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UK OFFSHORE WIND GENERATION CAPACITY: A RETURN TO PICKING WINNERS?

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On 14 July 2003, the UK government announced a second round of leasing for offshore wind farm sites. The imputed cost of offshore wind output from these sites, at least until 2010, is estimated at £80-85/MWh. This is a premium of 350% over the current non-renewable forward wholesale electricity price for 2004. It appears that the UK government is returning to a policy of picking technology winners as evidenced by the political and direct financial (investment capital subsidy) support being directed towards offshore wind projects. In so doing, it has ignored alternative conventional (e.g. CCGT and nuclear) and renewable (e.g. imported biomass) generating technologies that could also contribute to meeting UK commitments under the Kyoto Protocol and at lower cost.

The United Kingdom (UK) has ratified the Kyoto Protocol and in its 2003 Energy White Paper[2] the current government committed the UK to reducing carbon dioxide emissions some 60% below 1990 levels by 2050 with an aspiration to achieve a reduction of 20% by 2020. Under the European Union (EU) Renewables Directive, the UK is already committed to putting in place the necessary mechanisms to ensure that 10% of national electricity consumption is met from renewable sources by 2010, and 20% by 2020. In addition, the EU Large Combustion Plant Directive (LCPD) is currently being implemented that imposes very strict limits on pollutants emitted by large power stations. The UK already imposes a Climate Change Levy (CCL) of £4.30 per megawatt hour (MWh)[3] on industrial electricity consumers to provide them with an early incentive to mitigate carbon emissions and prepare them for the implementation of the EU Emissions Trading Scheme (EUETS) from 1 January 2005. This will introduce a pan-European carbon dioxide cap-and-trade regime. Both the LCPD and EUETS are expected to impose a gradually increasing cost burden on power stations generating electricity from fossil fuels, especially coal.

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[2] HMSO (2003), *Energy White Paper: Our Energy Future – Creating a low Carbon Economy*, February 2003. Downloadable document at: www.dti.gov.uk/energy/whitepaper/index.shtml.

[3] For the sake of consistency, and ease of comparison, power station electrical generation capacity is quoted throughout this paper in megawatts (MW) and power station output of electrical energy is quoted in megawatt hours (MWh).

On 14 July 2003 the UK Department of Trade and Industry (DTI) asked the Crown Estate to invite bids from developers of offshore windfarms for sites in the Thames Estuary (South East coast), The Wash (East coast) and the North West coast[4]. This announcement was accompanied by a blaze of publicity and a speech by the Secretary of State (Patricia Hewitt) that included the following extract:

> "This announcement represents a big step towards meeting our goals. Offshore wind has potential to provide a significant proportion of the UK's energy needs. It will help the UK renewables industry to grow, building on our world leading expertise in offshore manufacturing, creating over 20,000 new jobs in manufacturing, installation and maintenance, as the windfarms take shape". DTI Press Release: HEWITT ANNOUNCES BIGGEST EVER EXPANSION IN RENEWABLE ENERGY (14 July 2003).

Once constructed, these large-scale offshore windfarms, with hundreds of turbines, are expected to provide up to 6,000 megawatts (MW) of new generation capacity by 2010, "enough to power 15% of all households in the United Kingdom." This new capacity is in addition to the 1,500MW of offshore windfarms that have already been given consent as of mid-year 2003.

As the following statement embedded in supporting documents presented on 14 July 2003 makes clear, offshore wind has been selected, from among all the competing conventional and renewable generating technologies currently available and permissible, as the main mechanism by which the UK renewables target will be met:

> "There is clear evidence that the biggest new contributor to our renewables target is going to be offshore wind and government has a strong interest in encouraging it to develop quickly and successfully". DTI General Question and Answer Briefing (14 July 2003).

The size of the offshore wind generation capacity being planned, and the public money offered to ensure the capacity is built, suggests offshore wind is being given preferential treatment. It is therefore hard to escape the conclusion that the current government has returned to the failed policies of the 1950s and 1960s of 'picking winners' and then supporting them with open-ended subsidy schemes funded through direct and indirect taxes.

In the remainder of this paper, the claims being made about the potential benefits of offshore wind, and how the UK could meet its obligations under the Kyoto Protocol by using alternative forms of renewable and existing conventional generation technologies, will be discussed.

