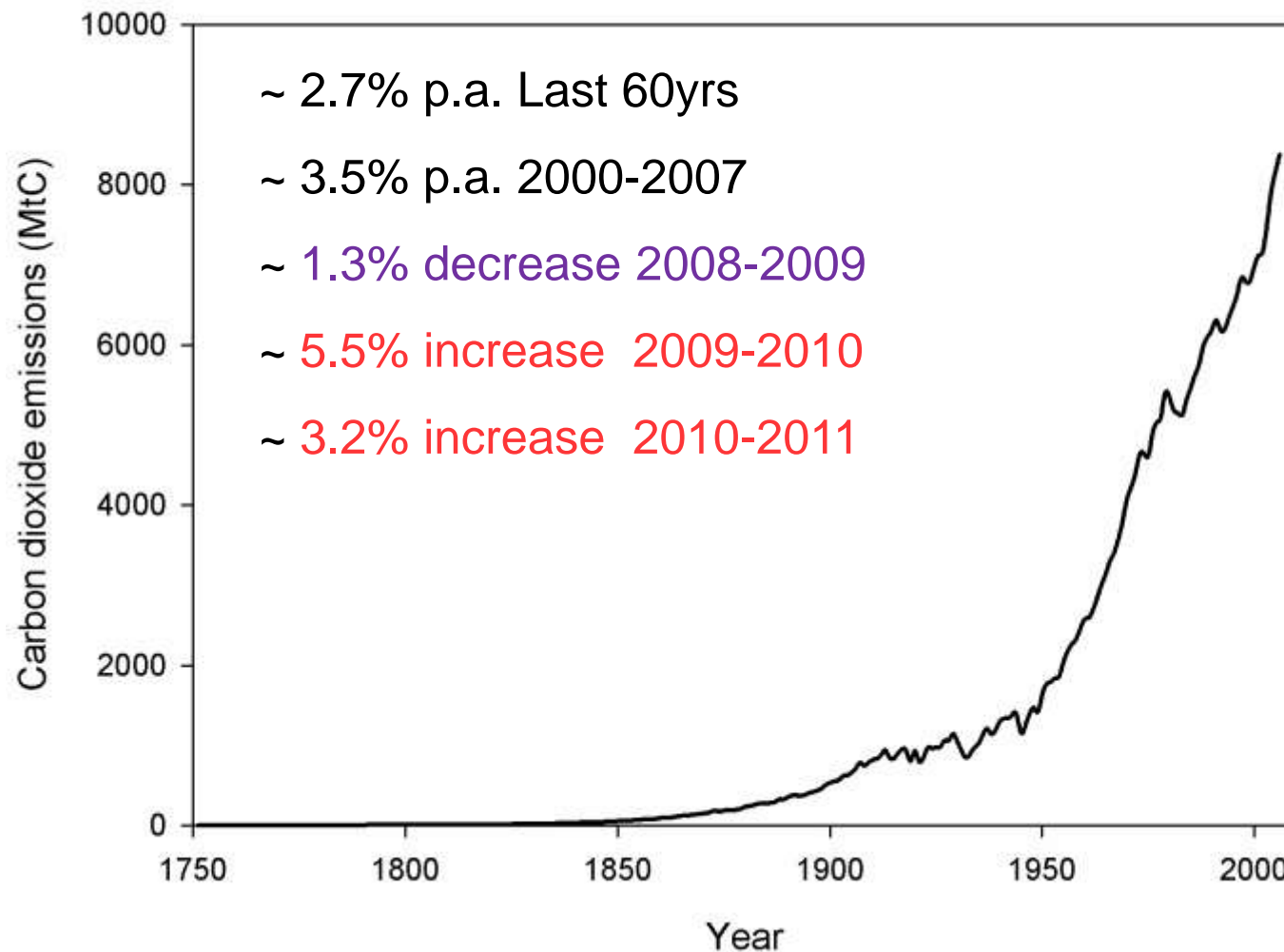


# Shale gas and the decarbonisation of energy Golden age or gilded cage?

Dr John Broderick, KT Fellow

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# Context: rising CO<sub>2</sub> emissions



# Key questions

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- Is shale gas ‘low carbon’?
- What is a relevant low carbon transition anyway?
- Is it prudent for the UK (and Europe) to pursue unconventional fossil fuels?
  
- Acknowledgements
  - » Contributors: Kevin Anderson, Alice Bows, Steven Glynn
  - » Funding: EPSRC and The Co-operative

