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The UK's 2°C Commitment, Aviation emissions and the EU ETS

Based on research by
Kevin Anderson & Alice Bows
Mechanical, Aerospace and Civil Engineering
University of Manchester

Kevin Anderson
Tyndall Centre

November 2008

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Talk outline

The Climate Change Context

- *What is dangerous climate change?*
- *Reframing the debate*

  … from long term targets to emission pathways

The Critical role of Aviation *(& shipping …)*

- *Aviation growth within a low carbon pathway?*
- *Responding to the challenge*

  *… the EU ETS – too little too late**?***

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The Climate Change Context

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What is dangerous climate change?

- UK & EU define this as 2°C

Emission-reduction targets for 2°C

- UK, EU & Global - long term reduction targets
  - *UK's 80% reduction in CO_2e by 2050*
  - *EU 60%-80% reduction in CO_2 e by 2050*
  - *Bali 50% global reduction in CO_2e by 2050*

- CO_2 stays in atmosphere for 100+ years, hence long-term targets are highly misleading

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Put bluntly …

the final % reduction in carbon has little relevance to avoiding dangerous climate change *(e.g. 2°C)*

What is important are the **cumulative** emissions of carbon & other greenhouse gases (*i.e. the carbon budget*)

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How does this scientifically-credible way of thinking, alter the challenge we face?

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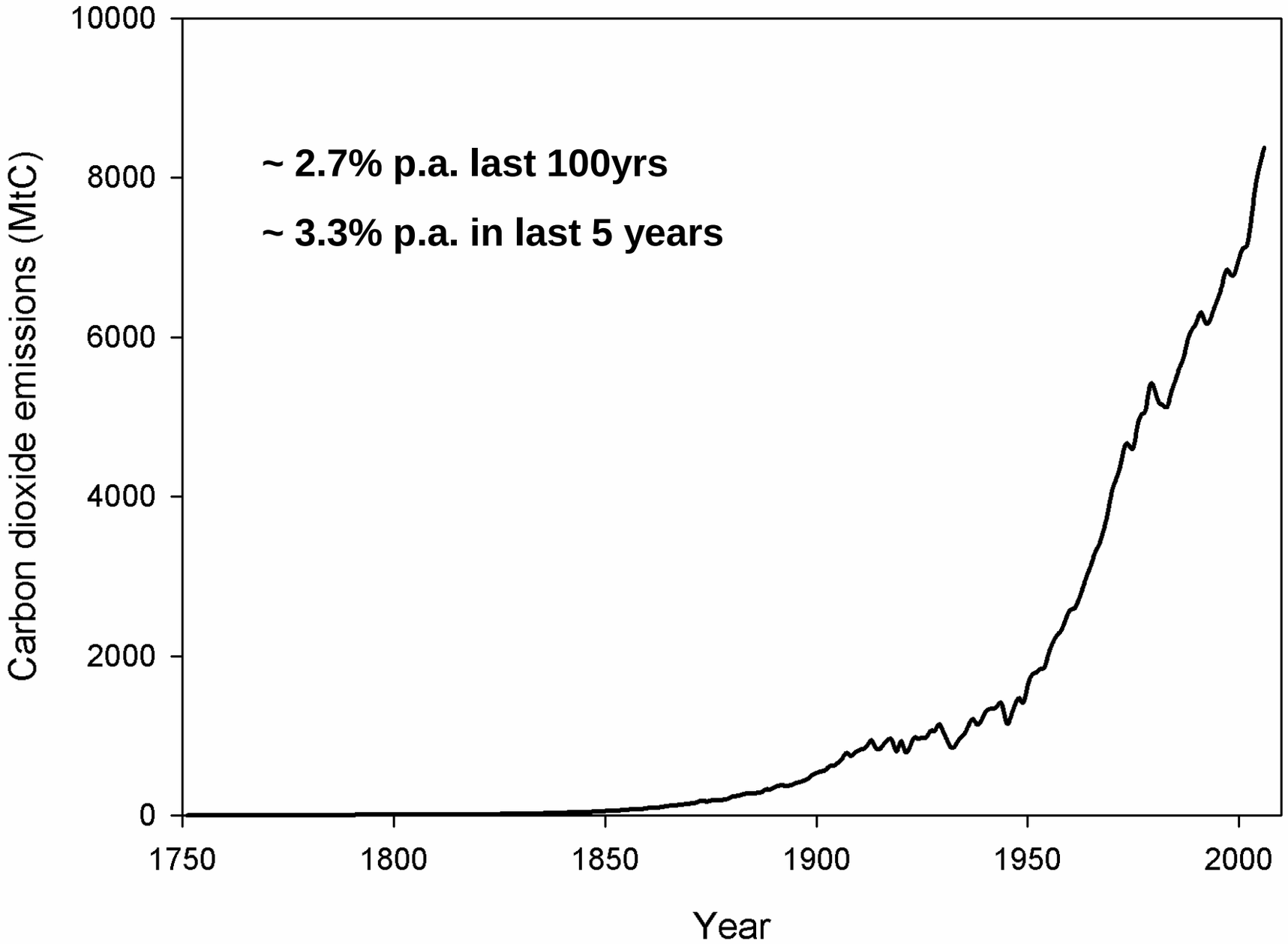
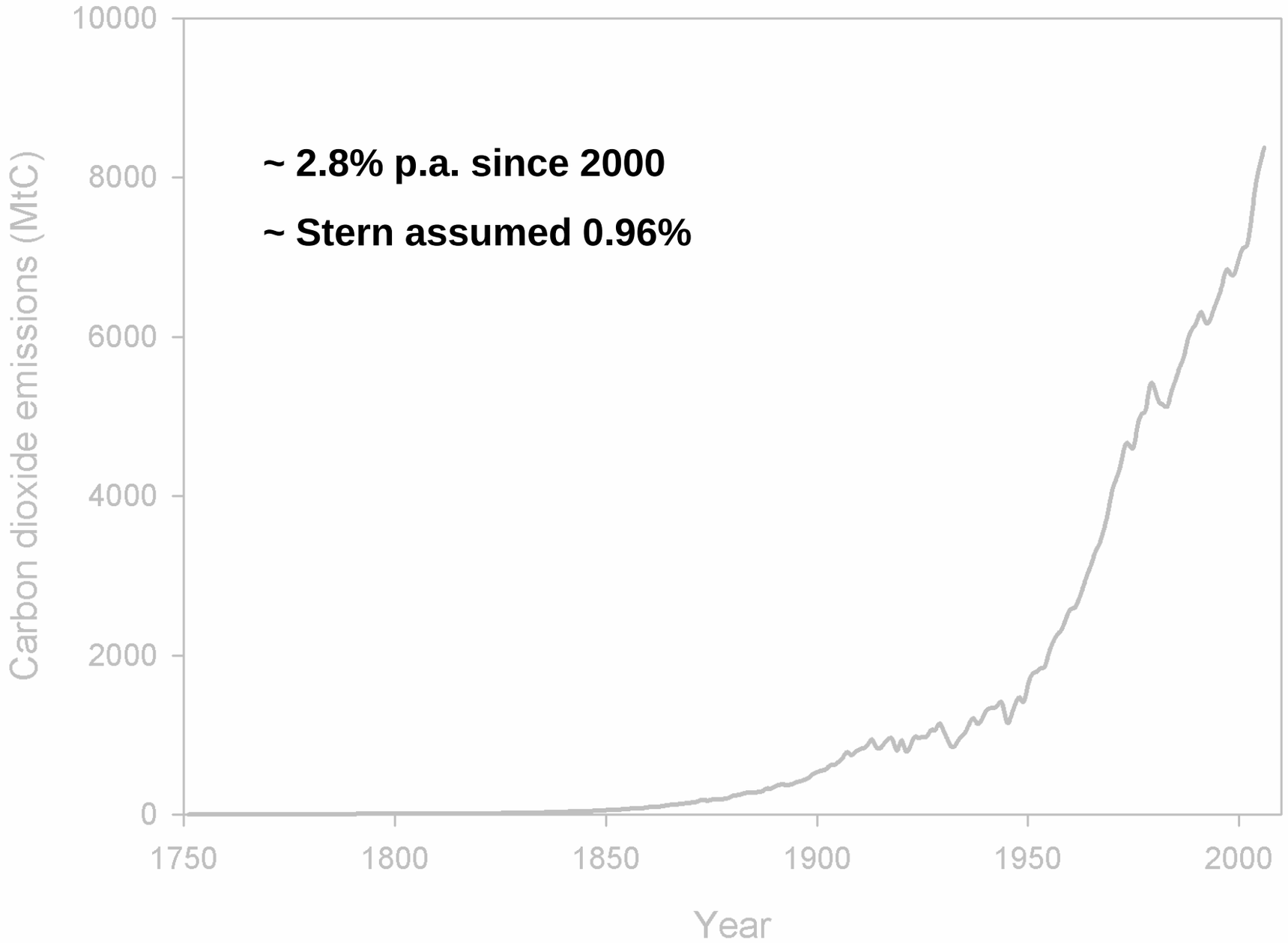
Tyndall's
'global emission scenarios (CO_2e)'

- What are the latest CO_2 emission trends?
- What are implications of factoring in:
  - land-use & forestry?
  - non-CO_2 greenhouse gas emissions?
- When will global CO_2e emissions peak – 2015/20/25?
- Use full range of *'with feedback'* AR4 cumulative values

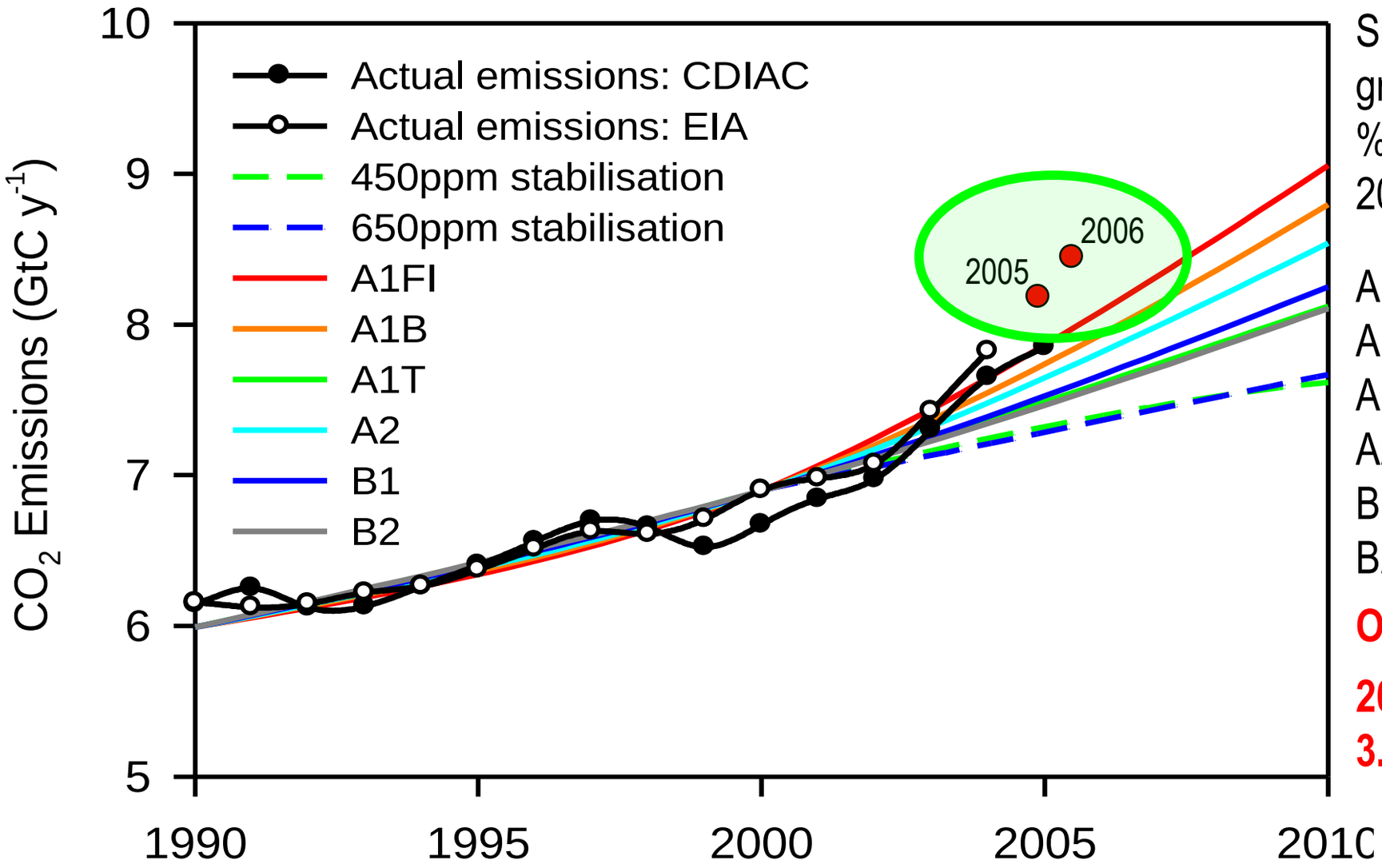
What are the latest global CO_2 emission trends?



What are the latest global CO_2e emission trends?



