



**Getting Ready for Zero Emissions and 100% Renewable Energy:  
Plans and Scenarios to Pave the Way for the Transition  
10 December, 2015 - 11:15-12:45 - Room 2  
Side event to the UNFCCC COP21, Climate Generation Area,  
Paris, France**

**Setting the Scene – The Demands of the Science  
Prof. Kevin Anderson  
Tyndall Centre, University of Manchester**

**Tyndall°Centre®**  
for Climate Change Research

*The event was organised by Nordic Folkecenter for Renewable Energy (Denmark) & NegaWatt (France) in cooperation with INFORSE, Track 0, Centre for Alternative Technology –CAT (UK).*

*The event was part of the “Climate Generation Area” Conference organised by the French Government parallel to the UNFCCC COP21  
- [www.cop21.gouv.fr/en/les-espaces-generations-climat/](http://www.cop21.gouv.fr/en/les-espaces-generations-climat/)*

# 2°C, carbon budgets & radical mitigation

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10 Dec. 2015

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# Our collective commitment on climate change

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*“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”*

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*“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”*



# Our collective commitment on climate change

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*“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**”*

# Yet, with publication of latest IPCC reports ...

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- The mitigation message has changed little in the last **twenty five** years
- CO2 in **2015** over **60% higher** than at time of the first report in **1990**

# So what has changed?

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Crucially...

in terms of temperature (**2°C**) rise,

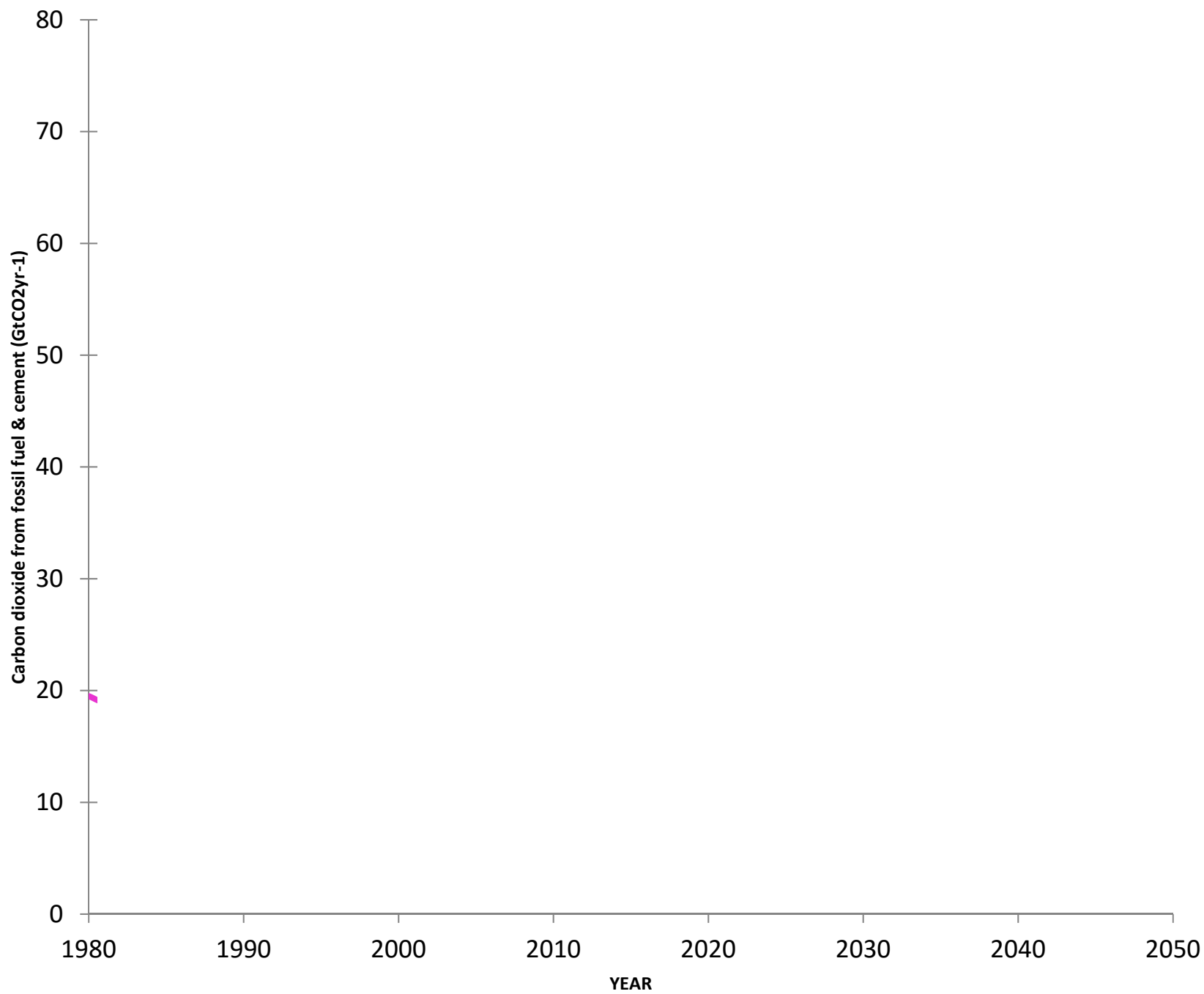
explicit recognition it's **carbon budgets** that matter,

