THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

UK OFFSHORE WIND ENERGY: WHAT ROLE FOR COMPETITION?

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With a foreword by Frank Vibert

Executive summary

The UK has recently led the world in the deployment of offshore wind farms as a source of renewable energy. It has committed substantial public resources to meeting international and national targets for increasing the proportion of energy derived from renewables.

By standard efficiency measures most renewable energy technologies require further innovation if they are to prove competitive. Incremental change alone will not suffice, and disruptive innovation across the value chain of processes, installation, and turbine technology is essential. Regulatory policies must support these market developments, not hinder them. Cost reduction must be the policy goal.

The UK has already done much to improve the local science base in renewable technologies, contributing to the global pool of knowledge and fostering clusters of expertise. Much greater emphasis must, however, be given to the role of competition at all levels, as a means of producing disruptive innovation. Innovation will be enabled if the sector has the security of a transparent and stable policy environment. Government policy must avoid creating artificial barriers to competition, change, and cost reduction. Where governments tie short-term subsidies to local employment, they endanger the long-term prospects for cost reduction, innovation, and employment.

Drawing on the experience of air transport liberalisation, the paper demonstrates how a focus on overcoming barriers to entry, and positively nurturing competition and new entry, brings long term benefits. State subsidies and state regulation, designed to support local suppliers and their employees, were harmful to the sector and its customers.

Within air transport, when policies were introduced to encourage competition, the traditional systems of airline operation were transformed, primarily by the new models adopted by new entrants into the market. The path and prospects of the industry were also transformed, with more people able to travel, and often more cheaply. Liberalisation, with proactive support for new entry in European markets, produced a more successful and sustainable industry, with capacity for growth.

Recent analysis has shown that within a liberalised aviation market a route that has one rather than two airlines serving it could see fares rise by 21%[1], consistent with reports that the new breed of low-cost carriers that enter the market do so with costs that are at least 30% lower than Europe's dominant national airlines.

Within the offshore wind sector, whilst Government policy supports competition *for* projects, and the new Contracts for Difference (CfD) system is designed to encourage competition between individual projects, there is a real risk that the rise of 'techno-nationalism 'will serve as a substantial barrier to competition elsewhere within the supply chain: developers are prevented from even competing for CfD projects unless they have already received Government certification of their supply chain plan; whilst these plans cannot legally stipulate levels of UK content, it has been made very clear to the sector that this is their principal purpose.

Even China has recently moved away from localisation laws in order to boost competition in its large domestic market for onshore wind energy. Despite the range of fiscal incentives to invest in the UK, there can be good reasons why all but the largest players remain unable to do so to a significant extent. The strong emphasis on British jobs for British wind, may put long-term energy policy at risk and lock the UK into the path of incremental innovation. It risks

pursuing manufacturing jobs at the expense of substantive long-term jobs in R&D and in the operation and maintenance of the UK's offshore wind farms.

Uncertainty over the UK commitment to offshore wind energy, with no target as yet beyond 2020, also acts as a barrier to entry, creating a political risk that hinders both competition and inward investment given the time and financial scale of the investments required. Confidence in the potential for market growth is a prerequisite for investment in the supply chain.

In his foreword to this paper Frank Vibert highlights the importance of careful scrutiny to the whole 'chain of intermediation', to ensure that barriers to entry and to cost reduction are minimised throughout, from finance to project delivery.

The air transport sector has demonstrated the value of a strong commitment to competition, even whilst some local state subsidies persist. The development of a transparent system of regulation, which is pro-active in support for competition, irrespective of nationality, has allowed innovators to win a greater share of existing capacity and use cost reduction strategies to build new capacity. This has built a stronger, more sustainable industry. A similar approach is needed for offshore wind if it is to fulfil its potential in the energy mix.

Foreword

Frank Vibert[1]

This paper by Dr Tony Hockley on the UK Offshore Wind Industry paints an unsettling picture. On the one hand the UK is now one of the leaders in renewable energy through offshore wind. Installed capacity (2015) is 5GW with 10GW planned for 2020, by which time offshore wind is expected to supply 8-10% of the UK's electricity[2]. On the other hand the outlook is adverse.

According to Dr Hockley's analysis the difficulties confronting the offshore wind industry fall into two groups – economic/financial and political/regulatory.

On the economic side, changes in relative prices are having a major impact on the energy mix. Most notable is the fall in the price of oil and gas. But also important is a prospective relative decline in the price of solar energy. Offshore wind is becoming relatively less attractive as a result of both developments.

On the political/regulatory side there appears to be some confusion about regulatory goals. Objectives relating to security of supply and the cost competitiveness of British manufacturing argue strongly in favour of the development of fracking for oil and gas extraction. Environmental concerns, including carbon reduction goals, favour a continued emphasis on the development of renewables.

The tensions within the regulatory framework are signalled by the fact that a goal for renewables in the total UK energy mix has not been established for the period beyond 2020. For an industry with long investment lead times this is already a reason for hesitancy.

Complicating the regulatory/political picture still further is an industrial policy that favours local content in the supply chain within the offshore wind industry. It is justified by the government as a job creation policy. It has also been supported as a form of 'green fiscal stimulus'.

Critical infrastructure

Offshore wind generation can now be seen as part of the UK's critical infrastructure. It is critical for meeting renewables goals. It is also a critical component for security of supply.

As a general policy stance, UK governments of all political stripes have seen the provision of critical infrastructure as involving some kind of partnership between the public and private sectors. The issue has been how best to organise this partnership in different market circumstances. Both sides to any partnership agreement need an acceptable relationship between risk and rewards.

These general considerations apply also to offshore wind. A partnership is required. The risk-reward relationship has to be got right.

The chain of intermediation

One way of looking at how to structure the relationship is if the offshore industry is viewed as a chain of intermediation. The analogy is with chains of intermediation in the financial sector.

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In the financial sector the need for intermediaries relates to a requirement for expertise; but expertise in financial engineering and in sophisticated financial products is costly to put together. Once established, a position in the chain may constitute a barrier to entry for other potential players. The same applies in offshore wind. Expertise, including expertise that comes from operational experience, is costly to acquire, and once acquired may pose barriers to new entrants.

Oversight over the chain

In the case of the financial sector it is accepted that regulatory oversight of how chains of intermediation operate is necessary and desirable. Oversight takes place at the beginning of the chain, the middle and the end. At the beginning the regulators apply a test that market participants are 'fit and proper'; in the middle they watch over the 'conduct of business'; and, at the end they exercise macro-prudential oversight to check on system stability. The need to ensure competition is included as an objective. The analogy can be extended to the offshore wind sector.

At the beginning of the chain the government has applied the 'fit and proper' test to require local content. Dr Hockley suggests that this is misguided. What is important is for companies to have acquired relevant operational skills and expertise. This means that contracts must be awarded to more than one dominant supplier.

