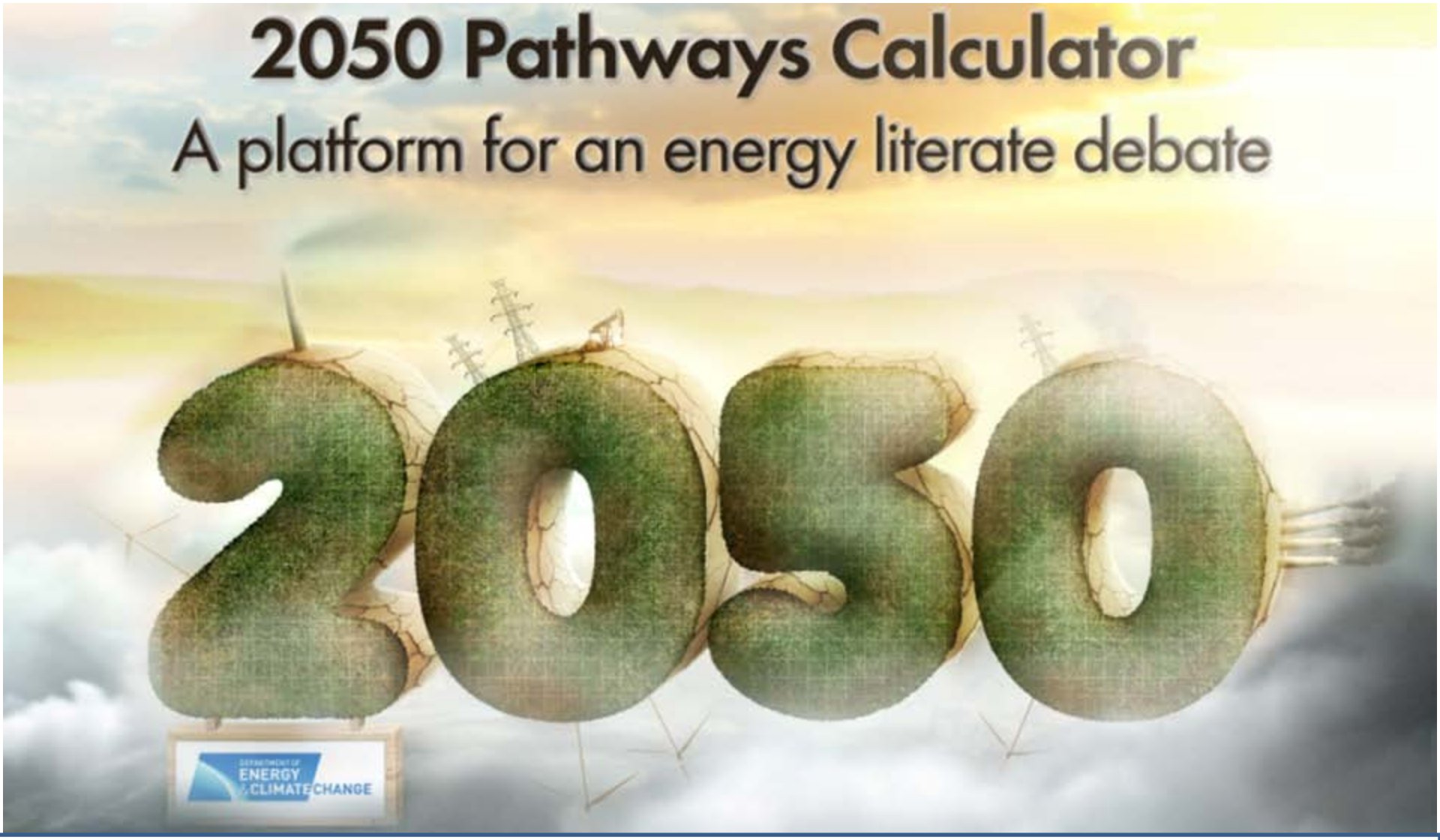
2050 Pathways Calculator

A platform for an energy literate debate



UK Government's and other international approaches on modelling energy development and emissions challenges of the future

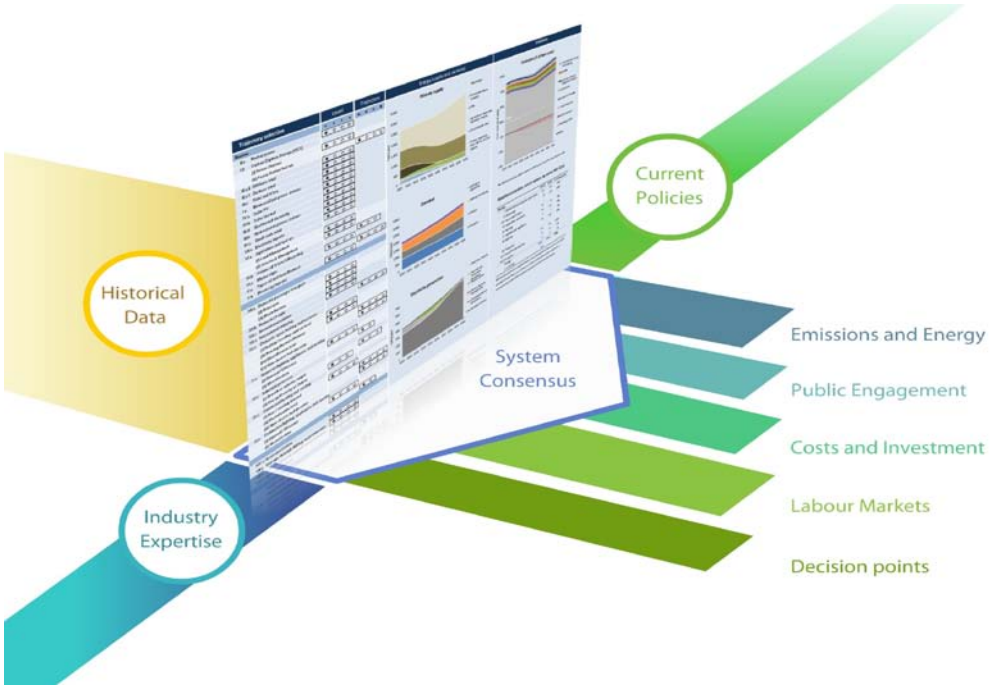
Friday 30th November 2012; 18.30 - 20.00; Doha Climate Change Conference

Dr Jan Ole Kiso
Strategy and Communication Directorate to the UK Department of Energy and Climate Change

http://decc.gov.uk/2050

2050 Pathways Calculator

- The Challenge
- UK 2050 Pathways
- China 2050
- Next Steps



Why think now about 2050?

TV – 7 years average lifetime

Car – 13 years average lifetime

Gas Boiler – 10 to 20 years average lifetime

Aeroplane – 30 year average lifetime

For electrification of road transport current **fuel infrastructure** would have to be replaced.