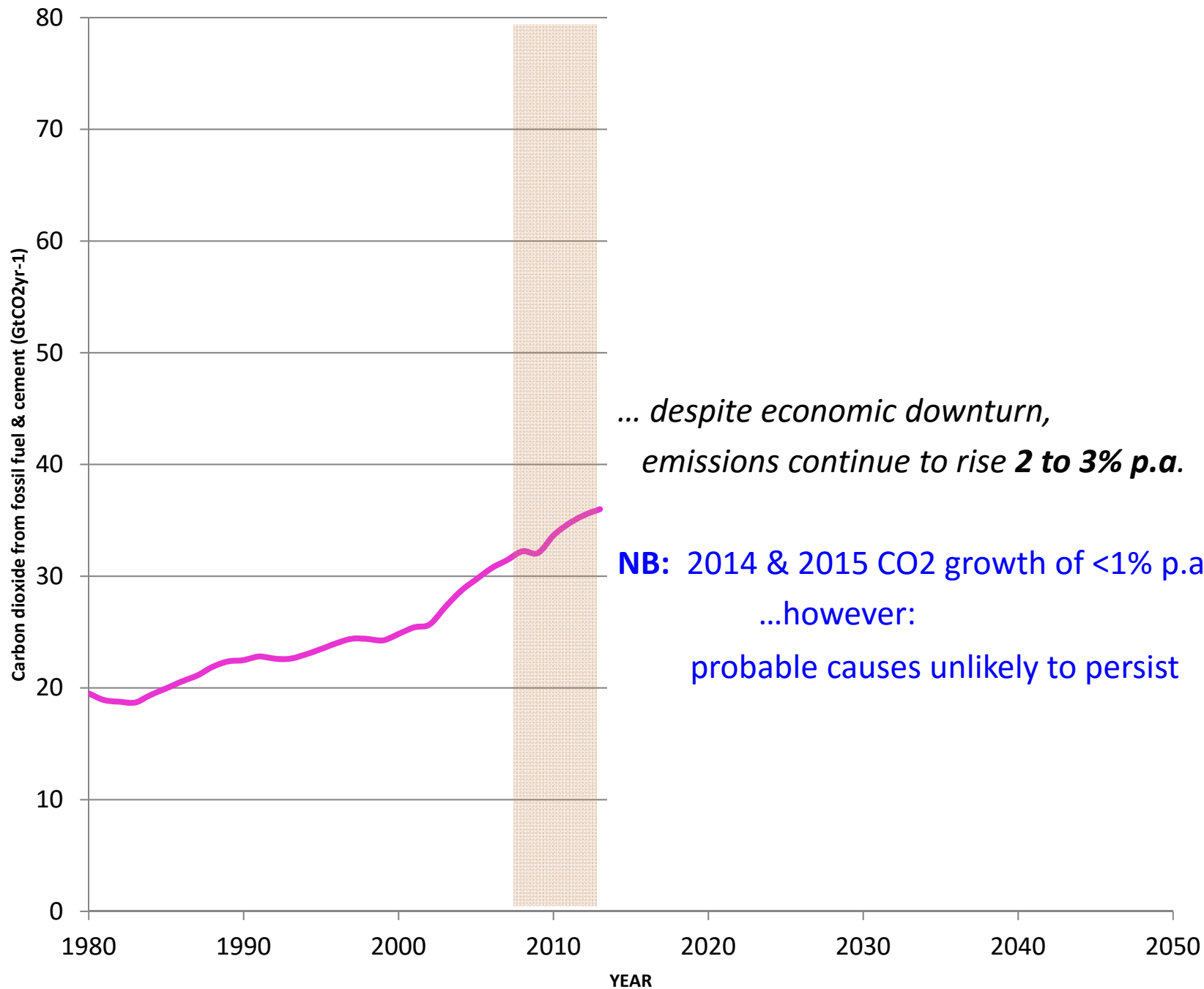
**not** long-term (**2050**) targets

