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Effectiveness through risk reduction: a comparison of the renewable obligation in England and Wales and the feed-in system in Germany

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Abstract

The European Union is particularly rich in variations of different delivery mechanisms for increasing the use of renewable energy. The requirements of liberalisation in continental Europe, the re-regulation of the UK's gas and electricity sectors in 2000 and ongoing environmental commitments has meant the establishment of a new generation of mechanisms following on from early prototypes. This paper analyses two new mechanisms in detail: the England and Wales RO (Renewables Obligation) and the German EEG (Erneuerbare Energien Gesetz), with a particular focus on how they reduce risk for generators. Assuming that risk reduction is an important way to make a support mechanism effective in promoting deployment, the analysis will look at three different kinds of risk, namely, price, volume and balancing risk. It is argued that the German EEG is more effective at increasing the share of renewables than the England and Wales RO because it reduces risk for RES generators more effectively.

Keywords: Renewables; Delivery; Risk

1. Introduction

The European Union is particularly rich in variations of different delivery mechanisms for increasing the use of renewable energy. The 1990s were dominated by two types of mechanisms: On one hand, competition or quota based—for example, the Non-Fossil Fuel Obligation (NFFO) in the UK (Mitchell, 2000), alternatively, variations on pre-determined premium payments or tariffs, as in Germany. However, the requirements of liberalisation in Continental Europe and the re-regulation of the UK's gas and electricity sectors in 2000 and ongoing environmental commitments, has meant the establishment of a new generation of mechanisms to follow on from these early prototypes. These mechanisms, while still displaying fundamental differences, represent a more sophisticated vintage of their earlier versions (Menanteau, et al., 2003). This paper analyses two mechanisms in detail: the England and Wales RO (Renewables Obligation) and the German EEG (Erneuerbare Energien Gesetz), with a particular focus on how they reduce risk for generators.

Assuming that risk reduction is an important way to make a support mechanism effective in promoting deployment, the analysis will look at three different kinds of risk, namely price, volume and balancing risk. It is argued that the German EEG is more effective at increasing the share of renewables than the England and Wales RO because it reduces risk for RES generators more effectively.

Reducing risk for generators is important because risk has a price. Reducing risk can make a larger number of projects attractive, mainly because lowering risk reduces the cost of capital. For the same reason, risk reduction is also one way of increasing the efficiency of a support mechanism. As Langniss (1999, pp. 112) has pointed out, "in policy development, mitigating risk is certainly an alternative to raising the level of compensation".

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Although feed-in systems may still not be as efficient in the short-term, they do provide long-term stability, incentives and resources for innovation leading to efficiency improvements in the long-term. Decreasing feed-in tariffs can be used to pass on some of the cost-savings resulting from these improvements to those who pay for the feed-in mechanism.

Section 2 will provide a description of how the mechanisms work, while Section 3 will analyse them in terms of risk reduction. Finally, we will provide a brief comparison of the two mechanisms, based on the distinction between price, volume and balancing risk.

2. The delivery mechanisms—how they work

2.1. Feed-in system—the German EEG

Germany has seen an impressive growth of electricity generation from renewables during the 1990s. This success is to a large extent due to a feed-in mechanism laid down in the first German feed-in system, introduced in 1991 (Stromeinspeisegesetz). This was a feed-in system based on the "market price" topped-up by a premium payment. Utilities were required to buy power from renewable generators and pay this premium for it, which was calculated as a percentage of the average price of electricity to end-customers. In such a system, the feed-in tariff would vary according to the general electricity tariff, exposing the generator to the development of these tariffs. As long as there was a monopolistic market, this was not a problem because prices were both high and relatively stable. As electricity prices went down after the market had been liberalised in 1998, prices paid to renewable generators fell and many came under pressure. The introduction of the fixed rates in the EEG that came into force in 2000 was largely a response to this.

The diagram below (Fig. 1) shows the growth of renewables stimulated by the first mechanism from 1991 to 1998 and the even stronger increase after the introduction of the new EEG mechanism in 1998. The EEG does not stipulate any upper capacity limit and the growth of renewable generation is likely to continue.

