Renew On Line 116  Jul-Aug 2015
Technology for a Sustainable Future

A bimonthly roundup of news and views on renewable energy developments and policies

Produced by NATTA, the independent Network for Alternative Technology and Technology Assessment.

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Renew adopts an independent critical approach. It should not be taken to necessarily reflect the views of the Open University

Renew was for many years produced by Prof. Dave Elliott and Tam Dougan, then based at the Open University, as a bimonthly NATTA membership subscription journal, with, after issue 100, a free shortened version, Renew on Line (ROL), also produced for NATTA’s web page. Now run by NATTA independently of the OU, ROL is currently delivered as Blog, and continues with the same numbering system. It includes a Forum section for commentary and feedback. An expanded version, called Renew, continuing with the old Renew numbering system, is also produced for use by students on relevant courses, on a course linked password protected subscription basis. Course leaders wishing to subscribe on behalf of their students should contact NATTA for details of charges. Students on the OU Renewable energy course T313 have access to it: www3.open.ac.uk/study/undergraduate/course/t313.htm

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Also see Renew Extra which is posted alternate months to the bimonthly Renew On Line at: http://renewextra.blogspot.co.uk

For a full guide to NATTA’s various offerings, and access to our free annual end of year review, see: http://renewnatta.wordpress.com

A big change for the good - Green energy futures

Out soon  Dave Elliott’s latest e-book
1. UK Developments - new scenarios overview

In ETI’s *Patchwork* there is 75 GW of wind, nuclear stays at the 16 GW ‘replacement’ level. PV is at 28 GW, Tidal 10 GW and Wave 4 GW - by 2050. In *Clockwork* nuclear is at 40 GW.

1000 Flowers Transition Pathway

The ETI’s decentral *Patchwork* pathways has some similarities with the *Thousand Flower* pathway to 2050 explored in ‘Distributing Power: A transition to a civic energy future’, a report on research by the EPSRC-funded Realising Transition Pathways Research Consortium of 9 UK universities. However, it puts much more emphasis on (mainly) local biogas-fired CHP/district heating (44 GW) and only has 30 GW of wind and 16 GW of PV, while nuclear falls to 5 GW. The diagram left shows the proposed new integrated system for supply and smart grid demand management. Around 50% of electricity use is met by distributed and low carbon sources, which also supply 60% of heat. There is little CCS, no extra storage but more grid interconnectors to help with grid flexibility. Devolved governments, municipal authorities, co-ops and communities play a major role on the supply side, consumers play a key role in demand management. A big job for all the local-level actors: the report lays out ways in which it might be carried out - so as to get the UK to near zero carbon by 2050.

UK renewables hit 19% and overtake nuclear

The output from the UK’s 24 GW of renewables, at 64.4 TWh - 19.2% of electricity supply - overtook that from the UK’s troubled nuclear fleet at 63.8 TW in 2014. Wind provided 31.6 TWh, 9.4% of UK electricity, solar 3.9 TWh (1.2%), hydro 5.9 TWh (1.8%) and bioenergy 22.9 TWh (6.8%). Emissions fell 8.4%, from 2013 levels, though partly due to a warm year. And Scottish renewables supplied the equivalent of 49.6% of Scotland’s electricity use…

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http://www.realisingtransitionpathways.org.uk/realisingtransitionpathways/news/distributing_power.html

http://www.lwec.org.uk/sustainable-pathways-low-carbon-energy

Wind **Roaring ahead**, at over 12 GW supplying 32 TWh p.a.  
That may miss the output from smaller un-metered projects - which survey tries to remedy:  
http://euanmearns.com/untangling-uk-wind-power-production  But at the big scale, **offshore wind** thrives, with the GIB investing £236m in the 400 MW Rampion project off the Sussex coast, though there are post-election uncertainties ahead for **on-shore** wind… despite it being the cheapest new renewable, adding €906m in revenue to the UK economy in 2014. See later.  

**Solar**: The UK installs more **PV** than other EU countries.  
The UK beat all comers last year, and there was a last minute flurry of 2 GW of large **solar farm** projects aiming to beat the April deadline for the end of Renewables Obligation support for projects over 5 MW. That will no doubt now tail off, though the UK will still have more utility-scale solar than Spain, Italy and France and possibly Germany. Though less than the US, India and China: see  
http://wiki-solar.org/region/countries/index.html  But over 5 GW of PV in all.  
The **Green Deal** been struggling to get going but has seen renewed growth driven by **PV** which now accounts for around a third of measures installed under Green Deal finance, with boilers and solid wall insulation the next most popular.

**Battery bonus** Batteries may help domestic PV projects boom.  
Jeremy Leggett’s *Winning the Carbon War* web site says: ‘The world’s largest private bank predicts that by 2020 it will be possible to have a solar roof, an electric vehicle and a domestic battery bank, powering everything you need in a home, with mouth-watering economics. That energy-trio purchase will be able to pay for itself within six to eight years, while giving a 7% pre-tax annual return on investment. Such household economics, UBS concludes, will change the face of the energy industry.’  
www.jeremyleggett.net/download-page  
Also see:  

**Good Energy** is already testing this idea out:  
www.goodenergy.co.uk/blog/new-developments-in-home-energy-storage  And the advent of cheaper batteries, like Tesla’s **Powerwall**, could make it viable for day-to-night time domestic use: batteries are no use for summer-to-winter storage, so in winter you may need other inputs than PV. It’s not on sale in the UK yet, but Tesla’s 7 kWh wall mounted unit will retail at $3000 in the US, the 10 kWh unit at $3500- installation and inverters are extra. The Tesla Li-ion unit is not unique e.g. see this German unit:  
www.photovoltaik4all.de/speicher/sma/3359/lg-chem-resu-6.4ex-lithium-ionen-speicher  
It’s seen as a breakthrough, ‘another nail in the coffin of conventional utilities’, since it will help decentral power to lift off, said Prof. Catherine Mitchell, University of Exeter. She added ‘Storage offers the ability to extend both the displacement of fossil fuels and reduction of prices beyond peaks - making it even worse for companies whose business models are based on fossil fuels and peak pricing profits’. The Ecologist said it could also finish off nuclear:  
www.theecologist.org/News/news_round_up/2852623/mayday_mayday_teslas_battery_just_killed_fossil_and_nuclear_power.html  
They quoted 2c/kWh cost, though that ignores inventor/installation costs. Perhaps more importantly, Tesla is also working on utility scale systems for grid balancing and short-term ramp protection, with 100 kWh battery blocks grouped to scale from 500 kWh to 10 MWh+.  
They say ‘these systems are capable of 2hr or 4hr continuous net discharge power using grid tied bi-directional inverters’.  
www.teslamotors.com/presskit/teslaenergy  For some excellent images:  
http://insideevs.com/tesla  
Tesla got widely covered in the media - good PR for decentral power. This may also help:  
www.virginmediabusiness.co.uk/pitch-to-rich/new-things/energy-local/  
*There are fire risks with Lithium-Ion Batteries, and safer Aluminium-Ion units may yet win out :  
www.theecologist.org/News/news_round_up/2838775/the_new_battery_that_could_power_the_renewable_revolution.html

**Storage** is included, along with renewables (PV especially) and smart grids, as target areas identified in the proposed new $150bn 10 year **Global Apollo** R&D programme fronted by Sir David King:  
Tidal lagoon - splashing out?

The proposed Swansea tidal lagoon project, sometimes referred to as being 240 MW, but which might be up to 320 GW, will be expensive - £1bn. It has got promises of £400m so far from private investors and more may be forthcoming, but to attract that the developers say they would need a £168/MWh CfD strike price, which is higher than offshore wind is now getting, although subsequent (larger) lagoons, like the ~2.5 GW scheme proposed for Cardiff Bay, would be cheaper, and could be roughly competitive with on land wind - and Hinkley. However as a ‘First of a Kind’ (FOAK) scheme, the Swansea project will be costly and that will invite invidious comparisons. It already has. As the last Renew noted, the Citizens Advice Bureau has come up with a sharp critique: it wasn’t worth spending so much for uncertain cost reductions later - essentially FOAK-off! Egged on by the promotion of the scheme in the Budget announcement, as an example of the sort of thing the (late) coalition government might back, the Telegraph’s reliably contrarian columnist Christopher Brooker then weighed in with a damning put-down, under a headline asking if it was ‘the craziest ‘green’ project ever’. He quoted 495,000 MWh a year as the expected output and calculated that this meant ‘the average output would be just 57 MW’. Not much for £1bn.