# “Gas is green” rhetoric

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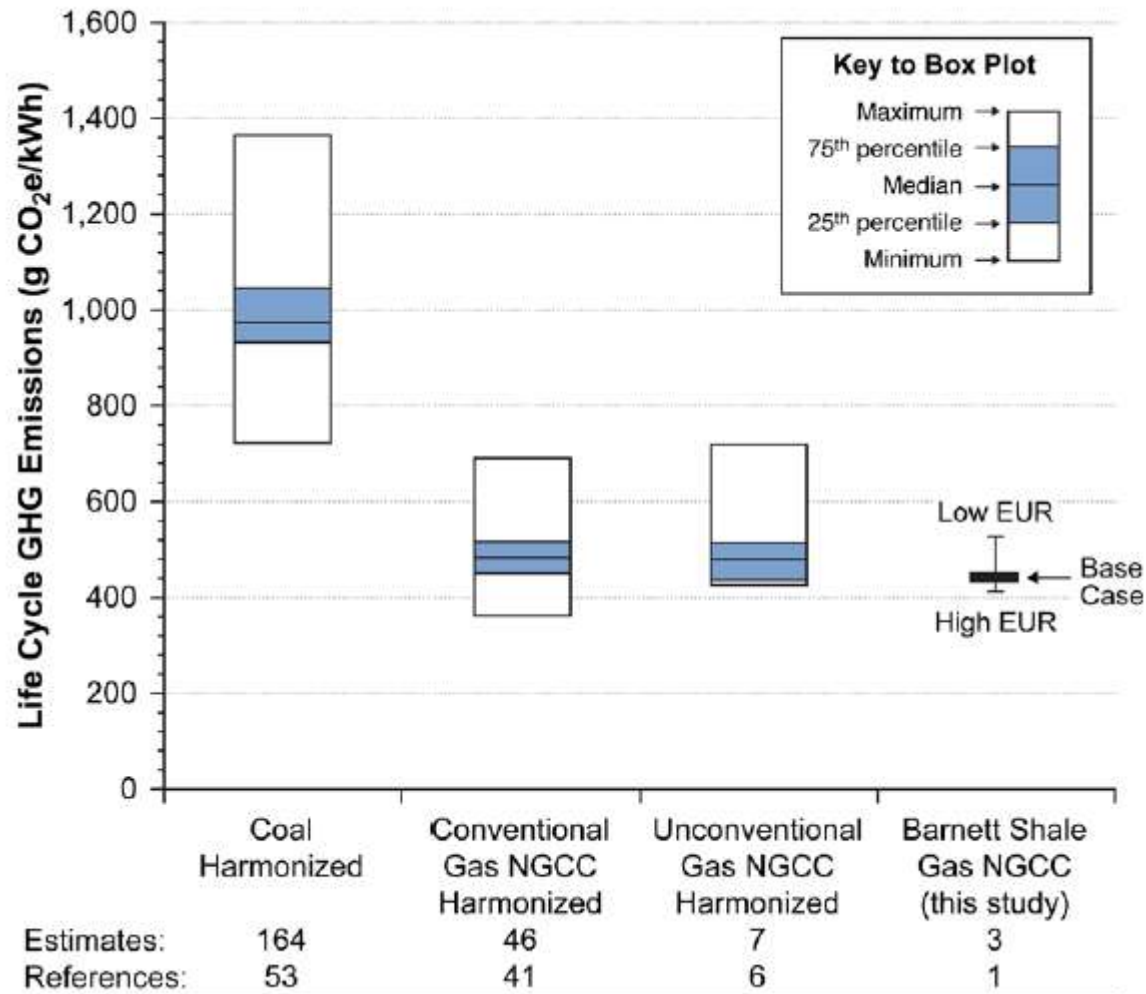
“Because natural gas is **the cleanest fossil fuel** it makes sense to use it, where ever possible, **in place of other carbon-heavy fuels**. As the UK moves to low carbon and renewable energy sources, natural gas **will be an important transition fuel.**”

*Cuadrilla Resources, 2012, [About natural gas](#), emphasis added*

“We see natural gas as a **key part of the lower-carbon economy** as it is a plentiful resource that releases less CO<sub>2</sub> than other fossil fuels when burned. Most importantly, the technologies needed to produce and use it are widely available today. We are playing a major role in the growth of gas”

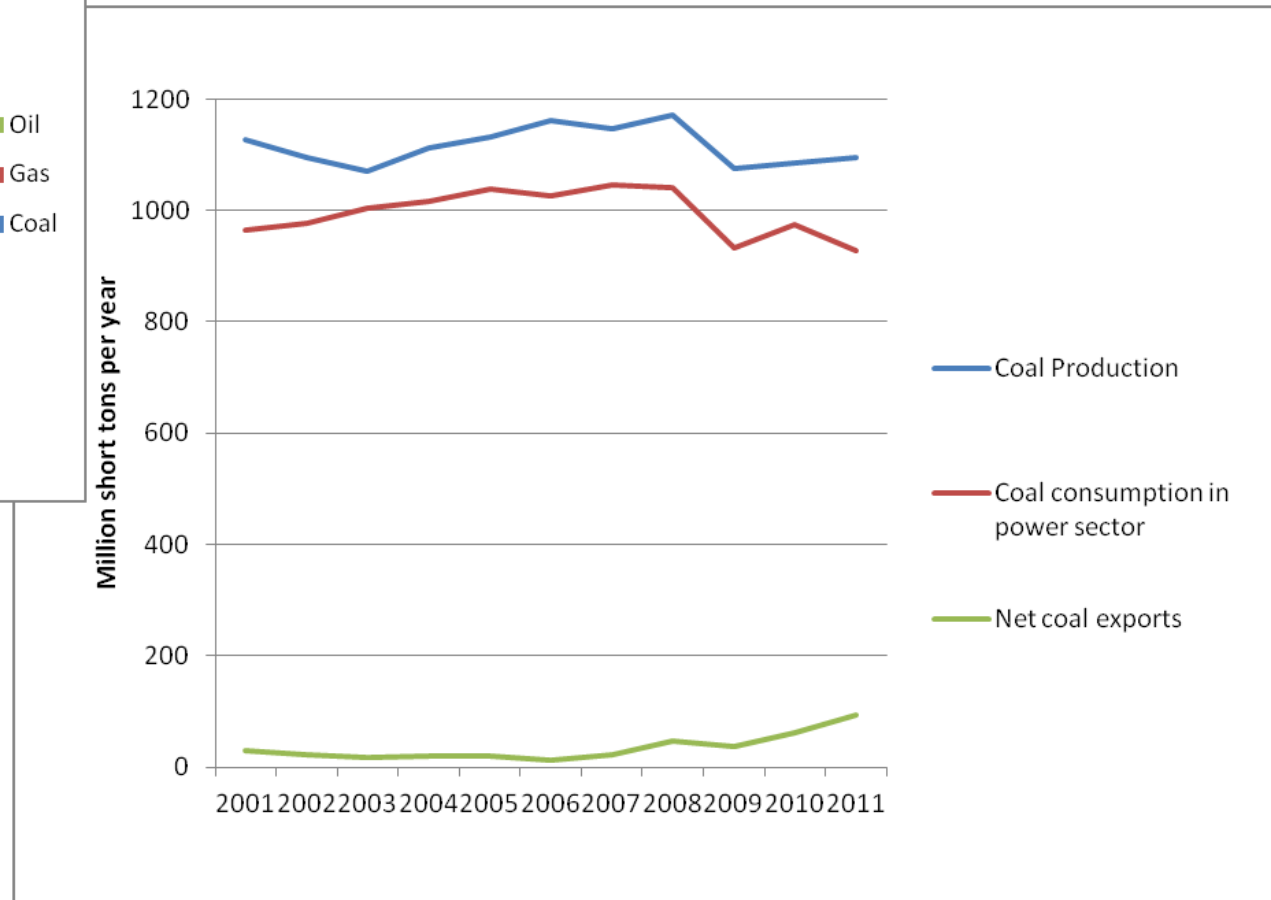
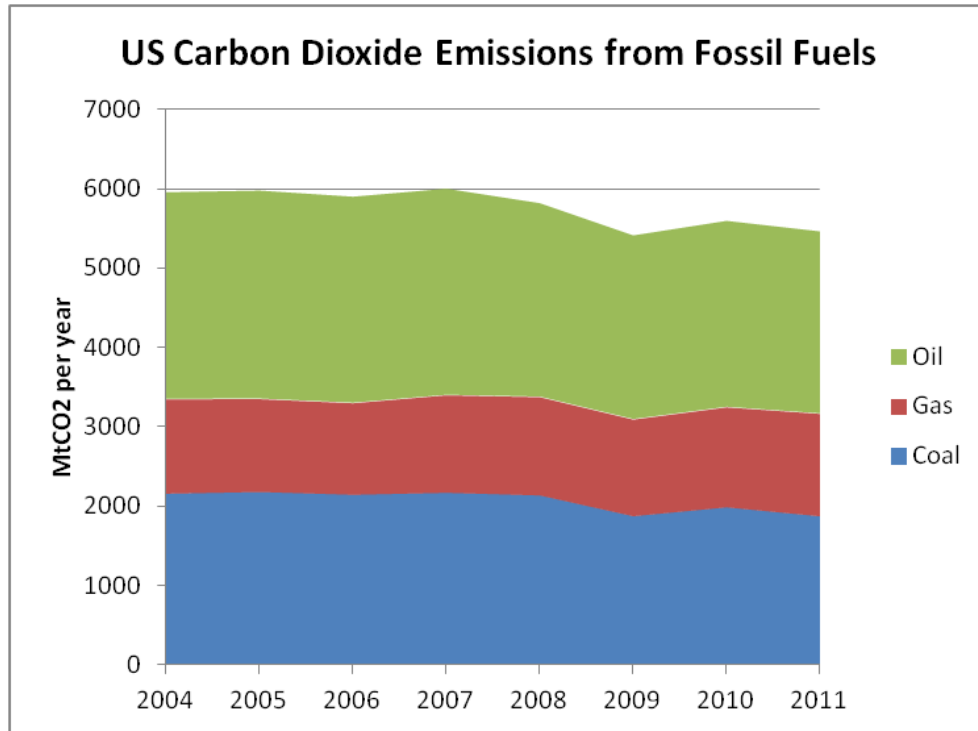
*BP, 2012, [Our programme of action on climate change](#)*

