The King Review of low-carbon cars

Part 1: The potential for CO_2 reduction
Part 2: Policy Recommendations

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Promoting Low Carbon Vehicles: Policy and Practical Action

7th November 2007

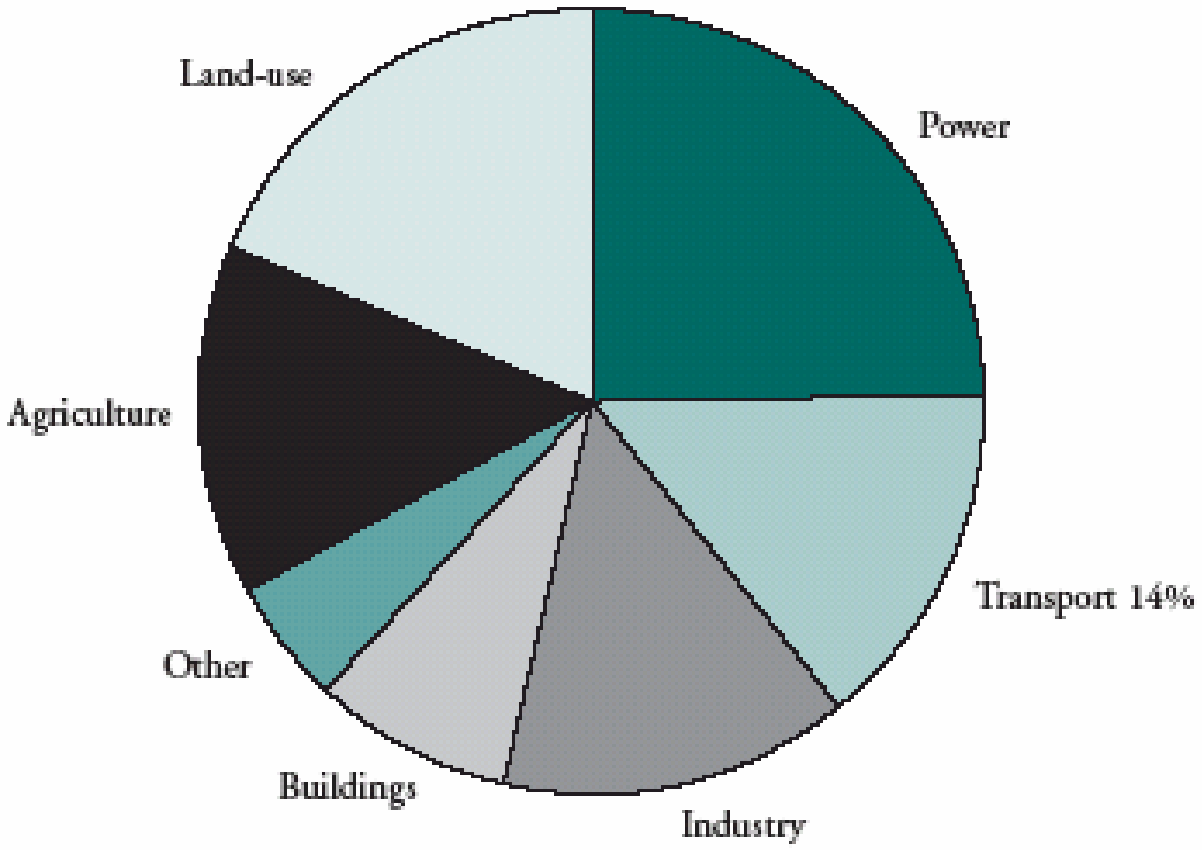
Background: introduction to the King Review

- King Review of low-carbon cars launched in Budget 07 by Gordon Brown
- Independent Reviewer Professor Julia King, with support from Sir Nicholas Stern
- Cross-Government Review Team, led by Chris Mullin in HMT, with members from DfT, DEFRA, BERR and HMT
- Reporting to 4 Secretaries of State: DfT, HMT, BERR and DEFRA
- 2 publications:
  - Part 1: The potential for CO_2 reduction – published in October with PBR 07
  - Part 2: Policy recommendations – expected to publish Budget 08
- Terms of reference: to examine the technologies that can help de-carbonise road transport, particularly cars, in the next 25 years, and make recommendations on how the UK should respond to these

