From source to use: the role of fossil fuels in delivering a sustainable energy future

Progressing CCS

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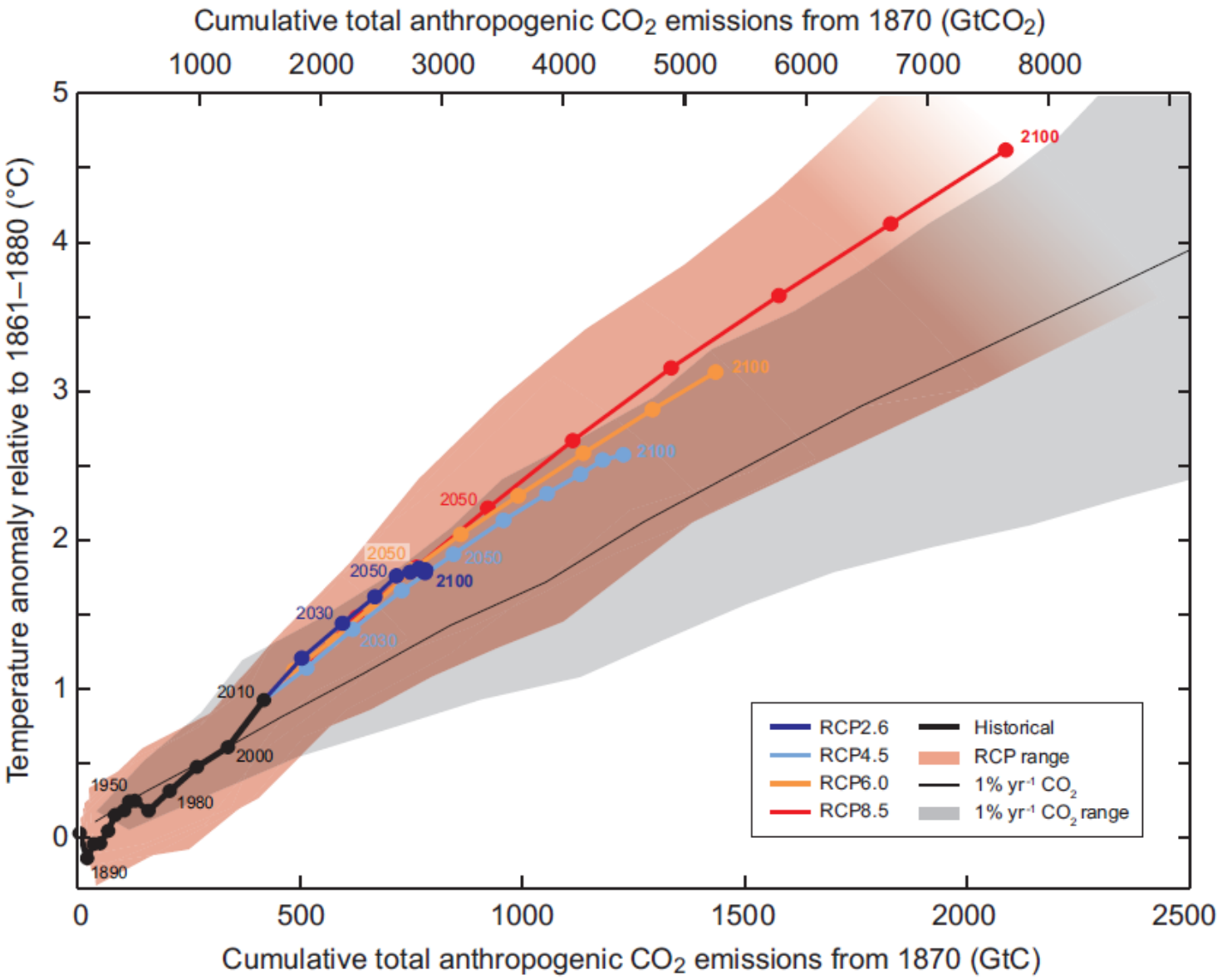
IPCC Climate Change 2013 'The Physical Science Basis'

http://www.ipcc.ch/report/ar5/wg1/



The Climate Problem

- **Agree a division of the remaining space in the atmosphere between member states (and not between fuels).**

- **Make sure that the rate of emissions from all member states goes to zero in time to cap global cumulative emissions.**

IPCC WGII AR5 Summary for Policymakers - *Climate Change 2014: Impacts, Adaptation, and Vulnerability*

If CCS is not available analysis shows average costs are more than twice as high for achieving mitigation scenarios reaching about 450 ppm CO2eq in 2100 (consistent with a *likely* chance to keep warming below 2°C relative to pre-industrial level).