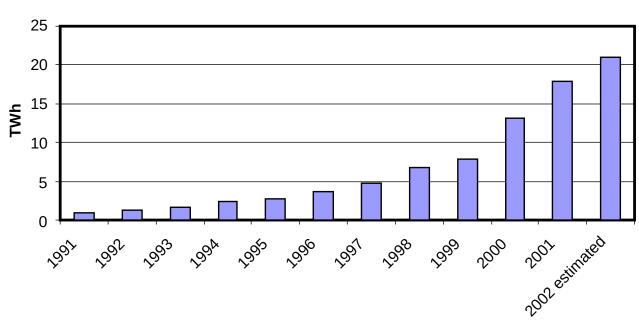

Fig. 1. Annual electricity generation benefiting from the feed-in mechanism (BMWi, 2002).

The EEG requires network operators to:

- connect renewables to their grid;
- accept the entire electrical output from these plants;
- remunerate generators at a pre-determined rate for every kWh produced. Plants that do not feed into the public grid are also remunerated. The remuneration decreases over time, but generators are guaranteed to receive remuneration for 20 years.

As shown in Table 1, the EEG supports a wide range of renewable technologies and places a lot of emphasis on differentiated remuneration:[1]

- First, the remuneration depends on the technology, with only 7 ct[2]/kWh being paid for large geothermal plants and up to 51.62 ct/kWh for solar plants.
- Second, the commissioning date is also relevant. For wind plants, for example, the remuneration decreases by 1.5% every year for new plants.
- Third, the remuneration is site specific. Wind plants currently receive 9.1 ct/kWh for 5 years after commissioning (plants coming on-line next year will receive 1.5% less, see above) After that period, the remuneration depends on the income of a plant compared to reference plants.[3] Plants that have done well, for example due to relatively good wind conditions, and have received a remuneration that exceeds 150% of the reference plant income will receive less money after 5 years. Lower-quality sites, on the other hand, will continue to receive the full remuneration for longer, depending on the extent to which they are below the 150% threshold.
- Moreover, there is a review carried out by the government every other year, looking at technological and market developments. The review is required to make a recommendation to the parliament which can then decide to change both the tariffs and the reduction rates. They will only be changed ex ante, i.e. only for plants that have not been commissioned yet.

Table 2 shows the share of total generation that has been supported under the EEG and the average remuneration.

The costs of the feed-in mechanism are met by all end customers. Whilst under the old Stromeinspeisegesetz, each distribution network operator (DNO) had to bear the total costs of renewables in their area individually, the EEG has established a mechanism whereby the costs

[1] In August 2003, the German environment department tabled an amendment to the EEG that includes an even greater differentiation according to technology and plant size. The new EEG is expected to come into force in early 2004.

[2] Throughout the paper, ct is used to represent euro cents.

[3] The reference plant is defined in the appendix of the EEG.

Table 1
EEG remuneration by technology (EEG)

Erzeugungstechnologie	Remuneration (ct/kWh)
Wind	9.1
Solar	
Capacity <100 kW	51.62
Plants on a building, capacity <5 MW	48.1
Biomass	
Capacity <500 kW_e	10
Capacity between 500 kW_e and 5 MW_e	9.0
Capacity between 5 MW_e and 20 MW_e	8.5
Hydro, landfill and sewage gas	
Capacity <500 kW_e	7.67
Capacity between 500 kW_e and 5 MW_e	6.5
Geothermal plants	
Capacity <20 MW_e	8.5
Capacity >20 Mw_e	7.0

Table 2
Average remuneration for plants covered by the EEG law (VDN)

Year	Share of renewables supported under the EEG of total generation (%)	Average remuneration (ct/kWh)
2002–Q3	5.14	8.82
2002–Q2	4.28	8.74
2002–Q1	4.69	8.79
2001	3.89	8.64
2000	2.90	8.54

are spread country-wide. The DNO has the obligation to buy the output from renewables, but has the right to sell it on to the transmission network operator (TNO) it is connected to. The TNOs spread it equally amongst themselves, depending on the share of electricity sold in their grid area. They then pass it on to the suppliers in their region. The costs of developing renewable energy in Germany is now socialised across all electricity customers rather than impacting more heavily on customers in areas where more renewable energy resources are being exploited.

