

Comments on the report by Frontier Energy on International Support of Onshore Wind

Keith Bell BEng (Hons), PhD, MIET, FHEA, CEng

*Department of Electrical and Electronic Engineering, University of Strathclyde
April 2013*

Introduction

Frontier Economics has presented a report that summarises a review, commissioned by the Department of Energy and Climate Change (DECC), of the levels of financial support of onshore wind generation found internationally. The present note has been invited by DECC and is provided in respect of a peer review of Frontier's report. In particular, I have been asked to consider whether the study makes use of the best available evidence, uses a robust approach with information and analysis of good quality, has made an appropriate choice of a limited number of countries to examine in more detail and has delivered a report of publishable standard. In addition, I have been asked to comment on the limitations of the report and whether those limitations are reasonable given the available data.

This reviewer finds Frontier's report to have addressed the most pertinent issues in the respect of the income that might typically be expected by the developer or operator of onshore wind generation capacity:

- the value of direct financial support mechanisms, generally related to energy production;
- the value of indirect financial support, e.g. tax breaks;
- the absolute levels of income in local currency;
- the net levels of income over and above income from competitive electricity wholesale markets in local currency;
- the influence of the time duration of financial support mechanisms on the effective levels that can be directly compared with arrangements in the UK;
- the pound sterling equivalent of the absolute and net levels of support based either on currency exchange at the time of interest or equivalent purchasing power.

Furthermore, another, critical question has been addressed:

- how do expected levels of income in a particular country compare with the costs in that country of wind generation development, operation and maintenance?

The absolute and net levels of support in a set of 26 different locations – nations or North American states with their own support mechanisms – have been reported. The basis for selection of these 26 is sensible for the purposes of allowing a useful comparison: at least 1GW of onshore wind generation capacity installed by the end of 2011, the most recent year for which complete records are available for all the regimes reviewed. The 26 locations encompass a range of levels of wind generation capacity, both in absolute terms and as a proportion of total generation capacity, and of different support mechanisms, namely: quotas (analogous to the Renewables Obligation currently in place in the UK); a 'classic' feed-in tariff (FIT) that is a fixed, total

income per MWh of generated electrical energy; a premium FIT, i.e. a fixed sum per MWh that is added to wholesale market income; and a FIT with a contract for difference.

The first finding is that the level of financial support given to onshore wind in the UK is towards the top of the range found internationally.

Comparison of levels of financial support with the cost of onshore wind energy

In respect of a comparison of levels of support with the costs of onshore wind, any or all of the 26 locations might have been investigated by Frontier. However, in view of the time and budgetary constraints for the study, this has been performed for 5 countries, the choice of which seems to me to be appropriate in terms of providing useful comparisons with Britain and encompassing different sorts of financial support mechanism:

- Denmark;
- Germany;
- Ireland;
- The Netherlands;
- Poland.

The single, main finding is perhaps this: that, although the absolute level of financial support for wind generation developed onshore in the UK is in the top half of support levels examined, so too is the levelised cost of wind energy in the UK. Thus, in comparison with the other 5 countries examined in some detail by Frontier, the level of incentive to development of onshore wind generation in the UK is not unduly high relative to that seemingly available in other countries. However, this raises another important question: why is the cost of wind energy in the UK higher than that apparent in 4 out of the 5 other countries examined in some detail?

Knowing where to look, it should be possible to ascertain the net level of support provided to onshore wind in different countries. In some cases in which the total income per MWh is determined by a clearly defined and invariable mechanism, the absolute level of support can also be identified. However, in others, e.g. Germany, different mechanisms are available. Moreover, it is not straightforward to quantify, with confidence, the costs of wind energy.

In many countries, there are actually different support mechanisms that cannot always be directly compared. For the purpose of a fair comparison, these should somehow be expressed on a common basis and Frontier's work to do this is both necessary and very welcome.

For new generation, current or planned support mechanisms are what count. However, it can be instructive to review past mechanisms and levels of support and judge, based on the evidence of how much wind generation capacity was developed at different times, whether those mechanisms were sufficient to encourage investment. In expressing a single figure for support for each year within a given historical period, account should be taken of the proportion of capacity that has benefited from different kinds of support. It is not clear if Frontier has been able to do that. Comment is made by Frontier where past levels of support appear to have led to decreases or increases in investment in new onshore wind generation capacity but

these comments are, perhaps by necessity given the availability of data and the time available for the study, quite high level.

A key question is whether a current or planned mechanism and level of financial support is sufficient to drive new investment or, indeed, whether it is excessive and implies higher costs to consumers or taxpayers than necessary to meet targets for energy security or reduction of carbon emissions associated with electrical energy. This is difficult to determine since it depends on a judgement of the costs of new generation and whether the rate of return, dependent on the difference between income and cost, is sufficient for investors.

Frontier has sought to summarise, based on publicly available information, the levelised costs of onshore wind generation in the 5 other countries plus the UK examined in relative detail. This work to draw together the main available information is very useful and welcome and suggests that, although the level of financial support available to onshore wind in the UK is higher than in Denmark, Germany, Ireland and the Netherlands, it is not exceptional in that it is commensurate with the apparent levelised cost of wind energy, which is also higher than in these countries.