The economics of offshore wind

In common with most renewable energy technologies, offshore wind turbines are not economically viable if considered purely for their ability to generate bulk electrical energy (except in remote locations) when competing against conventional coal or Combined Cycle Gas Turbines (CCGT). The value of electricity generated from offshore wind and other renewable resources must therefore be defined in terms of its environmental benefits, compared to power from fossil fuel stations.

To overcome the poor economic fundamentals of renewables and to 'kick-start' their deployment, investors are given an incentive to build renewable generation capacity in the

[4] DTI (2003) *Offshore Windfarms Round 2*, 14 July 2003. Downloadable documents, press release and summary briefing notes at: www.dti.gov.uk/energy/renewables/technologies/offshore_wind.shtml.

UK through the Renewables Obligation (RO), which the current government introduced in to law on 1 April 2002. This requires all UK electricity suppliers in England & Wales to supply a specified and growing proportion of their electricity sales to consumers from a choice of eligible renewable sources. In the financial year 2002/03, this was 3% and will increase gradually to 10.4% by 2010/11.

Suppliers meet their obligation by buying Renewable Obligation Certificates (ROCs) from certified renewable energy generating firms. The ROCs are actually issued by the regulator (Ofgem) that independently verifies and certifies that a specific quantity of output has been produced from a specific renewable generation plant in a specific period. Should suppliers fail to buy sufficient ROCs, they are required to pay the 'buyout' price that was £30/MWh in 2002/03 and escalates by the Retail Price Index (RPI) each year thereafter. In practice, suppliers have been willing to pay well over £30/MWh because any supplier that does meet the obligation by buying ROCs also receives a share of the recycled revenue arising from suppliers who have chosen to pay the buyout price. In 2003, the typical price of ROCs from wind capacity suggests a price premium of £44.00/MWh after subtracting the wholesale electricity price and Climate Change Levy Exemption Certificates (LECs)[5] component.

The RO scheme is guaranteed to continue until 2027 and consideration is being given to raising the obligation above the 10.4% level after 2010. This is by no means certain but it appears that the current government intends to ensure renewables capacity will be rewarded with a guaranteed price premium of at least £30/MWh (adjusted for inflation) up until that date. A future government may change this policy, and investors will bear this political risk in mind when setting their investment hurdle rates on bids for the recently announced offshore windfarm leases.

Compliance with LCPD/EUETS will gradually raise the marginal and variable costs of generating electricity from fossil fuel, with coal-fired power stations being most heavily penalised. These schemes will therefore potentially provide a further source of revenue for renewable generators, including offshore wind, as the emissions caps begins to bite and feed through to the marginal wholesale price of electricity being generated from coal. Ultimately, some or all of these costs will be passed on to consumers in higher retail electricity prices.

What is rather curious about the announcement of the 14 July 2003 is that it was preceded by a speech on 7 July 2003 by the new Energy Minister (Stephen Timms)[6] who openly acknowledged that ROCs payments (and presumably the expected future revenue from tighter emissions controls) are "insufficient to bring on those renewables that have potential but are further from the market place, such as offshore wind, biomass (UK grown), solar photovoltaics, wave and tidal power". He also drew attention to the special capital grants that had been made available directly from central government funds "such as those that have already been awarded to the offshore windfarms that have received consent", which amount to £260 million over the next three years. The most advanced of the existing offshore wind projects is at North Hoyle, about 5 miles off the coast of Wales, which consists of a 30 x 2MW (total 60MW) array of turbines plus two undersea cables linking them to the onshore

[5] In England & Wales the value of ROCs includes the wholesale price of the electricity, the LECs value and the scarcity value of renewable electricity. In Scotland the ROCs value does not yet include the wholesale value of the electricity, as NETA has not been introduced there. Industrial consumers can avoid paying CCL by making efficiency savings and or buying electricity from renewable sources. This qualifying mitigation is certified by the issuance of LECs which can be traded and are theoretically worth the value of CCL avoided – which is currently £4.30/MWh.

[6] Speech by Stephen Timms (MP), *Renewable & Sustainable Energy*, PRASEG Conference 7 July 2003 downloadable at www.dti.gov.uk/ministers/speeches/timms080703.html.

transmission grid. This received a capital grant of £10 million in Spring 2003 and is expected to complete in late Autumn 2003. This equates to a subsidy of £166,000/MW of capacity which compared with the full capital cost of an offshore wind farm project of around £1 million/MW is quite substantial.