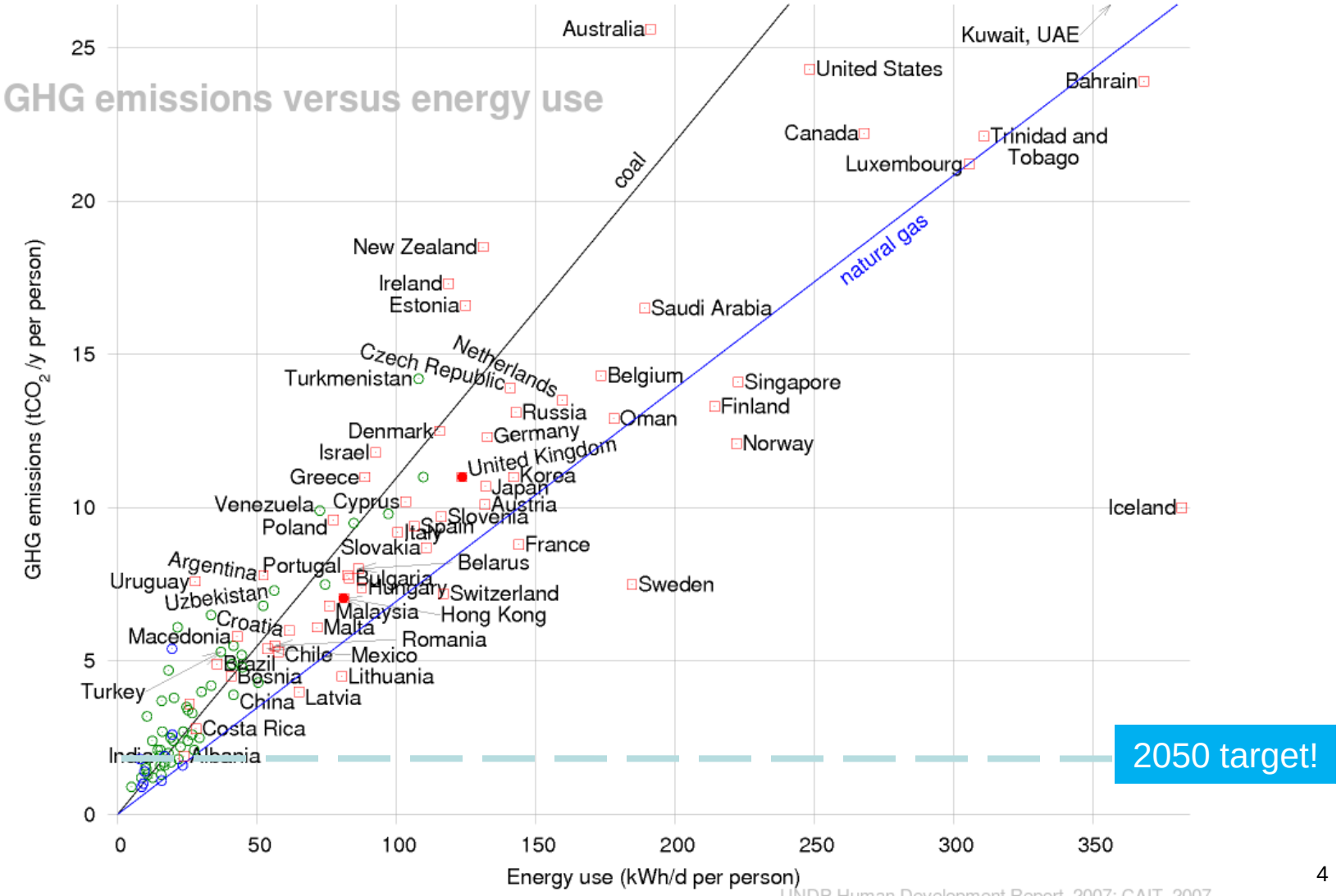
Current gas infrastructure in streets and within homes would have to be replaced. This therefore only likely to happen once.

Nuclear Power Station – 30 to 40 years lifetime

Coal Power Station – 40 to 50 years lifetime

It is important to manage the risk of locking in ‘dirty’ technologies to ensure we can meet our 2050 target – equally, new technologies should not be locked-out just for being new.

Scale of the international 2050 challenge – breaking the link between energy use and emissions

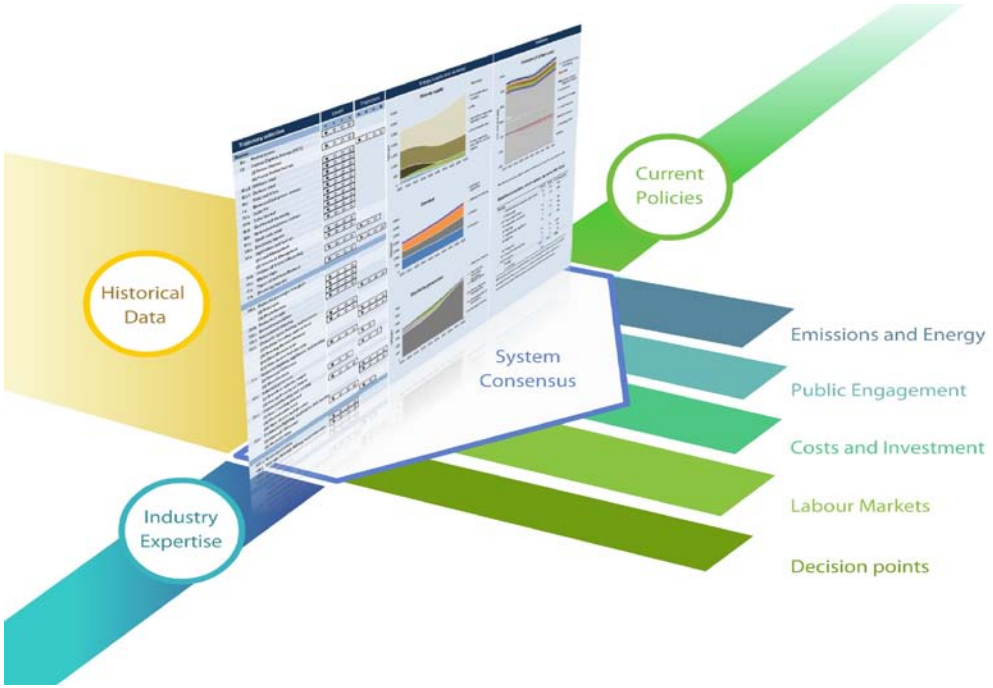


From David MacKay – 'Sustainable energy without the hot air'

