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Incentivising renewable electricity – a comparison of Renewable Obligation Certificates and Feed-in tariffs

NIAR 300-10

Paper examining the two main financial incentives used to stimulate renewable electricity development in Europe.

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Executive Summary

The following paper outlines two incentives designed to stimulate renewable electricity generation – Renewable Obligation Certificates and Feed-in Tariffs – as well as examining the debate surrounding their relative effectiveness.

It should be noted that Northern Ireland does not have legislative powers to introduce a Feed-in Tariff at this point.

Renewable Obligation Certificates

The Renewable Obligation model is a quota based system that requires electricity suppliers (or transmission service operators in some cases) to supply increasing amounts of electricity sourced from renewable generation.

In order to demonstrate that their obligations have been met suppliers must produce a Renewable Obligation Certificate (ROC) for every Megawatt hour (MWh) of electricity they supply to the relevant authority (Ofgem in the UK). Should they fail to produce the predetermined amount of ROCs, suppliers are required to pay a buy-out fee (in Northern Ireland this was £37.19 per MWh during 2009/10). The proceeds of this buy-out fee are redistributed amongst suppliers who have produced the required amount of ROCs in a particular period.

ROCs are issued, free of charge, to generators for every MWh of renewable electricity produced. These are then sold to suppliers as a separate entity to the electricity itself.

This has the effect of creating two markets and two revenue streams for generators – the electricity market and the ROC market. ROCs act as a premium on top of the market price (spot price) of electricity, and as such act as an incentive to RE development by contributing to its cost.

Demand, within ROC market, is stimulated by the legal requirement placed upon suppliers to produce an increasing number of certificates at the end of each obligation period. The buy-out fee and redistribution mechanism serve as an extra incentive for suppliers to purchase and hold ROCs.

Since the price of a ROC and the price paid for renewable electricity are determined by market forces, the revenue streams available to generators in jurisdictions operating this system are variable.

Northern Ireland, like the rest of the UK utilises ROC system. These systems offer different incentives for specific technology types by banding ROC levels according to technology (e.g. Onshore wind up to 50kw installed capacity receives the equivalent of four ROCs per MWh produced, where as Offshore wind receives the equivalent of two ROCs).

Certificates issued as part of the Northern Ireland Renewable Obligation and Great Britain Renewable Obligation are mutually tradable across the UK.

Feed-in Tariffs

At their most basic FITs work by setting a fixed price for renewable electricity for a fixed rate of time. Suppliers (or transmission service operators) are obliged to purchase every MWh of renewable electricity produced.

There are two broad categories of FITs – market-independent FITs and market-dependent FITs. Within each category there are number of subcategories which operate at various levels of complexity.

There are four examples of market-independent FITs:

- Fixed-price model: the simplest model which offers a fixed rate for renewable electricity for a fixed amount of time;
- Fixed price model with full of partial inflation adjustment: as above, although the price offered tracks inflation;
- Front-end loaded tariff model: under this model the price paid for RE decreases near the end of a specific projects life; and
- Spot market gap model: the FIT price paid to a renewable electricity generator is comprised of the spot price for electricity plus a subsidy, with a limit placed on the maximum amount of remuneration a generator can receive.

Market-dependent FITs include:

- Premium price model: the simplest form of market-dependent FIT offers a constant rate of premium over and above the spot market price;
- Variable premium model: the variable premium model is a more sophisticated extension of the premium model that utilises a premium cap and a premium floor; and
- Percentage of retail price model**:** the final model type calculates the FIT as a percentage of the retail price of electricity.

The specific design of a FIT affects how successful a model is in stimulating investment in renewable electricity, as well as the type of market created (centralised or decentralised).

The recently introduced UK FIT is comprised of two fixed rate tariff types – a generation tariff and an export tariff. The cost of providing these tariffs is to be taken-up by electricity suppliers (with a minimum of 50,000 domestic customers), with allowance made for implementation costs.

Debate

The debate surrounding the two broad incentive models – ROC and FITs – considers the following issues:

Investment and renewable energy development: Germany has operated a market-independent FIT since 1991 and Denmark operated a similar model between 1993 and 2004. Both regions have experienced a more rapid growth in renewable electricity than the UK which has moved from a Non-Fossil Fuel Obligation (1998-2002) to a ROC system (2002 to present).

The literature suggests that market-independent FIT models tend to lead to the rapid development of renewable electricity. The greater security offered to investors by market-independent FIT models is often cited as one of the key reasons for their success.

