CO_2 emissions reduction from HGVs and freight, the UK perspective

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Challenge Bibendum

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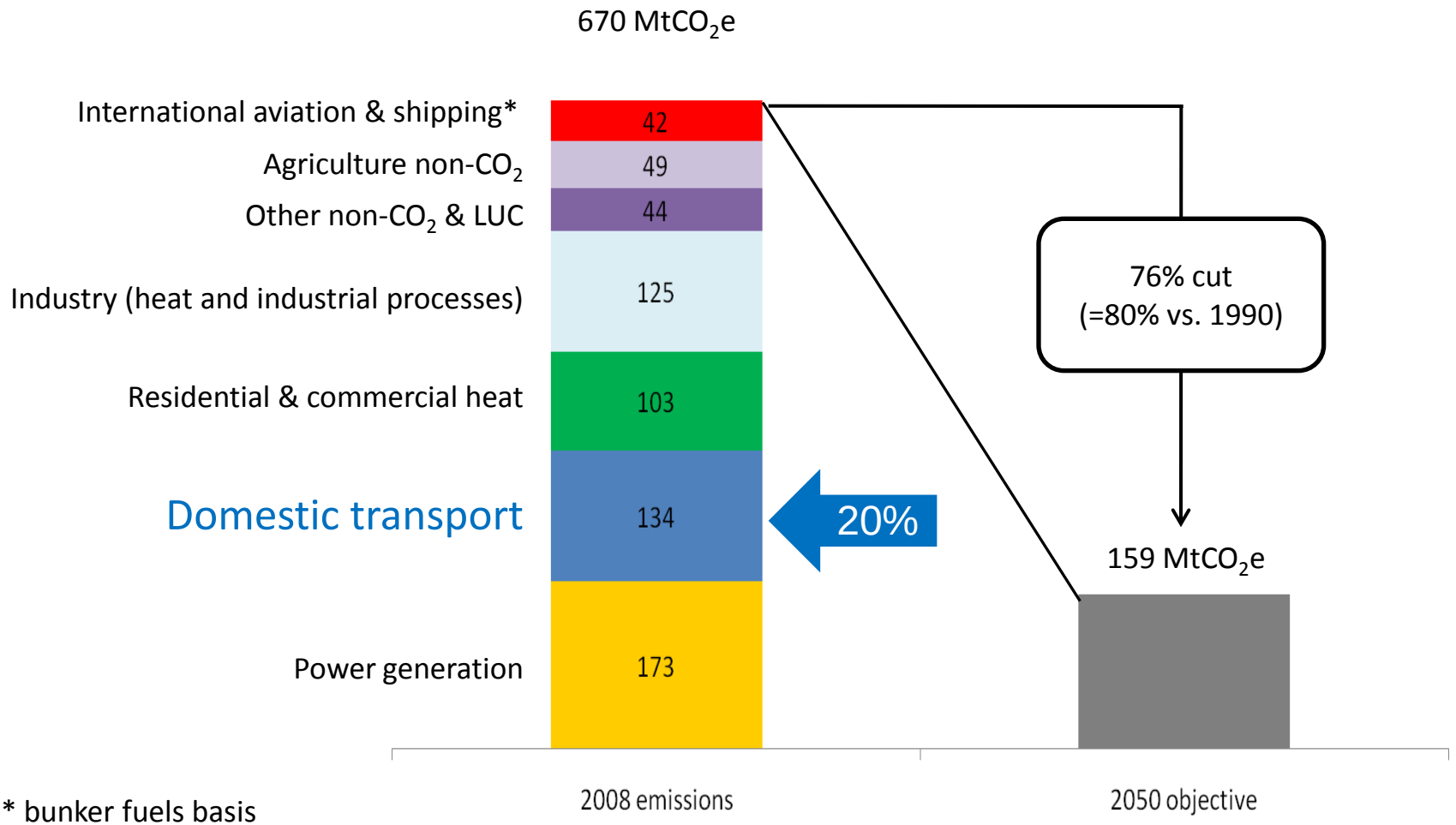
Background

- The UK's approach to reducing CO_2 emissions is through 5 year, legislated 'Carbon Budgets'
- The 4th Budget, 2023 – 2027, has just been accepted by Government and is about to be recommended to Parliament for approval
- The first three Budgets (2008 – 2022): focus on emissions from cars and vans
- 4th Budget (2023 – 2027): HGVs and freight start to make a significant contribution in scenario modelling – and more is needed

The UK's 2050 target



* bunker fuels basis

90% reduction needed for surface transport

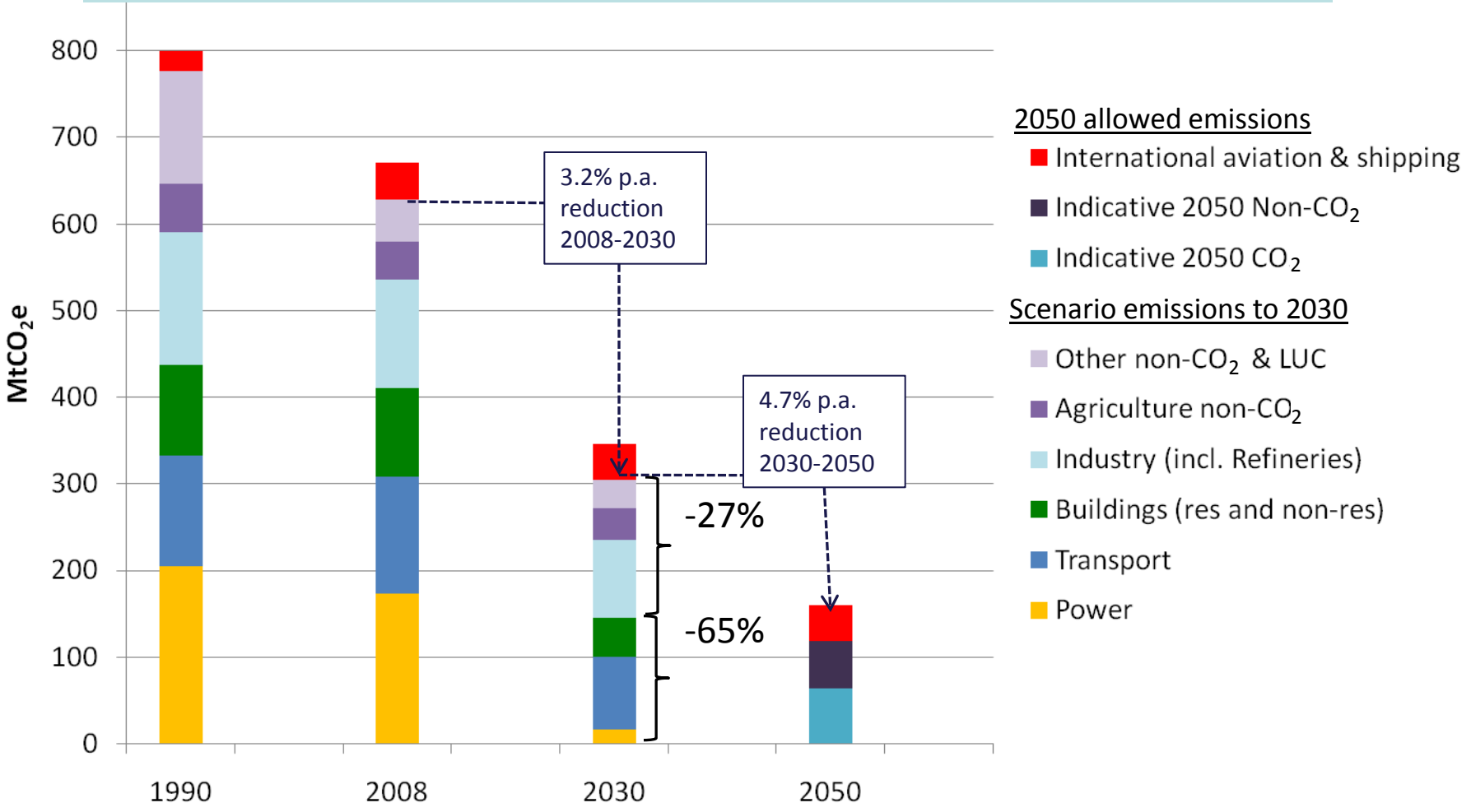
- 80% reduction in GHG emissions from 1990 levels by 2050

