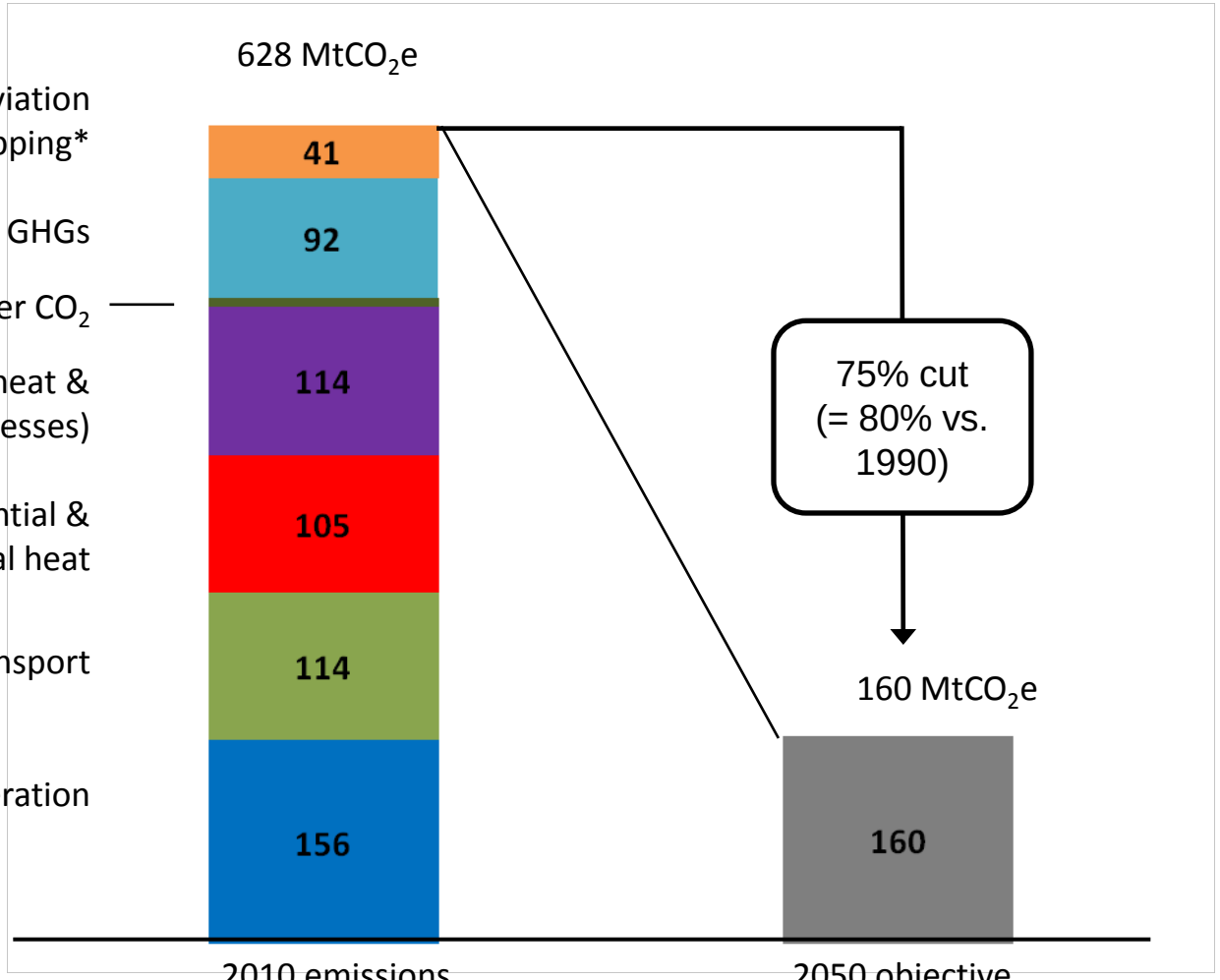
Energy and emission scenarios to 2030 and 2050:
Committee on Climate Change perspective