By contrast, market-dependent systems (the ROC model in particular) do not allow for the same degree of predictability as market-independent system and have proven less effective. They do, however, retain the potential of offering high-profit margins.

Long-term contracts are available as part of the ROC system but they often lead to a reduction in value per ROC. Significantly, long term contracts are not an intrinsic element of ROC arrangements (as it is with market-independent FITs); the onus is placed upon the generator to secure terms with a supplier.

Issues surrounding risk and the availability of financing are heightened under current economic conditions.

Market diversity: The low-risk nature of FIT systems ensures that they have a tendency to encourage a number of different types of energy generator into the market, local-community groups, for example. This has led to a decentralised energy market in many regions utilising FIT models.

By contrast, market orientated solutions, including ROCs, tend to favour producers who can *'hedge these risks effectively'.* This often results in a market dominated by large-scale producers.

Funding and impact on consumers: FIT and ROC models often place a burden to pay on the industry which is subsequently passed onto the consumer. There is evidence to suggest that RE is cheaper in Germany than in the UK. Further research, to determine the extent to which this is attributable to the incentives employed, as opposed to other factors, may be desirable.

A number of studies suggest that 'willingness to pay' amongst consumers in the UK is increasing. In other words, a greater proportion of consumers are willing to pay more for the electricity to secure 'green benefits'.

Increasing the retail price of electricity in this way runs the risk of environmental policy competing with other social policies – particularly fuel poverty. As such, incentives must be carefully managed to ensure price increases are not borne by the fuel poor.

As an alternative, renewable electricity models may be funded by government subsidy – effectively transferring the cost for the customer to the tax payer. Funding incentives in this way gives rise to a different set of potential problems. The future security of project financing becomes dependent on government budgets, the current squeeze on public financing exemplifies the dangers this could hold.

EU Harmonisation: Finally, both FITs and ROCs appear compatible with the European Commission's plans to harmonise EU renewable energy policy. Operating on an EU level, it is argued, will have specific benefits for ROCs – most notably driving down the cost of renewable development.

Contents

1 Introduction

The development of renewable energy globally has been accompanied by a debate over how best to incentivise this growth. This debate has focussed on two main mechanisms – the market-orientated Renewable Obligation quota method (ROC) and the price led Feed-in Tariff model (FIT) – both which have been utilised to encourage development of renewable electricity (RE). The purpose of this paper is to outline how these mechanisms operate and to examine the associated debate with a particular emphasis on each incentive's ecological and economic effectiveness.

It should be noted that Northern Ireland does not have legislative powers to introduce a FIT at this point.[i]

2 Renewable Obligation Incentives

Renewable obligation schemes are quota based incentives to renewable electricity development. Their operation is typified by the systems in operation in the UK, both the Northern Ireland Renewable Obligation (NIRO) and Great Britain Renewable Obligation (GBRO)

UK renewable obligations legally require electricity suppliers to source an increasing proportion of their electricity from renewable sources. At the end of each obligation period, suppliers present Renewable Obligation Certificates (ROC) to Ofgem to prove they have supplied the required amount of RE[ii].

Suppliers who fail to meet with the obligation are required to pay a buy-out fee to Ofgem at the end of the obligation period (obligation periods last one financial year). During 2009/10 the buy-out fee was set at £37.19 per MWh of obligation not met. The proceeds of each year's buy out fee are redistributed amongst suppliers who met the quota.

Suppliers purchase certificates from RE generators. Ofgem issues ROCs to generators for every MWh of RE they produce free of charge. Generators sell electricity and ROCs as two separate entities. This creates two separate markets providing two separate revenue streams. In the first instance, revenue is gained from selling electricity at the market price - the RE generator will compete with fossil fuel generators in this market, potentially incurring a relative loss due to the cost disadvantage of renewables. This loss may be recouped accessing the second revenue scheme – selling ROCs at their market price.[iii] Demand, within ROC market, is stimulated by the legal requirement placed upon suppliers to produce an increasing number of certificates at the end of each obligation period[iv], and as such, were there is a shortfall in ROCs in any period the market value will, theoretically, increase[v]. The buy-out fee and redistribution mechanism serve as an extra incentive for suppliers to purchase and hold ROCs. It also ensures that the market-value of a ROC remains above the buy-out fee as from a suppliers perspective the value of a ROC is equal to the buy-fee plus the redistributed fund.[vi]

In providing additional revenue streams, ROCs act as a premium on top of the market price (spot price) of electricity, and as such act as an incentive to RE development by contributing to its cost.[vii]

However, since the revenue streams supplied to renewable generators through the ROC scheme is determined by the market, the price for electricity produced and the ROC top-up premium received are variable.