Background: wide stakeholder consultation

- Meetings with over 100 stakeholders
  - Energy companies: Shell, BP, E.on etc.
  - Vehicle manufacturers: Ford, GM, BMW, Toyota etc.
  - Other industry players: Johnson Matthey, Lotus, Ricardo, Zytec etc.
  - Industry organisations: SMMT, Cenex, LowCVP, BVRLA etc.
  - Environmental groups
  - Academics, research councils
  - Whitehall: cross-Departmental group and numerous officials from across government, TfL etc.
  - Secretaries of State
- King Review-Low CVP seminar series, involvement at industry events
- Approximately 100 detailed submissions from public Call for Evidence

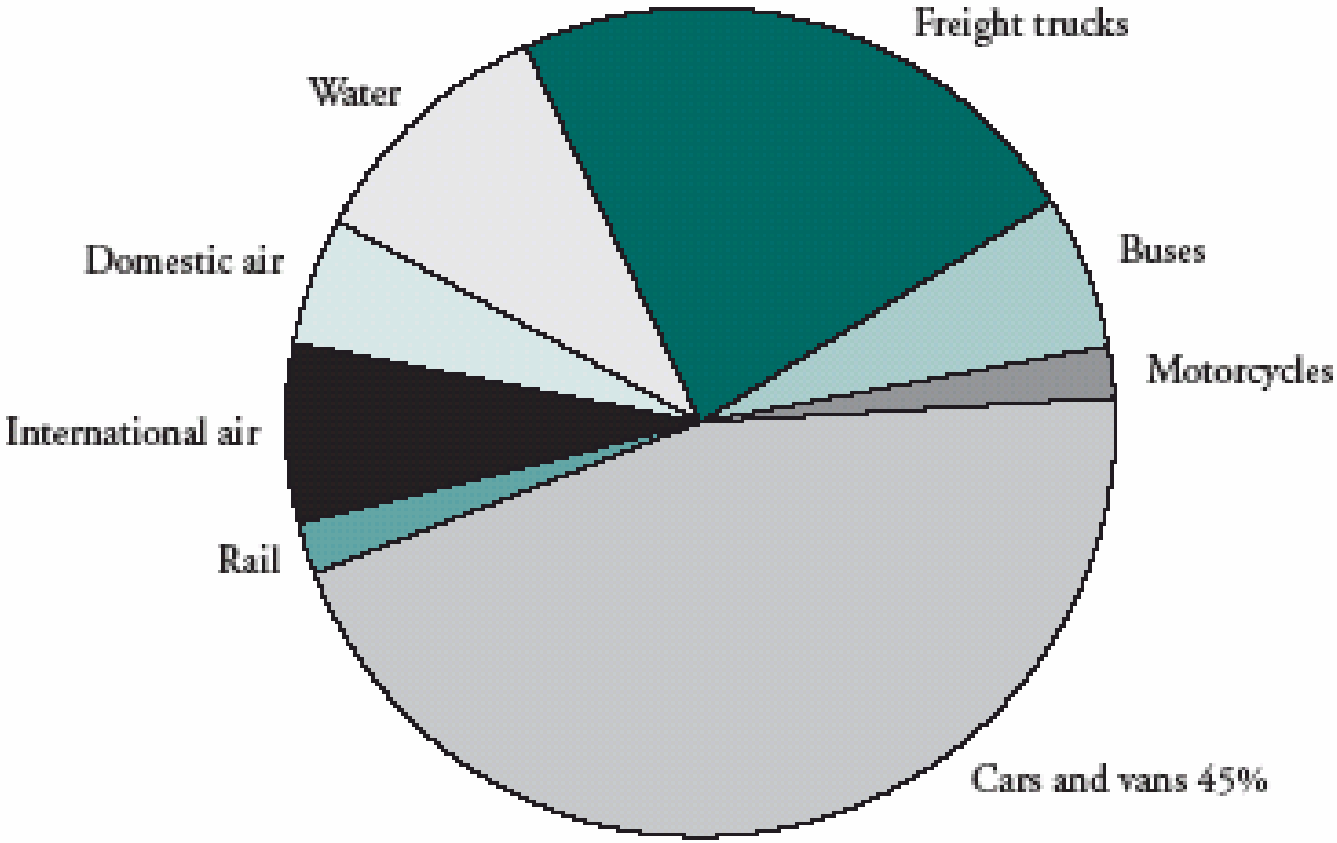
Global CO_2 contribution from transport: 2000