According to the German government (BMWi, 2002), the feed-in mechanism has increased the cost of electricity to end users by 0.18–0.26 ct/kWh, depending on the market price for electricity.

3. The England and Wales RO—how it works

The RO came into effect in April 2002 (DTI, 2002), succeeding the NFFO which was in place from 1990 to 1998. The RO was chosen to follow on from the NFFO because it was thought that:

- a market-based mechanism was more desirable on the grounds that it would increase deployment whilst at the same time maintaining a competitive incentive to keep prices down;
- it would enable renewable generators to become more integrated into the electricity market;
- it was non-technology specific so would not be attempting to pick winners.

The RO is a legislated obligation on licensed electricity suppliers to buy a certain percentage of their supply in each 1-year compliance period, starting from 3% in 2002 to 2003, initially rising to 10.4% for the period 2010–2011. This was raised to 15.4% for the period 2015–2016 in December 2003. The RO is intended to stay at the 15.4% level until 2027—in theory, guaranteeing it for 25 years. The RO Order is the legal basis of the RO and obligatory reading for anyone interested in it (DTI, 2002). An Order is issued annually and sets out the list of eligible technologies for public subsidy within the mechanism as well as providing legal confirmation of the level of the obligation for the operator. The RO generators must be situated within the UK or its territorial waters, and must have been built, or have been refurbished, since 1990. Compliance of suppliers with the obligation is monitored by the UK gas and electricity markets regulator, Ofgem, which facilitates the system through:

- operation of a certificate system for eligible projects;
- monitoring generation output and the creation of renewable obligation certificates (ROCs, 1 ROC = 1 MWh);
- monitoring supplier compliance (suppliers have to provide Ofgem with proof of an appropriate number of ROCs);
- monitoring the links between ROCs and Levy Exemption Certificates (LECs) available to companies who have agreed to reduce their climate change levy by undertaking various energy efficient measures (including buying renewables).

Suppliers have to demonstrate they have fulfilled their obligation by presenting a certain number of ROCs each year to meet their supply obligation. ROCs can be bought directly from an eligible renewable energy generator or from another supplier. ROCs are thus a tradable commodity, and up to 25% of a supplier's obligation can be met from ROCs banked in the preceding 1-year period. The potential for the use of borrowing of ROCs against generation in future years was discussed as an option within the RO, but was rejected due to the potential for manipulation of the ROC market.

The RO allows suppliers to choose whether or not to meet their obligation. They can 'buy-out' of their obligation by paying a fixed sum for each MWh that they do not meet through the presentation of ROCs to Ofgem, and this cost can be passed on to customers. The buy-out price was set at £30/MWh for 2002–2003 and will rise annually in line with the Retail Price Index. The presence of the buy-out price means that from the perspective of the supplier, it is in their economic interest to buy renewables up to £30/MWh above the premium of conventional power. If the price of electricity available from renewables should be above this figure, then it would be in the economic interest of suppliers to buy the conventional power from the electricity market and to pay the buy-out price. However, this basic calculation by suppliers is complicated by the 'recycled green premium'. This is the re-distribution to suppliers of monies collected by Ofgem from the payment of the buy-out price. The monies are re-cycled to suppliers on the basis of the volume of ROCs they presented to Ofgem as a fraction of all the ROCs presented to Ofgem in the specified period. For example, if a supplier presents 5% of all the ROCs presented in a 1-year period, then that supplier would receive 5% of the buy-out fund for that period.

The recycling of the buy-out fund introduces an element of 'gaming' into the RO. Suppliers have to understand in detail the provision of total renewable electricity supply for any 1 year. They can then estimate the short-fall on meeting the RO and therefore the total 'buy-out' and hence their green premium income. In effect, the green premium raises the price per kWh at which a supplier remains economically indifferent to buying renewables rather than paying the buy-out price.

