UK Energy Policy: Secure, Sustainable, Sane?

Dr Ian Fairlie Consultant on Radiation in the Environment London, United Kingdom www.ianfairlie.org Background scene-setting UK Electricity Supply Policy Peak Oil Demand and Supply Nuclear Power Recent Labour promise to freeze energy prices

Whither UK Energy Policy?

How to deal with dwindling world reserves of crude oil/gas? How to meet future energy needs, safely and economically? Especially new needs for electricity? How to respond to global warming? Need for Jobs? Fuel Poverty?

Rapid Changes in EU Energy Scene

Energy demand is falling in EU countries Local communities taking control RE costs down: fossil / nuclear costs up RE with zero marginal costs is putting big pressures on fossil / nuclear in Germany Shale gas/oil has caused big changes in US EU next?

Peak Oil

Very little hard data on reserves/resources
But very important issue
Likely reached in 2006
Leggett's book "The Energy of Nations"





a. Some Background (Global)

1. World Energy Use by Source



2. How much RE available globally?

Annual Global Energy; flows and sources Exajoules (EJ) = 1 billion billion joules (10¹⁸ joules) Data: Boyle G (ed) 2012 Renewable Energy 3rd edn (Oxford University Press)

Total incoming energy from sun	5,400,000	2 Card State
Solar radiation (air, land and oceans)		2,650,000
Hydrological cycle (rain feeding rivers)		1,080,000
Wind convection (hence also waves)		11,700
Photosynthesis (in biomass)		1,300
Geothermal (conduction from hot rocks)	and the	1,000
Ocean tides (gravitational)		100
Available for mankind's use	3,744,000	21 10 10
For comparison:	500	
annual global energy use now	~1/7,500	

3. Global RE Power Capacities



4. Gov't Subsidies: Fossil vs RE

dhttp://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8668.pdf

Figure 10: E11 climate finance provided, as compared with domestic fossil fuel subsidies²⁵

OURCE: OECD (2012), IEA (2012) AND (SS (2012)

23,200



n/a

Russia³⁶ United States Australia Germany United France Canada Italy Spain Portugal Japan (2010) Kingdom



Fossil fuels subsidies (\$ million 2011)



Climate finance delivered average annual (\$ million 2010-2012)

b. UK Electricity Scene

Cut Demand vs Increase Supply?

In 2011, UK Gov'ts Revised Overarching National Policy Statement = doubling of installed electricity gen capacity by 2050

http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/consents-planning/nps2011/1938-overarching-nps-for-energy-en1.pdf

In 2011, German Gov't = seek 25 % cut in electricity consumption by 2050

http://www.bmu.de/fileadmin/bmu-import/files/english/pdf/application/pdf/energiekonzept_bundesregierung_en.pdf

UK Electricity Sources 2013



www.gov.uk/government/uploads/system/uploads/attachment_data/file/249679/et_sep_13.PDF

Chart 5.1 Electricity generated by fuel type



https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/249679/et_sep_13.PDF

RE capacity in UK

http://en.wikipedia.org/wiki/Renewable energy in the United Kingdom



Year

Electricity Generated by RE in UK



Year

UK Windfarm Growth



Which direction?

•Globally, in last decade, >30 GW nuclear closed, 80 GW wind + 80 GW solar thermal has been installed •Germany, Switzerland, Italy, Japan all exiting nuclear •Germany now has >30 GW wind capacity •Denmark generates >30% of its electricity from wind (40% from all RE) and has no nuclear power

% Renewable Energy Use and 2020 Targets

http://www.eurobserver.org/pdf/bilan12.asp	2010 Actual	2020 Target
Sweden	47.6%	49%
Denmark	40*	30
Finland	33.0	38
Austria	30.9	34
Portugal	26.8	32
Germany	25*	25
Spain	15.1	20
France	13.3	23
Italy	11.2	17
Belgium	5.6	13
Netherlands	4.4	14
United Kingdom	3.8	15* (now removed)
Malta	0.4	10
EU overall 2020 energy target		20

Wind capacity GW

China*	75
US	60
Germany	31
Spain	23
India	18
UK	8
Italy	8
France*	7

c. Nuclear Power

Does nuclear provide an answer to CO₂ emissions? Fukushima, Chernobyl? High costs of nuclear Recent proposed agreement with **EdF and Chinese Government**

Is nuclear a cost effective way to reduce CO₂ emissions ?

