

**Iterative UK energy modelling and policy making:
2000 Royal Commission to the 2008 Climate Change Bill**

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Barclays Premier League : Table
Monday, 8 December 2008 21:56 UK

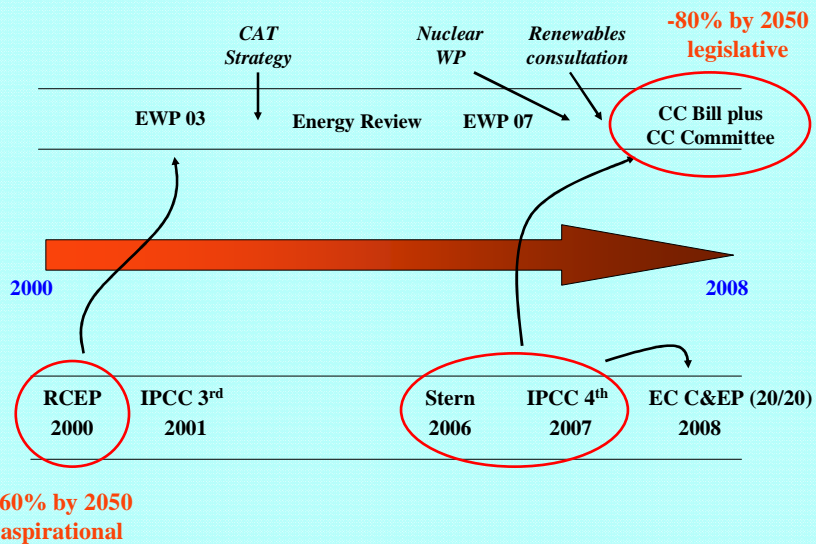
Team	P	Home					Away					GD	PTS
		W	D	L	F	A	W	D	L	F	A		
1 Liverpool	16	5	3	0	11	4	6	1	1	13	5	15	37
2 Chelsea	16	3	3	2	14	5	8	0	0	21	1	29	36
3 Man Utd	15	6	1	0	19	4	3	3	2	8	6	17	31
4 Arsenal	16	5	1	2	15	10	4	1	3	13	9	9	29
5 Aston Villa	16	3	4	1	10	7	5	0	3	15	11	7	28
6 Hull	16	3	2	3	9	15	4	3	1	15	10	-1	26
7 Portsmouth	16	4	2	2	13	10	2	3	3	6	13	-4	23
8 Everton	16	1	3	4	9	15	5	1	2	13	10	-3	22
9 Fulham	15	5	2	1	11	6	0	3	4	2	6	1	20
10 Bolton	16	2	2	4	6	9	4	0	4	12	10	-1	20
11 Wigan	16	3	2	3	6	9	2	2	4	12	11	-2	19
12 Middlesbrough	16	3	2	3	8	12	2	2	4	8	11	-7	19
13 Stoke	16	5	1	2	12	10	0	3	5	5	17	-10	19
14 Man City	16	4	0	4	19	9	1	3	4	11	15	6	18
15 Tottenham	16	3	1	4	7	7	2	2	4	12	14	-2	18
16 West Ham	16	3	1	4	11	13	2	2	4	6	11	-7	18
17 Newcastle	16	3	3	2	13	11	0	4	4	6	13	-5	16
18 Sunderland	16	2	1	5	7	13	2	2	4	6	12	-12	15
19 Blackburn	16	1	2	5	5	15	2	2	4	12	16	-14	13
20 West Brom	16	2	2	4	9	15	1	1	6	3	13	-16	12

UK policy matrix

		Energy White Paper (2007)			
		Climate change mitigation	Energy security	Fuel poverty	Competitive energy markets
Stern Review (2006)	Carbon pricing (tax, trading or regulation)	Up	Up	Down	Down
	Innovation policies (low carbon and efficiency techs)	Yes	?	?	No
	Behaviour change (esp. barriers to energy efficiency)	Yes	?	Yes	No

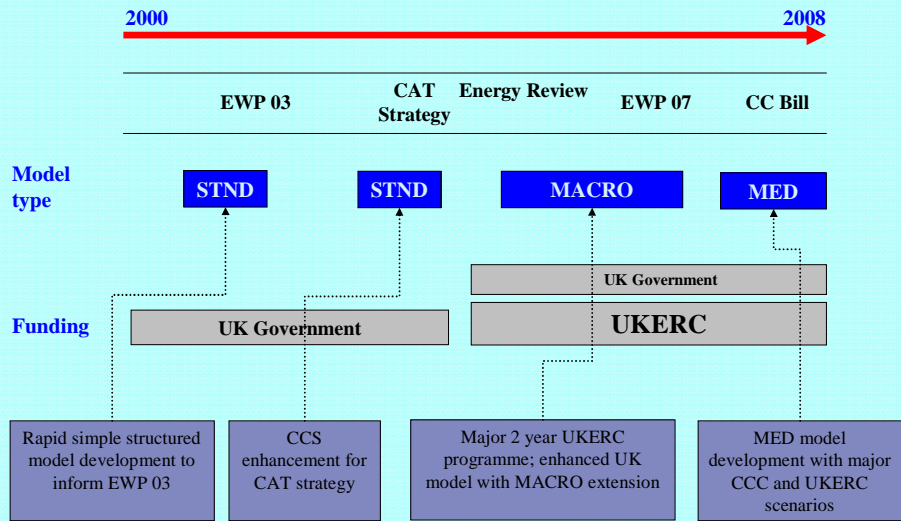
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UK energy policy timeline



