Strengthening strategic and sustainability considerations in Ofgem's decision making

Aquamarine Power's response

1. Introduction

"With a quarter of the UK's generating capacity shutting down over the next ten years as old coal and nuclear power stations close, more than £110bn in investment is needed to build the equivalent of 20 large power stations and upgrade the grid. In the longer term, by 2050, electricity demand is set to double, as we shift more transport and heating onto the electricity grid. Business as usual is therefore not an option.[i]"
Department of Energy and Climate Change, 2010

The coming decades will see a radical shift in the way in which electricity is generated and how it is paid for, and we welcome this discussion paper.

We believe marine energy – wave and tidal power – offers a potential new energy source which can make a significant contribution to the UK and global energy mix in the decades ahead.

But we are concerned the current charging regime fails to take account of the particular economic challenges faced by these early stage technologies, and as a consequence there is a danger that wave and tidal energy will be 'locked out' of any future energy scenario.

This would mean UK consumers would miss out on a new form of energy which has the potential to drive down consumer bills in the long term, and also that UK would miss out on a major economic opportunity to become a global leader in new technologies.

As project Discovery stated, the lowest domestic fuel bills would be likely to be realised under the 'Green Stimulus' scenario in which the UK reaches its 2020 renewable energy target[ii].

We believe a greater diversity of renewable energy sources will :

a. Reduce energy price volatility
b. Suppress consumer prices in the long term

Furthermore we remain concerned that the current system of transmission charging does not fully take account of the system benefits of more renewable energy in the overall energy mix, with the following potentially negative consequences:

a. Lack of diversity of energy sources
b. Lost opportunity to the UK in taking a global lead in new energy sources – ie new sources are precluded or 'locked out'
c. No opportunity to drive down LCOE of new energy sources, or develop UK supply chain
d. Not meeting UK's legally binding carbon reduction and sustainability goals
e. Security of supply failure

2. Energy price volatility and domestic fuel bills

Predicting future energy prices is difficult. The Department of Trade and Industry white paper from 2004 estimated oil would reach $23 per barrel by 2010. In 2010 it forecast oil at $80 per barrel. As of September 2012, Brent crude is currently trading at $115 per barrel[iii]."

From 2000 to 2010, and after adjusting for inflation[iv]:

- Average electricity bills increased in real terms by 30%
- Average gas bills increased in real terms by 78% - peaking at 91% above 2000 levels in the year 2009

This has been overwhelmingly driven by one factor: the rising costs of fossil fuels. From 2000 to 2010, and again after adjusting for inflation:

- The price paid by power producers for coal increased in real terms by 71%
- The price paid by power producers for natural gas increased in real terms by 90% - peaking at 123% above 2000 prices in the year 2008

The wholesale price of gas has been attributed by utilities[v] as the main cause of the recent rise in energy prices. Cutting the amount of gas we consume was shown by Project Discovery as being key to constraining price rises. [vi]

In addition, Ofgem's report anticipated that the lowest domestic fuel bills would be likely to be realised under the 'Green Stimulus' scenario in which the UK reaches its 2020 renewable energy target[vii].

3. Renewable energy as a hedge against volatility

There is an increasing body of evidence which suggests wind energy and other renewables lower the price of electricity. Prof Harry Markowitz, the Nobel Prize winning Chicago school economist was one of the first to describe modern portfolio theory. The theory, simply put, states that to deliver the best possible return from an investment portfolio you need a mix of high and low risk assets. Apply Markowitz's theory to electricity markets and you observe the same result – where an optimal mix of risky (gas and coal plant with high price volatility) and non-risky (free fuel wind and solar plant) delivers the best possible risk adjusted return – which in this case is a lower electricity price than a comparable market with no wind or solar plant.