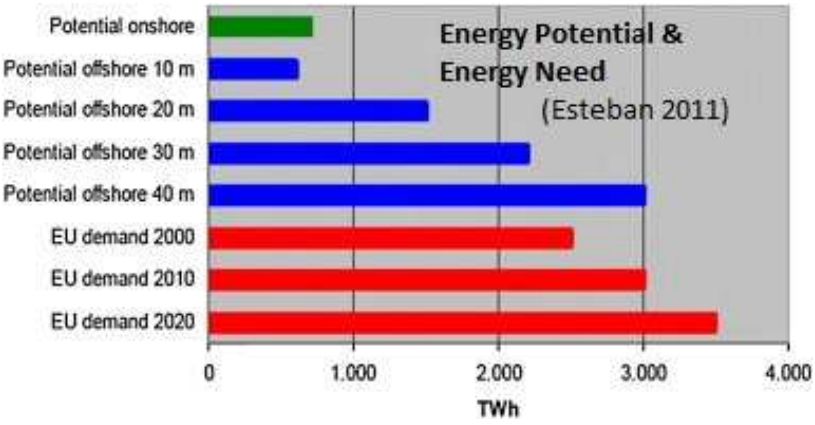
In the middle of the chain it is important to avoid excess leverage on the balance sheets of investing companies. Off-balance sheet financing comes potentially from two sources – project financing and securitised lending. Both have a role to play. However, it is not clear that the current framework is fully conducive to either.

At the end of the chain, systemic stability is a requirement for critical infrastructure as much as it is for the financial sector. This means that the government needs to provide a long-term framework for off-shore wind that matches the 20-30 year time frame required by investors and suppliers.

Public private partnerships are difficult to get right. The UK's record in all sectors is a decidedly mixed one. In the case of offshore wind Dr Hockley argues the case for a more stable long-term regulatory framework, incorporating competition as one of its objectives and with an emphasis on the need to build up the UK's stock of operational skills and expertise.

Introduction

Offshore wind is set to play a significant part in meeting the UK's energy needs and climate change obligations. There is an inherent logic in this approach to renewable energy for an island nation, with a growing population, scarce land space and reliable prevailing winds. The chart below shows the potential from wind onshore and offshore (by water depth) set against Europe's energy needs[3]. Nevertheless, much remains to be done as the technology is still relatively early in its development path. Investors face high R&D and construction costs, the need to develop both the infrastructure and the supply chain, and a high degree of political uncertainty over future energy policy.



The UK is bound by international and domestic legislation to reduce its carbon emissions and increase its use of renewable energy sources. International agreements began with the Kyoto Protocol of 1997. The original 2012 targets for greenhouse gas emissions were later updated with targets for 2020. It is expected that the Paris climate conference in 2015 will once again revise this with 2030 targets.

In 2008 the newly-established UK Committee on Climate Change recommended that the UK should extend the Kyoto ambition beyond 2020, and aim to achieve an 80% reduction by 2050[4:xiv]. This target was made a statutory obligation in the 2008 Climate Change Act, although this is, of course, open to amendment more readily than an international agreement[5]. The Climate Change Act requires 'carbon budgets' to be set for economy-wide emissions across five year periods. The fourth carbon budget, which runs from 2023 to 2027 limits UK emissions to 1,950 MtCO2e over the five year period. This is approximately equivalent to a reduction of 50% compared to 1990 emissions.

In 2007 the European Union also set binding targets for 2020, including a 20% reduction in greenhouse gas emissions, against the 1990 baseline, and a requirement that 20% of energy should come from renewables by 2020[2]. The EU extended the climate and energy package in October 2014 to a 40% reduction by 2030, and 27% of energy derived from renewable sources by then. The aim of these new targets was to keep the EU on track to achieve the Kyoto objective of an 80% reduction by 2050[6]. The latest EU agreement is, however, for the EU as a whole. The UK has not yet set the next milestone for renewable energy use beyond 2020, en route to the 2050 target. This has led to some questioning of the UK commitment to maintain the pace of progress with investment in renewables. This was compounded by the UK's active opposition in October 2014 to revised EU renewable energy targets. The UK

[2] When broken down into EU Member State targets this produced a UK 15% target share for renewable energy by 2020.

Prime Minister argued that flexibility was needed to allow the EU to meet its climate change obligations, whilst keeping energy costs down for British businesses and households[7]. This suggested that UK enthusiasm for renewable energy may be waning.

In a very short space of time the UK leapt from a *'laggard to leader'* in the development of an offshore wind sector, due to strong political support and its international obligations relating to climate change targets [8:10]. The first offshore farm was operational, in Blyth Harbour, in 2000, and following the three licencing 'rounds' that have taken place since 2001 the UK is now the global leader in this form of energy generation. It had more than 4GW of capacity in operation by 2014, which is set to more than double to around 10GW by 2020. By 2020 it is expected that offshore wind will meet 8-10% of the UK's annual electricity needs[2], having overtaken the countries that were early adopters of this technology. In 2014 the UK did fall behind Germany in terms of annual installation. However, several new UK farms are scheduled to complete in 2015, but there will be no major UK installations coming on stream in 2016, whilst the German and Dutch expansion of offshore wind capacity continues. New capacity additions to 2020 in the UK and Germany are expected to be broadly similar.

The industry has suggested that uncertainty around the UK's future political commitment to offshore wind has undermined investment[9]. According to Ed Davey whilst Secretary of State for Energy & Climate Change: *'The politics of renewables has been turning ugly'*, blaming 'populism', 'vested interests', and 'anti-science' for this. Nevertheless, industry and investor concerns appear to be related more to uncertainty within existing policy than to uncertainty around future decisions. When the Managing Director of Siemens Energy was asked to report on issues in the UK offshore wind supply chain, uncertainty over policy beyond 2020 was revealed as a significant barrier to the investment needed from firms that might compete in the local supply chain. According to the report: *'The Government should exercise its powers available through the Energy Act 2013, as early as possible in 2016, by setting a clear 2030 emissions target for the power sector'*, setting out a clear *'direction of travel'* in the meantime, and *'provide clarity sooner rather than later on how it will deliver its share of the EU 2030 greenhouse gas target'* [10:30].

