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



Why think now about 2050?





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



UNDP Human Development Report, 2007; CAIT, 2007

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2050 Pathways Calculator



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 openaccess 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



We are committed to a collaborative and open-source approach





- 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



'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



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



	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	~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 meant



2050 Pathways Calculator



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://2050pathwayen.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?









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 highcarbon 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



 China 2050 Pathways Calculator - Microsoft Internet Explorer provided by FUJITSU China 2050 Pathways Calculator - Microsoft Internet Explorer provided by FUJITSU http://china-en.2050calculator.net/pathways/22102202203430340202203333022022333022022333022022333022022	- <mark>- X</mark>
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Do nothing option also is not attractive from an energy security perspective



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- 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
- 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

Gas

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2050 Pathways Calculator



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.

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- 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.

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



Help See in	nplications This is a mockup of a global 2050 calcultor. Do not trust its results.	Example Pathways Share	
	Global average annual temperature change relative to 1980-1999 (°C) 0 1 2 3 4	5 °C	
WATER	Increased water availability in moist tropics and high latitudes Decreasing water availability and increasing drought in mid-latitudes and semi-arid low latitudes — — Hundreds of millions of people exposed to increased water stress — — — — — — — — — — — — — — — — — —	WGII 3.4.1, 3.4.3 3.ES, 3.4.1, 3.4.3 3.5.1, 3.3, 20.6.2, S.5	 DECC is considering a Global Calculator which links our global
ECOSYSTEMS	Up to 30% of species at	4.ES, 4.4.11 4.1, 4.4, 4.4, 6.4.1, 66.5, 6.1 4.ES, 4.1, 4.2, 4.4 4.2, 2, 4.4, 4.4, 4.4, 5, 4.4, 6, 4.4.10, 4.5 19.3.5	energy and land-use choices with impacts on:
FOOD	Complex, localised negative impacts on small holders, subsistence farmers and fishers Tendencies for cereal productivity Productivity of all cereals to decrease in low latitudes Tendencies for some cereal productivity Cereal productivity to to increase at mid- to high latitudes decrease in some regions	5.ES, 5.4. 5.ES, 5.4.2, 5.2 5.ES, 5.4.2, 5.2	Global fossil fuel resources
COASTS	Increased damage from floods and storms About 30% of global coastal wetlands lost ⁴ Millions more people could experience	6.ES, 6.3.2, 6.4.1, 6.4.2 6.4.1 6.6, 6.8, S. 5	Climate impacts
HEALTH	Increasing burden from main utrition, diarrhoeal, cardio-respiratory and infectious diseases — — • Increased morbidity and mortality from heat waves, floods and droughts — — — — — — — — — — — — — — — — — — —	8.ES, 8.4.1, 8., 8.2, 8.4 8.ES, 8.2.2, 8.2.3, 8.4.1, 8.4.2, 8., 8.3, 8.3 8.ES, 8.2.8, 8., 8.4 8.6.1	Land-use change and availability!
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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