Trajectory of Global Fossil Fuel Emissions



SRES (2000) growth rates in % y^{-1} for 2000-2010:

A1B: 2.42
A1FI: 2.71
A1T: 1.63
A2: 2.13
B1: 1.79
B2: 1.61

Observed

2000-2006
3.3%

Raupach et al. 2007, PNAS

Land-use, forestry & non-CO_2 emissions

- 12 - 45% of global emissions
- Tyndall use most ‘optimistic’ 2000-2050/100 estimates from the literature
- Tyndall-derived very low emission scenarios

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2°C

greenhouse gas emission pathways

(450ppmv CO_2e)

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For 450ppmv CO_2e, emissions between 2000-2100 *(the carbon budget)* are estimated to be

~ 1400 to 2200 $GtCO_2e$

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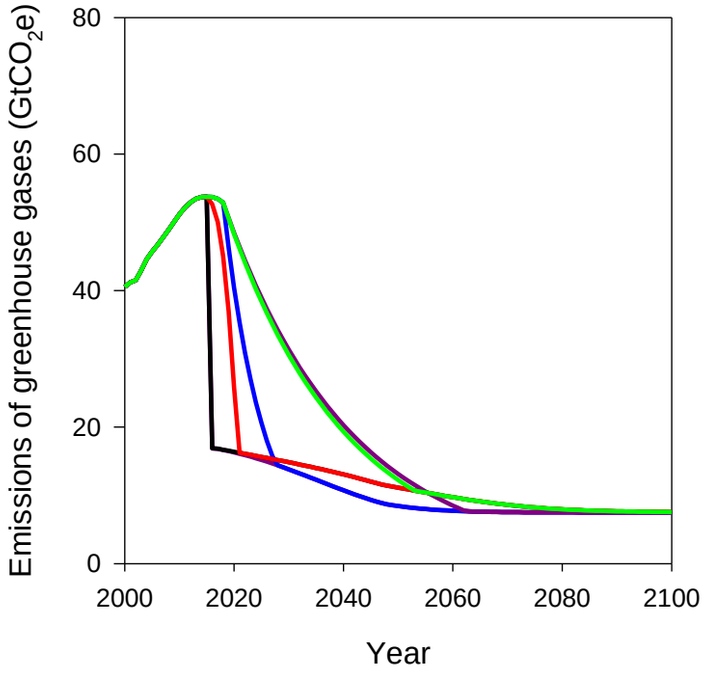
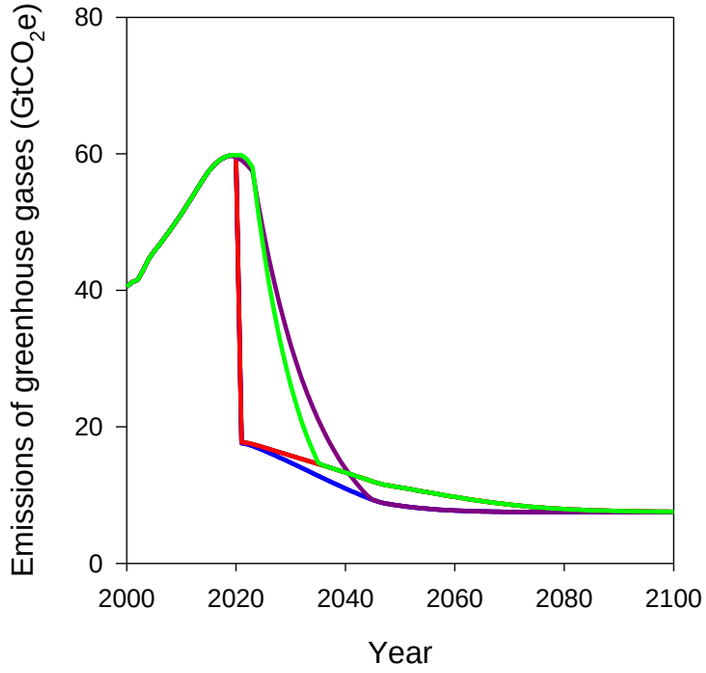
Total greenhouse gas emission pathways

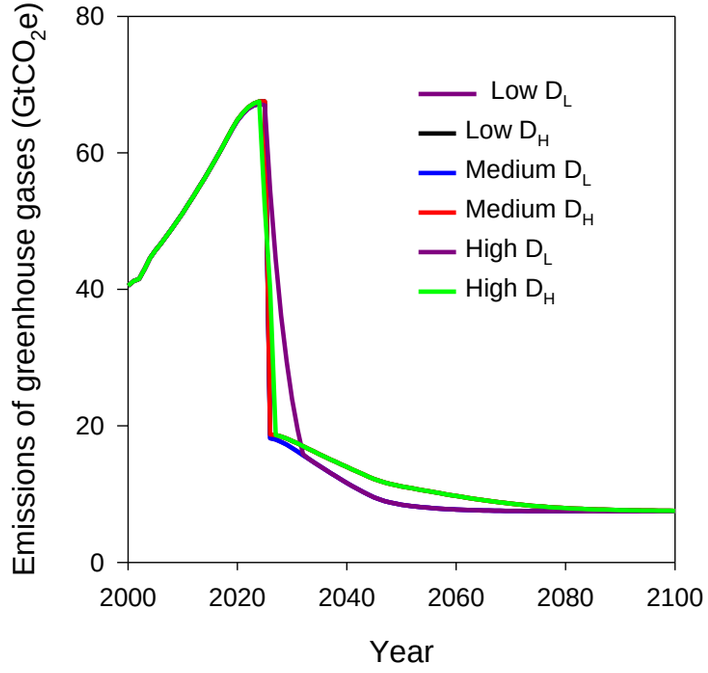
2015 peak



2020 peak



2025 peak



(Anderson & Bows. 2008 Philosophical Transactions A of the Royal Society. 366. pp.3863-3882)

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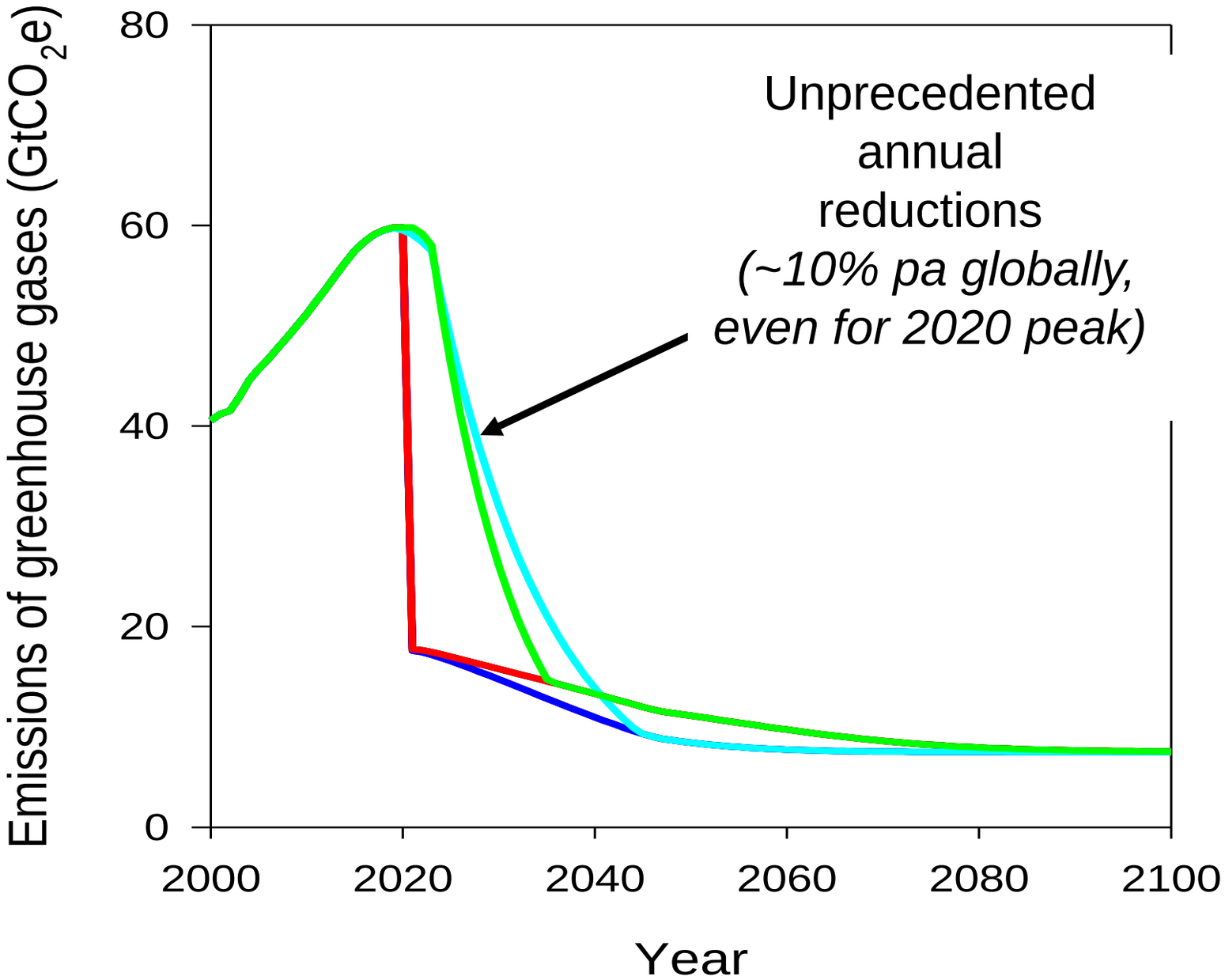
What does all this imply for a 450ppmvCO_2e future?



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3°C & 4°C

greenhouse gas emission pathways

(550 & 650 ppmv CO_2e)

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For 3°C *(550ppmv CO_2e)* with emissions peaking by 2020:

- *9% annual reductions in CO_2 from energy*

For 4°C *(650ppmv CO_2e)* with emissions peaking by 2020:

- *3.5% annual reductions in CO_2 from energy*

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What are the precedents for such reductions?

Annual reductions of greater than 1% p.a. have only

"been associated with economic recession or upheaval"

Stern 2006

- *UK gas & French 40x nuclear ~1% p.a. reductions*

  (ex. aviation & shipping)

- *Collapse Soviet Union economy ~5% p.a. reductions*

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the *UK* level

(older work based on CO_2 only - to be updated)

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For a 30% chance of 2°C

the UK's budget is

~ 17-23 $GtCO_2$

between 2000-2050

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From this two questions arise

1. What are the emissions between 2000 & today?

2. What emissions are we locked into in the immediate future?

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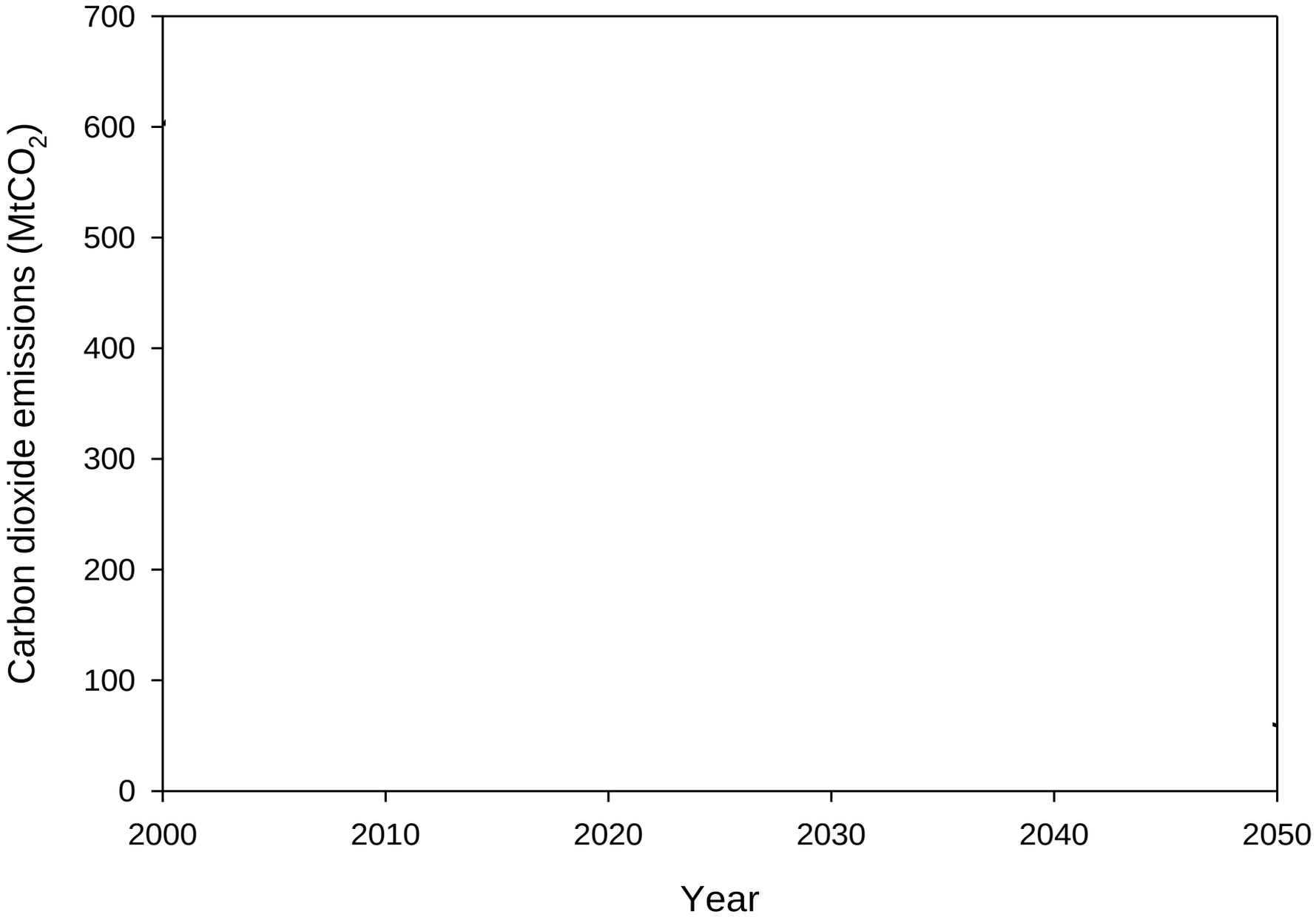
Answer 1