In addition, the buy-out price is the cap on expenditure of the RO each year. It ensures that customers do not pay more than an additional 3 p/kWh for a maximum of 10% of electricity. This is a vital part of England and Wales strategy. Without a price cap (and hence a cost limit to the customer), it is unlikely that the Department of Trade and Industry could have got agreement for the RO from the Treasury.

An RO generator has, de facto, four revenue streams:

- payment for energy;
- payment for the ROC;
- payment for the LEC if final customer is eligible for levy exemption;[4]
- the recycled buy-out payment or green premium (Table 3).

Table 3
Constituents of total value of renewable generation eligible for RO in early 2003

	p/kWh	ct/kWh
Energy	1.5–1.8	2.25–2.7
ROC	3.0	4.5
LEC	0.086	0.129
Recycled Green Premium	1.5–2.0	2.25–3.0
Total	6.1–6.9	9.15–10.3

Conversion rate 1p = 1.5 ct.

The RO is therefore agreeably simple but has a number of distinct advantages for a market-orientated Government:

- it acts as an accounting system to verify whether the obligation has been met;
- all suppliers are legally bound to fulfil the obligation on them, although they are able to choose how they fulfil it or whether they wish to 'buy-out' at 3 p/kWh rather than buy eligible electricity;
- the suppliers have to pay whatever it takes up to 3 p/kWh to meet their obligation. The RO is therefore a way to generate finance to pay for renewables external to Government;
- they facilitate trade which allows the obligation to be filled either by buying physical electricity with ROCs or by ROCs alone in the alternative tradable ROC market (Santokie, 2002);
- suppliers are able to pass costs on to customers, but there is a cost cap to customers of the RO.

4. Effectiveness through risk reduction

The EEG and the RO are analysed in the sections below with a particular focus on risk reduction. The following section will first explain price, volume and balancing risk in more detail, while at the same time showing how a feed-in mechanism like the German EEG reduces these types of risk. The second part of the section will analyse the England and Wales RO in more detail, contrasting its potential to reduce risk with that of a feed-in mechanism.

5. The German EEG

Both the effectiveness and the efficiency of a feed-in system are to a large degree dependent on the magnitude of the guaranteed feed-in tariff. If this tariff is too low, it

[4]Under the climate change levy (CCL) agreements, certain major energy users are able to reduce the normal CCL payment (0.43 p/kWh on all business customers) to a fifth (i.e. (0.086 p/kWh) if they purchase renewable electricity from eligible power plants or undertake certain energy efficiency measures (agreed with the Energy Savings Trust). This provides a value for Levy Exemption Certificates (LEC = 1 MWh). The major users provide proof of LECs to both Ofgem and to Customs and Excise.

will not lead to a significant increase in renewable generation. If it is too high it provides renewable generators with additional income, whilst triggering investment at increasingly disproportionate cost to the consumer and eventually no additional investment at all. In the case of feed-in systems, however, finding the 'right' price is relatively easy compared, for example, to a tax on CO_2 emissions, because the costs of avoiding CO_2 are less well known than the generation costs of renewables.

A feed-in system is one mechanism for ensuring a renewable generator receives a price that is above the market price, reflecting the fact that these technologies are not, as yet, competitive. However, it is the manner in which this premium price addresses the problems facing renewable energy projects that distinguishes the feed-in system from other mechanisms where plants also receive a price above market levels, e.g. through selling green certificates as in the RO, discussed below. The success of feed-in-systems in increasing the share of renewables can be explained in terms of the lower risk/higher security it gives to investors compared to other support mechanisms (Oppermann, 2001; Menanteau et al., 2003, see also Langniss, 1999). This security can be split into three elements:

- price risk,
- volume risk,
- balancing risk.

5.1. Price risk

A fixed feed-in price, as with the German EEG, does not have any price risk for the renewable generator since the price paid does not depend on the market price.

