Briefing paper: How the U.K can incentivise the energy sector to use renewable energy.

Contents

1. Introduction

This is a briefing paper for the U.K. Secretary of State for Energy and Climate Change on the use of economic incentives to adopt renewable energy. Unlike other forms of energy government intervention is required to promote the use of renewable energy (Garcia, Alzate, & Barrera, 2012, p. 316). This is because renewable energy tends to be more costly than other energy sources and as a result is unattractive to investors as it is uneconomical (Birkett, 2012, p. 1323). As they are part of the E.U. the U.K must adhere to the 2009 Energy Directive. This means they must obtain 15% of their energy from renewable sources by 2020. However there are concerns that they will not meet this target as only achieved 6.5% of their 10% target for 2010 (Cherrington, Goodship, Longfield, & Kirwan, 2013, p. 422). Therefore the U.K. is in need of a new policy programme to increase the use of renewable energy in order to meet its 2020 target of 15%. The Secretary of State for Energy and Climate Change is responsible for renewable energy strategy and energy market reform (GOV.UK). This makes them the ideal target for this paper as they enact policy to reach the 2020 target and need to be well informed of the best policy options to make that happen.

1.1 Research Aims

1. Summarise the policy options for renewable energy economic incentives in the U.K.
2. Show the costs and benefits of these policy options
3. Advise the Secretary of State for Energy and Climate Change on the best policy action to increase the use of renewable energy in the U.K.

These aims will be realised by clearly defining the policy options available. Using statistical and contextual evidence these policy options will be measured against each other to determine the most effective policy for use in the U.K. The research conducted for this paper suggests the best policy option is Feed in Tariffs.

2. Benefits of a Renewable Energy Sector

The need to meet the E.U. 2020 target demands the increase of the percentage of renewable energy generated in the U.K. however there are wider benefits to having a renewable energy sector including energy independence, energy market stability and declining costs over time. Currently much of the U.K. energy resource demand, such as oil, is imported from unstable or unfriendly areas (Davies, 2012, p. 458). As a result these require large supply chains to move the resources to the U.K. which is costly and time consuming (Scheer, 2007, p. 21). A renewable energy sector would mean that the U.K would be less dependent on these imports as it could produce its own energy. These regions can also cause energy price fluctuations due to their political instability (Neuhoff, 2007, p. 288). Energy prices can also fluctuate due to resource constraints and demand (Neuhoff, 2007, p. 288). Renewables sources however are not subject to the same price variations as they are abundant and fairly constant (Leete, Xu, & Wheeler, 2013, p. 867). Renewable energy systems have most of their lifetime costs concentrated in their initial investment (Sørensen, 2011, p. 811). They also become cheaper with time and technological innovation whereas fossil fuels are becoming increasingly expensive (Scheer, 2007, p. 21). Hence the costs of renewable energy decline over time. Overall it is beneficial to have an increasingly large renewable energy sector as they increase energy independence, energy market stability and its costs decline over time whereas non-renewables will increase in cost.

3. Policy Options

As renewables are abundantly available and can produce near infinite energy they are not subject to the same cost variations as non-renewables (Leete, Xu, & Wheeler, 2013, p. 867). However they are still costly compared to non-renewables and cannot compete without government support (Cherrington, Goodship, Longfield, & Kirwan, 2013, p. 426). Therefore in order to reach the EU Energy Directive target of 15% the government must intervene to increase the use of renewables as the market will not do so naturally. The policy measures to increase renewable energy's attractiveness in this paper are Renewable Obligations (RO), Feed in Tariffs (FIT) and Feed in Premiums (FIP). Each policy option shall be described, its costs and benefits considered and the possible political consequences outlined.

4. Renewable Obligations

The Renewable Obligation is where energy suppliers are obligated to invest in an annually increasing amount of renewable energy as a percentage of their energy generated or pay a fee (Reno, 2011, p. 394). This "Buyout Fee" is applied per megawatt hour the supplier falls below the obligation. Per megawatt they achieve this obligation they purchase a RO certificate. The amount of money created by the buyout fee is then divided up by the amount of RO certificates and redistributed proportionally to the owners of the certificates (Reno, 2011, p. 294). The Renewable obligation scheme was introduced in the U.K. in 2002 primarily for systems over 5 megawatts (Ares, 2012, p. 2). Since 2009 this scheme has been banded so that each megawatt requires a different amount of certificates dependent on the technology used (Ares, 2012, p. 2).