- At least 90% reduction likely to be required in surface transport sector
  - more challenging sectors (international aviation and shipping, agricultural non-CO_2, some areas of industry) unlikely to achieve 80% reduction
  - 90% total reduction likely to be required across other sectors (transport, buildings and industry, power)

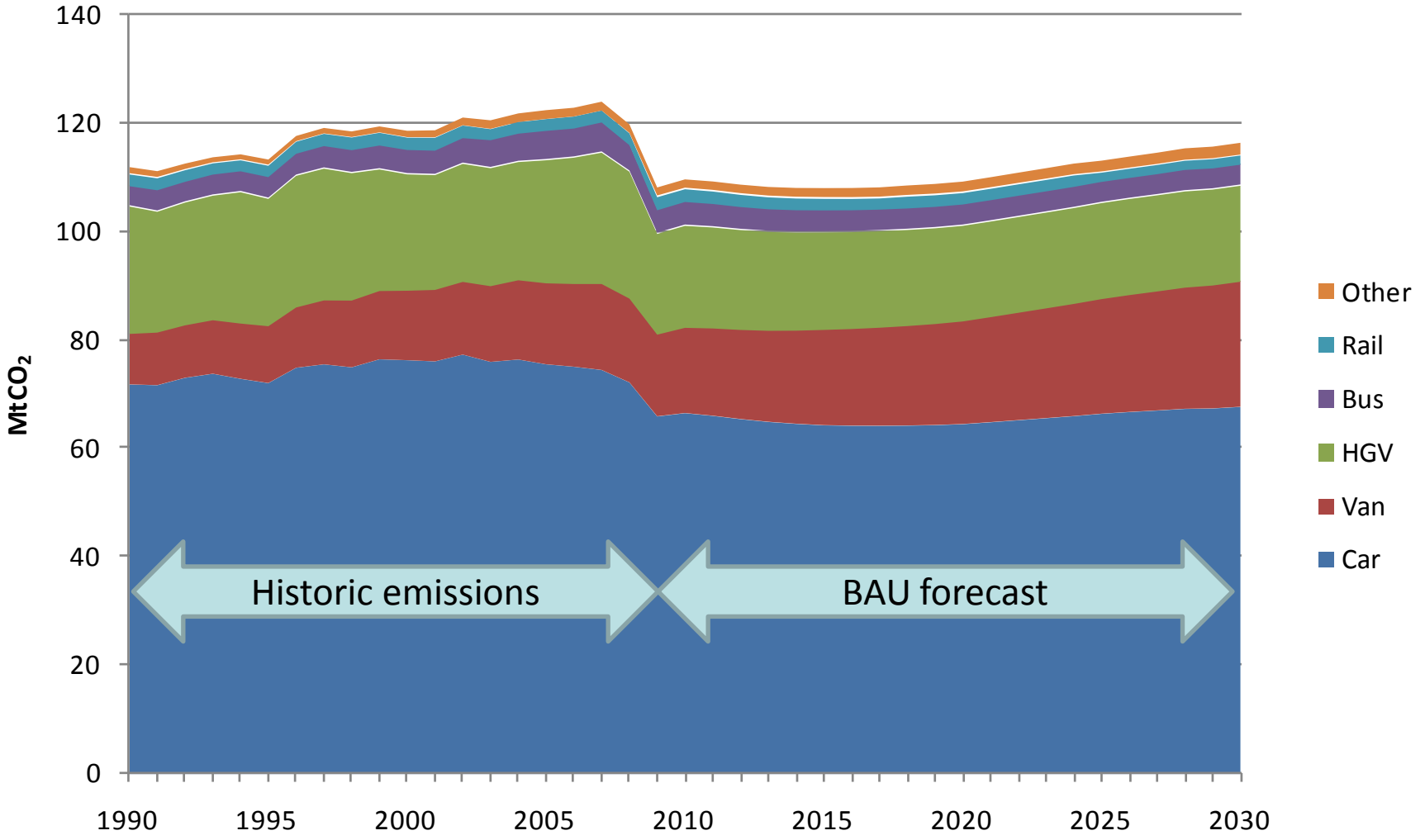
- Emissions reduction measures need to be consistent with 90% reduction in land transport by 2050

4th Carbon Budget planning scenario

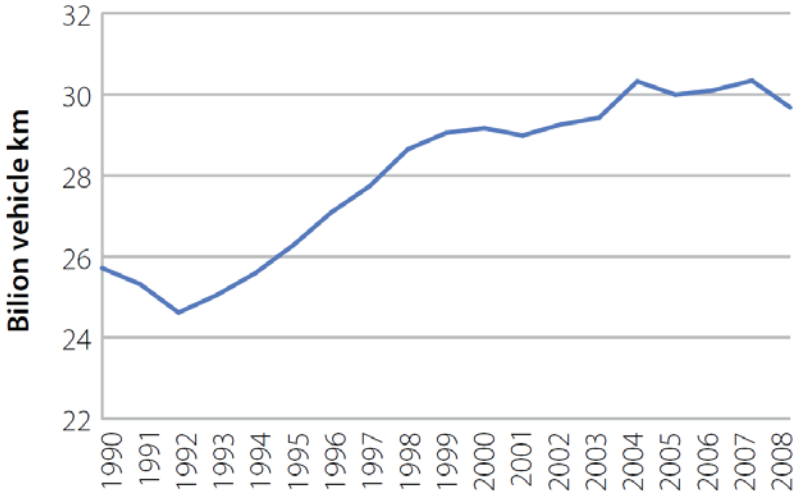
2030: a 46% reduction from today, leaving a 63% reduction to 2050