In a liberalised market, this price guarantee is arguably more valuable than in a monopolistic market. In the former market, prices are normally much more volatile and market players pay high premiums for converting fluctuating market prices into fixed income streams. Hedging can be done through a contract that limits the price fluctuation to a certain price band or a fixed-price contract. The corresponding hedging fee reduces the risk, but at the same time represents an additional cost. As many renewable generators are small generators, they tend to be relatively risk averse due to a less diverse fuel portfolio and a limited ability to finance projects through the balance sheet. They are therefore likely to be disadvantaged by high-risk markets (Oppermann, 2001). They are therefore likely to pay relatively high hedging fees for reducing their risk to a minimum.

Thus, the guaranteed feed-in tariff gives generators not just a price that lies above the market price. It also provides a hedge against price volatility, thereby saving them money they would otherwise have to spend on hedging their price risk. The higher the price volatility, the higher the value of a guaranteed feed-in tariff.

5.2. Volume risk

A generator's revenue is a function of both price and volume. In a feed-in system, there is no volume risk because the network operator is obliged to accept all renewably generated electricity. A quota system sets an overall volume for renewable generation, it does not give individual generators a guarantee that their output will be bought. Under such a system, a plant that can sell all its output in the beginning may later be replaced by cheaper generation. Volume risk is related to the amount of money the Government is prepared to have spent on renewables, by whoever pays for it. If the mechanism is essentially revenue capped as both competitive mechanisms and quota mechanisms are, then there will always be volume risks.

5.3. Balancing risk

A feed-in system side-steps the risk of balancing. This important point is generally not discussed by other analyses of how the feed-in system reduces the generators risk (e.g. Oppermann, 2001). For example, in Germany, EEG plants do not need to supply a certain load profile. They simply feed their output into the grid and the (DNO[5]) has to deal with giving it the right shape (Bauknecht, 2003). The DNO has to remunerate the electricity at a fixed rate irrespective of the load profile. For many renewable power plants which generate intermittent power, this reduces their risk significantly as shown by the experience of renewables under the New Electricity Trading Arrangements (NETA) in the UK (Bathurst and Strbac, 2001; Bauknecht and Colella, 2002). As discussed later, NETA places a high premium on flexibility and penalises unreliable generation. A feed-in system that is based on the number of kWh and does not take into account the load profile does not penalise unreliable generation.

On the other hand, such a system does not give generators any incentive to reduce their load fluctuation or benefit renewables which provide reliable power. There is scope for biomass plants to react to market conditions and even for wind generators to run slightly below their maximum to provide a certain reserve capacity. Further exploration is needed to determine how a feed-in system can be more effectively combined with incentives for generators to provide some balancing capacity.

[5]A DNO in this context is a company which is both the distributor and the supplier to customers.

5.4. Conclusion

The current German feed-in system for renewables has a number of advantages for renewable generators in terms of reducing their risk. The effect of this reduced risk is an increased ability for renewable generators to finance their investment through the capital market. This way of financing is particularly important for the large number of small companies active in the renewable market, as they normally cannot finance their projects through their balance sheet. The low risk improves their access to capital markets and reduces the cost of capital. This effectively means a reduction in the overall costs of renewable generation, which should be reflected in the level of feed-in tariffs.

6. The England and Wales RO

As will be shown below, the RO does not remove risks. Only large, integrated energy companies appear able to overcome the price, volume and balancing risks and for those companies, the RO is a welcome and valuable mechanism. Other smaller or independent companies do not find it sufficiently 'powerful, persistent or predictable' (Jacobsson and Bergek, 2002) to either enable, or induce, their involvement (Johnson and Jacobsson, 2001a, b, 2003). Whether the large companies will be sufficient to deliver the successful deployment of 10% of renewables by 2010 is too early to say.