ROC schemes can be designed to differentiate between various technologies, by weighting certificates for each technology.[viii] This approach has been adopted in the UK. Table 1 provides an overview of 2010 ROC values for different technologies for the NIRO. In addition to the figures in Table 1 all microgeneration up to 50KW receives two ROCs per MWh produced, except for the hydro which receives two ROCs per MWh up to 1MW and onshore wind which receives two ROCs per MWh up to 250KW of installed capacity.

Certificates issued as part of the NIRO and GBRO are mutually tradable across the UK.

Table 1: 2010 ROC banding by technology – NIRO[ix]

Generation type	Existing Generators ROC/MWh	New Generators Accredited from 1 April 2010 ROCs/MWh
Hydro-electric		
<= 20kW	2	4
> 20kW – <= 50kW	2	3
> 50kW – <= 250kW	1	3
> 250kW – <= 1MW	1	2
> 1MW	1	1
Onshore Wind		
- up to 50kW	2	4
- 50kW – 250kW	1	4
- 250kW +	1	1
Solar Photovoltaic		
up to 50kW	2	4
50kW +	2	2
Other		
Offshore Wind	1.5	2
Wave	2	2
Tidal Stream	2	2
Tidal Impoundment – Tidal Barrage	2	2
Tidal Impoundment - Tidal Lagoon	2	2
Geothermal	2	2
Geopressure	1	2
Landfill Gas	0.25	1
Sewage Gas	0.5	0.5
Energy from Waste with CHP	1	1
Standard gasification	1	1
Standard pyrolysis	1	1
Advanced gasification	2	2
Advanced pyrolysis	2	2
Anaerobic Digestion	2	2
Co-firing of Biomass	0.5	0.5
Co-firing of Energy Crops	1	1
Co-firing of Biomass with CHP	1	1
Co-firing of Energy Crops with CHP	1.5	1.5
Dedicated Biomass	1.5	1.5
Dedicated Energy Crops	2	2
Dedicated Biomass with CHP	2	2
Dedicated Energy Crops with CHP	2	2

3 Feed-in tariffs

As of 2008, 63 jurisdictions worldwide were operating a form of Feed-In tariff (FIT).[x] The mechanism has support at EU level:

> *…well adapted Feed-In tariff regimes are generally the most efficient and effective support schemes for promoting renewable electricity.*[xi]

FITs have also been identified as a significant contributory factor to the development of new renewable energy technologies in those regions typically identified as European success stories:

> *Renewable Energy Feed-In Tariffs have been used to support what are to date the three biggest (in terms of contribution to national electricity requirements) renewable energy programmes in Denmark, Germany and Spain.*[xii]

This is not to say that FITs have acted as the sole catalyst for renewable energy development in these regions (other issues, not least cultural factors and political impetus have played a role – such factors will be examined as part of a subsequent research).[xiii] Nor is it the case that the FIT system is without criticism and disadvantages (see below).

At its most basic a FIT offers a guaranteed price for RE for a fixed period of time. The price offered can be tailored to suit particular technology types, installation sizes, the resource quality, the location of the project, etc. In many cases the FIT price paid for electricity corresponds to its generation cost, allowing for the cost-effective development of the technology. Furthermore, by guaranteeing a clearly determined payment for a fixed period of time FITs can reduce the risk associated with investment in renewable generation.[xiv] As such, it is generally recognised that FITs can, if administered effectively, stimulate **rapid** RE growth.[xv] [xvi]

3.1 FIT models

The specific form a FIT takes is often determined by the context in which it is developed, i.e. the FIT is usually country specific (FITs are determined by and operated on a federal or regional government level[xvii]). There are, however, two broad categories of FIT – Market-dependent FITs and Market -independent FITs – within which exist a number of common sub-categories.

Market–independent tariffs generally offer a fixed price for RE sold to the grid. Market-dependent tariffs comprise of a fixed RE premium, paid on-top of the spot price for electricity. The latter tariff results prices which vary in-line with the wider market.[xviii]

Importantly, under each model type *'the lawmaker obliges regional or national transmissions systems operators (or supplier) to feed in the full production of 'green'* *electricity*[xix]*.* In other words they are obliged to purchase all RE electricity produced within their region.