That calculation assumes a load factor of only18%, which seems low, especially if pumped storage is included. But, on IRENA estimates, by 2020 some tidal stream projects may be cheaper. And, arguably, apart from proving the (quite well established) proposed aggregate/sand-filled geotextile bag lagoon-wall construction technique, there will be little potential for learning. Each site is unique, and the turbines are fairly standard. If all went well, it would be a very visible green energy symbol. But is it the best ‘flagship’ new renewable project to push? Some say no: https://carboncounter.wordpress.com/2015/03/02/should-britain-bother-with-tidal-lagoons/

Energy Storage - an uncertain future?

The Parliamentary Office for Science & Technology has a new POSTNote on energy storage. It says there’s uncertainty about the future need for storage outside the transport sector, but in some scenarios it could help, the Low Carbon Innovation Co-ordination Group offering as an example a scenario with 9 GW of grid-connected electricity storage by 2020 and 27 GW in 2050, with consumers saving £4bn cumulative by 2050.

Compressed Air Energy Storage (CAES) came out well. POST noted National Grid’s view that ‘new CAES would cover its costs by providing one balancing service, while other technologies need further cost reductions’. However small single schemes were not so good. POST noted a Bloomberg study view that ‘providing single balancing services is not profitable for storage, but that providing multiple balancing services may be profitable’. So what happens next? POST notes that ‘the 2013 Energy Act established the Capacity Market, which offers regular payment to organisations that can guarantee to supply electricity when required. The market offers a potential source of revenue to electricity storage alongside markets that are organised by National Grid to ensure the second-by-second balance between electricity supply and demand. Competition for the limited Capacity Market revenue is via an annual auction, which does not favour any particular technology. The first auction took place in December 2014. Existing electricity storage accounted for 5% of the total capacity awarded; no new storage projects received support. In addition to the main auction, an additional ‘transitional’ auction will run in 2015 and 2016 to help smaller (<50 MW) localised generation, electricity storage and demand-side response to build capacity. The Electricity Storage Network says that it is unlikely that the additional auctions will incentivise new storage construction because of the short one-year contracts and competition from small diesel-fuelled generation units.’ So it’s not going to be fast.

Will Tesla prove them wrong?

The EU has awarded Minesto €13m to work on its tidal kite in Wales.

www.parliament.uk/briefing-papers/POST-PN-492/energy-storage

Tesla’s 109kWh power packs- an exception?
After the election a quick round up

‘The Government’s ambition remains to move to a competitive price discovery process for all technologies as soon as possible. Eventually, we will have a technology neutral auction in place for all low carbon generation.’ From DECC, just before the election close down:


In reality renewables are competing with each for CfDs, but Hinkley didn’t - its CfD was uncontented. And the ‘Tory’ manifesto opposed the cheapest option, on-land wind farms: it said they were ‘unable by themselves to provide the firm capacity a stable energy system requires’. And with the Tories now in power alone, and DECC now Lib Dem free, we can expect other policy changes. They are unlikely to include any of the more radical approaches to energy policy, governance, and even elections, that emerged during the election campaign. Like Labour, IGov at Exeter University had called for a new more open independent energy regulation agency, and quite liked coalitions: http://projects.exeter.ac.uk/igov/new-thinking-first-past-the-post-politics-is-a-major-barrier-in-gb-to-a-legitimate-long-term-energy-policy-framework/#_ftn1 A dead option for now! Similarly for the Greens’ radical policy, with very ambitious renewable targets: 42 GW of offshore wind by 2020 (in 5 years time!) 60 GW by 2030, plus 25 GW of PV by 2020, all in a £35bn 5 year programme, plus 42 GW of community power. Wild stuff!!
http://www.theguardian.com/environment/2015/apr/14/is-the-green-partys-climate-change-plan-realistic

But, along with the Lib Dems ‘60% from renewables by 2030’, that may set a maximal benchmark. Though it was trumped by Ecotricity, who in their own Manifesto called for 80% renewable electricity by 2030, with ‘quantitative greening’: http://socsi.in/j7lNE. But the Green’s claim that wind creates 12 times more jobs than nuclear for the same cost, and PV 360 times more, was very wide of the mark! And their personal carbon quotas? A dodgy idea some say - the rich could buy themselves out and a black market in dirty power could emerge. Instead we can now expect a focus on renewable cost cutting, limits to on-land wind and more battles over solar farms. Plus a last ditch effort to get funding for Hinkley agreed and a big push on shale gas, with Amber Rudd the new Secretary of State of Energy and Climate Change, replacing Ed Davey. Her first task was to block on-shore wind: see Box And below for more.

Wind cuts ‘We will remove all subsidy for on-shore wind’ David Cameron

Around 7GW in all is to be halted under the governments new plan. But some projects can’t be stopped: 15 new on-shore wind farms (near 750 MW in all), were awarded contracts under the first full round of the new Contracts for a Difference (CfD) support system, which is taking over from the existing Renewables Obligation (RO) fully from 2017, with large solar farms already having been blocked from using the RO. But from April next year (if the plans go ahead) that will also apply to new onshore wind projects- no more RO. However there are over 5 GW of projects in the pipeline with planning permission, and there will be a ‘grace’ period for some of them, so some may get RO contracts. But it seems none will be eligible for contracts in the next CfD round, under the new policy. Similarly for the 7 GW or so of other onshore wind projects still in the pipeline, without planning permission. Most of them are below 50 MW - so they will still be decided by local planners as now.


Many may get the planning go ahead: 3.8 GW are in Scotland, which zealously guards its devolved planning powers, and is pro-wind! But Westminster may stop them getting RO or CfD support.


www.publications.parliament.uk/pa/cm201516/cmhansrd/cm150622/debtext/1506220001.htm#1506220001


Solar cuts PV solar projects are being blocked by central government

PV has been struggling to get subsidy-free, despite, you could say, the government efforts to slow it: www.renewableenergyfocus.com/view/41794/uk-progress-towards-subsidy-free-solar-and-the-impact-of-policy-stability e.g. the 49MW solar farm proposed on a disused airfield in Wiltshire that has some Science Museum displays. It had got strong local support and was passed by the local planners, but was then called in by DCLA. Hopefully Greg Clark, the replacement for Eric Pickles there, will be better! But going on the offensive, there’s a ‘let us buy local power’ campaign: www.1010uk.org/ourpower
Red, green, Amber? The Reds and the Greens failed to win power…

She’s pro-fracking and pro-nuclear, but what will Amber do about renewables?
The new Secretary of State for Energy and Climate Change, Amber Rudd, has a track record of support for local solar (see below), but will no doubt stick with the Tories opposition of large solar farms and has already indicated that she will ensure that legislation is introduced ‘next year’ to end subsidies for onshore wind, while giving local opposition more reign:

There may be problems If the UK is to meet its legally binding EU requirement to get 15% of UK energy from renewables by 2020, something may have to expand to make up the reduced solar and wind input. DECC says there will be enough on-shore wind still coming through. But if not, since on shore wind is the cheapest renewable and big solar is also getting cheap, that will cost more. However there is a cap on spending, set under the Levy Control Framework (LCF), which already looks likely to be breached - see Box. Will it be expanded, or will renewables get an overall cut? If so, the (untrue) claim that they and nuclear were getting equal treatment will look even weaker, and the EU may renegot on it’s agreement to the generous Hinkley CfD. Quite a minefield… with Brexit lurking too!
The plan to let local views determine whether onshore wind projects went ahead may also backfire. Public opinion (even Tory!) is still pro on-shore wind: http://renewes.biz/88622/tory-voters-back-onshore/.

Ministers may yet regret allowing locals to have the final say - previously ministers decided on projects over 50 MW. Though there are few new ones planned, so maybe there will be no big changes. Tim Yeo MP, past Tory chair of Energy & Climate Change Select Committee told Cameron: ‘There are some parts of the UK where they seem to be happy with onshore wind. If people are happy to see some wind turbines in their area, and the cost of subsiding those is significantly lower than the subsidy we are offering for offshore wind, I would urge him to let the local view prevail.’