# Relative GHG Intensity



- [JISEA/NREL \(2013\)](#)
  - » Impact of single event sources of emissions highly dependent on well productivity (EUR)
- [Weber et al \(2012\)](#)
  - » Upstream emissions potentially substantial
  - » Energy systems effects likely more significant
- [AEA \(2012\)](#)
  - » Shale gas 1-8% higher than European gas
  - » Shale gas 2-10% lower than LNG or pipeline gas

# Is shale gas even a substitute?



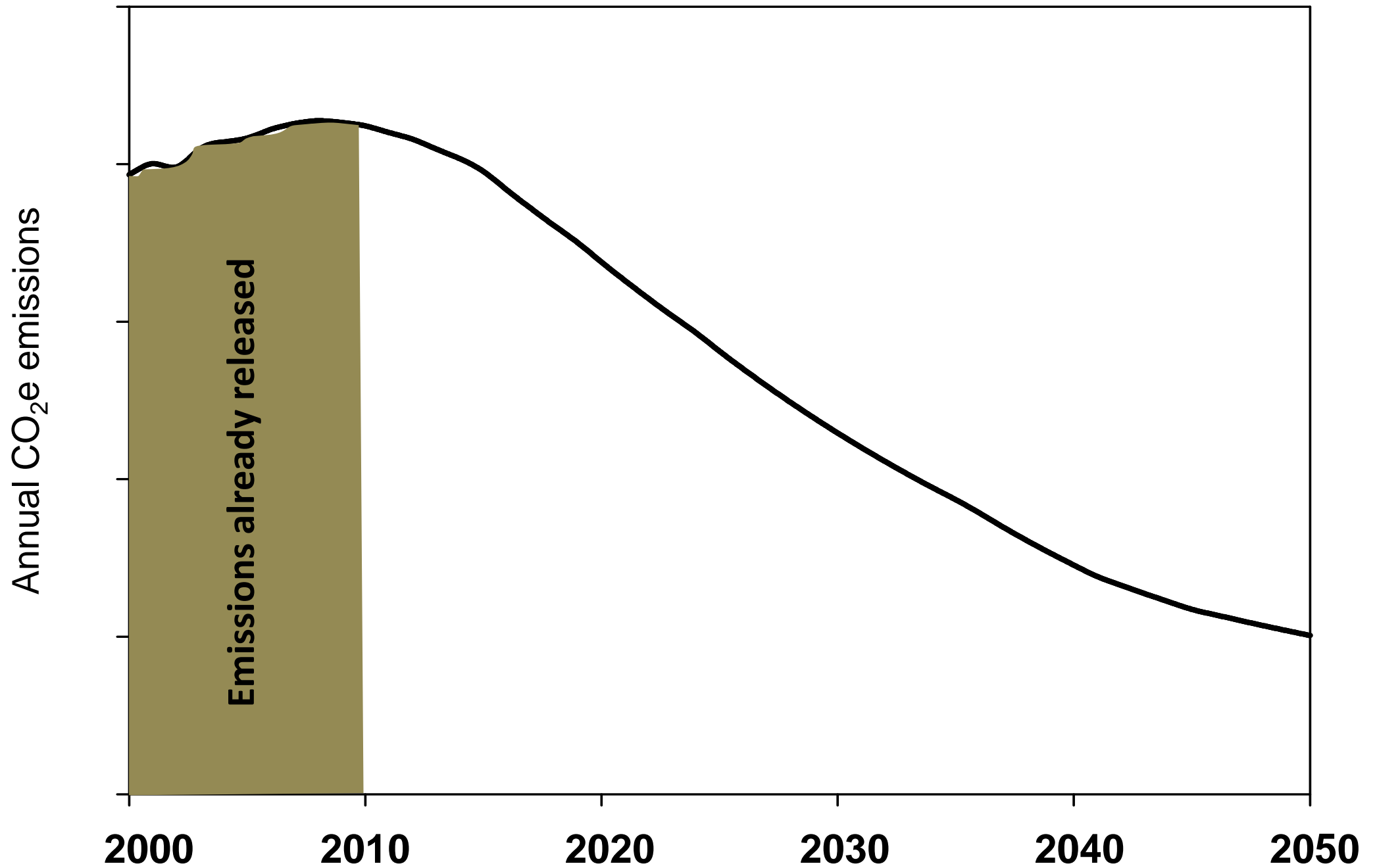
[Broderick & Anderson \(2012\) Has US Shale Gas Reduced CO2 Emissions?](#)

