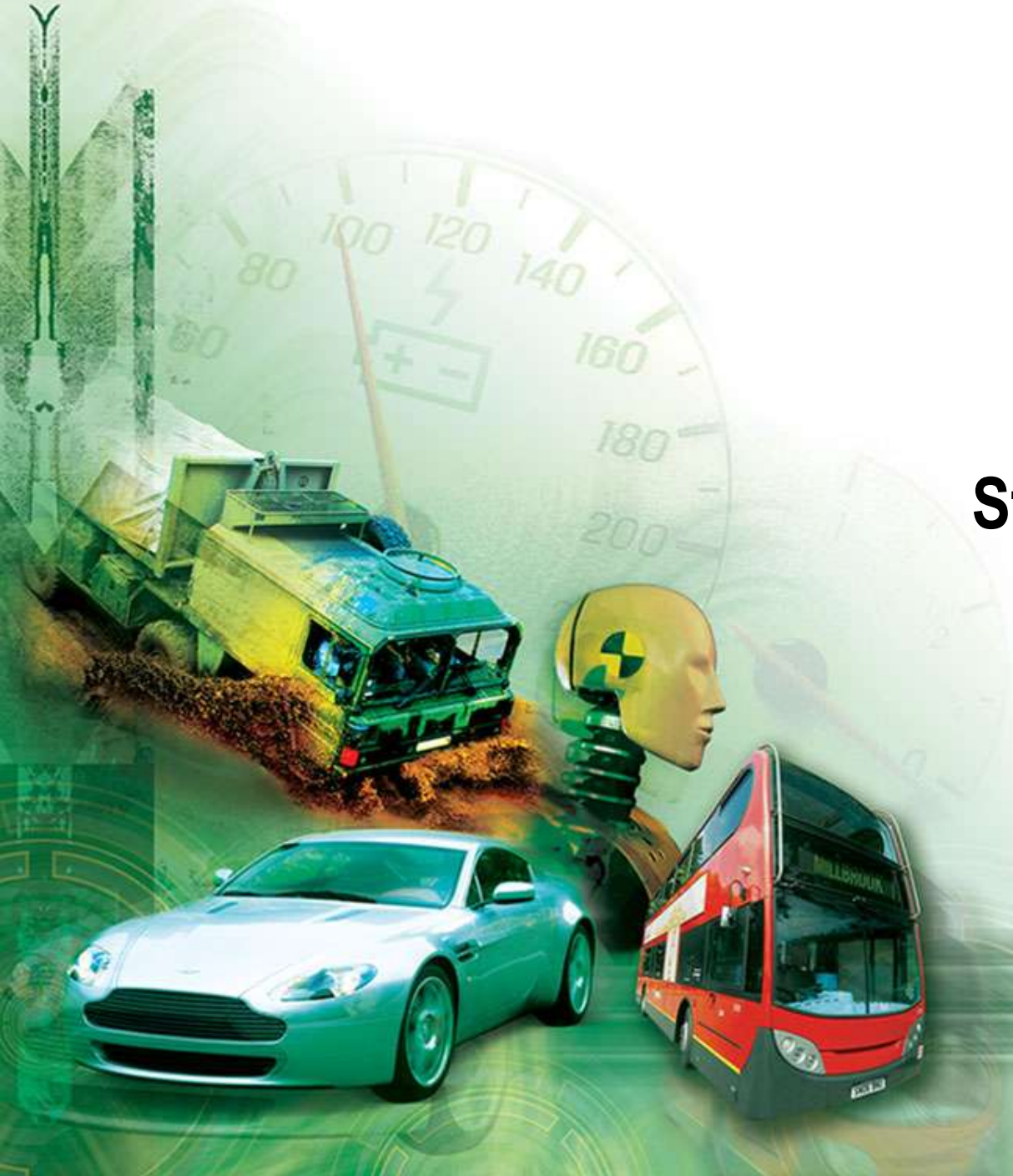

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Drive Cycle Standards and Issues