Installed Offshore Wind Capacity

	BE	DE	DK	NL	SE	UK
Farms	5	16	12	5	6	24
Turbines	182	258	513	124	91	1301
Capacity (MW)	712	1049	1271	247	212	4494

Source: EWEA (2015)

Worldwide, the transition to renewables can involve substantial state subsidies in order to facilitate the high investment costs required, and has also become increasingly typified in some countries by state *'techno-nationalism'*[3][11, 12] and protectionism in pursuit of competitive advantage and employment. Governments have sought to justify their significant

[3] The term 'Techno-nationalism 'is attributed to Professor Robert Reich (*The Atlantic Monthly*, May 1987, pp62-66)

renewable energy commitments not just on environmental grounds, but also by tying subsidy decisions to local socio-economic measures, and sometimes quite explicitly so, despite the substantial constraints of international trade and competition laws designed to restrict such uses of state aid [13]. This approach has been particularly prevalent in France[14] and the UK, where potential bidders for projects must now earn 'points 'for their supply chain plans. Both of Britain's major political parties committed to 'green growth 'in their manifestos for the 2010 General Election, promising new jobs in the manufacture and installation of renewable technologies. The Liberal Democrats made a more specific commitment to: *'Invest up to £400m in refurbishing shipyards in the North of England and Scotland so that they can manufacture offshore wind turbines and other marine renewable energy equipment'[15:59].*

In the 2015 General Election the Conservative Party promised to continue to use industrial policy as a targeted regeneration tool. The manifesto talked of a 'Northern Powerhouse', citing offshore wind turbine manufacturing at Green Port Hull as an example (whilst also promising to 'halt the spread of subsidised onshore wind farms')[16]. The Liberal Democrat manifesto proposed a 'Zero Carbon Bill' that would set a 2030 target on carbon emissions, and take the UK 'as close to zero carbon as possible by 2050', to 'create 250,000 low carbon jobs by 2020'[17].

Tying subsidies to local socio-economic criteria has added further complexity to the policy environment confronting companies that wish to invest in UK renewable energy developments or enter the supply chain. The recent Growth Commission emphasised that private investment and innovation are highly dependent upon whatever the policy environment confronts them with: *'A climate of macroeconomic stability is an important background factor, but many other policies influence investment and innovation, including policies that affect competition, market access, finance, taxation and regulation.'[*18]

The conflation of energy policy and industrial policy has been formalised through the Electricity Market Reform process, so that bidders for projects over 400MW (most offshore wind projects) within the new Contracts for Difference (CfD) system must first obtain a certificate of approval for their Supply Chain Plan from the Department for Energy and Climate Change (DECC). Some insight into the industrial policy decisions was given when DECC officials appeared before the House of Commons Public Accounts Committee in 2014 to discuss the early CfD contracts. Questioned about job creation under CfD, Hugh McNeal, Director of DECC's Office for Renewable Energy Deployment said *'For each of these contracts they are going to have conversations with us. This is a cross-Whitehall thing – DECC, BIS and UKTI. We will monitor all the jobs that come here directly, and we try where possible to see the links to other jobs'*[19:Q189]. One MP on the Committee went further and argued that contracts for new wind farms should be delayed whilst UK manufacturing capacity was built[19:Q73].

When pressed to set out what the Government was doing to ensure significant local content in offshore turbines the Under-Secretary of State for Climate Change told the House of Commons:

'To get a CfD one has to have a supply chain plan in place, so we hope that that will reinforce the need to have local support and an effective local supply chain'[20].

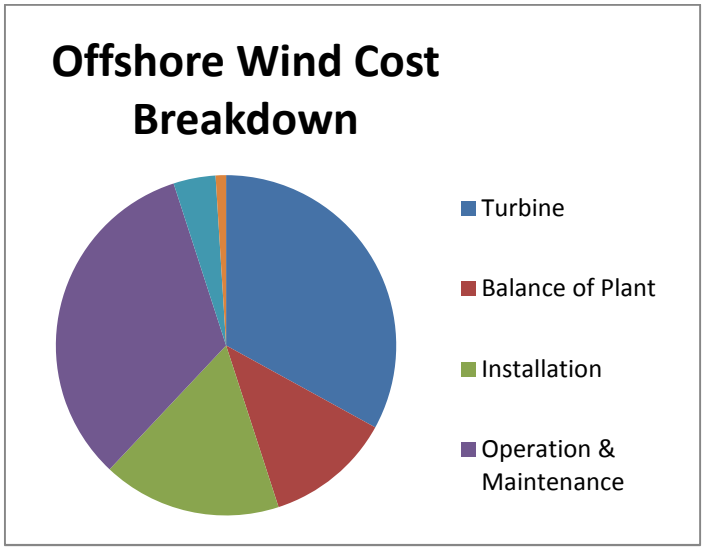
Another Minister, Michael Fallon, also told the Commons that whilst consultations with the European Commission over state aid rules had meant that specific local content requirements could not be imposed on supply chain plans:

'We will ensure – we have done so through the consultation – that developers know which areas they must consider'… 'I hope that what is being developed as a supply chain plan can

be a model for other forms of procurement. Under European Union rules, we are not allowed to order companies to buy British or to specify specific percentages, but we want to encourage developers to consider seriously exactly how they will source the products, goods and services that they will need. [21].

Despite the election of a majority Conservative government at the 2015 general election the techno-nationalist industrial policy for offshore wind energy was maintained. Indeed, the new Secretary of State for Energy and Climate Change told the industry in 2015 that there must be a pay-back for the *'moral and financial support'* provided to the sector: *'this means that the commitments being made on UK jobs and UK content in supply chain plans must be met'*[22].

There is a serious risk from conflicting messages – between explicit policies that support competition, and the implicit requirements to develop and maintain a British supply chain. In other sectors the UK Government has led Europe in tackling such conflicts and bringing transparency and competition to important markets.



This paper discusses issues around the relationship between government policy, market competition, and innovation. It argues that each of these has an important role in securing the long-term viability of offshore wind energy, and that competition should be accorded a high priority. Policy, it says, should actively support and sustain competition, as the principal means by which innovation will drive down costs.

This approach has been well tested in other sectors, with considerable success. As a sector with relatively high costs it is vital that government policy does not encourage the offshore wind sector to rely solely upon incremental innovation and industrial collaboration to produce the step change in its cost base that is required if it is to have a long-term future. It will reap maximum benefit if it is fully open to global market competition, focused on cost minimisation.

Energy policy is at a critical point and the Government stands accused of pursuing a policy of 'picking losers'[23]. Such criticism is closely associated with the relatively high costs of offshore wind energy. These stood at around £140/MWh[4] in 2011[24:vii], reducing to around £120/MWh by 2017[25]. Analysis by the UK Department for Energy and Climate Change

[4] Using the Levelised Cost of Electricity (LCOE) method

found that only solar energy showed a higher cost, with both nuclear[5] and gas estimated to be costing around £80/MWh[26:10].

In the 2015 announcement of the outcome of Allocation Round One of CfD the two successful offshore wind bids provided strike prices of £114.39 and £119.89MWh, and a combined capacity of almost 1.2GW[27].

Around 70% of the costs of electricity from offshore wind are determined by the initial investment cost, and costs are accounted for by three roughly equal activities: the turbines themselves, their installation and foundations, and subsequent operation and maintenance[28].