In addition, the "Merit Order effect" states that the most economically efficient method of utilities to satisfy consumer demand is by utilising plants with the lowest marginal cost of generation. Wind and solar plants – with zero fuel cost – are zero marginal cost plants and sit at the top of the "Merit Order". The most efficient thermal plant is next to be brought on line, and as customer demand increases towards peak the least efficient, and most expensive fossil plant, gets used. The Merit Order effect is the term used to describe the displacement of more expensive marginal cost thermal plant by wind or solar which has zero marginal cost.

In March 2012 the Illinois Power Agency published its annual report[viii] on the costs and benefits of renewable resource procurement. In Illinois, in common with the UK, consumers pay through their bills for a support mechanism to incentivise renewable energy. The IPA's analysis has shown that in 2011 the Merit Order effect *lowered* the wholesale price by $1.30 per MWh for a total saving of over $176m for Illinois electricity consumers. Or as the report put it:

"...when the sun is shining or the wind is blowing, the combined output of renewable generators benefits all customers by bringing down the market price of electric energy for all resources operating at that time."

In Europe, where there is a longer history of wind generation, there is a wider body of evidence supporting this effect. In February 2011, the Irish grid operator Eirgrid published a study[ix] demonstrating the price lowering effects of wind. Ireland has roughly twice the installed amount of wind plant on its electricity system than the UK, despite having a peak demand of around one tenth that of ours. Like the UK it relies largely on imported gas for additional generation.

Eirgrid showed that the generation of electricity by wind plant on the Irish system in 2011 *lowered* total wholesale costs by €74m. Not only was this more than enough to offset the cost of the subsidy paid by Irish consumers (€50m) but it was also sufficient to offset the additional constraint costs associated with increased wind on the system, delivering an overall **net** benefit to the Irish consumer. Eirgrid concluded that wind was *not* contributing to higher wholesale electricity prices in Ireland.

In the UK it is very difficult to observe the Merit Order effect because of the way the market is constructed. However, there is no reason to doubt that the portfolio and Merit Order effects are at work in the UK, with wind energy reducing the wholesale cost of electricity. But without real transparency in the market, these effects are hard to detect. It is erroneous to conclude that subsidies for wind energy put up consumers' bills, when in fact they help keep down the price rises caused by the rising cost of gas.

4. Why ocean energy?

Ocean waves represent our planet's last untapped natural renewable energy resource. Over 70 per cent of the earth's surface is covered with water. The energy contained within waves has the potential to produce up to 80,000TWh of electricity per year - sufficient to meet our global energy demand five times over. The potential to capture energy from the sea offers a vast and endless source of clean sustainable electricity.

In comparison with wind energy, it's easier to accurately predict how much energy can be generated by waves, and when. In addition, the peaks and troughs of wind and wave energy do not always coincide. This means there are times when there is abundant wave energy and little wind. This diversity helps even out the fluctuating nature of some renewable energy sources. When combined with other renewable energy, such as hydro power, it helps provide a more predictable and steady renewable energy mix.

A diverse renewable energy portfolio means a more stable energy system, reduced variability and lower cost. In addition, a strong renewable energy mix means we become less reliant on traditional power sources such as oil and gas. This gives us greater energy security.

5. The economic opportunity of marine energy

The recent European Commission paper "Developing a Maritime Strategy for the Atlantic Ocean Area[x]" states:

"The potential of the Atlantic's powerful waves and strong tides needs to be exploited as well. The predictable nature of energy from tides can complement the fluctuating energy from wind. Islands can receive a high proportion of their energy from the sea. However successful deployment of large scale offshore renewable energy will only happen if grid connections are ensured to link the main production centres to the consumption."

In February this year, the UK Parliament's Committee on Energy and Climate Change published its report into marine energy. Committee Chairman Tim Yeo MP said "Britannia really could rule the waves when it comes to marine renewable energy".

The Committee calls for the Government to set more ambitious targets for the wave and tidal sector, and to provide greater revenue certainty, in order to maximise the likelihood of the UK benefitting from a lucrative export market in clean energy technology.