# Framing a low carbon transition

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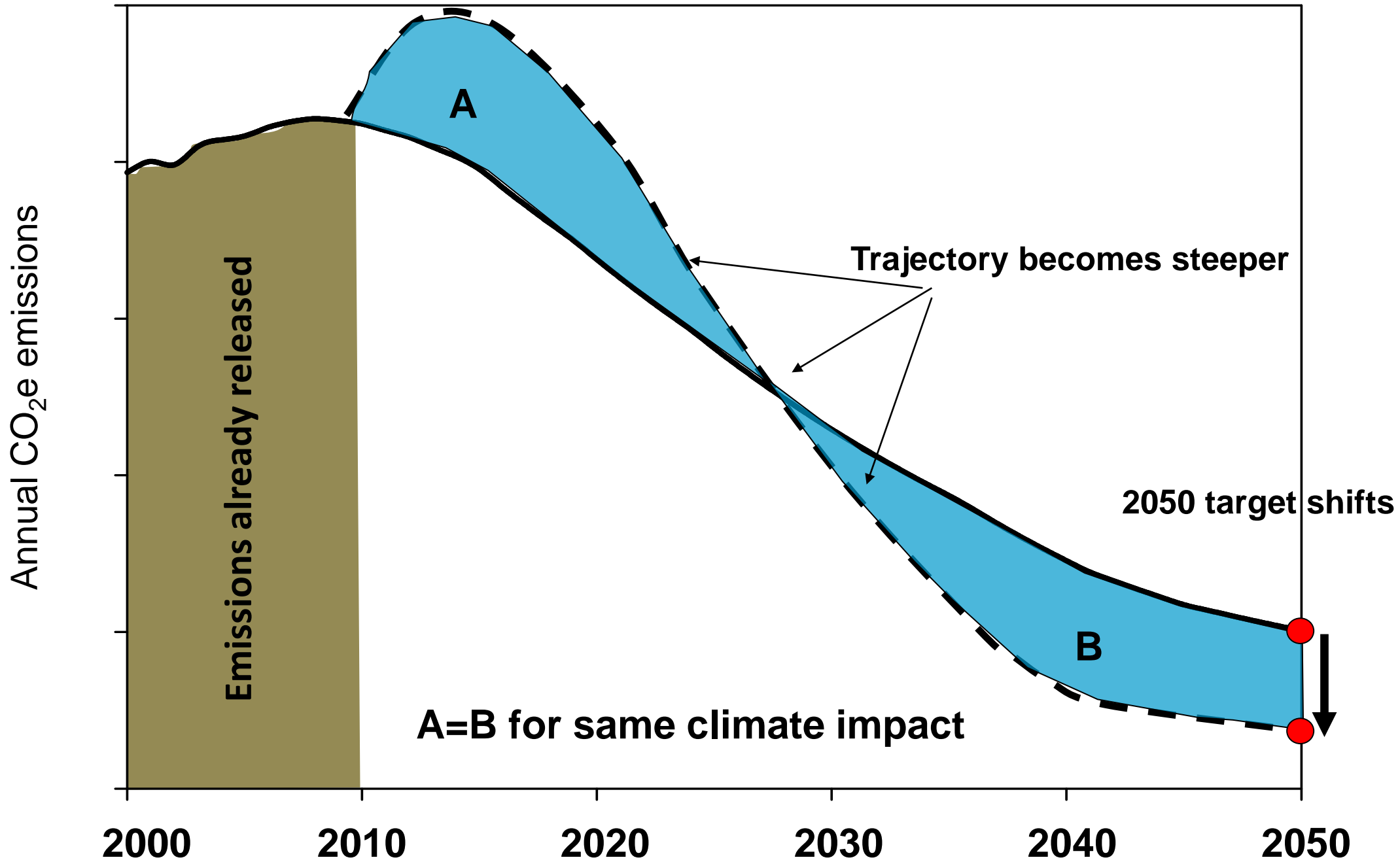
- But what does “a low carbon transition” look like anyway?
  - » From what?
  - » To what?
  - » When?
  - » Where?
  