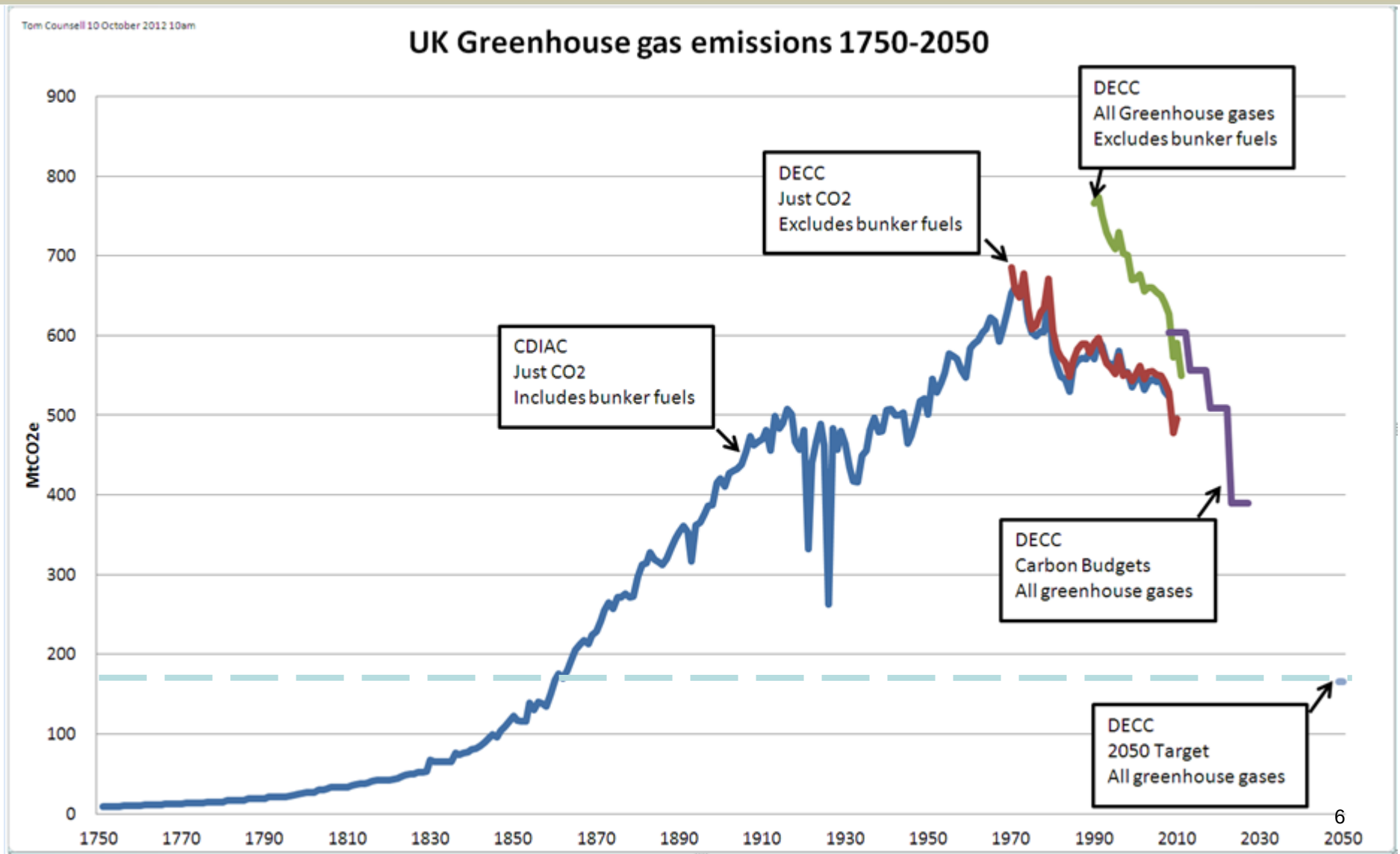
UNDP Human Development Report, 2007; CAIT, 2007

2050 Pathways Calculator

- ☑ The Challenge
- ■ UK 2050 Pathways
- ❑ China 2050
- ❑ Next Steps



Scale of the 2050 challenge for a developed economy – UK example



What is the 2050 Calculator approach?

2050 Analysis

- All energy and all GhG emissions options calculated in an easy-to-use and open-access model
- Understanding what can 'happen on the ground' from an engineering and land-use perspective
- Aim is to better understand trade-offs, impacts and scales of change in a holistic way

2050 UK Outputs

Product	My2050	Web Tool	Excel Spreadsheet
Audience	• Educational tool • and initial engagement for members of the public	• Technical expert stakeholders • and well-informed public	• Technical expert stakeholders • and policy-makers

Complexity

We are committed to a collaborative and open-source approach

DEPARTMENT OF ENERGY & CLIMATE CHANGE

Some of the UK 2050 Pathway Analysis Contributors

- All views from credible stakeholders have been taken on board
- Organisations with different perspectives can model their future by using the UK 2050 Calculator.
- All analysis and software is open-source and for all to use

Aim to create a platform for an ‘energy-literate debate’

Demo of 2050 Pathways Calculator's common messages

See:
http://2050-calculator-tool.decc.gov.uk/pathways/11111111111111111111111111111111111111111111111111/primary_energy_chart

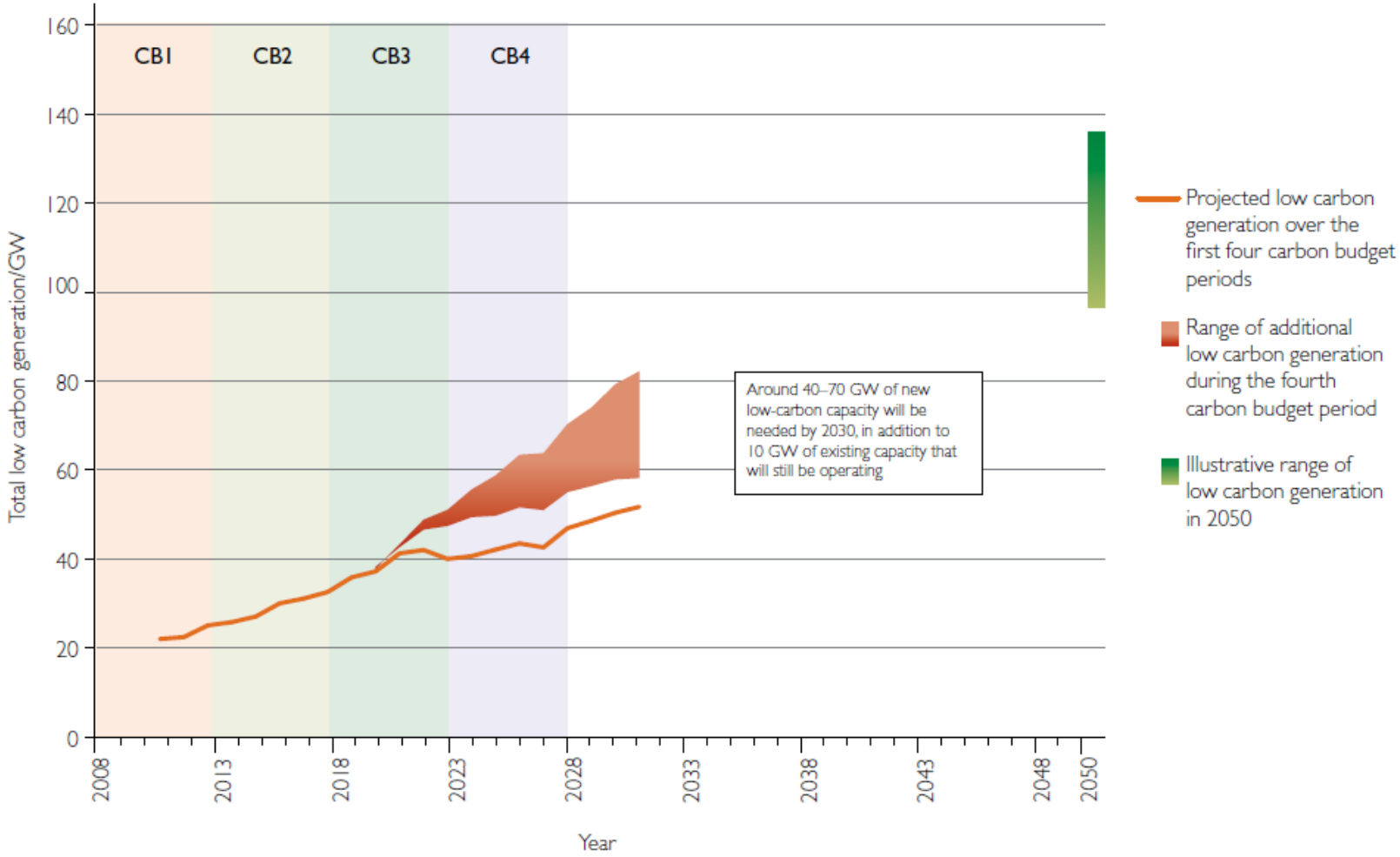
‘2050 Common messages’ emerged out of the UK 2050 Pathways Calculator