Total emissions in 2000: 42GtCO_2e
Energy emissions are mostly CO_2

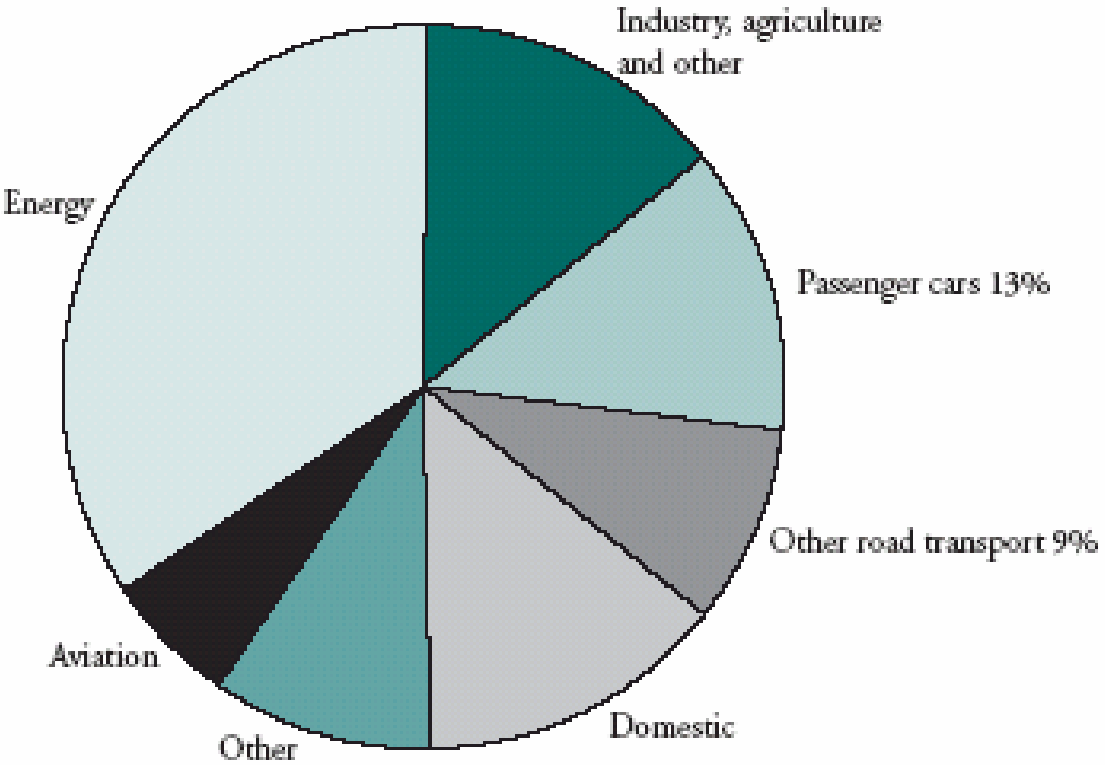
Source: WRI (2006).

Global transport CO_2 by mode: 2000



Source: WBCSD (2004).

