

# ***Shale gas: a Golden Age or a Gilded Cage?***

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# Sequential approach

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- *What levels of climate change are we committed to avoid?*
- *How does this translate to carbon budgets/emission pathways?*
- *How do budgets divide between nations?*
- *What is the carbon footprint of shale gas?*
- *Is shale gas a substitute for or additional to other fossil fuels?*
- *If it's a substitute, can it fit within emission pathways?*
- *Conclusions for Annex 1 and non-Annex 1 nations*

# UNFCCC to Copenhagen & Camp David

- *“stabilization of greenhouse gas concentrations ... at a level that would prevent dangerous anthropogenic interference with the climate system”*  
Article 2 of UNFCCC
- *‘To hold the increase in global temperature **below 2 degrees Celsius**, and take action to meet this objective consistent with **science** and on the basis of **equity**’*  
Copenhagen/Cancun/Doha/Camp David declarations
- *‘... **must** ensure global average temperature increases **do not exceed** preindustrial levels by more than **2°C**’*

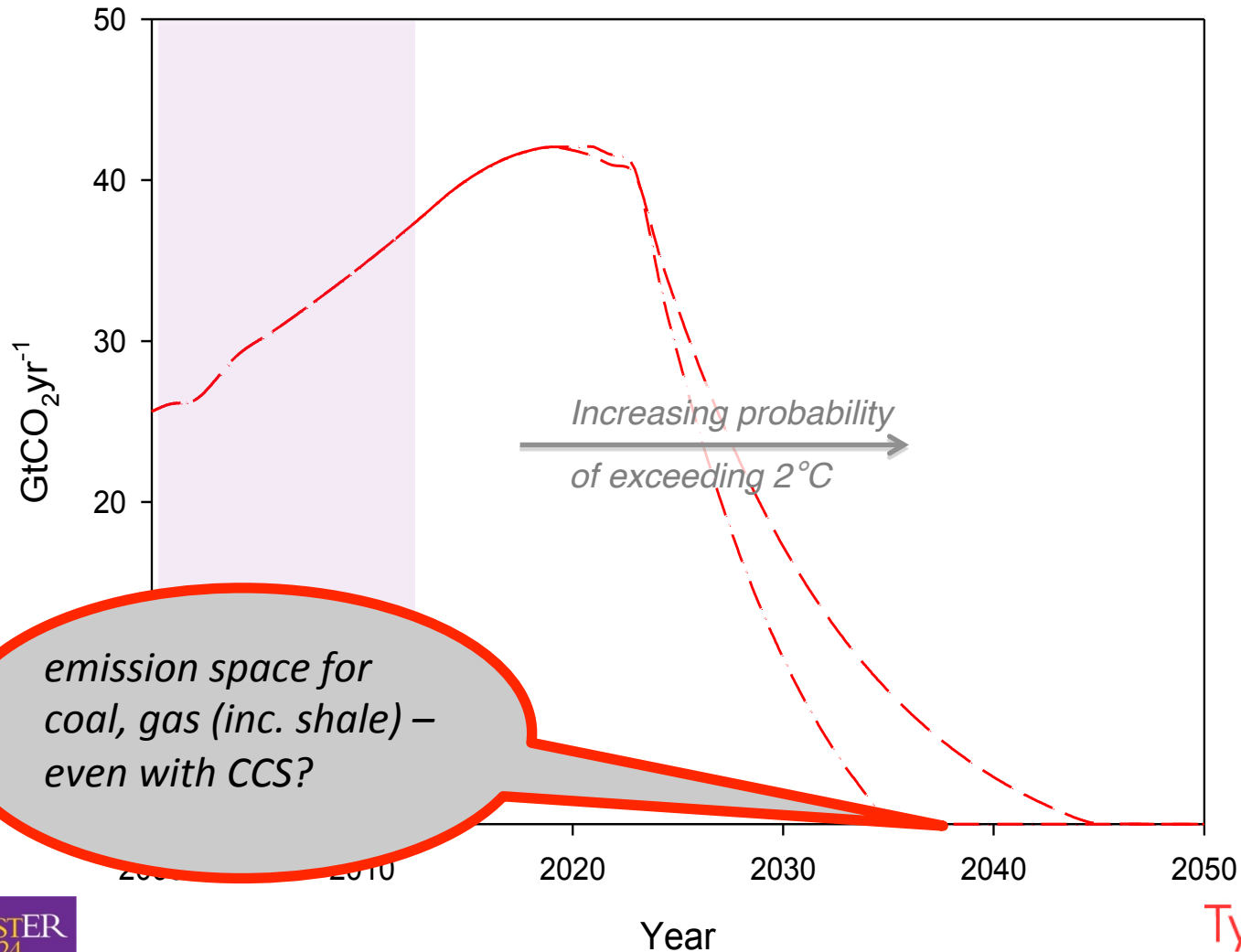
European Commission’s annual communication