How To Mitigate Climate Change

- 1. Renewable energy
- 2. High efficiency tech, eg CHP, smart grids
- 3. CO₂ sequestration
- 4. Low carbon fuels, eg gas not coal
- 5. Greater energy efficiency
- 6. Nuclear power



The Role of Nuclear Power in a Low Carbon Economy http://www.sd-commission.org.uk/publications.php?id=344 (March 2006)

• estimated a 10 GW replacement nuclear programme would displace 6.7 tonnes C, ie a 4%-8% cut in CO₂ emissions from 1990 levels (165 tonnes C)

if only one station ~1%-2%

 concluded "Nuclear power is not the answer to tackling climate change ..." <u>http://www.sd-commission.org.uk/pages/060306.html</u>

Nuclear Construction Costs – extremely high

proposed Hinkley C ~ £16 billion 1.5 times cost of 2012 UK Olympics ~100 x higher than gas-fired equivalent requires enormous Government subsidies, insurance guarantees, R&D, and market interventions Eg Treasury guarantee of £10 billion

Date	Country	Government/	Nuclear Pull-outs, Closures,
	affected	Utility /Company	Withdrawals
Nov 2013	US	5 NPPs shut in 2012	Forbes predicts closure of 6 more NPPs
Oct 2013	UK	Iberdrola/GDF Suez	Try to sell controlling interest in NuGen
Oct 2013	Canada	Ontario Government	Pulls out of new reactors at Darlington
Feb 2013	Bulgaria	Bulgarian Parliament	Abandons Belene NPP project
Feb 2013	Poland	Polish Government	Refuses to support NPP construction
Feb 2013	UK	Centrica, UK	Pulls out of EdF plans at Hinkley C
Dec 2012	France	Enel, Italy	Pulls out of Flamanville project
Oct 2012	UK	Areva, France	Pulls out of bid for UK Horizon
Oct 2012	UK	CGNPC, China	Pulls out of bid for UK Horizon
Oct 2012	UK	CNPTC, China	Pulls out of bid for UK Horizon
Oct 2012	World	Toshiba, Japan	Tries to sell ¹ / ₂ its Westinghouse shares
Sept 2012	Canada	Quebec Government	Announces closure of Gentilly-2 NPP
August 2012	Finland	Fennovoima	Six investors pull out of Fennovoima Oy
March 2012	UK	EON, RWE, nPower	Pull out from UK Horizon
Sept 2011	World	Siemens, Germany	Quits nuclear industry
May 2011	Switzerland	Swiss Government	To phase out nuclear power by 2034
May 2011	Germany	German Government	To phase out nuclear power by 2022
June 2011	Italy	Italian Government	94% voters oppose Gov't nuclear plans

Nuclear Generating Costs

Also very high due principally to high capital costs Recent proposed deal with EdF = £92.50 per MWh Double present cost Higher than all renewables Deal universally panned

IRENA global levelised costs 2012£/MWh

Hydroelectric	£20–35
Biomass (non-OECD)	£30–40
Geothermal	£30–60
Wind - on land	£50–80
Photovoltaic*	£70-90
Nuclear (EdF-Govt deal)	£92.50

http://www.irena.org/menu/index.aspx?mnu¼Subcat&PriMenuID¼36&CatID¼1 41&SubcatID¼261

Compare generating costs/ kW

Figure 1: Cost of new delivered electricity



Criticisms of Hinkley C Deal

The Energy Secy had let EdF "take the British	Lord Lawson,	The Times 8th Nov 2013 http://www.thetimes.co.uk/tto/busin
Government for a ride" over the "ludicrously high"	former Chancellor	<u>ss/industries/utilities/article3916199</u> ece
subsidy deal to fund the proposed £16 billion Hinkley		
nuclear plant		SEE MARKE
"Flabbergasted we are frankly staggered	Peter Atherton,	http://tinyurl.com/lfacr3c 30 th Oct 20
Hinkley will be the most expensive power station	Mulu Sun at	
in the world"	Liberum Capital	
"we could be staring at a truly astronomical cost	Nils Pratley	http://tinyurl.com/ot3uhuv Guardian 18 th Oct
by the end of the contract. 'The government surely	Guardian columnist	a horizan lice
can't be that dumb ,' comments one City analyst. One assumes not."		211-12-12-13
"When City analysts tell you a contract is	Caroline Lucas MP	http://tinyurl.com/ncfv9ph Guardian 30th Oct
'economically insane', it's time to admit that you	Contraction of the	
might have got it wrong."	and the set	Constant in the
"The Brits are crazy How can one build new	Claudia Roth,	http://tinyurl.com/pcptd6m Guardian 31 st Oct
nuclear plants when all the world understood, or	deputy speaker of	
should have understood, that Fukushima was not an	German Bundestag	
exception but part of the industry."	والانتقاد والمحادث	

