UK Energy Policy: Secure, Sustainable, Sane?

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- 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
a. Some Background
   (Global)
1. World Energy Use by Source

Total World Energy Consumption by Source (2010)

- **Fossil fuels**: 80.6%
- **Renewables**: 16.7%
- **Nuclear**: 2.7%

**Renewables**
- Biomass heat: 11.44%
- Solar hotwater: 0.17%
- Geothermal heat: 0.12%
- Hydropower: 3.34%
- Ethanol: 0.50%
- Biodiesel: 0.17%
- Biomass electricity: 0.28%
- Wind power: 0.51%
- Geothermal electricity: 0.07%
- Solar PV power: 0.06%
- Solar CSP: 0.002%
- Ocean power: 0.001%
## 2. How much RE available globally?

### Annual Global Energy; flows and sources

**Exajoules (EJ) = 1 billion billion joules (10^{18} joules)**


<table>
<thead>
<tr>
<th>Source of Energy</th>
<th>Available for Mankind’s Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total incoming energy from sun</td>
<td>5,400,000</td>
</tr>
<tr>
<td>Solar radiation (air, land and oceans)</td>
<td>2,650,000</td>
</tr>
<tr>
<td>Hydrological cycle (rain feeding rivers)</td>
<td>1,080,000</td>
</tr>
<tr>
<td>Wind convection (hence also waves)</td>
<td>11,700</td>
</tr>
<tr>
<td>Photosynthesis (in biomass)</td>
<td>1,300</td>
</tr>
<tr>
<td>Geothermal (conduction from hot rocks)</td>
<td>1,000</td>
</tr>
<tr>
<td>Ocean tides (gravitational)</td>
<td>100</td>
</tr>
<tr>
<td><strong>Available for mankind’s use</strong></td>
<td><strong>3,744,000</strong></td>
</tr>
</tbody>
</table>

**For comparison:**

- **Annual global energy use now**
  - 500
  - \(\sim 1/7,500\)
3. Global RE Power Capacities

Global renewable power capacities (excluding hydro)

Data source: REN21, Renewables Global Status Report (2006-2012)

- (1) Renewable power excluding hydro
- (2) Wind
- (3) Biomass
- (4) Solar PV
- (5) Geothermal
4. Gov't Subsidies: Fossil vs RE

Figure 10: £11 climate finance provided, as compared with domestic fossil fuel subsidies\textsuperscript{25}

(Source: OECD (2012), IEA (2012) and GSI (2013))

- 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

- In 2011, German Gov’t = seek **25 % cut** in electricity consumption by 2050
UK Electricity Sources 2013

Q2 2013

- Renewables: 15.5%
- Gas: 28.5%
- Nuclear: 18.6%
- Coal: 35.0%
- Oil: 0.8%
- Other: 1.6%
Chart 5.1 Electricity generated by fuel type

RE capacity in UK

http://en.wikipedia.org/wiki/Renewable_energy_in_the_United_Kingdom

![Chart showing the installed capacity of renewable energy in the UK from 2006 to 2012, with categories for Onshore Wind, Offshore Wind, Solar PV, Small scale hydro, Landfill gas, Municipal incineration, Sewage sludge, Animal Biomass, and Plant biomass.](http://en.wikipedia.org/wiki/Renewable_energy_in_the_United_Kingdom)
UK Windfarm Growth

The graph shows the growth in MW (megawatts) of windfarms in the UK from 1990 to 2012. The growth is categorized into offshore and onshore windfarms. The bars represent the total MW output from each year, with offshore growth indicated by red and onshore growth by blue. The graph illustrates a significant increase in windfarm growth, particularly from 2009 onwards, with a notable surge in 2012.
• 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

<table>
<thead>
<tr>
<th></th>
<th>2010 Actual</th>
<th>2020 Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td>47.6%</td>
<td>49%</td>
</tr>
<tr>
<td>Denmark</td>
<td>40*</td>
<td>30</td>
</tr>
<tr>
<td>Finland</td>
<td>33.0</td>
<td>38</td>
</tr>
<tr>
<td>Austria</td>
<td>30.9</td>
<td>34</td>
</tr>
<tr>
<td>Portugal</td>
<td>26.8</td>
<td>32</td>
</tr>
<tr>
<td>Germany</td>
<td>25*</td>
<td>25</td>
</tr>
<tr>
<td>Spain</td>
<td>15.1</td>
<td>20</td>
</tr>
<tr>
<td>France</td>
<td>13.3</td>
<td>23</td>
</tr>
<tr>
<td>Italy</td>
<td>11.2</td>
<td>17</td>
</tr>
<tr>
<td>Belgium</td>
<td>5.6</td>
<td>13</td>
</tr>
<tr>
<td>Netherlands</td>
<td>4.4</td>
<td>14</td>
</tr>
<tr>
<td><strong>United Kingdom</strong></td>
<td><strong>3.8</strong></td>
<td><em><em>15</em> (now removed)</em>*</td>
</tr>
<tr>
<td>Malta</td>
<td>0.4</td>
<td>10</td>
</tr>
<tr>
<td><strong>EU overall</strong></td>
<td></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>
## Wind capacity GW (GWEC 2013)

