Summary

To support the cheapest and locally sourced form of low carbon electricity, onshore wind, this report recommends investing in strategically placed large scale pumped hydro, the cheapest form of storage. This will help National Grid to manage the intermittency of onshore wind, whilst the combined solution remains cheaper than nuclear electricity. As onshore wind continues to grow, pumped hydro can store this cheap, low carbon, renewable form of electricity at times of high wind and low demand, whilst releasing it at times of high demand and/or low wind.

The overall point that I make in this short report is that onshore wind combined with pumped hydro is cheaper and more secure than nuclear. For this reason I believe it should be given serious thought when considering infrastructure projects of national interest.

The objective is to highlight that renewable projects providing similar electricity volume and consistency to the National Grid as the proposed Hinkley Point C could do so at cheaper prices whilst providing more flexibility in output.

The table below compares some key variables, showing that onshore wind with pumped hydro is more cost effective than nuclear:

Parameter	Project consisting of onshore wind with pumped hydro – see next chapter for assumptions	Nuclear (Hinkley Point C)
Installed capacity	3,200MW pumped hydro and 7,000MW onshore wind	3,200MW
Annual output	25,000GWh	25,000GWh
Capital costs	£14,000m	£16,000m – £24,500m
Government subsidy (2012 money)	~£75/MWh for 30 years	£92.5/MWh for 35 years
Lifetime	30 years for onshore wind 60+yrs for pumped hydro	60 years
Decommissioning cost	Generally cost neutral	DECC currently spends £6bn/yr, committed for 80 more years to decommission current fleet
Fuel source	Wind – blows across land freely	Uranium – Main global supplier is Kazakhstan, followed by Australia, Niger and Namibia.
Amount of private investment in UK	£8bn - Over the last 5yrs onshore wind has received over £8bn of private investment in the UK	£0 – No UK nuclear power station has been built with private capital – last investment was in 1987 by CEGB, a Government quango.
Amount of capacity in UK	8,516MW onshore wind 2,860MW pumped hydro	8,883MW
% of generation	5%	19%
Amount of capacity worldwide	370GW onshore wind 127GW pumped storage	370GW
Worldwide electricity produced	599TWh wind	2,410TWh

Details of assumptions

In terms of the nuclear assumptions these have been taken from the EDF website on Hinkley Point C.

In terms of the assumptions for onshore wind, this is assumed to be one large onshore windfarm consisting of turbines at up to 200m tip and up to 150m rotor size. The windfarm would consist of about 800-1,100 turbines and cover an area of 70-100km2. For comparison this is equivalent to the following:

Bare land	Area km2	% needed
Bodmin moor	208	33%-47%
Dartmoor	954	7%-10%
Exmoor	692	10%-14%
North York Moors	1,436	5%-7%
Salisbury Plain	780	9%-13%
North Pennines	2,000	3%-5%
Cairngorms National Park	4,528	1%-2%

Please note that these large open spaces are used for illustrative purposes only.

For onshore wind a more realistic option would be to allow a large scale ‘distributed windfarm’ made up of many parts. This would be achieved by encouraging more sensitively placed onshore wind development across the UK. This would be more costly that a single large wind farm as there is not as much scaling. This solution would still be competitive with Hinkley Point C however. The UK National Grid enables all wind parks connected to it to act as one large powerstation. The pumped strorage would enable National Grid to match supply and demand.

In terms of pumped hydro the latest figures from National Grid have been used. The UK’s largest pumped hydro station at 1.7GW, Dinorwig Powerstation in North Wales was built in the 1970s. It is still a cornerstone of the UK National Grid. Interestingly a large pumped hydro plant was planned in Exmoor back in the 70s/80s at the same time as this one.

Realistically most onshore wind capacity will be in Scotland going forward. Therefore a large scale pumped hydro station to work with these in the north of the island is probably the best option.

Onshore wind combined with pumped hydro provides the following to the UK consumer:

- Low cost electricity
- Low carbon electricity
- Energy security as it is home grown electricity – not reliant on foreign fuel imports

Answers to Electricity interconnection and storage

1. What changes may need to be made to the electricity market to ensure that supply and demand are balanced, whilst minimising cost to consumers, over the long-term?

My assumption with this question is that with cost the following is meant:

1. Minimising cost in terms of p/kWh to the end consumer
2. Minimising the cost of fluctuations by increasing energy security (reducing reliance on imported fuel)
3. Minimising costs due to climate change – therefore focusing on low carbon / renewable technologies

Onshore wind is top on all of the three criteria above. Storage is essential to the UK electricity generation as it enables more installation of onshore wind onto the grid. Pumped storage is still by far the cheapest form of energy storage for electricity at scale.

2. What are the barriers to the deployment of energy storage capacity?

No comment

3. What level of electricity interconnection is likely to be in the best interests of consumers?

No comment

4. What can the UK learn from international best practice in terms of dealing with changes in energy technology when planning to balance supply and demand?

No comment