Adrian Gault
Chief Economist
Committee on Climate Change

RCEP ESF Workshop, 24 October 2012

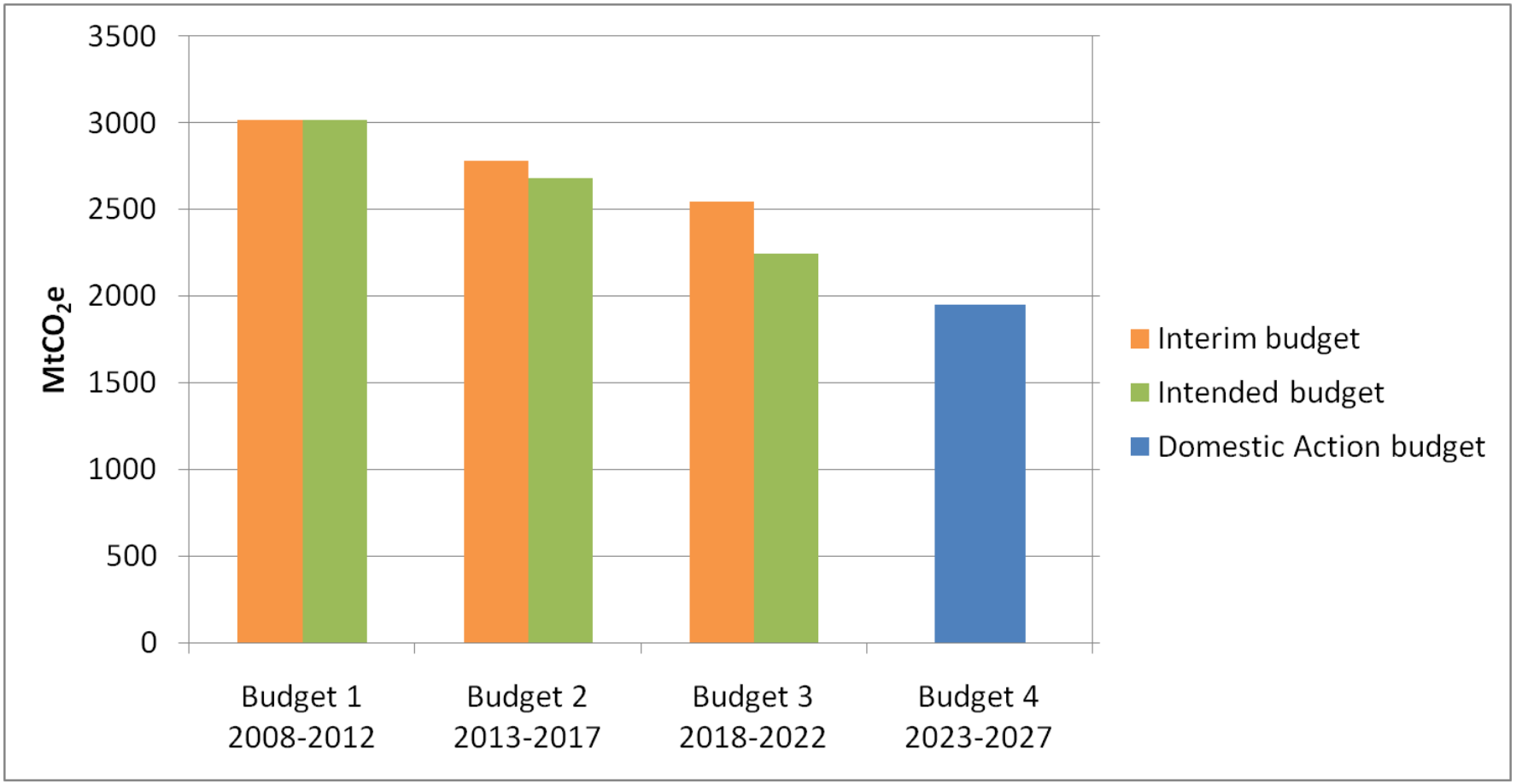
The 2050 Challenge



* bunker fuels basis

1. Fourth Carbon Budget recommendations (December 2010)

Interim, Intended and Domestic Action budgets



Considerations for an indicative 2030 target

Expected Implementation of UK 2050 target

- 80% overall (160 $MtCO_2e$)
- 85% excluding IA&S (120 $MtCO_2e$)
- 90% reduction in CO_2 (60-70 $MtCO_2$)
- Delivered through domestic action

Likely/required emissions level in early 2020s

Feasible pathways during 2020s

Indicative target for 2030

- Around **60%** from domestic emissions reduction (310 $MtCO_2e$)
- Around **63%** as contribution to global emissions reduction

(all GHGs relative to 1990)

Feasible pathways from 2030-2050

Implied 2030-2050 path

- 5% reductions per annum
- Lower 2030 target would leave very challenging and expensive reductions beyond 2030

Recommendations on fourth budget period (2023-2027)

Recommendations on approach to first three budgets and international aviation and shipping

Domestic Action and Global Offer budgets

Awaiting global deal for 2020s

UK needs to:
- **develop options** for decarbonisation
- **avoid lock-in** to high-carbon assets
- **progress** towards 2050 target

Domestic Action budget now

Global deal for 2020s

UK needs to make contribution to global emissions reduction

Global Offer budget in future

We developed a feasible and cost-effective scenario for 2030 that is appropriate on the path to 2050