There are four sub-categories within the broad market-independent category:

- **Fixed Price Model:** represents the market-dependent tariff type in its simplest form. Under this type model electricity generated from renewable sources will be purchased at a set price for a designated period of time. This isolates the price of RE from a number of variables, particularly investment and fluctuations in the price of fossil fuels.
- **Fixed price model with full or partial inflation adjustment:** the simple model outlined above is problematic as it does not allow the price of RE to adjust in-line with inflation. Failure to include such a mechanism may lead to a decline in real value for RE generators as the price they sell the product for is delinked to changes in the wider economy. In an attempt to circumvent this occurrence some regions have chosen to include a mechanism for altering the FIT price to accommodate changes to inflation. Some regions, e.g. the Republic of Ireland, apply a pre-established formula which can readjust the entire tariff to inflation annually. Others, e.g. Ontario, apply the inflation adjustment to a percentage of the base tariff. A third method is to adjust the base tariff in its entirety minus a number of base points. There are also different approaches as to how frequent such adjustments occur, annually or quarterly.
- **Front-end loaded tariff model:** the front-end loaded model operates by offering higher prices for RE during the early years of a specific generation project than the later years. The rationale behind such an approach is that is provides project developers with higher revenue during the start-up phase, whilst reflecting the decrease in project cost over time. It also serves to reduce retail electricity prices over the lifetime of renewable projects. The model also retains the benefit of offering predictable prices over a fixed period.
- **Spot market gap model:** in the final market-independent model the FIT price paid to a RE generator is comprised of the spot price for electricity plus a subsidy, with a limit placed on the maximum amount of remuneration a generator can receive. This approach displays some of the characteristics of a market-dependent FIT, but the fixed maximum price places it in the former category. Under this model, it is feasible that the spot price may rise above the maximum level FIT price. In such a scenario, the price paid for fossil fuels generated electricity may exceed that paid for RE. In some regions, the subsidy used to top-up the retail price to the predetermined FIT level is paid by the government. This effectively passes on the cost of the FIT onto the tax payer rather than the consumer as is the case in other models (the possible impact of both funding methods is discussed below).[xx]

Three market-dependent models are identified in the literature each operating with a varying degree of complexity;

- **Premium price model:** the simplest form of market-dependent tariff offers a constant rate of premium over and above the spot market price. This ensures that the price paid for RE varies in parallel to the spot price but always remains above it. Such policies generally operate in deregulated markets. It is argued that they are compatible with competition. On the other hand, the relative unpredictability ensures that investor risk is increased.
- **Variable premium model:** the variable premium model is a more sophisticated extension of the premium model. The variable premium model utilises a premium cap and a premium floor. As the spot market price increase the level of premium decrease at a graduate rate until a predetermined point, at which stage the premium level reaches zero and RE generators are paid at the spot price. In a situation where the spot price declines, the premium rate will increase at a graduated rate, until such point as the premium represents all or the majority of the amount paid to the RE producer (a floor below which the price for RE cannot fall). The purpose of the model is to minimise windfall profits that a RE producer could receive under the basic premium price model. It also serves to lessen the risk associated with RE investment by guaranteeing a minimum remuneration level.
- **Percentage of retail price model:** the final model type calculates the FIT as a percentage of the retail price of electricity. In this model the FIT tariff can vary above, below or equal to the spot price. The model places the FIT at the mercy of the market. Should the market price of electricity increase dramatically the producer will receive a considerable windfall. On the other hand, large swings in the opposite direction result a considerable loss of revenue. Such models were previously adopted by Germany (90% of retail price), Denmark (85% of retail price) and Spain (operated a variable rate according to technology) but were abandoned in 2000, 2001, and 2006 respectively.[xxi]

3.3 The UK FIT

The Labour Government launched a FIT on the 1 April 2010. The tariff, which is applicable to England, Scotland and Wales, but not Northern Ireland[xxii], is targeted towards small-scale renewable generation – installations below 5MW[xxiii] (as such it will run in conjunction with the Renewable Obligation Certificate, although the ROC will be used to incentivise large-scale generation primarily[xxiv]).

The FIT is comprised of two fixed rate tariff types, a generation tariff (details of which are outlined in Table 2) and an export tariff. The cost of providing these tariffs is to be taken-up by electricity suppliers (with a minimum of 50,000 domestic customers), with allowance made for implementation costs:

> *…it is a basic principle of FITs that the cost of the scheme should be borne by all licensed suppliers in proportion to their share of the UK electricity supply market… broadly speaking suppliers who pay out a large amount on*

> *FITs relative to their market share are recompensed for part of that expense by suppliers who spend relatively less on FITs payments.*[xxv]

This process of *'levelisation'* will be carried out by Ofgem in their roll as scheme administrators:

