# Breaking the Trend: Measures to Reduce $CO_2$ Emissions from Transport

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# Structure

- Context and trends
- Measures in place
- Further measures?
- Feasibility?
- Conclusions

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# Context and Trends

Global greenhouse gas emissions (ghg) increased by 70% between 1970-2004

- ghg emissions from transport rose by 120% over the same period

In Europe (EU25) emissions grew by 26% from 1990 to 2004

- Freight emissions grew 43% 1992 to 2004
- Emissions from international aviation (not included in international agreements) grew even faster 86% in the EU15 1990 to 2004

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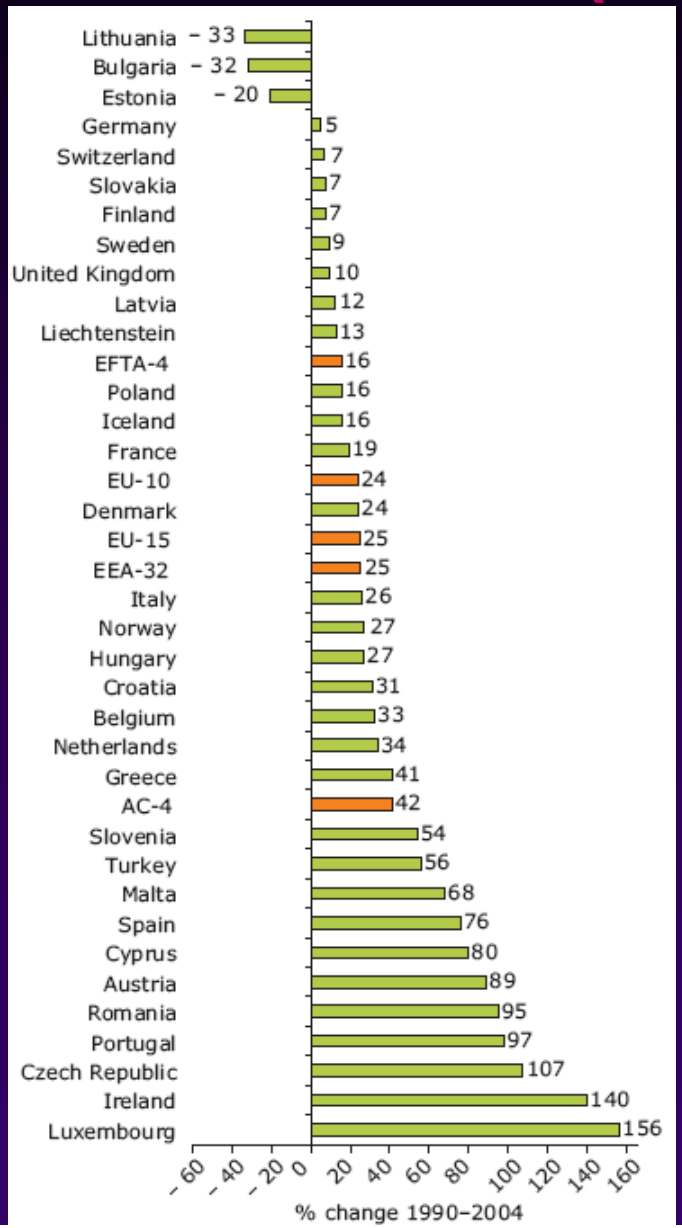
# Trends in transport greenhouse gas emissions 1990-2004 (EEA, 2007)

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# EU Targets

- EU15 Kyoto target 8% reduction from 1990 levels
- EU commitment to a 20% reduction over the same time period.
- Support for a 30% reduction *if* other developed nations also commit.
- This would place the EU on  a path towards the 60 to 80% reductions required by 2050

Progress 1990 to 2004

- 0.9% reduction in overall emissions
- 26% increase in transport emissions

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# Targets

"we will consider seriously the decisions made by the European Union, Canada and Japan which include at least a halving of global emissions by 2050"

G8 Summit Declaration 7th June 2007

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# Measures in Place

Policies at:

- European level,
- National level and
- Local levels will be examined
- using the UK as a case study.

Europe: key policies:

- Voluntary Agreement
- Renewable Transport Fuels Obligation

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# Voluntary Agreement (VA)

Aim: average new car $CO_2$ emissions of 140 g/km 2008

Progress: starting point: 186 g/km in 1995.