Nevertheless, it is predicted that costs will fall over time to £100/MWh, as the size of the market and of the turbines themselves both increase[24:vii], given emerging evidence of economies of scale, as well as economies from 'learning by doing'[29]. Examples of promising areas of innovation include:

- Financing: de-risking projects raised the scope for substantive project finance, and at least cost[6]
- Turbines: increasing size and power rating, up to 8MW each; improved reliability
- Balance of plant: increasing size of monopile structures, novel foundation structures, higher cable ratings
- Installation: bespoke vessels with a wider range of possible operating conditions for installation
- Operation & maintenance: condition-based monitoring systems allowing proactive maintenance, offshore crew accommodation[28]

A step change in costs and ongoing efficiencies will be required to reduce the cost gap if gas sources also make incremental improvements in their efficiency over the same period. Beyond this there is also the potential for nuclear cost reductions once the European Pressurised Reactor at Hinckley Point C comes on stream during the 2020s, and potentially Sizewell C thereafter. Helm predicts that, of all renewable technologies, the future for offshore wind is *'particularly bleak'* once subsidies are removed. Thus a policy focus that supports innovation in its widest sense above any other ambitions for the sector is crucial to its sustainability and the eventual development of grid parity.

The market for offshore wind

The Government has linked public investment to achieve international climate change targets with local industrial policy. Given the economic climate it has understandably placed great emphasis upon the creation of UK jobs as a justification for the substantial subsidies provided. This justification has, however, exposed the renewable energy strategy to powerful criticism. If subsidies are explained by job creation then the cost per job appears extremely high, providing strong arguments for critics of offshore wind's intended role as a long-term contributor to the UK's energy needs[30]. Some have presented this as a valuable 'green fiscal stimulus', in which the temporary nature of some of the jobs created is well matched to the need of the current economic cycle[31]. Many of the promised jobs, however, will take

[5] The 35-year contract for the new Hinckley Point C nuclear power station was agreed at a (2012) strike price of £92.50/KWh (*World Nuclear News*, 8th October 2014)
[6] The Dutch 600MW Gemini wind farm has been made possible by €2.1bn of project finance

several years to create, as British manufacturing or research plants are planned, built and brought into service. The stimulus has a significant time lag. In the longer term real economic value is derived from innovation, cost-reduction, and growth of the global market rather than from the growth of local production and jobs. Indeed, reliance upon the latter is inherently risky given the changing landscape of global manufacturing. Using the example of solar photovoltaics, Carvalho demonstrates that: *'The increased consumption of green technologies builds out markets – thus creating market-related jobs … The sum of these 'market related jobs' outnumbers those purely in manufacturing. For example, the global automobile industry employs about 8 million people in manufacturing, but around 20 million people in the sale and servicing of vehicles'[32]*.

It may be more justifiable to concentrate on the argument that innovation in offshore wind will produce an energy source that is both green and efficient; and, therefore, one that will support a range of long-term local jobs in their operation and maintenance, particularly as these tend to be located in deprived coastal areas close to the projects. The long-term prospects for manufacturing jobs, as opposed to ongoing operation and maintenance work, depends upon the length of the market's initial growth period in European waters and local manufacturing plants' ability to win contracts for future refurbishment and replacement in the face of international competition[33:4].

Seen at the global level the market for the production of turbines[7] appears competitive, with two major suppliers and a plethora of smaller competitors[8]. By 2013 Siemens had 698 turbines installed, and Vestas 533. Five other firms had installed more than 10 turbines each[34], although Siemens was achieving a share of new installations as high as 80% by 2014 [35]. Regional and national markets, however, show substantial variations, and it is particularly notable that Chinese firms have so far mostly served the Chinese market[36]; unlike the changing marketplace for solar PV units, global competition is constrained to some extent by the high transport costs of large wind turbines.

Within Europe Siemens had a 85% share of the turbines installed in European waters in 2013, with Vestas at 11% and Areva at 2.2%[37], which represented a further increase in market concentration over the preceding year[38][9]. These figures are, of course, heavily affected by the rapid rise of UK installations, and the complete domination of this market by Siemens, which has taken a 100% share of new offshore installations in the two years from 2012 to 2014. Its dominance of the UK market is expected to continue in the years immediately following 2014[39:38].

This level of local market concentration may encourage cautious, incremental innovation throughout the supply chain, if it creates a degree of protection from international competition. This may make ambitions for ongoing cost reductions more difficult to achieve. At the same time Government policies that do not extend beyond 2020 can serve to discourage investment (and innovation) amongst smaller companies in the supply chain and potential new entrants. Competition, underpinned by stable market structures, encourages firms to invest in more risky, long-term research and the search for new pathways, rather than focus (even substantial) R&D spending on incremental gains[40]. As a substantial European customer British policy will inevitably have some effect upon market strategies.

[7] ie both onshore and offshore
[8] Manufacturing is, of course, just one aspect of the market, with different levels of concentration in others segments, including project finance and project management
[9] The markets for foundations and cables showed much lower (and falling) levels of market concentration, with six or seven firms competing successfully

High levels of market concentration do not affect all aspects of the European offshore wind energy sector, as shown by the shares of 2014 installations[37].

- **Wind farm ownership**: DONG energy is the largest owner of wind farms in the European market. It accounts for less than one-quarter of the market
- **Foundations**: Four major firms accounting for 11% to 44% of the market
- **Inter-array cables**: Four major competitors with a market share between 16% and 35%
- **Export cables**: Two major providers with 25.7% and 51.4% of the market, with the remainder of the market shared equally between four competitors

Open markets and local competition are widely accepted as the best means of securing cost reductions. In 2009 the Chinese government moved towards policies based on competition, after a period of protectionist policies whilst the industry in China was developing. It abandoned its *'localisation'* requirement for wind farms and scrapped the VAT refunds that had been given to domestic production facilities[41:65].

In October 2013 the UK Prime Minister argued that the Government would aim to reduce energy costs for consumers, in part by promoting greater competition amongst retail energy providers. He announced a *'proper competition test'*, saying: *'I want more companies, I want better regulation'*[10]. It is evident that support for competition is widespread within energy policy, and that it is only in certain aspects of the supply chain that other considerations appear to have been accorded a higher priority, despite the already strong tendency towards market concentration in sectors with high investment and high transport costs.

Nevertheless, the concern for costs to end users is very real. Although the average costs to households due to subsidies for investment in renewable electricity generation are small, they can vary according to a household's main source of heating. The Committee on Climate Change estimates that less than half of the 'low-carbon' element of increases in household energy bills up to 2030, would be due to direct subsidies for low carbon generation, including nuclear[11]. From 2030 onwards, the Committee estimated, the earlier investments would contribute to falling energy falling costs.

In 2013 the Government introduced substantive changes to the mechanisms for subsidising renewables: a CfD scheme[12]. Funding for the CfD scheme was part of the overall cap on low-carbon project support, known as the *'Levy Control Framework'* (LCF)[13]. Furthermore, the longstanding system of Renewables Obligations (RO), paid by electricity supply companies to renewable energy generators[14], would cease to be available to new offshore wind projects in 2017.