To capture an equivalent amount of subsidy revenue through ROCs, assuming the scheme runs until 2027, at a typical average capacity availability of 32% for offshore wind turbines, and a discount rate of 15%, ROCs prices would have to rise by £9.25/MWh from current levels. This estimate does not include any costs associated with deep reinforcement of the inland electricity transmission grid necessary to carry the output from the planned 6,000MW of offshore wind capacity to load centres in the South East of England, where it is needed. A recent government sponsored report[7] suggests this investment would cost an additional £605 million. Calculated on the same basis as above, this additional capital cost equates to a further £2.75/MWh on the ROCs price.

The price of renewable electricity underpinning the offshore wind projects currently being planned, and expected to come on stream in 2006/07, can be imputed from the sum of the current £18.00/MWh forward wholesale price for 2004, plus £44.00/MWh current ROCs premium, plus the £10/MWh expected impact of LCPD/EUETS on the marginal cost of coal fired generating plant, plus the £9.25/MWh implied ROCs equivalent value of direct capital subsidies, plus the ROCs equivalent value of socialised grid reinforcement of £2.75/MWh. In total this suggests the true cost of electricity produced by offshore wind, at least until 2010, will be of the order of £80-85/MWh. That is a premium of 350% over the current non-renewable wholesale forward electricity price for 2004.

To put that in perspective, the price at which new CCGT investment becomes viable, even at historically high UK forward gas prices for 2004 of £0.22/Therm and allowing £7/MWh for the future LCPD/EUETS effect on CCGT marginal costs, is £40/MWh. New nuclear plant including all fuel processing and decommissioning costs would become viable at around £50/MWh. In this latter respect, it is noteworthy that the UK government specifically refused to include nuclear generation (along with large hydro) in the RO scheme or exclude it from CCL[8] even though it is in financial difficulty and operates with zero emissions. If it had been included, the market signal from an electricity price of £80-85/MWh would clearly be to build nuclear – but this is unpalatable politically because of years of failed nuclear policy that has left nuclear poorly supported in the UK public perception. Indeed, nuclear was left out of the White Paper for this reason. In summary it appears that offshore wind is a very expensive option compared with the conventional alternatives to reduce (CCGT) or eliminate (nuclear) emissions from electricity generation. The total estimated cost (including all subsidies) of building 6,000MW of offshore wind capacity with an average available capacity of 2,000MW, amounts to some £7 billion. For the same amount of money, 14,000MW of CCGT plant could be built on the sites of existing coal-fired plants to provide an average available capacity of over 11,000MW. Clearly, replacing 14,000MW of old coal plant with new CCGT capacity would bring about substantial reductions in carbon dioxide emissions.

Even if conventional generation technologies are ignored, the UK government still acknowledges that the current RO offshore wind scheme cannot compete with alternative

[7] DTI (2003) *Transmission Issues Working Group: Final Report* [Annex 2: England & Wales Transmission], June 2003.

[8] After much lobbying, industrial consumers using output from good quality Combined Heat and Power plants (CHP) were excluded from CCL levy. CHP had been given heavy political support, but falling wholesale electricity prices from 1999, and the cost of participating in the balancing mechanism under NETA from 2001, undermined its economic viability that brought about the sudden redefinition even though CHP burns fossil fuel and clearly emits carbon dioxide.

renewable sources (e.g. large hydro, biogas from municipal waste, onshore wind, and co-firing of imported biomass). It is therefore unclear why it has been given capital subsidies. The answer appears to be that the decision is mainly a political one, rather than economic, and that the justification goes beyond the narrow criteria of whether the expected future marginal value of electricity and emissions abatement will cover the investment cost. Some of these justifications are examined below.

The UK is endowed with a valuable wind resource so we must not waste it

It is true that the UK has the largest wind resource in Europe, due entirely to its geographic location. However, having access to a resource does not mean it is economic or sensible to exploit it. For example, it is equally well known that the UK possesses a large number of unexploited coal deposits, yet UK electricity generators have increasingly preferred to import foreign coal simply because it is cheaper than UK deep mined coal. As a result, and despite ongoing subsidies, the UK deep mine coal industry is in steep decline since it cannot compete at world prices. By definition, there is no incentive to either extract or transform an energy resource if it cannot be sold at a price that covers the costs of extraction and processing and in the long run provide a surplus sufficient to cover the cost of capital employed. Currently, offshore wind should not be viewed as an exploitable 'energy reserve', even allowing for the putative market value of emissions it would displace, but merely as a resource. It should remain so until it becomes economically viable to make the necessary productive investment.