- Use cumulative emissions accounting to examine the issue

# Illustrative pathway for a carbon budget





# Illustrative pathway for a carbon budget



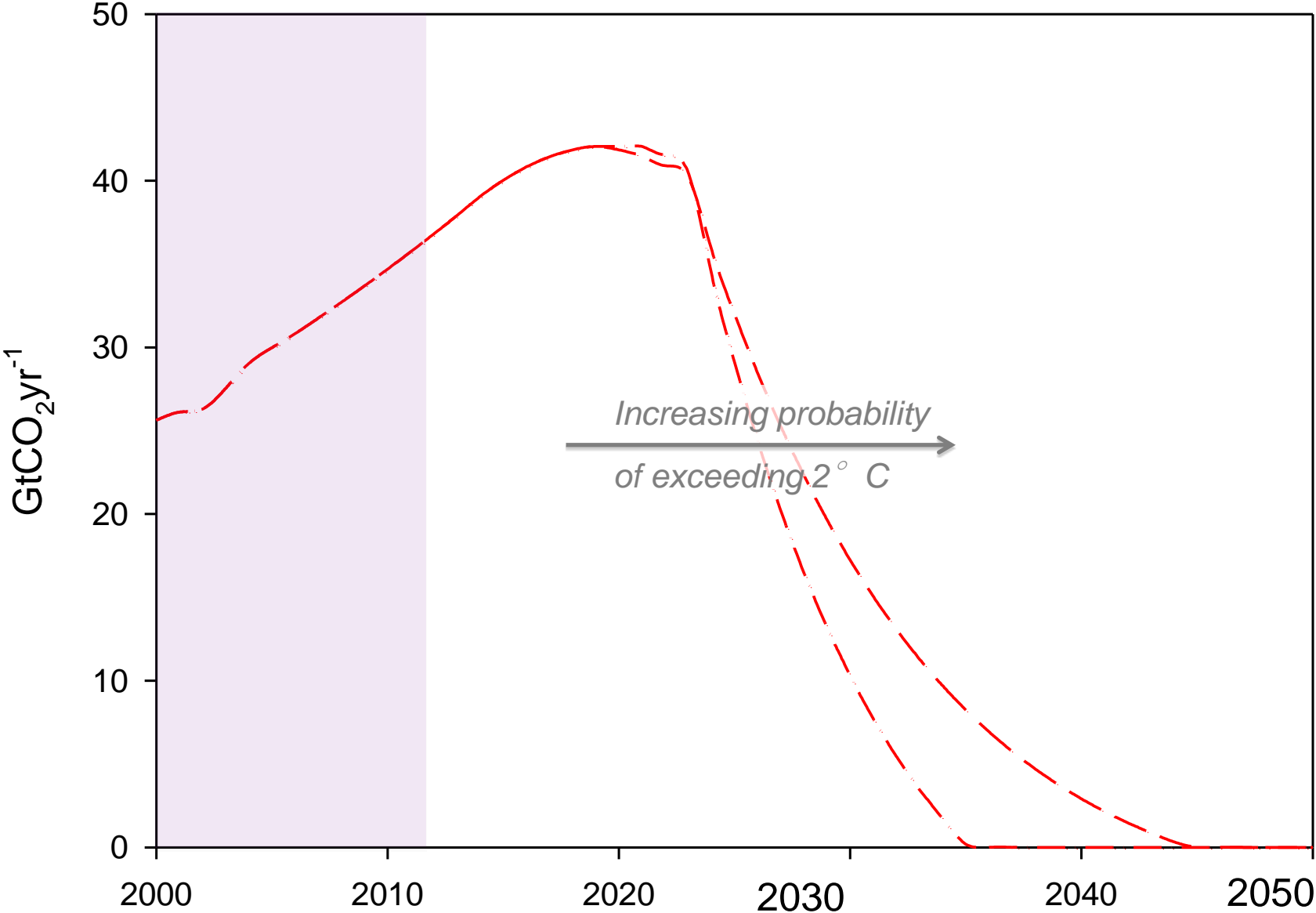
# Cumulative emissions budgets

- Mitigation challenge
  - » *To hold cumulative emissions of CO<sub>2</sub> in the atmosphere at levels that provide a high probability of staying below a 2 ° C rise in global surface temperature*
  - » *Enshrined in UNFCCC, repeated most recently at G8 Camp David*
- In 2013 it is too late for a high probability of staying below 2C  
i.e. already blown the budget for our existing commitments
- Take an outside chance (<50:50) chance of ‘avoiding dangerous CC’ with significant reductions in deforestation & halving food-related emissions
- What is left for emissions from energy?  
i.e. the pathway for 50:50 chance of avoiding dangerous CC



# Emissions from energy use

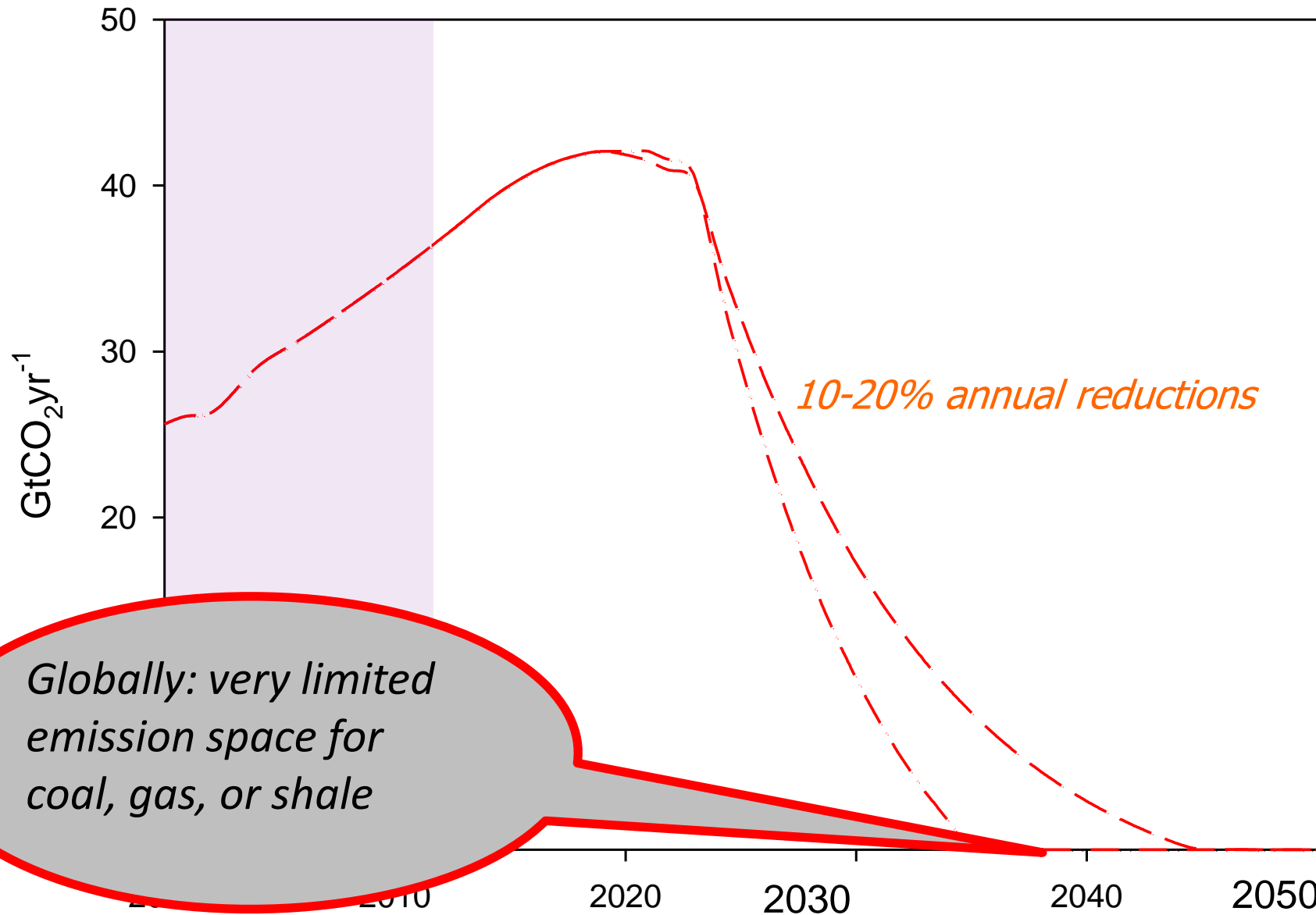
*(with 2020 peak & a high probability of exceeding 2° C)*