1	Ambitious per capita energy demand reduction is needed – but is not sufficient
2	Substantial electrification of heating, transport and industry is needed
3	Electricity supply needs to be almost totally decarbonised, while supply may also need to double
4	A growing level of variable renewable generation increases the challenge of balancing the electricity grid
5	Sustainable bioenergy is a vital part of a low carbon energy system
6	Reduction in emissions from agriculture, waste, industrial processes and international transport will be necessary by 2050
7	Fossil fuels will continue to play an important role
8	Costs of tackling climate change can be less than not tackling climate change

For each sector the UK Carbon Plan sets out ambitious deployment targets out to 2027 and a range to 2050

DEPARTMENT OF ENERGY & CLIMATE CHANGE

Chart 4: Projected deployment of low carbon generation over the first three carbon budgets and illustrative ranges of deployment potential in the fourth carbon budget period and in 2050



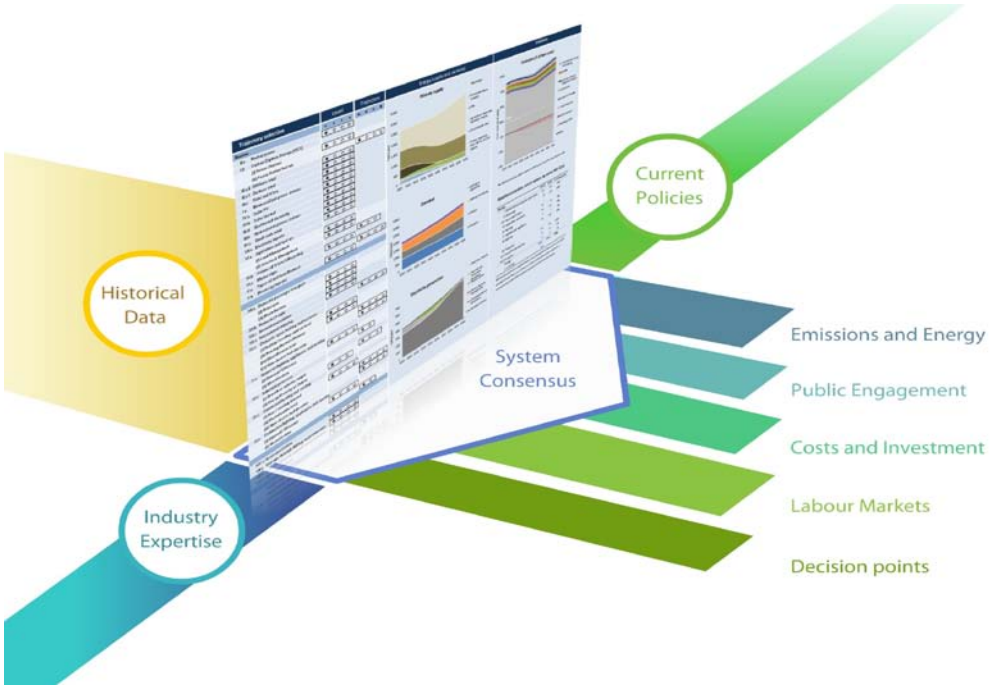
UK Government now has a plan that 'adds-up' to an 80% GhG emission reduction in 2050

DEPARTMENT OF ENERGY & CLIMATE CHANGE

	Cost Optimised	Renewables; more efficient	Nuclear; less efficient	CCS; more bioenergy
Electricity	33 GW nuclear 18 GW wind 28 GW CCS 27 GW other renew 33 GW gas	 16 GW nuclear 82 GW wind 13 GW CCS 14 GW solar 10 GW marine 24 GW back-up gas	 75 GW nuclear 20 GW wind 2 GW CCS 2 GW hydro 11 GW back-up gas	 20 GW nuclear 34 GW wind 40 GW CCS 2 GW hydro No back-up gas
Buildings	Heating mix of heat pumps, resistive heat, biomass pellets, district heat	 7.7m SWIs, 8.8m CWIs, 100% house-level heating systems	 5.6m SWIs, 6.9m CWIs, 90% house-level heating systems, 10% network-level	 5.6m SWIs, 6.9m CWIs, 50% house-level heating systems, 50% network-level
Transport	75% ULEVs, unclear on modal shift	 100% ULEVs, high modal shift	 80% ULEVs, 20% ICEs, low modal shift	 65% ULEVs, 35% ICEs, medium modal shift
Industry	Medium growth, over half of emissions captured by CCS	 Medium growth, 48% of emissions captured by CCS	 Medium growth, 0% of emissions captured by CCS	 Medium growth, 48% of emissions captured by CCS
Bioenergy and land use	~350 TWh of bioenergy, low ambition on land mgmt	 181 TWh of bioenergy, low ambition on land mgmt	 461 TWh of bioenergy, high ambition on land mgmt	 471 TWh of bioenergy, medium ambition on land mgmt