6.1. Price risk

There is a great deal of price risk within the RO in comparison with the EEG. The value of the ROC and green premium depends on supply and demand (Smith and Watson, 2002). The DTI has set out the level of obligation in each of the years to 2010 (DTI, 2001). An exact knowledge of the state of deployment and generation output for every eligible renewable power plant is necessary to understand the value of the ROC and green premium for each year, based on the expected percentage of buy-outs (Santokie, 2003). The Renewable Power Association (RPA) has predicted a shortfall between supply and demand of 55% in 2003–4 and 20–30% in 2006–7. They predict this shortfall will continue until the target is met, more likely in 2012/2013 (RPA, 2003). As a result, the value of ROCs with recycled premium will stay at around £45/MWh until about 2007. Platts suggested in June 2003 that the projected build rate for renewables projects stimulated by the RO was higher than previously expected, and reduced their projections for ROC values accordingly. The price still has considerable scope for change, with Platts/RPA suggesting a potential future range for the period 2007–08 of between £44/MWh if the build rate should continue to rise, and up to £78 should planning issues hold up the build rate. (Platts, 2003).

Once the 10.4% target has been met, the value of the ROC will fall. This is because renewable generation beyond 10.4% is not guaranteed a ROC. As supply increases, suppliers will be able to choose between generation and this also reduces the value of the ROC.

The value of the ROC therefore:

- Depends on the rules of eligibility of the RO remaining unchanged. If eligibility altered, it would have an effect on the supply curve. If eligibility increased, which seems more likely than it reducing, in order to meet the Government's target figure, it would increase available supply, and the value of ROCs would reduce.[6]
- Will alter once the 10.4% target has been met, since this implies that some renewable generated electricity will be unable to sell their ROCs, though this will not necessarily be in 2010-11 and only in the continued absence of a higher target (Oxera, 2001)

The highest prices so far paid within the RO is for ex-NFFO generation, now auctioned off every six months by the Non-Fossil Purchasing Agency. This is for a six month contract and for existing generation. Prices paid for the RO become lower than this depending on length and type of contract and type of generation (Table 4).

Trading of ROCs is limited as most of the larger generating companies sell to their in-house suppliers. For example, National Windpower and Powergen Renewables are likely, although not certainly, to sell their ROCs to Innogy and Powergen, their parent company's supply or trading arms.

The ROCs are not traded separately in the ROC market, which makes the latter market illiquid. ROCs for the first obligation (i.e. for the six months from April 2003) were recently bought at £46.75 p/MWh. This value represents the ROC, the recycled green premium and potentially a LEC. The energy value (about 1.5–1.8 p/kWh), obtained by selling it separately, should be added to this to obtain the total value to the generator[7]. ROCs for the second obligation period (i.e. 2003–2004 or OP2) are currently bid/offered £47–49/ROC and the third obligation period (i.e. 2004–2005or OP3) is bid/offered £42–44/ROC (Natsource Europe, 2003). However, in October 2002, the supply company TXU Energi was cut off by its US parent and subsequently acquired by Powergen. On August 2003, Ofgem announced that the TXU administrators continue to have responsibility for

[6]The DTI has made a number of proposals in its statutory consultation on the RO to change the regulations concerning co-firing with biomass, extending the present rules by up to five years.

[7]ROCs derived from projects in the Scottish equivalent of the NFFO are sold separately from the associated electricity in order to take advantage of higher prices available in England and Wales.

Table 4
NFPA auction prices

Technology Price	Feb-01 p/kWh	Sep-01 p/kWh	Feb-02 p/kWh	Aug-02 p/kWh	Feb-03 p/kWh	Aug-03 p/kWh
Small hydro	1.84	2.81	6.4	6.69	6.45	6.83
Landfill gas	1.92	2.84	6.74	6.76	6.56	7.13
MIW	1.59	2.21	2.27	1.93	1.64	2.42
Biomass	1.85	2.61	6.52	5.88	3.68	5.43
Wind	1.85	2.84	6.31	6.65	6.41	6.70
Average	1.89	2.81	6.44	6.5	6.26	6.81

Prices are for electrical output, and for appropriate technologies, inclusive of Climate Change Levy.Exemption Certificates (LECs) and Renewable Obligation Certificates (ROCs) (NFPA, 2003).

the obligations on some of the supply licenses held by TXU before Powergen made its acquisition. It is possible that the administrator will not make the full contribution to the buy-out fund, with the result that those submitting ROCs will see less of a refund at the end of the authentication period. Trading for the first period, OP1 has thus fallen such that current bids are expressed in terms of percentage of RO buy-out plus percentage of ROC recycle payment, and Natsource Tullett report that no outright bids had been made for ROCs from OP1 into September 2003. Payments for OP2 and OP3 remained within the price ranges noted above. It can be noted that these contracts are only for a year. A generator which wishes to have a longer term contract will be paid less. The maximum length contracts to independent generators are usually for five years, not enough to obtain project finance, while larger integrated companies may obtain longer contracts for around 10 years or so.