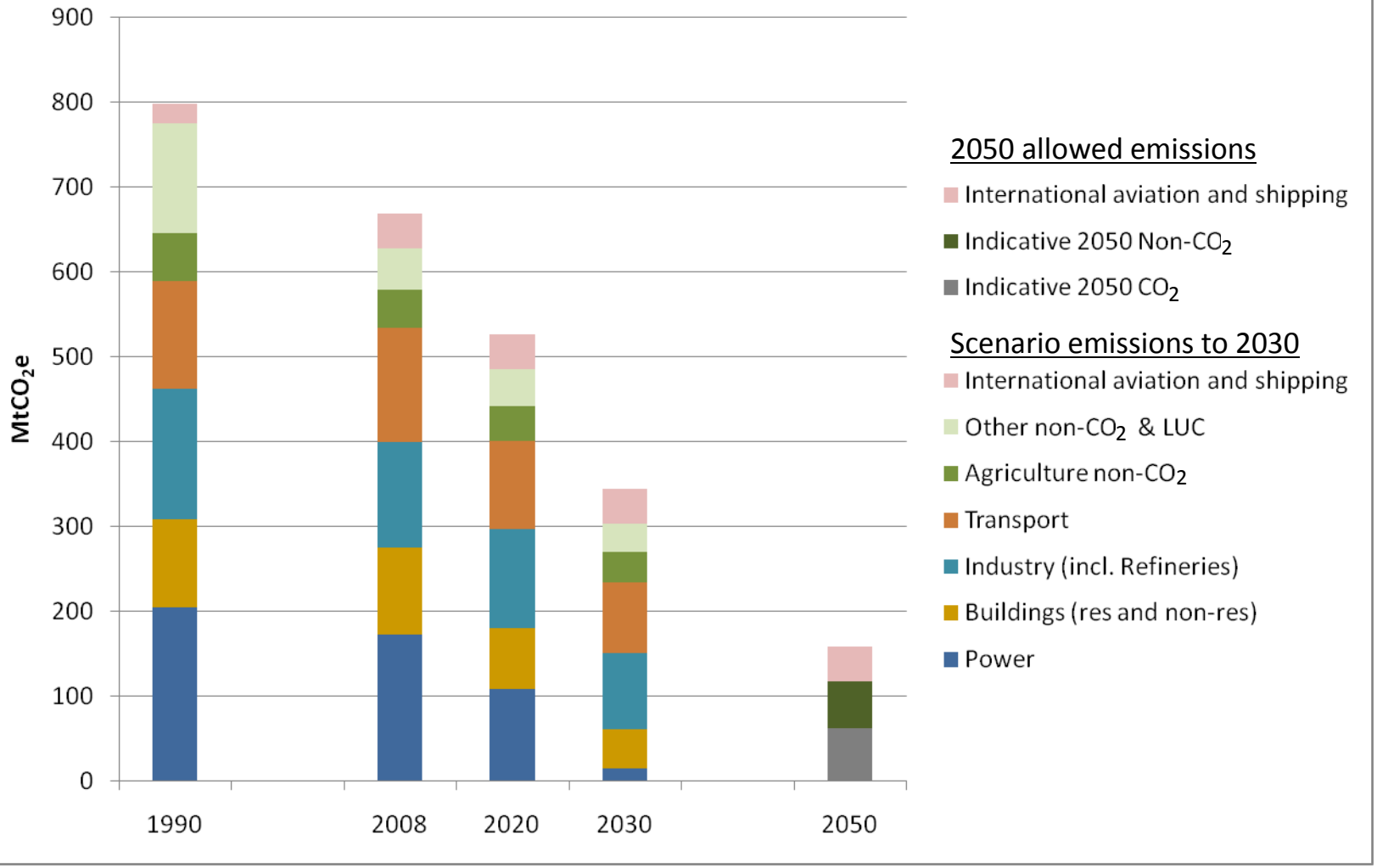
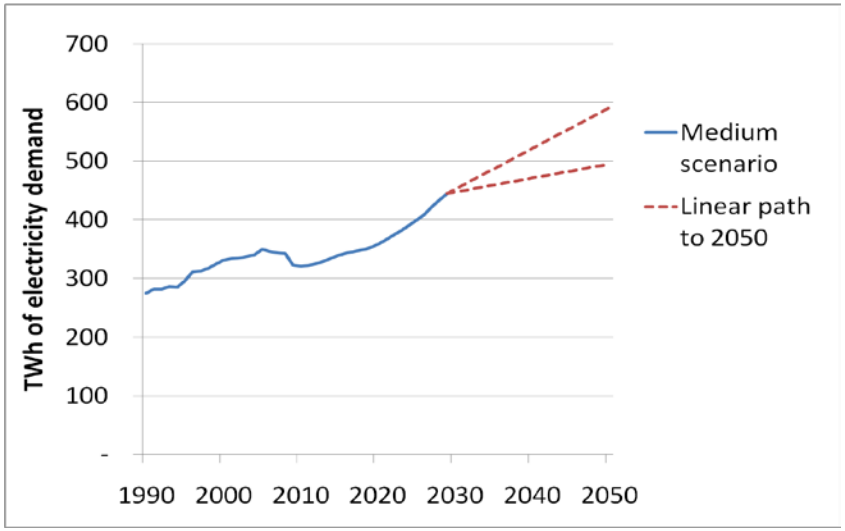
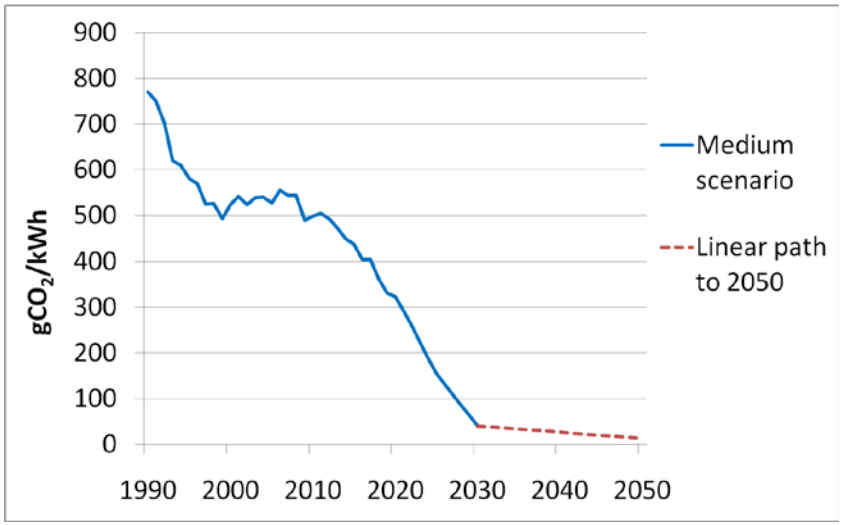
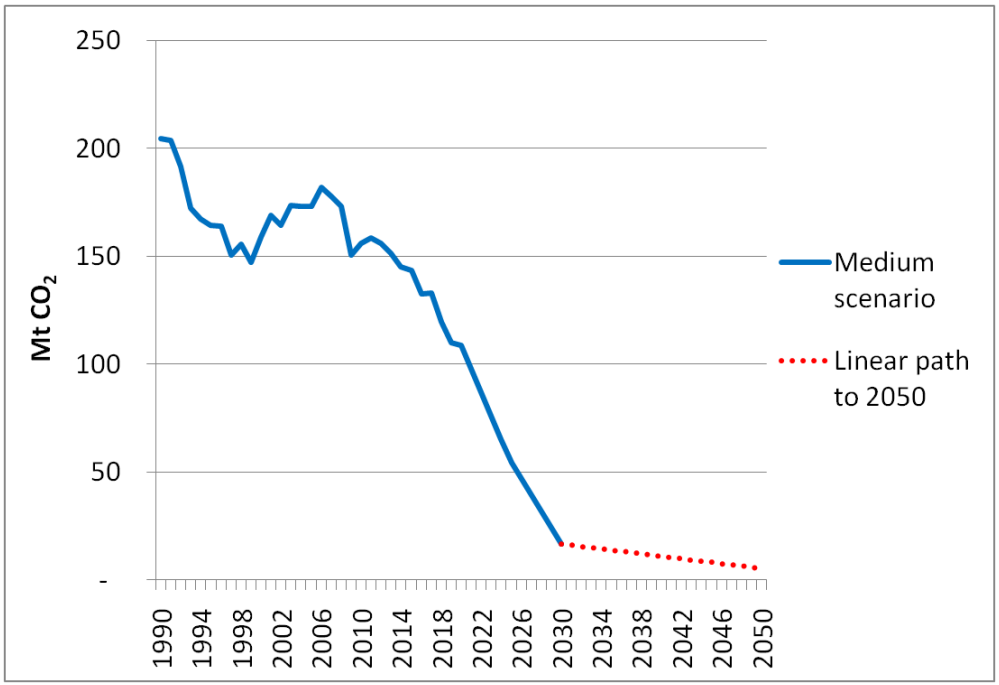


