Making the UK Renewables Programme FITTER

The Renewables Obligation, the general case for a feed-in tariff and the feasibility of a feed-in tariff for small renewables

A submission to the 2007 Renewables Obligation reform consultation. Produced for the World Future Council by Dr David Toke

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World Future Council

The following parties support the introduction of a UK feed-in tariff for small renewables:

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Green Alliance
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NB Some parties represent personal positions only; some parties support the call for a UK Feed-in Tariff, if not endorsing the report in detail.

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Acronyms and Abbreviations

CERT	Carbon Emissions Reduction Target
DBERR	Department for Business, Enterprise and Regulatory Reform
EU	European Union
FIT	Feed-in Tariff
GWh	Gigawatt hour
GWp	Gigawatt-peak
IRR	Internal rate of return
kW	Kilowatt
kWh	Kilowatt hour
LEC	Levy on electricity consumption
MRDF	Marine Renewable Deployment Fund
MW	Megawatt
MWh	Megawatt hour
MWhs	Megawatt hours
NFFO	Non-Fossil Fuel Obligation
NFPA	Non-Fossil Purchasing Agency
PES	Public Electricity Suppliers
PSO	public service obligation
PV	Photovoltaic(s)
RE	Renewable Energy
REFIT	Renewable Energy Feed-in Tariff
RO	Renewables Obligation
ROC	Renewable Obligation Certificate
UK	United Kingdom

Foreword

The recent exposure of the UK's inability, under current conditions, to meet both its renewable energy and carbon reduction targets highlights, yet again, the desperate need for a new policy path on energy. Renewable energy has long waited to be taken seriously here, while other countries, to their great economic and environmental benefit, have moved rapidly ahead. The revival of the nuclear argument, this time in the name of low-carbon electricity generation, is absurd in view of the temporal implications alone, leaving aside costs, uranium costs and supplies, terrorism, transport and disposal of waste, siting and planning issues and so on.

Renewable energy, however, is something the UK is destined to do well; our wind, wave and tidal resources are often quoted as being the best in the continent, yet we lag behind many other countries due to a combination of factors including the discovery of North Sea oil and gas, the decision to invest vast sums of money in civilian nuclear power, and a historic unwillingness, on the grounds of economic ideology, to opt for the feed-in tariff route on renewables.

Renewable energy feed-in tariffs (REFITs) have been shown overwhelmingly in many key studies to be the most successful policy mechanism for the promotion of renewable energy, in terms of fastest, most technologically-diverse deployment at lowest cost. A critical added benefit is that the general public, and other smaller investors such as community groups, farmers and businesses, can participate in this simple and rewarding system. The most common alternative systems are built on higher investment uncertainty, which generates higher costs for investment, and tends to seal the energy market shut, allowing only large, sufficiently credit-worthy companies to monopolise the production of energy. The democratisation and true decentralisation of energy production is thwarted under such conditions. The option then becomes to offer government-administered subsidies for smaller or developing renewable technologies. Clearly, rapid, low-cost, widespread deployment of renewable energy production is best served under the straightforward REFIT system. In view of the facts, choosing any other system demonstrates very publicly a lack of real commitment to renewable energy.

The World Future Council advocates long-term, ethical decision-making; we have commissioned this report as accelerating the global transition to an energy system based on renewable energy, rather than fossil fuels, is an example of both, and REFITs are proven to drive this change fastest. Renewables make a unique and integrated contribution to climate protection, energy security, peace, democracy and human rights, as well as creating new jobs and industries. The interlinked nature of the above issues is becoming increasingly understood and acknowledged, and the pace of climate change is accelerating – and moving closer to home in its effects. Renewable energy is now receiving large and rapidly growing investment around the world, and is set to become *the* industry of this century.

Never has the rationale been stronger, or the need to implement an effective, efficient renewables policy been more urgent. The UK government must finally take the opportunity to grow its industry, create new jobs, meet its targets and put itself in a position to show true environmental leadership on the world stage.

Executive summary

The report discusses the performance of the Renewables Obligation (RO), and both the general case for a Renewable Energy Feed-in Tariff (REFIT) and the specific proposal for a small renewables REFIT. As we explain in this report, the proposal for a small renewables REFIT can easily be harmonised with the existing RO. The RO could continue for the larger technologies in the form currently proposed by the Government, although our preference would be for a transition to be made to a REFIT system for all technologies and scales. This report also sets out the means by which the objectives of the report could be implemented in practice.

A REFIT sets a minimum guaranteed price for electricity generated from renewables, using contracts that last for 15-20 years. We believe that the establishment of a REFIT, starting with small renewables such as wave, tidal stream, biomass, small hydro and solar photovoltaics (PV), is the optimum reform trajectory for the renewable energy programme in the UK. This would increase the volume of delivered renewable capacities whilst minimising costs to the consumer. We wish to distinguish the REFIT approach from the calls to effectively return to the inadequate 'competitive' tendering system of the 1990s which is liable to produce very low volumes of renewables.

The RO has achieved a significant expansion of renewables capacity in the UK over the last 5 years. However, we still lag seriously behind the expansion generated by REFIT systems such as in Spain, Germany and Denmark. Whilst the UK boasts a total renewable energy supply of 4 per cent of electricity, the comparable figures in countries with REFIT systems such as Spain, Germany and Denmark are 12 per cent, 10 per cent and 25 per cent respectively. Moreover, the RO is an expensive way of funding renewables, compared with a REFIT, which can deliver higher levels of capacity for the same cost to the consumer. This is because REFIT systems offer much greater certainty to investors about future returns, thus lowering the risk premia payments compared with the RO. By contrast, the RO is actually constructed on the basis of uncertainty about future returns leading to much higher costs of raising capital. Although the Government is proposing to reform the ROC values, and this will help the more expensive technologies, the reforms will do very little to reduce the fundamental uncertainty about future ROC values, and do nothing to affect the uncertainty over future electricity price changes. High electricity prices since the end of 2004 have been a major source of cost inefficiency in the RO for the consumer.

We estimate that the current levels of renewable deployment have been achieved at a cost to the consumer that is over 40 per cent higher compared with what could have been achieved with a REFIT, organised in a way that is broadly similar to that operating in Germany. This is a conservative estimate because use of other plausible criteria suggests that the difference in costs could be even greater. This conclusion is achieved both by analysis of the nature of contractual conditions used by renewable generators in the UK and also comparisons with REFITs in Germany and Spain.

We analyse how smaller renewable projects, which occupy technology bands such as wave power, tidal stream, biomass, small hydro and solar PV would fare under a REFIT, and also the RO under the Government's proposed reforms. We conclude that significantly greater volumes of these technologies would be deployed for a given consumer outlay compared with the RO arrangements. We set out how a scheme for a small renewables REFIT could be implemented, and also how it would be possible to harmonise this with existing RO arrangements. We dispel fears that a transition for some or all renewable technologies from the RO to a REFIT would disrupt the renewables programme. Much of the machinery already exists to harmonise a REFIT with the RO via the operations of the Non-Fossil

Purchasing Agency (NFPA). In addition, the interests of electricity suppliers in using promotion of micro-renewables (such as solar PV) as a marketing device to domestic consumers can be protected, and indeed probably enhanced, under a REFIT system for small renewables.