Factors influencing cost of onshore wind energy, and evidence of costs

A particularly important thing made clear in Frontier's report (and also noted in other reports on the cost of electrical energy) is that the levelised cost of wind energy depends on large number of different factors, principal among which are:

- capital cost;
- cost of operation and maintenance;
- insurance;
- charges for use of the main distribution or transmission network;
- the load factor in a 'typical' year;
- the cost of capital.

The information on levelised costs that Frontier has retrieved suggests that there are significant differences in the above among the 5 main review countries and the UK. What seems to me to be a particularly useful chart – Figure 4 in the Executive Summary and Figure 17 in the main body of the report – summarises these differences showing how the levelised cost of wind in the UK would be changed were, for example, the capital costs of new wind farms in UK to be the same as (according to the data obtained by Frontier) those in Denmark, Germany and so on rather than what is apparently typical for the UK. This suggests that the most significant causes of the higher levelised costs in the UK are higher capital costs and cost of capital. The cost of operation and maintenance in the UK is also higher than in the other countries.

The above observation gives rise to two further questions:

1. is what is suggested by the reports reviewed by Frontier actually the case? In other words, how strong is the evidence?
2. if the capital costs and cost of capital are higher in the UK than elsewhere, why are they higher?

It seems to me that it is difficult to be absolutely sure about the answer to question 1. This is because the costs of actual developments are generally commercially confidential. The reports cited by Frontier, in turn,

tend not to cite specific projects. For example, the main source used for costs in the UK – the report produced by Arup for DECC in October 2011¹– uses ‘proprietary information’ and results from a survey sent to parties active in the renewables industry while another cited report, that by Mott MacDonald in 2011 for the Committee on Climate Change (CCC)² cites only Mott MacDonald as the source. In addition, ideally each specific item of information quoted in the report would have the specific source cited. This is often but not always done. In Figures or Tables such as Figure 7, many sources will have been used, but the reader could be directed to a specific list. I feel that clear citation of sources is important as (a) it allows the reader to make their own judgement about the accuracy of the information and (b) as part of the consultation process, it gives the reader the opportunity to suggest better evidence that can, in turn, help inform all interested parties.

Notwithstanding the above caveats about the degree of confidence one can have in the readily accessible cost information, my understanding from some of my own informal contacts within the wind industry suggests that capital costs and the cost of capital are indeed higher in the UK than elsewhere in Europe.

Among the reasons for high capital costs and cost of capital I have heard suggested (informally) are that the terrain in many of the most favourable locations for onshore wind farm development in the UK is more difficult than in many other countries, e.g. deep peat or very hard rock, leading to higher construction and foundation costs, and that the banks to which UK developers turn for finance view investment in renewables as relatively risky. In addition, I have heard it suggested that UK onshore wind farms tend to be developed in a more ‘piecemeal’ fashion (which I take to mean smaller projects) than those in, say, Germany, and that this leads to higher capital costs.

The information obtained by Frontier is broadly consistent with the above anecdotal evidence. That is, the single biggest element of capital cost – that of the turbines – does not seem to vary substantially among the countries reviewed and the difference in capital costs is explained by other factors. The information on costs of capital, mostly taken from academic publications (and not industry sources), also suggests that the UK is expensive. However, it would have been preferred if Frontier had provided a fuller discussion of influences on cost of capital and challenged the numbers published in reports commissioned by DECC. The influence of risk, in particular, could have been discussed more with perceptions in different countries compared with, for example, what Oxera reported for the CCC³.

The obvious thing to do to verify the apparent findings would be to invite the wind industry to submit evidence.. However, rightly or wrongly, an independent observer will always be conscious that parts of the industry may have a particular interest in presenting a particular picture. One therefore looks to other sources that might help to corroborate the main findings. Even if – again for reasons of commercial confidentiality – they are reluctant to go on the record, one would like to think that international engineering consultants (such as Arup and Mott MacDonald mentioned above) would have experience of project costs in different countries and no reason to talk them up or talk them down. Insofar as apparent costs of capital are published, they could be compared for other large energy construction projects. This should both allow a comparison between different countries and, for the UK, a judgement on whether lenders do regard renewables projects as being more risky than, say, major network developments or construction of combined cycle gas turbines. The relative costs of capital and capital costs internationally

¹ “Review of the generation costs and deployment potential of renewable electricity technologies in the UK”

² “Costs of low-carbon generation technologies”

³ “Discount rates for low-carbon and renewable generation technologies”, April 2011

might also be compared for other sectors, e.g. transport and for construction projects in different terrains. It should also be possible to find data on the typical sizes of different onshore wind projects in different countries.

Even though the above information may not be sufficient to prove a relationship beyond doubt, it might serve to lend additional credibility to what appears from Frontier's work to be the case and to provide a starting point for further investigations.