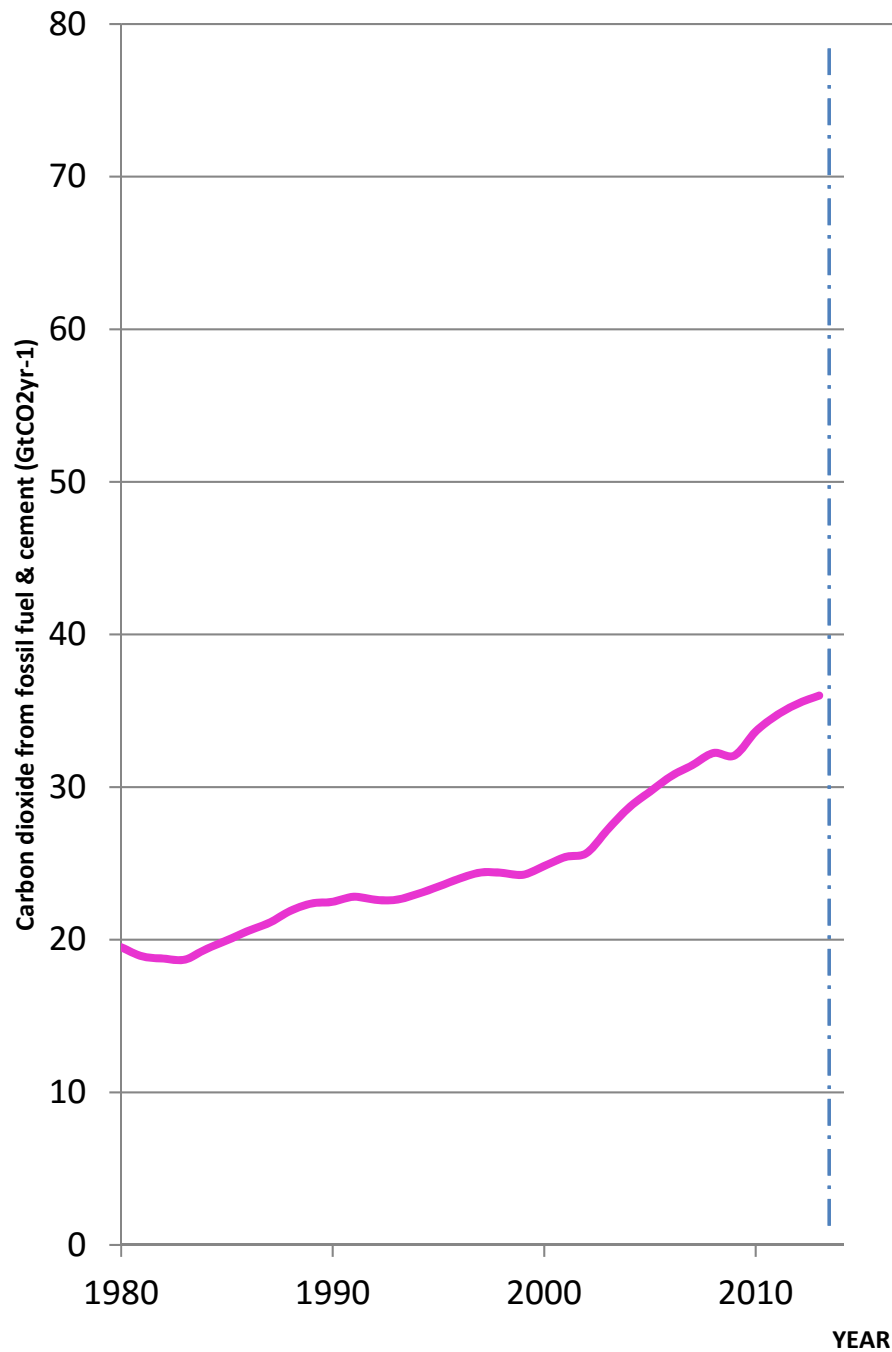


Thinking about this  
'graphically'