More Raspberries

"the economics of the deal are simply bonkers. Appalling value for	George Monbiot,	http://tinyurl.com/q8bjwv5
money."	Guardian columnist	Guardian 21 st Oct
"The deal with EDF is so bad that my bet is that this is going to	Sir Jonathon Porritt,	http://tinyurl.com/q2hvh25
come badly unstuck."	former head at FoE	Independent 3 rd Nov
"The deal is a disastrous one for the UK, its taxpayers and energy	Oliver Tickell, The	http://tinyurl.com/jwddzs9
users. We will be locked into a punitively high electricity price, index-	Ecologist	Ecologist 21 st Oct 2013
linked, from 2025 to 2060."		
"Hinkley – a lousy template for nuclear Britain "	Alistair Osborne,	http://tinyurl.com/m6gmcz4
	Daily Telegraph	Telegraph 21 st Oct 2013
"Rarely have we seen a policy shrouded in so many what-ifs. [The]	Tony Lodge, Centre	http://tinyurl.com/qz3djun
deal shows the government and its negotiators were and are convinced	for Policy Studies	City AM 23rd Oct 2013
that electricity prices will double in the next decade and beyond. This is	1.	and the second second
naïve."	De El Cale	The second second
"Hinkley C is to be paid more than twice as much as German solar PV	Dr David Toke,	http://tinyurl.com/oern237
arrays"	Reader in Energy	27 th Oct 2013
	Politics Aberdeen U	
" a huge public contribution towards yesterday's energy thinking."	Alan Simpson, ex	http://tinyurl.com/q4wtmpq
	Labour MP	Int Business Times 23rd Oct
"Mr Davey. If there is no public subsidy for Hinkley C why are you	Tom Burke, former	http://tinyurl.com/pe9zfpq
having to make an application to the Brussels for state aid	advisor to Energy	Ecologist 26 th Oct 2013
clearance?"	Secretary	

How much CO₂ saved per \$



Nuclear vs photovoltaic

Solar-Nuclear Kilowatt-Hour Cost Comparison



increasing costs (per kW installed)



Sources:

Darlington construction costs, Ontario Hydro; Ontario Power Authority 2007; Standard & Poor and Moody's Investment Service; the Toronto Star.

Renewable Energy Cost Trends November 2005

(levelised sent-out cost of energy in constant 2005 US\$, excluding subsidies) Source: US NREL Energy Analysis Office www.nrel.gov/analysis/docs/cost_curves_2005.ppt



Comparison

Nuclear

- •Can't contribute in short term (~15 years to plan/build) or long term (exploitable reserves of U ore are limited) •Dangerous – eg Chernobyl, Fukushima No solution for radioactive wastes Proliferation of nuclear weapons •Expensive: £15 billion to construct: PV cheaper Renewables
- faster, cleaner, safer, cheaper, no emissions, no wastes, no proliferation, no resource depletion worries

Miliband Promise to Freeze UK Energy Prices Is this meritable/possible? 2012 profits of Big Six power companies (SSE, Scottish Power, nPower, EdF, Eon, British Gas) = ± 3.4 bn, up 73% in 3 years Gas prices to increase ~10% in 2013 But wholesale gas prices only increased ~1.6% in 2013 ww.carbonbrief.org/blog/2013/11/rising-costs-or-corporate-greed-exploring-retail-andwholesale-energy-price-data

Conclusions 1

Sustainable? Secure? Sane?

Conclusions 2

 nuclear provides very small contribution to CO₂ reduction
 cheaper, more cost effective, quicker, safer options
 Renewables and Energy Efficiency

A radioactive future?



Or a renewable future...?