*The new Select Committee chair is to be from the SNP, which may liven up Westminster politics! www.telegraph.co.uk/news/earth/energy/windpower/11465812/Onshore-wind-farm-ban-will-raise-energy-prices-Tory-MP-Tim-Yeo-warns.html

LCF Crisis Some of the levies related to renewables fall under the ‘Levy Control Framework’. This was agreed between DECC and HM Treasury in 2010. The LCF cap has been set at £4.3bn in 2014/15, rising to £7.6bn in 2020/21 The Policy Exchange says that the LCF cap ‘was exceeded in all of the last three financial years’ with the bulk of this overspend relating to the small scale Feed-in Tariff (mainly used for domestic PV) which it says ‘exceeded its original budget by 100% (or £450 million) in the last financial year’. Looking forward to 2020 it notes that DECC (in its Annual Energy Statement) suggest that the remaining budget amounts to £1 bn p.a. in 2020/21. However, the Policy Exchange says, DECC has significantly underestimated the cost of existing policies, given that ‘the outlook for wholesale electricity prices has reduced substantially over the past year as a result of falling commodity prices. This increases the subsidy payable to renewables projects under the new ‘Contract for Difference’ subsidy model.’ Under the CfD, projects are topped up from the market price to a pre-agreed ‘strike price’ so, perversely, it costs more if prices fall. Of course, you might blame the haste to find a way to insulate Hinkley from market competition for this! But the Policy Exchange seems more concerned about knocking solar. It says ‘DECC is vastly underestimating the cost of the small scale Feed-in Tariff - which appears to be growing out of control, DECC assumes that the cost of the scheme will increase by around £60m per annum to 2020, but the cost of the scheme has been growing at £160 million per annum to date. Solar PV has been deploying at an unprecedented rate. DECC’s assumptions as to the future cost of the scheme appear to be based on wishful thinking rather than hard evidence.’ It also has a go at offshore wind, but has to admit the problem is that they have turned out to perform better than expected: ‘it appears that DECC has systematically underestimated the subsidy payable to new offshore wind farms. DECC assumes a ‘load factor’ (a measure of energy output per unit of capacity) for new projects of 38%, based on the current fleet average. However, recent improvements in technology mean that the new generation of offshore wind farms being built over the next few years is likely to achieve much higher load factors - e.g. potentially 45%+. The higher the load factor and output of the project, the greater the subsidy payable under the current mechanism. This overspend has not been factored into DECC’s budget calculations.’ The right of centre Policy Exchange clearly thinks the whole thing is a shambles and claims that the entire budget remaining under the Levy Control Framework (assuming no further changes in policy) may have already been spoken for: ‘DECC may have already committed the entire budget out to 2020, which will make it difficult or impossible to proceed with any additional projects, unless actions are taken to stem the rise in other costs’. They could be (partly) right. More cash is needed! https://greener-cheaper.squarespace.com/blog/2015/5/12/dear-energy-secretary-im-afraid-to-tell-you-there-is-no-money

But for REF it’s easy - it’s all too much: www.breitbart.com/london/2015/05/20/insult-and-injury-for-turbine-blinded-communities-britain-to-massively-overshoot-renewable-energy-targets/
Energy saving *Despite all the new gadgets we are using less energy*

UK energy consumers are using 10% less energy than 5 years ago, even though the economy is growing and we are using more gadgets, with the link between energy use and growth apparently now broken. This seems to be partly due to the take up of more energy efficient consumer devices - a new A-rated fridge-freezer uses 73% less energy, compared with its 20-year-old counterpart, according to trade association AMDEA. That leads to about £100 p.a. off a household energy bill: [www.f2c.org.uk/chilling/new-case-study-of-20-yr-old-fridge/](http://www.f2c.org.uk/chilling/new-case-study-of-20-yr-old-fridge/) And the adoption of low energy lamps has meant that consumers used 29% less electricity for lighting in 2013 than in 2008. A report from the Committee on Climate Change said household bills would have increased by an extra £165 between 2004-2013 if the energy savings had not been made. It said gas use for heat and hot water had declined more than a quarter since 2004 for a typical household, reflecting improvements in boiler efficiency and pipe insulation, while the number of homes with loft and cavity wall insulation is up from 39% in 2004 to 67% in 2013. The recession has also led to behavioural change - turning off radiators in unused rooms. DECC’s statistics (Dukes), says consumption of all energy in 2013 was the lowest since 1985 after adjusting for temperature, and energy intensity - the amount of energy per unit of wealth created - fell by 70% between 1970 and 2013 in the industrial sector. That may be because the UK has exported high energy manufacturing activities and switched more to service/retail, but even there energy use has fallen by 55%.


Energy for Homes *ETI wants heat networks*

The ETI’s commitment to [heat networks](http://www.t2c.org.uk/news/business/30518649), a key part of their new energy scenarios (see above), shows through in their report by Jeff Douglas **Decarbonising Heat for UK Homes**. This has smart heat networks, with CHP and heat stores, offering some balancing and being a less disruptive option than in-house heat pumps in urban/suburban areas. The report stressed the need for a system-wide approach. Interestingly, while it supports some upgrades, it says the ETI’s ‘Optimising Thermal Efficiency of Existing Housing’ project, had concluded that a basic ‘Retrofix’ package of measures could achieve CO2 savings of around 33% at costs ranging from £7,500 to £21,000 per building. A more extensive ‘Retroplus’ package could it suggested reduce CO2 by around 45% for between £15,000 and £31,000 per dwelling. But, it says, even with this scale of national investment (several hundred billion), ‘the emissions savings across the UK house archetypes are somewhat lower than half the desired 80% target’. And it sees its heat network approach as being more effective, at least in some locations, accounting for near half of heat by 2050 - electricity supplies the rest. Though, on current plans, with gas heating being phased out, local electricity grids will have to be upgraded to feed domestic heat pumps. Heat networks might avoid the need for some of that! [http://theeti.cmail20.com/t/j-i-l-djihol-otiukhuij-k/](http://theeti.cmail20.com/t/j-i-l-djihol-otiukhuij-k/)


**CPRE** see it differently: [www.dailymail.co.uk/wires/pa/article-3042828/Focus-needed-conserving-energy.html](http://www.dailymail.co.uk/wires/pa/article-3042828/Focus-needed-conserving-energy.html)

CCS ETI’s parallel report on **Carbon Capture and Storage** was perhaps less welcome. It warned that any delay to the roll-out of CCS ‘increases costs through the need to deploy higher cost technologies to cut emissions, and failing to deploy CCS at all could double the annual cost of carbon abatement by 2050’. It looks to a 10 GW CCS sector by 2030. [www.eti.co.uk/carbon-capture-and-storage-building-the-uk-carbon-capture-and-storage-sector-by-2030/](http://www.eti.co.uk/carbon-capture-and-storage-building-the-uk-carbon-capture-and-storage-sector-by-2030/)

However, it’s not clear what other options will be ‘higher cost’. Nuclear maybe (though ETI backs that). But surely not renewables, which are getting cheaper daily, while CCS remains a long shot and everyone accepts it will be costly, at least at first. Then again, if by 2030 we had 10 GW of CCS, plus more renewables, we wouldn’t need nukes. The UK **Green Alliance** has come out in favour of CCS, arguing that it will get cheaper. But they don’t mention CCS with biomass (BECCS), which offers a *carbon negative* bonus, making CCS more attractive. [http://greenallianceblog.org.uk/2015/03/25/why-using-ccs-for-industry-as-well-as-power-makes-sense/](http://greenallianceblog.org.uk/2015/03/25/why-using-ccs-for-industry-as-well-as-power-makes-sense/)

Scottish power exports and imports

There have been claims that Scotland will have to import more power from England since it’s renewables (now near meeting 50% of annual power demand) were not able to meet peak demand reliably and a coal backup plant was being closed. www.heraldscotland.com/politics/scottish-politics/labour-attacks-scottish-ministers-over-increased-reliance-on-english-ener.121280737

This seems overstated. The Scottish Government pointed out that: ‘Scotland is a substantial and reliable exporter of electricity, with well over a quarter of all power generation exported in 2013…Around 90% of the time electricity flows from Scotland south to England, with it flowing in the opposite direction only 10% of the time.’ With more renewables on the Scottish grid, there will be times when much of this will be green power - by 2020, assuming that the 8.7 GW of consented wind farms are built, Scotland will surpass its 100% renewables pledge by nearly 20%. So at times it will have more than it needs, and only occasionally (low wind) should it have to import power from England or via inter-connectors from continental Europe.