(Anderson and Bows 2008)

# Transition to what sort of energy system, when?

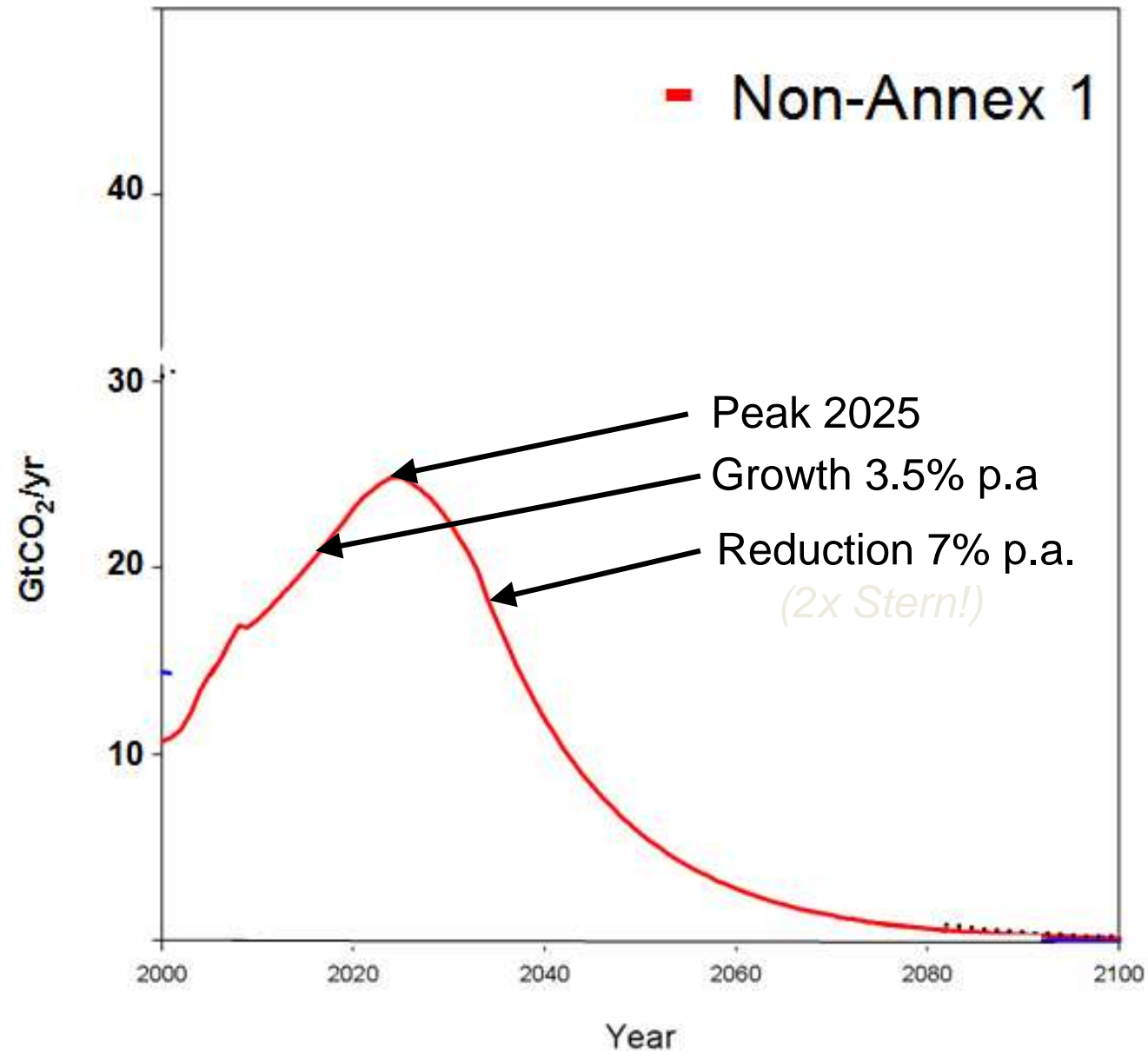
*(with 2020 peak & a high probability of exceeding 2° C)*



(Anderson and Bows 2008)