2050 Pathways Calculator

- ☑ The Challenge
- ☑ UK 2050 Pathways
- ■ China 2050
- ❑ Next Steps



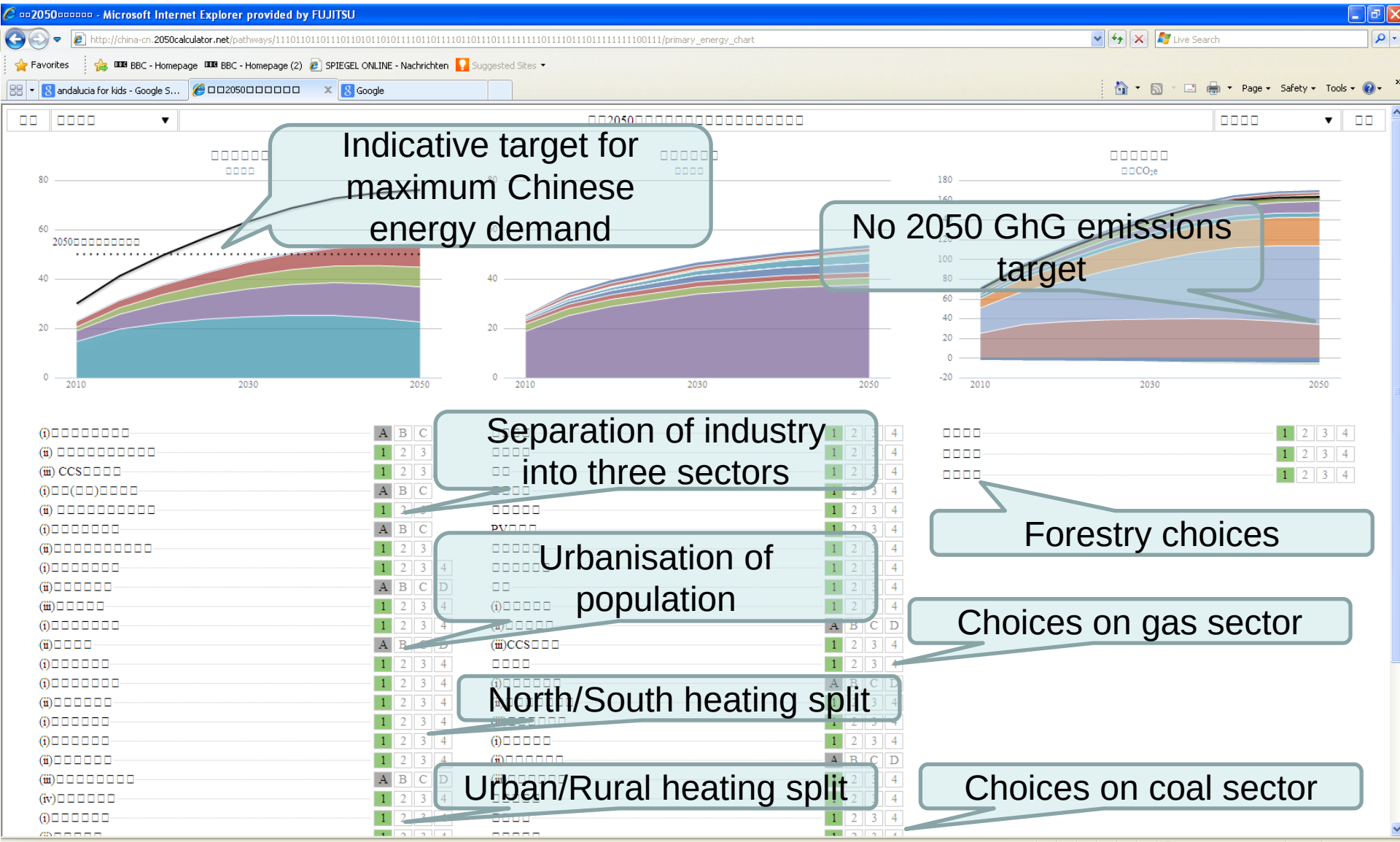
How long has the UK/China 2050 cooperation been going on for?

- China 2050 Calculator was developed by the Energy Research Institute of the National Development and Reform Council (NDRC) from the People's Republic of China
- The China 2050 webtool is published under http://2050pathway-en.chinaenergyoutlook.org/
- UK/China cooperation took around 2 years

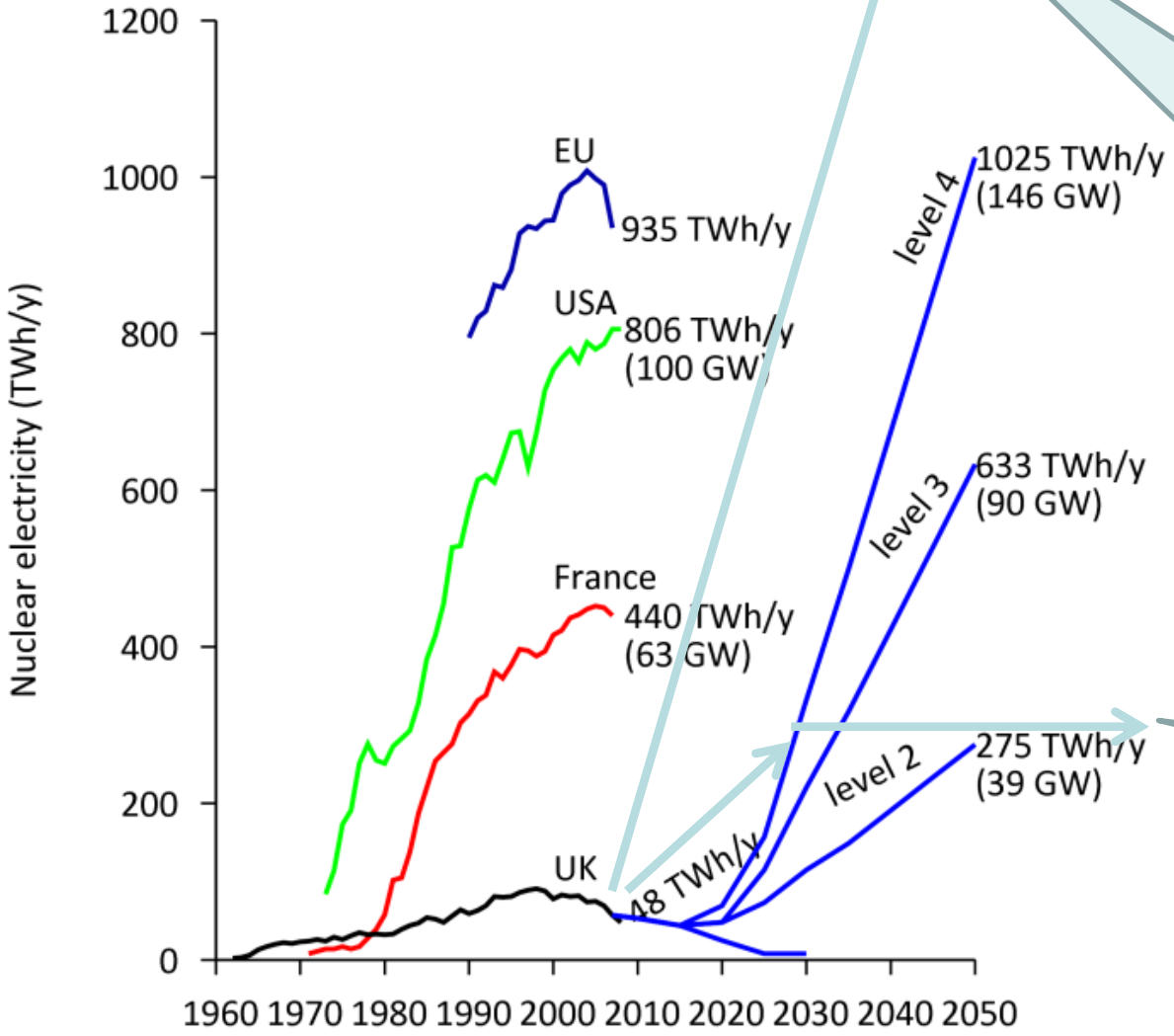
China 2050 Calculator was launched at the 'International Conference on 2050 Pathways' in September 2012 in Beijing

How did the China 2050 team adapt the Calculator approach?