> *On an annual basis, suppliers will provide information to Ofgem on FITs payments they have made and other relevant information. Ofgem will use this and other sources to calculate the total cost of the scheme, and to divide that cost among all the suppliers according to their share of the electricity market (excluding any imports of green electricity from outside GB). Suppliers who have paid out less than their calculated share – including those that are not offering FITs – will need to pay into a fund administered by Ofgem. This will then be redistributed to those that have paid out more than their share.*[xxvi]

Examining the tariffs in more detail, the generation tariff is paid to households regardless of whether they export the energy generated to the grid or not. The tariff will guarantee a price rate, index-linked to inflation and differentiated according to technology type, for a twenty year period for most technology types (twenty-five years for solar PV, see Table 2 for further details). It is also proposed that the tariff will be reviewed every five years (beginning 2013) and that it will remain subject to the *'principle of degression'.*[xxvii] The latter point is explained as follows:

> *…some technologies are expected to get cheaper as volumes build in the future, so the Government has decided to adjust some tariff levels for systems installed after April 2012.*[xxviii]

The export tariff is set a 3p/kWh (linked to inflation) for all technology types. At present, in lieu of the widespread installation of smart metering, export levels are calculated at 50% of total power generated. Households have the option of installing an approved metering system if they believe they are exporting more than this assumed figure. Those who take up the scheme will also be given the option to opt out of the baseline 3p/kWh rate. Taking this option will allow small-scale generators to negotiate a price with their electricity supplier.

It is estimated that installation of a 2.5KWs of Solar PV in an average three to four-person household consuming approximately 4,500KWh per annum will result in a tax free income of £836 per annum via the FIT. This would be accompanied by a reduction in electricity cost from £450 per annum to £300 per annum.[xxix]

The FIT scheme does not set tariff rates for certain technologies. Biomass, landfill gas, waste-to-energy and power from liquid biofuels are excluded on the basis that they are technologies typical to large-scale electricity generation. The exclusion of *'innovative technologies'* – wave, tidal and geothermal – is due to their limited use, which the government argued, prevented a tariff being established.[xxx]

The FIT, as it currently exists, is a policy introduced by the former UK government. Both the Conservatives and Liberal Democrats, in their election manifestos, made commitments to retain, but alter the policy. The Conservatives made a pledge to extend the 5MW ceiling, where as the Liberal Democrats promised a more attractive FIT. The Coalition Programme for Government has made a commitment to:

> *…establish a full system of Feed-In tariffs in electricity – as well as the maintenance of banded Renewables ObligationCertificates.*[xxxi]

Table 2: UK FIT – tariff levels by technology type[xxxii]

Technology	Scale	Tariff level (p/kWh)	Tariff lifespan
Anaerobic digestion	≤500kW	11.5	20
Anaerobic digestion	>500kW	9.0	20
Hydro	≤15 kW	19.9	20
Hydro	>15-100 kW	17.8	20
Hydro	>100 kW-2 MW	11	20
Hydro	>2 MW – 5 MW	4.5	20
MicroCHP pilot	<2 kW*	10	10
PV	≤4 kW (new build)	36.1	25
PV	≤4 kW (retrofit)	41.3	25
PV	>4-10 kW	36.1	25
PV	>10-100 kW	31.4	25
PV	>100kW-5MW	29.3	25
PV	Stand alone system	29.3	25
Wind	≤1.5kW	34.5	20
Wind	>1.5-15kW	26.7	20
Wind	>15-100kW	24.1	20
Wind	>100-500kW	18.8	20
Wind	>500kW-1.5MW	9.4	20
Wind	>1.5MW-5MW	4.5	20
Existing microgeneration transferred from RO		9.0	to 2027

4 Discussion

4.1 Investment and renewable electricity development

The key aim of both incentives is to encourage investment in, and thereby increase the penetration of, renewable electricity generation. Examining the jurisdictions that have utilised the two policy types, it is evident that both have succeeded in driving up RE generation, although the rates of success have been varied.