Policy for offshore wind

The 2010-2015 Coalition Government set out its *'Offshore Wind Industrial Strategy'* in 2013[42]. The strategy put an unusually heavy emphasis on job creation, producing an

[10] HC Deb 23 October 2013, Col 293-4
[11] The average annual total (dual fuel) household energy bill is expected to rise from £1140 in 2013 to £1305 in 2030
[12] Involving the price-based auction of 15-year contracts within annual project 'allocation rounds '(UKTI 2014)
[13] The LCF is set at £3.3bn in 2014/15, rising to £7.6bn in 2020/21 (at 2011/12 prices)
[14] The RO is estimated to provide a premium of £95/MWh to offshore wind generators in 2014/15 (UKTI 2014)

internal conflict between this and its ambitions for efficiency gains. In the Foreword to the Strategy the three Government ministers responsible make comparisons with the offshore oil industry, stating that they wish to:

'achieve levels of UK content in our offshore wind farms which are similar to those achieved by our North Sea oil and gas industry where more than 70% of capital expenditure is through UK based suppliers'[42:2].

The relevance of the comparison is questionable. The North Sea oil industry developed out of the oil crisis of the 1970s, when BP was ejected from the Middle East, and the development took the equivalent of one-third of Britain's annual manufacturing investment. The industry is now struggling with the costs of maintaining or decommissioning ageing installations, and any new investment is closely linked to high oil prices [43]. Whilst the North Sea oil industry has developed over 30 years, the UK offshore wind industry is intended to scale up within a much shorter time frame. This will inevitably pose a serious local skills challenge, generating cost inflation. The level of political risk involved, particularly in the potential for policy changes, means that offshore wind developers are hesitant to take the lead in training. The HR manager for RWE npower has argued that:

'It is a high risk environment for us to be operating in … The industry is committed to training and development, but we cannot afford in the current economic climate to be holding double the headcount we require because we may not need half of them in five years'[44].

Both the European Union and the UK have produced renewable energy 'roadmaps' to offer some degree of reassurance to the industry beyond 2020. The 2011 European Directive acknowledges that *'uncertainty is a major barrier to investment'[45].*

As the rapid development of wind farms is underway employment is naturally concentrated in their planning and development, construction and installation. These activities account anyway for the majority of the sector's employment. Nevertheless, even during this phase of roll-out of new farms manufacturing alone accounts for just 10% of the sector's employment[46:3]. Whether these jobs become permanent and grow depends largely upon the level of UK commitment to offshore wind, as a strong commitment is most likely to see local manufacturing develop[47], thus raising the prospect of export potential as other EU countries increase their rate of installations[46:31]. But these new manufacturing jobs would still face strong competition from the well-established industry bases in Germany and Denmark.

British political support for offshore wind appears to depend upon UK job creation as a means of clearing the political hurdle of high costs[8]. Thus the industry itself has set a voluntary target of 50% UK content, allowing the Government to avoid the contravention of international trade rules and European competition policy of imposing a formal target[48]. The dominant supplier of UK turbines, Siemens signed a Memorandum of Understanding with the Government in 2010 to develop a UK facility, and in 2014 unveiled its deal for a joint venture with ABP to develop a site in Hull Docks that had by then been designated as an Enterprise Zone [49, 50].

In addition to the subsidies available through the low-carbon energy programmes, funded from within the energy market, the Government's ambitions for UK content of the offshore wind market have also been supported through general taxation. Establishing a facility within an Enterprise Zone attracts up to 100% relief on business rates, up to £50m of enhanced first-year capital allowances against corporation tax, and simplified planning processes. The Government has also established an 'innovation and research centre' for offshore wind, wave and tidal energy, with a commitment of almost £1bn of public financing[51], in addition to the

support for its location within the North East Enterprise Zone. In the specific case of Hull, £25.7m from the Regional Growth Fund has been allocated to Green Port Hull, for uses including training, R&D, and export development[52].

The ambition is to create a longstanding cluster of offshore wind expertise in the North East. Local clusters of companies and institutions involved in wind energy have already developed elsewhere in Europe. Where these produce rather standardised components for onshore wind farms they may not be directly threatened by global competition from Asia. This is not yet the case in the more specialised, expensive and still immature supply chain for offshore wind energy. Analysis of the Basque cluster highlights the vulnerability. In 2011 Gamesa took a strategic decision to step outside the Basque cluster and invest in both Glasgow (UK) and Virginia (USA), and reduce its collaboration in the Basque region. Other major firms in the cluster then followed suit and also began to pursue new worldwide investments in R&D and manufacturing facilities[53].

Immediate industrial policy ambitions and strategies to develop local clusters and jobs, are undermined by longer term uncertainty in the UK market for offshore wind. Despite current levels of financial and regulatory support there is rising concern that investors in renewable projects and supply chains lack the fundamental assurances over future policy that they require. This is, of course, a consistent problem for the sector. After the failure of the 2009 Copenhagen summit to agree further binding targets on emissions a spokesman for E.ON explained: *'Having long-term targets in place is absolutely critical to energy firms, because we're making investments now for 30 or more years in the future'.*

Innovation and cost reduction

Innovation takes many forms, and often follows an unpredictable path. The offshore wind sector presents a range of opportunities for innovation, not only in turbine technology, but also in the sector's processes, construction and maintenance systems, and in financing. The central questions for policymakers are how an environment can be developed and maintained to foster strategic innovation, and how they might maximise the returns to innovation.

An OECD study on innovation and green growth highlighted the bleak outlook for such growth if only incremental innovation is pursued. The transformation that is required may depend upon a degree of *'creative destruction'.* It argues that policies that provide a stable environment for investment, including the carbon pricing system, are essential, as is public investment in basic research, but further steps are also required to overcome the dominance of particular techniques and firms. Policy must *'avoid favouring incumbents or providing opportunities for lobbying'* and seek to foster the growth of new, entrepreneurial firms, and enable market entry and exit[54:11-12]. The study highlights evidence of how R&D can spill over between sectors[54:50], and the risk that policies can inadvertently *'lock in'* existing technologies and deny international competition the opportunity to drive down costs[54:55]. These appear to be very real risks within the implementation of the UK strategy for offshore wind.

The experience of sectors that require high levels of capital investment or which face other barriers to entry may offer useful lessons for policy with regard to offshore wind. Vigorous competition has delivered significant benefits to consumers and society. This is particularly true in sectors with high investment costs, when these costs are often irretrievable by the company concerned, and which are prone to monopoly because of such barriers to entry. There are numerous examples of cost reductions that have resulted from regulatory policies that support competition.

