Sustainable low carbon transport

SHIFT09 Conference
by Cambridge Investment Research

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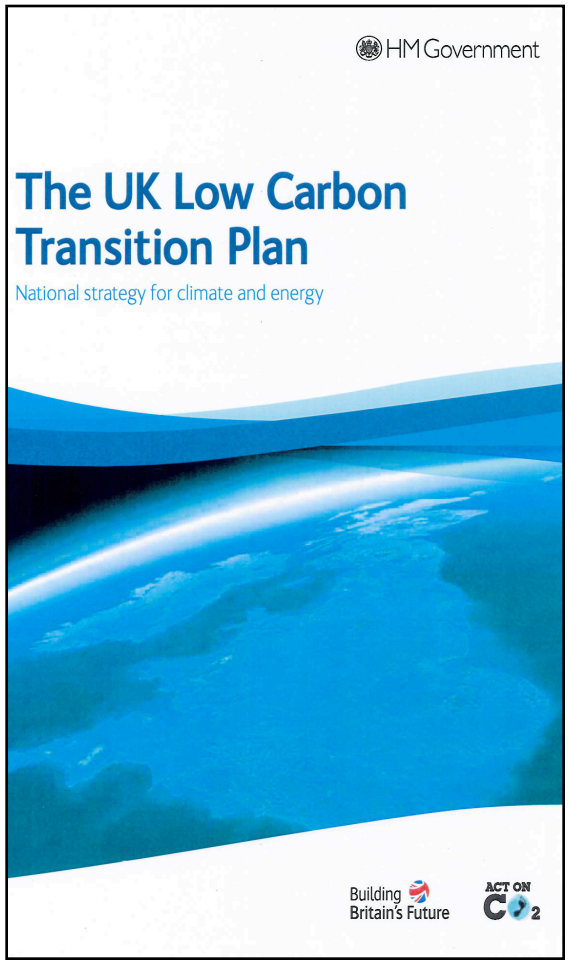