UK transport emissions: 2005



Source: AEA/DEFRA

UK road transport: 22% of total emissions

Approximately double the proportion globally

The challenge

- The Stern Review set outs the overall challenge of 60-80% emissions reductions by 2050 in the developed world

- With passenger cars contributing 13% of the UK's total emissions, this sector will need to make major reductions

- The Eddington Transport Study (2006): under a BAU scenario road transport in the UK is predicted to rise by 28% between 2003 and 2025

    - ***extrapolating this trend, road transport could double by 2050***

- To achieve an 80% reduction in CO_2 emissions from cars in the UK by 2050 implies a 90% reduction in emissions per km

    - ***almost complete 'decarbonisation' of cars***

Potential for CO_2 savings

- The King Review was set up in the wake of the Stern Review to look at ways of reducing CO_2 emissions from cars, on the way to complete de-carbonisation

- There is huge potential for CO_2 savings, with a role for vehicle manufacturers, fuel companies, consumers and Government

- We need to ensure progress in all areas:

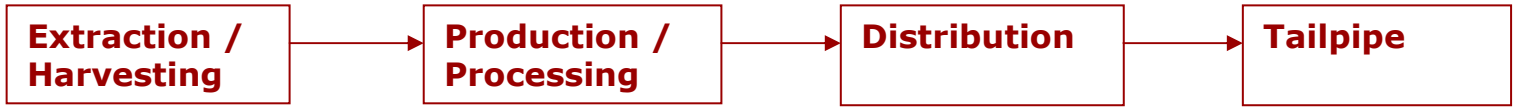
  - **cleaner fuels**

  - **more efficient vehicles**

  - **smart driver choices and behaviour**

Cleaner fuels: all fuels need to be considered based on *life-cycle* CO_2

- CO_2 emissions from fuels occur at different stages of the lifecycle



- With conventional petrol and diesel most CO_2 emissions are downstream
  - petrol and diesel (typically 85% tailpipe)

- With alternative fuels most CO_2 emissions are upstream
  - biofuels (mostly harvesting, production)
  - electricity, hydrogen (almost totally production)

- There are many different ways of making the same fuel: with a major influence on CO_2 emissions
  - petrol from oil sands has 25% higher CO_2 emissions than from conventional sources
  - biofuel CO_2 emissions vary between 10% and 100% of petrol emissions depending on feedstock, fertiliser use and production technique
  - electricity varies between 5% and 90% depending on energy source
  - hydrogen varies between 5% and 400% depending on energy source

Cleaner fuels: proceed with caution on biofuels

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- As a low-carbon, energy-dense liquid fuel, biofuels will have a role in road transport
  - ***the development of this industry is important***
- But - expand too fast, and there will be damaging environmental consequences
  - there are "good" and "bad" biofuels, depending on how and where they are produced, with impacts on biodiversity, water supplies, food markets, overseas development objectives etc.
  - if rainforests are cleared to grow biofuels, either directly or indirectly, the net effect is more damaging to the environment than using petrol
  - ***annual global emissions from deforestation are 18% - cf 14% from transport***
- Robust sustainability safeguards - in place and proven – are critical to ensuring that the expansion of biofuel demand is an environmental 'good'
- In the long term: we should not anticipate more than a small proportion of the UK's car 'fuel' coming from biofuels
  - land requirements for biofuels are high
  - ***approximately 1% of the world's agricultural land is currently needed to grow 1% of world's fuel - IEA***
  - biomass can be more directly and efficiently used in power generation, from a total CO_2 perspective
  - niche requirements for liquid fuels will remain: aircraft, military etc

Cleaner fuels: clean power generation is critical to de-carbonising road transport

- Biofuels can only ever be part of the solution – and increases in the efficiency of conventional vehicles will not be enough to get us where we need to be by 2050

- In the long term, CO_2-free road transport fuel is the only way to achieve almost de-carbonised road transport
  - electric vehicles, with novel batteries
  - charged by 'zero-carbon' electricity
  - or hydrogen produced from 'zero-carbon' electricity