Wind energy is necessary for the UK to develop a low carbon economy

The introduction of UK electricity market liberalisation resulted in carbon dioxide emissions from the electricity generation sector falling by some 18%[9] between 1990 and 2001. Although carbon emissions from the transport sector have continued to rise, the deregulation and privatisation policies implemented by Margaret Thatcher's government in the late 1980s and early 1990s meant that by the time the UK signed the Kyoto Protocol it was already well on the way to meeting and exceeding its commitment to reduce carbon dioxide emissions. This had largely been brought about by the rapid introduction of CCGT plant with outturn thermal efficiencies of 50% and above. This was partly a rational response to the market forces that had been released, and partly a response to an inadvertent policy outcome, namely the exercise of market power by the coal-fired generating duopoly that dominated the privatised industry, resulting in wholesale electricity prices well above the level required to support new CCGT entry over the period 1990 - 1999. Nevertheless, it does illustrate that conventional technology can deliver reductions in carbon dioxide emissions, through increased thermal efficiency and use of low fossil-carbon fuels, if the economic incentives are present.

More recently, the ROCs price has come under some pressure because owners of conventional coal fired plant have begun to successfully admix imported biomass with coal. This co-firing has allowed *coal* plant operators to begin to sell ROCs to supply firms, often in the same vertically integrated group, and hence meet their renewables obligations without purchasing ROCs from other forms of renewable capacity. This is one of the factors that is contributing to the continuing poor economic viability of offshore windfarms, and is one of the reasons why the UK government has had to introduce additional capital grants to make up

[9] DEFRA (2003) *Digest of Environmental Statistics*, Chapter 1. The Global Atmosphere. Data on IPCC basis downloadable at www.defra.gov.uk/environment/statistics/des/globatmos/gafg06.htm.

for the difference between their true cost and the economic value of the offshore windfarms currently being built.

The net result is that offshore windfarms would no longer go ahead without direct government subsidies. However, alternative investment plans are being considered to increase both coal and biomass import capacity by building larger jetties at existing ports to allow larger bulk carriers to be docked. Just as the advisors in the DTI's predecessor ministry in the late 1980s believed that fluidized bed combustion of coal would be the power generation technology of the future, and failed to anticipate aero derivative CCGT's, their successors failed to foresee this market response, driven entirely by private enterprise. It illustrates that offshore wind may not be the only, or even necessarily the best, solution for delivering reductions in carbon dioxide emissions. Large hydro projects have always been excluded from being ROCs eligible and the UK government is currently considering whether co-fired plant burning imported biomass should remain eligible to issue ROCs after 1 April 2006. Excluding certain types of renewable capacity, not only provides further hidden support for offshore wind but also cuts off other rational market responses that could potentially provide renewable energy at lower cost while still helping the UK to achieve its Kyoto Protocol obligations. Picking winners from uneconomic renewable technologies is one thing: dictating as losers other more viable forms of economic renewable energy such as large hydro now and possibly imported biomass in future, merely compounds policy folly.

Wind must replace old nuclear plant otherwise the UK will suffer blackouts

There is no doubt that the existing UK nuclear plant fleet will eventually close down, mainly for safety reasons, however, there is no reason why this should happen any more or less quickly if wind capacity becomes available. Although the two firms that run UK nuclear generation capacity (BNFL and British Energy) are both in financial difficulty and both will effectively remain dependent on government support for the foreseeable future, the modern nuclear plants still operate with reasonable reliability and at very low marginal cost. There is therefore no chance that offshore wind will displace nuclear plants from the merit order. It is not as reliable as nuclear and its cost is far higher even on a full investment cost basis and taking account of the expected marginal value of avoided emissions.

As far as physical capacity is concerned, there is a significant amount of mothballed coal and CCGT capacity in the UK that could potentially be reinstated if the wholesale electricity price were to rise to a sufficiently high level. However, average baseload forward wholesale electricity prices for 2004 are currently trading around £18.00/MWh and therefore too low to cover the costs of operating CCGT plant built even 6 – 7 years ago. The mean annual wholesale electricity price required to bring all of the mothballed capacity back on line would be around £21/MWh, which would cover all fixed and variable costs. But, to sustain a programme of entirely new CCGT capacity building, prices would have to be in the region of £33/MWh at current forward gas prices before the cost impact of LCPD/EUETS is taken into account.