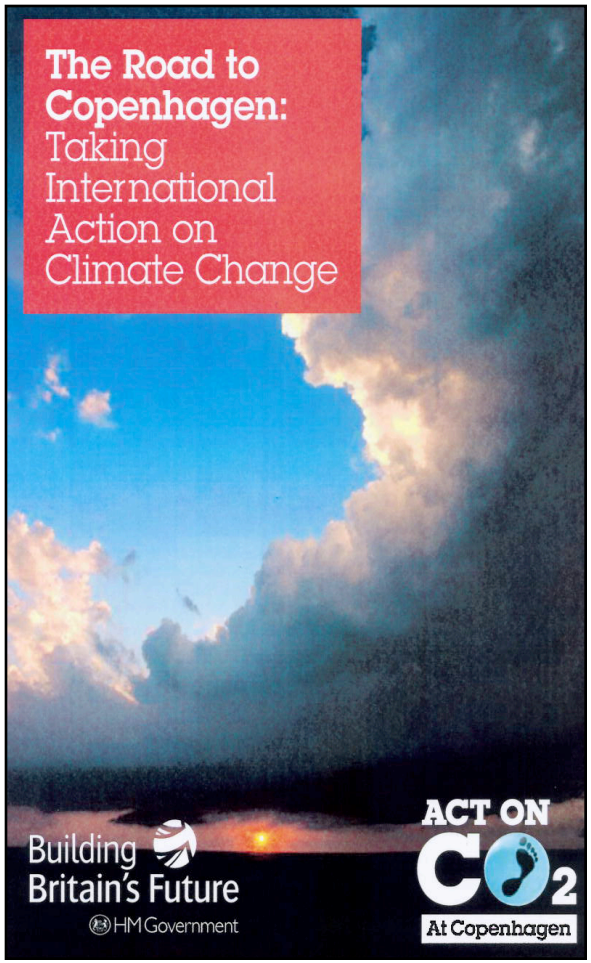
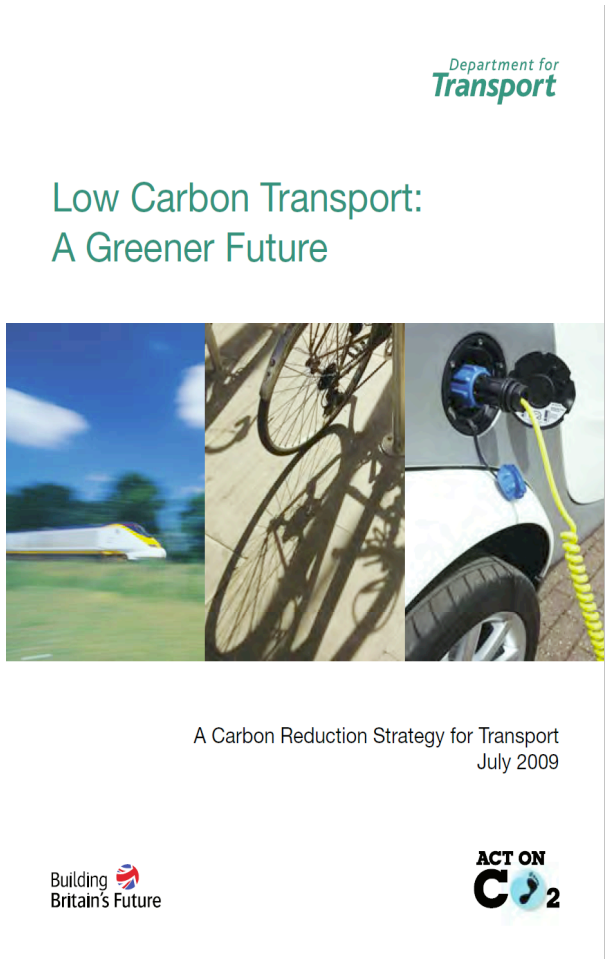
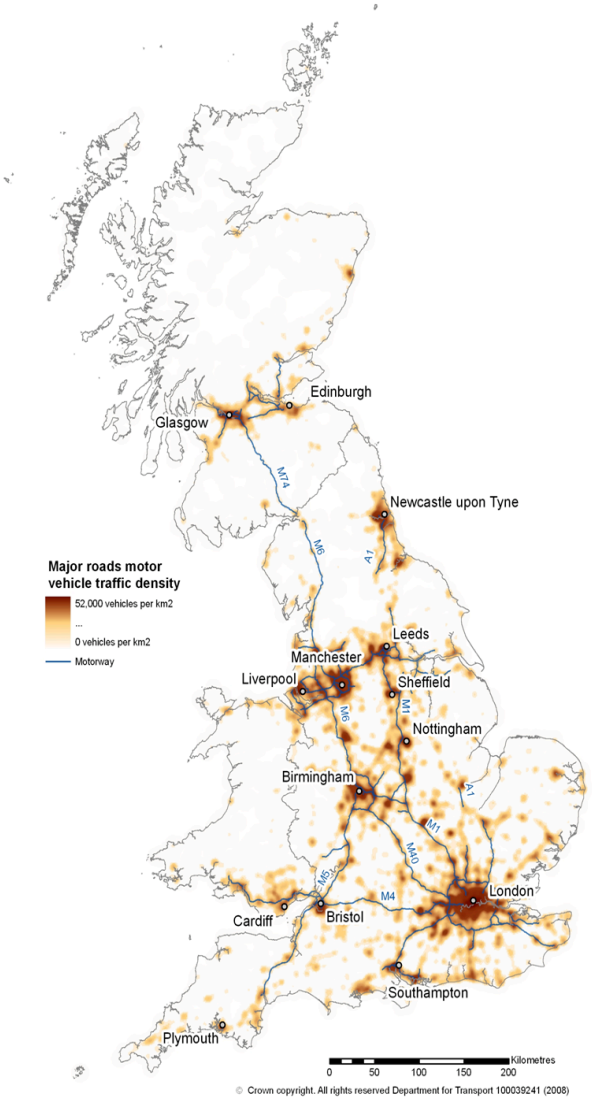
Prioritising climate change