Illustration of sector analysis - Power: Emissions intensity will have to decrease, whilst demand is likely to increase

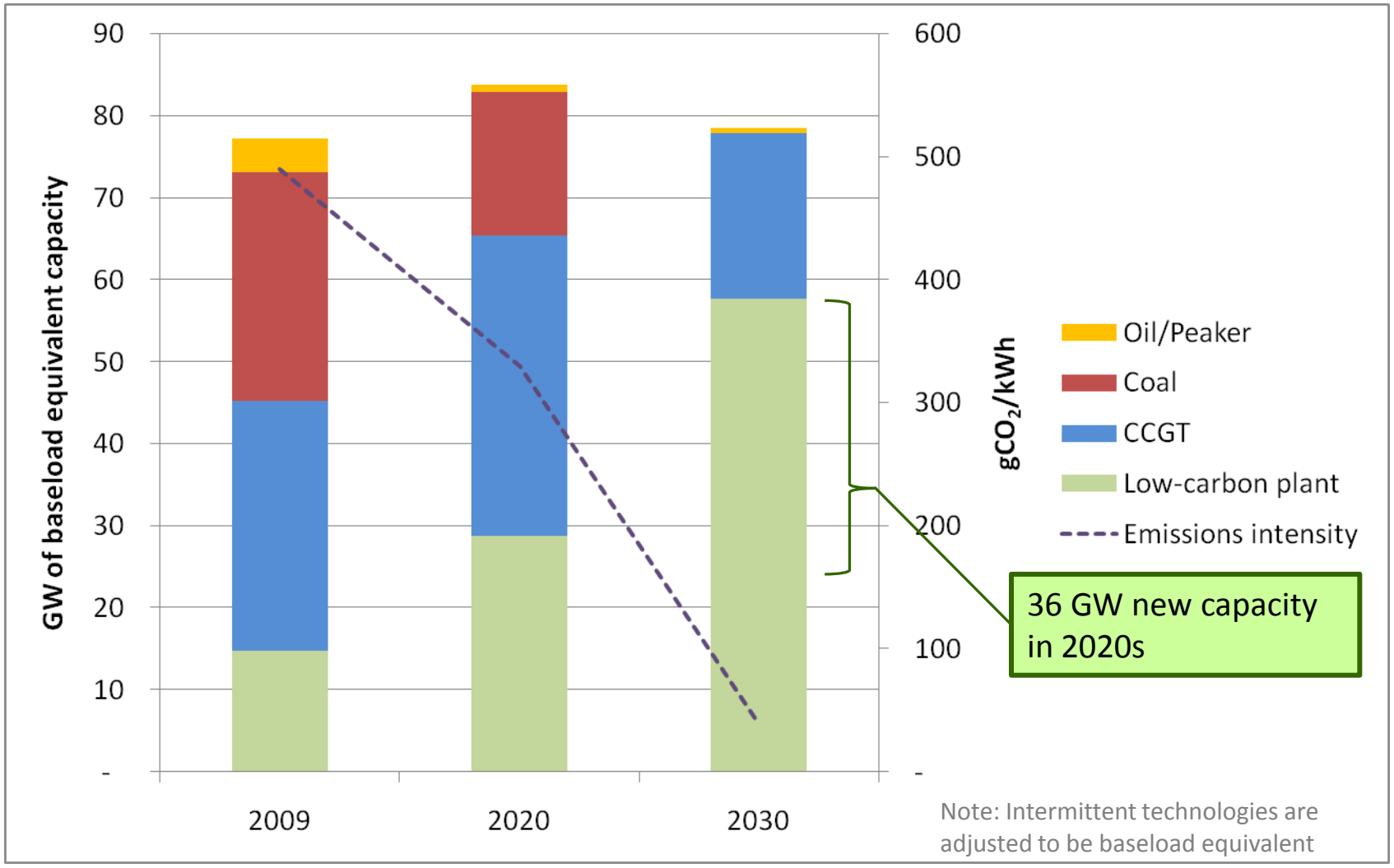




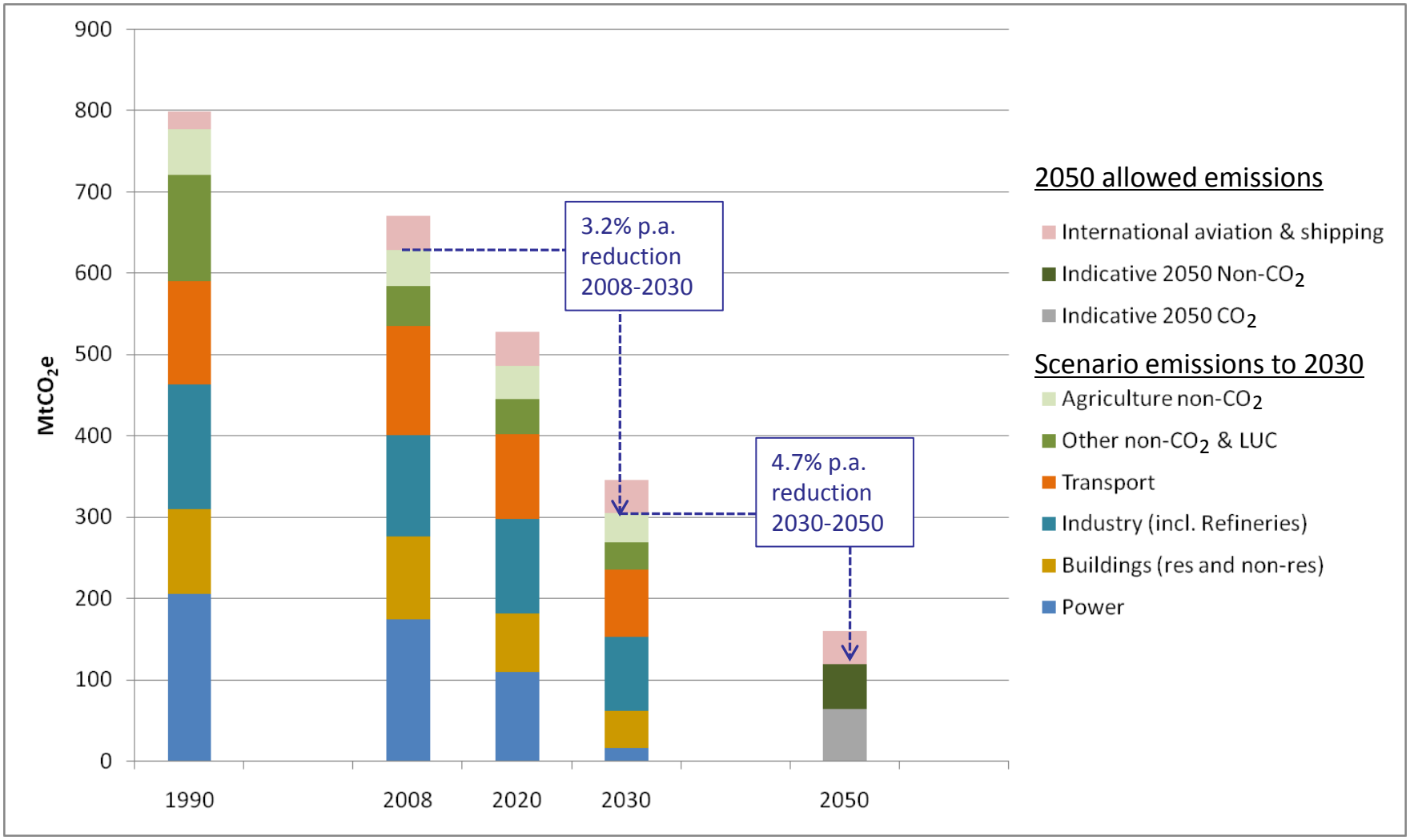


Source for 2050: range of MARKAL model runs for CCC (2010)

Illustration of sector analysis - Power: this decarbonisation will require 30-40 GW new low-carbon capacity through the 2020s



Emissions reductions will have to accelerate again from 2030 to 2050



2030 to 2050 – detailed assessment of opportunities suggests 'back-ending' is feasible

Power	Maintain annual low-carbon build rate (3-4 GW) through 2030s and 2040s	Zero-carbon power sector serving much higher demand
Buildings	• Further deploy heat pumps • District heating for built-up areas • Some resistive electric	Could be close to zero-carbon by 2050
Industry	• CCS where suitable • Biogas / biomass in high-grade heat	May also need product substitution, refinery restructuring, resource efficiency