- 163 g/km average in Europe, 2004
- 171.4 g/km in the UK, 2004

Technical gains offset by:

- Increased weight, power and size of vehicles
- Increased use as a result of reduced operating costs

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# Bio-fuels Directive and the Renewable Transport Fuels Obligation (RTFO)

Bio-fuels Directive targets for use in transport:

- 2% by 2005
- 5.75% by 2010

Progress

- 1% by 2005

Volumetric target: no guarantee of reduced emissions

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# UK Climate Change Programme

- Measures in transport:
- VA original and future + fiscal measures 2.4MtC
- RTFO 1.6MtC
- Fuel Duty Escalator 1.9MtC
- Wider measures 0.8MtC
- Sustainable Distribution 0.1MtC

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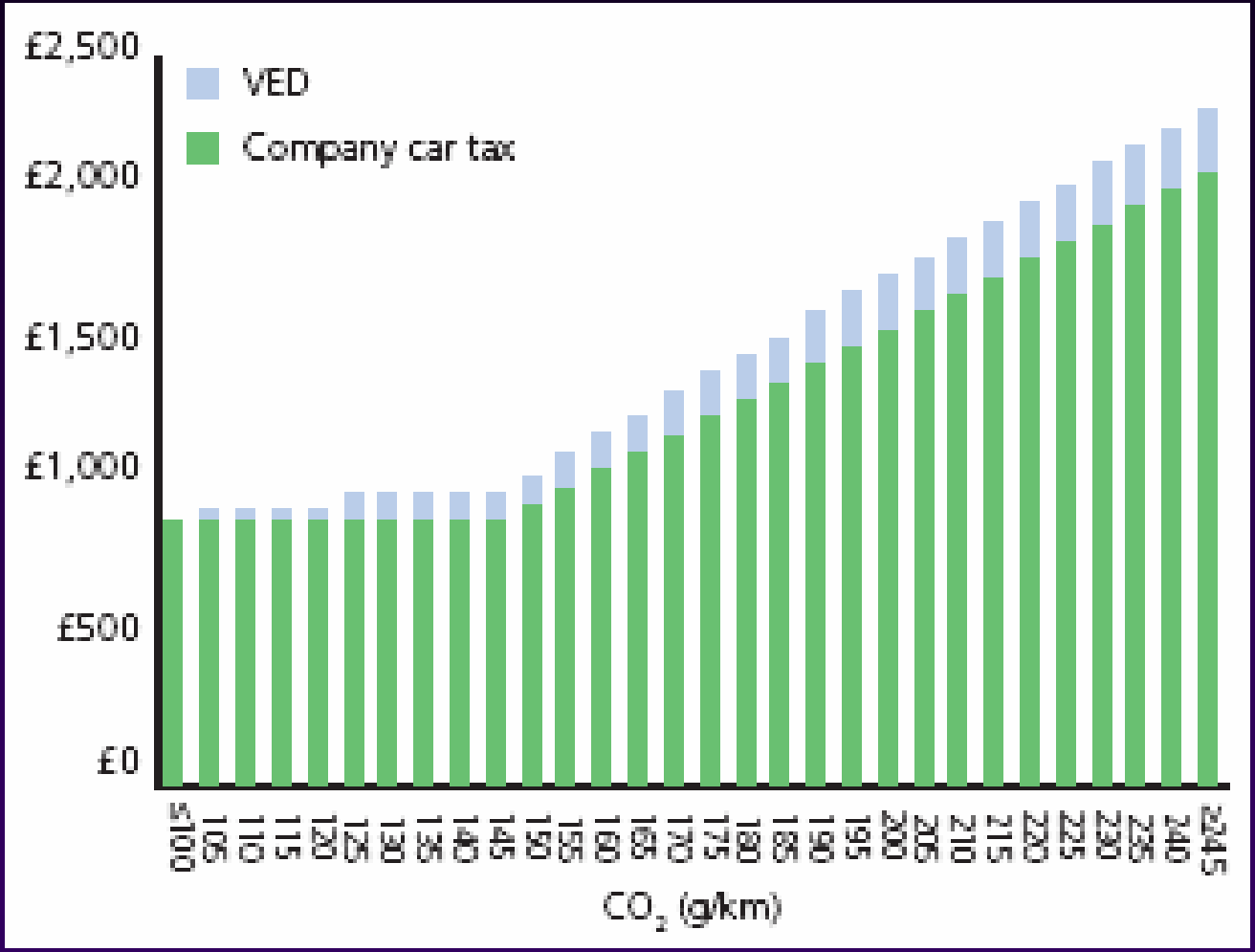
# Annual company car tax and VED paid a typical petrol company car (DEFRA 2006)