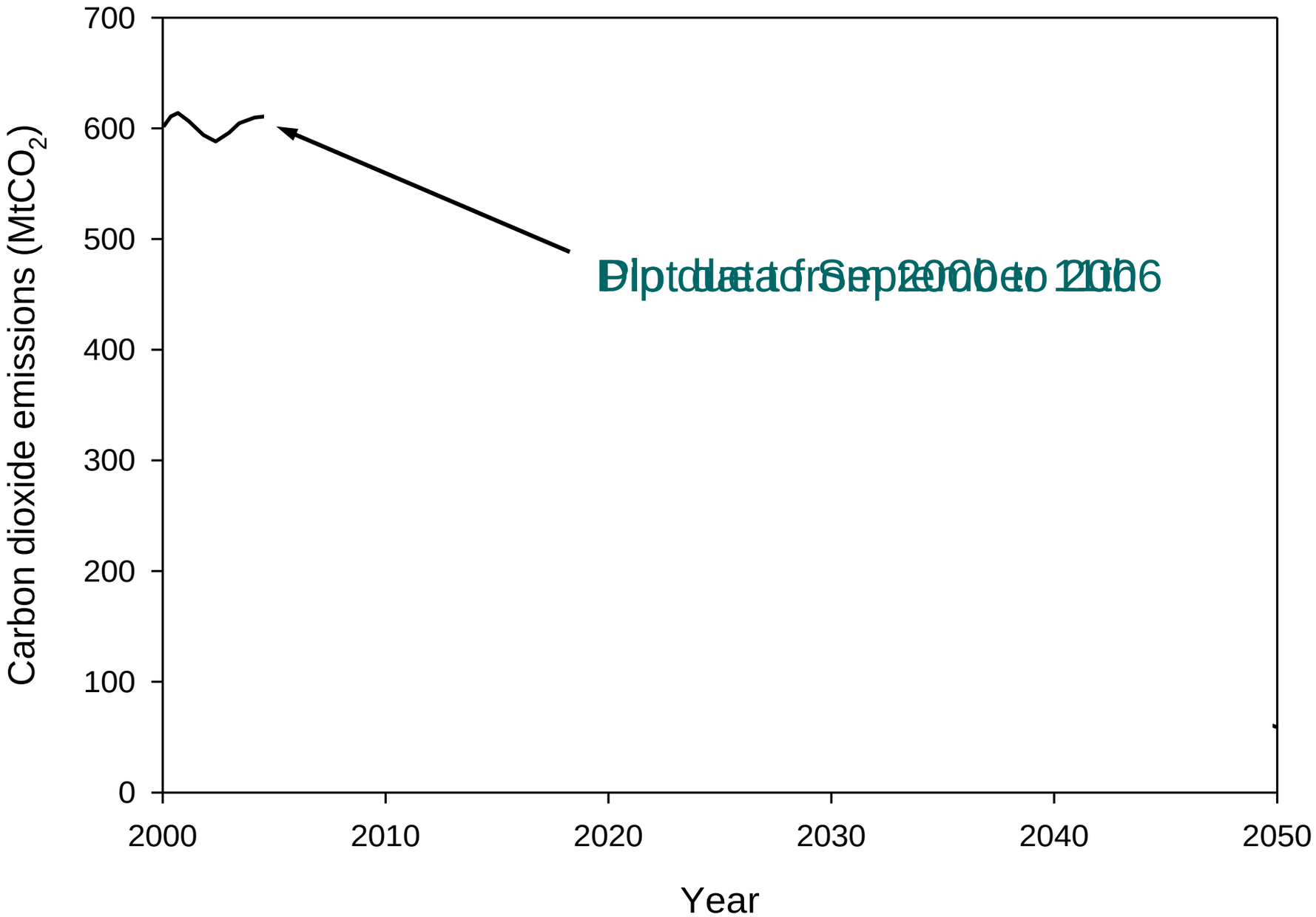
… emissions between 2000-2006 were ~ 4.5 billion tonnes of CO_2

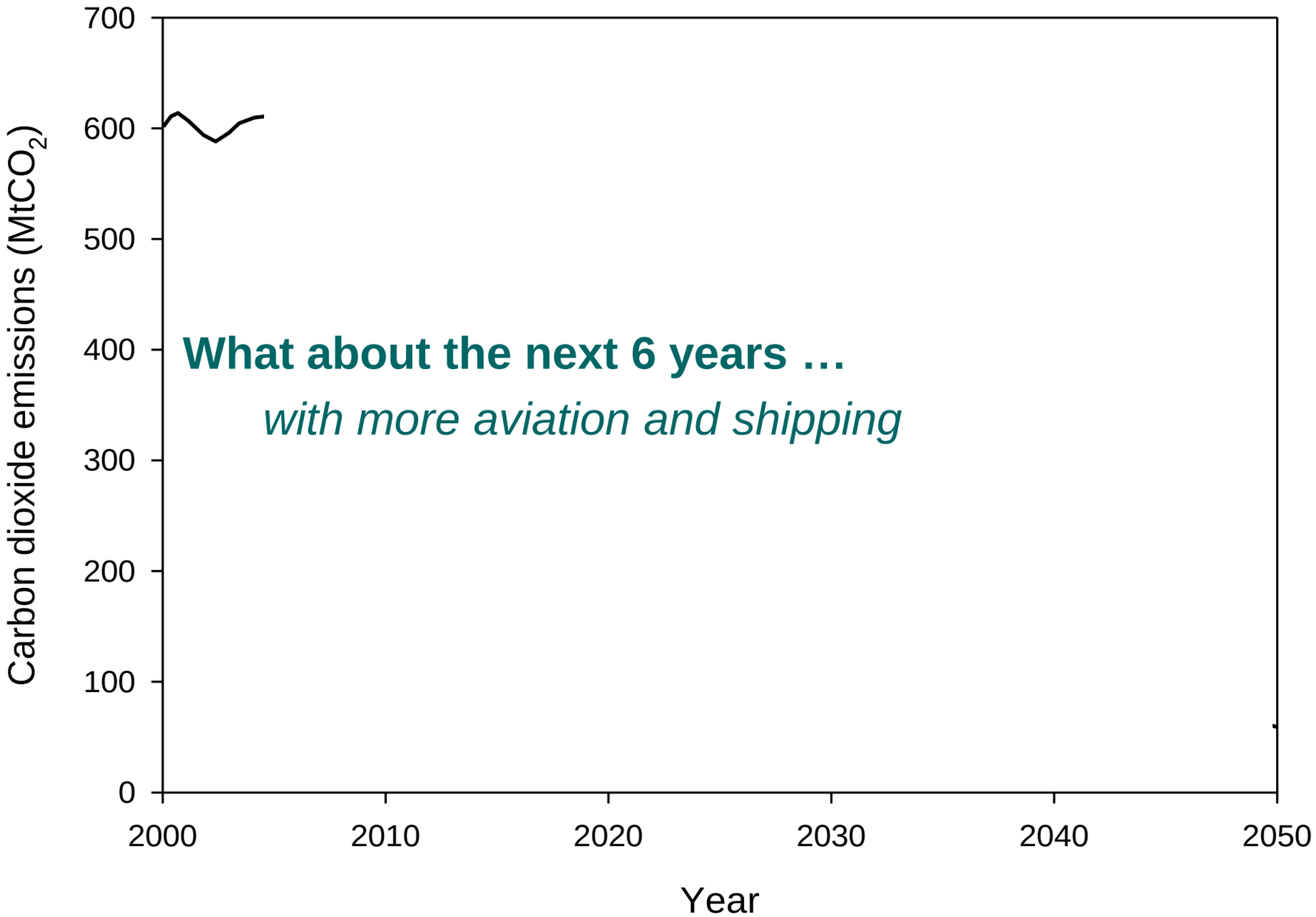
*… i.e. we've used ~¼ of our permitted emissions for 50 years in around **6** years*