# What emissions pathways fit with 2°C?

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- In 2012 it is too late for a high probability of staying below 2°C  
*i.e. already blown the budget for our existing commitments*
- So with a 60% chance of 'avoiding dangerous CC'
- ... and with reductions in deforestation & halving food-related emissions
- What is left for emissions from energy?  
*i.e. a pathway for 60% chance of avoiding dangerous climate change*

# For Energy - with 2020 peak & ~60% chance of <math> < 2^{\circ}\text{C}</math>



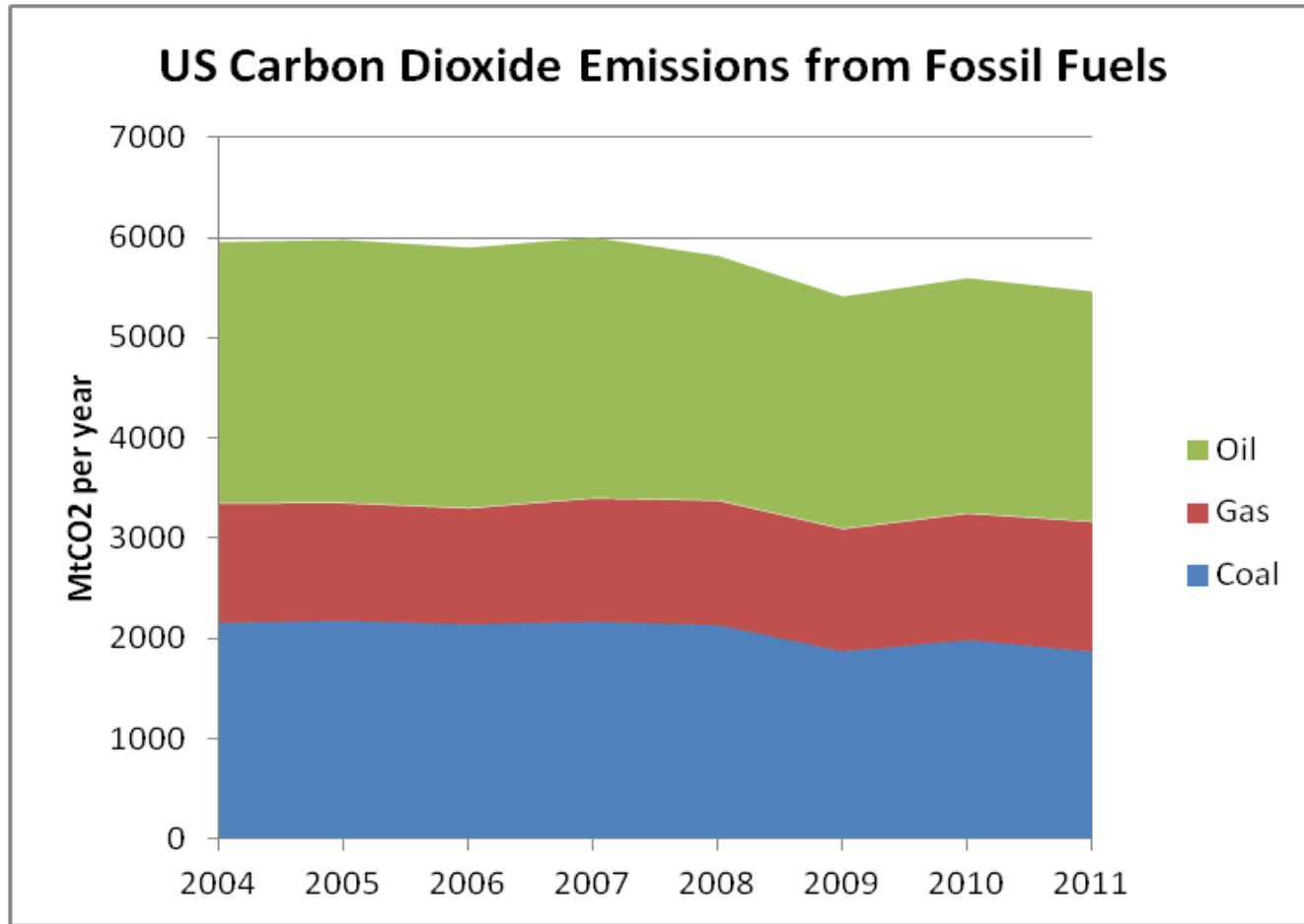
# So what of (shale) gas?