Introduction

The aim of this report is to discuss the arguments for introducing a system of feed-in tariffs for renewable sources of energy in the UK, with some proposals about how this might be implemented in the case of what could be called 'small renewables'. We use the term 'small' flexibly to include those technologies that may, in the near future, particularly benefit from the establishment of a feed-in tariff system to support them. We have in mind some types of biomass, wave power, tidal stream, small hydro and solar PV technologies.

We shall also discuss the arguments for moving to a feed-in tariff for renewable technologies in general, including onshore and offshore wind, although our specific proposals in this report are restricted to the earlier list of technologies. These, coincidentally, tend to be of a smaller size, i.e. no larger than 5 MW (installed capacity)[1] and generally rather smaller than this.

We propose that the small renewables FIT would apply to schemes involving emerging technologies that are generally likely to be under 5 MW in the next few years as well as schemes below 5 MW in other technologies. Emerging technologies include wave power, tidal stream, biogas and solar PV. Other technologies where schemes under 5 MW would be supported by FIT include biomass and small wind systems. In order to prevent artificially splitting up larger wind power projects to obtain the small FIT, wind projects should consist of units of less than 300 kW each. We would also include micro-hydro schemes that are no larger than 1 MW.

The priority which is increasingly attached to the need to develop clean sources of energy services makes this a crucial area of debate. In addition to this, many argue that while some progress has been made in developing the UK renewables programme through the Renewable Obligation (RO), there are significant deficiencies in the programme. It is important to discuss how these deficiencies could be alleviated by using a REFIT system.

The structure of the report is as follows: Initially there will be a discussion of the nature of a REFIT as opposed to a 'green electricity certificate' scheme such as the RO. Next we shall analyse the performance of the RO. We shall then move on to evaluate the ways in which a REFIT could improve the delivery of renewable energy in the UK. A key issue is how, in general, there could be a transition from the RO to a REFIT, and how a small renewables feed-in tariff could be harmonised with the existing RO. We conclude this report by itemising a series of options for moving ahead.

[1] We use installed capacity throughout rather than 'declared net capacity' (DNC) which has often been used by the Government.

Section 1: The Renewables Obligation and REFITs

1.1 Renewable Energy Feed-in Tariffs (REFITs)

Renewable Energy Feed-in Tariffs (REFITs) involve renewable energy producers being paid fixed prices that are set by the Government. Each producer is given a contract to supply energy which involves them being paid guaranteed amounts over a long term period. In Germany and Spain this is 20 years. A schedule of prices paid to different renewable generators in Germany is set out below in Table 1.

Table 1 German fixed price payments according to technology, with installed capacity, output (2005)

Resource	Limit	€cent/kWh	Decrease in incentive (% p.a)	MW (2005)	GWh (2005)
Hydropower	500 kW 5 MW	9.67 6.65	0%	4,680	21,524
Landfill gas, Sewage gas, Mine gas	500 kW 5 MW	7.67 6.67	1.5%	2,192	13,444
Biomass	150 kW 500 kW 5 MW 20 MW	11.5 9.9 8.9 8.4	1.5%		
Geothermal	5 MW 10 MW 20 MW > 20 MW	15 14 8.95 7.16	1%	0.2	0.2
Onshore Wind	First 5 yrs Up to 20 yrs	8.7 5.5	2%	26,500	18,428
Offshore Wind	First 12 yrs Up to 20 yrs	9.1 6.19	2%		
Photovoltaics	Ground mounted Building mounted (30 kW) Building mounted (<100 kW) Building mounted (>100 kW)	45.7 57.4 54.6 54	5%	1,508	1,000

Source: Bundesministerium fur UMWlt Naturschutz und Reaktorsicherbeit (2004); Staiss et al. (2006) Rickerson W. and Grace R., (2007), *The debate over fixed price incentives for renewable electricity in Europe and the United States: Fallout and Future Directions*, Washington DC: Heinrich Boll Foundation, http://www.boell.org/docs/Rickerson_Grace_FINAL.pdf, accessed July 2007, page 7

It should be noted that in the case of wind power, relatively lower-windspeed windfarm operators are paid at higher rates per MWh than higher windspeed sites. Under the Spanish system there is also a guaranteed minimum payment over 20 years, but the Spanish REFIT differs because each year the generators have the option of 'opting out' of part of the REFIT and instead selling their electricity on the electricity markets. There are further design options evident in the various adaptations of the model around the world (see Klein et al, 2006).

When we talk about renewable energy here and the way it is financed, we mean 'new' renewable energy. We exclude traditional large hydro-electricity schemes. We mean technologies such as onshore and offshore wind power, various types of biomass, solar PV, small hydro schemes, wave power, tidal stream technology and landfill gas and sewage gas.

The largest 'new' renewable energy programmes in Europe have been developed using REFIT schemes. In Denmark these types of renewable energy supply over 25 per cent of electricity. In Spain wind power alone now supplies 12 per cent of total electricity. Germany now supplies 12.5 per cent of its electricity from 'new' renewable energy sources. Around 16 EU states currently use a REFIT system, whilst only four use a system mainly involving green electricity certificates (Rickerson and Grace 2007). None of these compare in their delivery of renewable energy to the REFIT regimes. In the UK only 4 per cent of electricity is supplied by renewable energy established under UK new renewable energy programmes. The largest share of this is actually provided by landfill gas.

1.2 Workings and evaluation of the Renewables Obligation

The UK uses a green certificate system. It currently supplies less than 5 per cent of its electricity from renewable energy. This is a definite improvement, although, as we shall see, there are arguments to suggest that the UK renewables programme would fare better with a REFIT system. Let us look at the way that the RO works, and discuss some of the criticisms that have been made of this way of promoting renewable energy.

The UK Government has a target of providing 20 per cent of its electricity from renewable energy by 2020, and the RO is backed by legislation to promote the supply of 15 per cent of electricity from renewable sources by 2015. The system works by renewable energy producers being given 'Renewable Obligation Certificates' (ROCs) for every MWh of renewable electricity that they generate. Electricity suppliers have to buy ROCs in order meet quotas they have been set for the supply of renewable energy – gradually increasing until they supply 15 per cent of their electricity from RE by 2015.