DEPARTMENT OF ENERGY & CLIMATE CHANGE



Sector level example for nuclear

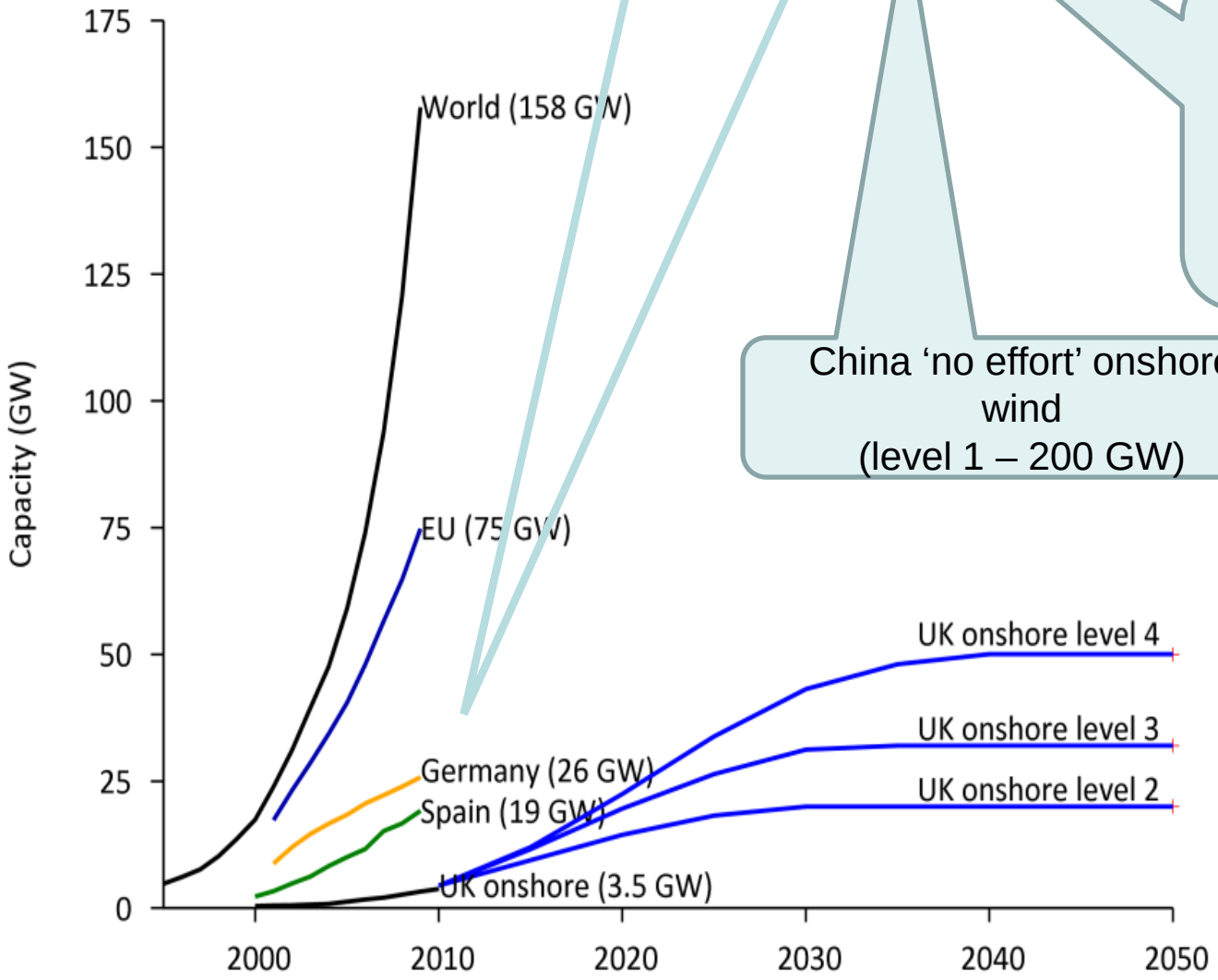


China maximum technical nuclear potential (level 4 – 450GW)

- Possible doubling of global capacity

China 'no effort' nuclear (level 1 – 50.8 GW)

Sector level example for onshore wind



China maximum technical onshore wind potential (level 4 – 1200 GW)

- Possible 5 fold of global capacity

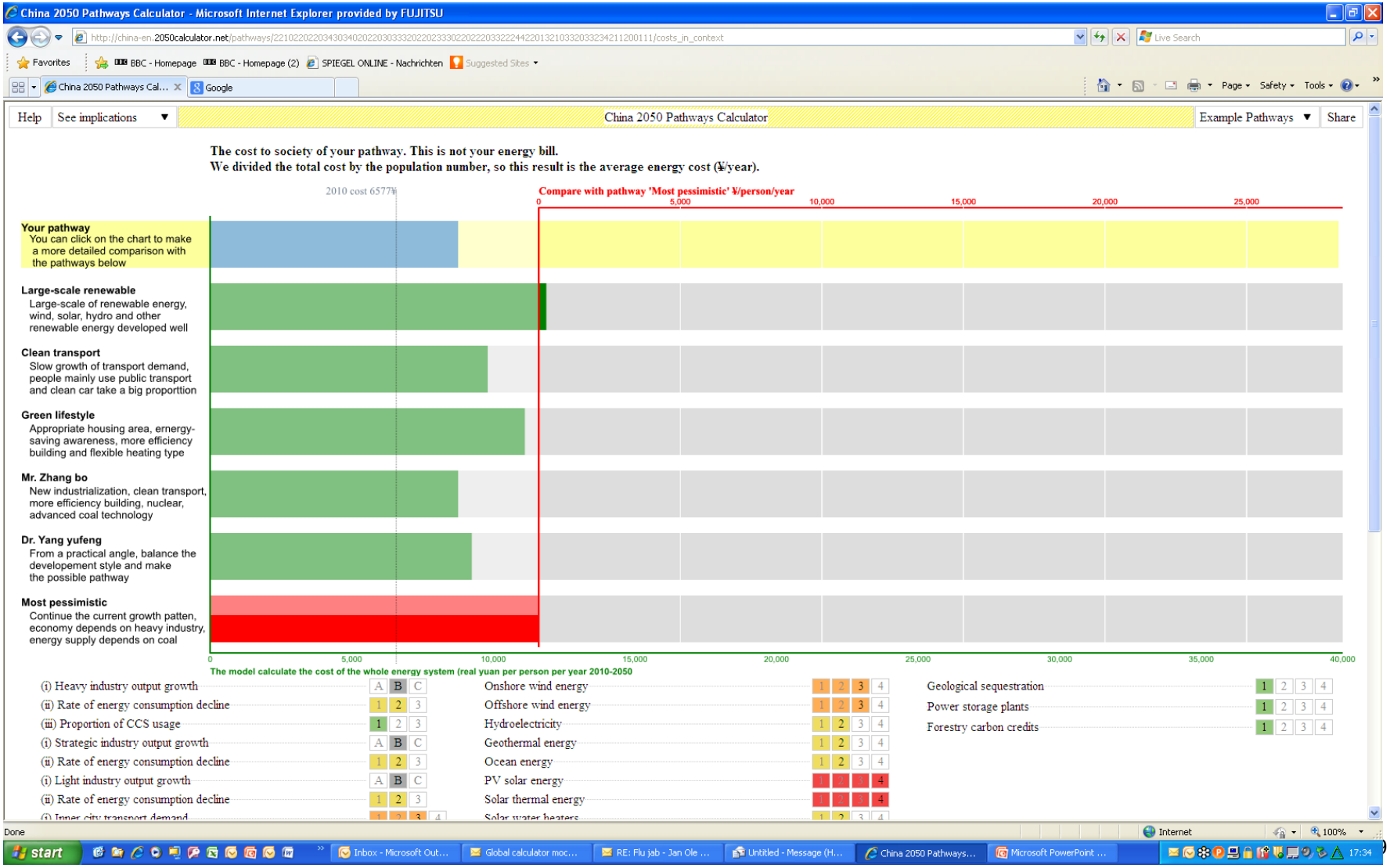
China 'no effort' onshore wind (level 1 – 200 GW)