Transport	• All cars and vans electric by 2050 • Hydrogen for HGVs and buses	May also need some biofuels to be zero-carbon Aviation hard to reduce
Agriculture	Reaching limits of known options by 2030	May need demand-side changes or radical supply-side options

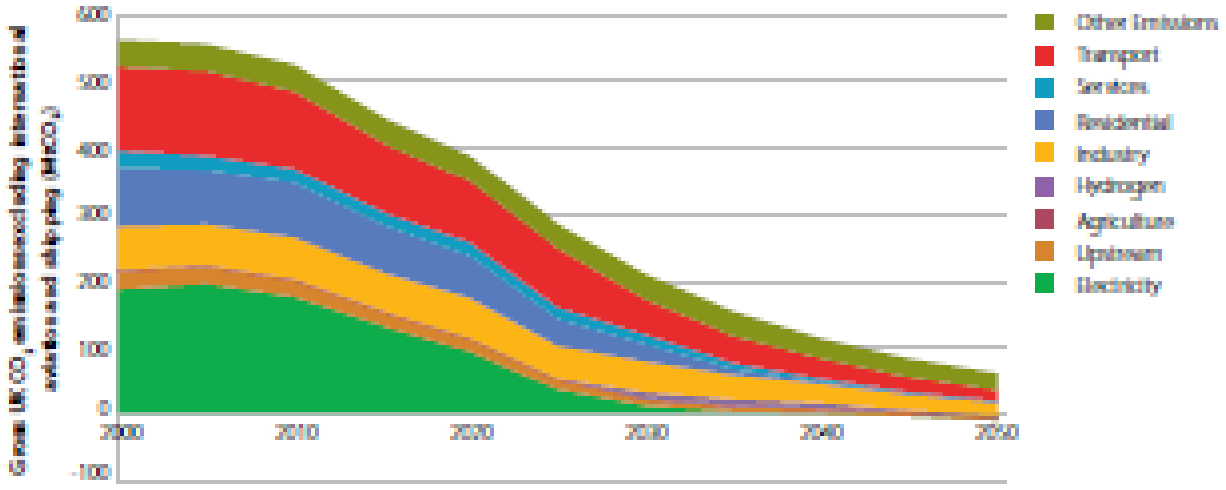
In summary, therefore, 4th budget framework for considering the path through the 2020s:

	Near-term considerations	Long-term considerations
4th budget (2010)	Uptake of measures determined by **cost-effectiveness vs. a rising carbon price** (and subject to build-rate constraints)	Further measures added, where solely cost-effective roll-out to 2030 was **not on track for 2050**

1. Fourth Carbon Budget recommendations (December 2010)
2. **Cost-optimisation modelling (e.g. in 4th budget analysis and IAS report)**

In the 4th budget report we also conducted high-level analysis using the MARKAL model....