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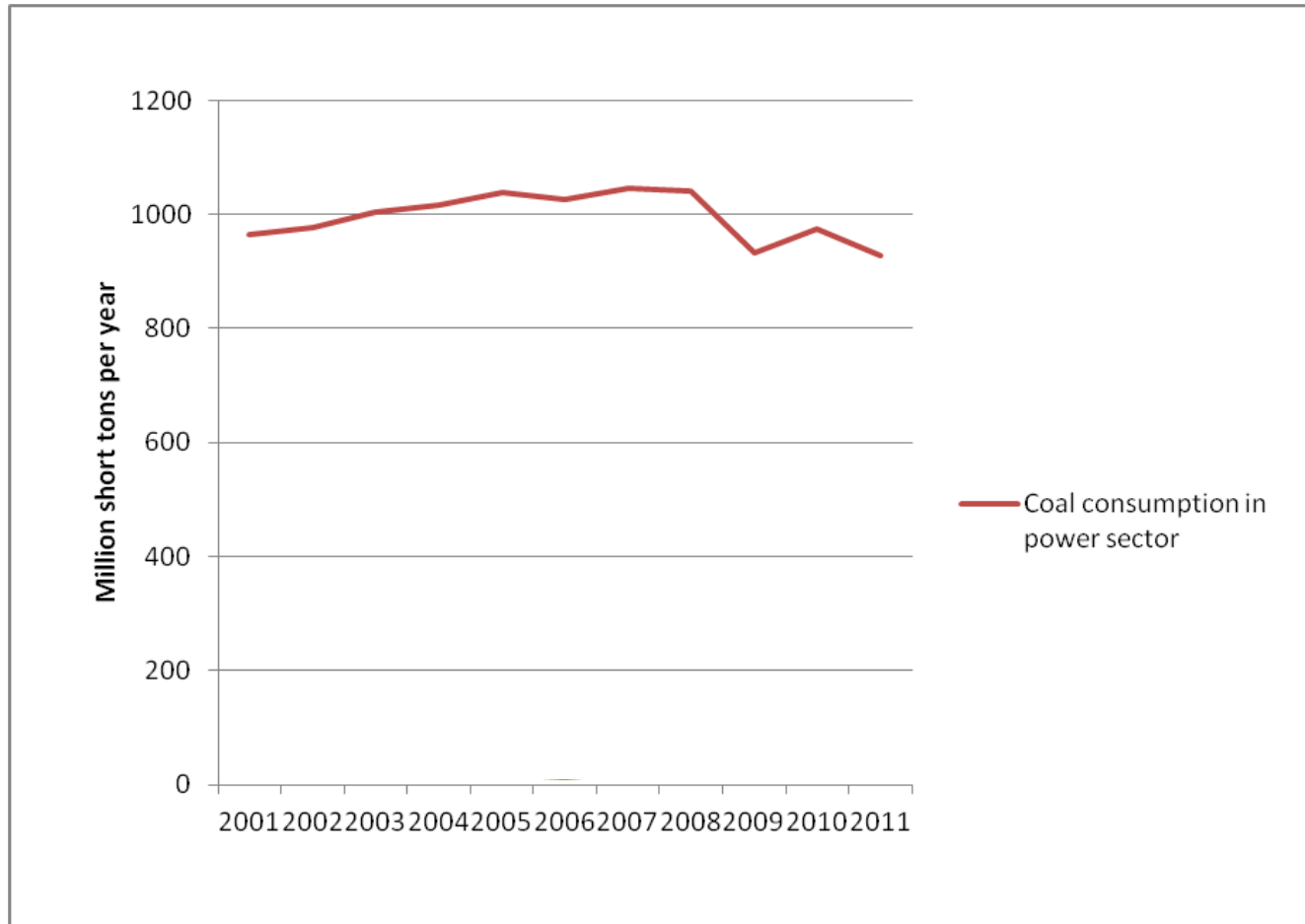
- It is a high carbon energy source (comprising 75% carbon)
- *“If a country brings any additional fossil fuel reserve into production, then in the absence of strong climate policies, we believe it is likely that this production would increase cumulative emissions in the long run. **This increase would work against global efforts on climate change.**”*