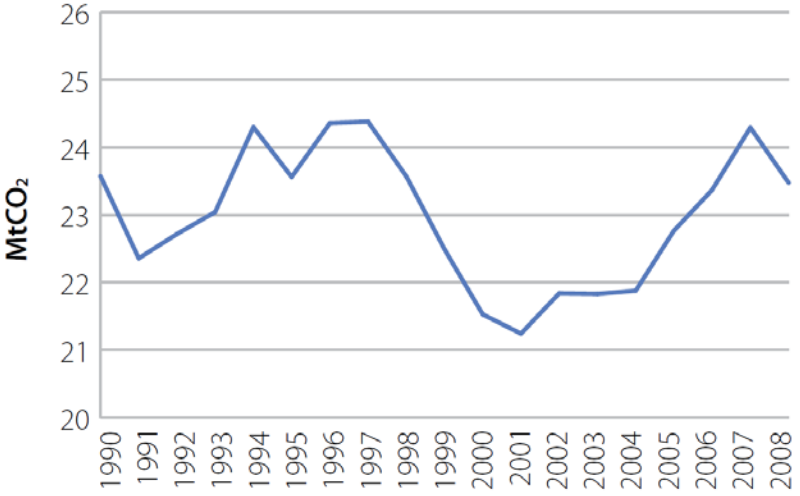
Context for transport scenarios
Past and forecast emissions

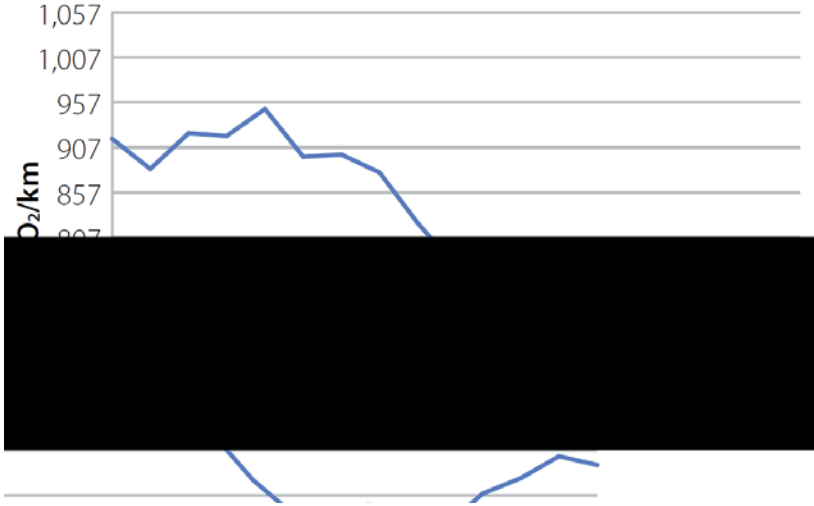


UK HGV emissions and distance travelled trends

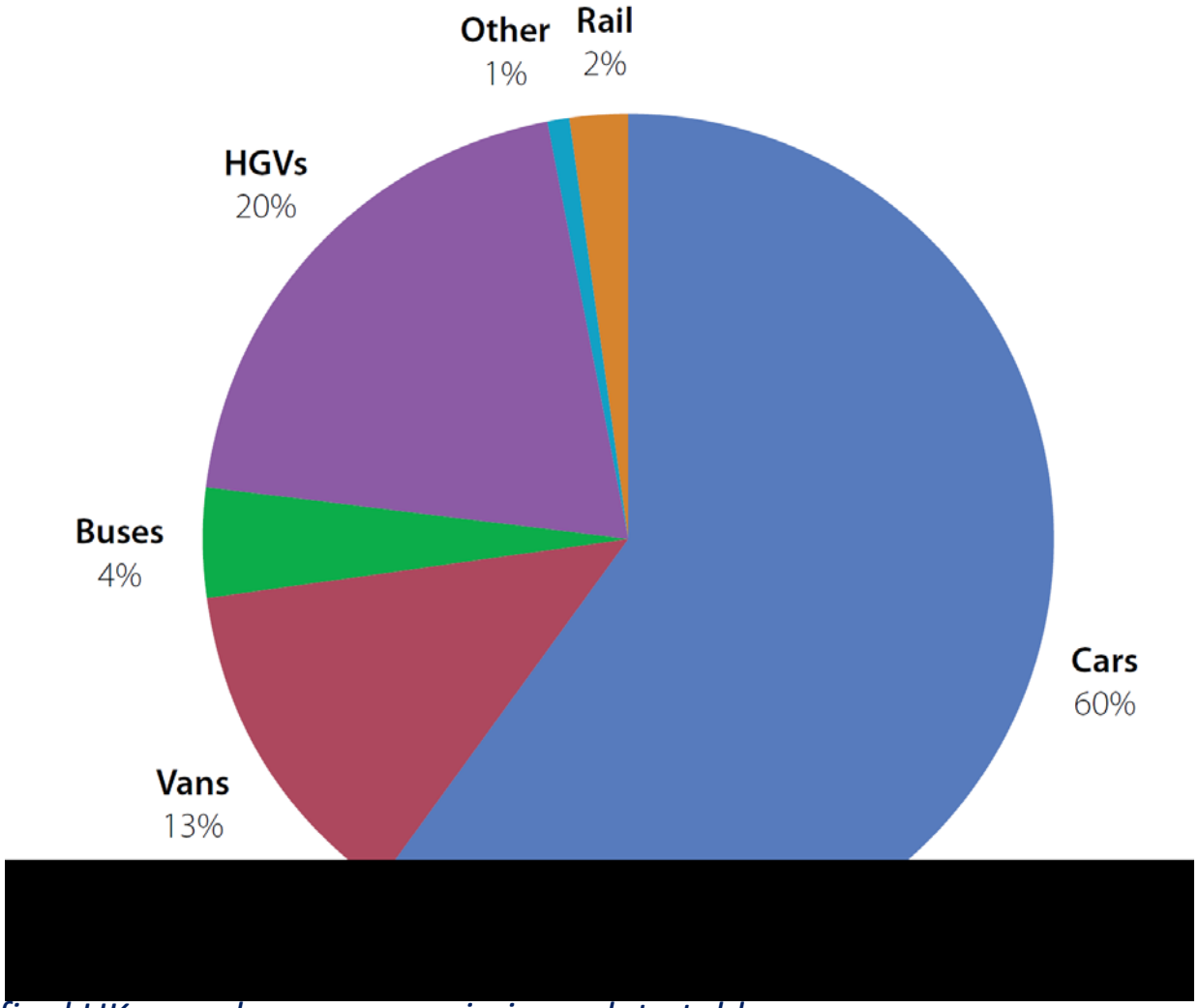


1990 – 2008
HGV g/km fell 14%: 917 to 791g/km
HGV km travelled increased by 15%
Cars g/km fell 16%, km increased 20%