It is true that the closure of the 2.4 GW Longannet coal fired plant, and uncertainties about the future of the two old nuclear plants, could increase the extent of that, at peak demand times, unless other balancing measures are adopted. But some are, including CHP/DH plants, which can vary their power/heat output ratios to meet varying demand. Demand-side management can also help by shifting peaks. So can storage and there are new pumped hydro projects planned. However there’s nothing wrong with importing power when needed, or with exporting excess power; the UK energy system needs to be planned as a whole, and that would be true even if Scotland went independent. This type of grid balancing could be the cheapest option, though adding a few small gas plants might be an even cheaper short-term option, perhaps using AD biogas or wind-to-gas longer term. WWF’s Pathways to Power says that, with expanded renewables and smart-grid demand management, by 2030 Scotland won’t need any nuclear, or any fossil backup, apart from the already planned 340 MW of gas-fired CCS at Peterhead, and could still export power to more than balance imports: http://assets.wwf.org.uk/downloads/pathwaystopower.pdf

Welsh tidal power

The proposed Swansea Tidal Lagoon (see above) is not the only tidal option for Wales and may not be the best. Load factors for tidal stream devices are expected to be higher (36%) than for barrages or lagoons (23%), and some tidal current device teams have reported higher load factors, with rotor pitch regulation. Sadly the Skerries MCT project off Anglesey is not live at present (though MCT has now been taken over by Atlantis, so that may change), but Tidal Energy Ltd is testing their Skerries device off St Davids and Minesto is to test their Tidal Kite off Anglesey. Large local economic/job benefits are predicted: http://www.marineenergypembrokeshire.co.uk/wp-content/uploads/2015/04/Marine-Energy-in-Wales-Investment-Jobs-Supply-Chain-2015-s.pdf

Capacity Market nasty diesels

About 22% of the UK’s short-term operating reserve (STOR) is made up of small diesel sets, used very occasionally for grid backup. The recent Capacity market auction awarded 121 small open-cycle gas turbines and reciprocating engines contracts for being available to meet shortfalls - about 2 GW in all, out of the 50 GW of contracted backup capacity, most of which was CCGT. This raised green hackles at the time, but then that’s what you get with competition - the cheapest options, not the cleanest options. The Guardian missed that:

www.theguardian.com/environment/2015/may/06/uk-energy-bill-subsidies-driving-boom-in-polluting-diesel-farms

Grid balancing does imply better grids and more connections in remote areas, but the new design T-shaped grid pylons are now being installed: www.bbc.co.uk/news/uk-32225276

Negative emissions

The Smith School of Enterprise and the Environment, Oxford University, says that the best bio-options for CO2 cuts are planting trees and improving soil quality to sequester more CO2 i.e. afforestation, planting trees where there were none before, and biochar, soil improvement by burying a layer of charcoal made from biomass. Between now and 2050, these were the ‘most promising’ options, it says, better than BECCS (Biomass Energy with Carbon Capture and Storage), or direct air capture (via chemical absorption from the air).
Looking back.. Oxford Prof. Dieter Helm’s chapter on energy policy in ‘The Coalition Effect 2010-2015’ (Seldon & Finn, CUP) is a stout defence of free market views, blaming Lib Dem-led DECC (or was it Milliband earlier?) for losing them! Either way, it’s not very edifying. Though he is right that the EMR, CfD, Green Deal and so on are not fit for purpose. But then what should be the purpose? Avoiding public expenditure seems to be the aim by enlisting the private sectors’ help. That has limits. They too adopt market-based views. Thus BP once relabeled itself as ‘Beyond Petroleum’, in a fit of wider strategic thinking, but then, as markets tightened, backed away from renewables, to focus mainly on oil again:

www.theguardian.com/environment/2015/apr/05/law-system-will-henceforth-be-unable-to-oppose-proposals-for-local-nuclear-waste-dumps

*Here is a quick look back at how governments have fared in the past - and at Rudd’s track record

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<th>Energy governance: a brief UK renewable history</th>
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| Although there had been some isolated experiments with wind turbines in the 1950’s, the development of renewables in the UK only really started on a significant scale in 1974, in the wake of the OPEC oil crisis. The then Labour Government set up an Energy Technology Support Unit (ETSU), based at Harwell, which was contracted to work for the newly established Department of Energy. ETSU produced a number of influential reports, as did various Select Committees. However there were some oddities. The Select Committee on Science and Technology (Session 1976-77) ‘saw little present potential for the use of wind power for electricity generation. The assessment prepared by ETSU identified a limited scope for the generation of electricity on most favoured hilltop sites, at costs possibly competitive with fossil fuels.’
| Wave energy attracted more support. John Moore, then an Energy Minister, claimed, at the opening of a wave energy test tank at Southampton in Sept 1980, that ‘whatever other problems our wave energy researchers may face, lack of Government support will not be among them’. However in 1982 the wave energy programme was all but wound up, after a critical review, in response to the new Conservative government’s policy of overall funding cuts.
| Interest in the Severn Tidal Barrage remained strong. ETSU’s 1982 ‘Strategic Review of Renewable Energy Technologies’, concluded that ‘the Severn Barrage generally has the best economic prospects of all the renewable sources, bettered only by on-shore wind power on the latter’s lower cost. In general, tidal power is roughly on a par with nuclear power in the benefit/cost ratios which it produces.’ Clearly that did not pan out - it was wind power that succeeded, first overseas and then, belatedly, in the UK. But PV solar was still hardly even talked about.
| ETSU was subsequently privatised and in 1992 the Department of Energy was abolished, the bulk of its work being absorbed into the Department of Trade and Industry. The Select Committee on Energy was also therefore wound up, but not before issuing a very critical report, in which it commented ‘it is difficult to regard the history of renewable R & D funding in the UK as other than a history of volte faces, premature judgements and plain errors’.
| 23 years on, can we say any better about the record of the Department of Energy’s eventual replacement, the Department of Energy and Climate Change? It did try. But fell foul of coalition politics. Now free of that, here we go again… See right.
| The above quotes are from NATTA’s 1997 Renewables Past, Present and Future, PDF available

<table>
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<th>Amber Rudd</th>
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| Some quotes from the new Energy & Climate Change Secretary: ‘I look forward to the day when a British city has a heat network to rival Copenhagen. If we are serious about tackling climate change, that’s what we need to see happen.’ (Carbon Connect Heat conference, Jan 2015) ‘I believe that the solar industry is on the up, and between our incentives and your dynamism, we will see real progress towards putting control in the hands of energy consumers and turning our buildings into power stations.’ (Solar Energy UK Conference, Oct 2014) ‘Community energy projects represent a huge opportunity for people to bring about change in their local areas. The sector has the potential to deliver as much as 3GW’. (PRASEG, July 2014)

Public support falls slightly 78% of the UK public back renewable energy DECC has found. But this is less than earlier. Support was at 79%, 82% and 80% respectively in 2012, 2013 and 2014. 81% now backed solar compared to 85% in 2014 and 2013. 74% backed wave and tidal, down from 77% in 2014 and 2013, while offshore wind was supported by 73% compared to 77% in 2014 and 76% in 2013. Support for onshore wind was also down to 65% and biomass had the lowest support at 63%, up from 60% in 2014 but down on the 64% in 2012. Opinion polls do give variable results...

While local views on wind farms will allegedly now drive policy, under the Tories Manifesto commitment, as backed by new Minister Andrea Leadsom, it seems that the local planning system will henceforth be unable to oppose proposals for local nuclear waste dumps:

www.theguardian.com/environment/2015/apr/05/law-changed-so-nuclear-waste-dumps-can-be-forced-on-local-communities

.. and forward What the public think now

Farming Minister George Eustice at the Devon Show: solar panels are ‘trash the countryside in Cornwall’
Nuclear - ‘more research needed’

**Hinkley** may be stalled (see below) but the Lords Select Committee on Science and Technology has been looking to the future and at ‘**Nuclear Research and Development Capabilities**’. It noted that ‘to meet the UK’s legally binding target of reducing greenhouse gas emissions to 80% below 1990 levels by 2050 it is likely that between 20 and 38 GW of nuclear power will be needed’, and it backed more attention being paid to more advanced **Generation IV** reactor and fuel cycle options, including breeders (as opposed to Gen III - the current range of upgraded PWR/BWR reactors). That’s despite the fact that ‘many witnesses, including the Government, took the view that up to 2050, the majority of nuclear electricity supply, regardless of the quantity, is likely to be through Generation III nuclear plant rather than Generation IV (because of the relatively early stage of development of Generation IV technology) and that uranium would not be a limiting resource over this period. They argued therefore that R&D capabilities and associated expertise in advanced reactor systems and fuel recycling need not be a primary consideration up to the middle of the century.’

The Lords were evidently much more sympathetic to the view expressed by Dame Sue Ion that ‘Government attention to these issues has been, and continues to be, woefully inadequate’. And they especially welcomed and shared Prof. **David MacKay**’s views (see Box) that, if the UK wants to keep the option of an increased nuclear energy capacity open in the future, it must be more actively involved in Gen. IV R&D - so as to gain ‘a seat at the table’.

It would also ‘enable the UK to act as intelligent customer and regulator’ and help with ‘the training and maintenance of the research base needed for both Generation III and IV’.

What about the zero nuclear option? That was quite quickly dispatched. Though some of its scenarios included ‘low nuclear’, Katherine Randall, DECCs 2050 Pathways Team Leader, told them that ‘while it is possible, technically... to generate a pathway that does not use nuclear’, it is not desirable, because excluding nuclear would put significantly more pressure on supply and the use of other technologies, some of which, such as CCS, were unproven. It would also require ‘a great deal more effort... on the demand side’ which has so far proven to be difficult and a ‘significant effort on balancing’ the grid system. Instead, the Lords say, more nuclear R&D is needed: ‘Without an increase in funding for fission research in the order of £20-50 m a year, the Government’s intention that nuclear should play a part in meeting the UK’s future energy needs simply lacks credibility’.