Figure 3.6: MARKAL possible emissions trajectory (2000-2050)



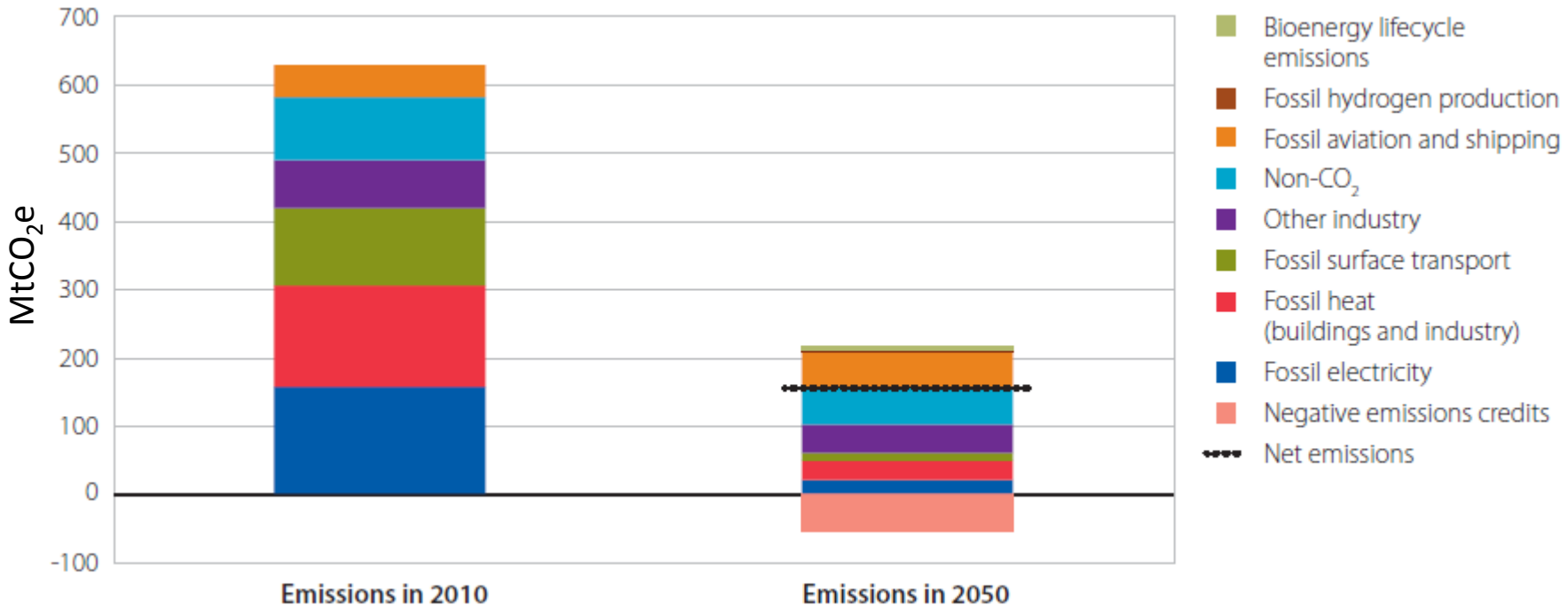
Source: MARKAL modelling by University College London for the CCC (2010).

Notes: Emissions are CO_2 only, i.e. agriculture excludes the much larger contribution of non-CO_2 emissions; the 'other' emissions category is comprised mainly of industrial non-combustion emissions, e.g. process emissions from production of cement and iron/steel; 2010 emissions are high relative to latest outturn as the baseline does not include impacts of the recession.

- This supported that the cost-effective path to delivering a cumulative emissions budget requires early action
- Though the bottom-up scenarios were the basis of the budget proposals

We also used a cost-optimising model to consider how to meet the 2050 target in our Bioenergy Review

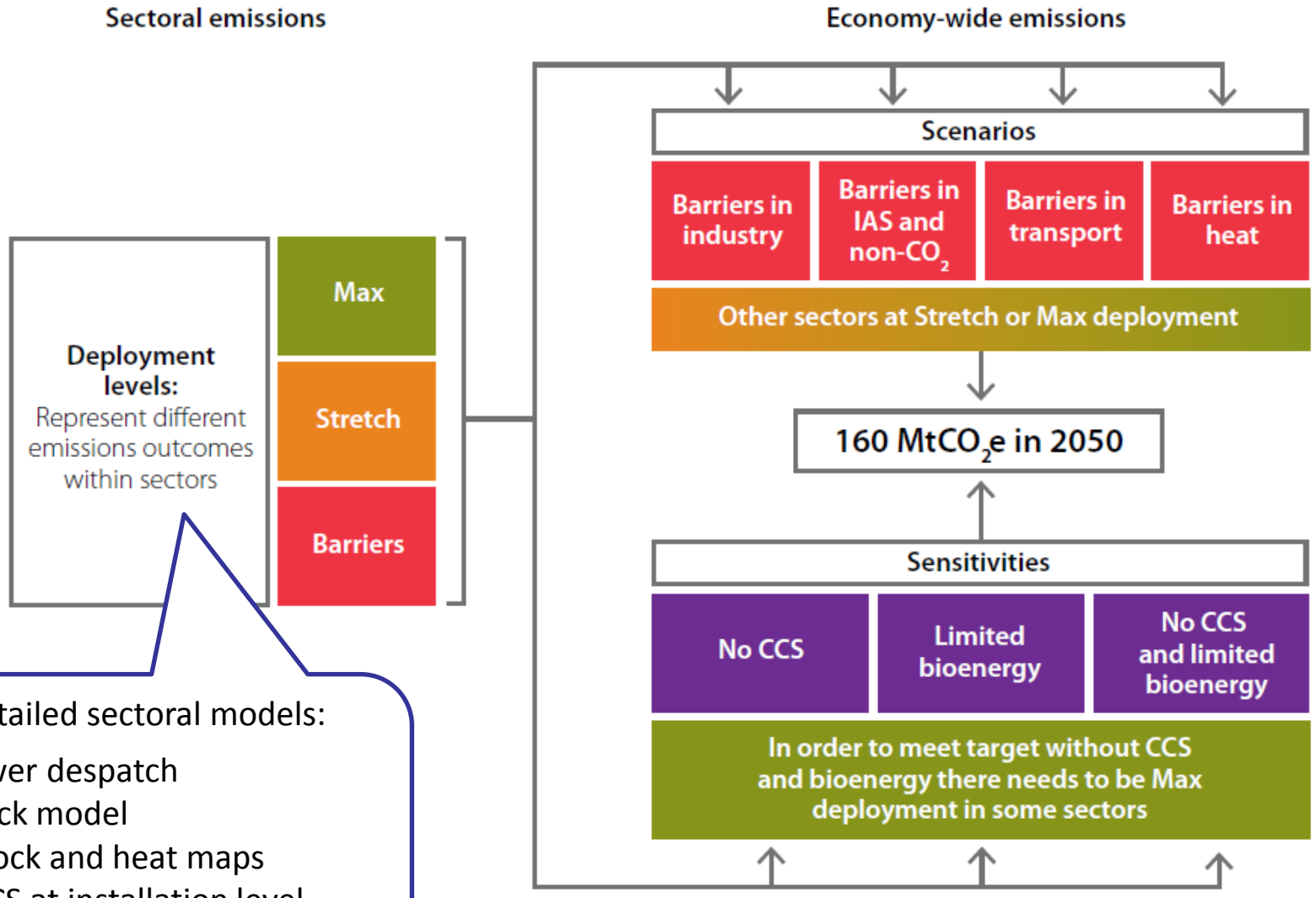
Cost optimising model -> remaining emissions in IAS, industry, non-CO_2