<table>
<thead>
<tr>
<th>Country</th>
<th>GW</th>
</tr>
</thead>
<tbody>
<tr>
<td>China*</td>
<td>75</td>
</tr>
<tr>
<td>US</td>
<td>60</td>
</tr>
<tr>
<td>Germany</td>
<td>31</td>
</tr>
<tr>
<td>Spain</td>
<td>23</td>
</tr>
<tr>
<td>India</td>
<td>18</td>
</tr>
<tr>
<td><strong>UK</strong></td>
<td><strong>8</strong></td>
</tr>
<tr>
<td>Italy</td>
<td>8</td>
</tr>
<tr>
<td>France*</td>
<td>7</td>
</tr>
</tbody>
</table>
c. Nuclear Power

- Does nuclear provide an answer to CO\(_2\) emissions?
- Fukushima, Chernobyl?
- High costs of nuclear
- Recent proposed agreement with EdF and Chinese Government
Is nuclear a cost effective way to reduce CO$_2$ emissions?
How To Mitigate Climate Change

1. Renewable energy
2. High efficiency tech, eg CHP, smart grids
3. CO$_2$ 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

- 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 ...”
http://www.sd-commission.org.uk/pages/060306.html
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
<table>
<thead>
<tr>
<th>Date</th>
<th>Country affected</th>
<th>Government/Utility /Company</th>
<th>Nuclear Pull-outs, Closures, Withdrawals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov 2013</td>
<td>US</td>
<td>5 NPPs shut in 2012</td>
<td>Forbes predicts closure of 6 more NPPs</td>
</tr>
<tr>
<td>Oct 2013</td>
<td>UK</td>
<td>Iberdrola/GDF Suez</td>
<td>Try to sell controlling interest in NuGen</td>
</tr>
<tr>
<td>Oct 2013</td>
<td>Canada</td>
<td>Ontario Government</td>
<td>Pulls out of new reactors at Darlington</td>
</tr>
<tr>
<td>Feb 2013</td>
<td>Bulgaria</td>
<td>Bulgarian Parliament</td>
<td>Abandons Belene NPP project</td>
</tr>
<tr>
<td>Feb 2013</td>
<td>Poland</td>
<td>Polish Government</td>
<td>Refuses to support NPP construction</td>
</tr>
<tr>
<td>Feb 2013</td>
<td>UK</td>
<td>Centrica, UK</td>
<td>Pulls out of EdF plans at Hinkley C</td>
</tr>
<tr>
<td>Dec 2012</td>
<td>France</td>
<td>Enel, Italy</td>
<td>Pulls out of Flamanville project</td>
</tr>
<tr>
<td>Oct 2012</td>
<td>UK</td>
<td>Areva, France</td>
<td>Pulls out of bid for UK Horizon</td>
</tr>
<tr>
<td>Oct 2012</td>
<td>UK</td>
<td>CGNPC, China</td>
<td>Pulls out of bid for UK Horizon</td>
</tr>
<tr>
<td>Oct 2012</td>
<td>UK</td>
<td>CNPTC, China</td>
<td>Pulls out of bid for UK Horizon</td>
</tr>
<tr>
<td>Oct 2012</td>
<td>World</td>
<td>Toshiba, Japan</td>
<td>Tries to sell ½ its Westinghouse shares</td>
</tr>
<tr>
<td>Sept 2012</td>
<td>Canada</td>
<td>Quebec Government</td>
<td>Announces closure of Gentilly-2 NPP</td>
</tr>
<tr>
<td>August 2012</td>
<td>Finland</td>
<td>Fennovoima</td>
<td>Six investors pull out of Fennovoima Oy</td>
</tr>
<tr>
<td>March 2012</td>
<td>UK</td>
<td>EON, RWE, nPower</td>
<td>Pull out from UK Horizon</td>
</tr>
<tr>
<td>Sept 2011</td>
<td>World</td>
<td>Siemens, Germany</td>
<td>Quits nuclear industry</td>
</tr>
<tr>
<td>May 2011</td>
<td>Switzerland</td>
<td>Swiss Government</td>
<td>To phase out nuclear power by 2034</td>
</tr>
<tr>
<td>May 2011</td>
<td>Germany</td>
<td>German Government</td>
<td>To phase out nuclear power by 2022</td>
</tr>
<tr>
<td>June 2011</td>
<td>Italy</td>
<td>Italian Government</td>
<td>94% voters oppose Gov’t nuclear plans</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Cost (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydroelectric</td>
<td>£20–35</td>
</tr>
<tr>
<td>Biomass (non-OECD)</td>
<td>£30–40</td>
</tr>
<tr>
<td>Geothermal</td>
<td>£30–60</td>
</tr>
<tr>
<td>Wind - on land</td>
<td>£50–80</td>
</tr>
<tr>
<td>Photovoltaic*</td>
<td>£70–90</td>
</tr>
<tr>
<td>Nuclear (EdF-Govt deal)</td>
<td>£92.50</td>
</tr>
</tbody>
</table>