The only way they can legally avoid this is to pay a 'buy-out' penalty for the amount of renewables that they are failing to supply. This buy-out penalty is set at £30 for each MWh (2002 prices, indexed with inflation) that they fail to supply to meet their target for a given year. The penalties are 'recycled' as payments to the people who actually submit ROCs by way of compliance (whether in whole or in part). Hence if, for example, the RO in any given year is only two-thirds fulfilled, this means that one third of the MWhs needed to make up the target are the subject of 'buy-outs.' These are then spread among the ROCs, which cover the two thirds of the MWhs of renewable energy that have been supplied. This would imply a ROC price, including the recycled element, of £45 per MWh. This is close to what has been achieved to date.

The extra costs that this system involves are passed on to consumers in the form of higher prices for their electricity. While opinion research suggests that there is overwhelming public support for generating as much as is possible from renewable energy sources, there is also consumer interest in keeping down the cost of doing this. It should be mentioned at this stage that a large part of income for renewable energy generators comes from other streams in addition to the value from ROCs. The market value of the so-called 'brown' rate for electricity is also paid to renewable generators, and they also will obtain most of the value of the so-called 'climate change levy', to which they are exempt. We call these credits the exemption from the ‘levy on electricity consumption’ or LEC exemption. In the UK, at least, they also receive an ‘embedded generation’ credit (termed a TRIAD benefit).

The 4 per cent of UK electricity that is being supplied by renewable energy in the UK represents a significant increase compared with the roughly 2 per cent being generated when the RO was started, although the RO is only meeting 70 per cent of its nominal target.

There have been criticisms about the costs of the RO. These have been voiced by bodies such as the Public Accounts Committee. Last year the Carbon Trust published a report suggesting that a REFIT system would have offered a cheaper path for (for the consumer) for supporting renewable energy (L.E.K. Consulting 2006).

Perhaps the most authoritative criticism of the expensive nature of green electricity certificate systems, including the RO, has come from the European Commission, which identified the RO as being much more expensive than REFIT systems. Rates of return for investors were identified as being much higher compared with REFIT systems. The report said:

> The three quota systems in Belgium, Italy and the UK, currently have a higher support level than the feed-in tariff systems. The reason for this higher support level, as reflected in currently observed green certificate prices, can be found in the higher risk premium requested by investors, the administrative costs and the still immature green certificate market. The question is how the price level will develop in the medium and long term. (European Commission 2005, 28)

There have also been various academic studies that have come to a similar conclusion, that is that REFIT systems are more cost-effective than green electricity certificate systems such as the RO (Butler and Neuhoff 2004, European Commission 2005a, Toke 2005, Toke 2007, Mitchell et al 2006). Indeed a report commissioned by the Carbon Trust concluded that:

> The overall cost of installed renewable energy to consumers will be higher than necessary, given the current technology cost because the RO is inefficient in a number of ways […] Feed-in tariffs have been proven to be successful elsewhere (Spain and Germany) in generating significant deployment of low-cost renewable energy. (L.E.K. Consulting 2006)

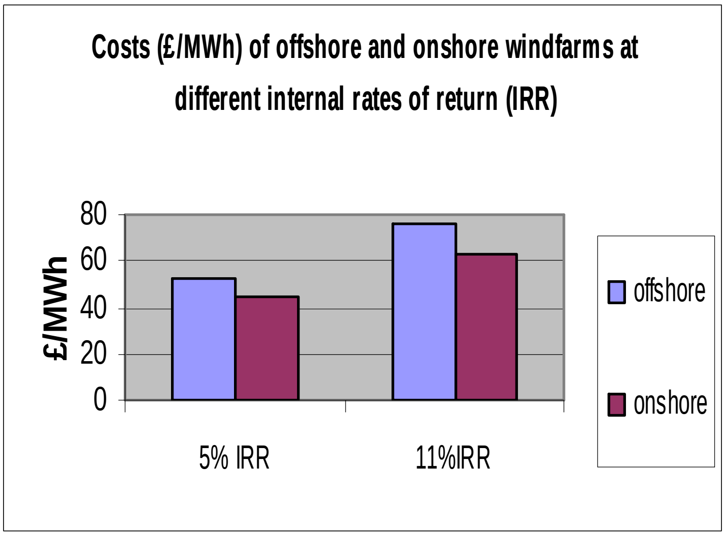
There is a simple, underlying reason for this. This is that the future prices of both ROCs and also electricity are uncertain, while under a REFIT system like that in Germany there is absolute certainty about the future price commanded by each MWh of renewable electricity. This has big implications for the relative costs of raising capital under these different arrangements. In the case of the RO, banks have assessed the financial profitability of a project by assuming that the ROC value will not be more than the buy-out price (£30 per MWh) and that the rest of the market value, that is the market price of the electricity and the exemption on paying the levy on electricity consumption (LEC) cannot be counted upon to be worth more than an additional £20 per MWh. In other words, the project must repay its loans and make adequate returns for its shareholders on a price of not more than £50 per MWh at the most.

The point is that in order to have the benefit of reasonably low interest charges, the projects have to secure bank loans. The traditional (debt:equity) ratio between bank loans and equity as a portion of total capital costs is 80:20. Equity shareholders expect much higher returns. Although the projects can be (indeed often are, at least initially) financed through equity investment, this is a very expensive way of doing it compared with one which consists mainly of bank loan finance. Even though the projects may be given project finance through a good debt:equity ratio, they have, in the practice of the RO, earned rather more than £50 per MWh.

The projects have tended to earn a much higher rate of return than if a simple REFIT system had operated which gave the certainty of £50 per MWh. In that case the same bank criteria would fund the project at the level at of £50 per MWh. The internal rate of return is much lower than that which generally obtains under the RO. Hence a REFIT would be much cheaper than the RO for funding a given level of renewable capacity.

You can see pictured in Figure 1 a comparative assessment of schemes under a 5 per cent IRR and an 11 per cent IRR (internal rate of return). The lower rate of return would be plausible if REFIT arrangements are in place, but the latter is typical for a project under the RO.

Figure 1



Source: David Toke 'Trading Schemes, Risks and Costs: the Cases of the EU ETS & Renewables Obligation' mimeo, University of Birmingham.
Assumptions: onshore wind capacity factor 27 per cent, offshore capacity factor 34 per cent. Onshore capital cost £850 per kW, offshore capital cost £1250 per kW. Note over the past two years capital costs for windfarms have risen by around 20 per cent due to the surging global demand for wind turbines and the temporary imbalance between supply and demand for these machines.

It is not difficult to see how it is that onshore windfarms have tended to be financed under the RO, whilst offshore windfarms had greater difficulty being financed. The finance for British offshore windfarms has come entirely off the ‘balance sheets’, i.e. the revenue streams, of the big electricity and other energy utilities. They have decided to take a long term view about the investments. On the other hand it is also the case that the schemes have been slow in being developed.