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MARKAL modelling for UK policy



Major modelling reports

- MARKAL
 - Energy White Paper 2003; DTI
- MARKAL-Macro
 - Energy White Paper 2007; BERR / DEFRA
 - Climate Change Bill Impact Assessment; DEFRA, 2007
 - 80% Vision; IPPR / WWF 2007
 - Japan-UK Low Carbon Societies project, UKERC/DEFRA/NIES; 2008
- MARKAL MED
 - *Building a low-carbon economy - the UK's contribution to tackling climate change (2008)*, Committee on Climate Change
 - *Pathways to a Low Carbon Economy: What will it take for the UK?, 2008*; UKERC Energy 2050 Project
- Documentation and stakeholder engagement – www.ukerc.ac.uk

Modelling journal publications

- Strachan N., S. Pye and R. Kannan (2008) *The Iterative Contribution and Relevance of Modelling to UK Energy Policy*, **Energy Policy**, doi: 10.1016/j.enpol.2008.09.096
- Strachan N. and R. Kannan (2008) *Hybrid Modelling of Long-Term Carbon Reduction Scenarios for the UK*, **Energy Economics**, Vol. 30, No. 6 pp. 2947-2963
- Strachan N., S. Pye and N. Hughes (2008) *International Drivers of a UK Evolution to a Low Carbon Society*, **Climate Policy**, Vol. 8, S125-S139
- Strachan N., N. Balta-Ozkan, D. Joffe, K. McGeevor, and N. Hughes (2008) *Soft-Linking Energy Systems and GIS Models to Investigate Spatial Hydrogen Infrastructure Development in a Low Carbon UK Energy System*, **International Journal of Hydrogen Energy**, doi:10.1016/j.ijhydene.2008.10.083
- Kannan R. and Strachan N. (2008) *Modelling the UK residential energy sector under long-term decarbonisation scenarios: Comparison between energy systems and sectoral modelling approaches*, **Applied Energy**, doi: 10.1016/j.apenergy.2008.08.005

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Scenario progression

Cluster 1 (60%, < barriers)	Cluster 2 (80%, < barriers)
60% reduction, fewer barriers Central case, Alternative trajectory, BERR assumptions, Low / high energy prices, Lower ESI costs	80% reduction, fewer barriers Central case, Alternative trajectory, BERR assumptions, Low / high energy prices, Overseas credits available
Cluster 3 (60%, > barriers)	Cluster 4 (80%, > barriers)
60% reduction, increasing barriers No new nuclear, No new nuclear / CCS, Restricted innovation to 2010 / 2020 levels, Higher ESI costs	80% reduction, increasing barriers No nuclear, no nuclear / CCS, Restricted innovation to 2010 / 2020 levels, Biomass constraints, International aviation included

(2008 CCC and UKERC)

Target stringency, cumulative constraints, no CCS/nuclear, renewables policy, international emission credits, sunk investments, discounting and hurdle rates

Key messages - UK policy studies

- Value of an energy systems approach
 - All sectors contribute to mitigation
 - Dynamic trade-offs between sectors,
 - Technology vs. behavioural responses
- Electricity generation sector has an early and key role to play in decarbonisation efforts
 - Linkages to transport and buildings
- Stringent decarbonisation targets are feasible
 - Consistent and high CO₂ price signal
 - Overall economic impacts by 2050 are not cost prohibitive
- Modelling provides **insights not answers**
 - Alternate/complementary modelling approaches required
 - Education of stakeholders and technical staff in policy positions

Post 2008 model development for evolving UK policy

- MARKAL / TIMES migration
- Model linkages with E3MG, CGE, CGEN / WASP, end-use sectoral models
- Assessment of uncertainty
 - staged foresight, stochastic programming
- Multi-regional modelling
 - UK regions (London), UK within global system
- Integrated assessment (GHGs & land-use, plus AQ)
- Macro-economic interactions
- Infrastructure depiction (spatial modelling)
- Energy service demands (e.g., agent based)