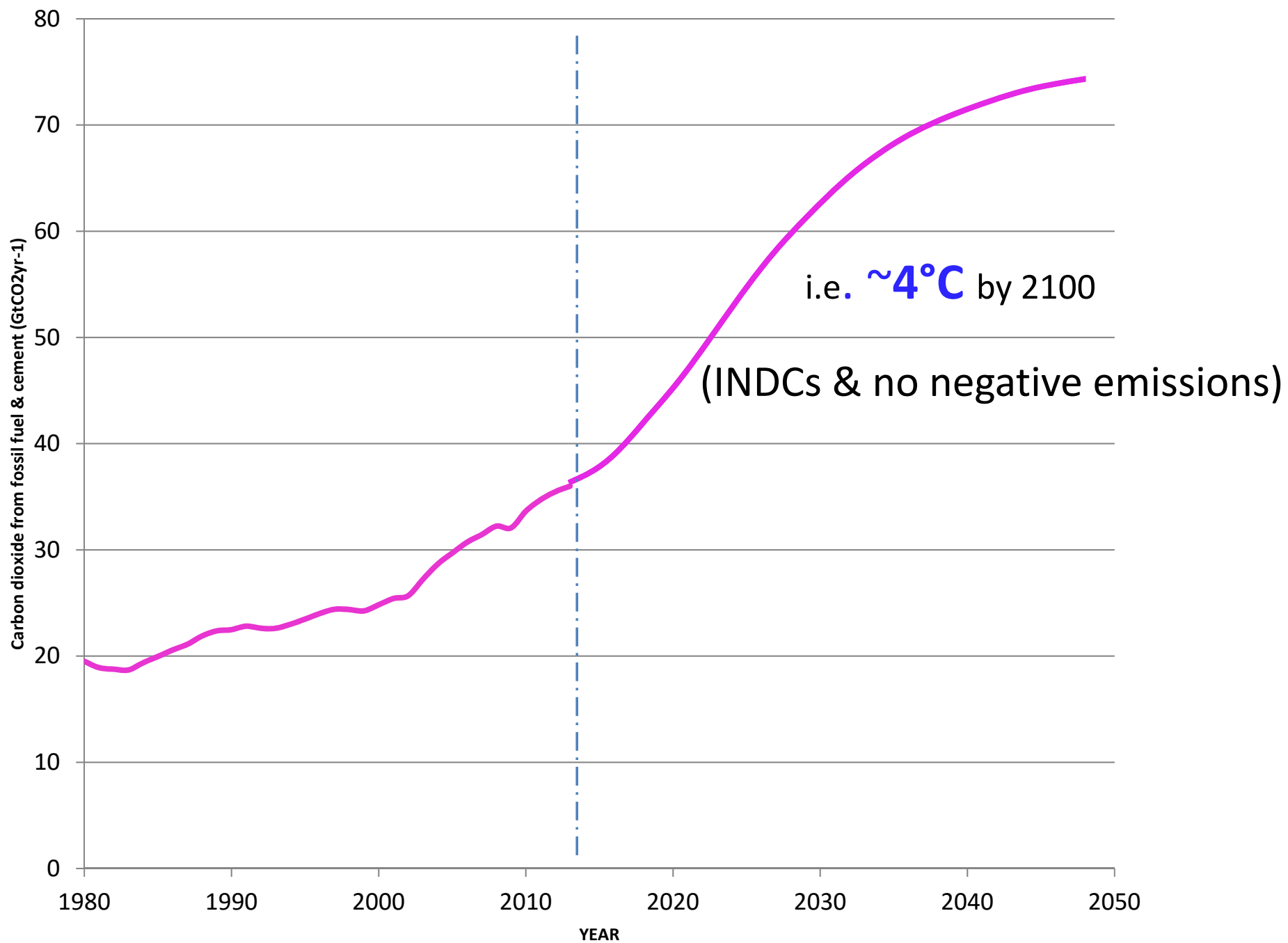




... nevertheless, as we build hi-carbon

- *power stations*
- *Infrastructures*
- *buildings*
- *aircraft & ships*

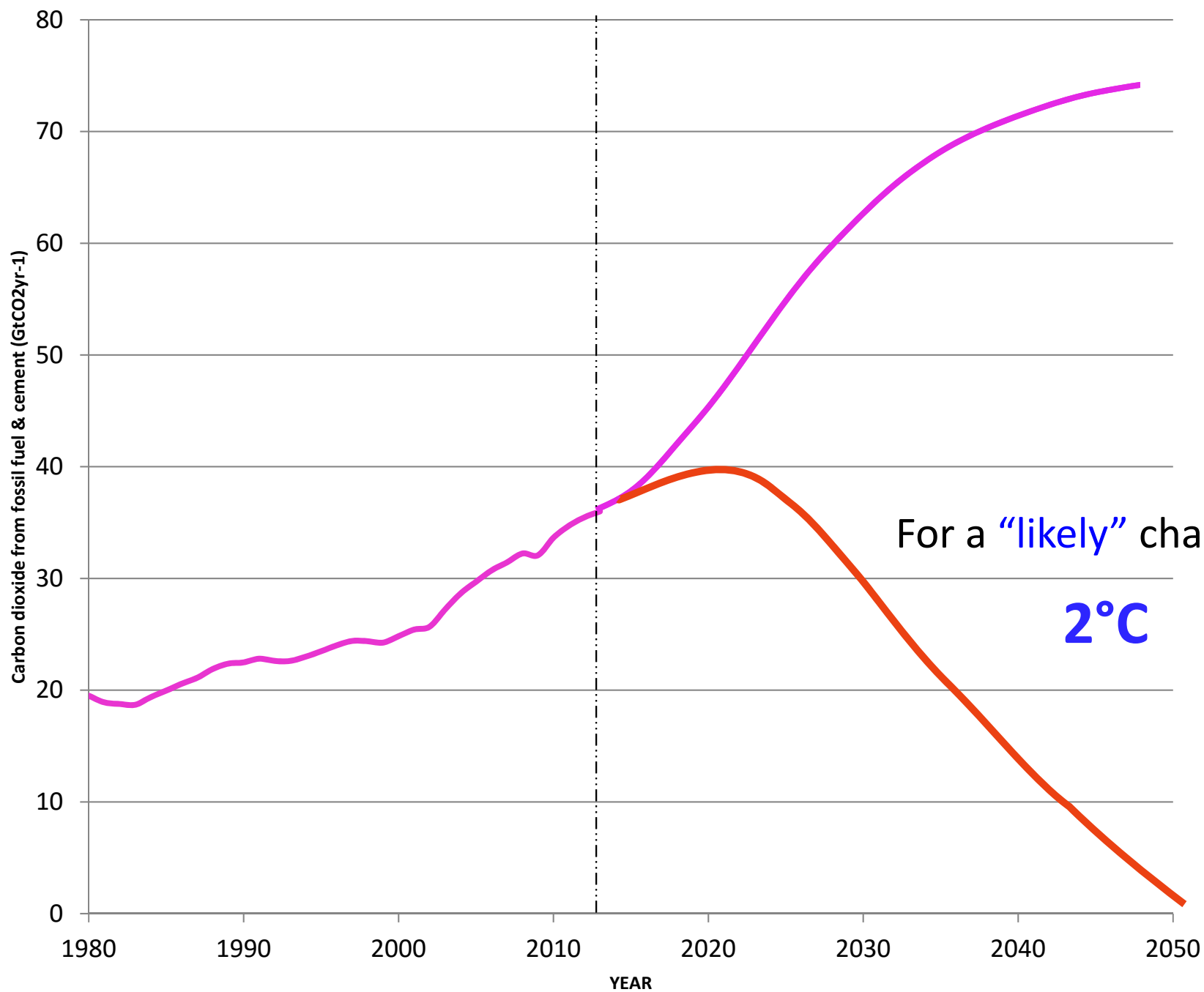
Lock-in  
30 to 100+ yrs



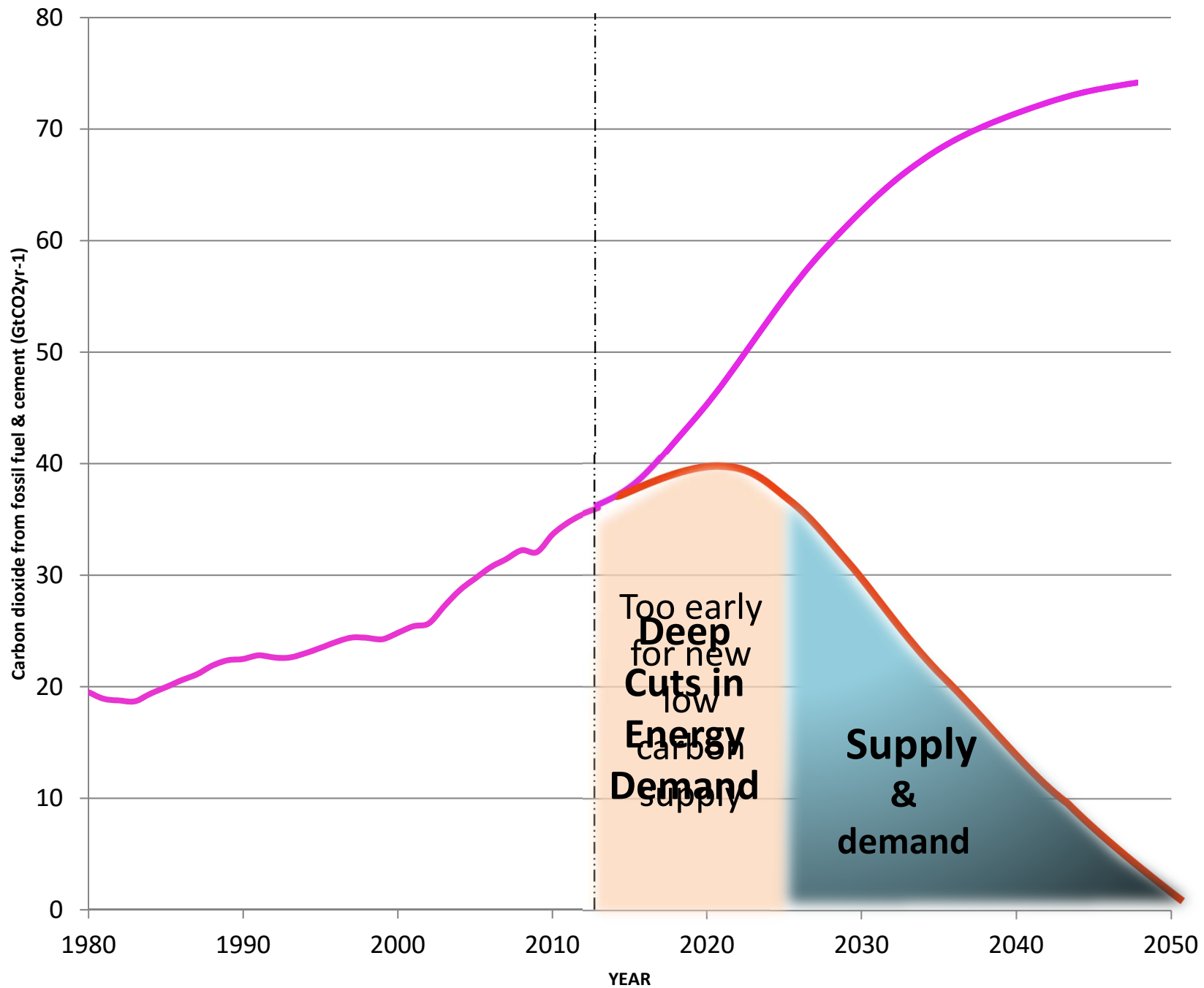


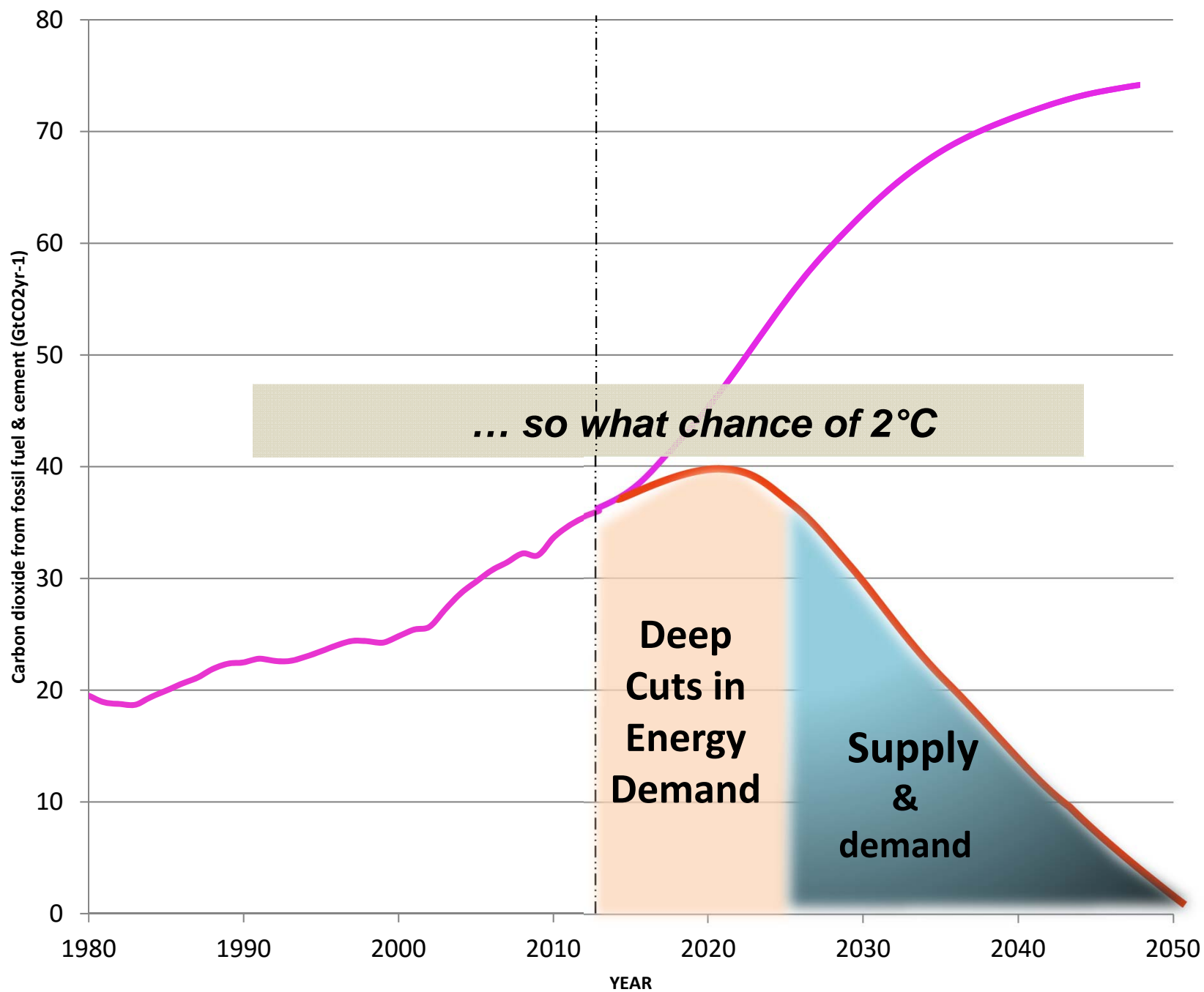
... but what about 2°C?