# Anderson-Bows: 2° C budget, CO<sub>2</sub> only

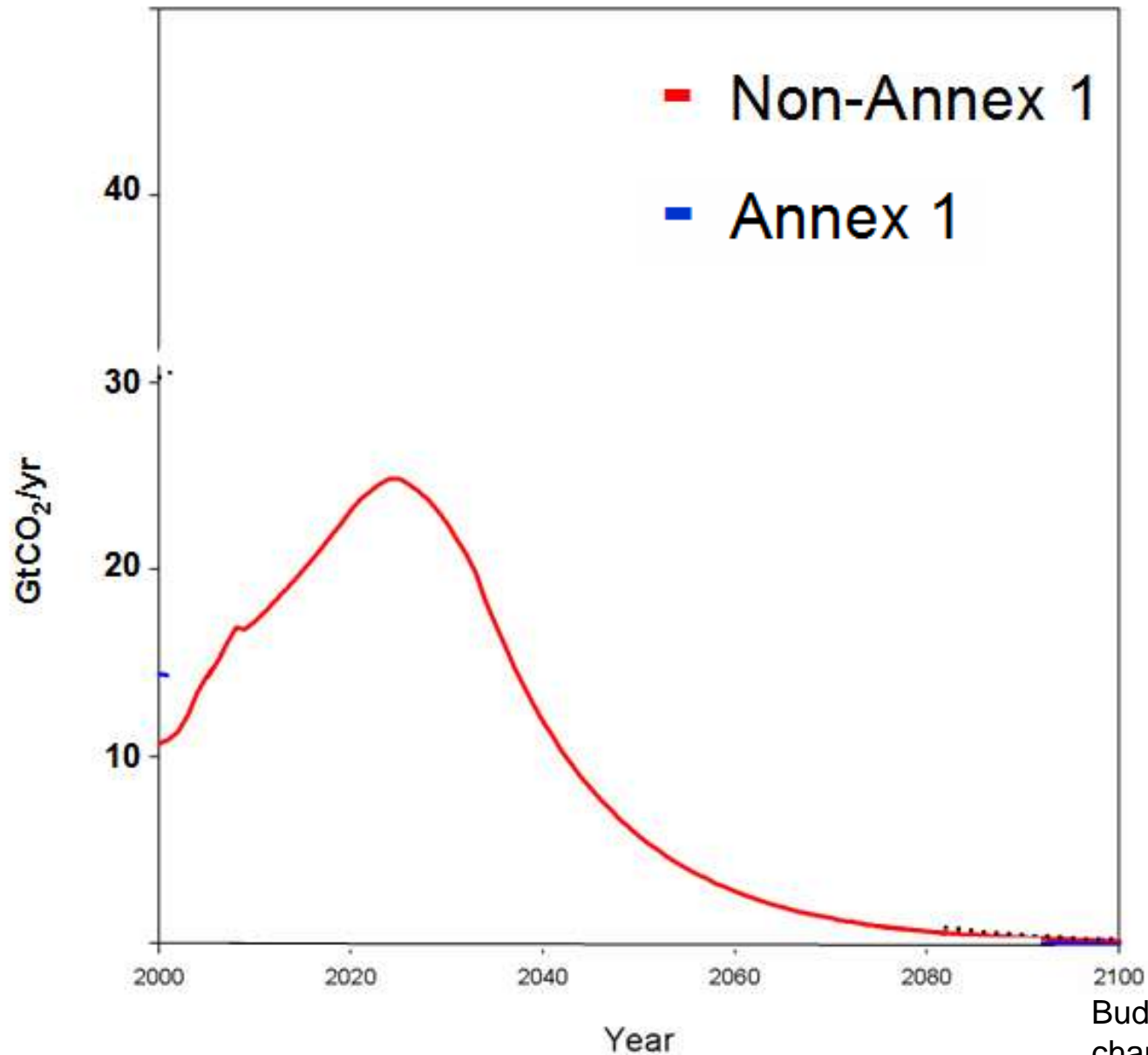
<http://rsta.royalsocietypublishing.org/content/369/1934/20.full.pdf+html?sid=423>



Budget premised on 37% chance of exceeding 2° C GMT rise

# Anderson-Bows: 2° C budget, CO<sub>2</sub> only

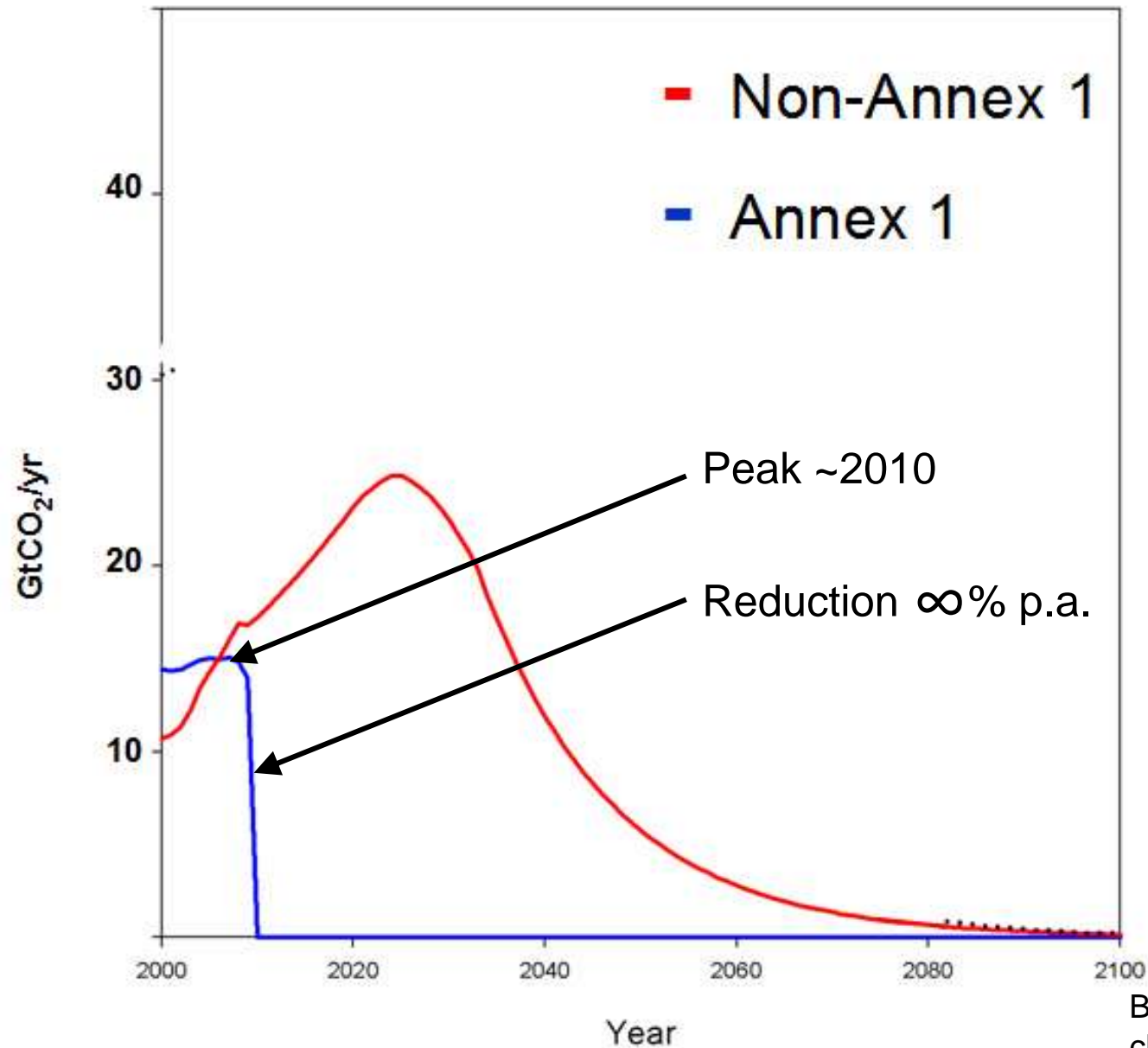
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Budget premised on 37%  
chance of exceeding 2° C  
GMT rise