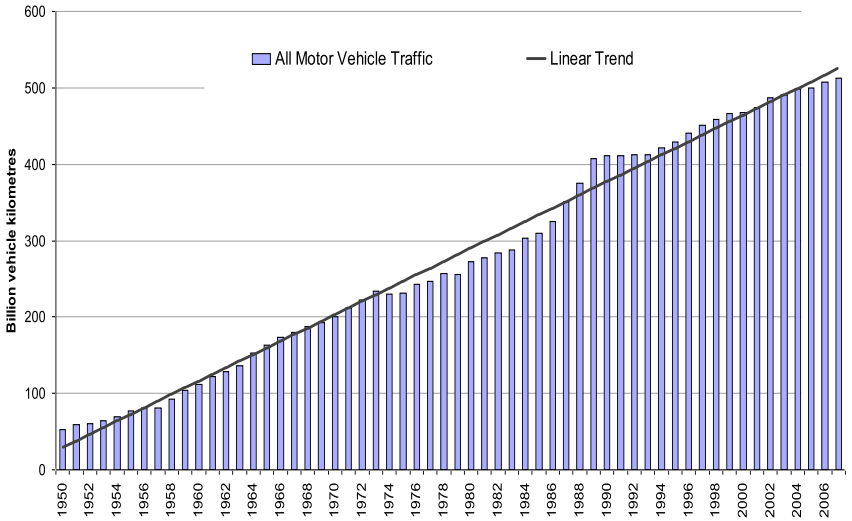






The challenge – traffic growth





Traffic growth (in vehicle miles) over the last 57 years - although the rate of growth has been falling, it is still currently running at about 1-2% a year

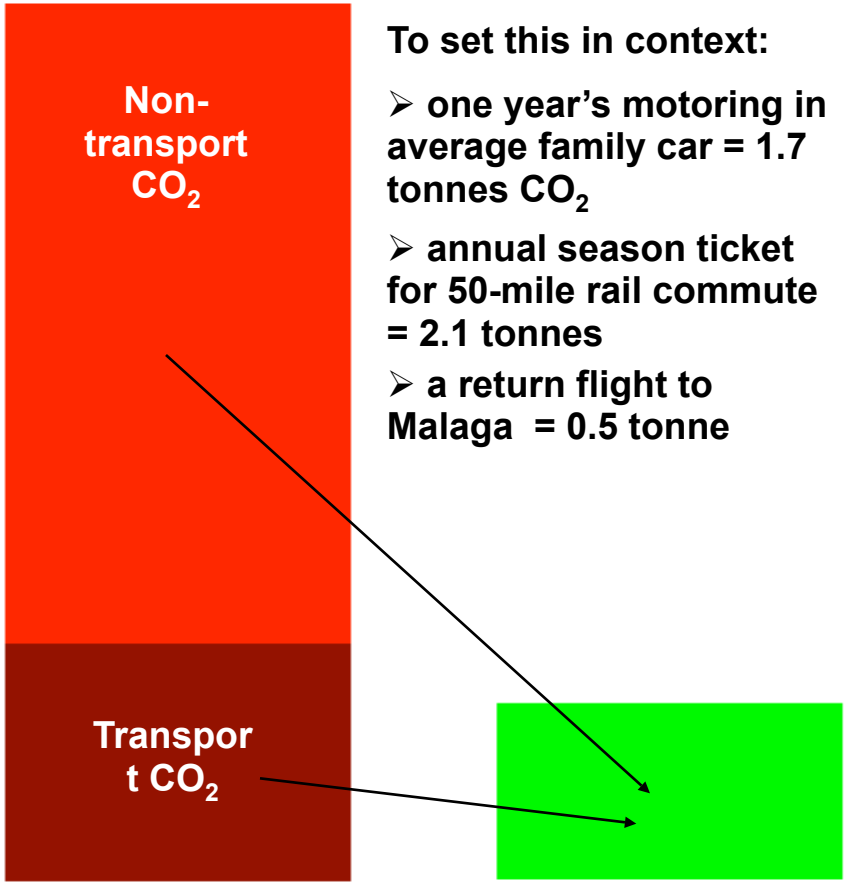
The challenge – scale of reduction

Challenging legal targets for GHG reduction are coming.