If offshore wind energy is to become self-sufficient, free of subsidies, then substantial innovation is required in all aspects of the sector, including finance, the supply chain, foundations, cabling, turbines and installation vessels. Such innovation is inevitably disruptive, affecting firms, jobs, and politics. To achieve real innovation the state must beware that a *'long-term embrace between the regulator and the market will end up doing severe damage to the integrity of the market because powerful economic and industry interests will mobilize political power in order to capture regulatory power.'[55:69]*

World energy markets have been transformed by the rapid growth in shale gas supplies through the use of fracking processes. Yet this has been an innovation that came about due to the sustained efforts of a small business, driven by the need to remain in business as its traditional reserves faced depletion. By pressing on against the industry consensus that this would be a wasted investment Mitchell Energy and Development Corporation eventually achieved an innovation that would be rapidly copied by the major oil and gas corporations. The US changed from being a net importer of gas to a major exporter, and the value of years of government policy directed towards the development of import facilities and an ambition of self-sufficiency was thrown into question. One adviser to the US Department of Energy has argued that: *'Energy independence is the wrong issue. It is reducing the cost of energy services and improving energy security'* [56:42].

It seems that it was a process of price deregulation rather than proactive state regulations that led to the shale gas 'revolution'[57]. Between 1978 and 1992 the US increasingly liberalised the market for natural gas, which made the substantial Mitchell investment in fracking for shale gas possible[58]. At the same time it undertook a radical liberalisation of its air travel market; an experience that prompted Britain to begin pushing for market liberalisation in the heavily subsidised and controlled European skies. At the time the airline industry was in the grip of subsidies associated with government industrial and employment policies, and issues of national 'status'. But it was still a young industry with great potential for innovation and cost reduction. An interesting analogy with the current situation for the offshore wind energy sector is very obvious.

Air transport

The experience of the air transport sector offers fascinating parallels in terms of former state commitments to national airlines, and the importance of promoting new entry into markets with substantial barriers, state subsidies, and risks of concentration. New entrants have brought substantive innovations, leading not only to significant cost reductions but also to increases in capacity and greater market stability through the economic cycle.

Whilst there are significant differences between the air transport and offshore wind sectors, there are some dramatic similarities in the challenges that policymakers have faced in securing the financial sustainability of these two industries that play an important part in meeting national infrastructure needs.

The 1990s saw a gradual change of direction in European air transport policy towards more liberal regulatory systems. This followed a more dramatic deregulation of US air services, that had stimulated significant cost reductions and passenger growth[59]. The European Union moved slowly and cautiously towards more open markets, led by domestic or bilateral developments involving the UK, the Netherlands and Germany. The British Government had, for example, privatised both its national airline and airport operator during the 1980s.

The EU began with a 1983 Directive liberalising the market for travel between regional airports; a fairly insignificant concession at the time. According to O'Reilly: *'In essence the status quo was unaffected: state-owned airlines continued to dominate the industry, barriers to entering the market remained and competition was virtually non-existent.'*[60:8] In the end it was to take 10 years of gradual policy change, through a series of European regulatory 'packages', and a series of competition cases in the European Court of Justice, to arrive at a situation within which air fares were no longer negotiated and approved, airlines were free to decide the European routes they would serve, and nationality restrictions on airline ownership were lifted.

Whatever the theoretical freedom that new entrants enjoyed under the liberalised system, however, capacity constraints at the major European airports and incumbent airlines' *'grandfather'* rights to hold onto their landing and take-off slots, provided few realistic opportunities for new entry. It quickly became clear to policymakers that local monopolies on slots to take off and land at Europe's main airports stood in the way of new entry. Most major routes were served by an established duopoly of two national airlines (representing the countries at either end of the route) acting in ways similar to a monopoly in other sectors, and often with overt or covert state subsidies. There was clear evidence that new entry into these markets had a significant effect on capacity and fares.

New regulations to encourage new entry

When the European Union introduced a Slot Allocation Regulation in 1993 [EEC 95/93], it was so ambiguously worded with regard to slot exchanges that very little changed in the years that followed, and dominant airlines had no need to relinquish their hold on airport capacity[61:34]. Nevertheless, the Regulation had been designed to offer some positive help to new entrants, on the basis that competition in general and new entry in particular had been the priorities of agreed European air transport policy. Article 10 of the Regulation therefore imposed a slot use-it-or-lose-it rule on incumbent airlines, and stipulated that half of the slots that go into the pool for distribution would be earmarked for new entrants.

European routes were usually a managed duopoly of two Member State 'flag carriers'. The challenge was to enable new entrants to break into these markets and be able to compete fairly with the dominant airlines. Between 1992 and 2010 the number of intra-European routes served by more than two airlines rose from 93 to 479[62]. Substantive new entry was difficult because strong competition required a third airline on a route to have a significant presence in terms of flight frequency, which required a significant number of slots. However, any airline that acquired more than a handful of slots no longer qualified as a 'new entrant' under the Regulation. In 2011 the European Commission drafted a new Regulation to address this important point and expand the definition of a new entrant [62].

It is important to note that new entrants that made use of this positive discrimination in their favour were not necessarily entirely new airlines or low-cost carriers. Many major airlines used the provision to establish new bases away from their previously constrained route network, either directly or through new subsidiaries or alliances. The central point is that it allowed the two flag-carrier duopoly on the main intra-European routes to be broken, as also happened on transatlantic and some other intercontinental routes where countries had agreed that this would be possible. Preferential treatment in slot allocation also provided small or new airlines the opportunity to enhance their value through their new slot rights, prompting established airlines to seek alliances with them that provided important financial stability to the newcomer.

Again it had been the UK that had led the way in encouraging new entry, and had used the ambiguity of the 1993 Regulation on slot ownership to allow a secondary market in slots at

Heathrow. The major beneficiaries of this were US airlines wishing to compete on transatlantic routes from Heathrow following a 2008 'Open Skies' agreement between the two countries. In 2007 British Airways increased its holding of Heathrow slots in a deal to buy more than 100 slots from British Midland (BMI), just two years before BMI was purchased by Lufthansa, giving that carrier a significant presence as a competitor to BA at Heathrow [63].

In 1995 the UK Civil Aviation Authority argued that: *'The aim of competition policy should be to create an environment which maximises the opportunities and the incentives for competition, whether from the major airlines or from new entrants or existing smaller or medium-sized carriers'[64:ix]*. In 1993 British Midland introduced a Business Class cabin on its European routes from Heathrow, and new business class fares were introduced on some major routes that were as much as 25% below the previous fare in this cabin. The most significant fare reductions were, of course, on routes that saw new entry, although new entrants also competed on fare types (restrictions) and service quality[64:24-27].

Low cost carriers: A disruptive innovation

Whilst the liberalisation of air transport was not driven by a quest for innovation, but by a general belief in the benefits of competition, the liberalisation process led to some important changes within the industry. This serves to emphasise the strong links between competition and innovation, and the unanticipated outcomes that can emerge once market competition is enabled.