It is clear that marine energy offers such potential. The recent Member State position paper on marine energy[xi], co-signed by nine Member States, underlines the potential for marine energy alone to provide 26,000 direct EU jobs from ocean energy by 2020 and 314,000 direct EU jobs from ocean energy in 2050.

Trade body RenewableUK estimates the UK marine energy industry could employ 19,500 individuals by 2035, bringing £6.1bn investment and generating a GVA of £800m per annum[xii], with over 800 people employed in the sector already.

The majority of proposed wave and tidal development in the UK is dependent on island links. The Crown Estate has granted 1600 MW of seabed leases to wave and tidal developers in the Pentland Firth and Orkney Waters leasing roundxiii. Of these, 1050 MW, or 66 per cent, are dependent on island interconnectors

The Crown Estate has also leased a further 125 MW leases outside of the PFOW leasing round[xiv]. Of these, 100MW, or 80 per cent are dependent on island interconnectors.

For wave projects only, the situation is much more severe. More than 92 per cent of all Crown Estate leased wave projects are dependent on island interconnectors.

It is therefore not overstating the case to say the UK's world-leading wave and tidal sector could be 'locked out' unless there is an equitable solution to the issue of transmission charging.

6. Why locate on Scottish islands?

Given that the TNUoS system is designed to offer a locational signal to developers, would it not make sense to follow that signal and move away from areas with high TNUoS charges?

This argument carries weight for forms of generation which are not dependent on the location of the energy source – such as base load coal, gas or nuclear. It also holds true, to a lesser degree, to onshore wind, where there is an energy gradient across the UK.

However, as we will go on to show, this does not hold true for wave energy.

Project economics dictate that the major economic driver for an early stage wave energy project is the wave energy resource. Capital costs for early stage technologies are high, and projects must seek out areas where the resources are the very best.

This is borne out by the evidence above, which shows all early stage wave developers are seeking leases in the most exposed, energetic, and therefore remote, locations.

TNUoS charges will have a significant and detrimental impact on the IRR of these projects – this is to be expected given the strong locational signal embedded within the methodology. But as we will go on to show, the TNUoS price signal is not sufficient to outweigh the need to locate in areas of high resource. Both price signals are strong, but the wave resource signal is stronger.

In this situation, TNUoS charges serve no function in driving location, and are simply a penalty on wave energy projects.

We have analysed four scenarios based on a 20MW Oyster wave project.

In all cases we have assumed 5 ROCs and identical project finance structures. Likewise we have made identical assumptions in terms of non-TNUoS grid and infrastructure costs.

The only two variables we have altered are wave energy resource and TNUoS.

- Scenario 1 is based on our real-life project in north-west Lewis, with a TNUoS of £77 per kW – as per Redpoint's modelling for Project TransmiT.
- Scenario 2 is the same project in Lewis, with a TNUoS of £8.50 per kW – the TNUoS applicable in Cornwall.
- Scenario 3 is the same project in Lewis, with a TNUoS of £110 per kW. This is based on the latest informal cost projection offered by National Grid, calculated using the most recent expected cost of the interconnector.
- Scenario 4 is based in Cornwall, at a nearshore site just south of Newquay, with a TNUoS of £8.50 per kW.

Of the three examples, scenario 2 (a project in Lewis, with low TNUoS) offers the best IRR – at a level which we believe would be attractive to a utility investor.

If, however, we take the same project on Lewis and factor in TNUoS at £77kW (scenario 1*), the project IRR is reduced by 2.6 per cent.*

If we use the figure of £110 kW, the IRR is reduced by 3.9 per cent.

These are significant reductions in IRR and will make the difference between a project being attractive to an investor and not. At the early stage of the industry customers will also require higher levels of return to compensate for the higher technology risk.

If the project were to move to a lower energy site near Newquay in Cornwall (scenario 4) *the project would offer a negative IRR* – in other words the project would be loss-making. The low TNUoS is not sufficient to offset the lower wave energy resource.