The Lords said Prof. **David Mackay** ‘appeared to have a more considered and far-sighted view than that of the Government’. He had commented: ‘I think there is widespread agreement around Europe and the world that, to keep options open, energy research should always adopt a considerably wider approach than the energy policy of any particular day. Even if UK nuclear power were to be provided by Generation II and III reactors only for the next 40 years, there is still a case for supporting Generation IV research because it is a very good way to spin out other benefits. It is a way to develop and retain experts and educators who can serve the role of advisers and inspectors and who have expertise in other countries’ reactors, so that when accidents occur in other countries we can give good advice to the Foreign Office. All of those roles: educators, advisers, inspectors and teachers, are needed by a Generation III programme today, so I think there are compelling arguments for involvement in advanced research along the lines of the Generation IV programme.’

The **UK Office for Nuclear Regulations**, has ruled that the radiation evacuation zone for Sellafield must be raised from 2km to 6-7km. The zone at Fukushima was and is 20km.

**Hinkley**: we still await EDF’s investment decision. In Sept? Oct? The Chinese companies who might back the project evidently refused to invest unless the French government promised to cover their share of any cost over runs. The Chinese also wanted EDF to hand over the Bradwell site in Essex, so they could build a reactor there later. With EDF & Areva’s finances in a mess, their bargaining position is weak. The reactor pressure vessel fault found at Flamanville (poor steel quality) could be the last straw... it may have to be abandoned.
2. Global news and developments

NREL’s ‘2013 Renewable Energy Data Book’ says that cumulative global renewable electricity installed capacity grew by 108% from 2000 to 2013 (from 748 GW to 1,560 GW), and renewables accounted for 23% of all electricity generation worldwide (5,095 TWh) in 2013.

- Wind and solar have been the fastest growing renewable electricity options worldwide. Wind grew 18 times and solar by a factor of 68 between 2000 and 2013.
- In 2013, China led the world in cumulative total renewable electricity installed capacity, as well as cumulative wind (91 GW*) and hydro capacity. Germany led the world in cumulative PV installed capacity (36 GW). The USA led the world in geothermal (3.8 GW) and biomass capacity (14.7 GW). http://lists.nrel.gov/t/121386/420842/100198/0/ *now 115 GW

**Fossil futures - leave it in the ground**

University College London research published in the journal Nature, assuming cost effective climate policies would use the cheapest fossil fuels first, identifies which fossil resources will have to be left underground, hitting major coal producing nations like the US, Australia and Russia, hard: more than 90% of their coal reserves would have to be left unused. The figure China and India was 66%. 50% of global gas reserves must also remain unburned, hitting the Middle East and Russia hard, although the US and EU can exploit 90% or more of their gas reserves (including some US shale gas) to replace coal and provide local power to their large cities. A third of global oil would have to be left unused and all of Canada’s oil sands after 2020, as well as oil/gas from the Arctic: http://www.nature.com/nature/journal/v517/n7533/full/517150a.html

It found that, globally, 82% of today’s coal reserves must be left underground, hitting major coal producing nations like the US, Australia and Russia, hard: more than 90% of their coal reserves would have to be left unused. The figure China and India was 66%. 50% of global gas reserves must also remain unburned, hitting the Middle East and Russia hard, although the US and EU can exploit 90% or more of their gas reserves (including some US shale gas) to replace coal and provide local power to their large cities. A third of global oil would have to be left unused and all of Canada’s oil sands after 2020, as well as oil/gas from the Arctic: http://www.nature.com/nature/journal/v517/n7533/full/517150a.html

Tragically though, we are not heading that way - indeed with gas, oil and, relatively, coal market prices falling, we are mostly going the opposite way. But it’s not all bad news: the fall in oil prices won’t have much impact on renewables says Forbes: http://www.forbes.com/sites/edfenergyexchange/2015/01/05/why-falling-oil-prices-dont-hurt-demand-for-renewable-energy/ And PV prices are still falling - see below. See www.theguardian.com/environment/ng-interactive/2015/mar/16/keep-it-in-the-ground-guardian-climate-change-campaign

**Renewable Integration round the world**

US energy expert Eric Martinot, now based in Beijing, is these days focusing on power grid integration and balancing of renewables - see his coverage of Germany, California, Denmark: www.martinot.info/renewables2050/2015/448 And China: www.martinot.info/renewables2050/2014/464

IEA-RETD has also produced a RE-Integration report, a study by Mott MacDonald’s of the challenges of integrating variable renewables energy (VRE) technologies into the electricity grids. It looks, via case studies, at typical country specific factors shaping the choice of integration options, the applicability and effectiveness of policy measures and draws general lessons for countries with similar underlying characteristics. It says ‘Interconnected countries can pool flexible resource by coupling markets and co-operating on reserve/balancing, isolated countries need to make the most of internal flexibility’, while ‘countries with low interconnection and internal flexibility have the greatest challenge’. http://iea-retd.org/re-integration

IRENA’s Renewable Power Generation Costs in 2014, concludes that they are all becoming competitive with fossil-fired plants, even without subsidy.

*IRENA has also produced an easy access global and national data base on renewables from which to create customized charts/graphs, REsource, at www.irena.org/resource.

In the IEA’s 2 Degree Scenario (2DS), fossil fuel primary energy use halves to ~40% in 2050, mainly via efficiency, renewables and a bit of nuclear. But we must move faster: www.iea.org/Textbase/npsum/ETP2015SUM.pdf

In his state of the union address in January, Obama said the US led the word in wind. Well, in output, re China, but not in capacity.
PV solar price falls continue around the world

PV solar continues its spectacular price reduction, even falling below the linear projection of this log-log learning curve. It’s from a Fraunhofer report (see PV in Germany below), which looks at the cost of getting the price down. It notes that consumers have born the brunt of it in Germany:

‘policy makers determine who finances the transformation to renewable energy. They have decided that energy-intensive industries, i.e. those who spend a high proportion of their costs on electricity, are to be exempted from the EEG surcharge to a large extent. Industries are to be relieved of costs totaling an estimated 5.1 billion euros in 2014. The total electricity falling under this exemption amounts to almost one-fifth of Germany’s entire power consumption.’ Even so, PV did get a lot of money:

‘Excluding external costs, the proportion of the EEG surcharge allocated to PV power generation amounted to ca. 55% in 2013. As PV was only expected to account for around 25% of the energy covered by the EEG in 2013 it is receiving preferential support. This is neither surprising nor unintentional. The disproportionate support granted to PV is a direct consequence of the fact that during the initial years of the EEG, the levelized cost of PV electricity and its feed-in tariff were many times greater than those of other RE sources, e.g. approximately seven times greater than those of wind power. The preferential treatment was also intentional since PV was expected to have the greatest cost reduction potential. In reality, developments greatly exceeded all expectations, with power from newly installed PV plants already receiving significantly less remuneration than wind power from new off-shore installations (initial tariff incl. bonuses).’

It’s similar elsewhere in the EU - PV cost a lot initially, but the market built by the FiTs got prices down. Compare that to the continuing subsidies for nuclear and fossil fuel, with a German Budget study noting that ‘up to now subsidies for the renewable energies have amounted to €54 bn. To compare, from 1970 to 2012 subsidies for hard coal amounted to €177 bn, for brown coal at €65 bn and for nuclear energy at €187 bn.’ And as elsewhere, the rising cost of energy has mainly been due to fuel cost rises not to renewable support. However the PV boom has an effect on other sources. In Germany, power use has been falling since 2007 and so the growth of PV and wind has put pressure on fossil plants: ‘the construction of new renewable power plants decreases not only the relative market fraction of the four big power suppliers in Germany but also it reduces their absolute turnover’ especially since PV can meet peak demand, undermining the economics of gas-fired peaking plant. Similar trends will occur elsewhere as PV and wind expand. There will also be more stress on transmission, though the report notes that ‘the feed-in of solar electricity takes place predominantly in a decentralized manner and hardly makes any demands on an expansion of the German national transmission network’.

Finally there’s the variability issue. PV output varies, but so does wind. The report says ‘Due to the particular climate in Germany, high solar irradiance and high wind strength have a negative correlation’ so they can often compensate for each other. In which case, ‘a balanced mix of solar and wind capacity is markedly superior to the one-sided expansion that would be brought about through the introduction of a competitive incentive model’ i.e. the contract auctions market being introduced in Germany, the UK and soon across the EU. And it notes that though nuclear & coal plants aren’t much use at balancing variable PV, during heat waves, when cold cooling water is scarce, PV reduces the load on the fossil and nuclear plants. (A key issue in MENA - see Box)

Overall a good selling job on PV in Germany and elsewhere e.g. the US. Florida should take note:

EU 2030 Renewables target

If the European Commission had not decided to avoid imposing national renewable energy targets for 2030, what would they have looked like? A clue can be found in ‘Implementing the EU 2030 Climate and Energy Framework - a closer look at Renewables and opportunities for an Energy Union’, an EC/Intelligent Energy backed Towards 2030-dialogue Issue Paper produced by a group of EU research groups. Within the overall EU Renewable energy target for 2030 set at 27%, it develops some indicative benchmarks as left, adopting the same methodology used when the EC set national target for 2020. Cheeky! The UK gets a weak 23%. The report said: ‘Moderate dedicated support for renewables is required to reach the 2030 target of 27% renewables’. That’s surely the least we should aim for.


