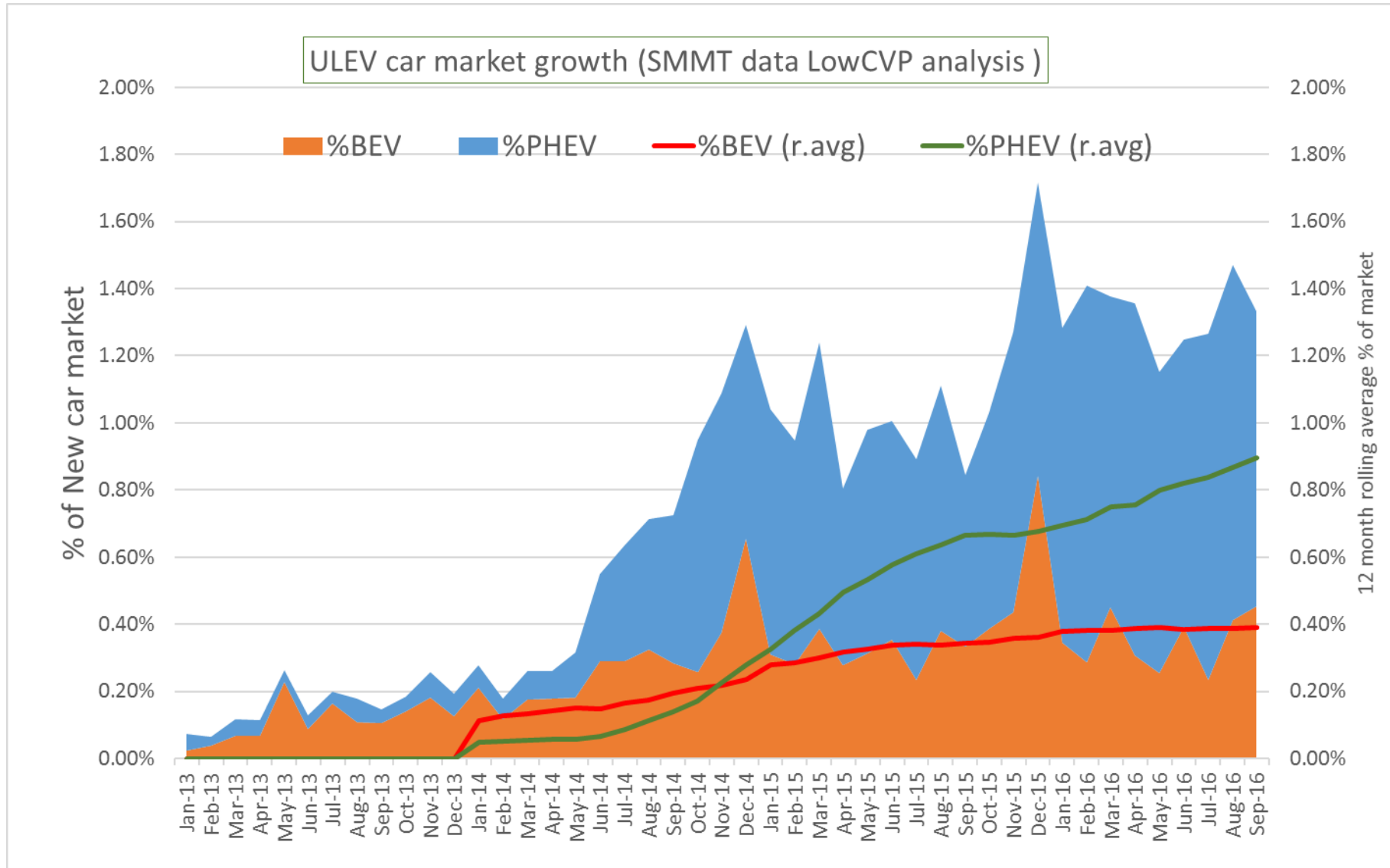


Importance of cycle v technology

Illustrative WTW GHG for laden Van cycles



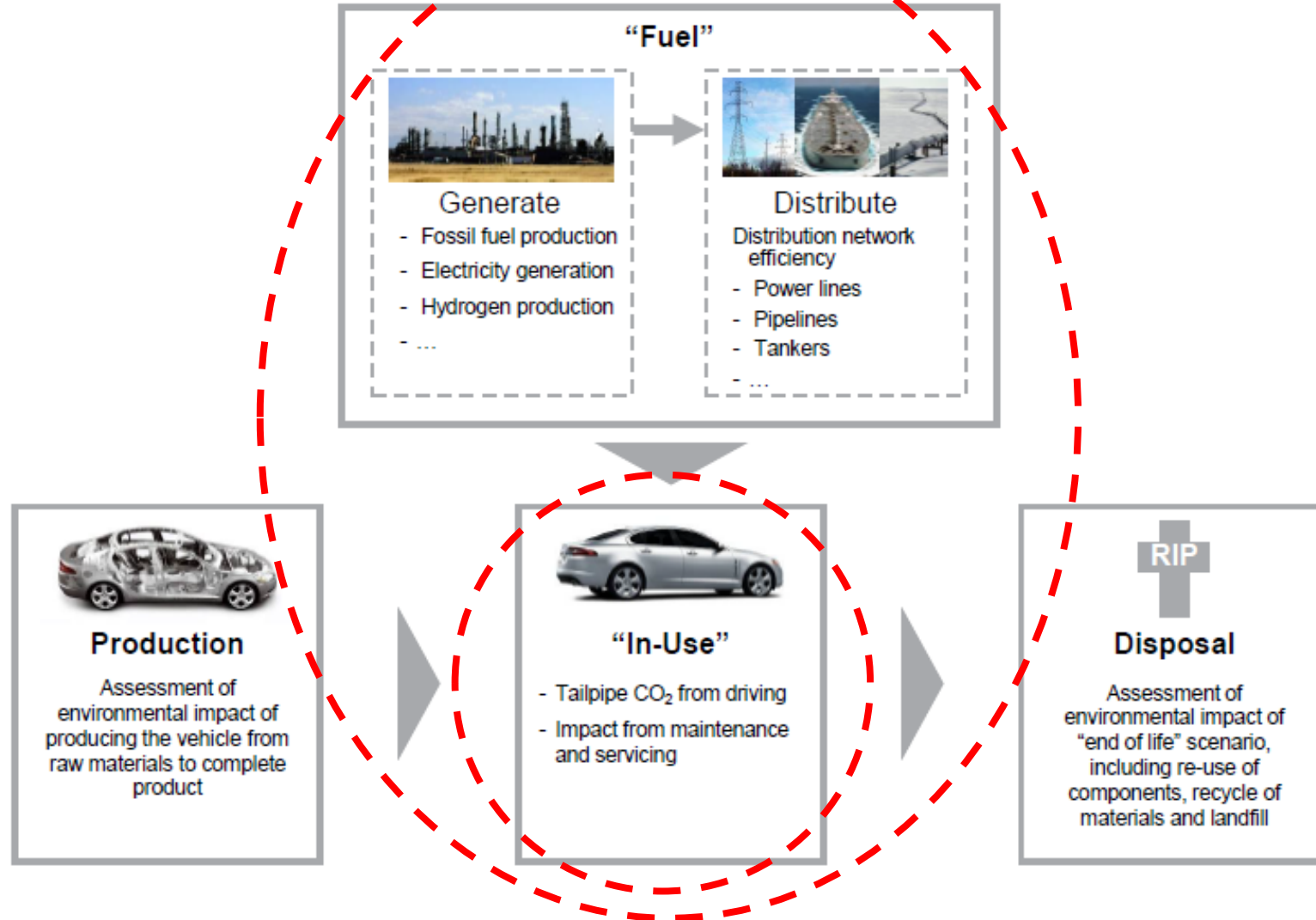
Consumers will make their own choice



- Question now is how to inspire mass market transition to more EV miles
- REEV/PHEV solution?
- Consumers resist giving up convenience
- True carbon impact of ULEVs depends on how they are used