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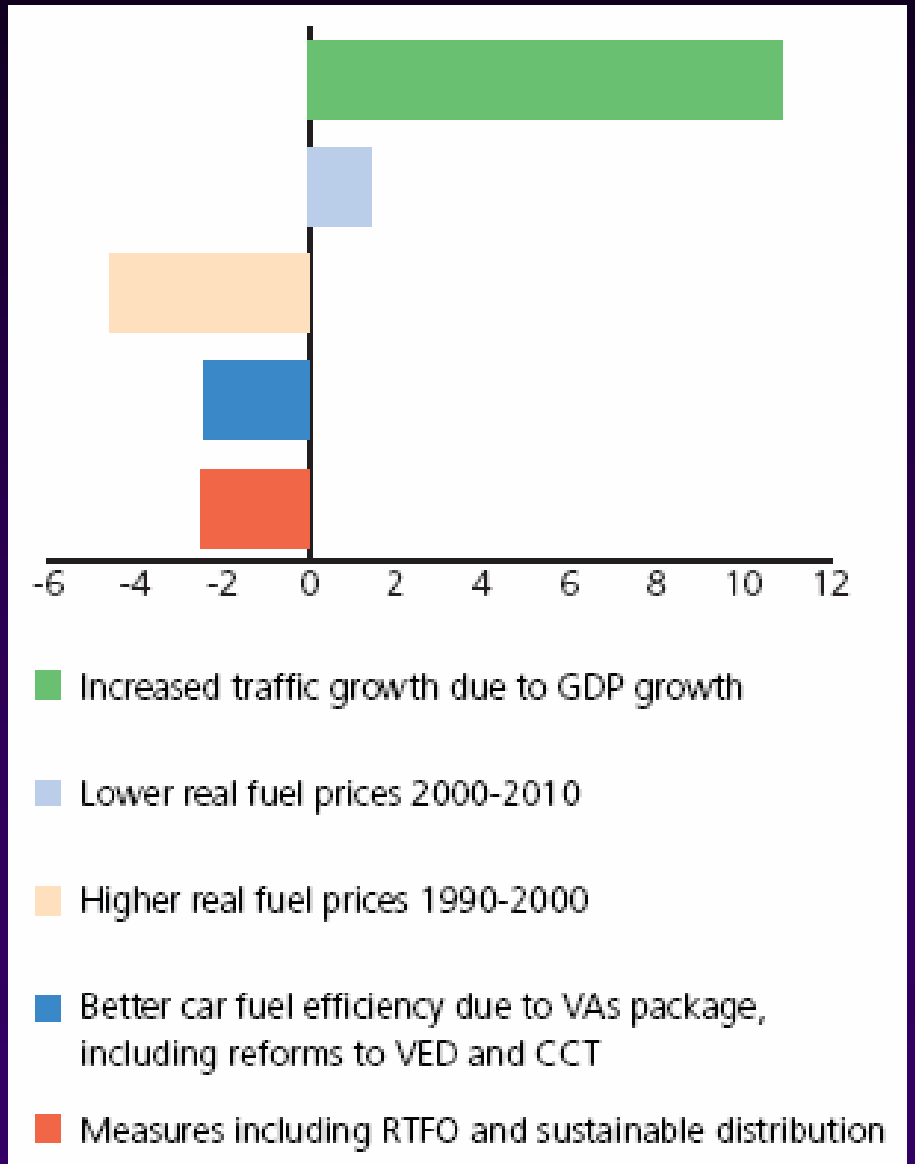
# Impact of Transport on Carbon Emissions 1990-2010 MtC, (DEFRA, 2006)