- We cannot have clean cars without clean power

- The extra electricity demand must be met from new low CO_2 sources
  - total conversion of the UK car fleet to electricity equates to 16% of current demand, or 30% if hydrogen is used – E4tech

- Transport cannot be viewed in isolation

Vehicle efficiency: significant scope for short-term savings

- Technology for conventional vehicles that can reduce CO_2 emissions per car by 30% is already "close to market"
  - this includes direct injection, variable valve actuation, cylinder-deactivation, stop-start; regenerative braking…and some non-propulsion technologies
  - this potential is in addition to savings from alternative fuels and smarter choices
  - they *could* could be standard within 5-10 years
- These technologies would be cost-effective for the user
  - some of these technologies will carry a cost premium - rough estimates suggest a cost of around £1000 - £1500 per car
  - but better fuel efficiency would reduce whole-life costs
- Barriers delaying deployment pose a challenge for policy
  - supply-side: manufacturers need to be confident of a market
  - demand-side: consumers have to want the vehicles
- Carbon pricing/trading is a necessary instrument, but not sufficient to make this happen with urgency

Vehicle efficiency: 'close to market' options

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New engine and transmission efficiency savings and indicative costs

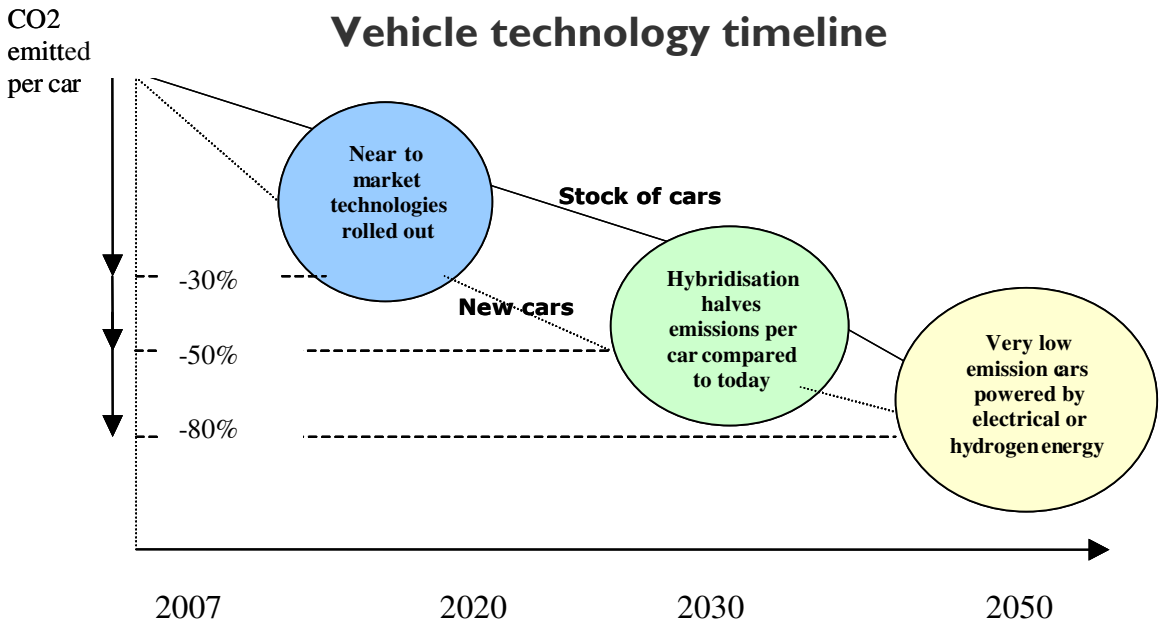
Technology	Efficiency saving	Cost per vehicle (£)
Direct injection and lean burn	10 – 13 %	200 – 400
Variable valve actuation	5 – 7%	175 – 250
Downsizing engine capacity with turbocharging or supercharging	10 – 15%	150 – 300
Dual clutch transmission	4 – 5%	400 – 600
Stop–start	3 – 4% *	100 – 200
Stop–start with regenerative braking	7%*	350 – 450
Electric motor assist	7%*	1,000
Reduced mechanical friction components	3 – 5%	Negligible

** Figure quoted is for the whole drive cycle. Savings are much greater in urban driving conditions.*

Ranges derived from a number of sources, including the International Energy Agency (IEA), Institute of European Environmental Policy (IEEP), California Air Resources Board (CARB), Ricardo. Cost estimates derived using approximate conversion to Sterling.