The first three budgets focussed on cars & vans

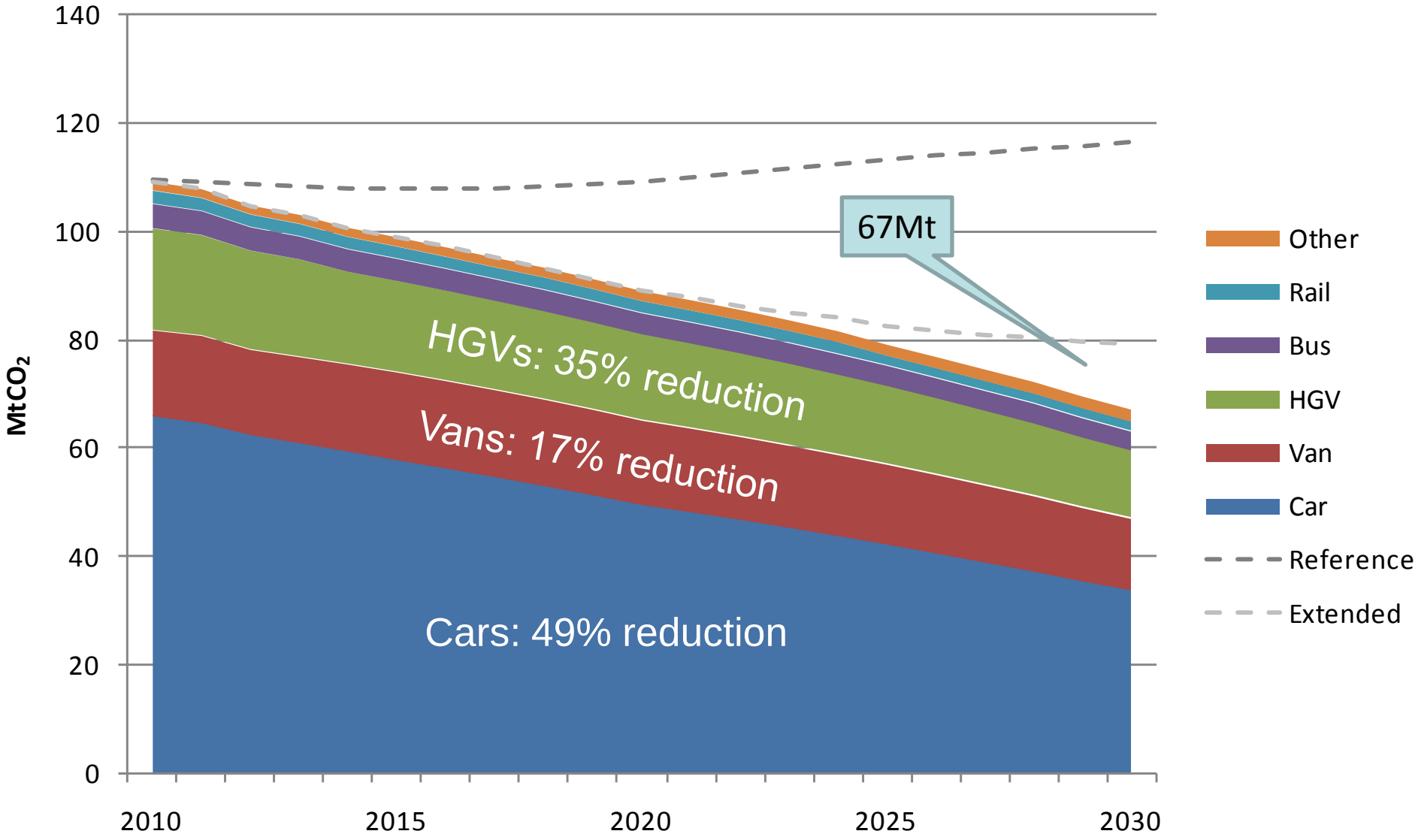


DECC 2008, *2008 final UK greenhouse gas emissions: data tables*

Context for transport scenarios
Scenario to 2020

- New car efficiency of 95 gCO_2/km including impact of electric vehicles
- Significant take up of electric cars (BEV and PHEV) with 16% of new car sales and 1.7 million cars on the road in 2020
- New van efficiency of 135 gCO_2/km in 2020 (in line with now superseded EU target proposal!)
- Limited abatement in HGVs
- Biofuels to supply 8% of total liquid fuel consumption (by energy)
- Roll-out of Smarter Choices to all UK cities and towns
- Training 10% of car and van drivers and 100% of HGV drivers in eco-driving techniques
- Enforcing the existing 70 mph speed limit on motorways and dual carriageways