15

1. Fourth Carbon Budget recommendations (December 2010)
2. Cost-optimisation modelling (e.g. in 4th budget analysis and IAS report)
3. **2050 scenario analysis in the report on inclusion of IAS in budgets (April 2012)**

New work for IAS report built scenarios bottom-up, rather than with cost-optimising model

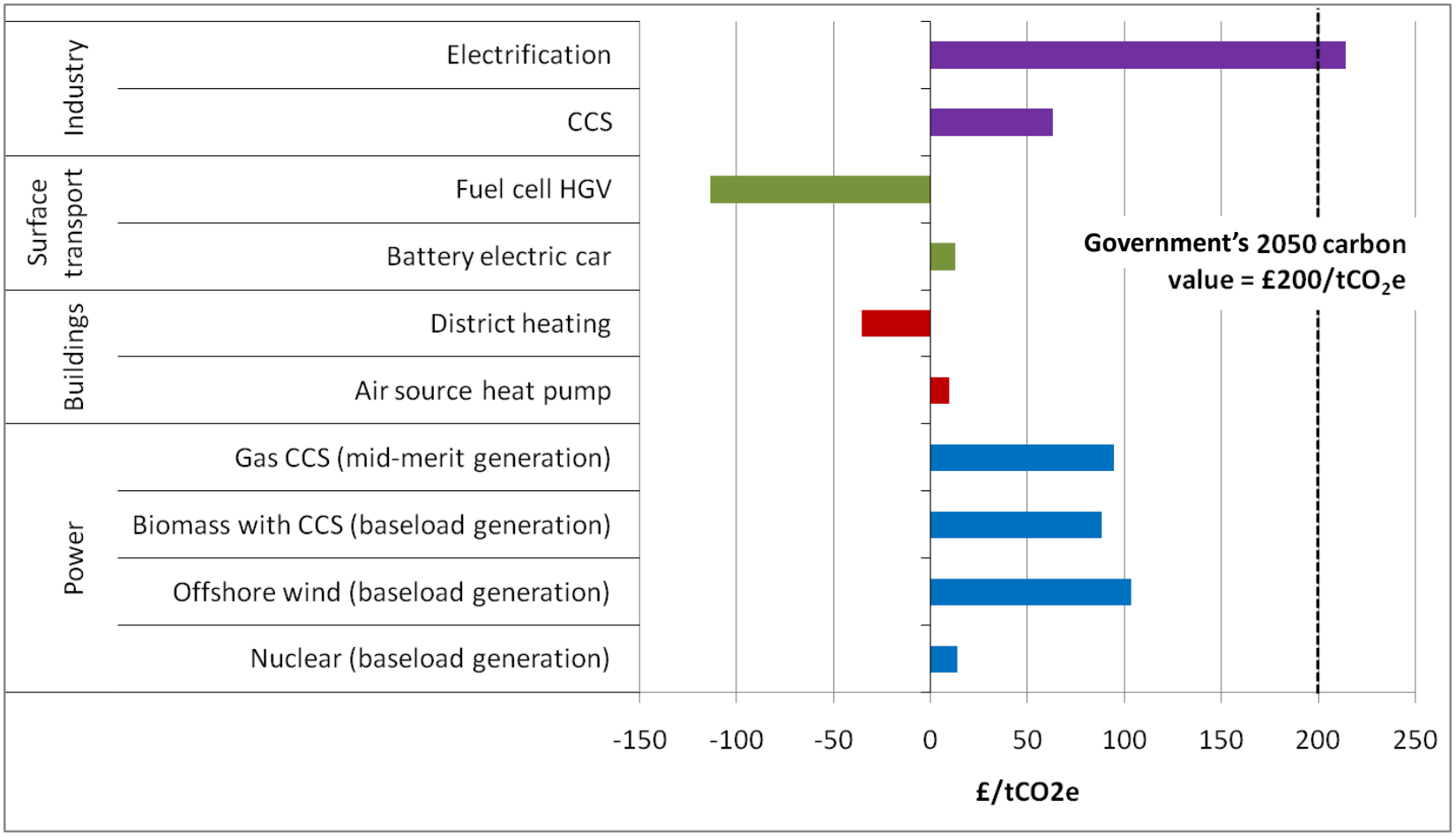


Based on detailed sectoral models:

- Hourly power despatch
- Vehicle stock model
- Housing stock and heat maps
- Industry CCS at installation level