# Returning to Carbon budgets

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# Numerically: based on IPCC Synthesis Report

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**Table 2.2 [TABLE SUBJECT TO FINAL COPYEDIT]**

Cumulative CO <sub>2</sub> emissions from 1870 in GtCO <sub>2</sub>									
Net anthropogenic warming <sup>a</sup>	<1.5 °C			<2 °C			<3 °C		
Fraction of simulations meeting goal <sup>b</sup>	66%	50%	33%	66%	50%	33%	66%	50%	33%
Complex models, RCP scenarios only <sup>c</sup>	2250	2250	2550	2900	3000	3300	4200	4500	4850
Simple model, WGIII scenarios <sup>d</sup>	No data	2300–2350	2400–2950	2550–3150	2900–3200	2950–3800	n.a. <sup>e</sup>	4150–5750	5250–6000
Cumulative CO <sub>2</sub> emissions from 2011 in GtCO <sub>2</sub>									
Complex models, RCP scenarios only <sup>c</sup>	400	550	850	1000	1300	1500	2400	2800	3250
Simple model, WGIII scenarios <sup>d</sup>	No data	550–600	600–1150	750–1400	1150–1400	1150–2050	n.a. <sup>e</sup>	2350–4000	3500–4250
Total fossil carbon available in 2011 <sup>f</sup> : 3670–7100 GtCO <sub>2</sub> (reserves) & 31300–50050 GtCO <sub>2</sub> (resources)									