Andy Eastlake
Head of Laboratories - Millbrook

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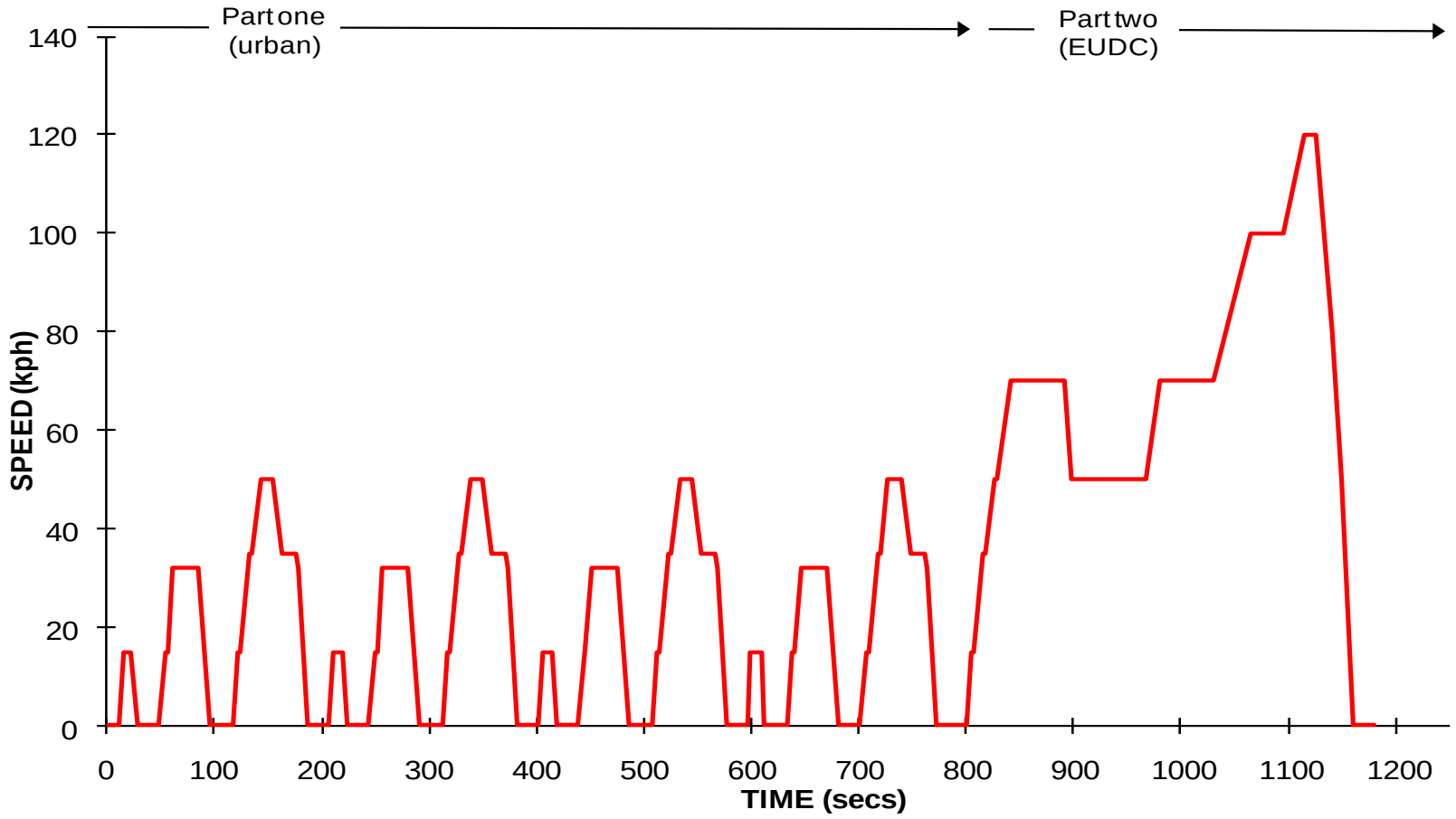
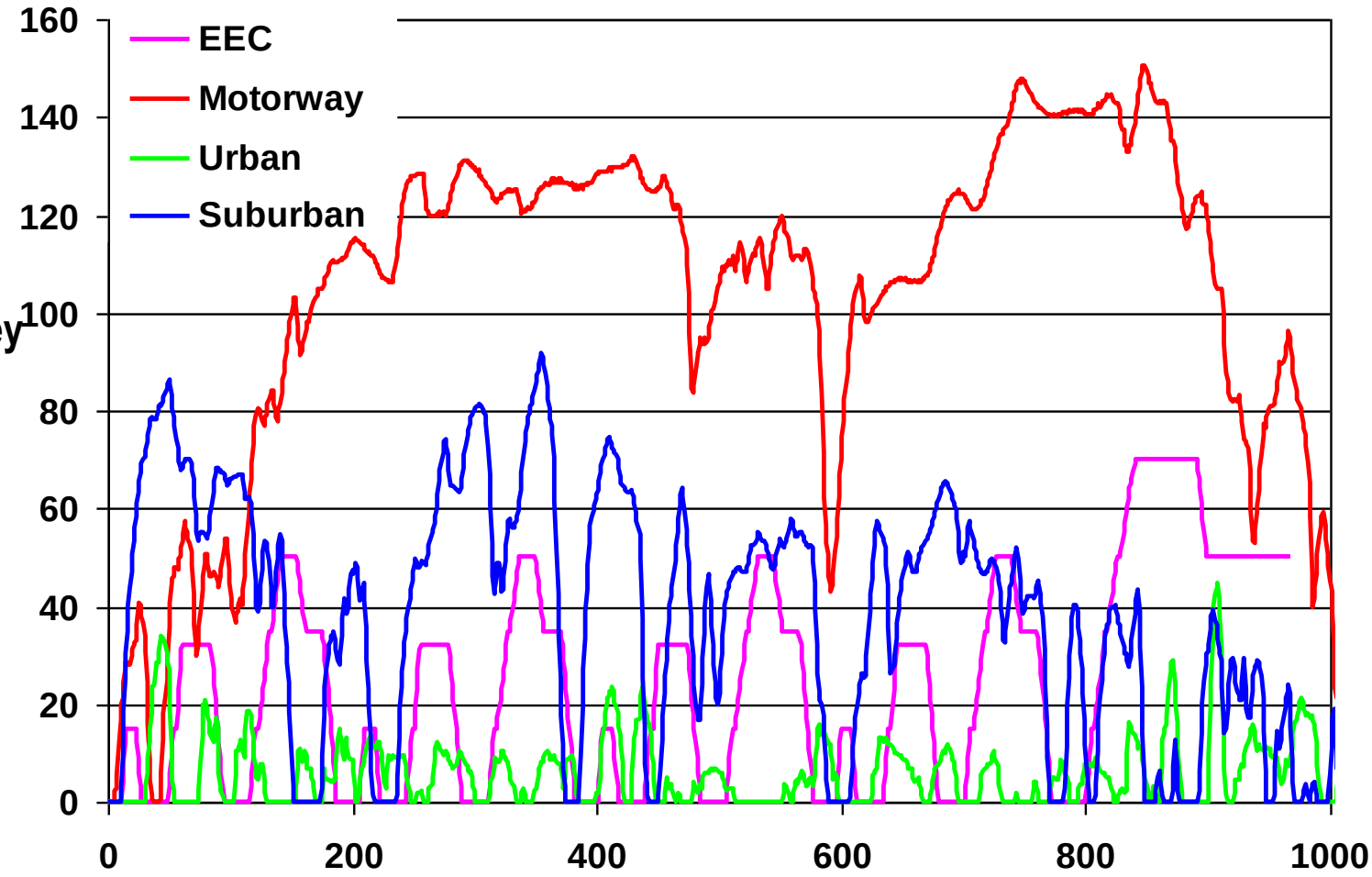
How it started – Millbrook in 1972