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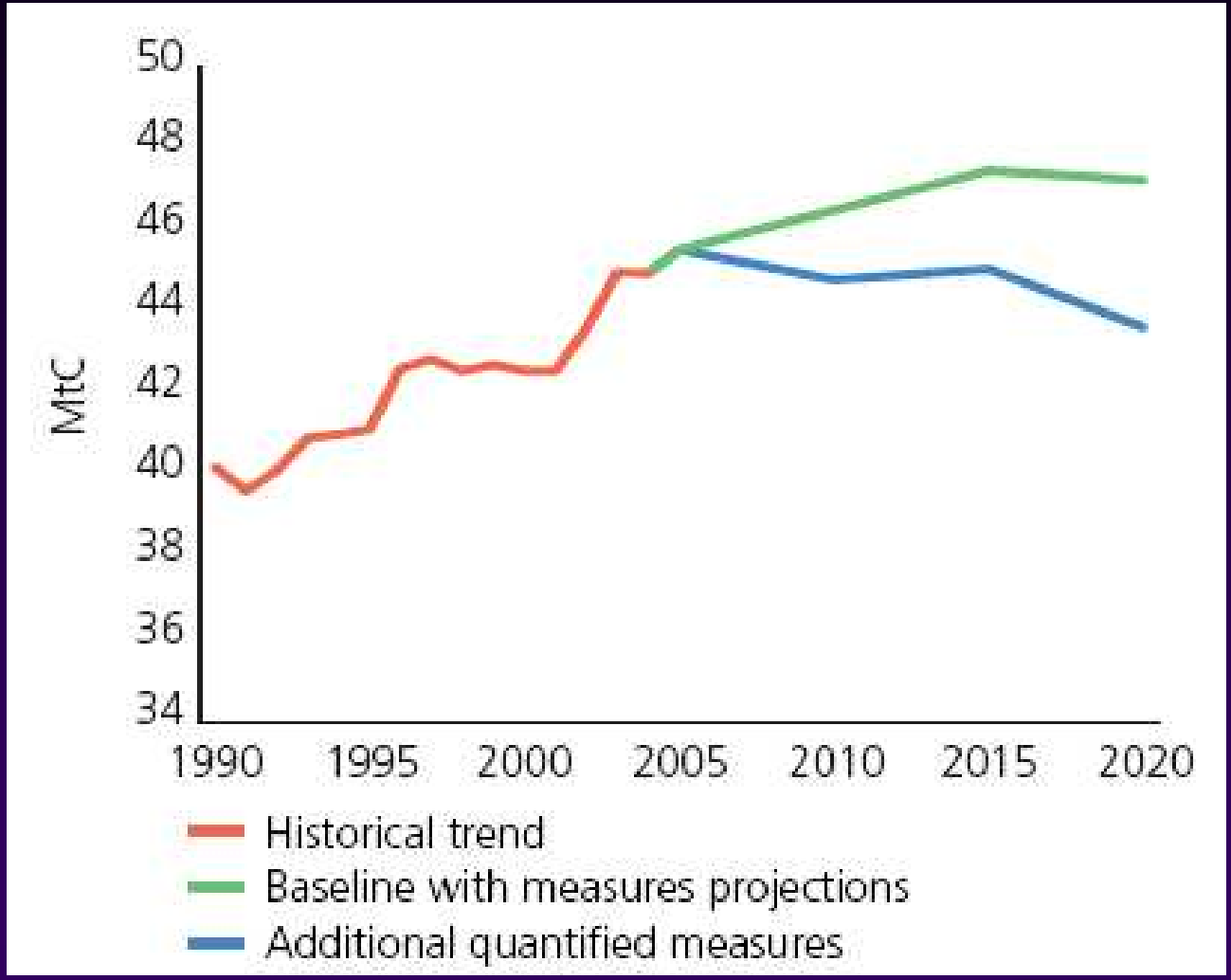
# National: UK Climate Change Programme (DEFRA 2006)

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# Regional / Local Initiatives - UK

London Congestion Charge:

- Reduced $CO_2$ emissions by 19.5% in the charged zone
- Reduced $CO_2$ emissions by 0.6% on inner ring road where increased traffic levels were offset by increases in speeds.