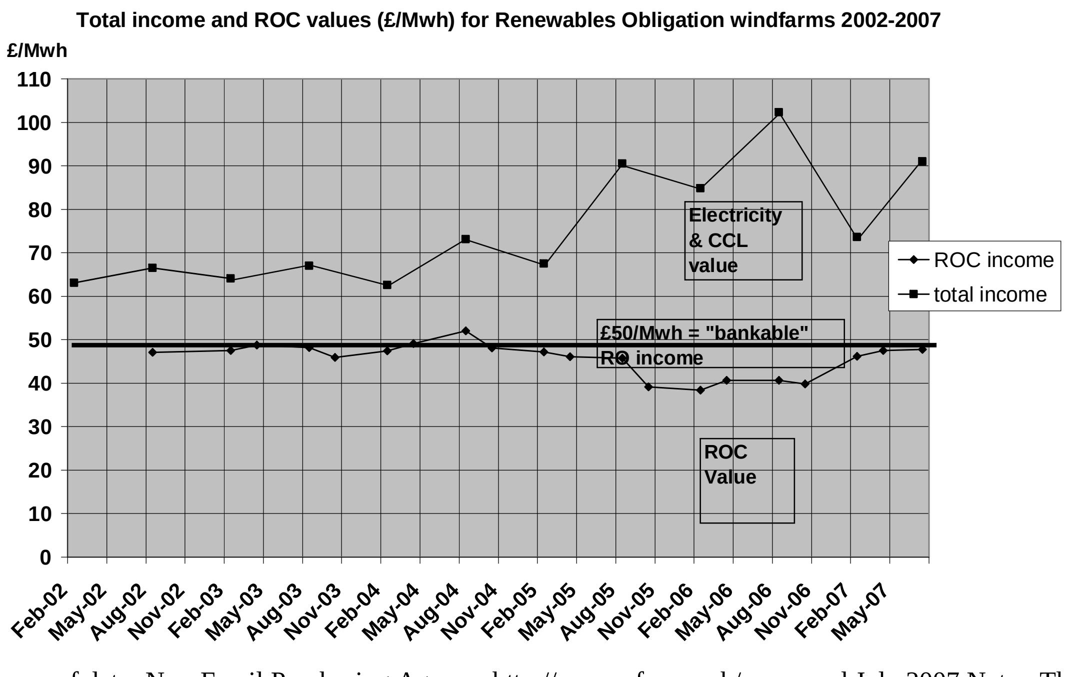
It is a plausible argument to say that financing of offshore windfarms would have been made easier with a REFIT system since it would have increased confidence in the returns. Hence the possibilities that bank loan finance (and hence cheaper means of investment) could be made more likely. It may be significant that in Denmark, where a REFIT system still operates for offshore windfarms (although not, since 2001, for onshore windfarms), offshore windfarms are being backed by bank loans. There is still not as much confidence in the technology compared with onshore wind power, and a REFIT system can only but help alleviate this situation. We note that *Npower Renewables* have already suggested a version of a REFIT system for offshore windfarms. It is also not difficult to see why the

Government has decided to reform the RO since the more expensive renewable technologies are not being brought on line.

While onshore wind, landfill gas and co-firing of biomass in coal fired power stations have been relatively easily financed, other technologies have found it much more difficult to gain finance. In some ways this is surprising given the high income streams available from the RO, especially during the 2005-6 period when electricity sales prices have surged upwards along with fossil fuel prices. Yet the high prices, which can be seen in Figure 2 are not 'bankable'. The £50 line marks the effective bankable element of the income available to RO generators. The point which needs to be made here is that **a REFIT of around £50 per MWh would have effectively financed all of the onshore windfarms that have so far come on line under the RO.**

In calculating the income streams that the consumer pays to renewable operators we recognise that it may be simplistic to take the total market income available for renewable power as the basis for this calculation. A significant proportion of this income stream goes into the hands of the electricity suppliers. This is a complex area and it could also be argued that even those renewable income flows that go to the electricity suppliers may contribute to electricity company profits, and therefore should be regarded as an effective cost to the consumer of the RO. However, we believe that the financial case for REFIT is very strong without making such judgements. Therefore we only include, as the assessment of the consumer costs of paying renewable generators, that income that goes directly to the renewable generators. We exclude the income that passes to the electricity suppliers.

Figure 2



Source of data: Non-Fossil Purchasing Agency, http://www.nfpa.co.uk/, accessed July 2007 Note: This graph shows the income obtained from the sale of the output and not the income received by the generator. More often than not this will be considerably smaller than these figures (see text explanation).

We use the data in Figure 2 as the starting point of our calculations. The data for Figure 2 are drawn from the Non-Fossil Purchasing Agency (NFPA), about whom we shall say much more later. The NFPA hold auctions for the full value of the renewable electricity for 'packets' which last over 6 month periods, the summer auctions being for the winter periods and the February ones covering the summer. A large proportion of renewable energy generators (who sell their output by other means) may well actually earn these amounts of money, although another large proportion will lose some of this income stream to the electricity suppliers with whom they need contracts in order to be lent money by banks. This is certainly not true for those generators who are paid through NFFO contracts (issued in the 1990s) where the bulk of the income actually goes to the Treasury.

So how much do we as electricity consumers pay on average for a MWh of renewable energy? In other words how much goes to the actual operators? That is very difficult to say, given the opacity of the system. But we can make an intelligent guess that does not aim to exaggerate the figures.

1.3 How much are renewable operators paid compared with REFIT systems?

Initially, up until around the autumn of 2004, some generators signed up to long term (15 year) contracts offering £50 per MWh – effectively a private version of a REFIT that was offered by one of the major electricity suppliers. Hence we assume that until the end of 2004 renewable operators would indeed have been receiving on average around this £50 per MWh figure. However, since then the income earned has been considerably higher and this is mainly due to the much higher level of electricity prices. We assume that renewable developers noted that forward energy prices suggested that after 2004 shorter term contracts would produce higher returns, and so the fixed price contracts were spurned. Most renewable generators will be rewarded through contracts with variable rewards. These involve short term or longer term options. The short term options (mainly one year annually renewable contracts) yielded around £70 per MWh in 2004 and around £90 per MWh in 2006 (See Figure 2). We do not have sufficient information to determine exactly how much renewable generation activity is actually funded using these short term options, but it is undeniably a lot more expensive compared with the REFIT system.

The other type of contracts involving variable rewards involve contracts of around 10 years in length. A typical ten year contract offered by electricity suppliers has, up until around 2006 at least, involved a guarantee of paying a minimum price of £43-£45 per MWh. In reality the generators have received a lot more than this. The renewable operators obtain a percentage, maybe 75 per cent, of the buy-out ROC price (£30 per MWh) and also 50 per cent of the recycled ROC value. However, crucially (in view of the electricity price ‘spike’ since 2005), they will also earn the full value of the short term ‘brown’ electricity element and the levy on electricity consumption.