Even if the combined impact of the LCPD/EUETS was to force all coal and oil-fired power stations to shut down, wholesale electricity prices should still not rise above the new entry cost of CCGT, which given current expectations of the future impact of LCPD/EUETS, would be around £40/MWh. At this price, there would also be an economic incentive to extend the lives of existing nuclear power plants. If prices rose further, to around £50/MWh, it would be profitable to build new nuclear capacity. Under these circumstances, and given

the imputed wholesale electricity price of £80-85/MWh required to support offshore wind capacity, as estimated above, it is nonsense to suggest that offshore wind would replace any of the existing nuclear power stations. Offshore wind is not a viable long-term replacement option for baseload power stations such as nuclear on either economic or physical system reliability grounds.

Wind power will reduce UK fuel imports and increase energy security

The current government target of generating 10% of electricity consumed by 2010 will reduce the amount of electricity generated from imported fossil fuels, especially coal, by 10%. However, it also acknowledges that offshore wind will only contribute 3.5 - 5.5% of that 10% even if all the planned 6,000MW of capacity is built. Setting aside the impact of the inherently intermittent nature of wind energy on the physical security of the electricity system itself, which is discussed in more detail below, the impact of 6,000MW of offshore wind capacity will be minimal. The plain fact is that at typical availability rates of 32% the planned capacity will only contribute an average of 2,000MW of capacity to the total UK generating plant capacity – or about 3.5% of national annual peak load.

Wind is free energy

Even if the capital cost of building wind turbines offshore, and the potentially significant variable cost of maintaining them in a hostile physical environment out at sea, were ignored then offshore wind power would not be free because it would impose an element of unreliability on the UK electrical system not present in the same magnitude from conventional generating units. Wind power supporters argue that in fact the geographic diversity of the recently announced offshore locations will allow for greater reliability than with existing and planned onshore windfarms. However, these comments are largely based on US studies that show how geographic diversity creates a portfolio diversification effect, which essentially means that although when wind stops blowing in one place the shortfall in output will be made up elsewhere where wind speed is higher. The net result is that there should be a relatively stable average output with reliability similar to the existing conventional fossil fuel fired generating units, providing wind turbines are located in geographically diverse locations.

Unfortunately, this analysis does not apply in the UK because portfolio diversification effects rely on independence (or at least low correlation) between wind patterns in different geographic locations. As a relatively small island, with a very narrow East-West axis, dominated by weather patterns predominantly coming from the Atlantic Ocean, wind speeds in the UK are highly correlated between geographic locations both seasonally and diurnally. This means that both very high and very low wind speeds are likely to simultaneously curtail generation across a large part of the installed wind turbine fleet. Moreover, calm conditions are most likely to occur when demand is highest at the winter peak that typically occurs in the period 5 - 8 p.m. on a cold clear night in January. These conditions are typically created by high atmospheric pressure (anticyclones) over the UK that result in both a lack of cloud cover, that allows temperatures to fall quickly after sundown, and low wind speed.

The only way that this lack of reliability can be made up is to hold spare backup capacity on the system available to generate not only at very short notice but also over extended periods of several days if weather conditions persist in reducing wind speeds. The provision of this reserve capacity currently comes from oil, coal and CCGT plant and the value of reliability

can be very high, as indicated by the System Buy Prices paid by the UK transmission system operator (NGT) when it covers shortfalls in notified generation output in the balancing mechanism under the New Electricity Trading Arrangements (NETA). Prices of £100/MWh or more are regularly, though not continuously, achieved. This balancing cost represents the real cost of wind and proves that it is not a 'free' energy source.

Firms who are proposing to build offshore windfarms in the UK are, of course, well aware of the potential additional cost imposed by the lack of reliability in wind generation. This has not been included in any of the calculations so far presented in this paper but estimates of the cost typically fall in the range of £1.50-2.50/MWh. In a much less well advertised DTI consultation process also ongoing in July 2003[10] it has been proposed that several of the offshore windfarms already under construction should be exempt from having a generation licence that all large conventional generating plants must have by law. Allowing them to operate as 'embedded generators' without a generation licence would give them an economic advantage because they would not participate in the balancing mechanism under NETA,[11] or provide frequency response capability, as all large generating plant must do. Although the projects in question are small, and few in number, so would not pose a significant physical risk to grid security now, allowing these existing windfarms to operate without a licence would set a legal precedent that could allow offshore windfarms built subsequently to also press the DTI to allow them to operate without generation licences. If this occurred, offshore windfarms would be allowed to avoid paying the balancing and other ancillary costs imposed by wind turbines. The cost is most likely to be covered through a smeared charge, which would represent a further hidden subsidy to offshore wind capacity, and ultimately met by consumers through their electricity bills. This is the familiar slippery slope of intervention, which begins with politicians picking a winning technology, and inevitably ends with the true cost of that choice being compounded and hidden through a series of further subsidies and special concessions that are designed to validate the original decision. The current government would do well to seriously reconsider whether it wants to step on the slippery slope in the case of offshore wind, in the same way that previous governments did with nuclear power in the 1950s. Wind power deserves better.