Vehicle efficiency: long term, 'zero-carbon' vehicles are a realistic aim

- Cars that emit 50% less CO_2 than today could be on the road by 2025-2030
  - probably plug-in hybrids with an electric system incorporating a small internal combustion engine
  - major advances in hybrid and battery technology are needed
  - vehicle costs must fall to be acceptable to the consumer
- By 2050 battery power could reduce CO_2 emissions per vehicle by up to 80%
  - if charged by zero-carbon electricity
  - the vehicle technology challenge is significant and needs addressing now



Vehicle efficiency: consumers

Box 5.2: Factors that are important to consumers in deciding which car to buy

Most important	Medium importance	Least important
Vehicle price	Performance	Depreciation
Size	Power	Sales package
Reliability	Image	Personal experience
Comfort	Brand name	Dealership
Safety	Insurance costs	Insurance cost
Running costs	Engine size	Engine size
Fuel consumption	Equipment	Equipment
Appearance		Recommendation
		Road tax
		Environment
		Recommendation
		Road tax
		Environment
		Vehicle emissions
		Alternative fuel

Source: LowCVP Car Buyer Research Report.

Smart driver choices: a low-cost quick win?

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'Smart' choices

Vehicle choice

- Going for best in class could alone reduce emissions by 10 - 25% over time
- If preferences changed and people downsized, much more is possible

Driver efficiency

- Eco-driving (e.g. not over-accelerating, optimal speed) up to 15% more fuel efficient
- Pumping tyres up, not carrying unnecessary weight etc
- Small reductions in marginal car use, car sharing and use of alternative means of transport can reduce emissions and congestion