Germany has operated a market-independent feed-tariff system since 1991.[xxxiii] In terms of installed capacity the region is the world leader in wind and solar energy production. By 2005 Germany had achieved 18,428MW of installed wind capacity and 1,400MW of installed solar capacity. This allowed the region to meet 10.2% of its electricity needs from renewable generation in that year.[xxxiv]

Denmark employed a FIT between 1993 and 2004; during this period wind power penetration grew from 500MW to over 3,000MW.[xxxv] Measured in capacity installed, by 2005, Denmark's level of renewable penetration ranked fifth in the world. However, examined from a per capita basis the region is a world-leader in installed capacity. In

2005, 3,122MW of installed wind capacity provided for 20% of the country's electricity demand.[xxxvi]

The UK ROC system has led to an increase RE penetration. The UK's installed RE capacity was 1,700MW in 2004, representing approximately 3% of electricity consumption. However, the largest proportion of this capacity was installed under the previous Non-Fossil Fuel Obligation (1989-2002), with 700MWs of the 2004 capacity attributed to the ROC scheme.[xxxvii]

Figure 1 provides a comparison of wind power development between 1998 and 2008. In the period covered, the main financial incentive utilised by the German government was the FIT model (the model has underwent a number of alteration throughout its lifespan), whereas the UK system during this period operated under the Non-Fossil Fuel Obligation between 1989 and 2002, followed by the ROC system from 2002 onwards. The figure demonstrates that although both regions began at a similar level, the growth of wind generation in Germany has been significantly more successful than in the UK. Other factors are likely to have had an impact on these development trajectories, not least *'guaranteed grid access'* and *'relatively smooth administrations procedures'.*[xxxviii] As evidenced in the statement from the European Commission above, there is a consensus that FIT model, as adopted in Germany, has had a significant impact in fostering RE development within the region.[xxxix]

By guaranteeing the price of RE for predetermined periods of time (20 years or more) and obliging suppliers/transmission services operators to purchase all RE produced, fixed rate, market-independent model FITs offer security to investors.

In other words:

> *By basing the payments levels on the cost required to develop RE projects, and guaranteeing the payment levels for the lifetime of the technology, FITs can significantly reduce the risks of investing in renewable energy technologies and thus create conditions to rapid market growth.*[xl]

It is this aspect of the model that has seen it result in rapid RE development.

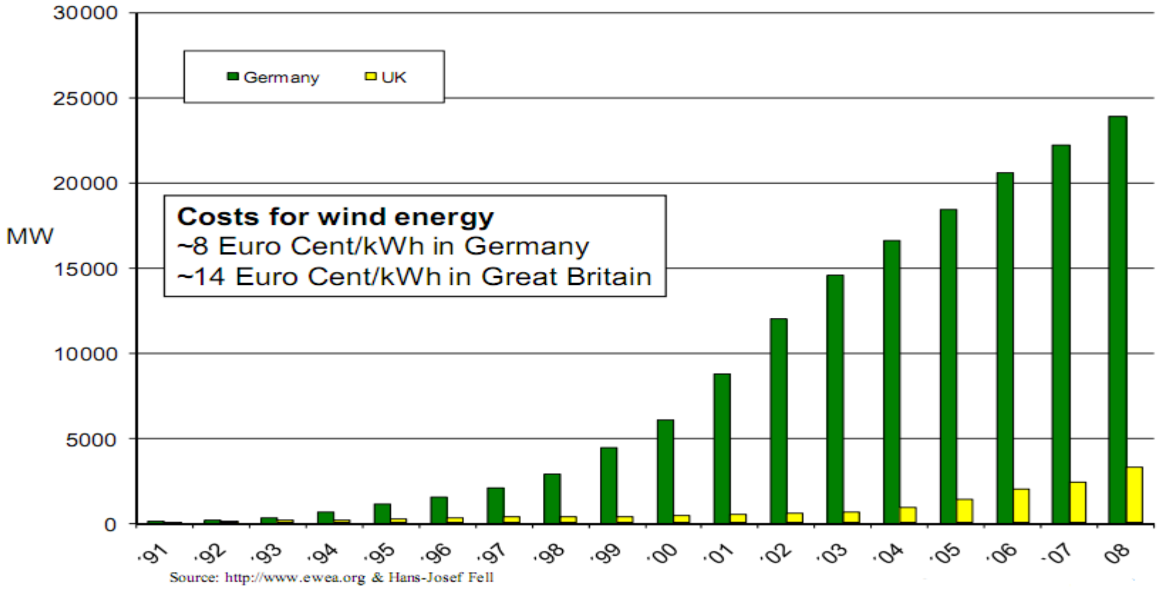
By contrast, the revenue streams provided to renewable energy generators through the ROC model and, to a varying extent, market-dependent FIT models, are intrinsically linked to movements of the wider electricity market and are therefore subject to variability. As such, investors may be put off RE projects due to the large upfront costs associated with development without a guaranteed return on investment.[xli] Market-dependent systems do not allow for the same degree of predictability as market-independent system and have proven less effective in stimulating investment. They do, however, retain the potential of offering high-profit margins.[xlii]

Long-term stability and predictability is not impossible within a market-dependent system, particularly within the ROC system. It does, however, come at a cost:

