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Agenda

Advancing economics in business

Renewable generation: is there a future for independent producers?

Many countries are looking towards renewable electricity generation to reduce greenhouse gas emissions. The UK renewable generation market is remarkably diverse; yet as it continues to expand, and the scale of the projects required to meet government targets increases, the nature of investment in renewable generation could change. What effect might this change have on the market for independent renewable generation?

As awareness of the risks of global warming continues to grow, many countries are looking towards renewable electricity generation as a way of reducing their emissions of CO_2 into the atmosphere. Because the cost of generating electricity from renewable sources is typically higher than conventional forms of generation, governments have adopted support mechanisms to encourage renewables investment. In the UK, the primary mechanism is the Renewables Obligation (RO). Following the RO's introduction in 2002, renewable generation has grown from around 5.5TWh per year in 2002/03 to 9.2TWh per year in 2004/05.

The UK renewable generation market under the RO is remarkably diverse, with over 250 producers, ranging in size from 1kW privately owned solar panels up to the large multi-site portfolios controlled by the major energy companies. At present, around 40% of RO-eligible renewable generation is controlled by companies with some interest in the electricity supply market, with the remainder controlled by a variety of independent players, including waste-disposal companies, water companies, environmental trusts and industrial sites.[1] However, as the renewable generation market continues to expand and the scale of the projects required to meet the government's targets increases, these independent producers may find it increasingly difficult to compete with the large vertically integrated energy companies. The key obstacles facing independent producers will be managing the risks inherent in renewables investment under the RO, and dealing with the influence that electricity suppliers are able to wield within the renewables market.

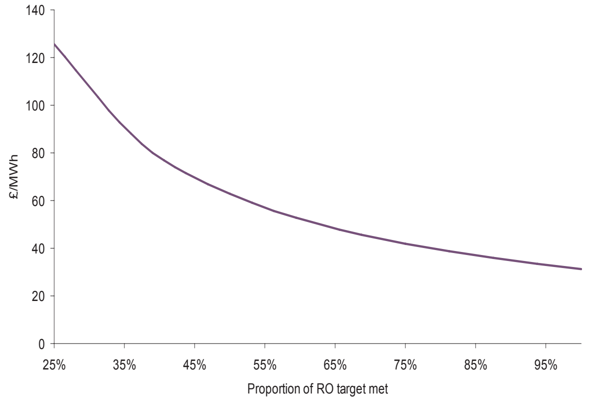
The nature of renewables investment

Renewable generation projects are similar to investments in conventional electricity generation in that revenues from the sale of electricity over the life of the asset are used to finance the typically large upfront costs of the investment. However, because the current costs of renewable generation are higher than can be supported by electricity market revenues alone, some form of additional support is required to encourage investment.

A fundamental feature of the RO is that it provides an additional revenue stream to renewable electricity generators. It works by requiring all electricity suppliers to acquire a growing proportion of their electricity sales from renewable sources, rising from 5.5% currently to 15.4% by 2015. Suppliers can purchase Renewables Obligation Certificates (ROCs) from renewable generators to use as proof of compliance with the RO, with the price of the certificates determined through bilateral negotiation. Alternatively, a supplier can pay an administered buyout price for any obligation volumes that cannot be met via ROCs, with the funds collected from this buyout mechanism recycled back to ROC holders.[2] Therefore, the value to a supplier of holding a ROC will be the buyout cost avoided plus a share of the buyout fund recycled to ROC holders. This relationship means that it is possible to calculate the ROC value, given the total number of ROCs issued, the buyout price and the overall obligation size.[3]

$$\text{ROC value} = \frac{\text{buyout price} * \text{overall RO size}}{\text{total volume of ROCs}} \qquad \text{Equation 1}$$

Figure 1 ROC price as a function of RO target achievement



Source: Oxera.

Essentially, the design of the RO means that the value of ROCs will fall towards the buyout price as the total volume of renewable generation approaches the obligation size, as illustrated in Figure 1.