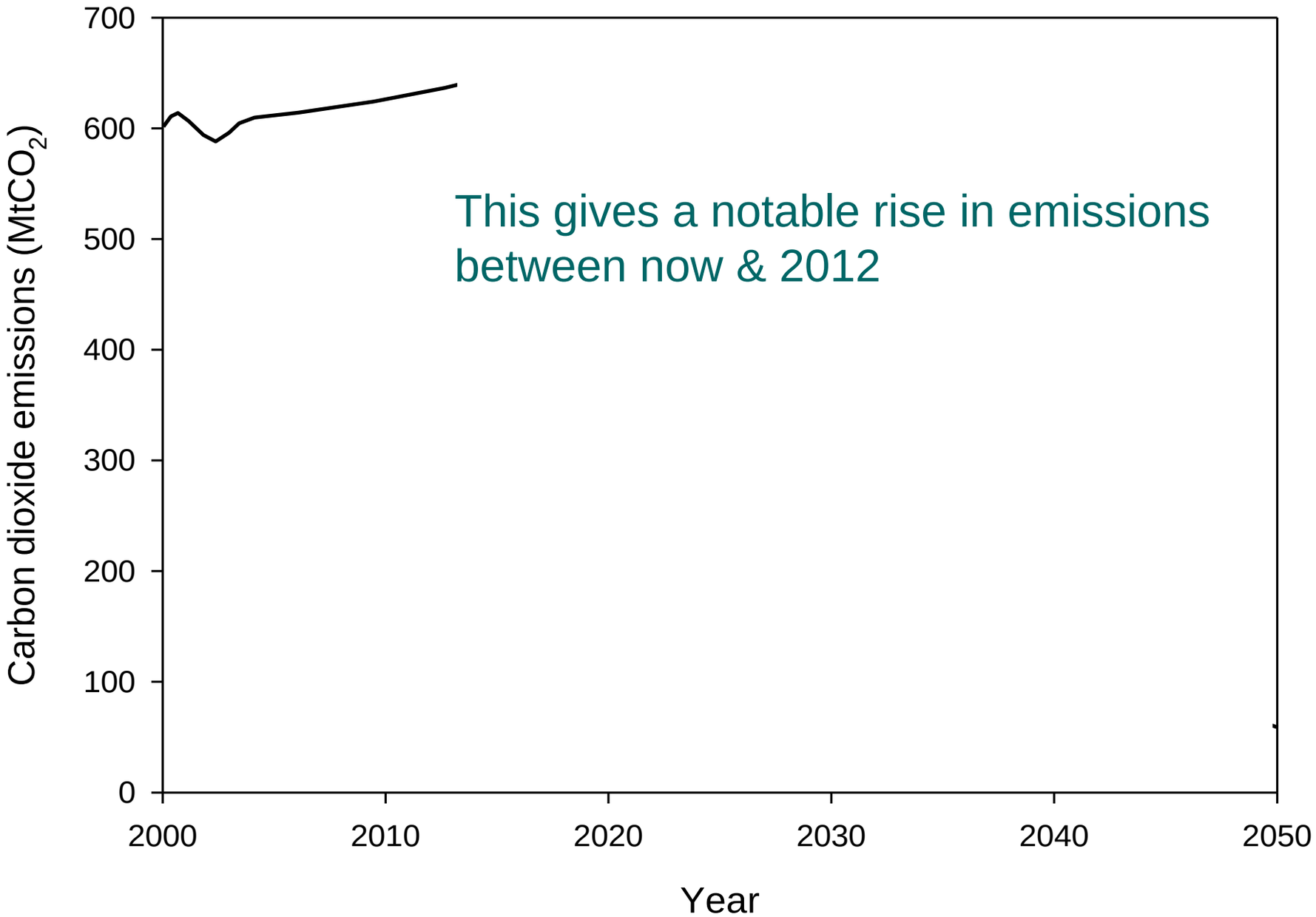
Answer 2

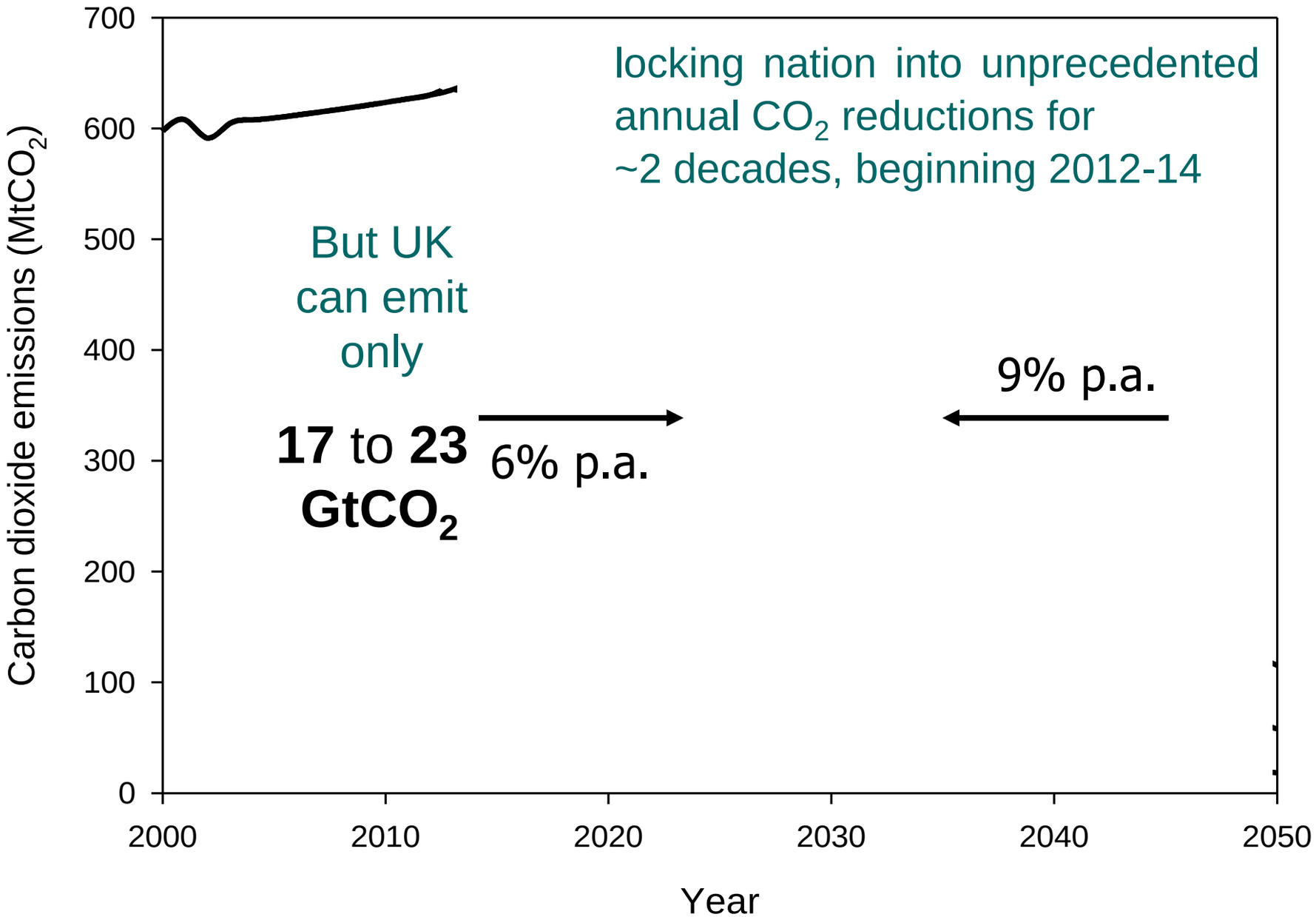
Looking at this graphically …


700
600
500
400
300
200
100
0
Carbon dioxide emissions (MtCO2)
2000
2010
2020
2030
2040
2050
Year

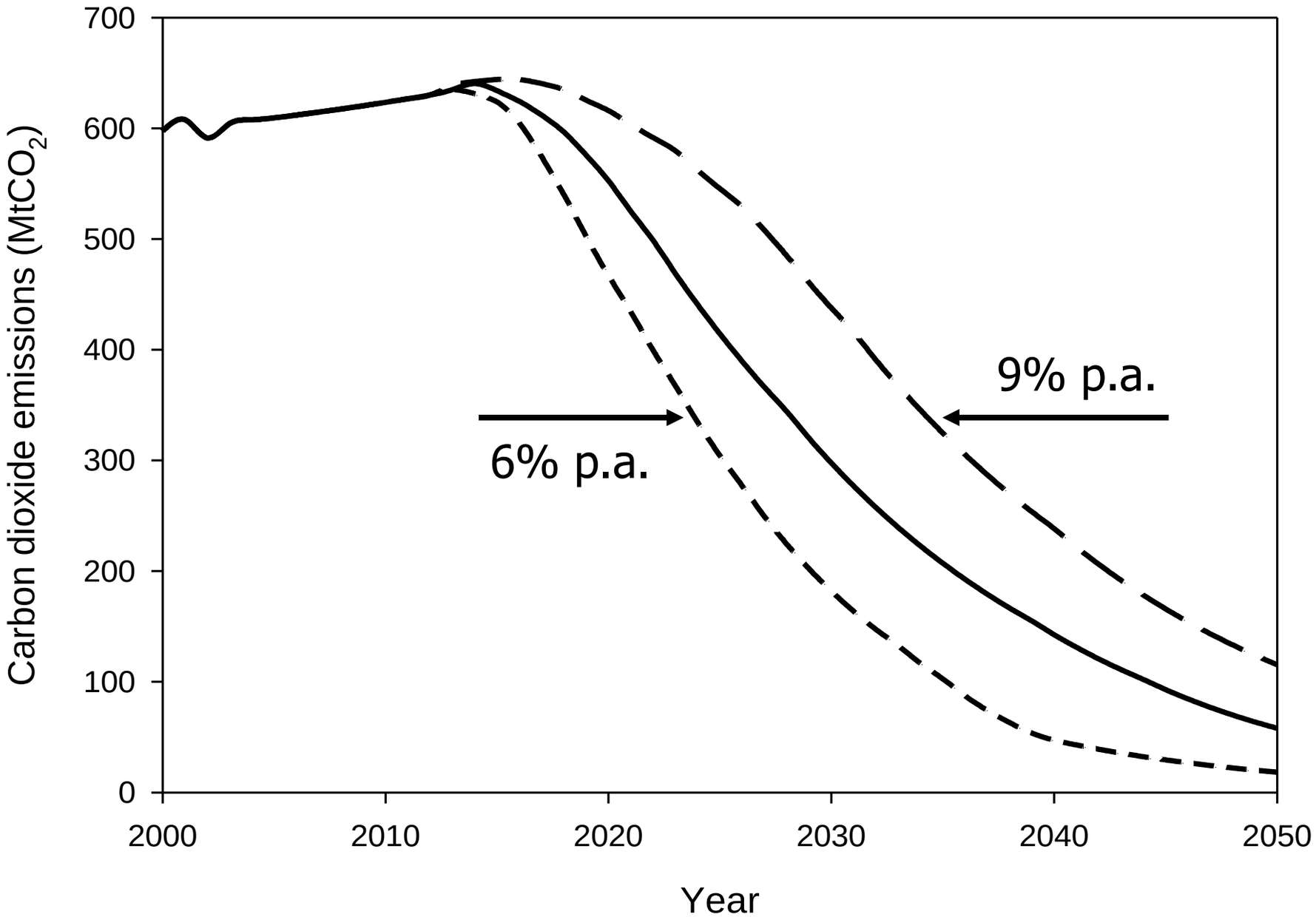

Plot data from Sept 2000 to 2006
Carbon dioxide emissions (MtCO2)
Year
0
100
200
300
400
500
600
700
2000
2010
2020
2030
2040
2050


700
600
500
400
300
200
100
0
Carbon dioxide emissions (MtCO2)
2000
2010
2020
2030
2040
2050
Year
What about the next 6 years …
with more aviation and shipping


700
600
500
400
300
200
100
0
Carbon dioxide emissions ($MtCO_2$)
2000
2010
2020
2030
2040
2050
Year
This gives a notable rise in emissions between now & 2012


700
600
500
400
300
200
100
0
Carbon dioxide emissions (MtCO2)
2000
2010
2020
2030
2040
2050
Year
locking nation into unprecedented annual CO2 reductions for ~2 decades, beginning 2012-14
But UK can emit only
17 to 23 GtCO2
6% p.a.
9% p.a.

… and this equates to only a 30% chance of staying below 2°C



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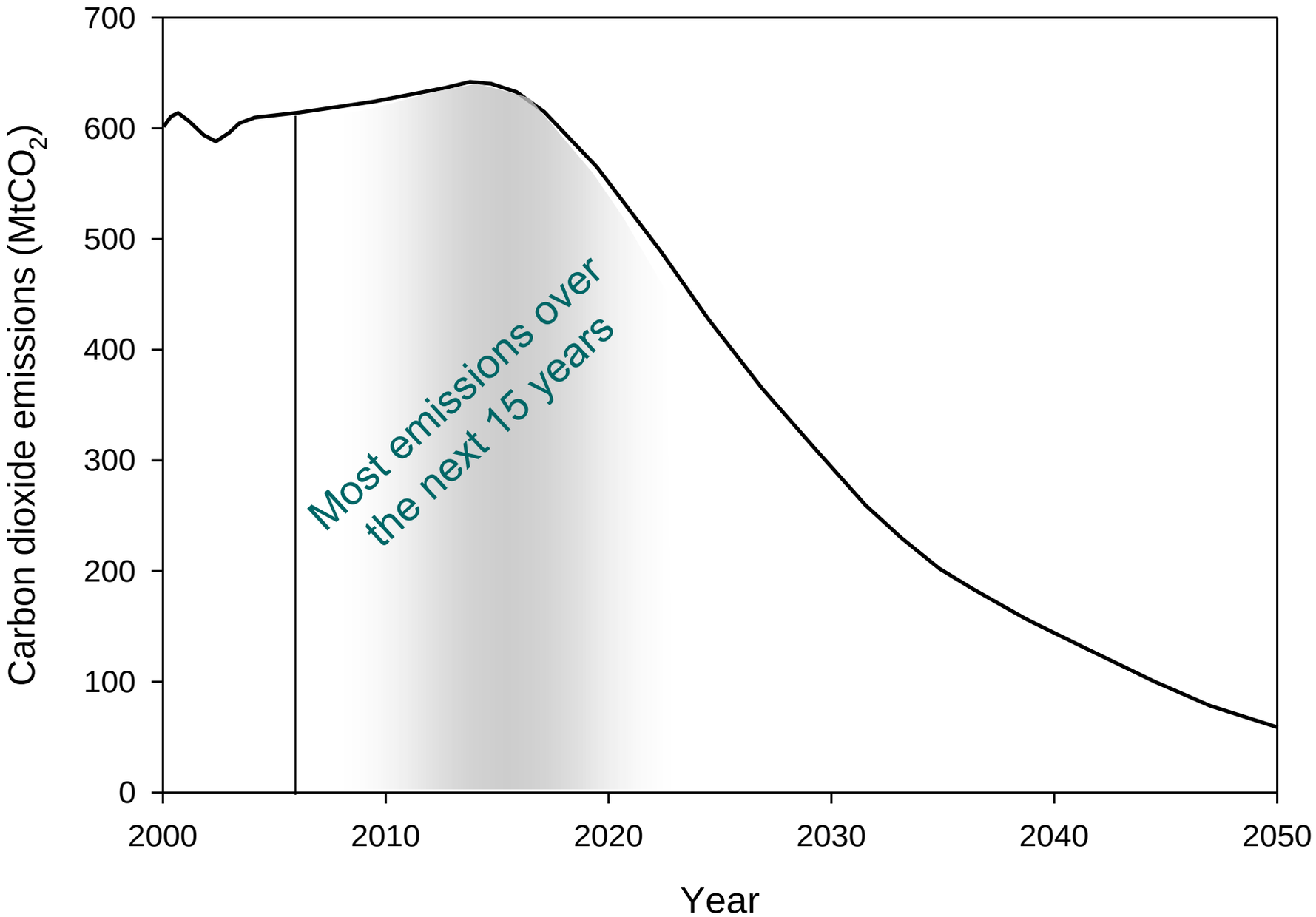
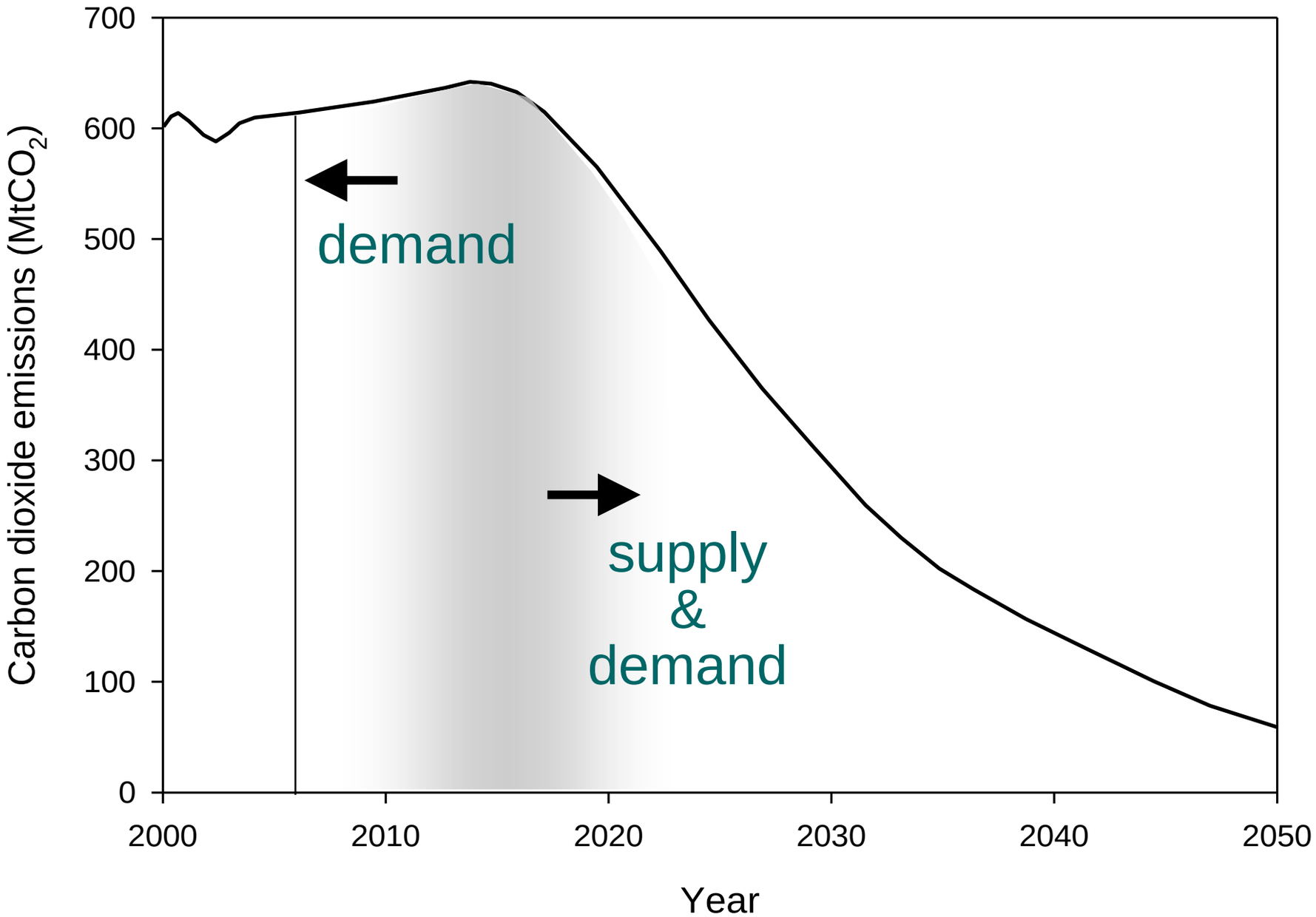
What does the pathway approach say about UK emission policies ?