The market in ROCs is a very competitive one, but most renewable energy generators require contracts to cover ten years in length. These contracts mostly specify appropriate levels of income in return for electricity to satisfy bankers and equity investors who provide the capital investment for the projects. In order to gain these contracts electricity suppliers have to exchange the part of the value of the ROCs for the security that is offered by a long term contract with a credit-worthy supplier.[xliii]

Significantly, long term contracts are not a guaranteed element of ROC arrangements; the onus is placed upon the generator to secure terms with a supplier. This is in contrast to the fixed rate FIT which places a legal obligation on transmission system operators or suppliers to purchase renewable electricity from generators at a fixed rate, for a fixed length of time. Such issues are likely to be increasingly significant as a result of recent economic conditions, particularly the difficulty businesses are experiencing in securing credit.[xliv]

Figure 1: Wind power development in the UK and Germany 1992-2008[xlv]



4.2 Market diversity

The contrasting investment security offered by the models outlined above has the potential to affect the types of actors who invest in the RE market. The lower risk associated with the fixed-rate FIT model may help to encourage non-traditional investors into the market, particularly small-scale investors and community groups.[xlvi] By encouraging local ownership it may become possible to diminish local objections to renewable technologies. The growth of Denmark's wind industry is, in part, attributed to this. For example, a government report noted:

> *The local environmental disadvantages can lead to a lack of public acceptance of wind farms. Local ownership wind turbines (local farmers, co-operatives or companies) can ensure local acceptance of projects.*[xlvii]

The German experience also suggests that the FIT model has helped develop an electricity system with a variety of participants rather than *'conventional groups'*:

> *…the Renewable Energy Sources act has also brought about the development of a highly diverse set of actors. Many new businesses have been founded.* ***This is due, in particular, to the fact that all the participants on the market have been able to obtain loans on account of the high degree of security for investors offered by rates of compensation that are set for 20 years.***[xlviii] (Emphasis added)

It should be noted that whilst FIT tariffs have been shown to aid diversity in the market place, by encouraging the entry of smaller companies and community groups, they are not a prerequisite to such an occurrence nor do they guarantee it. The Netherlands, for example, operated a system of tradable green certificates between 1996 and 2002, a period that coincided with a significant increase in the number of farmer-owned wind farms. This growth was aided by market liberalisation which allowed farmers to choose the most lucrative contract for supplying electriricty to the grid. This position was enhanced by the formation of a farmers lobby which was able to obtain better contracts from electricity companies.[xlix]

However, it is generally accepted that the increased risk associated with ROCs and other market based systems result in a market dominated by large-scale producers, i.e. producers who can *'hedge these risks effectively':*[l] Furthermore:

> *Compared to a minimum risk approach, higher market risks increase the project cost for renewable electricity generators. Consequently a higher level of financial support is required to stimulate renewable electricity development.*[li]

This tendency towards large-scale investors is true of market-dependent FIT models also. For example, the Spanish electricity market, which adopted a *variable premium FIT policy* design (see section 3.1), has a greater concentration of corporate investors than the UK.[lii]

4.3 Funding and the impact on consumers

The cost of implementing both FIT and ROC models are often placed upon the industry. In the case of FITs, the obligation to purchase RE electricity at a favourable rate (and paying the generation tariff in the case of the UK) increases transmission system operators or electricity supply companies costs. These costs are in turn passed onto consumers in the form of increased retail electricity prices.[liii] Similarly, the ROC system introduces a form of premium for RE, which is again is transferred from the supplier or TSO onto the customer.[liv]

The question of which method represents best value for consumers is a difficult one to answer. With regard to the ROC model, the assumption is that increased investment will lead to increased competition which will in turn serve to drive overall prices down.[lv] As outlined above, evidence suggests that the UK ROC has led to a limited increase in RE penetration. Furthermore, to determine whether a specific ROC system is more competitive than a fixed-rate FIT system (for example), it is necessary for the competitive pressures on the market to reduce prices in the former system to below that fixed rate (the outcome of such comparisons would also depend on what region's FIT was considered). This is further complicated by the trade in ROCs themselves which are a profitable commodity to energy suppliers and generators (who may be one and the same).

There is some evidence to suggest that the FIT system has led to cheaper RE than the ROC system. For example, one kWh of wind power in Germany cost approximately €0.08; in the UK it is €0.14[lvi]. Whether this is due to the incentives employed by each region, rather than other factors, is difficult to determine. Further research on this issue may be desirable.

