



Submission to the National infrastructure Commission Call for Evidence

Improving how electricity demand and supply are balanced

Greenpeace has a longstanding interest in the energy system because of its widespread impacts, especially through climate change. We have written extensively about potential changes of new storage technology¹. We welcome the fact that the newly formed NIC is looking at new opportunities for supply and demand balancing.

Demand Side response and system costs

We notice that sometimes this call for evidence is titled demand and supply balancing but at other times being principally about interconnection and storage as the major foci. We are very supportive of both storage and interconnection, but also believe demand side management is critical. All of these tools will be important in ensuring grid balancing. This is because there is a high likelihood that significant power sector decarbonisation (like the carbon intensity target for the UK of 50-100gCO₂/kWh proposed by the Climate Change Committee) will be met substantially by renewable energy. The other key low-carbon technologies are struggling: Carbon Capture and Storage has suffered a major setback with a second competition for public funds being cancelled – meaning any further competition or mechanism for awarding funds is unlikely to be taken seriously – whilst nuclear power continues to be many years away and subject to substantial delivery risks as identified by Sussex Energy Group², National Audit Office³ and other commentators such as the Financial Times⁴.

Under circumstances of high renewables penetration, all forms of balancing are helpful. Specifically, the analysis that Greenpeace commissioned for UK demonstrates that DSR is an important tool for delivering power sector decarbonisation, alongside interconnection, some storage, and a proper integration of thermal generation with heating needs⁵ – notably under these circumstances, a 2030 power system of 85% renewables is possible without new nuclear or CCS, and including substantial electrification of both heat and transport. Similar studies for the US have emphasised the role of

¹ The solar storage energy revolution is arriving, Doug Parr, Greenpeace, April 2015

<http://energydesk.greenpeace.org/2015/04/27/comment-the-solar-storage-energy-revolution-is-arriving/>

² Whither Energy policy, Sussex Energy Group, Dec 2015

<https://blogs.sussex.ac.uk/sussexenergygroup/2015/12/09/whither-uk-energy-policy/>

³ Over a third of major infrastructure projects branded 'undeliverable' or 'in doubt', report finds, Jan 2015

<http://www.telegraph.co.uk/active/12083669/Over-a-third-of-major-infrastructure-projects-branded-undeliverable-or-in-doubt-report-finds.html>

⁴ Beyond Hinkley — the need for a plan B, October 2015, <http://blogs.ft.com/nick-butler/2015/10/21/beyond-hinkley-the-need-for-a-plan-b/>

⁵ 4 ways the UK can get almost all its power from renewables – without Hinkley, Sept 2015

<http://energydesk.greenpeace.org/2015/09/21/4-ways-the-uk-can-get-almost-all-its-power-from-renewables/>

Full report: Greenpeace 2030 Energy Scenario, Sept 2015 <http://www.demandenergyequality.org/2030-energy-scenario.html>

DSR from both Stanford University⁶ and Rocky Mountain Institute⁷. In the former, the key balancing agents for their 100% wind, water and solar system are hydrogen production and THERMAL energy storage (rather than power storage). Notably the conventional costs of this system, with supply and demand balanced over every 30 second interval for 6 years, are the same as a 'business as usual' approach to energy provision, but with huge co-benefits on avoided air pollution & climate impacts. The Rocky Mountain Institute study stated that DSR and wider connection is more important than storage in providing for high penetrations of renewable power.

A similar detailed study for the European power system⁸ by McKinsey, KEMA and Imperial College showed that by 2030 interconnection and demand side response "shifting up to 10% of daily load in response to availability of supply, decreases the need for grid capacity by 10% and back-up capacity by 35% and thus helps in managing the risk of insufficient grid transmission. Demand response also reduces the volatility of power prices by better matching demand to available supply, reducing volatility by 10–30%".

In terms of overall system costs an earlier study by the same authors⁹, again looking at costs across the EU by 2050, indicated that a combination of interconnection, demand side response and storage would deliver system costs at 40% renewables similar to that of 80% renewables. 40% renewables is not far off where we are headed, with renewables expected to contribute approx. 30% to UK system by 2020 and further expansion in wind and solar to take place in 2020s.

Note that both EU studies took place before the sharp drop in solar costs over the past few years.