Carbon dioxide emissions ($MtCO_2$)
700
600
500
400
300
200
100
0
2000
2010
2020
2030
2040
2050
Year
Most emissions over
the next 15 years


700
600
500
400
300
200
100
0
Carbon dioxide emissions ($MtCO_2$)
2000
2010
2020
2030
2040
2050
Year
demand
supply
&
demand

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The Critical Role of Aviation Emissions

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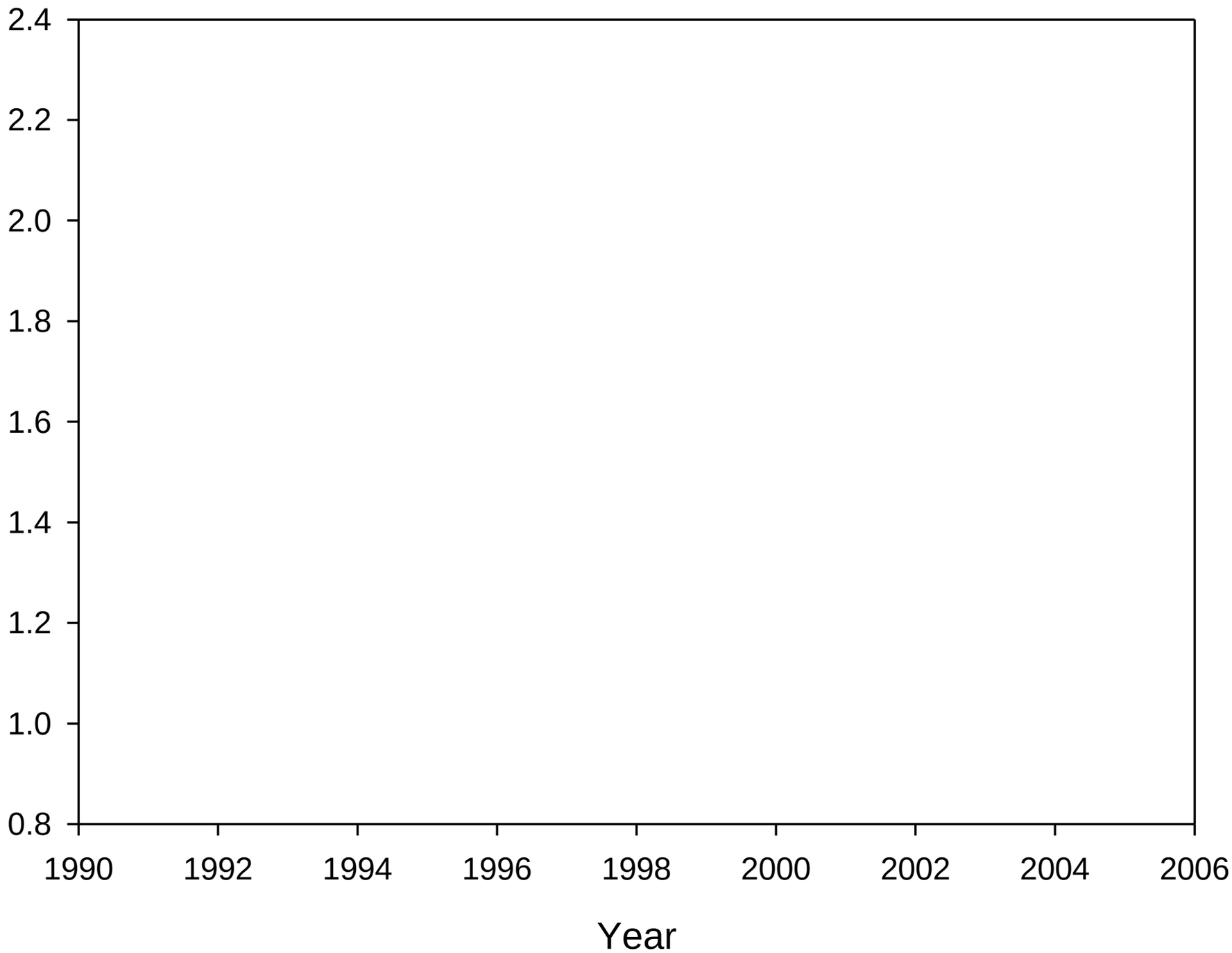
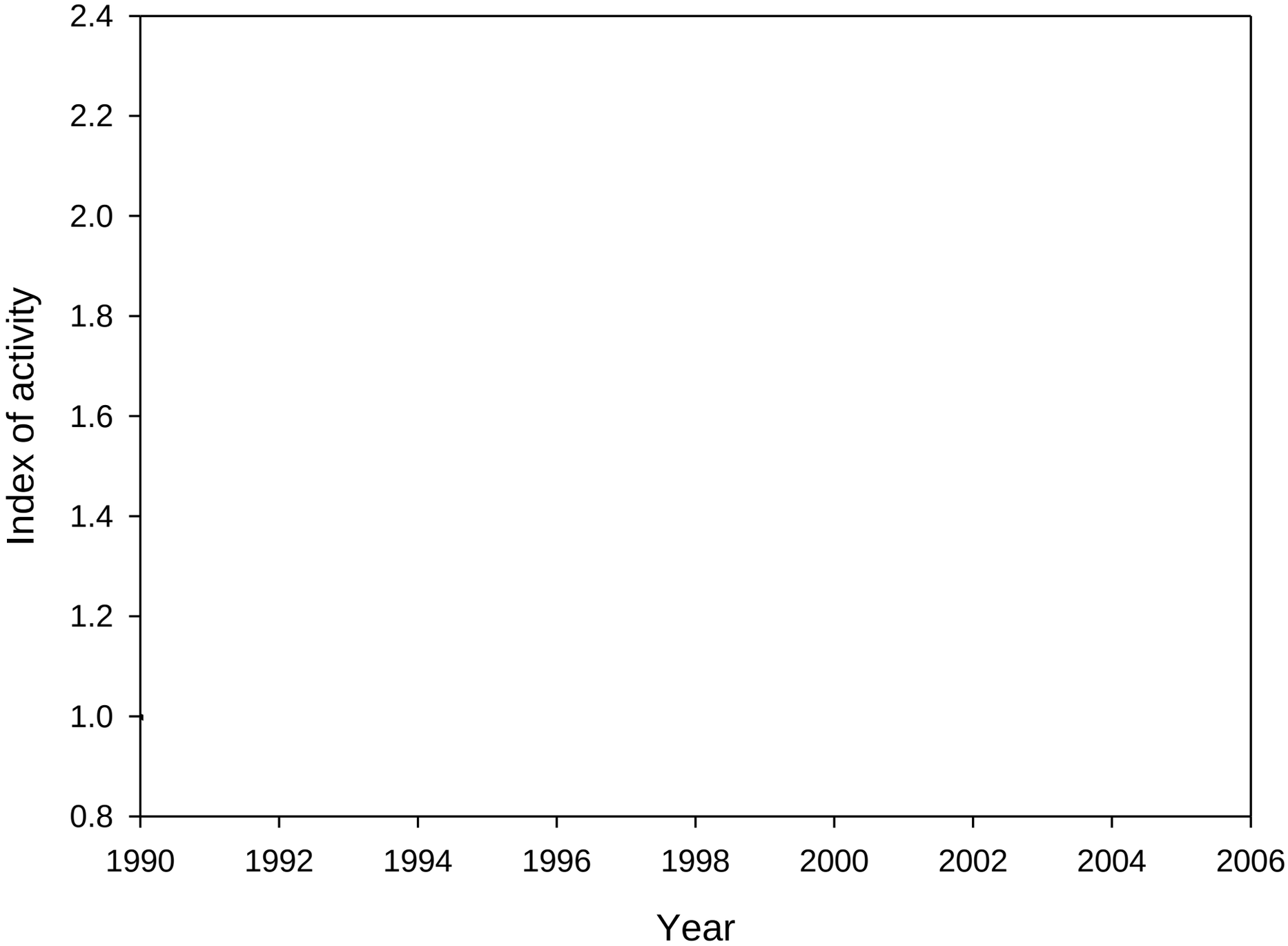
… how does aviation fit into this pathway?