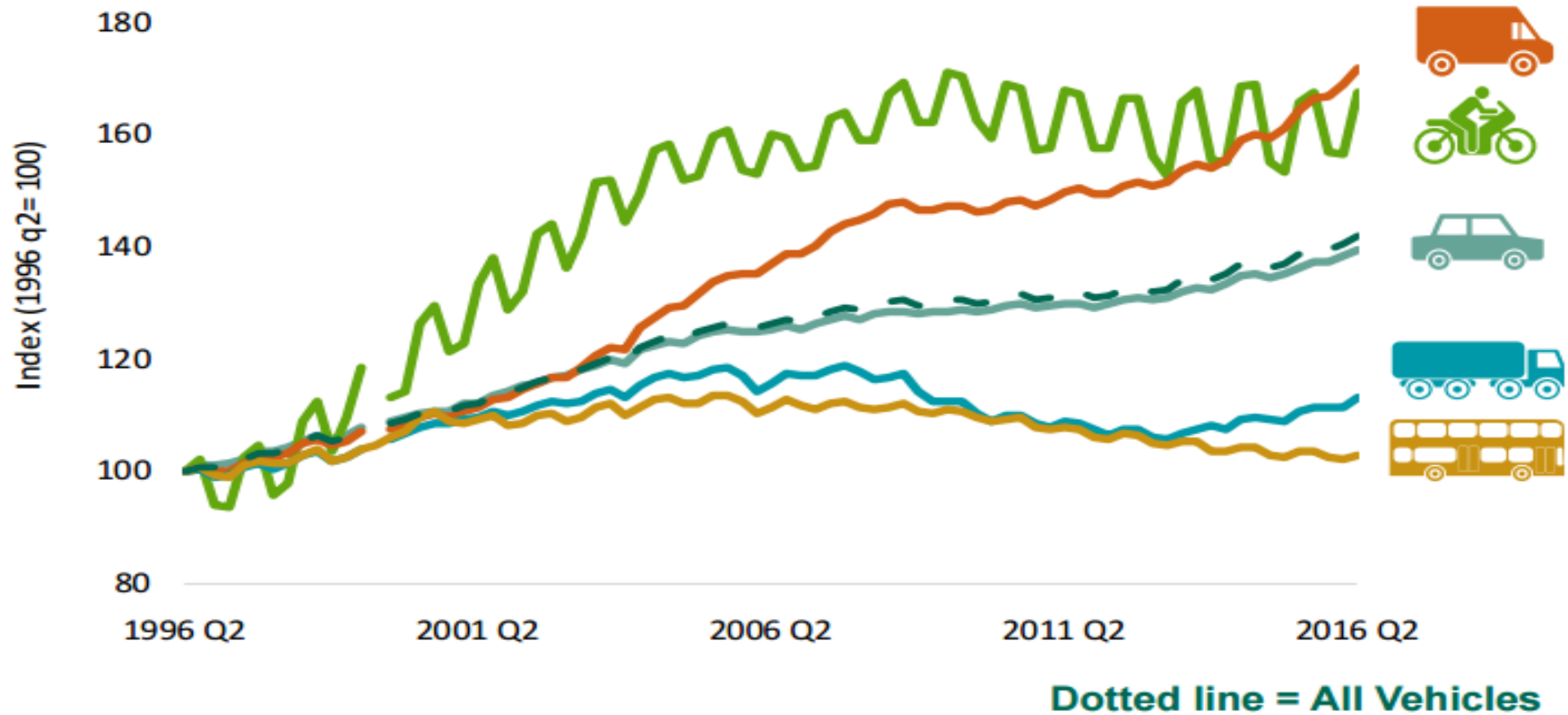
Progressively more robust assessment

- UK Bus support uses:
- Real world cycle
- Well-to Wheel
- Full Greenhouse Gas
- Zero emission range