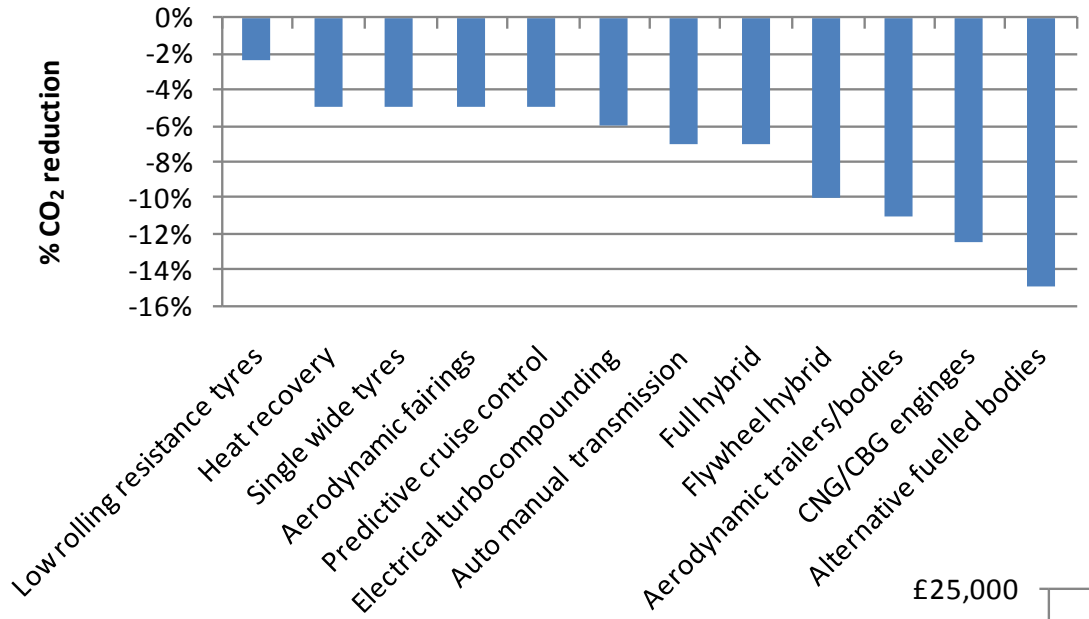
Transport scenarios to 2030
The 'Medium Abatement' scenario



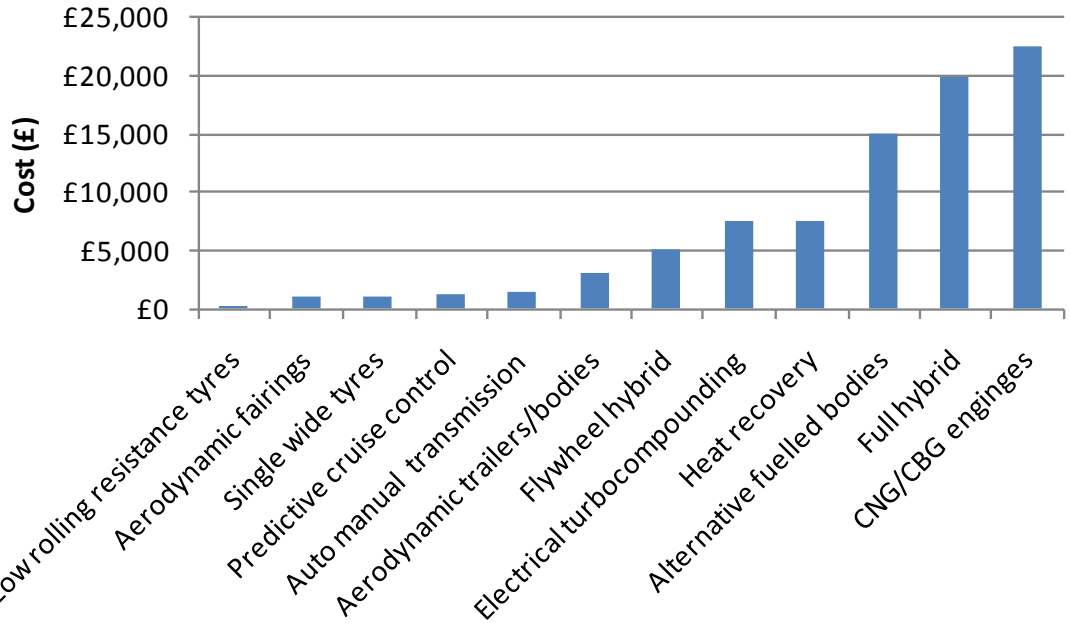
HGV improvement: Ricardo report for DfT

- **Review of Low Carbon technologies for Heavy Goods Vehicles** prepared for the UK Department for Transport, March 2010 Ricardo plc
- A technology study to look at the options for CO_2 reduction – effectiveness, limitations, safety, estimated costs – to inform a regulatory and funding framework to reduce emissions from HGVs
- **Medium Duty vehicle**: 7.5t, urban use – stop/start, 2-axle, rigid
- **Heavy Duty vehicle**: > 32.5t, motorway use, 3-axle, articulated
- **Vehicles**: aerodynamics, rolling resistance, driver behaviour, electric bodies
- **Powertrain**: engine efficiency, waste heat recovery, alternative powertrains and transmissions
- **Fuels**: biodiesel, biogas, hydrogen