UK aviation trends 1990 – 2005

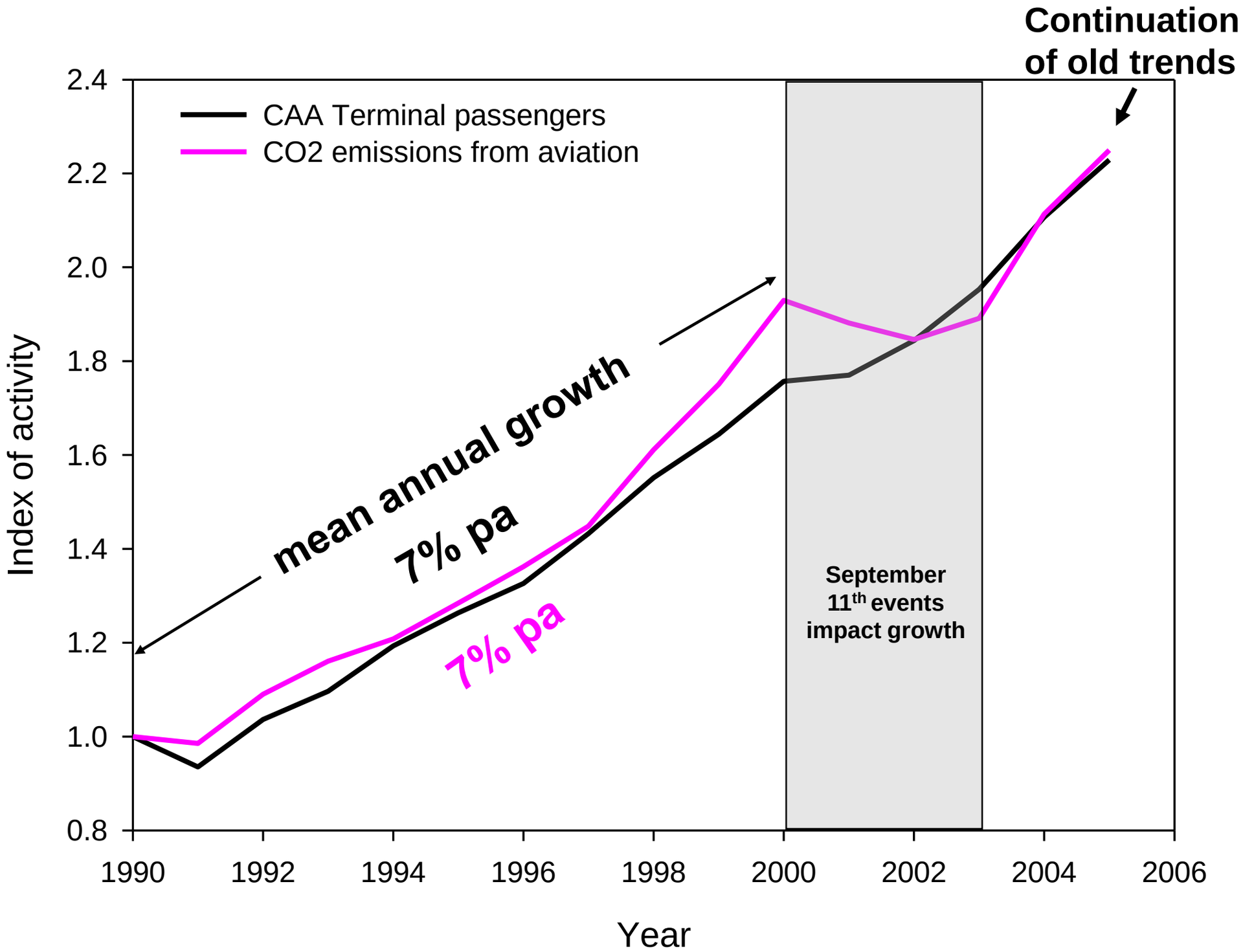
UK aviation trends 1990 – 2005



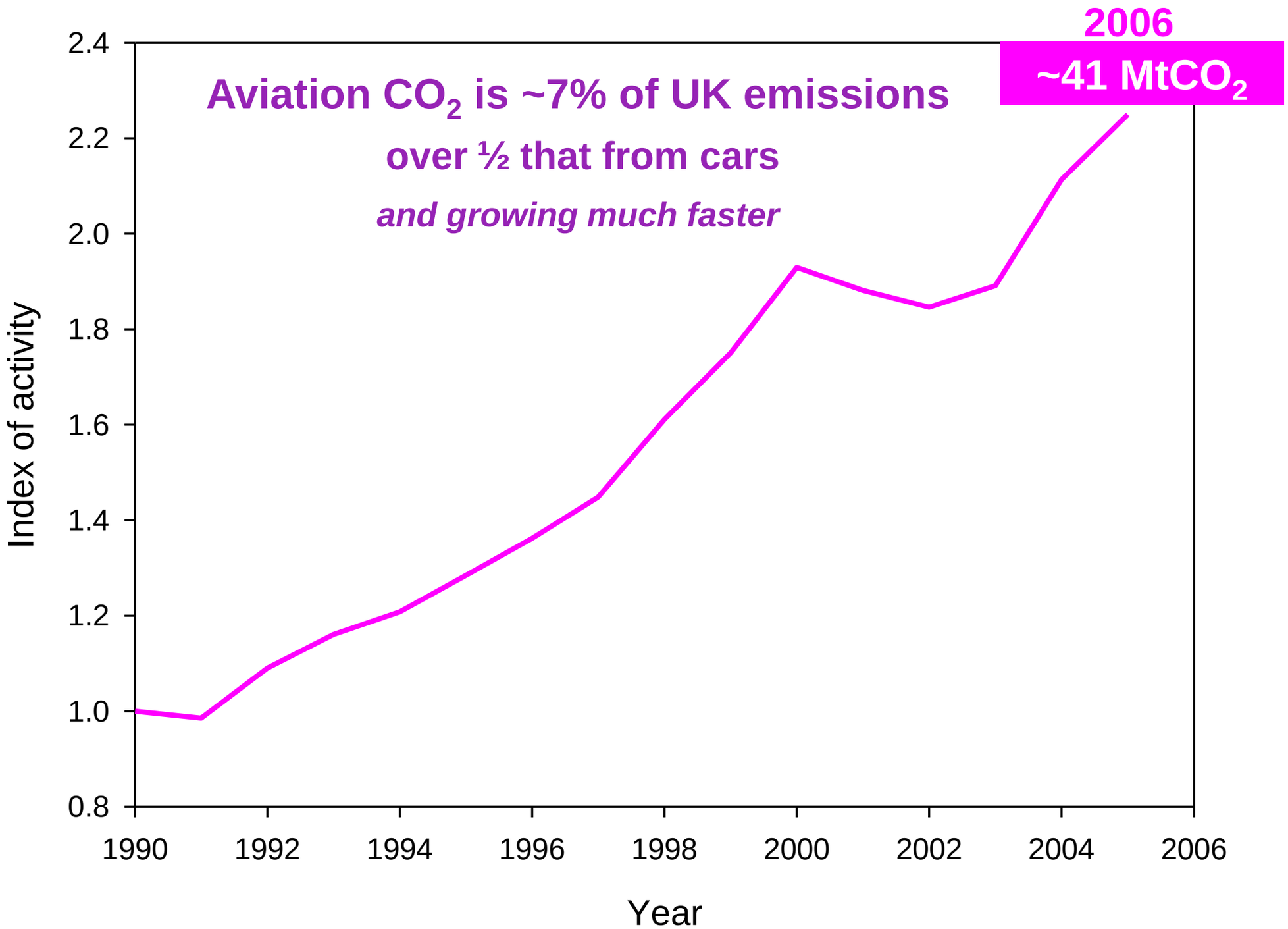
UK aviation trends 1990 – 2005



UK aviation trends 1990 – 2005



UK aviation trends 1990 – 2005



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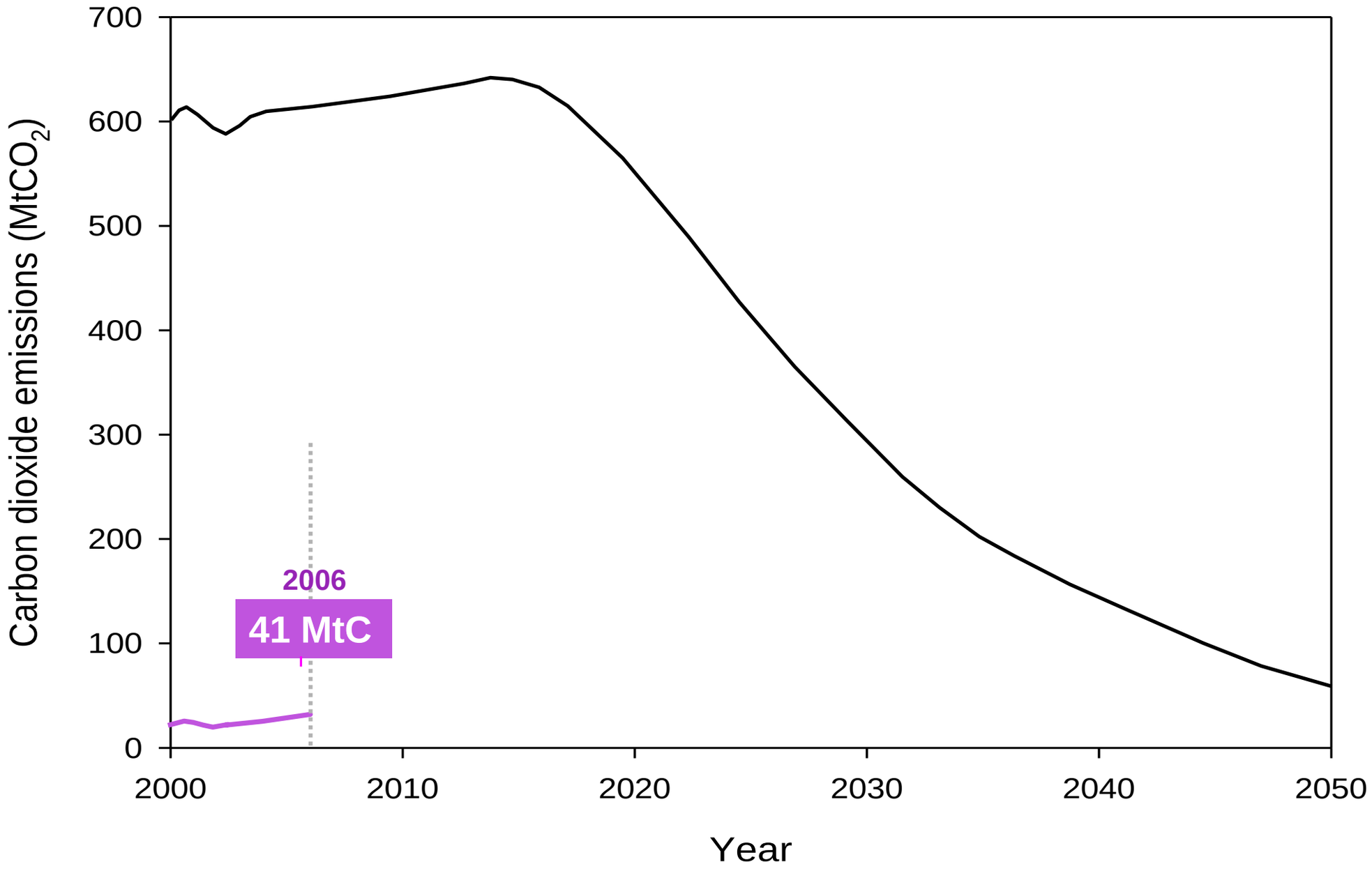
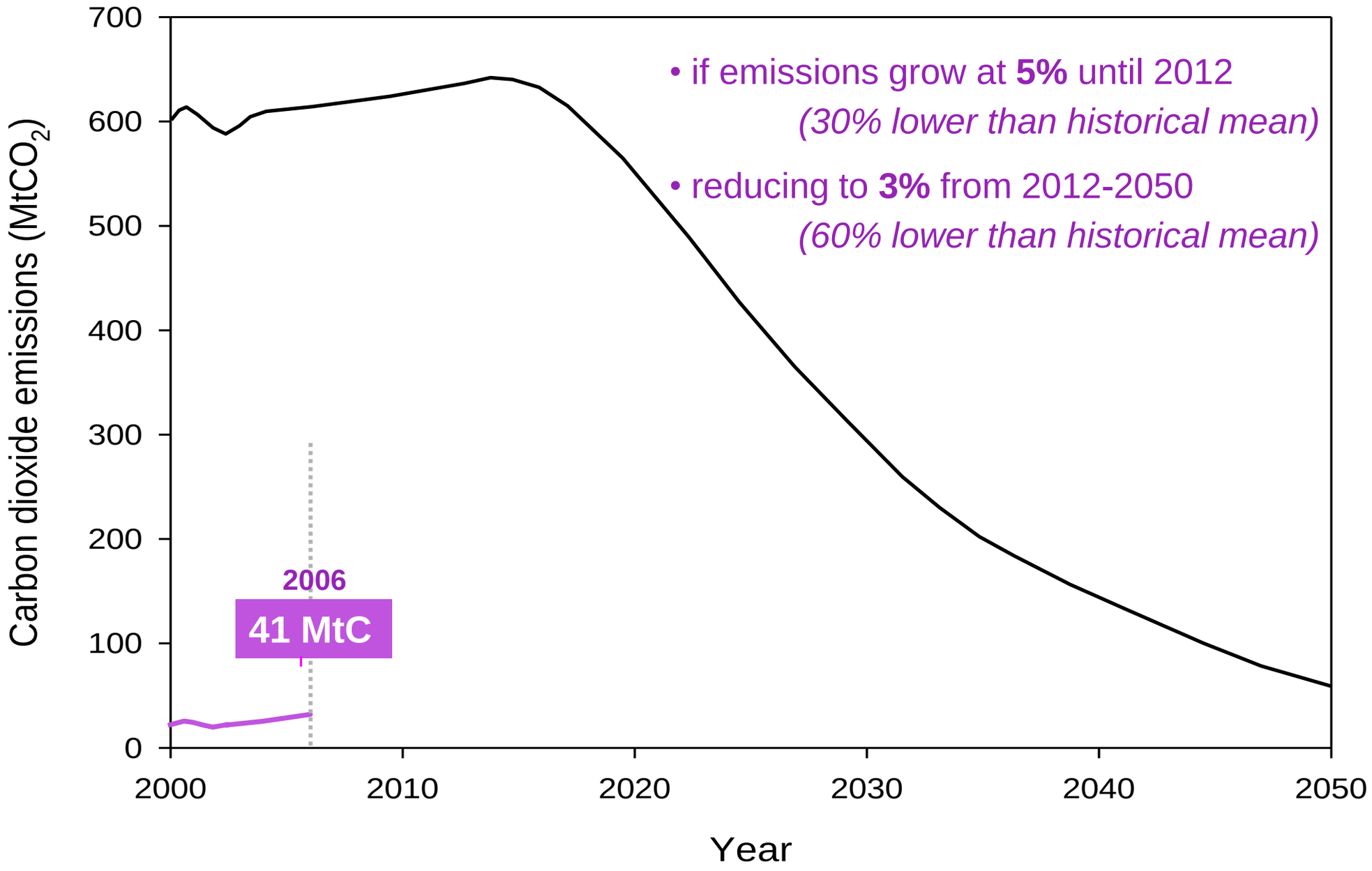
Looking at this growth graphically …