# Why such stark conclusions?

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## Context

- Take science-based view of 2° C (*i.e. cumulative emissions not 2050 targets*)
- ‘Fair’ division of emissions between Annex 1 & non-Annex 1 (*inc **peaking***)
- Explicit account of global deforestation and food production emissions

## Consequences

- Timeframe of transition to low/zero carbon **energy** system significantly reduced
  - » *NB: Decarbonising the present day power sector is not the same as “avoiding dangerous climate change”*
- Unconventional gas not compatible with timeframe implied by 2 degrees budgets.
- Gas with CCS only compatible with very high capture (over 95%) in non-Annex 1



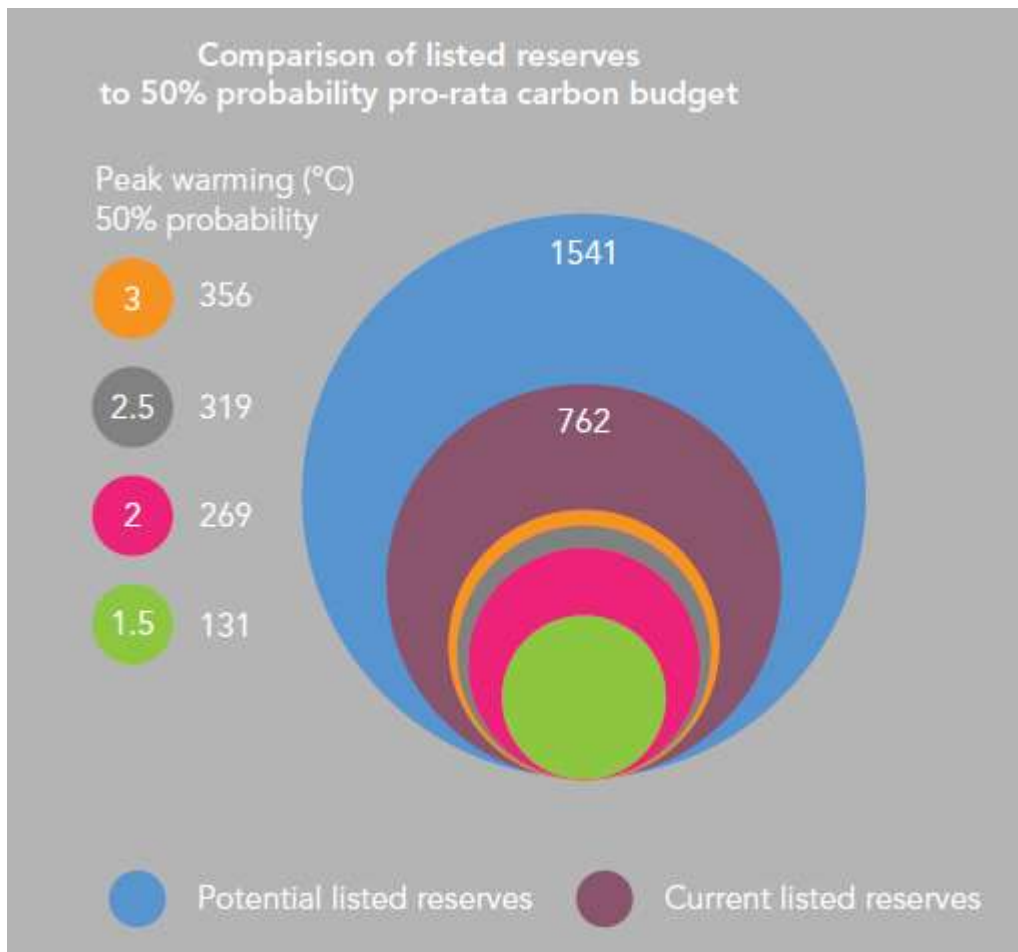
# Robust approach to energy and climate

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*“This is not a message of futility, but a wake-up call of where our rose-tinted spectacles have brought us. Real hope, if it is to arise at all, will do so from a bare assessment of the scale of the challenge we now face.”*

[Anderson & Bows. Beyond ‘dangerous’ climate change: emission scenarios for a new world, Philosophical Transactions of the Royal Society; Jan 2011](#)

# “Far from running out of fossil fuels, we have more than enough to fry the planet” – Dieter Helm (2012)



*A precautionary approach means only 20% of total fossil fuel reserves can be burnt to 2050. As a result the global economy already faces the prospect of assets becoming stranded, with the problem only likely to get worse if current investment trends continue - in effect, a carbon bubble.*

James Leaton, Carbon Tracker

*...this report shows that even a scenario for [CCS] deployment that is currently considered optimistic would only make a marginal difference to the amount of fossil fuels that can be consumed by 2050.*

Lord Stern, Foreword



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