+ detailed technology cost modelling

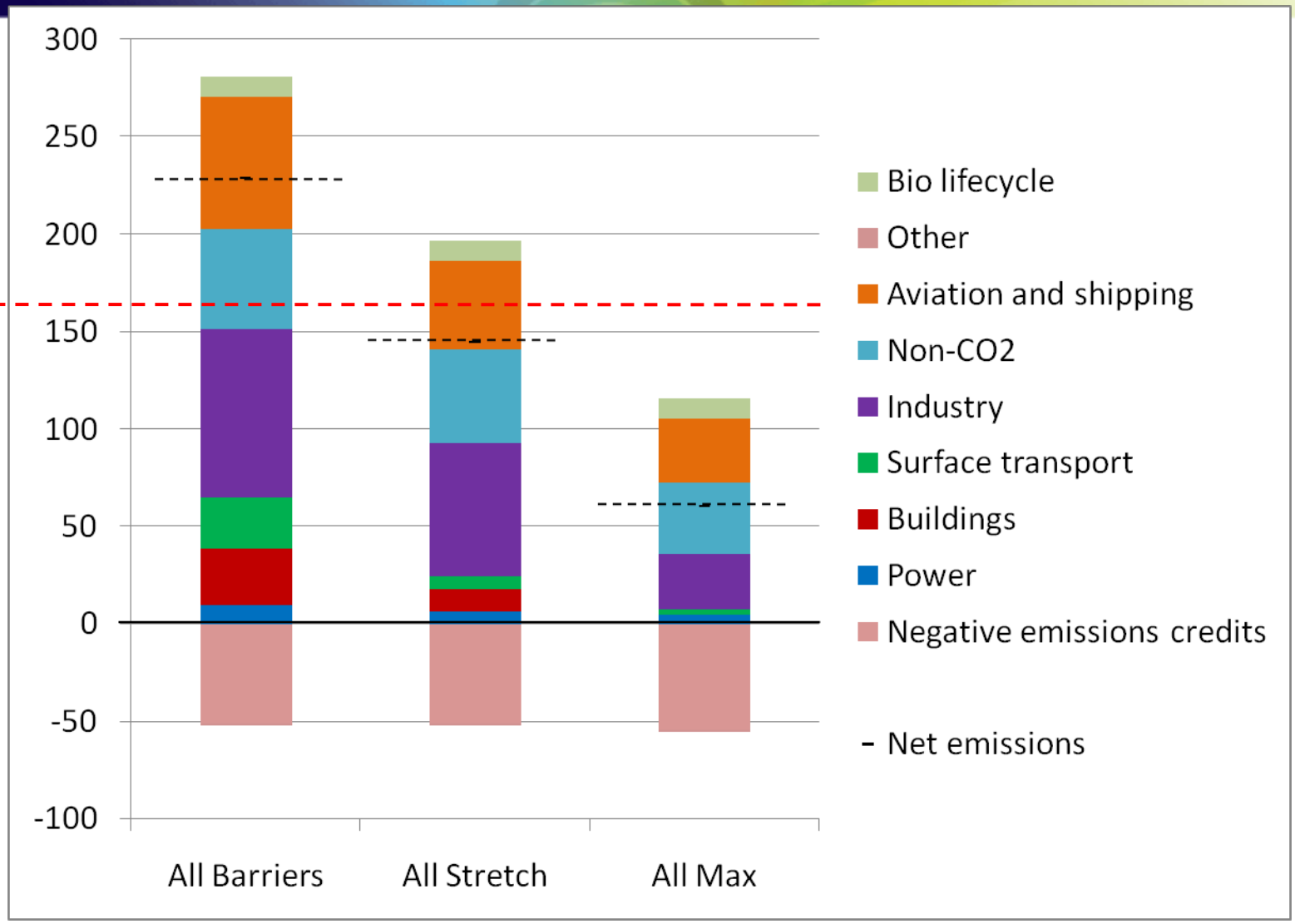
We identified cost-effective abatement options across the economy



Plus non-CO_2 measures generally low-cost or cost saving

18

Need to go beyond 'Barriers' deployment levels to deliver the 80% target



19

Multiple combinations could give plausible scenarios for meeting the 2050 target

	Barriers in industry	Barriers in aviation, shipping and non-CO_2	Barriers in heat for buildings	Barriers in surface transport and power
Power	Stretch	Stretch	Stretch	Barriers
Buildings	Stretch	Max	Barriers	Stretch
Surface transport	Max	Stretch	Max	Barriers
Industry	Barriers	Stretch	Stretch	Stretch
Non CO_2	Stretch	Barriers	Stretch	Max
Aviation and Shipping	Stretch	Barriers	Stretch	Stretch

Without CCS or with limited bioenergy flexibility is much reduced

	No CCS	Limited bioenergy	Limited bioenergy and no CCS
Power	Stretch[1]	Stretch	Stretch[1]
Buildings	Stretch	Max	Stretch
Surface transport	Max	Stretch	Stretch
Industry	Max[2]	Stretch	Max[5]
Non CO_2	Stretch	Stretch	Stretch
Aviation and Shipping	Stretch[3]	Stretch[4]	Stretch[4]

Note: Includes reallocation of bioenergy and use of substitute low-carbon technologies where available (e.g. nuclear/renewables for CCS in power).

21

1. Fourth Carbon Budget recommendations (December 2010)
2. Cost-optimisation modelling (e.g. in 4th budget analysis and IAS report)
3. 2050 scenario analysis in the report on inclusion of IAS in budgets (April 2012)
4. **Future work**

We are swapping the order of long-term vs. near-term considerations for the path through the 2020s

	Near-term considerations	Long-term considerations
4th budget (2010)	Uptake of measures determined by **cost-effectiveness vs. a rising carbon price** (and subject to build-rate constraints)	Further measures added, where solely cost-effective roll-out to 2030 was **not on track for 2050**
4CB review (2012-13)	Further deployment of measures is subject to **cost-effectiveness** vs. projected carbon prices	**Backcasting approach:** path to 2050 determines minimum deployment of technologies to 2030, regardless of a near-term carbon price

We propose to look more deeply into issues around transitions & the dynamic case for action in the 2020s

Committee on Climate Change

Minimum build of low-carbon by 2030, on the way to 2050

What do a range of scenarios for **2050**, together with plausible overall **build rates** and build **trajectories by technology**, imply for minimum low-carbon build by 2030?

Option value of offshore wind & CCS

Given uncertainties over the availability of nuclear and CCS, and the costs of these and offshore wind, what is the option value provided by offshore wind and by CCS?

Value of bridging technologies

What role might 'bridging technologies' have on the long-term path? Are some worth deploying given their **consumer acceptance benefits** (e.g. PHEVs), while others waste time needed for transition to low-carbon (e.g. gas CCGT)?

Lessons from historical / international transitions

How long do transitions to new technologies (e.g. heat pumps, ULEVs) really take, given need to roll out **infrastructure**, gain **consumer acceptance** and turn over stock? Role for **scrappage**?

Committee on Climate Change

Thank you

RCEP ESF Workshop, 24 October 2012