Sustainable travel demonstration towns:

- Surveys suggest reductions in car use of around 10%

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# Current Measures Conclusions

- Heavy reliance on technology to deliver savings
- Key measures are not delivering
- Absence of measures to restrain demand means that some of these benefits are lost

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# Measures to secure further reductions

EU proposals

- Efficiency of new cars and light goods vehicles
- Bio-fuels
- Extension of EU-ETS to include aviation

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# New car and light goods vehicle emissions

Latest proposals aim for new cars to achieve:

- 120g $CO_2$/km by 2012 95g $CO_2$/km by 2020

and for vans

- 175g $CO_2$/km by 2012 160g $CO_2$/km by 2012

Estimated cost of reaching the 2012 targets:

- €132 per tonne $CO_2$ relying on technological change within current test cycle
- €32 to €54 by allowing technologies that are cost effective *but* are not included within the current test cycle.
- €6 to €24 with effective demand management measures

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# Bio-fuels

Proposals for a binding target of 10% by 2020 if:

- Sustainable production of bio-fuels
- Commercial availability of 2nd generation bio-fuels
- Amend the Fuel Quality Directive to allow higher blends.

At present:

- Bio-fuels achieve greater $CO_2$ reductions if applied directly in the energy sector
- EU produced bio-fuels are not cost effective
- Carbon savings vary by type of fuel and production process and in some cases may be negative
- Direct and indirect impacts on deforestation

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# Aviation

Draft proposals (CEC 2006):

- open system applying to arriving and departing flights at EU airports
- Target is to stabilise emissions 2004/6
- Implies a 46% reduction from business as usual growth to 2020
- Dates: 2011 for intra-EU flights, 2012 by all flights arriving or departing EU.

Implications:

- 4 to 5% of the savings would come directly from aviation as the cost of reductions in aviation is relatively high
- Demand would reduce by 1.5% from business as usual

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# Tax and subsidy

Commission proposals for a $CO_2$ element to be introduced in annual car taxes.

- Clearly having some effect in the UK – greatest in the company car market.

*"Carbon and fuel taxes are the ideal measures for addressing* $CO_2$ *emissions. They send clear signals and distort the economy less than any other approach*." (ECMT 2007, p.9)

- Yet very little appetite for taxes on use.

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# Other modes and behaviour

Freight: fastest growing sector possible measures:

- HGV road user charging
- Measures to improve the vehicles and the use of the vehicles – McKinnon 2006 estimated that:
  - If fleets below the mean sub-sector performance were to achieve the mean, fuel savings of 5% would be realized.
  - If all are raised to the mean of the top third of performers, savings would be 19%.
- Savings through: aerodynamic styling, lower rolling resistance tyres, safe and fuel efficient driver training, consolidation etc can be cost effective to the operator.

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# Bus and rail

Table 1: $CO_2$ emissions grammes per seat kilometre for different classes of diesel train

| Train class | Type | Configuration | Power output kW | Seats | $CO_2$ g/ seat km |
|---|---|---|---|---|---|
| 43 HST | Intercity | 2 locomotive power cars + 8 carriages | 3360 (2x1680) | 477 | 31 |
| 180 Adelante | Intercity | 5 car DMU trainset | 2800 (5x560) | 265 | 26 |
| 150 Sprinter | Regional | 3 car DMU trainset | 639 (3x213) | 222 | 15.3 |
| 168 Turbostar | Regional | 4 car DMU trainset | 1260 (4x315 | 278 | 24.8 |

Source: AEA Technology 2005.

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# Bus

- Hybrid buses – savings 30 to 40%
- But more expensive

- In the UK, competitiveness further reduced by subsidy to fuel.

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# Behaviour

Smarter Choices

- Intervention at the destination to reduce car use: workplace or school travel plans
- Intervention through access to vehicles: car sharing, car clubs
- Intervention to increase awareness of options: public transport information and marketing, awareness campaigns, personalised marketing
- Intervention to reduce the need or desire to travel: teleworking, teleconferencing, home shopping.

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# Behaviour

Impacts of smarter choices, case studies (Cairns et al 2004):

- 8 to 15% reduction in car journeys to school from school travel plans
- 10 to 30% reduction in car journeys to work from workplace travel plans
- 1.5 to 5% increase in bus use from public transport information and marketing
- 2 to 15% reductions in general car use from personalised travel plans
- 10 to 30% reduction in business travel from teleconferencing
- Reduction of 2 to 6 car journeys per teleworker from teleworking initiatives.
- 1 car club car replaces on average 5 private cars.