Since the ROC value – and the level of recycled funds – falls if the obligation is met, the RO is a mechanism which inherently includes an incentive to under-meet the target. Since, in order to know what the value of the ROCs and recycled premium is, and given the very few generators around, it must arise that generators decide to commission to suit ROC values, although this is difficult to prove.

6.2. Volume risk

The RO also has volume risk, as touched upon in the section above. Once the 15% target has been met, if there is not a higher target, suppliers are able to choose from different sources of supply. This means that renewable generators do not have security that their generation will be bought after that date. The Government reiterated within the 2003 Energy White Paper that the RO would last until 2027, meaning that suppliers would be obliged to buy 10.4% of their supply until 2027. However, new generation which comes on line will have a zero ROC value unless it is bought to fulfil the obligation. In this case, it would displace existing RO generation. Suppliers can be expected to source cheaper generation, if it is available, once the 10.4% target has been met. Thus, the ROC values, as supply becomes greater, reduce (Oxera, 2001).

Whilst the RO is intended to exist until 2027, there is nevertheless political risk that the RO will end before that date; that another mechanism will be introduced which sidelines it; and even that it might be enhanced, for example with a rolling, increasing RO target. The renewable industry knows that this occurred with the NFFO contracts which are still in existence but at a much lower value than obtainable through the RO. The White Paper also stated that carbon trading would be at the centre of UK energy policy. This has given rise to concerns about how the RO will link with carbon trading in the future; whether the latter may undermine the former and what this means for ROC values.

6.3. Balancing risk

Generation from the RO is also open to balancing risk. The RO establishes a demand for renewable electricity by suppliers but it provides no other support. An explicit goal of the RO was to force renewable generators into taking electricity market decisions. This is a good long-term goal. The question is whether the positive effects of moving directly from the secure NFFO (15 year contract for a price/kWh and priority access by regional electricity companies) to the RO (where generators have to negotiate a contract with suppliers and work within the NETA) are outweighed by the problems for smaller and independent generators.

There are two key difficulties for smaller and independent generators:

- the fundamental idea of NETA was that it should be cost-reflective and promote reliability of power. NETA trading occurs between Balancing and Settlement Code (BSC) signatories and is a complex mechanism which imposes high transaction costs in terms of membership, personnel and information

technology expenditure, and together imposes a disproportionate, relative cost on small generators. Because of this most small generators do not sell through NETA but via a supplier. Many grid supply areas, the distribution network area that generators sell into, only have one supplier which means they have limited options for sale of their generation. If the renewable energy is sold outside of the grid supply point, it loses its distributed benefits.
- NETA has a unique dual price system with a system buy price (SBP) and a system sell price (SSP). The system operator balances the system and if renewable generation from a power plant is either over or below what it said it would generate in a half hour, it has to pay a penalty to 'balance' its output. There is a cost differential between the SBP and the SSP. In effect, it costs more to buy if you are out of balance as a result of under-generating. It is possible to have price spikes, although it is much less likely now than it was when NETA came into operation in April 2001. At those times, the cost of balancing can be onerous. As a result of this, suppliers are concerned at the additional risk of buying intermittent generation.

Most renewable generation in the UK is owned by subsidiaries of the larger energy companies which also own suppliers. NETA does not pose very much of a problem for them because the renewable generation becomes part of their portfolio to balance. However, from the perspective of new entrants, NETA is a barrier (Ilex, 2002a–c; Tudway, 2003).