Current Drive Cycle



Driving Cycles, speed v time

Comparison of NEDC to "real world" derived cycles shows how different they are



Standard NEDC Test

- Current test limits technology
  - Low acceln rates
  - Several steady speed sections, unrepresentative of real driving
  - Limited idle time
- Precludes optimisation (and demonstration of benefits) of technology for specific applications
- City driving
- Van delivery cycle
- Bespoke applications eg taxi
- Electric drive inherent transient benefits

Hybrid Regulations

- Regulation 83 Annex 14 regulates emissions.
- Regulation 101 Annex 7, 8 & 9 regulates CO_2 & Fuel Consumption.

- Regulation 101 based on Regulation 83 - Prescribed for:
  - Electric Only Vehicles
  - Onboard vehicle charging hybrid
  - External vehicle charged hybrid

(Currently on supplement 9, updated roughly annually).

Test burden

- Range – repeated NEDC's from cold start until depleted (10 – 15 tests?)
- Energy consumption – measured over NEDC or over Multiple NEDC
- PHEV's tested in high and low battery condition
- Discharge and charge procedures are lengthy
- Potential for multiple operating modes
- Complex operating strategies
- Enhanced test facility requirements

The whole story?

- Conventional vehicles report tailpipe CO2
  - Excludes consideration of fuel extraction, processing and transportation
  - Does not agglomerate GHG emissions into CO2e

- EV's if using Defra CO2 figures are not compatible with conventional fuels
  - Consideration of long term Electricity generation (v long term oil exploration)

Range anxiety

- EV Range is significantly affected by
  - Use of ancillary loads
  - Gradients
  - Driving style (braking)
  - Regen strategy (driveability)
- None of which are included in the legislative test
- Running costs are significantly affected by “time of refuelling”
- CO2 is highly variable depending on generation source

Assumptions about technology use

- Currently the regulation assumes that every PHEV driver will drive a full EV range and then a further 25km before charging.
- This is the basis of CO2 and emissions reporting

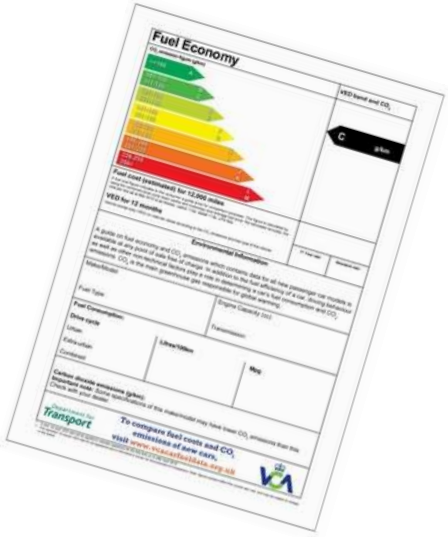
C/f emissions and CO2 for conventional vehicles assume every one drives 11km then parks for 6hrs!

Questions

- Eco-Innovations – how will these be applied to EV/HEV
  - Solar energy capture?
- Deterioration factors – how do we account for deterioration in battery performance? How realistic are emissions df's for PHEV's
- How do we optimise city cars and meet legislation?
- What s the effect of temperature on EV / PHEV

Public Information

- Diesel Smart – 86g/km, £720 pa fuel cost
- *Smart ED – 0km, £168 pa fuel cost (night electricity)*
- Many information providers, we need to have consist output from 'informed' debate



energy saving trust

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WHATCAR?
Britain's biggest and best car buyer's guide

LowCVP
low carbon vehicle partnership

Why does it matter

- Legislation used to be a formality required to sell a car?
- Public had very limited knowledge/interest
- Now it directly impacts
  - Public perception of running costs
  - Direct Taxation for company car drivers
  - Incentive schemes (parking/car share
  - Congestion charge
  - Peoples pockets!