We can calculate how much the renewable operators will be earning at a given time from the data in Figure 2, provided one takes into account that windfarm operators will generate more production in winter (when it happens to be worth rather more as well). So, since the winter of 2004, the variable 10 year contracts have paid well above the minimum prices of £43 per MWh. Indeed they have been worth around £80 per MWh in 2006. Yet, however remunerative this may be, it is still perceived as risky by investors, who consequently earn a ‘risk premium’ for the uncertainty over future returns.

We can also put these returns into perspective by comparing them with the returns under the REFIT systems in Germany and Spain, as shown in Table 2. Because of the greater transparency of the systems we have a clearer idea of the average income per MWh to renewable operators in Spain and Germany than we have with the UK. However, we can make an intelligent, and we think, fairly accurate, estimate of average returns in the UK.

We do not know the precise balance between income received on the various contracts that we have just discussed. We assume, for the purposes of this analysis, that 25 per cent is paid in respect of short term contracts that receive more or less the full income stream for renewable power and that 75 per cent is paid through the terms of the 'variable' rates in the 10 year contracts. We believe that the proportion of income received through the shortest term options could well be higher than 25 per cent, making our estimates of cost to the consumer conservative in nature. It can be seen in Table 2 that the returns per installed MW (after you have taken account of the much lower wind production in Germany) are around double what a German wind operator receives and about a quarter more than a Spanish wind operator is paid for each installed MW.

Table 2 Comparison of returns to installed MW of onshore wind power in the UK, Germany and Spain: 2005 and 2006 prices

Country	Tariff in p/kWh	Average Capacity Factor	Annual Return per Installed MW (£)
Germany	5.6 (declining)	18	88,000
United Kingdom	7.3	28	179,000
Spain	5.9	28	145,000

Source: Toke 2005 and 2007 and McGovern 2007, (and further interviews with Enrique Monasterio and Javier Marques 10/12/04 and a number of sources including unattributable interviews). UK average income based on yield from 10 year contracts plus 25 per cent of the difference between this yield and that from the short term contract or auction prices, calculations based on NFPA data http://www.nfpa.co.uk/. These figures make allowance for greater production during winter (Sinden 2004).

If we assume, as argued earlier, that the same amount of renewable capacity as has been achieved would have been achieved with a REFIT of £50 per MWh, then we can see that since the end of 2004 average payments have been, at around £73 per MWh, over 40 per cent higher than this figure. On the other hand it is also the case that project costs have increased by around 20 per cent because of the increase in wind turbine prices for projects being installed in recent months. This will affect new projects being installed now, although not earlier projects, and it is perhaps significant that there have been very few new wind power projects installed in the UK in recent months. However, a REFIT system could accommodate this situation by giving the Government the power to regularly review REFIT levels. In Spain there is a variation on the REFIT which allows this type of flexibility.

1.4 How do alternative systems compare?

In Spain, as in Germany, there are guaranteed fixed payments for contracts lasting 20 years. However in Spain the renewable operators can annually opt to receive the market rate for electricity as a substitute for part of the feed-in tariff. In Spain electricity sales prices have also increased because of the oil crisis, and as in the UK the renewable energy generators have benefited. In Germany the rates paid to wind power operators are very low, and even taking into account the differing tax laws in Germany it is difficult to understand how, by comparison with British conditions, the high rate of implementation of wind power schemes has been maintained. The German system is clearly by far the most cost-effective of the systems, even if the cheapness of the system is partially obscured by the much lower wind speeds in Germany. It should be noted that the REFIT rates for other renewable technologies such as biomass, are low compared with those likely to be available as market (although not 'bankable') rates available in the UK.

Ofgem is keen to prioritise the criterion of reducing consumer costs of the renewable programme. In January 2007 Ofgem put forward a proposal which had a number of serious shortcomings, but that was broadly similar to the system used in the 1990s to support renewable energy. This involves companies making bids to supply renewable energy for the lowest price. Although this does produce lower prices it is associated with low volumes of renewable energy take-up, with a lot of the successful contracts not being economic to put into practice (Mitchell 2000). It may be that some developers put in cheap, speculative bids, the main purpose of which was to sell on to others rather than develop the projects themselves. There are no obviously satisfactory ways of remedying this problem, as in practice it is very difficult to reconcile the low cost functioning of this procurement method with a system of penalising those contractors who fail to deliver projects.

It should, however, be noted that this system, as used in five NFFO rounds in the 1990s, did involve giving the generators who made successful bids secure, long term contracts at fixed (inflation adjusted) prices. It gave greater certainty to generators, a common feature with feed-in tariffs. However, because of the system's inability to deliver more than a small fraction of the needed capacity, we do not consider this mechanism to be a serious option.

Section 2: Reform

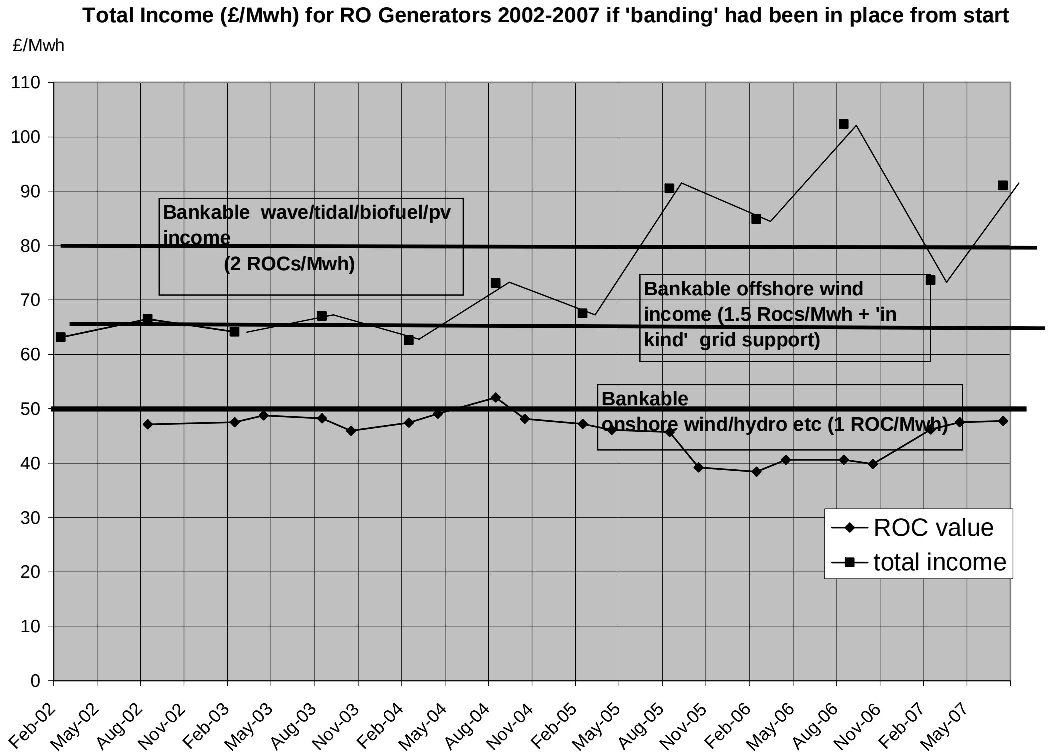
2.1 Effects of the proposed reforms to the RO

The Government has proposed to give extra ROC values to some renewable technologies from 2009. Offshore wind power will receive 1.5 ROCs and biomass energy crops, biogas, solar photovoltaics, wave power and tidal stream technology will receive 2 ROCs. The Government is also promising to introduce regulations to enable the RO targets to be lifted in the case that renewables production increases so fast that it threatens to reduce the value of ROCs. The latter reform, called 'headroom', is unlikely to make a difference to the bankable value of each ROC, and in addition the Government has no proposal to regularise the value of the brown electricity stream. Therefore, the problem that the bankable value of the RO income streams will be much less than the actual money available will continue.