4.1 Costs and Benefits

This policy incentivises the market to change through imposing a cost to their current method which can be alleviated by changing their method to the method the policy benefits. As a result the prices of RO certificates are determined by the behaviour of the market (Elliott, 2010, p. 176). This uncertainty leads to less investment as the risk is considered too high. Investors tend to only invest in low risk stable situations. Elliott (2010, p. 176) found that the RO tend to result in higher electricity prices than under other systems such as FIT. According to him the only reason that U.K. consumers did not pay more is that there were few projects. Under regular RO schemes all technologies compete the same regardless of their development or cost (Elliott, 2010, p. 182). Elliott (2010, p. 182) states that this results in only near market, highly developed and cost effective sources being used. Gürkan & Langestraat (2014, p. 86) however argue that the U.K. banded RO system helps encourage investment in newer and less developed sources by making them worth more per megawatt. This encourages research and development to make them more competitive. Gürkan & Langestraat confirmed this in their study and found that investment in less developed technology only occurs with technology banding. However they also found that the average consumer price increases with the levels of obligation placed on the energy providers (Gürkan & Langestraat, 2014, p. 92).

Garcia, Alzate, & Barrera (2012, p. 316) found that the policies to promote wind energy adopted by Germany, FIT, have been more effective that RO in the U.K. By 2004 Germany had installed 20 times more wind powered sources than the U.K. despite having a worse wind regime (Elliott, 2010, p. 174). The wind powered sources even cost less than those in the U.K. Reno (2011, p. 294) suggests that this encourages suppliers to overachieve their targets hence the rate at which renewable energy is used will increase.

A significant flaw with RO is that it only effects macro generation of renewable energy and does not address microgeneration. Not all renewable energy is generated in power stations. Small scale domestic installations can produce renewable energy through solar panels or wind turbines which contribute to the E.U. targets. However as they are not affected by RO the policy will not change the rate at which they are implemented. Whilst RO does increase the implementation of renewable energy sources the research suggests that it may be insufficient. This is because the uncertain nature of the market value of renewable energy in RO systems leads to less investment. More stability would be required to encourage investment. The usual RO systems also do not encourage the innovation and research into new or less developed sources which results in only near market sources being implemented. The U.K banded system does counter this by setting different values for sources which can be used to encourage the implementation of less utilised sources. Hence renewable obligations may not be the most effective policy to encourage the implementation of renewable energy.

4.2 Political Consequences

Renewable obligations will only benefit companies that meet them. Hence companies which are unable to meet the RO will only suffer from the policy. This is likely to generate opposition from companies who cannot or will not change their method. Due to the average consumer price increasing with the level of obligation (Gürkan & Langestraat, 2014, p. 92) the public will have to pay increasing energy prices over time. Therefore they will also be in opposition to RO as they see only costs and little or no benefits to them. However Simon (2007, p. 55) noted that the public are willing to pay increased energy premiums if it guarantees energy independence. So if the argument was made that RO will reduce the dependence on energy imports the public may be more likely to support it.

5. Feed In Tariffs

Feed in Tariffs are where all renewable electricity in the market is fixed at a pre-established price (Garcia, Alzate, & Barrera, 2012, p. 316) so that it is cheaper and therefore more competitive. FITs can also be used so households that generate renewable energy are not taxed on the sale of excess energy (Menaker, Kershaw, Letherman, Scoon, & Ng, 2012). The value of energy under the FIT is calculated to ensure profitability of generation regardless of levelized cost of energy (America's Energy Future Panel on Electricity from Renewable Resources, 2010, p. 154). The FIT was introduced in the U.K. in 2010 mainly to support generation of less than 5 megawatts (Ares, 2012, p. 2).

5.1 Costs and Benefits

Since the introduction of the scheme in 2010 there has been a boom in the introduction of domestic solar panels (Menaker, Kershaw, Letherman, Scoon, & Ng, 2012). FITs shift the burden of paying to the consumer as they drive up energy bills (Eichhammer, Ragwitz, & Schlomann, 2013, p. 22). However electricity generated on site will reduce the need for electricity supply and therefore electricity bills hence making domestic properties more likely to adopt renewable energy (Cherrington, Goodship, Longfield, & Kirwan, 2013, p. 422). Balcombe, Rigby, & Azapagic (2013, p. 633) found that home owners were more likely to install microgeneration technologies. They also found that 40% of those considering installation would not without the FIT and when the FIT was reduced the rate of installation also reduced (Balcombe, Rigby, & Azapagic, 2013, pp. 659-664).