EU wind at end of 2014:
130 GW.
Offshore: 10 GW

EU Renewable costs


The relative extra average costs in €/MWh of supporting renewables in EU countries in 2013.

‘Bangs per buck’ clearly vary! Partly due to location and support schemes - FiTs are usually cheaper/MWh than the competitive contracts/grant/certificate trading systems mostly used in Italy, Poland, Romania, Sweden & UK (UK has a FiT for some PV). But some like Germany pay more to get more capacity. French/Cz PV gets the most; in Estonia all get the same.
Denmark  Wind supplied 39% of Danish electricity in 2014: [https://stateofgreen.com/en](https://stateofgreen.com/en)

A big source of the surge of Denmark’s wind production came from the addition of around 100 new offshore wind turbines. The current aim is to get 50% of Denmark’s power from renewables by 2020, but the Danish Ministry of Climate, Energy and Building believes that the country could actually get 71% of its electricity from renewable sources by 2020, by expanding wind power and converting more heat pumps and power plants to use biomass. By 2020 coal consumption will be more than halved. The aim is to be fossil free by 2050. [http://www.kebmin.dk/en/news/baseline-projection-2014-the-transition-to-a-green-danish-energy-system-is-accelerating](http://www.kebmin.dk/en/news/baseline-projection-2014-the-transition-to-a-green-danish-energy-system-is-accelerating)

German overview - new model says 80% is possible

The Fraunhofer Institute for Solar Energy Systems in Freiburg has developed the [Renewable Energy Model-Deutschland](http://reneweconomy.com.au/2015/german-energy-prices-continue-plummet-cuts-prices-france-49853), or REMod-D, a computer simulation that models an all-sector future energy system for Germany, matching supply and demand on an hourly basis over a full year, tested using real data from 2011 and 2012. Eicke Weber, the institute’s director and a professor of physics at Freiburg University, told the *New York Times* that it showed that ‘it is economically to our advantage to move as quickly as possible to a system of 80% renewable energy. Our researchers have shown that the cost of this transformation of the entire energy system - not just electricity - would be the same as today’s system to run; but the needed investments would cost less than what would be saved by spending far less on fossil fuels. Our estimate is that the changeover will cost about 500 billion euros. However, between now and 2050 we will realize savings of between €600 billion and €1,000 billion. These are savings on the total energy system, including fossil fuels and the distribution system.’ Specifically the researchers put the cumulative investment over the next 35 years for all major renewable energy sources required by this system at €470 billion. But this would save €660 billion in avoided fuel costs, at constant fossil fuel prices. If fossil fuel prices rose by 1 percent per year during this period, then the avoided fuel cost would be €830 billion.

And if fossil fuel prices rose by 2% per year, the avoided cost would be €1,045 billion. Weber added ‘To go beyond 80% would cost a lot more. But the low-hanging fruit is to start with an 80% renewable energy system. The faster you add renewable energy to the grid, the faster you reach the crossover point where the savings become greater than the costs. We estimate that Germany could reach that point as soon as 2025.’

Hans-Martin Henning, one of the research team, noted ‘we would need 150 GW of PV, about 120 GW of onshore wind, about 30 GW of offshore wind, and an electric capacity of 60 would supply all the residual GW of CHP that electricity needs of the system’. The power system would incorporate substantial storage capacity to handle the fluctuations of supply & demand. This could he said take the form of about eight million batteries connected to home PV systems and a doubling of pumped storage capacity. Heat storage would be split among about 150 large-scale centralized storage plants and about seven million home storage units. Finally, about 33 GW of electrolytic plants would produce hydrogen or methane fuel for transportation.

‘Altogether, this system uses 78% renewable energy, and has a much higher overall efficiency than today’s system.’ And it would be possible to achieve balancing: ‘there are many hours when renewables are not sufficient to meet demand, but even more hours when we have too much renewable energy’. [www.nytimes.com/2014/12/01/business/energy-environment/plan-outlines-low-carbon-future-for-germany-energy.html](http://www.nytimes.com/2014/12/01/business/energy-environment/plan-outlines-low-carbon-future-for-germany-energy.html) But, there is no shortage of implementation issues, e.g. some local groups don’t like the [supergrid](http://reneweconomy.com.au/2015/german-energy-prices-continue-plummet-cuts-prices-france-49853) links proposed to shunt power from the north to the south: [www.nytimes.com/2014/12/25/world/europe/germans-balk-at-plan-for-wind-power-lines.html](http://www.nytimes.com/2014/12/25/world/europe/germans-balk-at-plan-for-wind-power-lines.html)

German Energy costs

PV in Germany

The Fraunhofer Institute’s report ‘Recent Facts about PV in Germany’ has some useful data and analysis. It notes that, with costs falling, albeit from a high level, ‘the EEG feed-in tariff for PV power is [being] reduced more rapidly than that for any other renewable energy source. Newly installed, large-scale plants have already achieved grid parity in 2011 for domestic consumers. Since then, the feed-in tariff has continued to drop well below the gross domestic electricity price. Since the beginning of 2012, newly installed, small rooftop installations also have achieved grid parity.’ See chart. And also, in 2013, for many industrial customers too. However, consumers using self-generated power won’t be doing so well under the new EEG arrangements. They have to pay the fixed cost of their grid connection even when they are not using it, and from August 2014, ‘a fraction of the EEG surcharge is... imposed on the self-consumed electricity from newly installed systems larger than 10 kWp’.

What next? Under the new reduced FiT system, capacity growth will slow, and so will the fall off of cost and the linked FiT price depression: ‘the smaller the amount of new and increasingly cheap PV installations annually, the slower the average EEG feed-in tariff will decrease’. And after 2020, ‘the feed-in tariff will gradually expire for the oldest plants, as their 20-year payment period begins to expire’. Nevertheless, the report concluded ‘these plants will continue to supply power at levelized costs that undercut those of all other fossil fuel and renewable energy sources. At present, old installations are currently bringing up the average value of the feed-in tariff; from 2020 on, however, they are likely to cut costs.’ Even so, for now, ‘as a result of the extreme drop in the feed-in tariff, along with the increasing amount of limitations dictating the construction of new systems and grid feed-in over the past few years, the number of new PV installations in Germany substantially declined by 55% in 2013. In the same year, new installations increased worldwide by almost 20%’. And it gets worse: ‘The already radical reduction in feed-in rates, the additional degressions agreed upon and the phase out of the EEG feed-in tariff for new PV systems at a threshold of 52 GW installed capacity ensures that total remunerations paid for PV are limited to €10-11 bn p.a. Based on the existing EEG, a further expansion of PV will increase the total remunerations paid only a moderate amount. (The) additional measures to throttle the expansion of PV will not affect a decrease in the total remuneration. Such a measure would, however, cause a slowdown in the construction of very inexpensive PV systems.’


Old energy goes broke

As energy prices fall, E.ON has reported a €3.4bn loss, and RWE a 45% profit fall. Both are now greening up. RWE is investing €1bn...
Energy Storage: goodbye to gas turbines?

The **energy storage** debate rumbles on. Some claim that storage units will take over peak load grid-power matching from gas turbines. The US Energy Strategies Group says ‘the costs for multi-hour energy storage are about to undergo a steep decline over the next 2 to 3 years. This cost trend will disrupt the economic rationale for gas-fired simple cycle combustion turbines (CTs) in favor of flexible zero emissions energy storage. This will be especially true for storage assets owned and operated by vertical utilities and distributed near utility substations. Simple cycle gas-fired CTs have been a workhorse utility asset for adding new peaker capacity for decades. But times and technologies change, and the power grid’s long love affair with gas-fired CTs is about to be challenged by multi-hour energy storage. Flow batteries that utilize a liquid electrolyte are especially cost-effective because the energy they store can be easily and inexpensively increased just by adding more electrolytes. CTs cost from $670 per installed kilowatt to more than twice that much for CT’s located in urban areas. But the economics of peaking capacity must also reflect the benefits side of the cost/ benefit equation. Distributed storage assets can deliver both regional (transmission) and local (distribution) level energy balancing services using the same storage asset. This means the locational value and capacity use factor for distributed storage can be significantly higher compared to CTs operated on a central station basis.’