Table SPM.2 [TABLE SUBJECT TO FINAL COPYEDIT]

	Mitigation cost increases in scenarios with limited availability of technologies[4] *[%increase in total discounted[5] mitigation costs (2015-2100) relative to default technology assumptions]*				**Mitigation cost increases due to delayed additional mitigation until 2030** *[% increase in mitigation costs relative to immediate mitigation]*	
2100 concentrations (ppm CO_2eq)	***no CCS***	***nuclear phase out***	***limited solar/wind***	***limited bioenergy***	***medium term costs (2030-2050)***	***long term costs (2050-2100)***
450 (430-480)	138 % (29-297%) 4	7 % (4-18%) 8	6 % (2-29%) 8	64 % (44-78%) 8	44 % (2-78%) 29	37 % (16-82%) 29
500 (480-530)	N/A	N/A	N/A	N/A		
550 (530-580)	39 % (18-78%) 11	13 % (2-23%) 10	8 % (5-15%) 10	18 % (4-66%) 12	15 % (3-32%)	16 % (5-24%)
580-650	N/A	N/A	N/A	N/A		

Symbol legend – fraction of models successful in producing scenarios (numbers indicate the number of successful models)

: all models successful

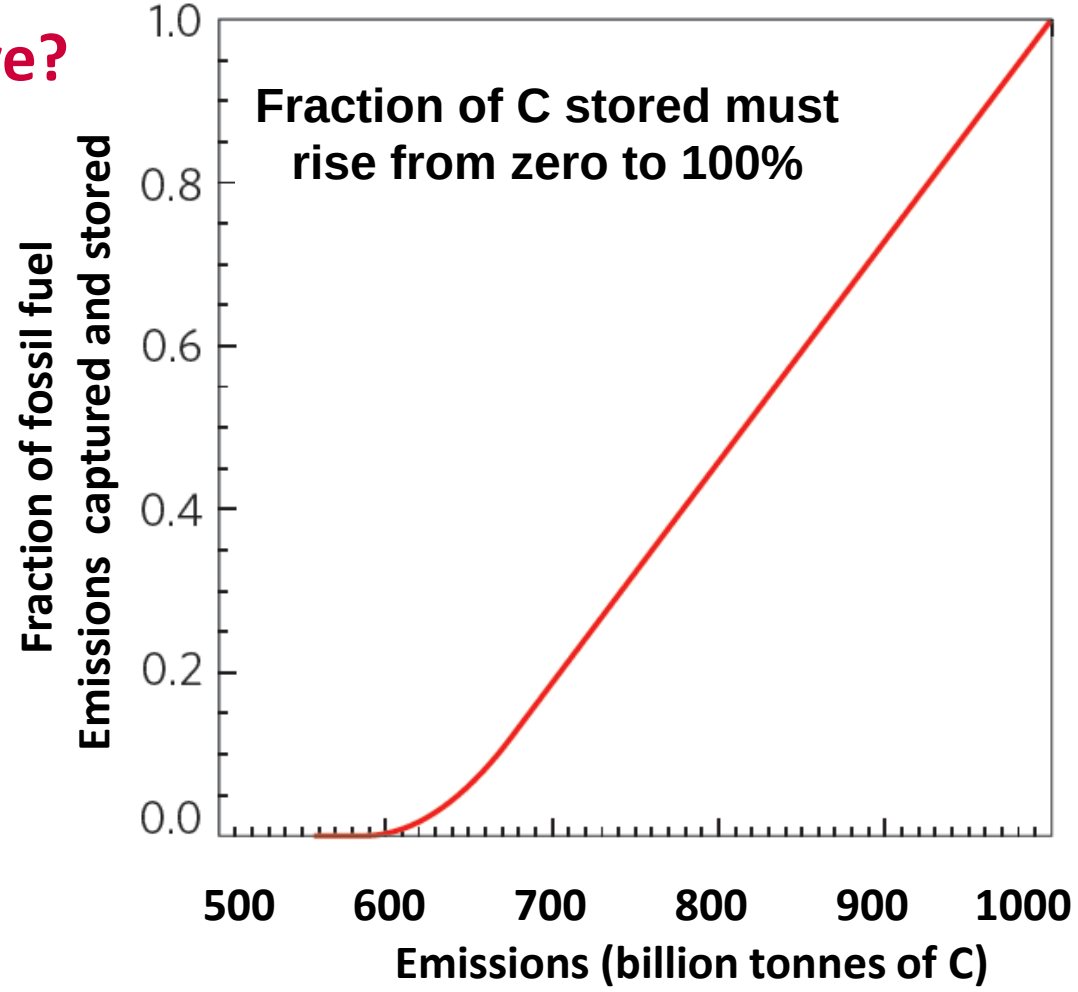
: between 80 and 100% of models successful

: between 50 and 80% of models successful

: less than 50% of models successful

What do we need to achieve?

CO_2 emissions are what matters for the climate. The prime climate objective is not to end the use of fossil fuels. The prime objective is to stop CO_2 emissions, with 100% CCS developed and deployed in time to cap cumulative emissions of carbon at a safe level.



Myles R. Allen, David J. Frame & Charles F. Mason, The case for mandatory sequestration, Nature Geoscience 2, 813 - 814 (2009), doi:10.1038/ngeo709

CO_2 EOR and other applications with partial overall capture should be seen as a stage in a path from zero CO_2 capture to 100% CCS.

They can be a move in the right direction from where we are now – emitting 100% of fossil carbon to atmosphere.

The key factor is the extent to which technologies and/or projects can readily be adapted to get higher fractions of CO_2 stored.