What implications, if any, can we draw on emissions reduction potential?

Caution: The analysis does not at the moment include industrial emissions, which could add up to 1 Gt CO_2e to the 2010 baseline

- Major challenge in increasing industry energy efficiency
- Gradual decarbonisation of grid
- Move away from high-carbon coal into, possibly, gas
- Demand sectors like transport and heating relatively small, but important decisions to be made today about their future direction

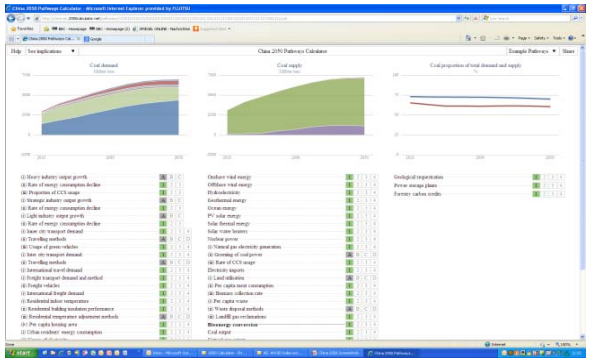
It appears that action is cheaper than inaction



Do nothing option also is not attractive from an energy security perspective

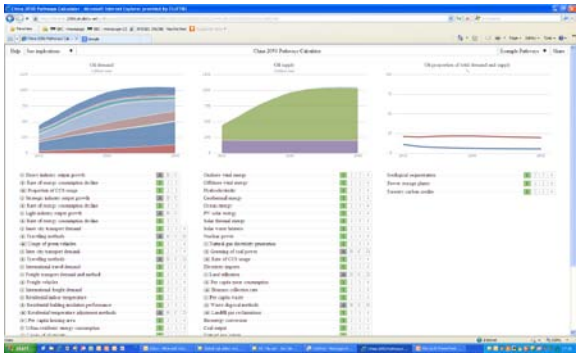
DEPARTMENT OF ENERGY & CLIMATE CHANGE

Coal



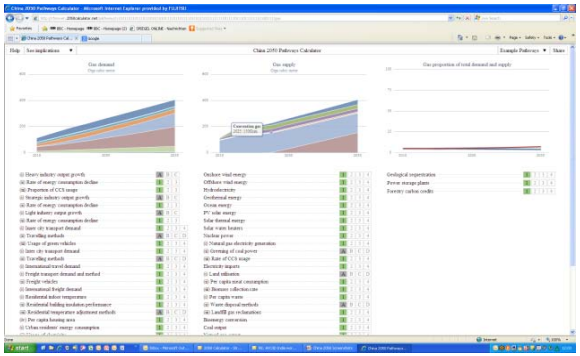
- Domestic coal production might double
- Coal imports might ten-fold
- Coal one of the main drivers of costs

Oil



- Domestic oil production stagnates
- Oil imports might four-fold
- Oil imports main cost driver and source of insecurity

Gas

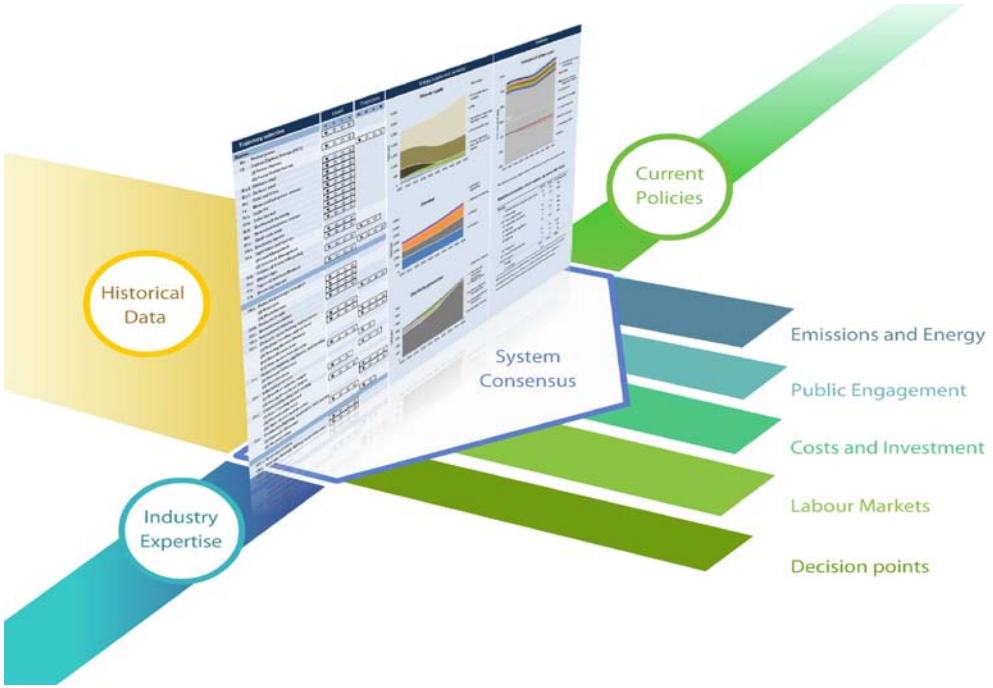


- China becomes gas net importer in 2025 and imports nearly a third of demand in 2050
- Limited role for shale gas