A REFIT, however, could pay the bankable rate. As stated previously, this could lead to the same sort of level of renewable deployment, but at a much lower cost to the consumer. Alternatively, as we would prefer, it would mean that higher REFIT rates could be offered to renewable operators (compared with the bankable levels) so that the whole programme would cost no more than the current RO, but deliver much higher levels of renewable capacity. Certainly this sort of saving could be used to promote the more innovative technologies such as solar PV, wave power and technologies such as biogas.

Figure 3 shows what the bankable values of each of the proposed ROC values would have meant for the period shown in the earlier Figure 2:

Figure 3



Source: Non-Fossil Purchasing Agency, http://www.nfpa.co.uk/, accessed July 2007. Note: these figures reflect the payments of 1 ROC to all renewable generators. Under the Government's proposed RO reforms the total income (although not 'bankable' income) of wave, tidal, dedicated biomass, solar PV and offshore wind would be higher because of their increased number of ROCs.

Even though several technologies will be receiving higher incomes streams as a result of the RO proposals, none of them will have bankable income streams that will be as high as the total income streams available for renewable generators in the period since 2005. In order to calculate what is bankable we simply assume the value of £30 per MWh per ROC, and add on £20 per MWh to represent the assumed future 'low risk' value of the electricity and LEC part of the income stream. The new bankable incomes of some of the technologies are shown in Figure 3 above.

Given the way that renewable financing has developed in countries where REFIT systems exist, it seems likely that the financial gearing and institutional make-up of the investments will be heavily influenced by the degree of certainty associated with the income streams. It is plausible to argue that if a REFIT system existed in the UK then bank financed 'project financing' schemes would predominate. The same amount of projects would be financed by REFITs set at the bankable levels indicated in the chart as would be achieved by the uncertain, if rather high levels of total income available to renewable generators under the RO.

We understand that equity finance will dominate, if not entirely make up, the capital financing of wave, tidal stream, biogas and dedicated biomass-energy plants likely to be brought forward in the near future. This pattern is likely to persist into the future with the result that the financing of these projects will be rather more expensive than would have been the case if a REFIT existed.

Offshore wind finance is likely to continue to be derived from the revenue streams of the major electricity companies allied to other non-UK energy utilities. We assume that the extra subsidies for offshore wind will consist of a) the RO re-banding of offshore wind (an extra 0.5 of a ROC), plus b) an agreement being negotiated through Ofgem to fund the bulk of offshore transmission costs through transmission charges to all consumers. We assume that this will (in fact or in kind) add around £20 to what we call 'bankable' income for offshore windfarm operators. The bankable value of the proposed RO arrangements for offshore windfarms is thus around £70 per MWh, after taking into account the 'in kind' value of the transmission subsidy agreement.

The bankable value of technologies receiving 2 ROCs will be something like £80 per MWh. (£30 x 2 plus the £20 value of the brown electricity and LEC exemption elements). However, this is before the impact of the Marine Renewable Deployment Fund (MRDF) which is funding wave power and tidal stream technology. Currently the funding arrangements are that the projects will receive grants making up around 25 per cent of the capital costs, a seven year subsidy of £100 per MWh and 1 ROC plus the brown electricity value. The second of the 2 ROCs will only kick in after the first seven years. A further issue is that even to access this funding stream the projects have to deliver 3 months worth of test generation data by the end of 2008. It may be that only one project will be able to fulfil these criteria. The lack of certainty about future funding streams will not help projects to raise funds even on an equity basis. Those projects which do not already have access to such funds will have difficulty in raising the money. It does seem that the perceived risks of wave and tidal stream technology mean that a feed-in tariff arrangement that guarantees a higher income streams than the (varying) income stream that has been available could be helpful to potential projects. None of the initial projects are likely to be larger than 1 MW.

In the cases of biomass from energy crops and also biogas, it seems that while some relatively larger projects (over 1 MW) may be funded through equity investment, once again it seems that the income streams will not be big enough to support farm-based projects in the 100-500 KW range. The energy input sources of the biogas are likely to be slurry, energy crops and vegetable matter at the farm level, and industrial sources such as sugar manufacturing wastes at the bigger, 1-2 MW scale. In the case of the solid fuel combustion plants the input sources will be straw and miscanthus (elephant grass) in addition to waste wood, the latter source being especially important if sited in the context of industries such as furniture manufacture. The farm-based plant can take advantage of a recently developed 100 kW micro-turbine biomass CHP unit produced by Talbott's, which was given an award by the Renewable Energy Association. Larger projects in the 2-3 MW range will use more conventional steam turbine technology.

Certainly if farmers are to invest in biogas and energy-biomass generation, a REFIT arrangement may prepare the conditions of confidence in income streams to allow them to do this. However, under present arrangements this is unlikely to happen, and those biomass plants that are funded will inevitably cost the electricity consumer more if they are funded out of equity capital with its high required rates of return.

Although solar PV has been given 2 ROCs under the RO reform proposals, the impact of this change is muffled by the lack of transparency in the current so-called 'feed-in tariffs' offered by electricity suppliers. It is very difficult for consumers to understand the differences between the confusing variety of offers. The lack of a market for solar PV in the UK pushes up the installation prices of the hardware compared with countries where there is better support, including Germany in particular.

2.2 How could a REFIT improve delivery of renewables?

We have already discussed how the onshore wind power programme would have delivered the same capacity with a REFIT of £50 per MWh. Lower windspeed windfarms could have been given a slightly higher rate, say £60 per MWh (mirroring the system in Germany). Comparing these returns with the previously estimated average income of £73 per MWh in 2005-6 it can be seen that considerable savings could have been made for the electricity consumer if a REFIT had been used, or as we would recommend, this saving was spent on funding more renewables.