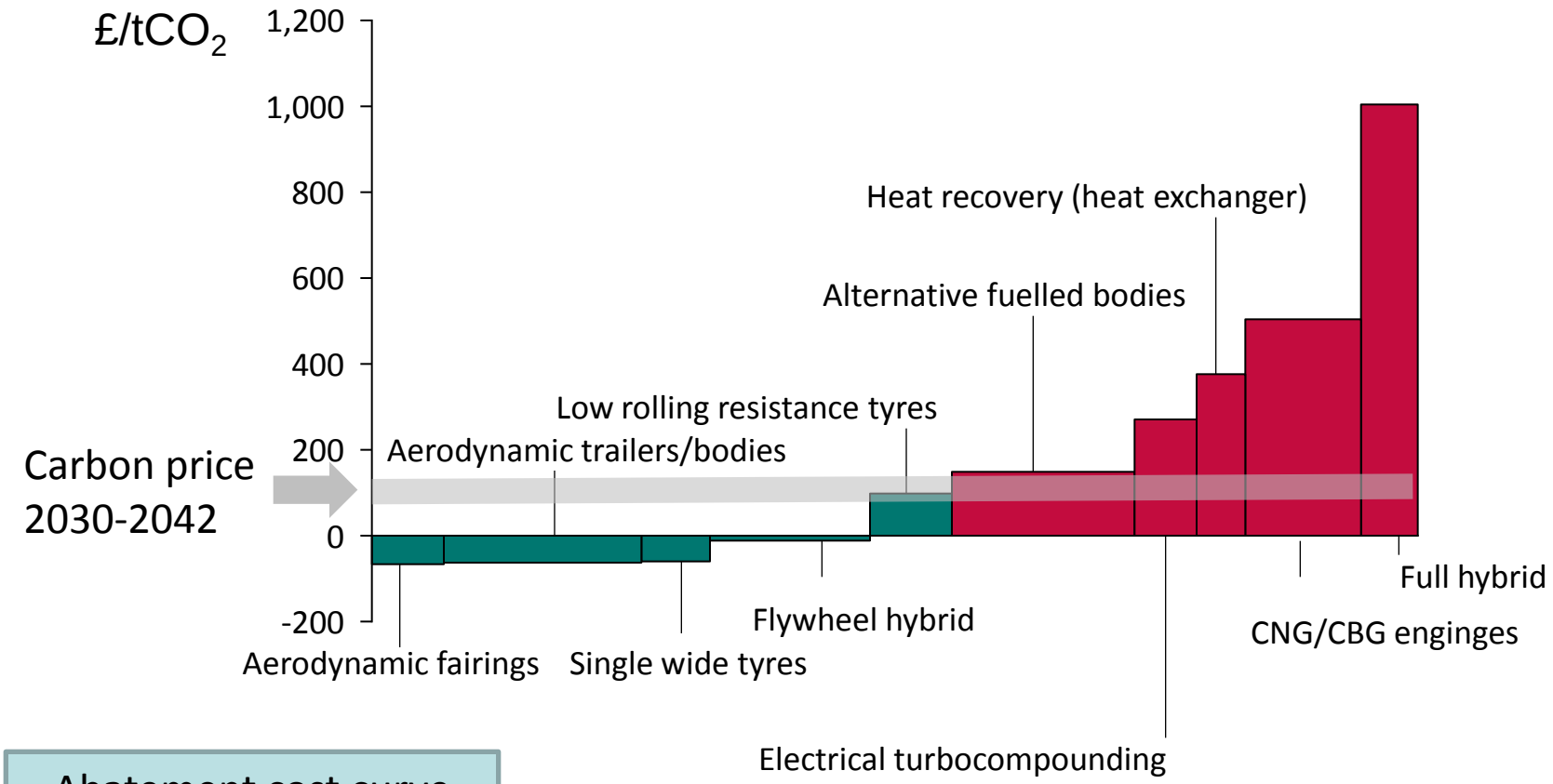
Significant abatement required for HGVs



Source: Ricardo (2010), Technology Roadmap Study for Low Carbon HGVs



Marginal Abatement Cost Curve for HGVs



Abatement cost curve for large articulated HGVs

Applicability of technologies: Automotive Council

Technologies for light duty cycles only

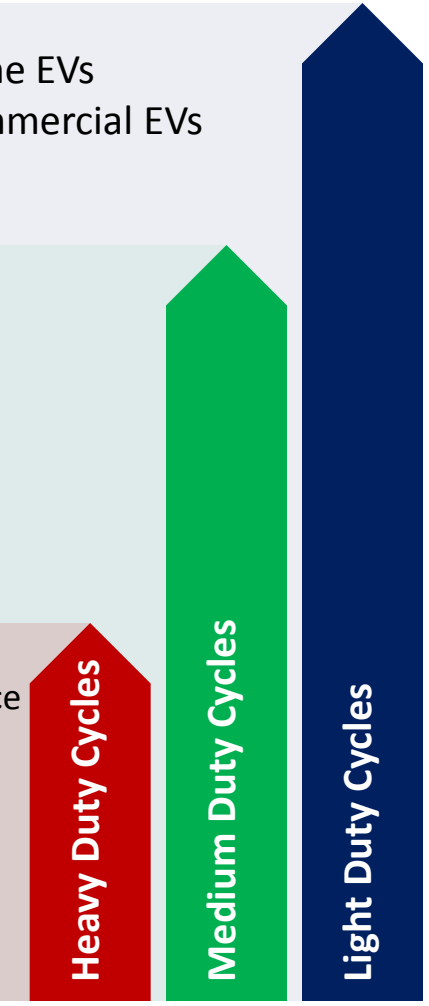
- niche EVs
- commercial EVs

Technologies which apply to medium and light duty cycles

- micro/mild hybrid
- full hybrid
- plug-in hybrid
- fuel cell APUs
- fuel cell vehicles

CORE TECHNOLOGIES: apply to all duty cycles

- intelligent logistics; driver behaviour
- advanced highway aerodynamics; lightweighting; rolling resistance
- electric bodies and ancillary equipment
- powertrain efficiency improvements
- biofuels/sustainable liquid and gaseous fuels
- waste heat recovery
- advanced thermodynamic cycles
- ICE engine efficiency improvements



HGV technologies in the 2030 scenario

- Rigid HGVs
  - Low rolling resistance tyres
  - Stop start hybrid

- Articulated HGVs
  - Low rolling resistance tyres
  - Flywheel hybrid
  - Aerodynamic trailer/body
  - Aerodynamic fairings
  - Single wide tyres

Energy: 52% overcoming rolling resistance
35% aerodynamic drag

- Emissions reduction delivered from these technologies
  - 17% for rigid HGVs
  - 28% for articulated HGVs

- Additional contributions for HGVs
  - 100% driver training in 'Eco Driving'
  - 11% biofuel by energy, 12% by volume
  - Demand reduction: 6.5% HGV km

Hydrogen vehicle assumptions in 2030

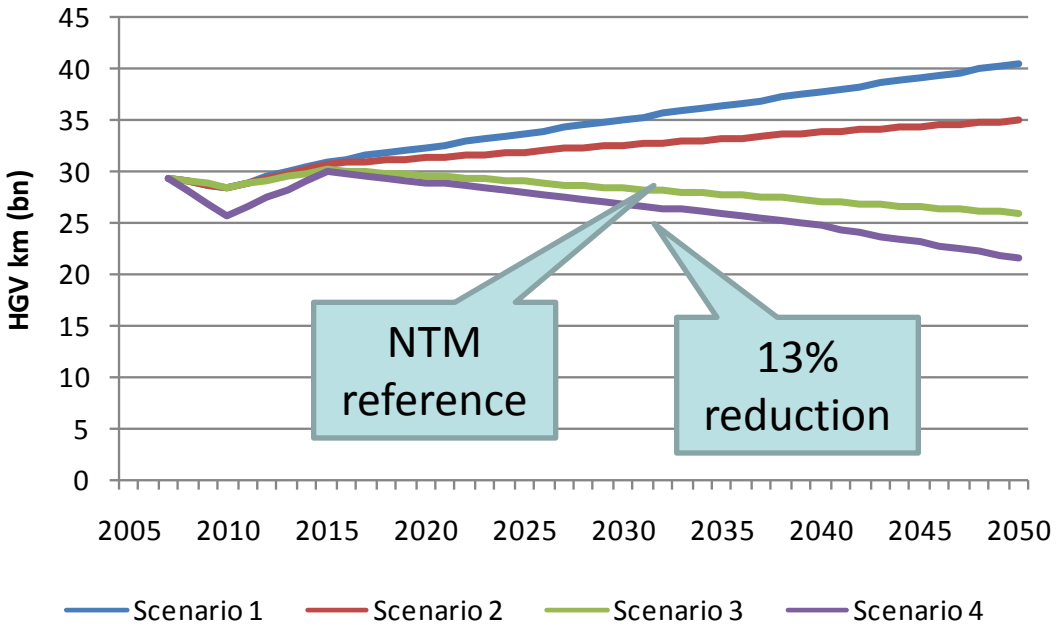
- Assumption that there is no widespread national hydrogen fuelling infrastructure in the 2030 scenario
- Opportunities for hydrogen limited to depot based fuelling model
- 50% new buses run on hydrogen by 2030
- We consider this a “worst/minimum case” hydrogen scenario; ideally cost and technology breakthroughs will make hydrogen a stronger part of the mix by 2030, especially in vehicles where battery technology is unsuitable