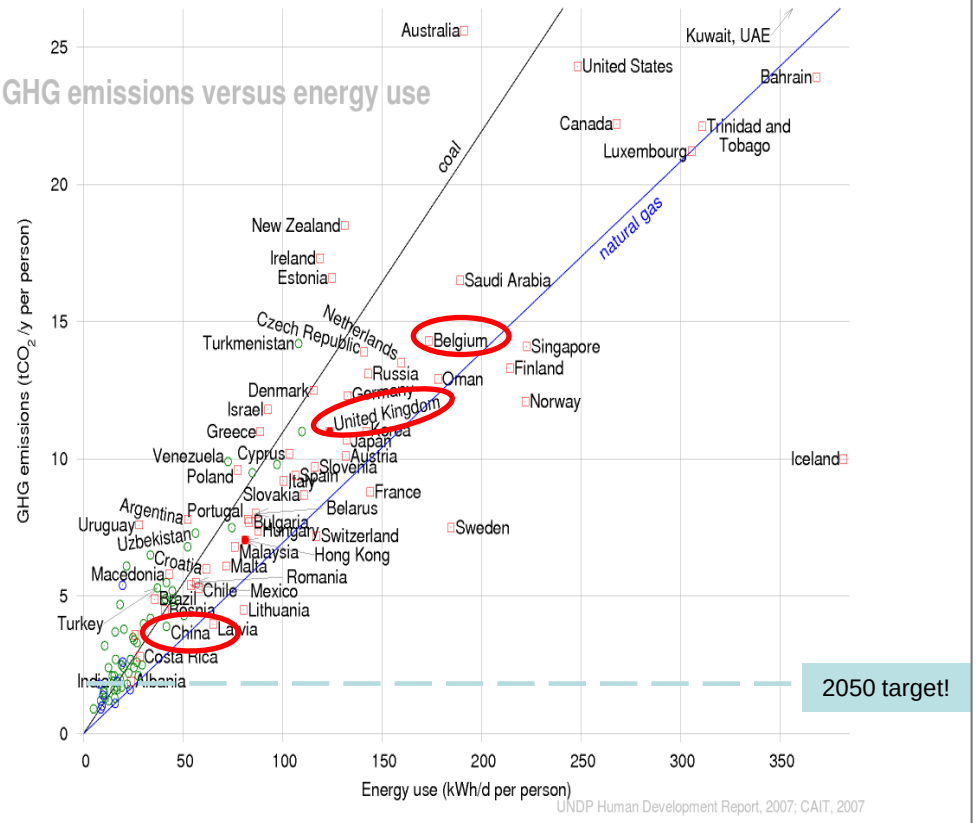
China 2050 Calculator indicates a do nothing scenario is unattractive from an energy security, costs and emissions perspective

2050 Pathways Calculator

- ☑ The Challenge
- ☑ UK 2050 Pathways
- ☑ China 2050
- ■ Next Steps



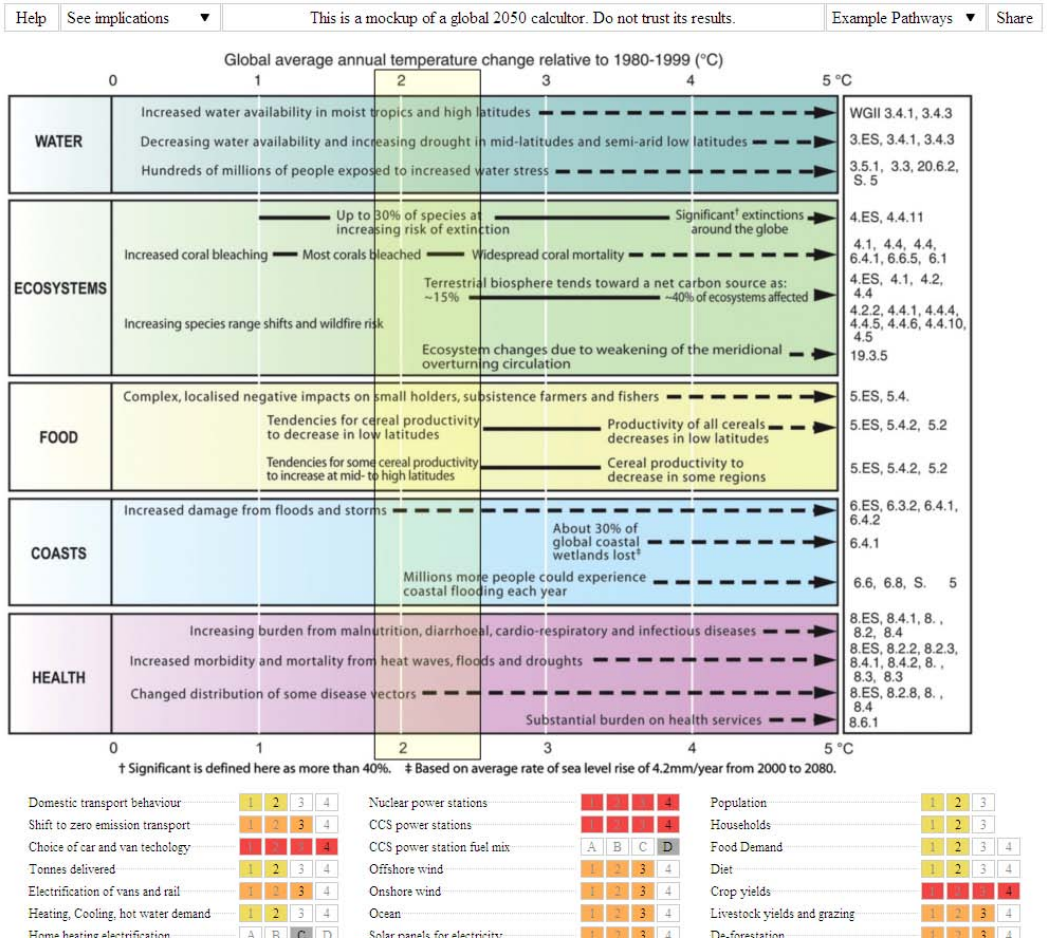
We are hoping to work with more partners on the 2050 Calculator Pathways challenge



- Expanding and building on the 2050 Calculator initiatives so far, DECC will assist ten developing country governments to build strategic platforms toward a low carbon future.
- DECC is happy to support, advise and provide software for national initiatives in other countries.
- Our 2050 Calculator partners in Belgium, China, South Korea, South Africa and Bangladesh are also happy to share their experiences so far.

From David MacKay – 'Sustainable energy without the hot air'

Can we link climate science directly with energy and land-use choices?



- DECC is considering a Global Calculator which links our global energy and land-use choices with impacts on:
  - ➢ Global fossil fuel resources
  - ➢ Climate impacts
  - ➢ Land-use change and availability!
- Let us know if you are interested

Can we include in our language engineering aspiration?

By focusing on the engineering challenge we hope to:

- **Bring the energy community closer to the climate challenge**
- **Create aspirational targets of action, rather than focus on reductions/limitations**
- **Make the challenge more understandable to the non-expert**