Jobs would be created if the UK can become a world leader in the wind energy

The discussion above shows that there are more economically viable alternatives to meeting the UK commitment to the Kyoto Protocol than offshore windfarms. Given a free choice, but assuming the Kyoto targets are rigorously applied, there is no reason why an electricity supplier would choose a more expensive method of cutting its carbon dioxide emissions than a cheaper method unless it was compelled to do so. The current government acknowledges that the UK and Denmark are the two countries in Europe where wind energy is most abundant but Denmark already has a better-established wind turbine manufacturing industry. Other Northern European countries have significant hydro endowments and southern European countries have a significant solar energy and locally produced biomass endowment so the potential market for wind turbines in Europe is small and already populated by established competitors. Since the US has indicated that it is unlikely to ratify the Kyoto Protocol and in any case has its own wind energy industry, the potential market there is also currently small and competitive. In developing countries, labour costs are far lower than the

[10] DTI (2003) *Electricity Generation Licence Exemptions*. Various consultations ongoing and completed are downloadable at www.dti.gov.uk/energy/consultations/index.shtml.

[11] Private communication with the DTI confirmed that this was indeed the prime reason why the firms involved in the projects had applied for a generation licence exemption.

UK so they have a natural competitive advantage in manufacturing turbines. Moreover, demand from these economies is likely to be small given their lack of investment capital and because their commitment under the Kyoto Protocol is unlikely to bind until their carbon dioxide emissions, however measured, rise to the same level as developed countries. The net result is that the only UK job creation likely to occur is in the area of offshore construction in home waters. The UK is already a world leader here because of its oil industry and UK firms are already active in overseas markets exporting this accumulated expertise. The construction of 2000-3000 offshore wind turbines is therefore unlikely to add much to the existing UK offshore construction knowledgebase.

In terms of jobs provided, employees with expertise in civil engineering and construction will be undoubtedly drawn from the economy to construct new offshore wind generation capacity but many of these employees could equally well be employed in constructing alternative renewable and conventional generating capacity to achieve the same objectives. Constructing offshore wind generation capacity will not therefore provide significant numbers of new UK jobs, but merely create a less optimal allocation of labour by distorting the labour market through the subsidisation of unnecessary offshore wind projects. Surely we have learned from past mistakes. Experience shows us that by picking winners, dictating losers, and offering special treatment on top of subsidies, any industry tends to lose sight of its real business because the 'business' becomes chasing government incentives and inducements. The result is that the industry's underlying technology is set back for decades. Nuclear energy comes to mind. That would be a tragedy if it were to happen to wind power.

Conclusion

This paper does not set out to question the UK ratification of the Kyoto Protocol or challenge the right of the current or future government to determine UK energy policy, including the setting of targets and deadlines for the reduction of UK carbon dioxide and other emissions. However, it does question why the current government has returned to the policy of picking energy technology winners. In deciding that offshore wind generation technology will be promoted, and that other forms of conventional and renewable generation technology will not, the danger is that wind technology will become discredited in the eyes of consumers and taxpayers when it either fails to live up to the exaggerated claims being made about its contribution to reducing emissions or its true cost and inherent lack of reliability becomes revealed to consumers.

The difficulty that lies at the heart of this discussion is that the current government has allowed the target of reducing UK carbon dioxide emissions from electricity generation to be transformed into a target of producing a certain percentage of UK electricity from renewables – and especially offshore wind. The two targets are not the same but have become so in the minds of politicians, business and the general public. This paper has attempted to take a step back and question the logic of the target as it now exists and attempted to show how some of the non-economic justifications that have been put forward to support a subsidised increase in investment in offshore wind generation capacity are based on flawed logic. Alternative solutions have been sketched out that show there is a potentially very significant economic consequence to picking offshore wind generation as the technology of choice in meeting the UK's international environmental commitments.