This is not to say that a nearshore wave energy project would not be economic in Cornwall in the longer-term, but at the present stage of industry development, with high capital costs, low energy sites in the UK cannot be economically exploited, regardless of low levels of TNUoS.

That is why the wave energy industry must remain focussed on the periphery of Scotland, including its islands – despite much lower TNUoS charges elsewhere in the UK. If developers are not able to economically exploit these areas of higher resource the industry will simply not happen.

7. Conclusion

The Scottish islands have a huge role to play in meeting Scottish and UK renewable energy targets. Project TransmiT provided the ideal vehicle for Ofgem to address prohibitive use of system charges for the Scottish islands. However we do not CMP 213 will deliver the significant reduction in charges this nascent industry requires.

As the scenarios above demonstrate – the locational signal offered by TNUoS does not work for early-stage marine renewables, and is outweighed by the need to locate in areas of high resource

Aquamarine Power remains very concerned that the proposed charges for Scottish islands set out in Project TransmiT will severely jeopardise the UK's position as a world leader in wave and tidal technologies.

A fair regime for the Scottish islands would not only enable the UK to meet its renewable energy aspirations in a fair and affordable way, but would incentivise the growth of a new marine energy sector which not only has the capacity to contribute to UK targets, but the potential to grow into a world-leading industrial sector which can impact on renewable energy targets around the globe.

If charges remain as modelled, there is a very high likelihood our proposed Lewis project and other developers' projects will not go ahead, and the UK's marine energy industry will not take off as planned. This would be detrimental to the UK not only in terms of energy security on the 2030-2050 roadmap, but also in terms of the potentially beneficial socio-economic impact of the marine industry to the UK.

Marine energy offers the UK the potential to invest in a new energy sector which will deliver jobs and economic benefit in the medium term, and contribute to a diversified low carbon energy mix and more stable consumer prices in the long term.

We call on Ofgem to look at potential solutions which will address high TNUoS charges on the Scottish islands and will unlock the massive potential offered by wave energy in the UK.

8. Contact

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[i] Department of Energy and Climate Change, December 2010

[ii] http://www.ofgem.gov.uk/markets/whlmkts/discovery/Documents1/Discovery_Scenarios_ConDoc_FINAL.pdf

[iii] Chris Huhne speech, RenewableUK conference, 26 October 2011
[iv] All figures are in 2005 prices. Source for all figures: DECC Energy Price Statistics: http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/prices/prices.aspx

[v] "With reduced quantities of North Sea gas, we are now forced to buy energy on the volatile global wholesale market. World events have pushed up prices and we believe this trend will continue." - Kevin Miles, chief commercial officer, RWE npower (http://www.npowermediacentre.com/Press-Releases/npower-to-increase-standard-dual-fuel-prices-by-12-2-1060.aspx). "The Bank of England's Inflation Report pointed out that wholesale gas prices had increased by around 20% between February and May alone" – Graham Bartlett, MD, EON UK (http://pressreleases.eon-uk.com/blogs/eonukpressreleases/archive/2011/08/05/1729.aspx) . See also: British Gas statement: http://www.britishgasnewsroom.co.uk/2011/07/information-about-your-energy-prices/, SSE statement: http://www.sse.com/PressReleases2011/HouseholdEnergyPrices/.

[vi] http://www.ofgem.gov.uk/Markets/WhlMkts/Discovery/Pages/ProjectDiscovery.aspx

[vii] http://www.ofgem.gov.uk/markets/whlmkts/discovery/Documents1/Discovery_Scenarios_ConDoc_FINAL.pdf

[viii] http://www2.illinois.gov/ipa/Documents/April-2012-Renewables-Report-3-26-AAJ-Final.pdf

[ix] http://www.seai.ie/News_Events/Press_Releases/2011/Joint_Eirgrid_release_RE_Pricing.pdf

[x] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0782:FIN:EN:PDF
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