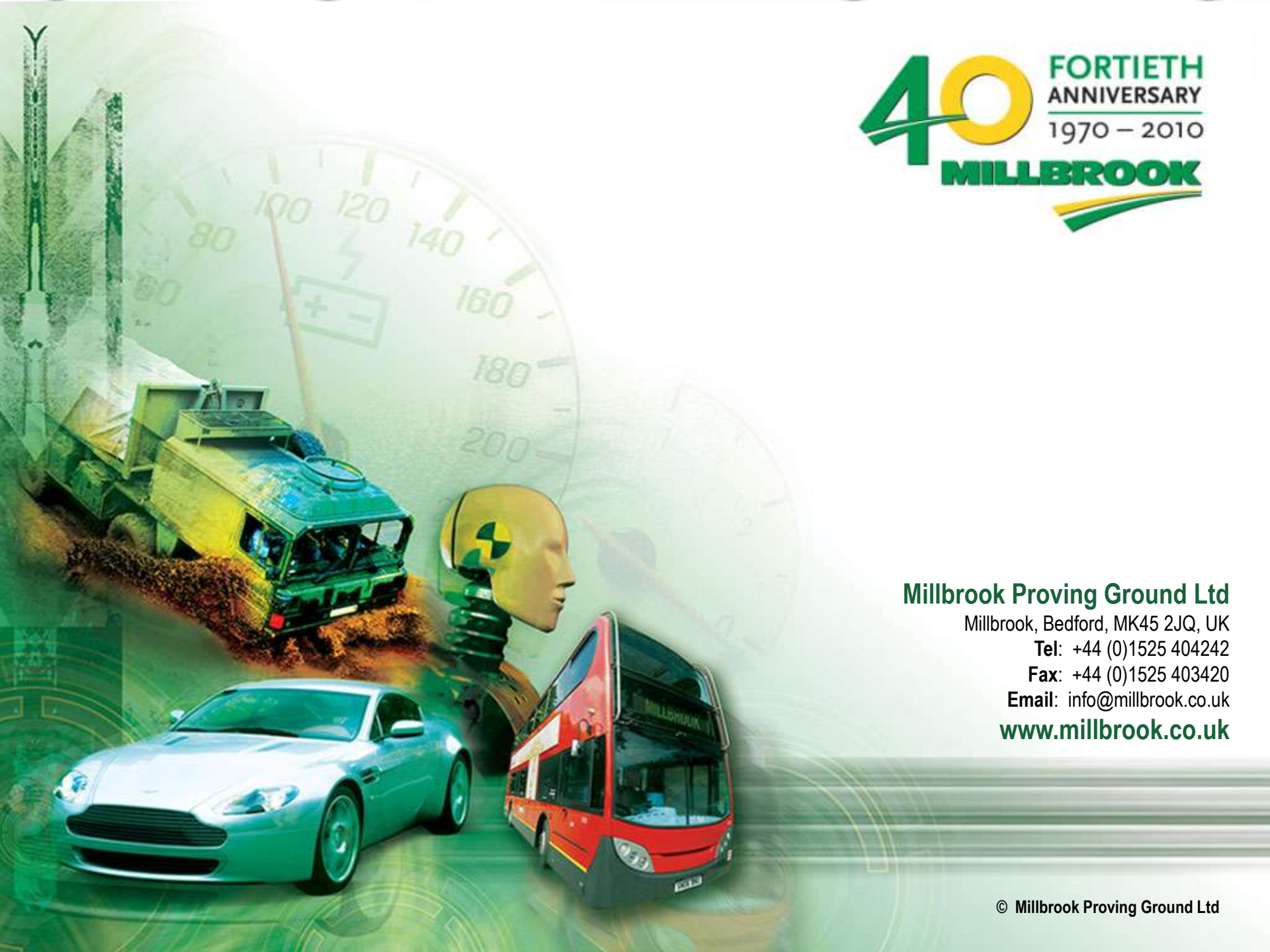
- Range has never been an issue for cars previously, but is a major factor in public perception of EV's

Conclusions

- Public need better and consistent information
- Comparisons to conventional fuels are complex
- Drive Cycle may be inappropriate
- Operating assumptions and calculations may be flawed
- Energy pricing assumptions will cause an influence
- CO2 and energy generation factors are important
- Fundamental energy efficiency benefits may be hidden

- Technology outpacing legislation!


Supporting the electric future



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