‘Cautious’ biofuel assumptions in 2030

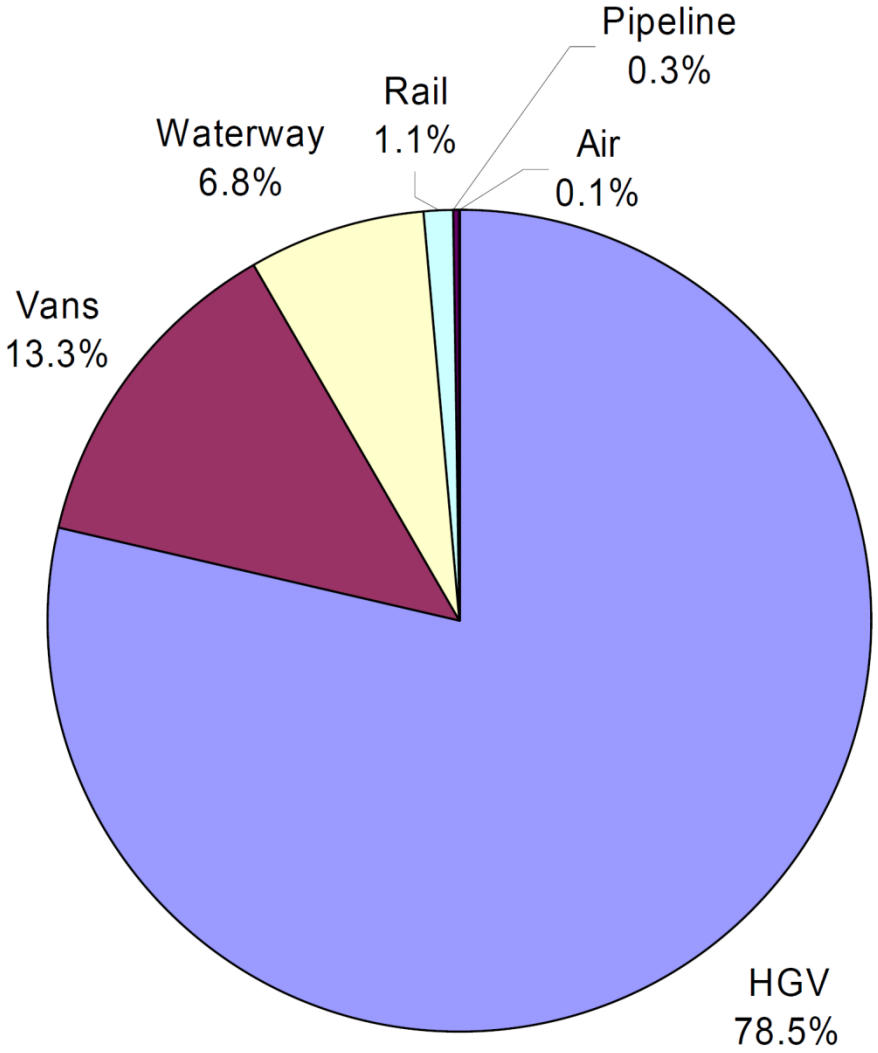
- Holding position in advance of 2011 Bioenergy Review
- Previous advice consistent with Gallagher Review (2008): maximum of 8% by energy in 2020
- 31TWh in 2020 held constant to 2030 (11% of liquid fuel by energy in 2030)
- High scenario based on IEA BLUE Map global biofuel consumption: 61TWh (21% of liquid fuel by energy) in 2030

Reduction in freight demand

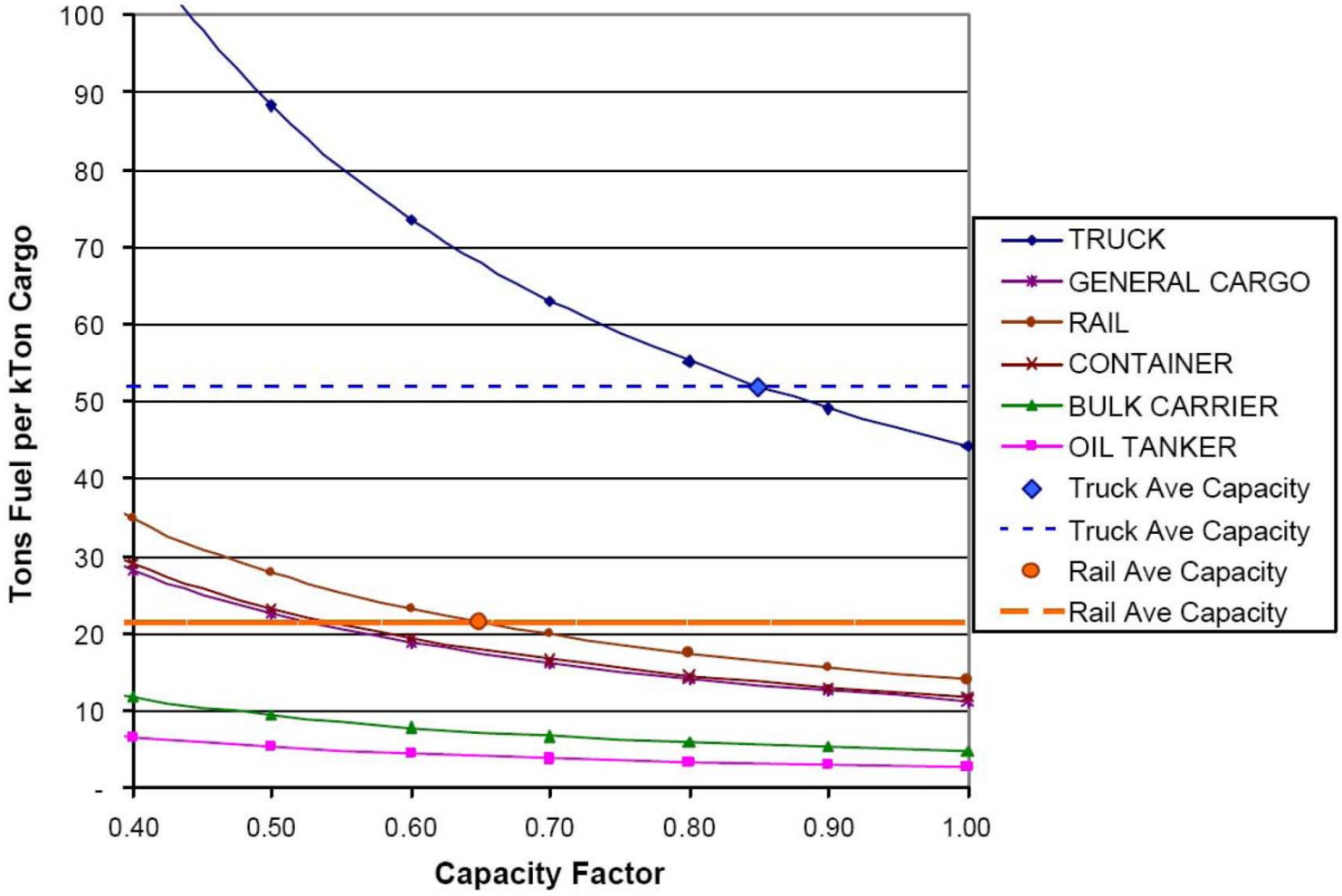
- Insufficient understanding of emissions reduction potential and cost
- Widespread agreement that km, fuel and CO_2 can be reduced
- Cautious 6.5% reduction by 2030