Perhaps the most notable by-product of airline liberalisation has been the rise of the low cost carrier (LCC) model, pioneered by Southwest Airlines in the US since deregulation of that market in the 1970s. The new LCCs achieve a significantly lower cost base than the old airlines through a combination of innovations[65]:

- Simple one-way fares
- Simple yield management systems
- Direct sales, with no distribution systems
- Point-to-point services only, with no connections
- Using regional/secondary airports, with low charges
- Rapid aircraft turnaround at airports
- Single aircraft type
- Single cabin
- Low staff costs and high staff productivity

As the principal pioneer of these changes Southwest can be seen as a prime example of disruptive innovation[66]. This transformation required no technological advance, but Southwest's operations represented an entirely new approach compared to the prevailing model of airline operation. It is a model that is now widely copied. This has seen the rise of airlines such as Ryanair and Easyjet in Europe in the 1990s, and others subsequently in markets worldwide, including India and China. Easyjet and Ryanair have developed different strategies, with the former acting as a new entrant on many routes served by the traditional carriers, breaking into the historic duopoly, whilst the latter has often developed new routes between little-used European airports, sometimes with substantial financial support from the airports or communities served.

The old airlines were forced to innovate in order to survive. Cost-cutting alone would be insufficient, as their operational system also had to change in order to compete with this new challenge. This meant, therefore, not only the rapid adoption of newer, more efficient aircraft, but also IT systems that would allow them to target a newly segmented market, and new modes of ticket distribution [67:28]. Whereas competition between the old full-service carriers,

where this existed, was reflected mostly in business fare reductions, competition within Europe involving the new LCCs brought down business and leisure fares alike, as well as increasing leisure traffic volumes[68]. By making very low fares possible when required, the LCCs also appear to have improved the resilience of the sector to the economic cycle and external shocks, so that traffic volumes appear to be more stable than was previously the case[65].

Analysis of the US market shows LCCs benefited from a 30% cost gap compared to the traditional carriers, provoking cost reductions that may have begun to reduce this differential. US Airways and United Airlines, for example, managed to reduce their unit labour costs by more than 30% between 2001 and 2006, and American Airlines reduced its non-labour unit costs by 28% over the same period[69]. Within the European market Easyjet[15] claims to have achieved an operating cost per Available Seat Kilometre, excluding airport and fuel costs, that is some 48% less than IAG[16] and more than 70% below Air France-KLM and Lufthansa[70].

Although most intra-European routes have been characterised by a duopoly of two flag carriers, some developments since liberalisation have produced scenarios that have broken free from this legacy. The growth of the LCC Ryanair at Dublin meant that over time it became a significant competitor to the Irish legacy carrier Aer Lingus. Competition was so fierce on these routes that Aer Lingus was forced to reduce its cost base significantly, and other countries' flag carriers withdrew from the routes. Eventually Ryanair bid to take over its rival. Analysis of the potential impact on competition of this proposed takeover provided some estimate of the gain from having two competing carriers on routes. This suggested that Aer Lingus fares would be some 21% higher in the absence of its low-cost rival[71][71].

Using subsidies to support competition, not prevent it

The growth of competition served, however, to highlight the underlying problems of Europe's national 'flag carrier' airlines, and the state aids that were keeping them flying with artificially high levels of employment and low levels of productivity. These aids were not just financial, through direct and indirect state subsidies, but also came in the form of restrictive regulations and practices.

Liberalising the European market also meant that competition law could now be enforced, albeit with a few (but now transparent) exemptions. In the 1990s, the European Commission began to pursue several state aid cases against national airlines, although political pressures from the EU member states concerned meant that it exercised a degree of leniency, usually permitting aid that was tied to restructuring the ailing airlines, in order that they could compete on a fair basis thereafter. Such assistance was often deemed to be a normal 'market economy investor' action, and therefore legal under the Treaty[72]. In the case of Air France the French state was allowed in 1994 to inject a further FF20bn into the airline over a number of years, to support its restructuring. This followed earlier injections in 1991 and 1992, either by the state or by state-controlled banks, to which the European authorities took a lenient approach. But the European Commission took a harder line on carefully crafted airport traffic rules that favoured the local airline over European competitors. Whilst attempts to directly support jobs within a flag carrier might have been a short-term political necessity, regulations that very directly prevented new entry were already a step too far. There was a very real risk

[15] A LCC that operates from major airports in direct competition with the flag-carrier airlines for business travellers
[16] The owner of British Airways

that actions on overt state aids might be compensated for by covert policies to protect the local supplier[73].

A further form of subsidy related to routes that Member States claimed were essential for socio-economic reasons, often to remote islands, or which were 'thin' and could not exist without subsidy. In order to avoid the maintenance of unfair state aids to national flag carriers a system was introduced that would allow Member States to designate essential routes and seek competitive tenders for Public Service Obligations (PSOs) on them. If no airline took up the PSO then the route could be advertised on a sole carrier basis, with a time limit. Under the 1992 air transport regulations PSOs had to be non-discriminatory and proportionate, in order to avoid their use as a route for state aid. When Italy attempted to impose restrictive terms on airlines that might enter such routes, in the form of a cut-off date for response to the PSO and a minimum three-year service commitment on routes from Sardinia, the Commission ruled that these were disproportionate; even subsidised routes should remain open to new entrants, who should also retain the freedom of exit. Furthermore, in order to ensure that overcapacity on a vital route is avoided, then the incumbent carrier should share route capacity with the new entrant. Italy also attempted to create a PSO that grouped several routes, but this was also ruled out by the Commission, because *'the PSOs grouped in this way, would only enable only a few existing operators to meet the requirements'[74].*

In 2008 the Commission used new, consolidated air transport regulations[75] to further clarify its requirements for PSOs to be transparent and proportionate, and to give maximum opportunity for new competitors to enter a route[17]. The entire process was intended to support new entry and to circumvent the inevitable risk that subsidised routes could reinforce the position of a locally dominant airline. Whilst the European Union must respect the principle of subsidiarity, so that individual Member States are responsible for the implementation of PSOs and any subsidy, the US Essential Air Services system, which has the same aim of maintaining travel connections, is managed at the federal level. This means that there is greater transparency that in the EU system, and also greater scope to encourage efficiency. A recent analysis of the EU system found not only that it is still mostly the national carrier that wins PSO contracts, but also that their efficiency declines once they have won their monopoly, so that technical efficiency is positively related to the length of time until the PSO is due for renewal[76]. The conclusion is that the combination of an increasingly cautious tendering authority as the term draws to a close and confident monopolist provides little competitive pressure. An important difference is that the US system allows new entrants to bid to serve an EAS route with less, or no, subsidy than the incumbent [77].