<2°C		
66%	50%	33%


... to stay below 2°C

... range of probabilities

emissions from 2011 in GtCO <sub>2</sub>		
1000	1300	1500

... range of carbon budgets  
for 2011-2100

# Estimating **energy-only** CO<sub>2</sub> budgets from **2015** to 2100



We need to note that:

- **Since 2011**, we've emitted about **~150GtCO<sub>2</sub>**
- **Deforestation & Cement** (process) **~250GtCO<sub>2</sub>** (2015 - 2100)

*i.e.: ... **subtract**, at least **400GtCO<sub>2</sub>***



... to stay below 2°C

emissions from 2015 GtCO <sub>2</sub>		
600 (66%)	900 (50%)	1100 (33%)

i.e.: the budgets from **2015 -2100** for **CO<sub>2</sub> from energy** only

# Considering **Industrialising** nations:

**GtCO<sub>2</sub>**  
(2015-2100)

1. Peak CO<sub>2</sub> **2025**; mitigate **10%** p.a. from **2035**
2. Peak **2025**; mitigate **5%** from **2035**
3. Peak **2030**; mitigate **5%** from **2035**

Consider these in relation to 2°C budgets ...

1.	<del>66%</del> (600GtCO <sub>2</sub> )	50% (900GtCO <sub>2</sub> )	33% (1100GtCO <sub>2</sub> )
2.	<del>66%</del>	<del>50%</del>	33%
3.	<del>66%</del>	<del>50%</del>	<del>33%</del>

# Considering wealthier **Industrial** nations:

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**GtCO<sub>2</sub>**  
(2015-2100)

1. Peak **now**; mitigate **5%** p.a. from **2025** **350**
2. Mitigate **10%** p.a. from now **130**

# Put bluntly

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- ~~66%~~ chance of 2°C is lost
- ~~50%~~ chance demands a *war-like* footing on mitigation - now
- **33%** chance demands mitigation far beyond anything discussed in Paris

... and

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without a belief in the huge & successful uptake of  
*highly speculative negative emission technologies*

***it is now too late for 1.5°C***

# How can this be reconciled with ‘official’ accounts?

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... mitigation costs would be so low that

*“global economic growth would not be strongly affected”*

WGIII Co Chair

... two rabbits from the hat:

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## 1. Negative emissions technologies (BECCS):

*Grow trees/plants*

*they absorb CO<sub>2</sub> through photosynthesis*

*burn trees in powerstations*

*capture the CO<sub>2</sub> from the chimney*

*~liquefy the CO<sub>2</sub> & pump it underground*

*store for many 1000s of years*

## 2. Peak global emissions in the past



... two rabbits from the hat:

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## 1. Negative emissions technologies (BECCS):

*Never worked at scale*

*huge technical & economic unknowns*

*major efficiency penalty*

*limited biomass availability (fuel or food?)*

*and fingers crossed on feedbacks*

## 2. Peak global emissions in the past

*We don't have a time machine ...*

# IPCC Scenario database:

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400 scenarios for 50% or better chance of 2°C, of these:

- **86%** include large scale **negative emissions**
- the remaining **14% peak in ~2010**
- *many use negative emissions & adopt a ~2010 peak*

Returning to 2°C ... is it still a viable goal?



# Hypothesis: yes

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**... but the probabilities are now very slim**

*(i.e. IPCC budget for only a 33% chance of staying below 2°C)*

# A Radical Plan for 2°C – two phases

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1. Deep **reductions in energy** demand from now to ~2030

*... by the **high emitters***

2. **Marshall-style** build programme of **zero carbon energy** supply

*... with **100%** penetration by **2050***



# Thank you

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Dec. 2015

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