Compare generating costs/ kW
The Energy Secy had let EdF “take the British Government for a ride” over the “ludicrously high” subsidy deal to fund the proposed £16 billion Hinkley nuclear plant

<table>
<thead>
<tr>
<th>Criticisms of Hinkley C Deal</th>
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<tr>
<td>The Energy Secy had let EdF “take the British Government for a ride” over the “ludicrously high” subsidy deal to fund the proposed £16 billion Hinkley nuclear plant</td>
</tr>
<tr>
<td>“Flabbergasted… we are frankly staggered…. Hinkley will be the most expensive power station in the world”</td>
</tr>
<tr>
<td>“..we could be staring at a truly astronomical cost by the end of the contract. ‘The government surely can't be that dumb,’ comments one City analyst. One assumes not.”</td>
</tr>
<tr>
<td>&quot;When City analysts tell you a contract is 'economically insane', it's time to admit that you might have got it wrong.”</td>
</tr>
<tr>
<td>&quot;The Brits are crazy … How can one build new nuclear plants when all the world understood, or should have understood, that Fukushima was not an exception but part of the industry.”</td>
</tr>
</tbody>
</table>
## More Raspberries

“…the economics of the deal are **simply bonkers. Appalling value for money.**”

George Monbiot, Guardian columnist | http://tinyurl.com/q8bjwv5
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“The deal with EDF **is so bad that... my bet is that this is going to come badly unstuck.**”

Sir Jonathon Porritt, former head at FoE | http://tinyurl.com/q2hvh25

“The deal is a **disastrous one** for the UK, its taxpayers and energy users. We will be locked into a punitively high electricity price, index-linked, from 2025 to 2060.”

Oliver Tickell, The Ecologist | http://tinyurl.com/jwddzs9

“Hinkley – a **lousy template** for nuclear Britain … “

Alistair Osborne, Daily Telegraph | http://tinyurl.com/m6gmez4

“Rarely have we seen a policy **shrouded in so many what-ifs.** [The] deal shows the government and its negotiators were and are convinced that electricity prices will double in the next decade and beyond. This is **naïve.**”

Tony Lodge, Centre for Policy Studies | http://tinyurl.com/qz3djun

“Hinkley C is to be paid **more than twice as much** as German solar PV arrays”

Dr David Toke, Reader in Energy Politics Aberdeen U | http://tinyurl.com/oern237

"... a huge public contribution towards **yesterday's energy thinking.**"

Alan Simpson, ex Labour MP | http://tinyurl.com/q4wtmpq

“Mr Davey. If there is no public subsidy for Hinkley C **why are you having to make an application to the Brussels for state aid clearance?**”

Tom Burke, former advisor to Energy Secretary | http://tinyurl.com/pe9zfpq
How much CO$_2$ saved per $
Nuclear vs photovoltaic

Solar-Nuclear Kilowatt-Hour Cost Comparison

- Nuclear
- Solar PV

2010 Costs per kWh

Year
increasing costs (per kW installed)
Renewable Energy Cost Trends November 2005
(levelised sent-out cost of energy in constant 2005 US$, excluding subsidies)
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
Conclusions 1

Sustainable?
Secure?
Sane?
Conclusions 2

- nuclear provides very small contribution to CO$_2$ reduction
- cheaper, more cost effective, quicker, safer options

= Renewables and Energy Efficiency
A radioactive future?
Or a renewable future...?