An 80% reduction in GHG means emissions per head down from c10 tonnes today to c2 tonnes by 2050

The UK Government's approach in the transport sector is based on:

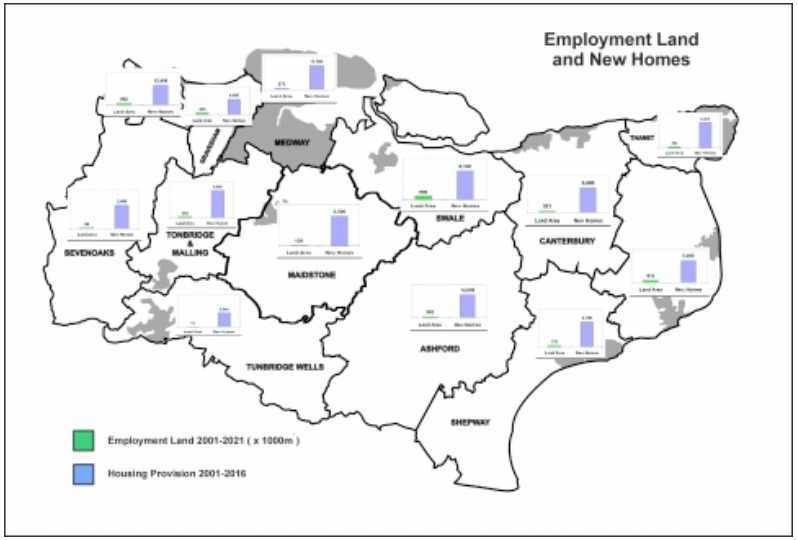
- **preserving choice**
- **facing people with true carbon cost**
- **forcing the pace of technological change**
- **promoting lower-carbon & non-travel alternatives**



To set this in context:

- **one year's motoring in average family car = 1.7 tonnes CO_2**
- **annual season ticket for 50-mile rail commute = 2.1 tonnes**
- **a return flight to Malaga = 0.5 tonne**

Conflicting demands



Where is energy consumed?

- Turning potential energy into kinetic energy
  - Chemical energy from fossil fuels used in ICEs
  - Chemical energy from biofuels used in ICEs
  - Chemical energy from fossil fuels and biofuels in jet engines
  - Electrical energy in batteries and fuel cells
  - Electrical energy from the Grid
  - Chemical energy stored in human tissue
- Making vehicles
  - Production lines
  - Raw material refinement and distribution
- Recycling
  - Use of energy in ‘waste’