Learning the lessons

The experience of air transport liberalisation demonstrates not only the benefits of moving away from the protection of 'national' service providers towards open competition, but also the value of giving positive support to new entrants, particularly where the route is served by one carrier, or two acting as a duopoly. The evidence from air transport demonstrates that it is insufficient for new entry to be just a theoretical possibility, but that the real benefits of competition are realised only once there are more than two competitors within a specific market[78]. This finding undermines contestability theory[79], with its emphasis on potential new entry. For decades air transport policy was affected by nationalist policies that supported the concept of state-subsidised 'flag carrier 'airlines. Indeed, many countries around the world still adhere to this approach. The sustainability of those airlines depends crucially upon the

[17] Where a 'sole carrier 'tender had become necessary then the Regulation stipulated that the PSO would be advertised for six months, rather than the usual two months.

ability and willingness of their governments and taxpayers to continue providing financial aid. This provides a salutary lesson for the pursuit of 'green growth 'policies. Nationalist policies are unlikely to support the real and constant innovation that is required in order to operate free of subsidies and to provide long-lasting local jobs in the market. The use of supply chain plans as a mechanism to ensure that subsidies generate local jobs is reminiscent of the covert systems of market manipulation that had held back the development of an efficient European air transport market during the final quarter of the 20th century.

Techno-nationalism presents a very real threat to renewables more generally. Rivalry between Germany and China in photovoltaics, with concerns over the arrival of imported units, could present a serious threat to the global achievement of the dramatic cost reduction that is required in order to make this sector sustainable without production and deployment subsidies[80]. Nevertheless, even within these two countries there exists a high level of competition within the supply chain, so that ongoing cost reductions remain likely. A Coalition ministerial aide, Stephen Lloyd MP, commented in October 2014 that competition in the solar energy sector was creating a situation within which the need for an ongoing subsidy could be questioned:

'I think it is going to happen quite soon. Where solar power doesn't even need a subsidy, because the costs have come down so much that the market forces mean that it is cost effective'.[81]

Some caution needs to be applied in interpreting recent falls in the cost of PV units, given the substantial spike in the cost of a core component, polysilicon, between 2004 and 2009. This played a large part in a 40% cost reduction in 2008/9, after which prices returned to their long-term trend[82:113]. Nevertheless, the high level of competition within the global supply chain is widely expected to continue to drive technological innovation and cost-reduction.

The same could be true in offshore wind, although policies within the major markets for this new technology would need to support a vibrant, competitive market. A recent joint government and industry study into offshore wind identified competition as an important factor in maximising the potential for cost reduction[24:53] and a study for the Government's Renewables Advisory Board also noted that market dynamics are a major driver of turbine costs and highlighted the prospect that competition in this may improve if, as seemed likely, more firms made the step across from the onshore market[83]. However, policymakers must have the confidence to put this theory into practice.

There are countless examples of countries pursuing local manufacturing jobs, as part of their industrial policies, but then having to deal with the adverse consequences on local employment of changes in technology and relative international competitiveness. In some sectors, for example, Britain has continued to benefit from strong export growth, but alongside a decline in employment. This has been particularly true recently in the pharmaceuticals and aerospace industries; pharmaceuticals sector employment fell by around 30,000 between 2000 and 2013, to 42,000 in total, as jobs moved overseas. Over the same period the sector's UK R&D and output continued to grow. The downturn in UK jobs and exports amongst the global big pharma was partly offset by growth in second-tier firms and the specialist 'small molecule' sector [84]. These are the types of change to which an open, competitive local market is able to adapt.

In air transport, the employment and economic value of the sector is felt much more in the supply chain and the catalytic effect of aviation than in direct employment in the sector[85] Britain no longer builds passenger airliners, yet it hosts the World's second largest civil aerospace industry, accounting for around a quarter of the value of Boeing's 'Dreamliner'[86]. The UK plays a significant role in aviation finance, leasing, and legal services, and a similar

level of expertise is already developing in offshore wind. Typhoon Offshore, for example, recently opened a London base, so that it could: *'be close to many of the developer/owners and other key stakeholders – lenders, investors, insurers, and the government bodies necessary to realise the potential of this huge market'*[87]. These natural developments of competitive advantage provide a stark contrast to attempts to force advantage in manufacturing alone. An advantage of Offshore Wind energy is its strong potential to create high quality employment in the operation and maintenance (O&M) of this very specialised technology, and to do so in coastal regions of Britain that have few such jobs. Whilst the market for manufacturing may shift as regional wind farm construction waxes and wanes, and relative competitiveness changes, the market for wind farm O&M has a more stable prospect.

Conclusions

Offshore wind energy is an attractive option for the UK, but it must make dramatic cost reductions if it is to play a significant part in the long-term energy mix once the current subsidies are removed. Current Government policies send mixed messages that discourage the investments required to innovate and reduce costs. Firstly, there remains no clear energy policy commitment to the sector beyond 2020. Given the scale of investment required and the lead times involved, this substantially increases the risk that companies face. Secondly, the strong emphasis on building a British supply chain, rather than just a competitive supply chain, may have important implications for the scope to innovate and produce the required cost reduction.

This paper shows how it proved essential in developing a sustainable air transport market to have policies that proactively supported competition. These policies included the phasing out of anti-competitive state support for national airlines, and securing the availability of take-off and landing slots for new competitors at busy airports. For many countries this was a dramatic change of direction. But it was a change that enabled cost reductions of 30% or more, and ongoing growth in the sector regardless of fuel prices and external shocks including wars and the 9/11 attacks in the US. The industry as a whole became more economically sustainable than ever before. The UK was at the forefront of pushing for this change. Recent analysis has suggested that fares could increase by 21% if some of the routes on which there are now two competitors fell back to having one dominant airline.

Policies around contracts for renewable energy need to take a similarly proactive approach to fostering long-term competition. Whilst there are several firms active in the UK market for the supply of foundations and of inter-array cabling, albeit with some capacity constraints given the pace of market growth, the UK market structure for the supply of turbines appears unusually concentrated. Whilst this could be explained by differences of technology or capacity, it should be a serious cause for concern. A careful assessment of existing or potential barriers to entry needs to be undertaken, and steps taken to facilitate long-term competition. The complexity of the UK system of financing is a particular problem, highlighted by the recent supply chain review.

The CfD prerequisite of DECC-approved supply chain plans, with ministers' repeated emphasis on their role in securing local content, may be a major new barrier to entry. Whilst jobs will naturally flow from offshore wind farms, both in the years of development and thereafter in the operation and maintenance, making these in any way a prerequisite defies the global role of the firms involved, and the reality that other markets will soon pick up the pace of development as UK market development begins to slow.

As 2020 approaches British policymakers need to address the uncertainty over the future commitment to offshore wind and regain their confidence in the role of competition and market growth as the primary means of securing cost reduction. An industrial policy that is focused on local supply rather than a sustainable market will do much more harm than good.

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