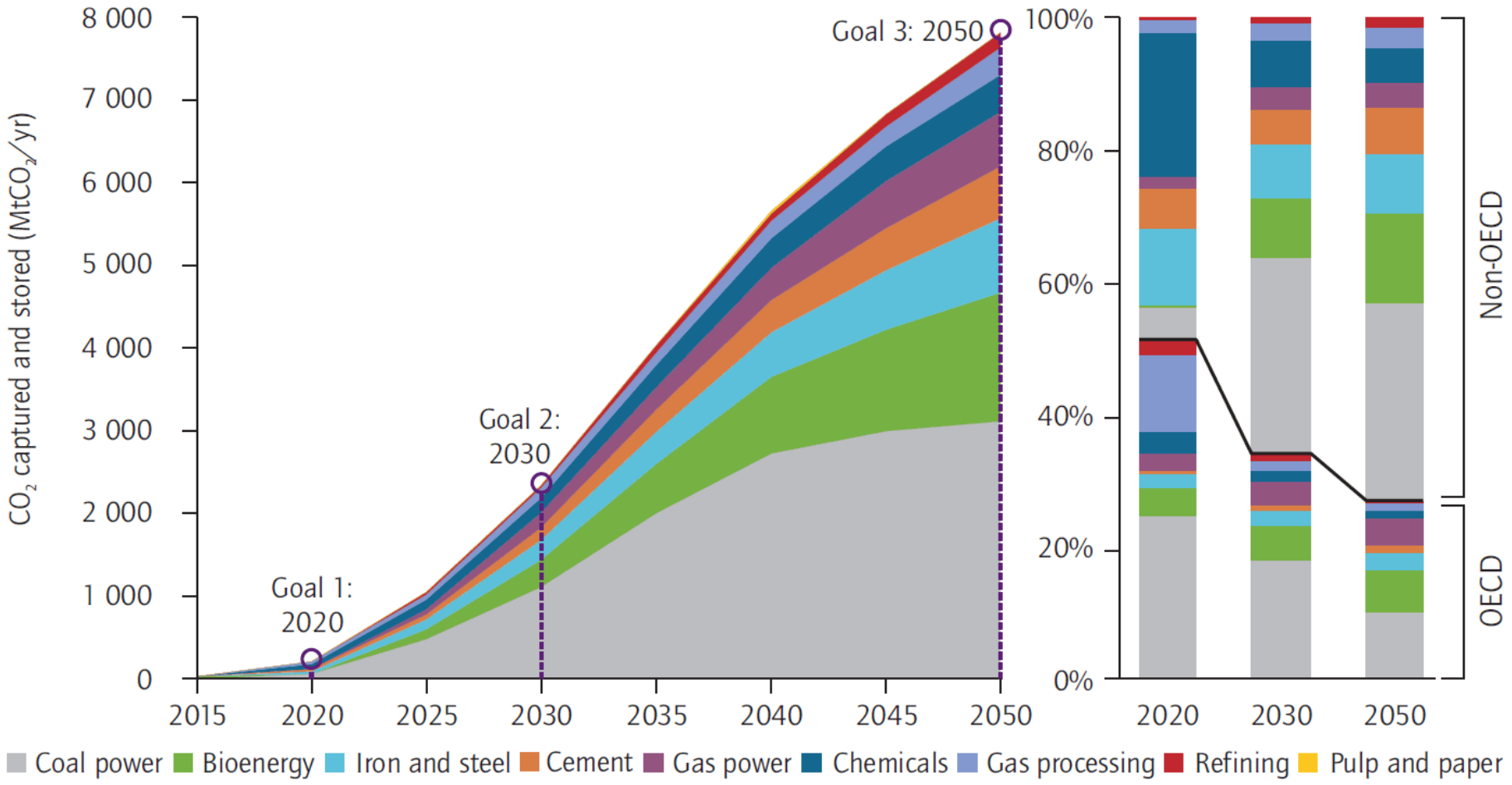
Saskatchewan, Canada, 2 October 2014
SaskPower Boundary Dam Unit 3 official opening

Lignite fuel, ~ 1MtCO_2/yr being sold for EOR

- Shell Cansolv amine capture technology, Additional units planned - Looking for 30% reduction in capital costs. UKCCSRC R&D collaboration under MOU

Deployment requirements from the IEA CCS Roadmap (2013)

CCS in the power and industrial sectors in the 2DS



Conclusions

Typical stages in power plant clean-up technologies:

1. 'It's science fiction!'
2. 'It's impossibly expensive and complex!'
3. 'It's a major investment but necessary.'
4. 'It's obviously just a routine part of any power plant.'

CCS is now in early stage 3 and we are working hard to get it to stage 4 as quickly as possible.

CCS gives a critical option for achieving zero emissions

- Can expect 2nd generation projects to appear soon that are based on 1st generation projects and that benefit from learning-by-doing ….
- Also developing carbon dioxide removal using biomass and CCS and direct air capture.
- But CCS started recently and there is still only a small amount of activity.
- So CCS needs to be developed to give tens of second and third generation projects to become a serious option that can help resolve future climate change negotiations.