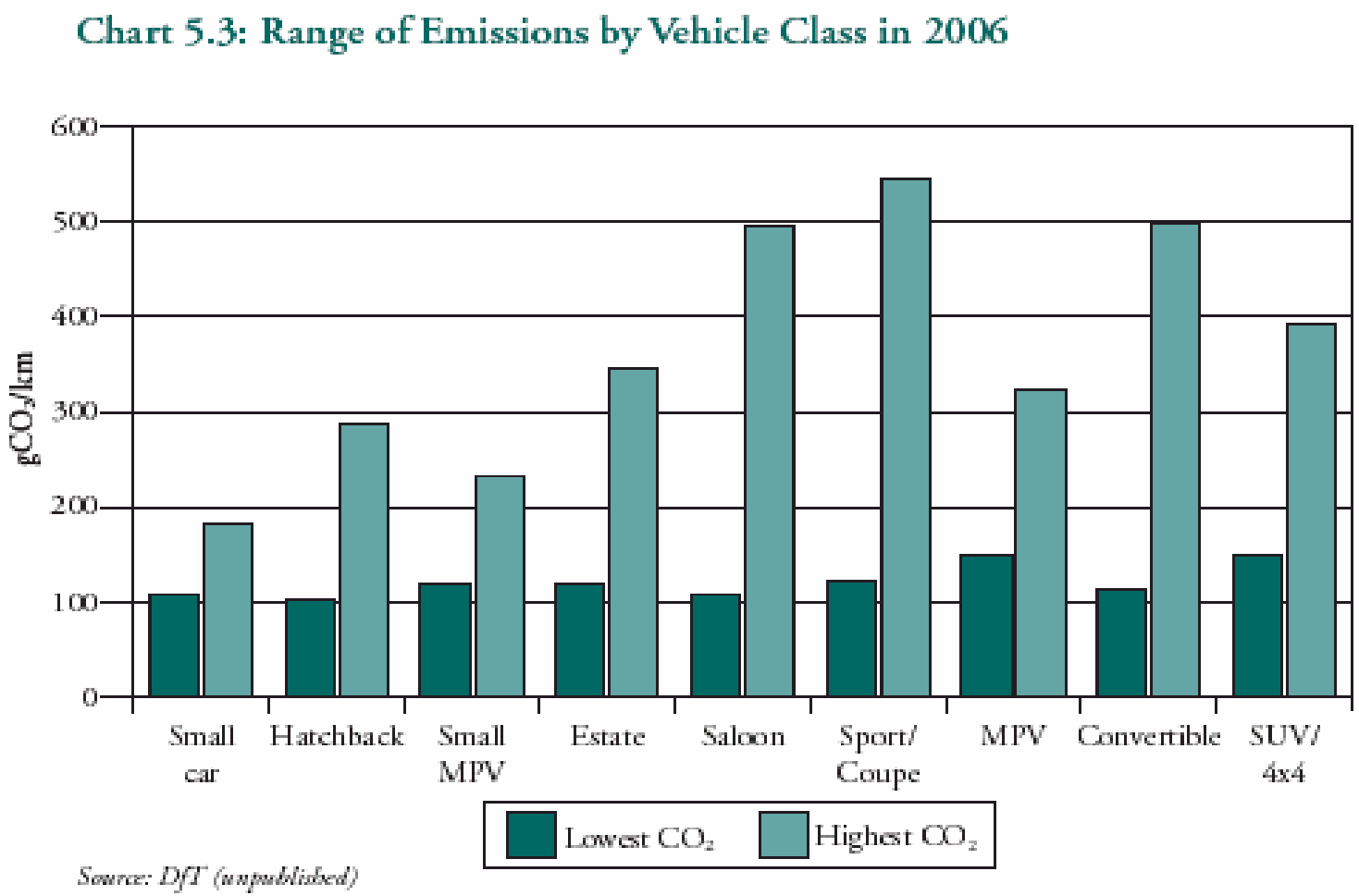
In theory, these could all add to a 50% reduction in emissions.

An ambition of at least 10% reduction in emissions from behaviours is challenging, but certainly achievable

- Everyone needs to play their part in meeting the challenge – especially us - the public
- Consumer behaviour has a big effect on CO_2 from road transport
  - the Review estimates savings of at least 10% over the next few years *could* come from consumer behaviour, 25% is possible
- These actions help the environment, and reduce fuel costs for the individual
- However, there are barriers to realising this potential:
  - environmental awareness and action in road transport lags other sectors - powerful cars are still symbols of status
  - people tend to discount heavily future fuel cost savings