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# Behaviour

Impacts may be: Overstated

- if first mover organisations are more committed than later adopters.
- Omit possible increases from: public transport emissions for trips transferred from car, rebound effects and induced traffic,

Understated

- the case studies are early examples - learning
- Longer run through changes in culture and driving behaviour may lead to further reductions in a “virtuous” circle.

Costs?

- DEFRA (2007) estimate a net benefit of £6 per tonne carbon

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# Cost effective?

UK estimates suggest the following **costs** per tonne carbon abated:

- VA 140 g £365
- RTFO 5% £127
- Smarter choices -£6
- Sustainable distribution -£130
- Fuel Duty Escalator -£250

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# Table 2: efficiency targets and costs to 2020

| Source | Efficiency target | Annual MtC saved | Cost per tC £ |
|---|---|---|---|
| DEFRA 2006 | 140g(2008) | 2.3 (2010) | 365 |
| DEFRA 2007 | 135g | 0.1 (2010)<br>2.0 | 220 |
| DTI 2006 | 135g | 2.0 | 184[1] |
| DTI 2007 | 135g<br>120g<br>113g<br>104g | 1.8<br>2.9<br>3.5<br>4.1 | -85 to + 105<br>-35 to +129<br>-3 to +141<br>36 to 151 |

[1] central oil price scenario, £270 low oil price, £97 high oil price.

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# Costs dependent on

- Assumptions on the costs of technology over time
- Degree to which efficiency savings are lost due to:
  - Increases in vehicle weight
  - Increases in power and size of vehicles
  - Increases in use as the cost falls

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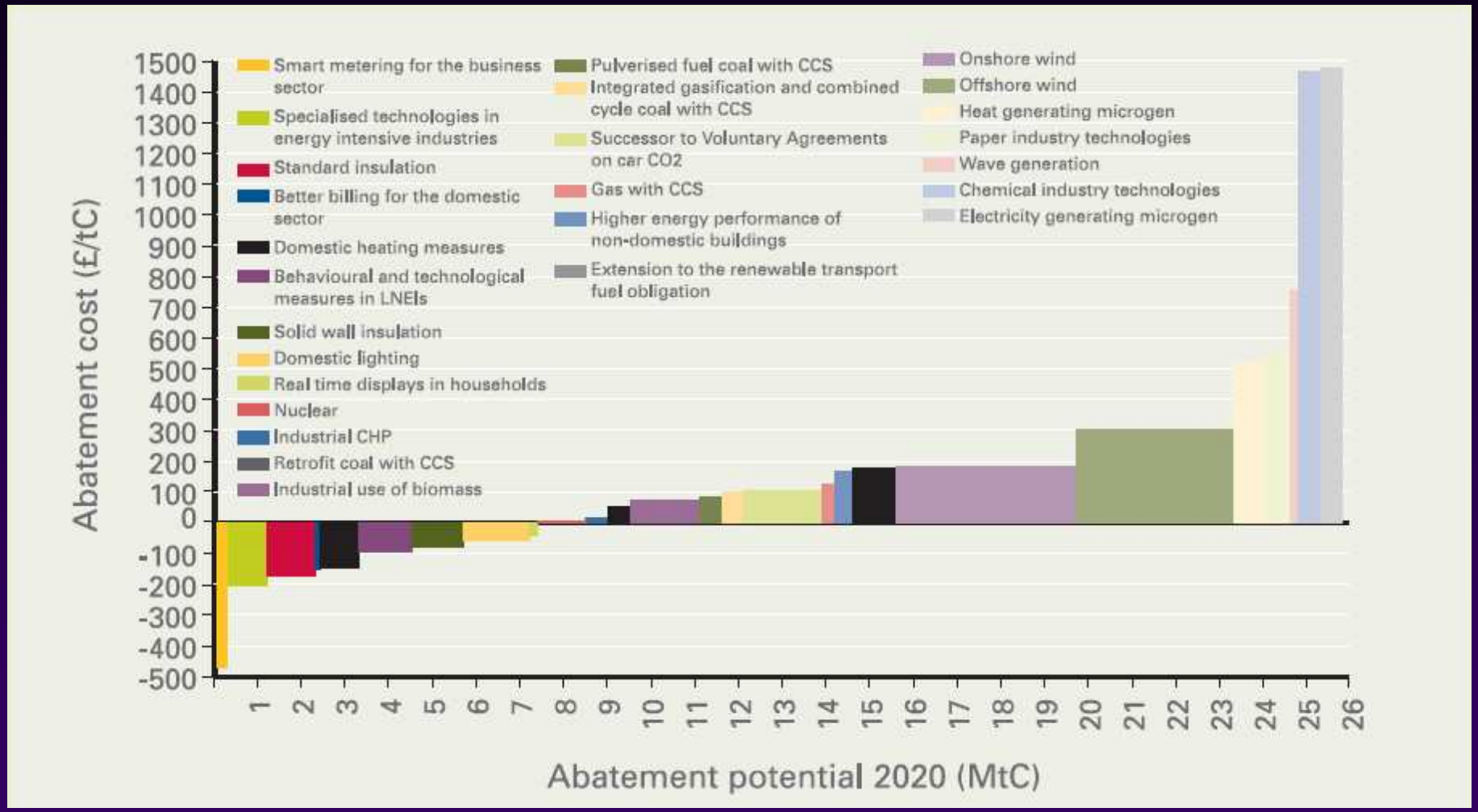
# Abatement costs: 2020 UK (DTI, 2007)