New carbon analysis provides critical insights

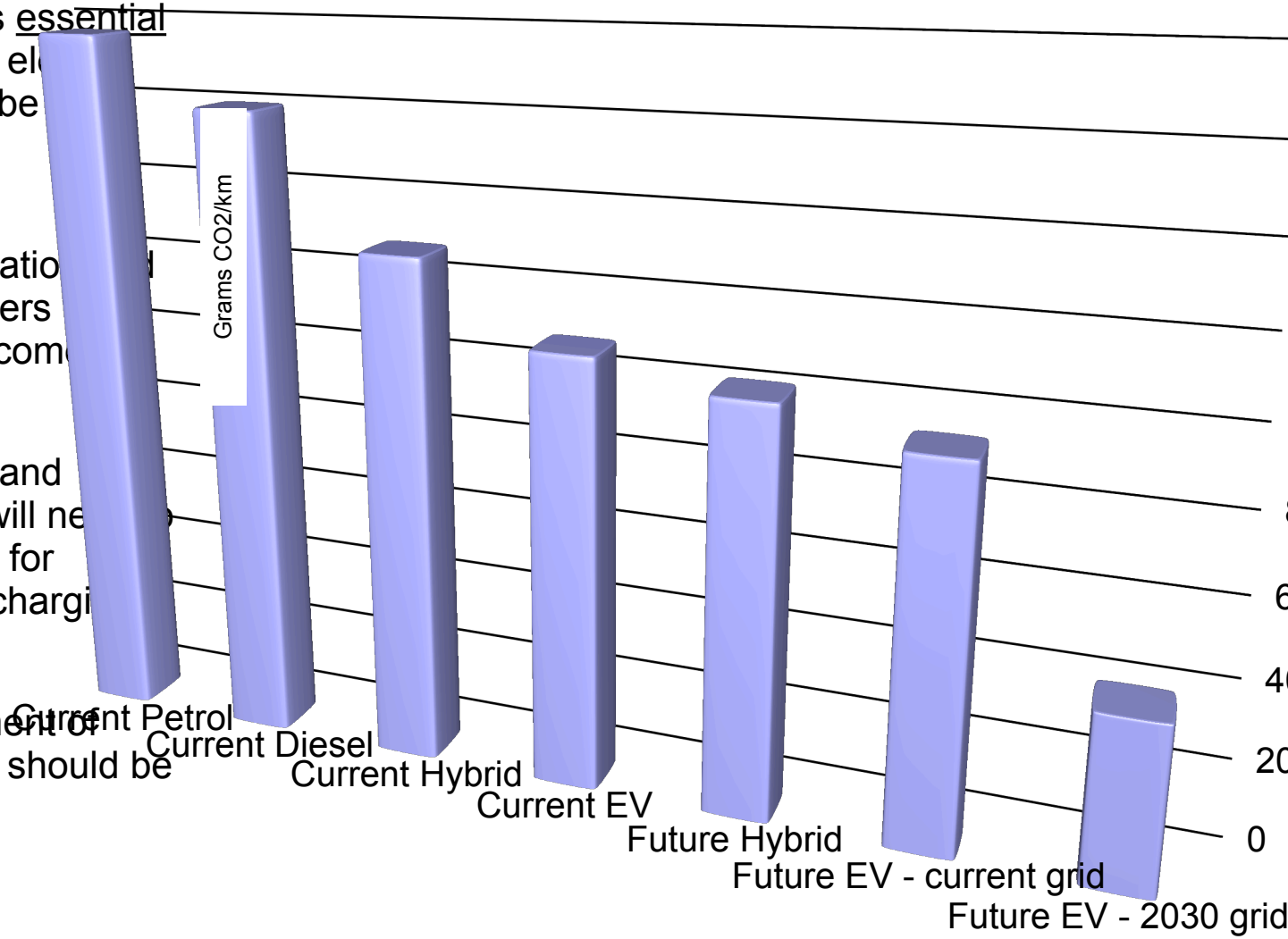
Investing in cleaner vehicle technologies

Opportunities for vehicle improvement

- ICE efficiency
  - Combustion processes
  - Fuel delivery
  - Conversion
  - Waste heat management
- Electric motors
  - Efficiency
  - Material supplies
- Smart electricity usage
  - Intelligent networks
  - Use of on vehicle storage as grid sources
  - Regeneration of kinetic energy via electric storage when braking
- Smart combinations
  - Range extended EVs using ICE powered electrical generators
  - Electrically supplemented human power
  - Biomass used to generate electricity

Challenges: Greening the Grid

- A greener grid is essential if the benefits of el transport are to be realised.
- Electricity generatio distribution barriers need to be overcom
- Smart metering and dynamic tariffs will ne be implemented for electric vehicle chargi
- Public procurement of electric vehicles should be encouraged.



Opportunities for supply chain improvement

- Minimum energy manufacturing
- Low energy materials for vehicle construction
- Smart logistics and distribution
- Improved raw material refining
- Synthetic materials and composites
- In service vehicle health management

Human factors

- Valuing journeys differently wrt energy
- Real-time energy cost information
- Collaboration in journeys
- Congestion v overcrowding
- Modal shift
- Substitution using ICT
- Pricing and taxation

Consumer behaviour

ACT ON CO_2

Provocation

- When will a tipping point on energy used in transport be reached, and will we able to anticipate it to prevent social and economic damage?
- Is human mobility a human right when it uses community resources i.e. energy and raw materials?
- Can technical improvements and organisational improvements deliver enough GHG savings in time?
- What would be the economic and social impact of radical reduction in personal travel?
- How could we organise logistics to be less energy consuming and at least as efficient?
- What is the role of ICT as a substitute for personal travel and what are the critical factors for success?
- How do we generate a sustainable aviation industry from where we are now
- Is Global trade at risk from marine environmental regulation – what are the technical measures to mitigate the risk
- What critical leapfrog innovations might be necessary and what would be their impact e.g. frictionless bearings in turbines, millisecond demand management, energy storage in the home, system of systems simulation software?
- How would control software be made reliable enough to ‘run the country and transport’ and at the same time be capable of remote upgrading?
- Can we model and analyse and make useful predictions of any of this with current methods?