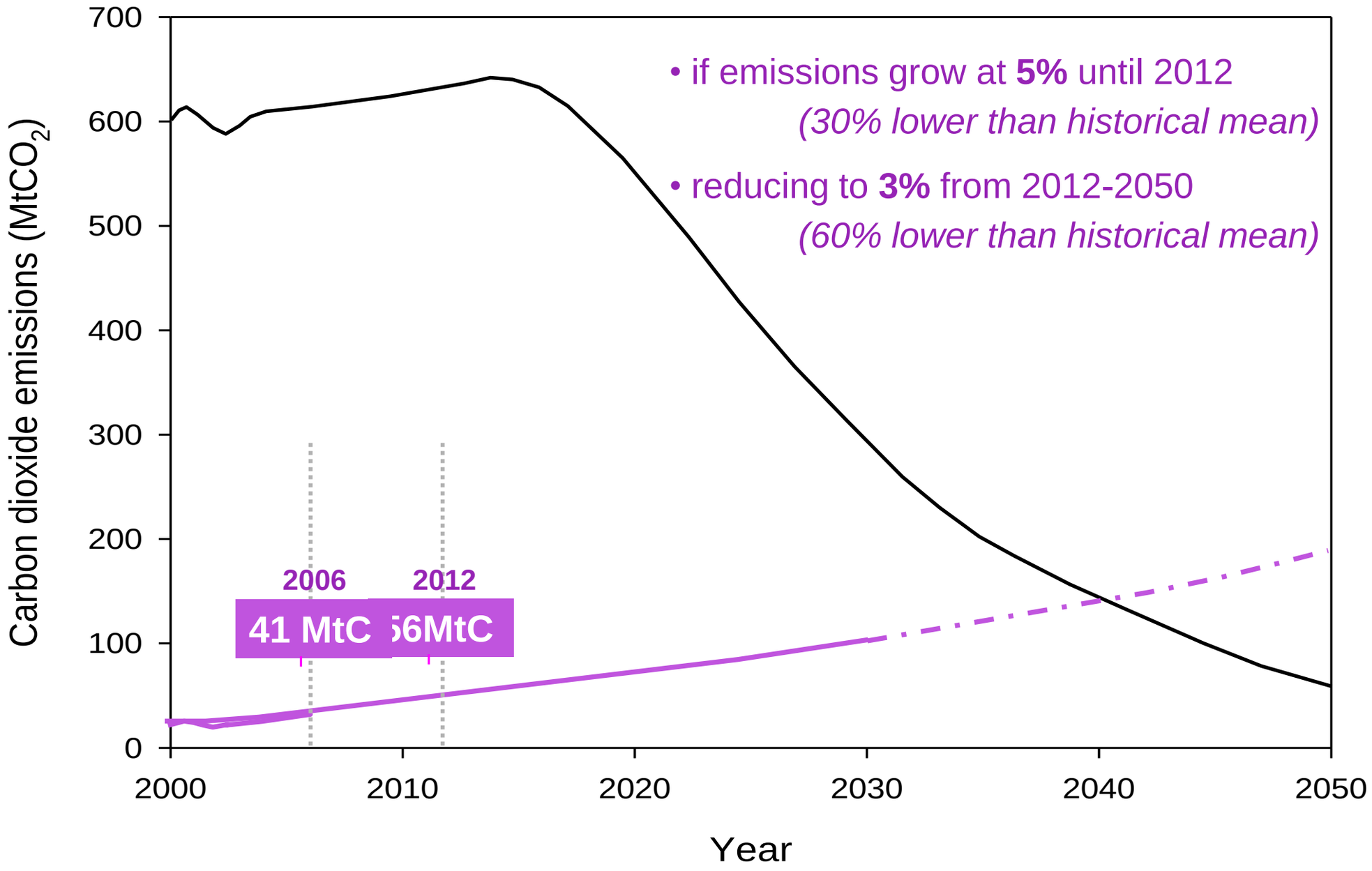
Aviation within UK's *fair* contribution to a 30% chance of a 2°C future



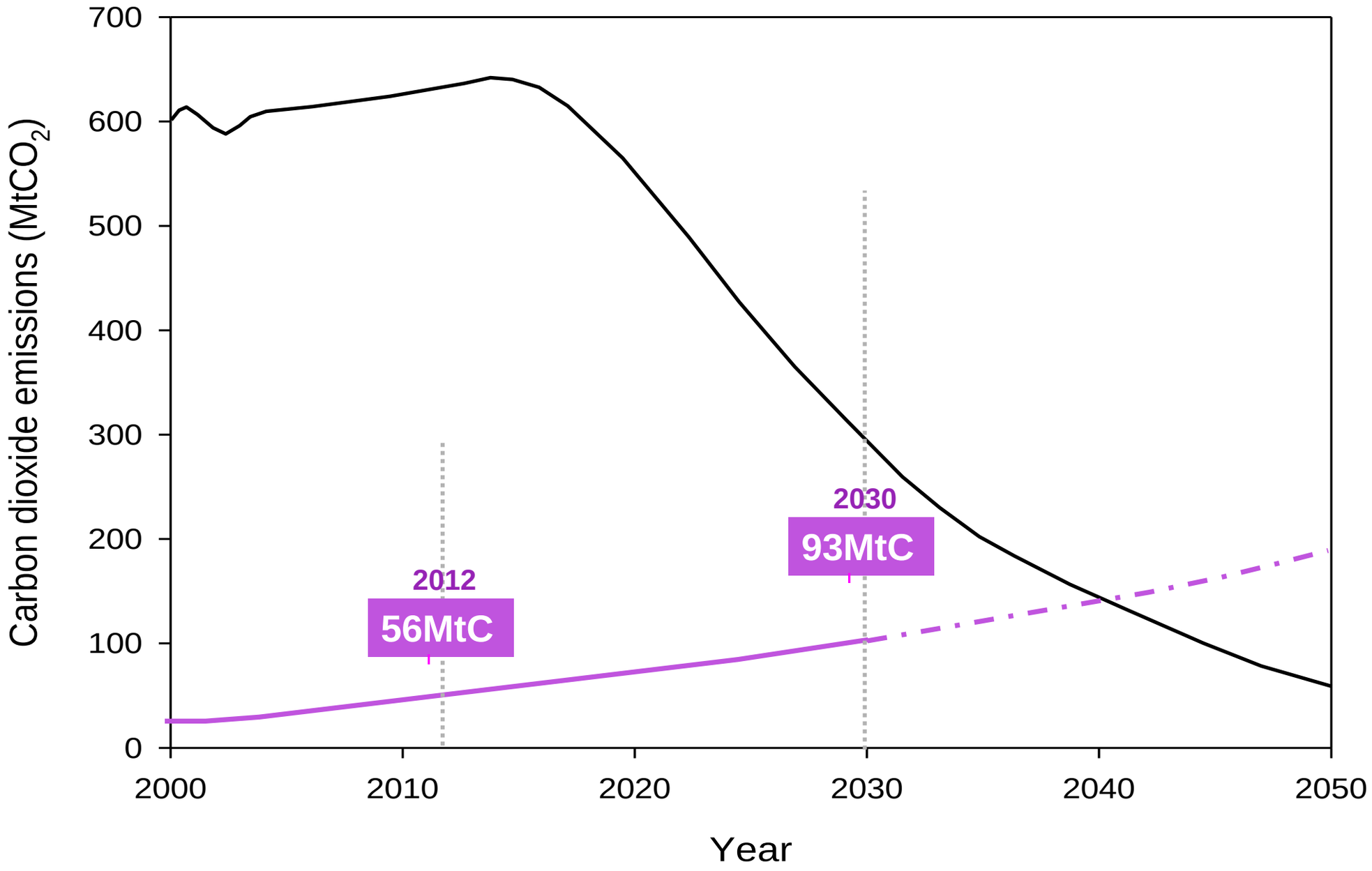
Aviation within UK's *fair* contribution to a 30% chance of a 2°C future



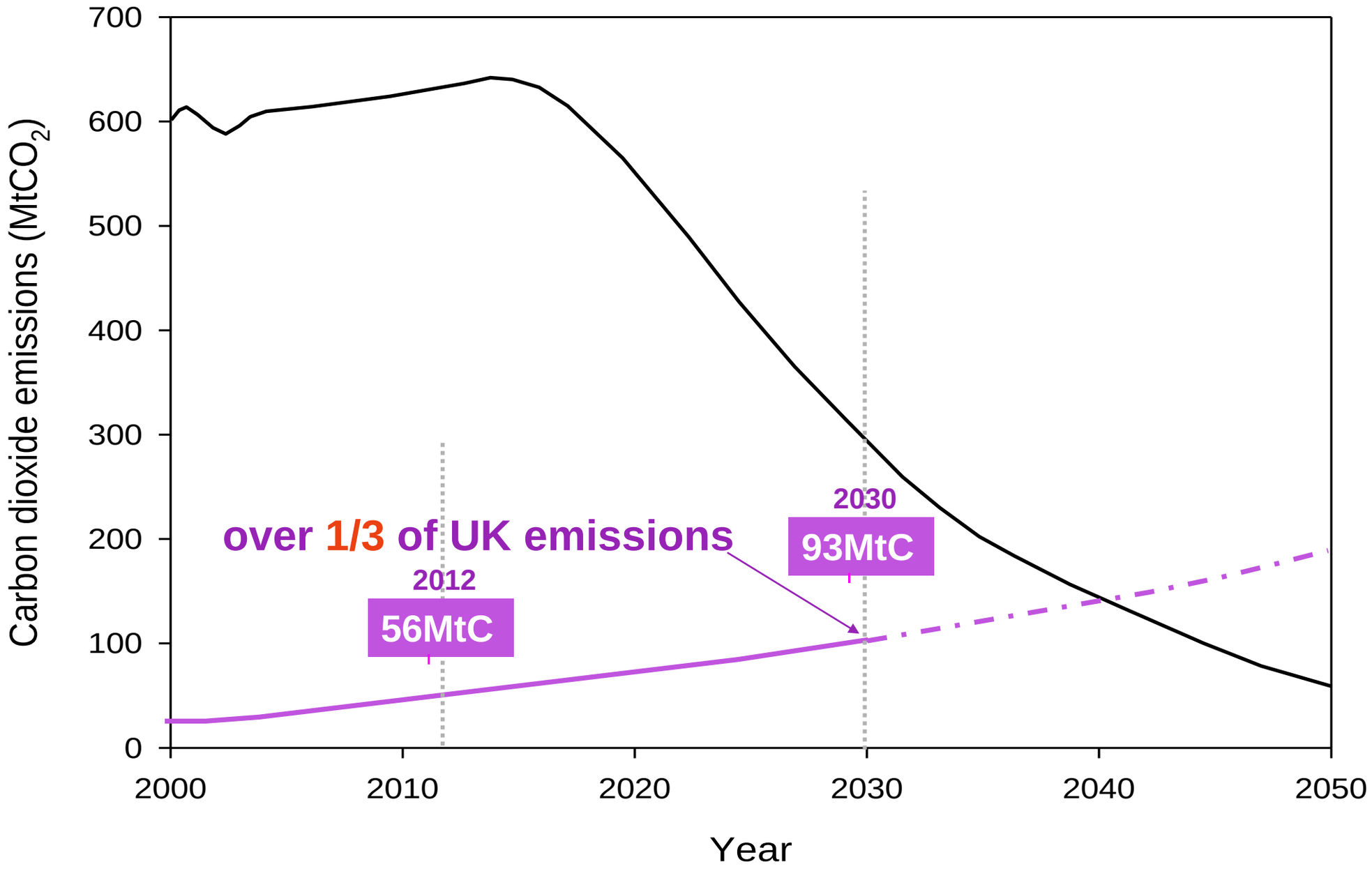
Aviation within UK's *fair* contribution to a 30% chance of a 2°C future