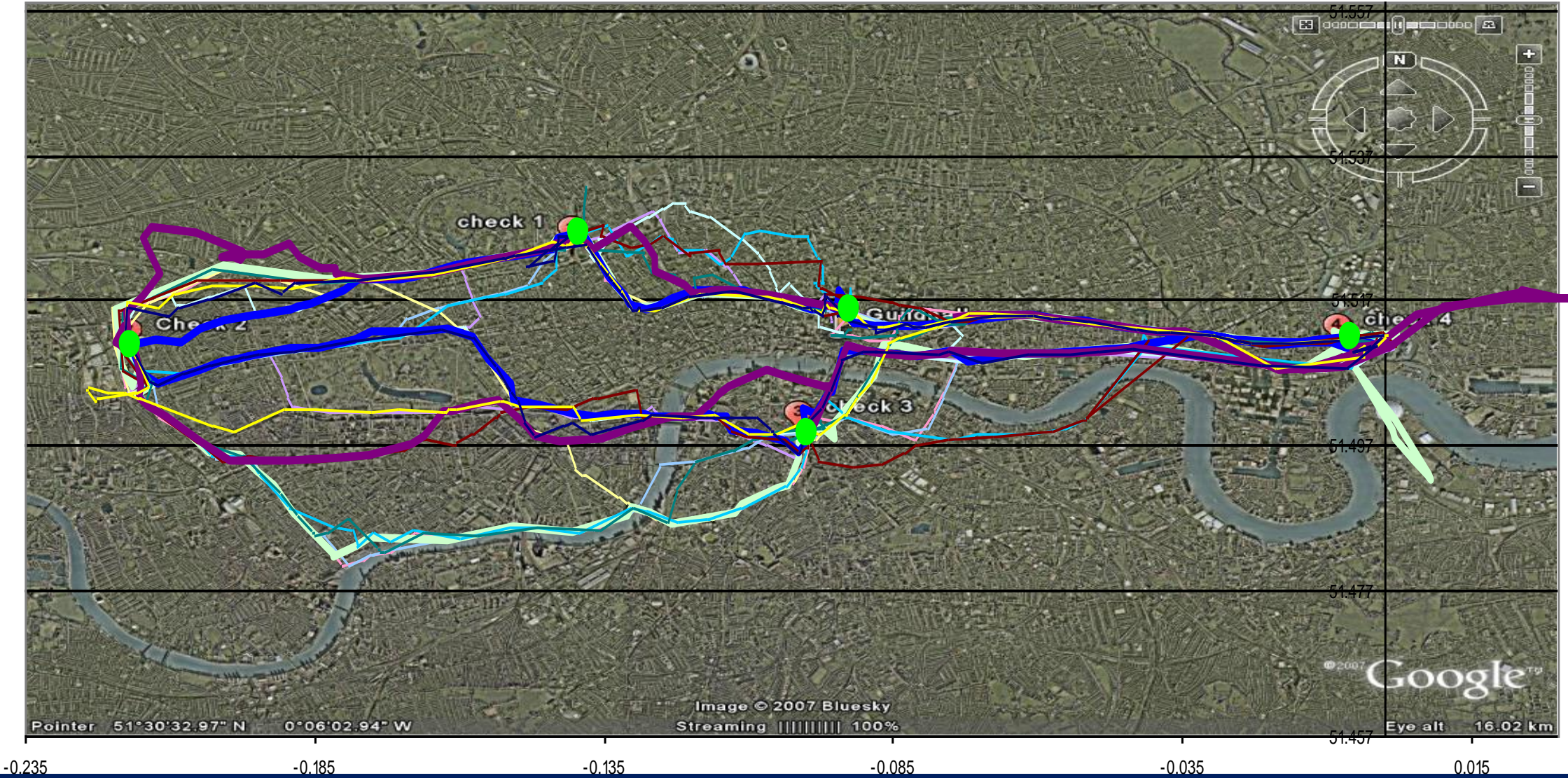


Commercial goods vehicles: The next big (low) carbon opportunity?

Figure 5: Licensed vehicles by type, GB: Q2 1996 - Q2 2016



Greenfleet Capital challenge, all given same task



Conclusion

- Keep focussed on the real world user.
- Develop the technology to deliver the market needs
- Aim for common assessment for Energy, Range, Emissions etc
- Don't assume you know what the driver will do!
- Communicate, collaborate and co-ordinate for success
- You can't test the real world, only a representative sample!

Efficient mobility, lower carbon, cleaner air

Creating the platform for robust support of low emission and fuel efficient technologies

- ❑ **Connect:** With privileged access to information, you'll gain insight into low carbon vehicle policy development and into the policy process.
- ❑ **Collaborate:** You'll benefit from many opportunities to work – and network - with key UK and EU government, industry, NGO and other stakeholders
- ❑ **Influence:** You'll be able to initiate proposals and help to shape future low carbon vehicle policy, programmes and regulations



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LowCVP is a partnership organisation with over 180 members with a stake in the low carbon road transport agenda.