Well, storage may get cheaper, but its widespread use assumes there is surplus power to store at the right time, that peaks can’t be met more economically by importing power on supergrids and that smart grid demand side management doesn’t reduce (delay) peaks more economically. Though if storage doesn’t turn out to be the dominant option, it may have a role at the local/regional level, balancing local renewables. For example, the Strategy Group says ‘Lower cost solar PV and its rising penetration in all market segments will have a profoundly disruptive effect on utility operations and the utility cost-of-service business model. This has already started to happen. Storage offers a way for utilities to replace lost revenues premised on margins from kilowatt-hour energy sales by placing energy storage into the rate based and earning low-risk regulated returns.’


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**Bye to fossils**
[http://worldbioenergy.org/content/wba-lima-initiative-climate-and-energy-2035](http://worldbioenergy.org/content/wba-lima-initiative-climate-and-energy-2035)

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**Goodbye to coal?**

Solar and wind energy got strong support from the **Australian** public, with 80% putting them among their top three energy choices in a poll for the Australia Institute. By contrast, coal and coal seam gas were chosen by 35% and 38% of those polled as being among the best three future energy sources. And yet the Australian government seems wedded to coal as the way ahead and in denial over climate change.


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**Wind for e-cars cheaper than oil**

says **investment bank Kepler Chevreux**

It calculates that $100bn invested in **onshore wind** to power electric vehicles, would actually produce 4 times more energy per dollar invested than $100bn invested in oil to power gasoline vehicles by 2020 and 6 times more by 2035, assuming a drop in wind capital-costs and a rise in oil prices. But perverse subsidies for oil remain and may slow the transition:


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**...and e-fuel even better?**

*With e-diesel made from air, water & green electricity*

Audi’s **Sunfire** plant in Dresden produces e-diesel using CO2 from the air and hydrogen made by the electrolysis of water using green electricity. The gasses are reacted together at 220°C and 25 bar to produce synthetic liquid hydrocarbon compounds, which can be converted to diesel.

Global roundup
CSP in Africa

Aora Solar is to build a hybrid CSP plant in Ethiopia. Its ‘Tulip’ CHP
Concentrating Solar power unit (right) will produce 100 kW of power
and 170 kW of heat, running not only on solar radiation but on almost any gaseous or liquid
fuel, including biogas, biodiesel, and natural gas, enabling a variety of operational modes and
ensuring 24/7 power supply. Namibia is also looking to CSP and there is good CSP potential

California aims for 50% renewables by 2030..

Governor of California Edmund G Brown has proposed an ambitious goal to source 50% of
the state’s electricity from renewables by 2030, and cut energy use in buildings by 50%. He
said: ‘We are on track to meet our 2020 goal of one-third of our electricity from renewable
energy. We lead the nation in energy efficiency, cleaner cars and energy storage.’

..but still no US offshore wind

US offshore wind is a long time coming. Two US utilities have
cancelled their power purchase agreements with the 468 MW Cape
Wind offshore wind farm, claiming it had failed to meet its milestones. Cape Wind said that
for ‘over more than a decade’, the Alliance to Protect Nantucket Sound, a local group fighting
against the project, had ‘systematically engaged in a pattern of behaviour calculated to delay
the development and financing of Cape Wind’s offshore wind facility’.


US renewables: 50% power by 2030

The International Renewable Energy Agency’s new report on the US, in its REmap 2030 series, says it can increase the use of renewable
in its energy mix from 7.5% in 2010 to 27% by 2030* (the same as the EUs target), and in the
power sector alone to almost 50% (it’s under 15% now).

Wind would dominate in the power sector (see Box). But in REmap 2030, 55% of all renewable energy in the US
would be in the form of non-electricity energy use, i.e.
bioenergy in solid, liquid or gaseous forms, or solar
thermal or geothermal heat, for heating, cooling and
transport applications, with the total use involving a 3 to
4-fold increase of renewables over 2010 levels. If bi-o-
mass use on the scale envisaged was constrained, EVs
and heat pumps could play more of a role.

The report says that to reach these levels would need an
annual investment in renewables of $86 bn between now
and 2030-$38 bn above business-as-usual. But it says
this will result in annual savings of $30-140 bn by
2030 due to lower health effects and fossil fuel use.


CCS cut

The US Dept. of Energy has pulled funding for the
FutureGen clean coal CCS plant due to project completion delays.

*Japan looks to 1.45 GW of offshore wind


Solar India

100 GW of PV by 2020...


Power REmap 2030 would entail a fivefold increase in US onshore wind
capacity, from 63 GW in 2014 to 314 GW by 2030. It also envisages an additional 40 GW of offshore wind
and that by 2030 total installed solar PV capacity could reach 135 GW, compared to 7 GW in 2012. Biomass
offers the potential for an additional 46 GW of power capacity, taking the total to 84 GW by 2030. REmap envisages an additional 18 GW in power generation from geothermal, adding to 6 GW under current plans.

*EIA say just 18% by 2040 under BAU...

Hawaii aims for 100% renewables by 2040


China has cut it’s wind FiT to slow growth- it had reached ~115 GW by the start of the year. Too fast?

Dying on its feet?

In the USA many new plant proposals have been abandoned and several existing plants closed early - Vermont Yankee being the latest. Elsewhere it may be different. China’s 12th Five Year Plan for 2011-15 called for a ‘small number’ of nuclear projects to be approved each year after full discussion, with, following Fukushima, coastal sites being blocked. But now the government is to resume approvals for coastal plants. It seems they now feel it’s safe. They should read: ‘On the institutional invisibility of nuclear disaster’:

www.lse.ac.uk/researchAndExpertise/units/CARR/pdf/DyingOnItsFeet_web.pdf

More Money The US Dept. of Energy is offering up to $12.5bn in loan guarantee for new nukes It will focus on advanced reactors and projects with ‘evolutionary, state-of-the-art design improvements in the areas of fuel technology, thermal efficiency, modularized construction, safety systems, and standardized design,’ as well as Small Modular Reactors, typically 300 MW or less, and uprate/upgrade projects, using innovative technology to improve existing reactor efficiency/capacity. With a proposed long-term EU investment programme of €315bn, 9 countries are said to be applying for a total of €100 bn investment subsidies for new n-plants/upgrades, including Romania, Poland & the UK. The UK wants €46 bn, Poland €12bn.

www.sunwindenergy.com/review/eu-investment-programme-eu-100-billion-nuclear-power.html

EUROfusion - hope rises eternal, so does the budget

The European Commission and the European fusion research labs have a joint programme on nuclear fusion, ‘EUROfusion’, with a budget of at least €850 m for 2014-18, of which about half will come from the Euratom Horizon 2020 fusion energy research programme. The main focus will be scientific and technical support for ITER, the International Thermonuclear Experimental Reactor, being built in France, but EUROfusion will also ‘address fundamental issues relating to the next generation fusion demonstration reactor, DEMO, that will be connected to the grid and provide a blueprint for the deployment of fusion reactors across the world, enabling fusion to contribute to meeting the world’s growing energy needs after 2050 alongside renewable energy’.

Nuclear options It’s not clear how fusion plants would be used: maybe to make hydrogen, rather than electricity - that, as oil declines, being a more lucrative market. With fission plants facing economic/flexibility/reliability issues, maybe some will go for batch hydrogen production now. Or sell their waste heat, to be more economic.


www.lockheedmartin.com/us/products/compact-fusion.html If real, fission will be dead. But the Weinberg Foundation says the Molten Salt Reactor is a ‘revolutionary’ advance for fission: it’s ‘extremely fuel efficient, generates very little waste, and offers unique passive safety features. Crucially, the MSR has outstanding load-following capability and will provide a low-carbon alternative to gas as a flexible source of electricity to support renewables’: www.the-weinberg-foundation.org But when? At what cost?
3. Forum Odds and ends for you to chew on

The UK Capacity Market - what is it for?

In a fully free-market system there is no direct commercial incentive for generation companies to ensure that the lights stay on long-term, by investing in new and/or backup capacity. Given that some old plants are scheduled for closure and more reliance on sometimes variable renewables is planned, the UK government has stepped in to create a new ‘capacity market’ to try to fill the potential gap in terms of reserve capacity and grid balancing capacity. Competitive market pressures have meant that some existing gas fired capacity has been moth-balled, and the new market is meant to draw on some of that - by offering an extra cash incentive for making it available for use if needed, the cost of which will be passed on to consumers by an extra levy on energy prices. It was also thought that this could incentivise investment in some new projects, including new flexible gas plants, but also energy storage facilities to help with grid balancing, as well as demand management projects, aiming to reduce demand peaks.

With maybe 30 GW of more of renewable expected on the grid by about 2020, and old coal and nuclear plants being closed, the UK government has adopted a capacity auction approach, seeking to eventually contract for around 53 GW of capacity to be available. The first round, earlier this year, led to ~49 GW of capacity being contracted for reserve/back-up duties from 2018 onwards if required, most of it being existing or refurbished fossil fired capacity, including 25 GW or so of gas plant, over 9 GW of coal/biomass plant, and near 8 W of existing nuclear.