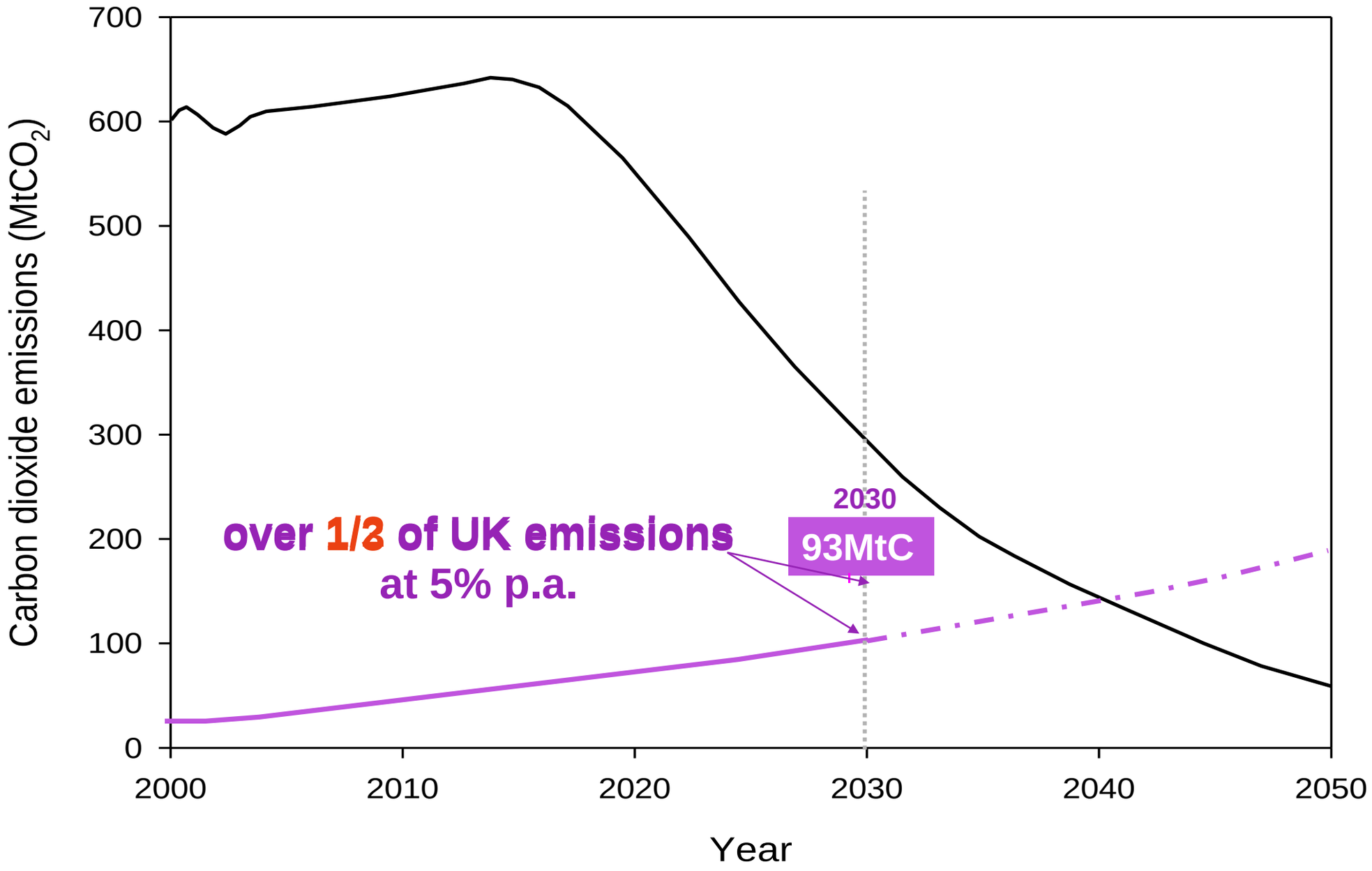
Aviation within UK's *fair* contribution to a 30% chance of a 2°C future



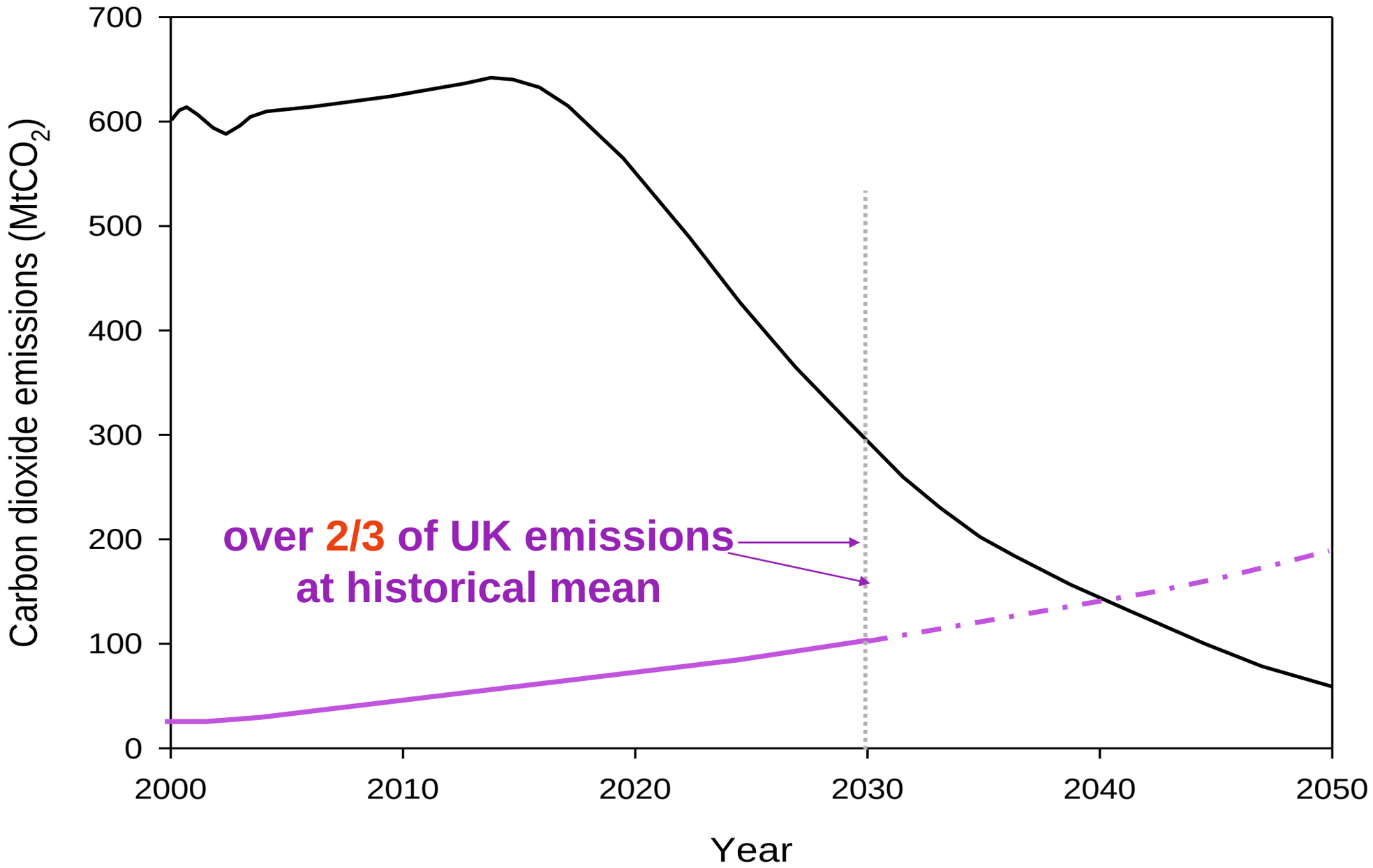
Aviation within UK's *fair* contribution to a 30% chance of a 2°C future



Aviation within UK's *fair* contribution to a 30% chance of a 2°C future



Aviation within UK's *fair* contribution to a 30% chance of a 2°C future



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… and this doesn't include '*uplift factors*'

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Interim conclusions

Omitting aviation negates the value of emission targets

Many problems for aviation:

- Long lifetime of aircraft *(2nd hand market)*
- Kerosene lock-in for 30-60 years
- Airport expansion stimulates growth
- No *rapidly penetrating* step change technology/operation

incremental options:

high load factors/seat density
ATC, slower speed & airport movements
winglets, composites, turbofans & bio-kerosene

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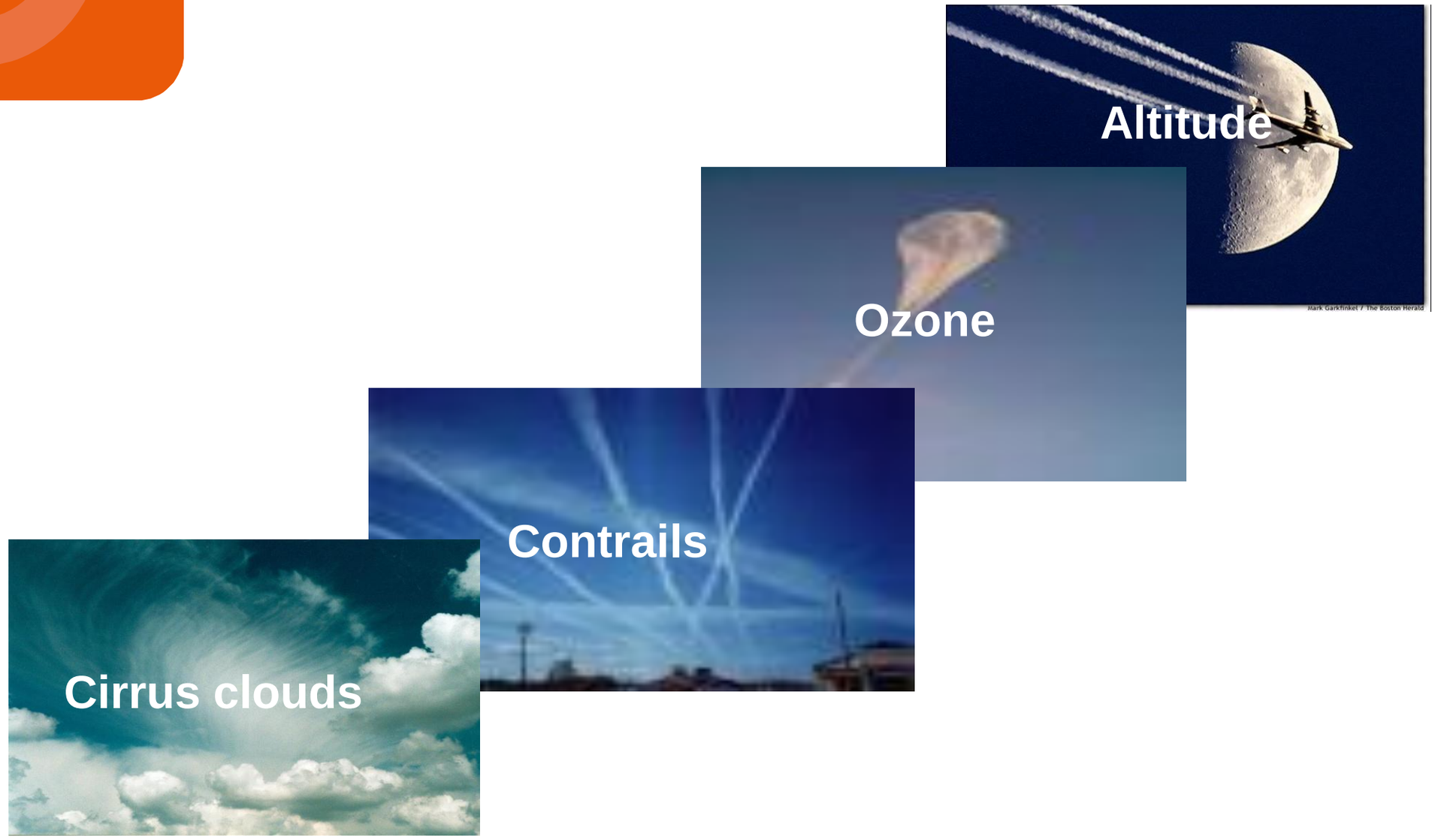
- & then there's the additional warming



~double the equivalent historical warming of CO_2 alone

… and then there's shipping …?

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Responding to the Challenge:

EU ETS – too little too late?

… a bit of policy context

Kyoto Protocol:

"… reduction of emissions of greenhouse gases from aviation … through the International Civil Aviation Organisation (ICAO) …".

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… a bit of policy context

EU Commission 2007:

"Regrettably, it has become clear to us… that it has not been possible for ICAO to agree on essential elements of a comprehensive approach. … the programme [they] put forward … is unambitious, piecemeal and lacking in credibility…"

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Principal mechanism proposed for Aviation meeting its climate change challenge is the price signal arising from EU ETS

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Tyndall examined the price signal for a suite of Aviation-ETS scenarios

(*"Aviation in a Low Carbon EU"* - www.tyndall.ac.uk)

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… used a set of 'what if' assumptions:

- **range of carbon prices**

  €50, €100 & €300 per tonne of CO_2

- **applied over different time frames**

  2012-2016; 2017-2030; 2031-2050

- **a range of baselines**

  1990, 2000 & 2005

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Assume all costs are passed onto passengers …

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Carbon supplement per passenger at *start* of ETS

Carbon price	London – Barcelona	London - Washington	London - Australia
€50-€100			

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Carbon supplement per passenger by *2017*

Carbon price	London – Barcelona	London - Washington	London - Australia
€300			

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To conclude

Today's aviation emissions are significant

Current aviation growth cannot be reconciled with the 2°C commitment

... little/no aviation growth is viable in a 450ppmv carbon budget

Moratorium on airport expansion prior to including aviation within EU ETS

... & even then only if EU ETS is based on a meaningful 2°C cap

Aviation is very likely to remain a 'privileged' sector

An order of magnitude increase in carbon price is necessary

An early baseline is essential

Indirect issues must be considered

Additional & substantial flanking instruments must be introduced

… & finally

*We delude ourselves if a **2°C future** relies on EU ETS & the low-carbon technologies/practices that may engender.*

*Technology has important medium-long-term role in reducing carbon intensity, but it is **negligent & irresponsible** not to engage with short-term emissions growth.*

*The **urgency** with which aviation must move to a low carbon pathway leaves no option but to instigate a radical and immediate programme of **demand management.***

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The UK's 2°C Commitment
Aviation emissions and the EU ETS

End

Based on research by
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November 2008