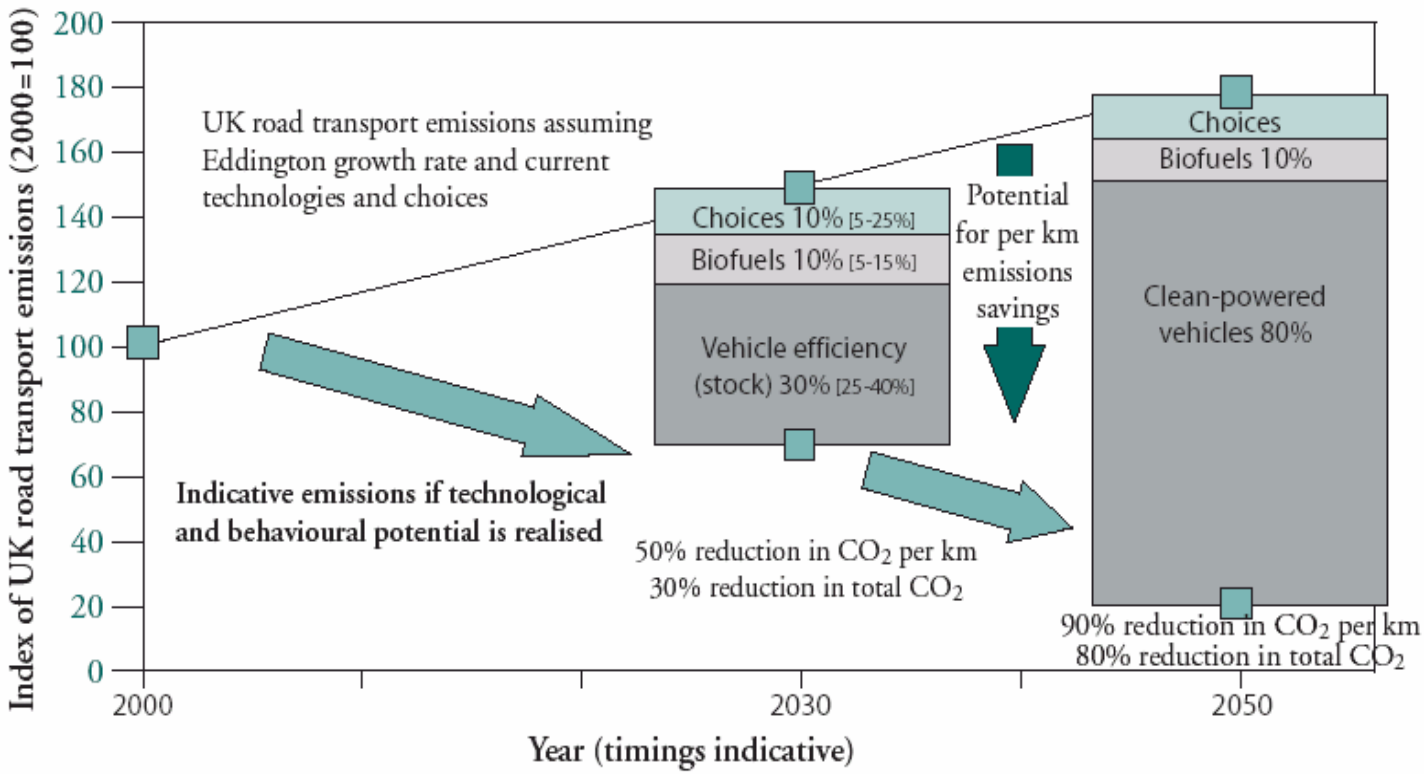
Consumer choices

- Choosing the lowest emitter in class can improve fuel efficiency by 25%



A Pathway to the Future

- Strong action is required across the board
  - cleaner fuels
  - more efficient vehicles
  - smarter driver choices



Summary messages

- Stern's challenge - to achieve 80% reduction in emissions by 2050 - is realistically achievable for emissions from cars, with action now
- It requires some significant developments: technical and 'behavioural'
- There is no single solution – fuels, vehicle technologies and consumer choices must all play a part
- Proceed with caution on biofuels: we must not see them as too much of the solution
- Vehicle technology is available for the immediate future, if there is a market
- Clean electricity for 2025–2050 is an issue for today
- Consumer choices and behaviour offer the quickest and cheapest, *but perhaps the hardest*, wins

Next steps

- **The King Review Part II will make policy recommendations and will report in time for the Budget 2008**

- The report will address **4 key challenges:**
  - how to take account of CO_2 emissions across the life cycle in monitoring and incentivising fuels
  - how 'close to market' vehicle technologies might be brought into widespread use
  - Government's role in R&D for automotive and fuel technologies
  - how to realise more of the potential from consumer choices

- The report will consider policy and interventions to deliver short, medium and long term requirements
  - Short term: how to develop the market and ensure 'good' biofuels
  - Medium term: consistent signals for industry and support to UK innovation, eg through development, demonstration, procurement
  - Long term: supporting 'Grand Challenges' in this area for the research community

- In the context of European and international collaboration and influence

Contact us

Contact the team at:

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See the full interim report at:

www.hm-treasury.gov.uk/king