There is, however, evidence to suggest that consumers are willing to pay more for their electricity in order to secure *'green benefits'.* A variety of studies in the following years, 1998, 2001, 2004 and 2006 found that 20%, 35%, 40% and 64% of consumers, respectively, were willing to pay a premium for green energy. This increased 'willingness to pay' has been attributed to greater awareness of environmental issues.[lvii]

Despite this, that increased energy prices are linked to incentives to stimulate RE penetration, there runs the risk of placing environmental policy at odds with other social policies – particularly fuel poverty. Friends of the Earth, in their defence of FITs note that with the introduction of any incentive to promote renewable electricity *'the impact on the fuel poor must be very carefully considered'.*[lviii]

An alternative to placing the cost on the industry is for the government to subsidise the FITs. The result of this is to shift the cost from the *bill payer* to the tax payer (a method employed by the Netherlands[lix]). This method also has drawbacks. Specifically, funding of FITs and the developments of RE in general becomes:

> *…contingent on a specific budgetary allocation, [and] there is a risk that the budget will become exhausted, or will fail to be renewed…*[lx]

Furthermore, the more successful a FIT policy the more strain it will put on government resource which in turn may place strain on the longer-term future of the policy itself.[lxi]

4.4 EU Harmonisation

The harmonisation of EU renewable electricity markets remains a policy at European Commission level. Harmonisation, it is argued, has a number of benefits. Current thinking regarding harmonisation does not rule out the:

> *…creation of a system of green certificates at the European level that would be more wide-ranging and therefore more liquid, making it possible to ensure greater price stability on national markets.*[lxii]

Nor does it rule out the creation of:

> *…a common Feed-In tariff system for the whole of Europe, bearing in mind the availability of resources at the local level. This could lower the cost of all RES technologies in the different Member States once installations are no longer reserved for only some of them.*[lxiii]

Both incentive models therefore are likely to be compatible with future EU plans.

Harmonisation may also have specific benefits for the ROC system. Operating the ROC system at a pan-European level *'is likely to bring about a more stable price of certificates and alleviate the problems in setting an adequate quota'.* Furthermore, it is argued, that a European ROC market for ROCs *'can allow a satisfactory degree of liquidity in the market for technology specific certificates'.* Finally, a European market for ROCs may also serve to drive down the cost of RE by encouraging growth in areas of lowest marginal cost.[lxiv]

It should be noted, however, that the European Commission has stated that harmonisation seems unlikely in the short-term.[lxv]

5 Conclusions

Drawing on the discussion above, it is evident that market-independent incentives, such as fixed-rate feed in tariffs, and market-dependent models, such as ROCs, have both led to increased RE in the regions they are employed in. Evidence suggests that the market independent FITs have yielded more success, particularly in Germany and Denmark, than ROCs in the UK.

The greater security offered to investors by market-independent FIT models is often cited as one of the key reasons for their success. Investment security has become increasingly significant in light of recent economic conditions.

It should be noted that neither model type operates in isolation; other factors will influence the growth of renewables in a specific region (these points are to be explored in a subsequent research paper).

The low-risk nature of FIT systems ensures that they have a tendency to encourage a number of different types of energy generator into the market, local-community groups, for example. This has led a decentralised energy market in many regions utilising FIT models. Local community involvement has the added benefit of helping to overcome some of the local (often planning related) objections to renewable technology proliferation. ROC models, by contrast, favour large-scale producers who can effectively hedge the greater level of risk.

FIT and ROC models often place a burden to pay on the industry which is passed onto the consumer. Given the unknowns involved in the ROC system and the variety of FIT models in operation globally it is difficult to determine which is the most cost efficient method. There is evidence to suggest that RE is cheaper in Germany than in the UK. Further research, to determine the extent to which this is attributable to the incentives employed, as opposed to other factors, may be desirable.

However, that both models lead to higher retail electricity costs is, in the short-term, unavoidable (with the exception of funding FIT incentives through tax, a method of funding that gives rise to its own potential problems). Energy derived from renewable is likely to be at cost-disadvantage to other forms of generation, until such time as they become cost-effective due to widespread proliferation.

Two issues should be considered in relation to cost. Firstly, there is evidence to suggest that consumers may be willing to pay more for their electricity if it is derived from renewable sources. At the same time, any moves that serve to increase the cost to the consumer should be carefully managed to ensure that environmental policy does not conflict with other social policies – notably fuel poverty.

Finally, both FITs and ROCs appear compatible with European Commissions plans to harmonise EU renewable energy policy. Operating on an EU level, it is argued, will have specific benefits for ROCs – most notably driving down the cost of renewable development.

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