This relationship and suppliers' historical levels of RO compliance can be used to show that the implied value of ROCs since the launch of the RO has been around £50–£55/MWh.[4] Recent analysis by Oxera (based on data from Enviros) suggests that the ROC price currently required to support the cheapest forms of renewable electricity (landfill gas and onshore wind) is lower than £30/MWh, implying a profit margin for these projects of at least £20/MWh. With such apparently high profit margins, it would be reasonable to expect significant volumes of new capacity to be brought to market until ROC prices fall to the level just sufficient to support new investment. However, this has not happened to date. The conventional wisdom holds that ROC prices have remained high because there are physical constraints on the rate at which new projects can be brought to market, which, combined with the annual increases in the size of the obligation, mean that ROC volumes cannot increase quickly enough to reduce the ROC value.

However, other factors could be at work—in particular, the risks faced by developers when investing in the renewables market and the control that large electricity suppliers are able to exert on ROC prices and volumes.

Risky business

In addition to the usual risks involved in electricity generation investments—high upfront costs, long payback periods and uncertain electricity revenues—renewable generators face uncertainty in the future level of ROC prices, as these will depend on growth in the size of the RO and the amount of additional renewable capacity built in the future. In the near term, it may be relatively easy to estimate the level of new build based on the stated intentions of developers and applications for planning consents. However, in the longer term, the level of new entry and hence ROC prices will be influenced by the long-run marginal costs of new entry. The relative immaturity of many renewable generation technologies means that it is difficult to predict how costs might change in the future. It is generally assumed that technological innovation and economies of scale will result in the costs of renewable generation falling in the future. However, weighed against this is the possibility that costs may rise as the cheapest renewable sources begin to be fully utilised.[5]

The potential for the costs of new entry to fall in the future represents a significant risk for renewable investors since new projects would be able to enter the market at ROC prices below the level required to fund existing investments. Although this issue arises in many other industries, it is more acute for renewable generation due to the typically low marginal costs of production. As a result, falling ROC prices may mean that existing generators are unable to cover their capital costs, but this would not result in capacity exiting the market.

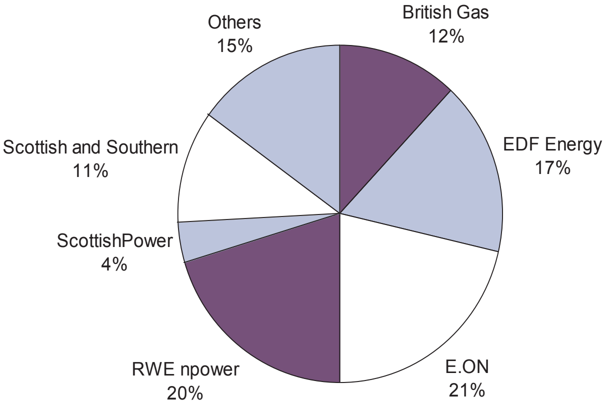
In a context where there is significant uncertainty regarding the future outcome of a key parameter affecting the success of the investment, real-option theory suggests that there will be a value attached to having the option to 'wait and see' whether one or other outcome is more likely. As a result, for investors to undertake a project, it will not only be necessary for the expected net present value (NPV) of revenues to exceed the expected NPV of costs, but for those revenues to exceed the costs by a sufficient amount such that they also cover the loss of the option to defer the decision. This in turn might explain some of the difference between the level of ROC support implied by estimates of renewable generation cost, estimated through a conventional rate of return analysis, and the ROC price actually required to stimulate investment in these projects.

Compounding this issue is the question of whether a renewable developer is able to capture the full ROC value implied by the current renewables capacity, or whether it will have to share some of this value with electricity suppliers. The answer to this question lies in the relative market power of the generators and suppliers.