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# Integrated Approaches to Cutting $CO_2$ Emissions from Transport: studies

Bristow et al, (draft): examined an 80% reduction by 2050:

- Increase real fuel prices each year drives change in vehicle technologies and use.
- Public transport becomes carbon neutral by 2050
- “smarter choices” measures support behavioural change

Results:

- emissions per new car are reduced to 56.72g $CO_2$/km and
- car kilometres fall by 38% from 2003 levels

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# OECD Environmentally Sustainable Transport (EST) Project

Examined 50 to 80% reductions by 2030.

Measures required for an 80% reduction in emissions by 2030 (Schade and Schade, 2005) include:

- reducing individual vehicles emissions to 58g $CO_2$/km;
- fuel costs per vehicle kilometre double;
- road user charges for heavy vehicles (balanced by fuel tax reductions) of 1.25 cents per kilometre;
- extensions to rail network;
- no further extensions to the road network after 2010.

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# VIBAT – Hickman and Banister: UK target of 60% by 2030 – two future images

New market economy:

- more travel and technological gains in vehicles to 90 g/km (all passenger modes), 50% fall in freight emissions.
- Even with additional supportive measures this “image” cannot reach the target.

Smart social policy:

- small technological gain (to 140 g/km) + societal change reduced car travel and increases in rail and bus use and emissions. Reductions from technological gains, eco-driving and slower speeds, hybrids in the freight sector, changes to freight operations and soft factors.
- just meets the target the changes envisaged could be enabled by personal carbon quotas or oil price changes.

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# Åkerman and Höjer (2006) reduction of 60%+ for Sweden by 2050

Even if vehicle efficiency improved by 30 to 75% passenger modes and 30 to 45% freight – potential savings would be largely offset by growth.

Sustainable 2050 future involves:

- energy efficient vehicles (includes hydrogen from renewable sources),
- increased use of telecommunications to provide alternative forms of access,
- urban planning including mixed developments achieving a 30% reduction in the distance of commuter journeys and a cut in city car use of 50%.
- Business journeys by air fall, but there is a small increase in leisure trips by air.
- Total car travel is reduced by 32%.

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# Forward look - lessons

Degree of consensus:

- Technology can only take us so far
- In the absence of other measures efficiency savings will be offset by increased demand
- ”the level of technological and behavioural change required is unprecedented” (Hickman and Banister 2005).

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# Conclusions

- Carbon abatement policy is over reliant on technological measures that to date have proved:
  - Costly and
  - Slow to deliver
- Cost effective measures that impact on behaviour have considerable potential.
- Fiscal measures can provide effective price signals
- This is starting to be recognised.
- A strategy that fully integrates technological and behavioural measures is most likely to maximise the performance of both.

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