UK freight emissions by mode



Capacity utilisation and fuel efficiency



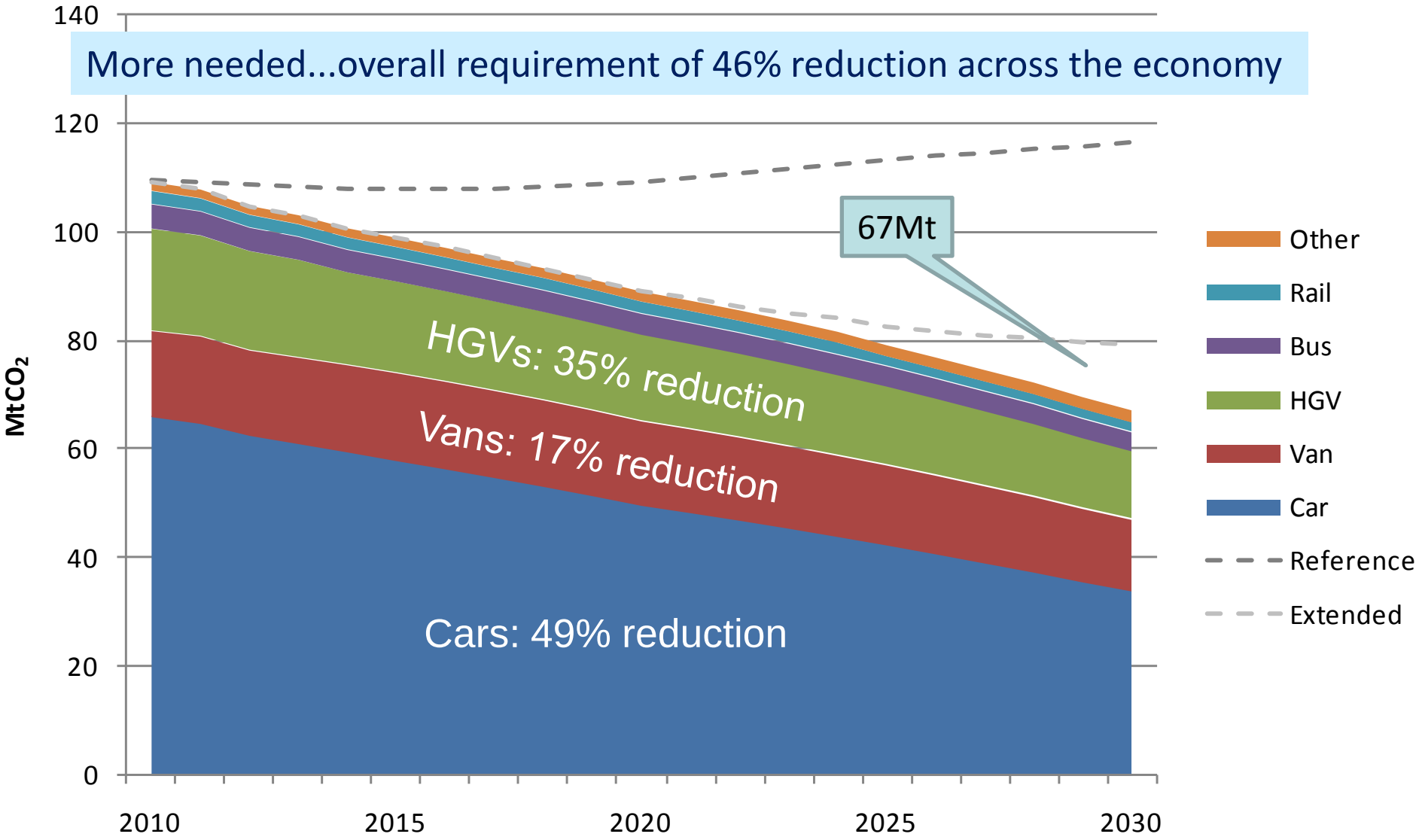
Martintek et al 2006, report for IMO

Transport reductions in 2030 scenario

- Surface transport emissions reduced from 110Mt CO_2 to 67Mt in 2030: 44%
- Demand reduction: Smarter Choices, Speed Limiting, Eco-driving, modest reduction in freight demand
- Conventional vehicle efficiency: 80g cars, 120g vans
- Electric and PHEV cars and vans reach 60% of new vehicles
- Overall vehicle emissions: 52g/km new cars - 64% reduction, 81g/km fleet - 53% reduction
- Biofuels remain at Gallagher level of 31TWh, 12% of liquid fuel
- Hydrogen buses reach 50% of new vehicles
- 17- 28% reduction in CO_2 emissions from HGVs
- Overall reductions
  - 49% for cars
  - 35% HGVs
- Total cost of abatement in 2030: £1890 million or 0.1% of GDP

Transport: 44% reduction by 2030

More needed...overall requirement of 46% reduction across the economy



Answers please...

- What else can should we include?
- What savings will it deliver?
- How much will it cost?
- What is it applicable to?

Challenges

- What will effective HGV fuel economy standards look like?
- Can regulations drive retrofitting?
- How to deal with complexity – vehicle configuration, application, duty cycle, local terrain...
- Euro6 and NO_x vs engine efficiency and CO_2
- Demonstration: confirm emissions reduction and abatement costs
- Lifecycle analysis of technologies
- Can we drive improvement faster?
- ...