The power of suppliers

The way in which the RO was designed means that ROCs have intrinsic value only for electricity suppliers, as it is only suppliers which can use them to offset their obligation volumes and share in the recycling of the buyout fund. The only way that generators can extract value from the RO is by selling their ROCs to suppliers;

Figure 2 Suppliers' share of total RO in Great Britain



Source: Ofgem (2005), 'The Renewables Obligation: Ofgem's Second Annual Report', February.

they are therefore dependent on their ability to negotiate with suppliers to realise any benefits from the RO. In this respect, it is of note that the electricity supply market in Great Britain has become relatively concentrated over recent years. As Figure 2 shows, approximately 85% of the RO across Great Britain is attributable to the six largest electricity suppliers.

This high degree of concentration of ROC buyers, compared with the nearly 250 different ROC producers, means that suppliers may have the potential to exercise buyer power in their negotiations to purchase ROCs from independent producers. As a result, suppliers may be able to capture a significant proportion of the ROC value for themselves. Furthermore, the high concentration of RO share among the six main suppliers means that they may have an incentive to restrict the total volume of renewable generation available in the market in order to maximise the total value of the ROCs that they control.

Because the total ROC volume affects the value of all ROCs, an electricity supplier will need to determine whether the value of bringing an additional ROC to market is greater than the cost of obtaining that ROC. The value of an additional ROC to a supplier can be calculated as shown in Equation 2.

In comparison, the marginal cost of an additional ROC would be either the cost of a supplier building its own renewable capacity or the price of purchasing ROCs from an independent generator.

Essentially, the profit-maximising position for a supplier will be to bring additional ROCs into the market until the marginal cost of these equals the marginal benefit on their total ROC revenues. However, the concentration of market power means that a supplier's decisions will also be influenced by the potential actions of the other suppliers, and it may therefore be reasonable to represent the functioning of the ROC market through an oligopoly model of competitive behaviour. Furthermore, the incentive for suppliers to control the quantity of ROCs available in the market suggests that a Cournot-type model (where the oligopolists are assumed to set output rather than price) may be most appropriate. Using this model, it is possible to estimate the price a supplier is willing to pay for additional ROCs as a function of the ROC value and a discount factor related to a supplier's market power (see Equation 3).

This essentially means that, as a supplier's share of the total ROC market increases, it would be willing to pay a smaller proportion of the actual ROC value to an independent renewable generator. Assuming that each of the six major suppliers controls around 14% of the ROC market, the price that independent generators could expect to receive for their ROCs is likely to be around 14% lower than the actual ROC value.[6] Therefore, although the implied ROC value in 2004/05 was £54.7/MWh, generators may have been unable to achieve much more than £47/MWh on the open market. This conclusion appears to be supported by the results of the Non-Fossil Purchasing Agency's (NFPA) ROC auctions, which show that the average price they were able to achieve for ROCs during 2004/05 was £48.6/MWh.[7] Uncertainty in the level of ROC compliance for the year and the actions of the smaller suppliers could account for the actual price achieved being slightly higher than what would be expected under the Cournot model. However, the general conclusion, that suppliers appear to be unwilling to pay up to the full ROC value, remains valid.[8]

A further consequence of the supplier's market power is that the total level of renewable generation brought into the market will be around 14% lower than if the ROC market were perfectly competitive. This shortfall occurs because, for a given actual cost of renewable generation, the ROC value would have to be 14% higher to accommodate the suppliers. This in turn means that ROC volumes would have to be commensurably lower.

$$\text{Marginal ROC value} = \text{ROC value} + \frac{\Delta\,\text{ROC value}}{\Delta\,\text{total ROC volume}} * \text{supplier's ROC volume} \qquad \text{Equation 2}$$

$$\text{ROC purchase price} = \left(1 - \frac{\text{supplier's ROC volume}}{\text{total ROC volume}}\right) * \frac{\text{buyout price} * \text{overall RO size}}{\text{total ROC volume}} \qquad \text{Equation 3}$$

What does this mean for renewable developers?