As discussed earlier, a REFIT for offshore wind may bring forward the day when offshore windfarms can be funded at least partly by finance from bank loans. This, in turn, would allow a REFIT to be set at a level for these windfarms that would reduce the costs of consumer cross-subsidies. A REFIT system that encompasses small hydro will make these schemes more economical and affordable, especially for incumbent landowners, because of the increased certainty in income stream that a REFIT brings. A REFIT should also be applicable to small wind systems. This could be set at the same level as the price that they would receive in total from the market, of around the £90 per MWh that was available in the 2005-2006 period.

Our central set of ideas, however, focuses on the way that a REFIT could improve delivery of smaller renewables. These include the wave, tidal stream, biomass and solar PV technologies. All of these will be deployed in units of less than 5 MW.

All of these technologies need to be established. They need confidence, and a REFIT will contribute greatly to that. This is especially the case at the smaller end of the technologies in the case of biogas and biomass CHP/electricity units of a few hundred kW and also wave power and tidal stream technology.

Ernst and Young (2007) have calculated, using their central estimate, that wave power will have a levellised cost of around £200 per MWh. Yet there is no certainty that this level of funding will be available under the Government's offer of 2 ROCs, at least after the first seven years. The Government is offering a mixture of incentives, yet it would be simpler and create more confidence if this were rationalised into one single instrument in the form of an initial REFIT of £200 per MWh plus some initial grant support from the MRDF. After the first 7 years, wave and tidal technologies, as with all renewables earning 2 ROCs, may be receiving a total income stream of around £130 per MWh (at current electricity prices). However, as discussed earlier, this only has a bankable value of £80 per MWh. Hence it is likely that wave and tidal stream technology would be much more securely helped, at no greater expense to the consumer, by paying them £130 per MWh in the form of a REFIT. The same logic will also apply to biomass schemes, which we discuss next.

Biomass energy crops have been assessed at being viable at around £130 per MWh. It should be noted, however, that the bankable value of the 2 ROCs plus electricity price is a mere £80 per MWh, meaning that once more, farmers will find it difficult to find sufficiently cheap finance for the projects of, say, 200-300 kW. A REFIT payment of around £130 per MWh should serve as an initial basis for kick-starting some projects at this level. A very similar story will be the case for farmers starting biogas projects of 100-300 kW in size.

Small hydro is, under the RO reform proposals, to be supported by 1 ROC. However the smallest small hydro schemes, up to around 500 KW and most of all, up to 100 KW, would clearly benefit from a REFIT of the same value (around £90 per MWh at current electricity prices) that would potentially be available as total income under the RO. This would increase the ease with which money could be raised and would reduce the cost of borrowing money for the schemes – the same principle as applies to other renewable technologies.

Solar PV would clearly benefit greatly from a REFIT. Although small amounts of funding are available from the Low Carbon Buildings Programme, the solar power industry recognises that these funds are going to be spread thinly and that not too much reliance should be placed on grant funding, useful though it may be.

As we have already discussed, the current tariffs on offer from electricity suppliers for solar PV are confusing. Merely rationalising the total value of the income (assuming 2 ROCs for solar PV) would involve paying around 12 p/kWh (£120 per MWh). However, to achieve anything like the sort of growth achieved in Germany would require something a great deal higher than this. German solar capacity is now over 2 GWp. In order to equal the incentives for solar PV in Germany we would need a REFIT of around 45 p/kWh. However, this should be put in context, because:

> In Germany, the global leader in wind and solar PV power, the total additional cost of supporting the German feed-in tariff scheme was 0.56 Euro cents per kWh in 2006. For a typical German household consuming 3500 kWh per year, this adds up to a monthly bill of 1.63 Euros for *all* renewable energy technologies and a tariff where there is no capping of system size. (Berry 2006)

We should remember that in addition to the solar PV, Germany boasts 20,000 MW of wind power and also other renewable technologies contributing over 10 per cent of electricity supply. This is all included in the above mentioned additional cost per kWh for the electricity consumer.

Section 3: How would we implement a (small) REFIT?

The discussion is organized around the issue of the different options of arranging funding. In the course of this we shall discuss some organizational issues and legislative/ administrative matters.

There are various combinations of possible ways of organizing the REFIT. It may be convenient to divide up the discussion of this into two sections, one describing the role of a 'Public Service Obligation' (PSO) approach to funding the REFIT, and secondly, the idea of harmonizing the REFIT with the RO arrangements. Along the way we shall discuss how issues such as the needs of micro-renewables (in the domestic sector) are specifically affected by these approaches.

3.1 (a) Public Service Obligation

The first, and simplest way of paying for a REFIT, is to fund all of it out of what is called (in the case of the REFIT run in Ireland), a PSO. This consists of a precept which is added to all electricity bills and which funds the payments made to renewable energy schemes for their electricity production. Precepts have been common in the UK electricity system since privatization, being used during the 1990s to pay for energy efficiency schemes. Electricity bills are, in practice, divided anyway into generation, distribution, transmission and supply elements.

Ofgem would be responsible for regulating the system and it would build on existing practice for the NFPA to have the job of administering the renewable energy contracts and administering the income flows. The NFPA would issue contracts to renewable energy generators for electricity supply who fulfilled some basic criteria (as set by law and

Ofgem). The NFPA would later pay renewable generators for the electricity they produced under a monitoring system agreed with Ofgem. The financial outlay for this would be recovered from the aforementioned PSO that would be levied on all electricity consumers. Of course the NFPA would still have the task of selling the electricity for as good as price as possible, and this could be achieved through the process of regular auctions which the NFPA has been conducting in recent years. Hence the PSO payment would consist merely of the 'excess' cost of the renewable energy over and above the market price for the electricity. This is, necessarily, a somewhat simplified description of the arrangements. The actual contractual arrangements would be somewhat different in detail, but the above discussion illustrates the viability of the structure without distracting from the argument by including detail which, while important for the specific implementation, would be a distraction from the strategic argument.

3.1a Micro-renewables

Slightly separate arrangements would be needed for micro-renewables such as micro-wind and solar PV that were under a minimum size, say 50 kW (ie domestic renewables). It would be administratively cumbersome for these to be contracted by the NFPA. Instead the Public Electricity Suppliers (PESs), i.e. the electricity suppliers, would have the duty (as part of their licenses) to pay a REFIT to micro-renewables of at least the value of a minimum rate set by the Government for a particular technology. The PESs would then reclaim the funds they had paid out to the micro-generators from the PSO up to the level of the minimum rate, minus an allowance made for the value of the electricity that the microgenerators had given to the electricity supplier. This type of mechanism would be needed in order to equalize the relative proportions of funding the micro-renewables REFIT between the PESs, some of whom may cater for a higher proportion of micro-renewable generation than others. This way of organizing things would have the advantage that the PES could still offer additional incentives or use other funding channels (e.g. CERT) to encourage consumers to adopt micro-renewables.