The main advantages of FITs are stable income flow, low administration costs, high dynamic efficiency and easy entrance for new investors (Eichhammer, Ragwitz, & Schlomann, 2013, p. 15). The FIT creates a more secure investment climate for expansion as the prices are set and therefore it is stable and risk is lower (Elliott, 2010, p. 176). This makes FIT more attractive to investors than RO is it is more certain (Elliott, 2010, p. 176). Whitmill (2012, p. 1001) argues that simply rewarding capacity could lead to mass application without any incentive to innovate. However this can be countered with degression where the subsidy decreases as the technology matures. This will incentivise the improvement and innovation of technology as it is more profitable than developed technology (Elliott, 2010, pp. 182-183). FIT can also be conditioned by site to preserve areas for larger deployment or from deployment at all (Neuhoff, 2007, p. 315). Neuhoff (2007, p. 315) argues this can be used to develop a wide range of sites which increases public exposure to renewables. Hence over time acceptance of them will become normal. However FIT does not incentivise the integration of the grid and market (Klobasa, Winkler, Sensfuß, & Ragwitz, 2013, p. 127). This is needed in the U.K as the national grid infrastructure is insufficient to cope with the intermittent nature of renewables and the distance from the sources to the centre of demand (Whitmill, 2012, p. 995).

Microgeneration is the primary target of FIT so it should be considered. Motivations to installing microgeneration technologies include saving money, helping the environment, self-sufficiency and protection from energy price rises (Balcombe, Rigby, & Azapagic, 2013, p. 658). The main barriers to installation are lack of confidence in the technology and the high costs to install and maintain it (Balcombe, Rigby, & Azapagic, 2013, pp. 658-660). These suggest that the motivators can be altruistic but are often outweighed by personal gain or cost from the installation. Balcombe, Rigby, & Azapagic (2013, p. 661) suggest that additional service and maintenance responsibilities for the installed should be minimised and this could increase the rate of installation. Schwarzer (2013, p. 39) credits FITs with driving 64% of global wind power and 84% of solar power implementation. However he cautions its use by stating that price based regulation needs to take into account that demand is generally unresponsive to price changes due to lack of alternatives (Schwarzer, 2013, p. 40). When the technology reaches the cost level of existing technologies there will be no further need for incentives (Neuhoff, 2007, p. 306). Overall FIT can be used to incentivise the use of renewable energy in many ways including microgeneration, by site and by technology. It encourages innovation, the use of a range of sources and provides a stable environment for investors. In most practical applications the FIT is more effective than RO to incentivise the use of renewable energy.

5.2 Political Consequences

Electric utility companies tend to oppose FIT while renewable generators support them (Yi & Feiock, 2014, p. 392). Governments will need to be aware of investor's confidence by reducing risk to them. FIT is a stable policy which should reduce risk significantly. Cherrington, Goodship, Longfield, & Kirwan (2013, p. 424) estimate that 25000 jobs were created as a result of the U.K. FIT. Hence the public may be inclined to support FIT as it creates jobs. Elliott (Elliott, 2010, p. 182) found that FIT in Germany only increased monthly energy bills by 3% despite large numbers of projects. Also there was little concern among consumers. However governments need to be careful not to pass on too many costs to the consumers as a result of FIT. Otherwise their support may fade.

6. Feed In Premiums

Feed in Premiums are where renewable energy generation receives a bonus payment via a support system (Eichhammer, Ragwitz, & Schlomann, 2013, p. 16). Renewable energy is generated from various sources both macro and micro and then sold. This sale is then topped up via a support scheme (Klobasa, Winkler, Sensfuß, & Ragwitz, 2013, p. 128). Variations on this policy include sliding premiums and cap and floor premiums. Cap and floor premiums pay enough on top of the sale to equal a set amount (Klobasa, Winkler, Sensfuß, & Ragwitz, 2013, p. 129). So the amount paid varies dependent on the difference between the sale of the energy and the total set price. With a sliding premium, generators receive a payment based on the difference between market price and average generation costs (Klobasa, Winkler, Sensfuß, & Ragwitz, 2013, p. 129).

6.1 Costs and Benefits

Klobasa, Winkler, Sensfuß, & Ragwitz (2013, p. 127) state that FIP is a "novel" idea to keep investment risk low while increasing grid and market integration. However they found that FIP involves higher risks which increase entry barriers (Klobasa, Winkler, Sensfuß, & Ragwitz, 2013, p. 130). As a result it is more difficult for smaller investors to gain access. However investor security as a whole is not affected (Klobasa, Winkler, Sensfuß, & Ragwitz, 2013, p. 141). FIP increases the diversity of market actors and generation forecast accuracy (Klobasa, Winkler, Sensfuß, & Ragwitz, 2013, p. 142). Kitzing (2014, p. 501) on the other hand found that both FIP and FIT resulted in the same return on asset but FIT had a lower variance. Therefore FIT is more stable and less risky as it consistently returns the same amount compared to FIP. Hence FIP is more risky for an investor than FIT (Kitzing, 2014, p. 501).