It should be clear that levelised costs are particular to a certain time as well as a certain place: the costs of turbines may be expected to change over time (and be susceptible to exchange rate fluctuations) as would the cost of capital (depending on base lending rates but also prevailing attitudes to risk and the degree of confidence in the particular borrower); the state of the construction industry as a whole may also influence capital costs and different load factors will naturally be experienced in different places. In addition, improved availability of turbines and more effective layout of sites may also improve load factors. However, although some correlation may be apparent between historic levels of financial support and the rate of development of wind capacity, a review of the historic costs of wind energy was not part of the scope of the study.

Unless otherwise stated, it will be assumed that the levelised costs of onshore wind relate to new projects when they are compared with current or planned levels of financial support. As already noted, there is significant variation within the elements of cost. In addition, for any one element of cost, different reports – entirely reasonably – suggest different values even for the same country and, one supposes, the same kind of project. (It may be expected that projects will vary in size, remoteness from the main grid, the average wind speed at the project location and so on). The sensitivity analyses of levelised costs presented in the report Annexes are useful in providing an indicative range and an illustration of the degree of uncertainty, but they cannot, in themselves, give an indication of what proportion of planned or envisaged onshore wind developments in the next few years will fall where within those cost ranges.

In respect of operating costs, a large part of the difference observed by Frontier is attributed in the report to transmission charging though it is also noted to be a much smaller factor than capital costs and cost of capital. This seems to me to be a reasonable conclusion. In addition, based on what Frontier reports, the financial support given to onshore wind development in the UK does seem to be sufficient to cover this additional cost, at least for the moment⁴.

Other influences on development of wind generation

Frontier's report does allude to influences other than direct finance on development of wind generation, e.g. public support for onshore wind, land availability (related to population density)⁵, the efficiency of the planning regime and grid connection availability and the time to connect. However, the information presented is very general and high level and, in the case of public support for wind, sometimes out of date, e.g. Figure 26 from 2006. In addition, there is little discussion of the issues involved in grid connection. For example, the time to obtain grid access in Denmark in 2008 is quoted in one of the Annexes to be 2 months.

⁴ There is a debate that might be conducted on whether it is right that transmission use of system charges are levied on generators or, in particular, renewable generators. That debate has been part of the scope of Ofgem's 'Project TransmiT' process – see, for example, <http://www.ofgem.gov.uk/Networks/Trans/PT/WF/Pages/WebForum.aspx> where, among other things, a report can be found comparing transmission charges around Europe.

⁵ According to what Frontier has reported, the cost of land is not a big influence. However, for some of the countries reported in the annexes, land is included as an operating cost ('land rental') while, for others, in the capital cost.

However, it is also noted that there have only been 12 projects since 2008 with an average size of 6MW. This compares with 65 onshore wind projects currently under construction in the UK with an average size of more than 25MW⁶. Furthermore, projects of 10MW or more in Scotland or 100MW or more in England and Wales tend to be transmission connected and so not directly comparable with 6MW projects that tend to be distribution connected. The result of the above is that little evidence is provided either in favour or against an argument that financial support should be higher in one place than another to compensate for adverse influences of the above factors. On the other hand, it might be questioned whether absence of evidence of an influence is the same thing as evidence of absence.

Concluding remarks

The report produced by Frontier seems to this reviewer to be of publishable quality and a valuable addition to the publicly available information on wind energy. In my view, it has addressed what was required of it in the scope of work. The gathering together of data on financial support for wind in different countries is useful in itself providing, as it does, more detail than, for example, IEA summary reports and also providing value in putting support levels on a common basis. It is entirely appropriate that levels of financial support should be compared to costs of onshore wind energy. Frontier has, it seems to me, asked the right questions and taken appropriate steps to find answers, i.e. the approach taken has been reasonable.

In light of what Frontier has reported, it seems to me that the most significant conclusion is that, although the absolute level of financial support for wind generation developed onshore in the UK is relatively high, so too is the levelised cost of wind energy in the UK. The attempt to explain that apparently higher cost is helpful and it seems to be due mainly to higher capital costs and cost of capital.

In common with other investigations of the costs of energy, the degree of confidence that one can attach to the findings is limited by the paucity of published information on actual projects. More might have been done to draw inferences by analogies with other sectors or to elicit comment from among consulting engineers and it would have been preferred if Frontier had made more explicit links in the report between particular data and specific sources. There could have been a fuller discussion of influences on cost of capital. Nonetheless, an important thing that this study adds is a comparison of costs between different countries. If what is reported is taken as being true, following publication of the report it may now be asked if the costs of onshore wind are nonetheless reasonable given the economic and physical conditions prevailing here. Clearly, the answers to that question will be considered alongside other issues such as the UK's 2020 renewable energy target, CCC advice on carbon reduction and risks associated with generation of electricity from sources other than onshore wind. In addition, another thing Frontier's report usefully highlights in the commentaries on other countries is that the story of financial support to onshore wind is often not a simple one that setting a level of financial support that is too low relative to cost leads to a drying up of investment.

It is to be hoped that readers of the report might respond to it not simply by challenging any of its assertions with which they disagree but also by providing evidence in support of their views. In eliciting such responses, the report will have served a very useful purpose.

⁶ See <http://www.renewableuk.com/en/renewable-energy/wind-energy/uk-wind-energy-database/index.cfm>