Given that the NFPA would be involved in administering funding streams through the PSO, it may well be appropriate for the NFPA also to organize the reimbursement of the PES from the PSO in respect of the REFIT paid to the PES. Once again, Ofgem would have the role of setting monitoring criteria for the process, and performing tasks such as assessing the value of the contribution of the micro-generated electricity to the electricity supplier. Much of the micro-renewable generation may have to be 'deemed' and the aggregate supply 'profiled' until appropriate 'smart metering' systems were in place. In this case, once again, the NFPA could absorb the ROC value of the micro-renewables through its auctions, thus reducing the size of the micro-renewable element of PSO charges to the consumer.

3.1b The Spanish mechanism?

A variation on the general approach of using a PSO would be to adopt the Spanish mechanism whereby renewable generators would be given contracts for guaranteed minimum payments over 20 years, but also given an annual choice about whether to sell their electricity on the electricity markets. In effect, renewable generators opting for this latter 'market' option would be given a fixed 'top up' that would be a proxy for the ROC value. However the generators would sell their electricity and LEC exemptions on the markets (quite possibly through NFPA auctions) in the expectation that such sales would increase their total income above the guaranteed minimum. This approach may well have advantages, especially for companies that for one reason or another rely on equity investment. However this mechanism also carries the risk that in times of high electricity prices (e.g. in the recent past) renewable electricity may become more expensive for the consumer than is strictly necessary to ensure long term investments in renewable energy capacity.

It is notable that in 2007 the Spanish Government has stepped in to ‘cap’ the income for renewable generators to deal with this issue. If the ‘Spanish option’ is adopted in this country it may be possible to give reserve powers to the Government to cap receipts to renewable generators who adopt the semi-market option. However, the complexity of arrangements that this would involve are beyond the scope of this report. It should also be mentioned that this approach would be administratively unsuitable for micro-renewables.

3.2 (b) Harmonising the REFIT with the RO

The mechanics of achieving harmonisation between a co-existing REFIT and the RO are surprisingly simple. They would consist in large part of merely replicating the arrangements whereby the old renewable NFFO contracts are harmonised with the RO. This harmonisation task is performed by the NFPA, which, as the data collected for earlier Figures suggests, holds regular auctions for NFFO contracts, effectively turning ‘water into wine’ by converting the electricity generated by NFFO schemes into ROCs and electricity plus LEC exemption elements. These are sold off in the auctions as future options. The NFFO schemes earn ROCs which are issued to the electricity supplier who has won the relevant scheme in the auction, and whose expected value is consequently included in the bid price paid by that supplier. The ROCs therefore are counted as contributing towards the achievement of the RO target. The money raised more than pays for the cost of remunerating the renewable generators and the (significant) balance goes into Treasury coffers. This has been a source of controversy.

The same procedure could be adopted for turning the production from generators with REFIT contracts into ROCs. The existence of a PSO would still be required. Because the REFIT system would be oriented to producing an increased volume of (the case of a small REFIT) higher cost renewables, it is unlikely that there would be a surplus generated for the Treasury. So the PSO (mentioned earlier) would still have to exist, albeit passing on a much lower cost to the electricity consumer than if there was no interface with the RO. A major benefit of this system is that it would answer many of the fears about introducing a REFIT in UK conditions. These concern how one manages a transition from the RO to REFIT without undermining the development of the renewables programme.

It should be mentioned in passing here, that, from a given point in the future, it could be decided that the larger renewables, as well as the smaller ones, could be funded out of a REFIT arrangement which could be harmonised with the RO. Holders of existing RO contracts have been concerned that abandonment of the RO would jeopardize their financial arrangements. The arrangements described above could ensure that the contractual position of existing RO generators would not be undermined since for them the RO arrangements could still function, although after a future date it would be closed to new entrants (who would be funded by a REFIT).

Yet another variation (which could apply either to a small REFIT, or a more general transition to a REFIT arrangement) is that generators could, at the beginning of their project, opt either for a REFIT or to be funded under the conventional RO arrangements. This may well have advantages for generators, although as has been discussed in the case of a Spanish-style mechanism, this may reduce the cost-effectiveness for the consumer of introducing a REFIT system.

Section 4: Other issues

4.1 Legal Considerations

It does not appear that the Government currently has the sort of reserve powers necessary to organize a REFIT, so new primary legislation would be needed to introduce a REFIT of whatever shape or size. It is not clear whether the Government will introduce a new piece of legislation to enact reforms of the RO or whether it will use powers under the Sustainable Energy legislation.

Primary legislation would be needed to establish the REFIT principle. It would follow from UK practice to give the Secretary of State reserve powers (actioned through statutory instruments or orders in council) to set REFIT rates. The German practice is to set out the REFIT rates on the face of the legislation itself. However, it may be that it allows greater flexibility to respond to changing market conditions if the Government has reserve powers to review and possibly change the rates of REFIT for new projects at regular intervals.

Ofgem would continue in its role of supervising the governance of the renewables arrangements. The NFPA would need to be given a specific contract by the Government (presumably DBERR) to fulfill the sort of role envisaged earlier.

4.2 Attitudes of key interest groups

This paper has been drawn up with the eminently practical objective of attempting to maximize the best fit with the various interest groups that are concerned with delivering renewable programme objectives. The various renewable generators are concerned to have good, reliable income streams that can secure sufficient investment, although they are also keen to ensure that reforms to the RO do not jeopardize existing financial arrangements. We believe that the proposals contained within this document can be tailored to fit in with these objectives as well as achieving consumer interests of maximising volume of renewable energy at least cost. Certainly Ofgem will prioritise the reduction of consumer costs. On the other hand there is very high public support for the achievement of a rapid and large build up renewable energy. A combination of these interests suggests that a REFIT system is desirable since, of the options that are available, this present the optimum basis for achieving high volume growth in renewables while minimizing cost. We have taken into account the interest of the public electricity suppliers in the micro-renewables sector, and we are confident that the sort of approaches outlined here can help them to use renewables as a means of marketing their services.

Conclusion

Significantly greater volumes of the renewable technologies that we have discussed will be deployed for a given consumer outlay in a REFIT, compared with the RO arrangements. Fears, sometimes expressed, that it would be difficult to move to a REFIT system without seriously disrupting the implementation of schemes in the pipeline are groundless. This is because REFIT contracts could be harmonised with the RO in much the same way as NFFO contracts are absorbed into the RO at the moment. Regardless of whether we should move quickly to a REFIT for the larger-scale technologies, there are excellent reasons and tremendous possibilities for starting REFITs for smaller renewables. These include wave, tidal, solar PV, small hydro and types of biomass. We have discussed how this can be implemented using the NFPA to administer the non-domestic renewables and how the micro-renewables can be given support which maintains the ability of electricity suppliers to use them as a marketing tool. It seems clear that until renewables are deployed with greater value under a REFIT system, the sector will continue to embarrassingly under-perform in terms of meeting our EU targets, and contributing to expansion of UK industry, job creation, energy security and climate protection.

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