Kitzing (2014, p. 501) advises to create a similar level of investor security for FIP as FIT governments should provide a considerably higher support level. Schallenberg-Rodriguez & Haas (2012, p. 294) found in their study of Spain's dual FIT and FIP system that FIP can create a more harmonised electricity market. This removes the difference between conventional and renewable energy allowing them to compete equally. However they state that if FIP is a fixed payment and market prices rise significantly there is a risk of overcompensation (Schallenberg-Rodriguez & Haas, 2012, p. 294). However Whitmill (2012, p. 998) states that the aim should be to reduce all subsidies to zero eventually anyway and this would be an appropriate situation to do so. Schallenberg-Rodriguez & Haas (2012, p. 304) also found that FIP was more costly to the consumer than FIT. Overall they do not advise a dual FIP and FIT system as it increases admin and system costs though it could be useful in the initial stages to attract the market (Schallenberg-Rodriguez & Haas, 2012).

By comparing the variations of FIP different effects can be seen. Fixed premiums send strong signals to producers but increase investment risk (Klobasa, Winkler, Sensfuß, & Ragwitz, 2013, p. 129). Cap and floor premiums on the other hand reduce the risk of over or undercompensating (Klobasa, Winkler, Sensfuß, & Ragwitz, 2013, p. 129). Schallenberg-Rodriguez & Haas (2012, p. 294) support a cap and floor approach as this simultaneously protects against price rises and falls. Finally sliding premiums are more likely to ensure profitability in reaction to market signals (Klobasa, Winkler, Sensfuß, & Ragwitz, 2013, p. 294). Overall the best variation of FIP is Cap and Floor as it ensures all renewable energy is valued the same. Fixed premiums are too inflexible and sliding premiums are too flexible. Cap and floor premiums are both stable and flexible due to its ability to fix the value of renewable energy and ensure every generator benefits the same. In comparison to RO FIP is superior as it is less risky and, if using the cap and floor approach, responds to market signals whilst remaining stable. However FIT is better than FIT as it is less risky for investors and less variable in its returns on asset (Kitzing, 2014, p. 501). Overall FIP is costly for the government as the burden is on them to pay and in a recession this may not be feasible. In a scenario such as this where prices are volatile FIT is more effective (Kitzing, 2014, p. 502).

6.2 Political Consequences

As direct consumer costs are smaller under FIT (Schallenberg-Rodriguez & Haas, 2012, p. 304) the public may not be as supportive of FIP as it would be of FIT. FIP is more risky for investors than FIT but less so than RO. Hence interested parties may be more supportive of FIT than FIP but more of FIP than RO. Small investors will prefer FIT as entry barriers are higher for them in FIP.

7. General Advice

Yi & Feiock (2014, p. 393) advise a complimentary policy program with several incentives which will be more effective when used in tandem. Therefore a multiple incentive policy may be advisable. Leete, Xu, & Wheeler (2013, p. 874) state that policy instability is a serious concern for investors as they consider investing risky when the circumstances could change so quickly. The International Energy Agency (2014) supports this as they claim that renewable energy expansion will slow over the next five years unless policy uncertainty is reduced. As a result they advise a clear long term policy vision for the industry to create a stable and risk free environment for investing. It is worth noting that renewables cannot run out of fuel or waste storage as none are required (Venables, 2012, p. 30).

Of the main renewable sources, Solar, Wind and Wave, these policies are most likely to benefit Solar in the U.K. First of all Solar is fast approaching residential load demand efficiency (Simon, 2007, p. 99) which makes it the most effective renewable source for microgeneration. As Solar panels are almost always smaller and better suited for residential installation, Wind turbines will for the most part be restricted to non-residential or macrogeneration. Wave power is less useful nationally given that it is restricted by the availability or water. Wind and Solar however are available everywhere in the U.K. Wind also suffers from being unpopular with residents due to visual and noise pollution (Simon, 2007, p. 106). This unpopularity does decrease once the turbines have been in place for a while (Neuhoff, 2007, p. 301) but remains a barrier to construction. Solar power however does not suffer from this hostility. This paper suggest that FIT is the most effective policy. As FIT benefits microgeneration most Solar would therefore benefit the most from FIT. Hence Solar would be the most popular and utilised source of renewable energy if FIT was applied.

8. Conclusion

Overall the research suggests that feed in tariffs are the most effective measures to incentivise the U.K energy sector to use renewable energy. They provide the most stable scenario for investment, encourages the use of a wide range of sources and locations and encourages innovation. RO tends to be too unstable as its price is determined by the market (Elliott, 2010, p. 176) and only reward capacity rather than efficiency which reduces innovation (Whitmill, 2012, p. 998). FIP is a better alternative to RO but is not as effective as FIT. With the cap and floor FIP variation the market can be stable but not as stable as FIT. Hence there will be less investment under FIP than FIT. The Stern Review (Stern, 2006, p. 366) found that research favours price pased support mechanisms such as FIT. Finally the Renewable Energy Association believes that the best course of action would be to stabalise the FIT to meet the 2020 targets (Venables, 2012, p. 30). In conclusion FIT is the most effect policy to increase the use of renewable energy in the U.K.

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