The combination of significant investment risk and potential market power in the supplier market means that the profitability of independent renewable generation projects may be less clear-cut than it initially appears. The ROC value implied by current levels of compliance appears to be well above the levels required to cover the costs of onshore wind generation, and is at a level where even many offshore wind projects appear viable.[9] However, the evidence suggests that independent generators are not able to capture the full ROC value and, furthermore, may require revenues well above their expected costs in order to cover the risks associated with uncertain ROC prices.

This does not mean that there are no profitable investments to be made in renewable generation. Indeed there are currently around 60 new projects (representing more than 3GW of renewable capacity), which have received planning approval, and a further 5.5GW where planning applications have been lodged. However, there may need to be a significant margin between generation costs and implied ROC values before many of these projects reach the construction phase.

Looking ahead, it appears likely that independent renewables developers will increasingly find themselves in competition with large vertically integrated energy companies in bringing new renewable generation capacity to market. The vertically integrated companies will have an advantage over independent developers since any investments they make will help to offset their obligations as energy suppliers. This means that they have a built-in route to market for their generation, are less exposed to ROC price risk, and may ultimately be able to finance projects at a lower cost of capital than independent developers. These advantages could become more important as the renewables market seeks to develop significant volumes of offshore wind generation—projects where the economics are less well established and the scale of investment is likely to be greater than the types of project currently under development.

Ultimately, the renewables market might evolve such that the large energy companies control, either through ownership or long-term contracts, the majority of the large-scale renewable generation sites. Independent developers could find themselves limited to niche projects or areas where they have some innate advantage, such as control of a fuel source, as is the case with landfill gas projects. In the long run, this may be detrimental to the government's renewable energy objectives, as the incentives on the energy suppliers will be to maintain a certain degree of shortage in the renewables market in order to maximise the value of their own portfolios.

A potential ray of light for the independent generators is provided by a set of proposals being considered by the current review of the RO that would reduce the influence of suppliers by allowing generators to use their ROCs directly, thereby bypassing suppliers. It remains to be seen whether the government will see the benefits of this approach and whether it is possible to find a way around the significant number of technical and administrative burdens that the approach could raise.

[1] Source: Ofgem's list of accredited generators for the RO and the Renewables Obligation for Scotland. The renewable capacity of co-firing biomass with fossil fuels has been assumed by Oxera to be 2.5% of a power station's total capacity.
[2] The buyout price was set at £31.39/MWh for the 2004/05 compliance period and rises in line with inflation each year.
[3] This equation only holds when the total volume of ROCs issued is less than the size of the obligation. If the ROC volume exceeds the obligation size, the value of a ROC is less well defined.
[4] Oxera (2005), 'What is the Potential for Commercially Viable Renewable Generation Technologies?', January, report prepared for the Department of Trade and Industry, available at www.oxera.com
[5] For example, the costs of producing energy from onshore wind turbines depend on the capital costs and the intensity of wind at the project site. As the windiest sites become fully exploited, additional capacity would need to come from less windy sites, thereby increasing the cost of generation from onshore wind.
[6] It is a supplier's share of total ROCs issued which is important, not its share of the total RO size (as shown in Figure 2). A supplier with a large obligation size, but only a small proportion of its RO covered by ROCs, may have a lower ROC market share than a smaller supplier meeting all of its obligation through ROCs. The 14% average ROC market share used here is illustrative, based on an assumption that each of the six major suppliers meets a similar proportion of its total obligation size via ROCs.
[7] The NFPA was set up in 1990 to coordinate the purchase of renewable electricity under a series of five Non-Fossil Fuel Orders made under the Electricity Act 1989. The ROCs associated with generation under these Orders are accredited to the NFPA, which sells them on to suppliers via periodic auctions. The results of the auctions are available at www.nfpa.co.uk.
[8] Smaller suppliers, with a much lower share of the ROC market, might be willing to pay much closer to the actual ROC value.
[9] Based on the costs calculated for the Department of Trade and Industry's Renewables Obligation review, see Oxera (2005), op. cit.

If you have any questions regarding the issues raised in this article, please contact the editor, Derek Holt: tel +44 (0) 1865 253 000 or email d_holt@oxera.co.uk

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