This led to criticisms, although some may have been due to confusions about what the Capacity Market actually aims to do. Some evidently hoped it would add new, ideally green, capacity rather than supporting old fossil and nuclear plants. That’s not what has happened, but some of the plants it has backed will help support the grid given the variable inputs from renewable plants, so, arguably, it is part of an overall green energy approach. Though it could have been greener, if more storage and (especially) demand management was included. And while gas-fired plant can help balance variable renewables, in terms of short-term variations, nuclear is pretty irrelevant - it can’t load follow rapidly or regularly. In theory, if there are long lulls in wind or solar availability or other shortfalls (e.g. due to longer-term plant or grid failures, or cold spells), then nuclear might play a role if it was seen as part of the reserve capacity, along with old occasionally used coal plants. But then that implies that nuclear would also not be used fully at other times, which would undermine its economics.

Is that what its inclusion in the capacity market means? Nuclear no longer being seen as baseload, with the capacity market payments being offered as a compensation for lower average operation? But that begs the question of whether it is actually any good in this role. The recent experience with many nuclear plants being off-line does not make it look like a very reliable reserve capacity option. Or for that matter much use for baseload. So, either way, why is it getting extra support? Similarly for the 9 GW or so of coal and biomass plant that was supported. The suspicion is that, as with the 7.9 GW of nuclear, the Capacity Market has just been used to as backdoor way of providing extra finance for it. If extra baseload was needed, why not support it in the normal way, via the CfD? Plenty of issues to be resolved before the next CfD round! Though as for CCS, will that ever get CfD backing? See below.

www.gov.uk/government/uploads/attachment_data/file/389832/Provisional_Results_Report-Amendment.pdf There will also be a new Capacity Market round soon... Will DSM get in properly?

**CCS Carbon Capture and Storage** seems a long time coming, despite £1bn being available in the UK, but enthusiasts say globally there are 8 operating full-chain CCS projects (some running for >10 years) plus 15 in build or advanced development. And some new technologies may help cut costs, e.g. for amine capture: www.chemengonline.com/modified-mofs-cut-carbon-capture-costs-half/ and sandstone storage www.myscience.org/news/2015/study_suggests_method_is_rock_solid_for_storing_carbon_dioxide_deep_underground-2015-imperial
CHPA becomes ADE

What’s in a name?
The UK’s long established Combined Heat and Power Association has changed its name to the Association for Decentralised Energy to better reflect its wide range of interests - CHP, district heating & cooling, and demand side energy services. DSM is of course a new venture, evidently one that is seen to be important: think CHP/DH with large heat stores being used to balance variable demand and supply. Back in the 1970s, when the CHPA was founded, the focus was mainly the campaign for city-wide CHP/DH, and after a long lull, that’s beginning to be taken seriously, with DECC supporting local heat networks. It’s interesting this is still labeled ‘decentralised’, given that it’s large or at least community scaled, and possibly based on quite big plants, as opposed to being scaled for individual homes. But then that would be micro-generation, and there is already an association for that! The phrase ‘decentralised energy’ also tends to be associated with smaller-scaled renewable energy systems, in contrast to large-scale centralised fossil and nuclear units. Sometimes it is also taken to mean ‘off-grid’, usually in the context of small domestic units in remote areas. While CHP plant usually are not very large, most so far use fossil fuel, and some CHP units are run independently, supplying heat and power to a factory complex, or feeding local private wire power networks and local heat mains, as in Woking. So maybe the term decentralised makes sense. That wider definition is evidently used by WADE, the US-based World Alliance for Decentralized Energy, which covers local renewables as well as CHP/cogen: www.localpower.org But then there’s distributed power - i.e. a system with smallish plants of any type linked to grids at the local distribution level, rather than using power sent down long transmissions lines from big central units. Help!

* Other changes: after the Solar Trade Association left the Renewable Energy Association, the REA set up UK solar and also a UK energy storage initiative. The STA carries on independently.

Media biases…

Tom Burke had a go at the FT for being status quo oriented: http://tomburke.co.uk/2014/12/09/on-turning-good-news-into-bad/ By contrast, Gossage, Electrical Review’s indispensable gossip column, is (usually) a welcome relief. A sample: ‘So far this century, not only is overall energy use down 14%. But per capita electricity consumption has also already fallen by 10%.’ www.electricalreview.co.uk/features/opinions/10408-gossagegossip Good news, and the sometimes reliable BBC relayed it: http://www.bbc.co.uk/news/business-30518649 and also www.bbc.co.uk/news/business-24823641 Even the often staid UK magazine Prospect managed a mention of this significant change, by Mike Grubb, in an otherwise dire cheap oil special. For the rest, well you usually know what you will get. Good green coverage often in the Guardian and Independent, but also useful bits in the Telegraph and even the Times! The Ecologist of course can be relied on for positive up-beat coverage, e.g: http://bit.ly/1x1PR9r

…and myths ‘There are some myths that we need to get over: the myth that fracking would be a disaster for the environment; the myth that GM technology means that we are all going to be eating fish-flavoured tomatoes; the myth that nuclear power is inherently unstable and we should not pursue it. Those are myths that we need to confront if we are going to be a successful science-based country in the future’ - PM David Cameron. Why didn’t he add the one about CO2 being plant food, so global warming was good for the planet.
EROI disagreements A paper in the journal *Energy* looks once again at energy returned on invested, EROI, with updated material databases, and updated technical procedures ‘making it possible to directly compare the overall efficiency’ on a uniform mathematical and physical basis. Pump storage systems, needed for solar and wind energy, have been included so that the efficiency can be compared with an ‘unbuffered’ scenario. The results show that nuclear, hydro, coal, and natural gas power systems (in this order) are one order of magnitude more effective than pv solar and wind power. This is a very different conclusion to those produced by most other studies e.g. see Dan Harvey’s book *Carbon Free Energy Supply*. A key differences that the new study does not include the energy content of the fuel that the technology concerned uses in its assessment - just the energy used in its construction. Hardly surprising then that fossil and nuclear get off lightly while the renewables lose one of key advantages - no fuel requirement. The inclusion of energy storage also it says reduces the renewables EROI remarkably. But it just assumes pumped storage. There are many other grid balancing options, some of which may be less carbon intense: www.sciencedirect.com/science/article/pii/S0360544213000492 (See the critique at /S03006373).

Another nuke goes The *Vermont Yankee* nuclear plant shut down earlier this year. It’s the fourth old US nuclear plant to close in two years, following San Onofre in California, Kewaunee in Wisconsin, and Crystal River in Florida. 42 years old, it needed upgrades to keep it going, but the owners said ‘when we looked at the cost of those improvements with what we projected as the cost of energy, the decision was that it would be better to shut the plant down’. Many other US nuclear plants are old, and progress on new ones is slow. Moody’s Investors Service says 10 old nuclear plants can’t compete in current markets. Exelon said it will need to charge about 83% more than wholesale prices to earn a profit at its Ginna New York plant and 5 of its others plants are at risk. Nuclear is in effect phasing itself out in the US. Will markets be fixed to slow this? www.world-nuclear-news.org/C-Market-reforms-needed-to-prevent-US-closures-0801157.html Meanwhile, old *Soviet era* plants are not doing any better. In the Ukraine, there were two sudden plant shut downs at the end of last year at the huge 6-plant Zaporozhye complex (pic) near the Crimean border: http://rt.com/news/218199-ukrainian-nuclear-reactor-shut/ France of course still leads globally, with nuclear supplying around 74% of it electricity, and though that’s to be cut back to 50%, and though the industry is in financial crisis, there has amazingly been talk of building new plants. Energy Minister Segolene Royal told *L’Usine Nouvelle* magazine, there was a need to ‘programme the construction of a new generation of reactors, which will replace old plants when these cannot be renovated anymore’. WNN

Even more amazingly, *Japan* is talking of restarting enough old reactors to supply 20% of electricity by 2030, nearly the same as for renewables. But no new plants are likely and it’s a fall from the pre-Fukushima 29%.

Ditch climate arguments - to save nukes!

Steve Kidd, once a senior nuclear lobbyist for the World Nuclear Association, has left the WNA and outlined a new policy. His proposed revised strategy is to dump climate arguments (since they was uncertain and also, in practice, just strengthened the case for renewables rather than nuclear) and sell nuclear ‘on grounds of cheapness, reliability and security of supply’. With the costs of new plant construction rising and the reliability and economic viability of many old plants in question, we wish him luck with that! He also had little time for the handful of ex-green ‘turncoats’ who now backed nuclear: not reliable allies. http://www.neimagazine.com/opinion/opinionis-climate-change-the-worst-argument-for-nuclear-4493537/