*DECC: MacKay & Stone shale gas review (2013)*
- In an energy-hungry world without stringent carbon caps shale gas is likely to be used in addition & not as a substitute for coal or oil.  
*(other than for peat, has a fossil fuel ever substituted for another?)*

## ... what does the evidence from the US suggest?

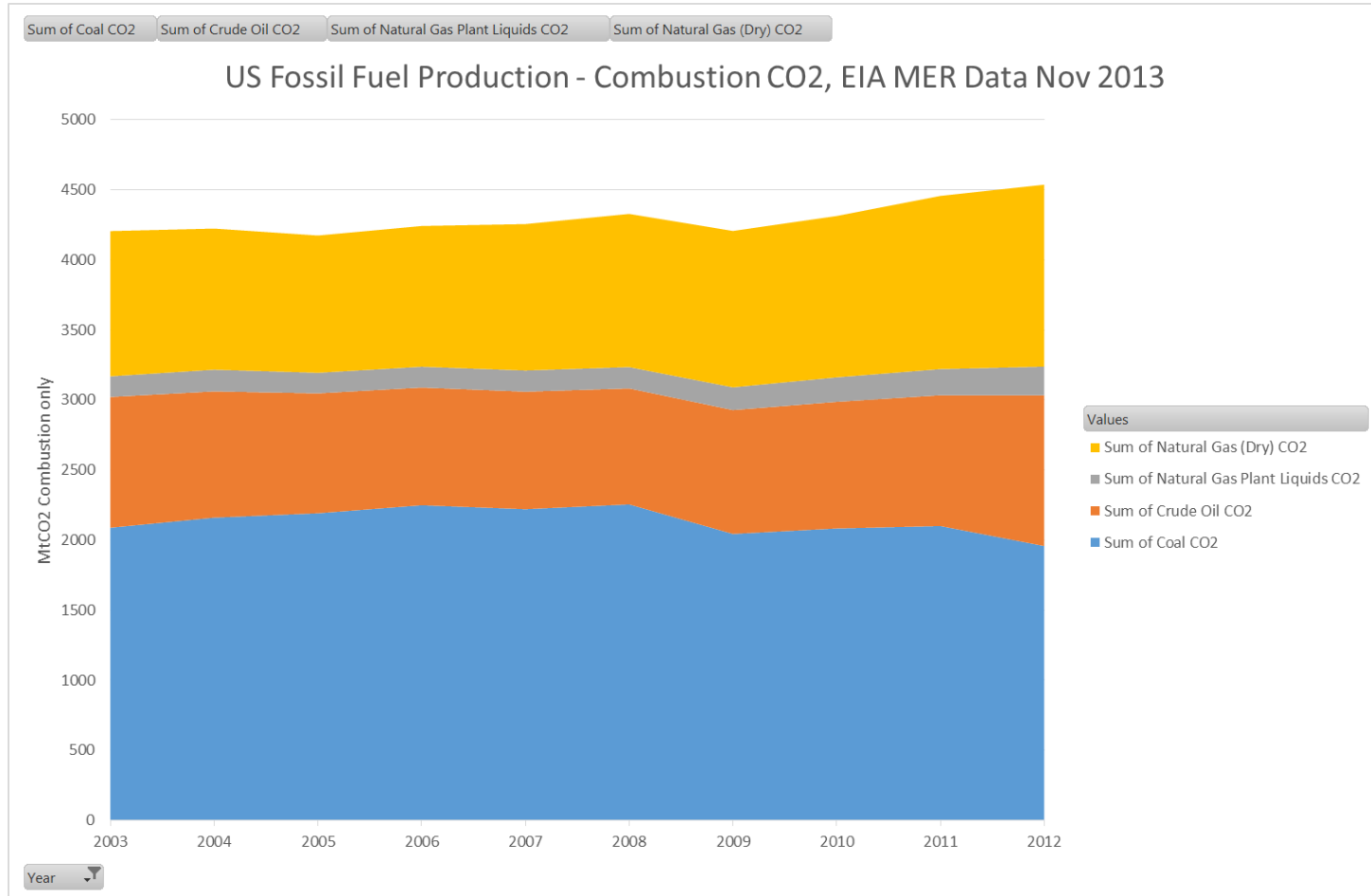


# ... but is the coal really staying in the ground?

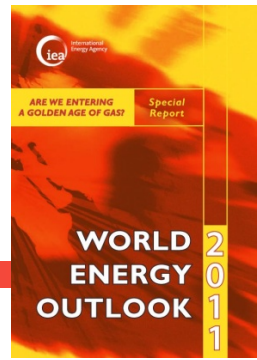




# ... & what of total US fossil fuel production



# So is this really The Golden Age of Gas?



- Shale gas with CCS can't be major component of energy system – lifecycle emissions projected to be  $\sim 80\text{-}120\text{gCO}_2/\text{kWh}$

*(c.f. renewables & nuclear at  $\sim 5$  to  $20\text{gCO}_2/\text{kWh}$ )*

- If poorer (non-Annex 1) nations peak by 2025 before reducing at 5-8% p.a. then  $2^\circ\text{C}$  obligation requires wealthier (Annex 1) nations to be very-low carbon by  $\sim 2030\text{-}35$

***i.e. no emission space for shale in Annex 1 nations***

- Even DECC's UK position is for the 2030 grid to be under  $50\text{gCO}_2/\text{kWh}$  with heating & cars on the electric grid

***...so why invest in 'unusable' new shale-gas reserves?***

# Conclusions

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*Absolute emissions + knowledge of time constraints =>*

## **Poorer (non-Annex 1) nations**

Shale gas as part of rapid carbon intensity reduction

*if upstream emissions* are managed

... but must lock out other fossil fuel infrastructures & enable CCS

## **Wealthier (Annex 1) nations**

Shale gas incompatible with even weak version of 2°C commitments

» Need a *rapid reduction* in energy demand; and

» and an increase in *very low/zero energy supply* necessary

# Why such different 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
- Explicit account of global deforestation and food emissions

*NB: decarbonising power sector is not the same as “avoiding dangerous climate change”*

## Implications

- Timeframe of transition to low/zero carbon **energy** system significantly reduced
- Gas not compatible with such a science-based timeframe
- Gas with CCS only compatible (in non-Annex 1) with very high capture (over 95%)

*NB: research & investment priorities should centre on genuinely low or zero carbon energy*

## 20<sup>th</sup> century fuel out of place in the 21<sup>st</sup> century?

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- *“If a country brings any additional fossil fuel reserve into production... it is likely that this production would increase cumulative emissions in the long run. This increase would work against global efforts on climate change.”*

*DECC: MacKay & Stone shale gas and climate review (2013)*

# Thank you

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