6.4. Conclusion

The RO means that developers bear far more risk than is the case in the feed-in mechanism. From the perspective of financiers, payments which result from the RO cannot be secured for the several years they require. The majority of finance has therefore been provided from the balance sheets of the large generating companies, which are all subsidiaries of the old monopoly companies. Achieving the 2010 policy target of 10% requires about 1250 MW of new build a year (DTI, 2003). This equates to at least a billion pounds of investment a year and it seems unlikely that even the deepest of corporate pockets will want to provide all of this by corporate finance. If limited project finance is forthcoming, then the ability of the RO to deliver the 10% is questionable (RPA, 2003).

Independent generators may obtain finance but usually on the back of the assets of other power plants. Smaller generator communities or individuals, without assets, are unlikely to find finance. In this sense, the RO is a large company mechanism. It does not promote mentors for renewable electricity.

7. A comparison of the RO and EEG

This article set out to compare two support mechanisms for renewables, namely the German feed-in mechanism and the England and Wales RO, in terms of how they reduce risk for generators. Risk reduction is seen as important because it increases the level of deployment, i.e. the effectiveness of a support mechanism. Risk has been split into three different elements: price risk, volume risk and balancing risk.

In terms of price risk, the German feed-in mechanism provides a fixed tariff for each kWh generated, removing any price risk for generators. The England and Wales RO, on the other hand, splits a generator's income into two elements: a price for the electricity generated and a price for the "greenness" of the product. For both products the generator is exposed to fluctuating prices, because neither the market price for electricity nor the ROC price is pre-determined. An alternative way of designing a feed-in system would be to pay a bonus on top of the market price, which would expose generators to the volatility of the market, but would still provide them with one fixed income stream.

Although the prices available within the RO are now similar to those available under the wind tariff of the EEG, the RO creates less attractive conditions for investors, because of the price risk resulting from the volatility of both the power and the ROC market, UK wind projects require a higher price than German ones to make up for that risk.

As for volume risk, the comparison between the two mechanisms yields a similar result: While the German EEG takes away any volume risk, RO plants are exposed to volume risk on both markets they participate in, because in both markets they may be "out of merit". While in Germany, plant projects can be evaluated on guaranteed priority access for a 20-year period, plants in the UK may well be competitive in the ROC market when they start operating, but may later be pushed "out of merit" by new plants. While the RO supports only a fixed volume of kWhs, the EEG sets no upper limit, so that plants do not carry the risk of being pushed "out of merit".

In terms of balancing risk, the EEG provides a fixed tariff per kWh irrespective of the load profile a plant generates. The RO, on the other hand, leaves plants exposed to the full balancing risk. While the analysis of price and volume has shown that plants are exposed to these kinds of risk in both the ROC market and the power market, balancing risk is obviously something that is specific to the power market and there is no balancing risk in the ROC market. Balancing risk therefore depends on the design of the power market and not on the ROC market. Nevertheless, there is a link between the RO and balancing risk, because the RO requires plants to operate in the normal power market for part of their income, while under the EEG plants receive the entire income through the feed-in tariff.

8. Conclusion

Germany and the UK have followed very different paths in support of renewable energy development. The UK has promoted market-based mechanisms with the goal of developing renewable energy at least cost to the customer, based on the belief that it is the most efficient way to produce competitive technologies and renewable energy actors which can work in the electricity market.

The comparison between the UK RO and the German EEG, however, has shown, that risk reduction is an important criterion to evaluate support mechanisms and that, looking at both price, volume and balancing risk, a feed-in system is more likely to provide such risk reduction.

While this paper has argued that risk reduction is an important element of an effective support mechanism, the link between risk reduction and efficiency also needs to be investigated. As it reduces the cost of capital, risk reduction is also one way of increasing the efficiency of a support mechanism. Although feed-in systems may still not be as efficient in the short term, they do provide long-term stability, incentives and resources for innovation leading to efficiency improvements in the long term (dynamic efficiency). Decreasing feed-in tariffs can be used to pass on some of the cost-savings resulting from these improvements to those who pay for the feed-in mechanism. The German EEG represents an attempt to provide security, while also trying to incentivise price reduction.

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