Specific barriers do exist to DSR: the UK capacity market has been widely criticised as unfriendly to demand side response, even during its development¹⁰. The Belgian market allows DSR to compete directly with new plant and takes a larger share of the market than the one allocated to it in UK¹¹.

Innovation

The NIC call for evidence, quite reasonably, asks for evidence on costs. However it needs to be borne in mind that a number of new technologies are coming on stream with costs shifting all the time.

⁶ Low cost solution to grid reliability problem with 100% penetration of intermittent wind, water and solar, Jacobsen et al, 2015

<http://web.stanford.edu/group/efmh/jacobson/Articles/I/CombiningRenew/CONUSGridIntegration.pdf>

⁷ Is Storage Necessary for Renewable Energy?, August 2014

<http://www.engineering.com/ElectronicsDesign/ElectronicsDesignArticles/ArticleID/8272/Is-Storage-Necessary-for-Renewable-Energy.aspx>

⁸ Power Perspectives 2030, European Climate Foundation, Nov 2011

http://www.roadmap2050.eu/attachments/files/PowerPerspectives2030_FullReport.pdf

⁹ Roadmap 2050, European Climate Foundation, April 2010 <http://roadmap2050.eu/project/roadmap-2050>

¹⁰ Criticism from NGOs: The Energy Bill: Matching supply to demand, Dec 2012

http://www.foe.co.uk/sites/default/files/downloads/matching_supply_demand.pdf. Criticism from Parliamentarians <http://www.theguardian.com/environment/cif-green/2011/jan/14/energy-market-reform-plans>. See also <https://alansenergyblog.wordpress.com/>

¹¹ How to generate 'negawatts' through demand response, Sept 2014. <http://utilityweek.co.uk/news/how-to-generate-%E2%80%99negawatts%E2%80%99-through-demand-response/1048152#.Vo6ixvmlTIX>

Any framework proposed by NIC should give ample scope for innovation and stress flexibility. Two examples would be:

- A) power-to-gas plant. Here intermittent renewable power is converted to gas for storage or later use. Experimental facilities have been set up in Germany and Isewhere¹² and although costs are early stage, we are aware of at least one study in preparation that suggests high levels of cheap onshore renewables with power to gas plant provides cheaper baseload than nuclear¹³. Nor is it clear that power-to-gas plant will necessarily be large scale, as at least one company is looking at plant suitable for individual buildings¹⁴
- B) Northern Power Distribution voltage control technology, which preliminary data suggest if applied across UK could reduce demand at peak times by approximately 4GW¹⁵.
- C) Innovation is not simply technology development. Again drawing on the possibilities from demand response, REGEN SW is looking to develop a tariff with Tempus Energy and Wadebridge RE Network to shift power usage to when solar is delivering. But the contractual relationships need to be worked out¹⁶.
- D) Business innovation may be delivering 'behind-the-meter' solutions in combinations of solar plus battery storage if low cost finance can be delivered. Here at North Star Solar¹⁷ and Moxia Tech¹⁸.

¹² The story of storage — and where we go from here, Dec 2014

<http://energydesk.greenpeace.org/2014/12/23/story-storage-go/>

¹³ Michael Freidrich, pers. comm.

¹⁴ New Clean Power Powerhouse: Power-To-Gas Plus Software Defined Power Plants, Dec 2015

<http://cleantechnica.com/2015/12/14/new-clean-power-powerhouse-power-gas-plus-software-defined-power-plants/>

¹⁵ Why your kettle could take longer to boil when the wind isn't blowing, Aug 2015

<http://www.telegraph.co.uk/news/earth/energy/11799573/Why-your-kettle-could-take-longer-to-boil-when-the-wind-isnt-blowing.html>

¹⁶ Cornwall experiments with 'sunshine tariff' as possible alternative for UK solar, Oct 2015

http://www.pv-magazine.com/news/details/beitrag/cornwall-experiments-with-sunshine-tariff-as-possible-alternative-for-uk-solar_100021583/#.Vjhy4dSNBtc.twitter

¹⁷ North Star Solar to test solar-plus-storage systems in London boroughs, Dec 2015

http://www.solarpowerportal.co.uk/news/north_star_solar_to_test_solar_plus_storage_systems_in_london_boroughs

¹⁸ <http://www.moixatechnology.com/case-studies.php>