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An analysis of feed-in tariff remuneration models: Implications for renewable energy investment

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ABSTRACT

Recent experience from around the world suggests that feed-in tariffs (FITs) are the most effective policy to encourage the rapid and sustained deployment of renewable energy. There are several different ways to structure a FIT policy, each with its own strengths and weaknesses. This paper presents an overview of seven different ways to structure the remuneration of a FIT policy, divided into two broad categories: those in which remuneration is dependent on the electricity price, and those that remain independent from it. This paper examines the advantages and disadvantages of these different FIT models, and concludes with an analysis of these design options, with a focus on their implications both for investors and for society.

1. Introduction

Feed-in tariffs[1] are increasingly considered the most effective policy at stimulating the rapid development of renewable energy sources (RES) and are currently implemented in 63 jurisdictions worldwide (Klein et al., 2008; Ernst and Young, 2008; Mendonça, 2007; IEA, 2008; European Commission, 2008; REN21, 2009). They have consistently delivered new renewable energy (RE) supply more effectively, and at lower cost, than alternative policy mechanisms (Menanteau et al., 2003; Ragwitz et al., 2007; Stern, 2006; Lipp, 2007; Butler and Neuhoff, 2008; de Jager and Rathmann, 2008; Fouquet and Johansson, 2008; IEA, 2008). Indeed, according to a recent European Commission update on renewable energy policies in the European Union (EU), "*well-adapted feed in tariff regimes are generally the most efficient and effective support schemes for promoting renewable electricity*" (European Commission, 2008).

The central principle of feed-in tariff policies is to offer guaranteed prices for fixed periods of time for electricity produced from Renewable Energy Sources (RES). These prices are generally offered in a non-discriminatory manner for every kWh of electricity produced, and can be differentiated according to the type of technology, the size of the installation, the quality of the resource, the location of the project, as well as a number of other project-specific variables (Mendonça, 2007; Fouquet and Johansson, 2008; Langniss et al., 2009). This enables a greater number of investors to participate, including homeowners, landowners, farmers, municipalities, and small business owners, while helping to stimulate rapid renewable energy deployment in a wide variety of different technology classes (Klein et al., 2008; IEA, 2008; Lipp, 2007; REN21, 2009).

In the most successful[2] jurisdictions, the FIT payment levels offered to particular projects are determined as closely as possible in relation to the specific generation costs (Mendonça, 2007; Klein et al., 2008). More specifically, they are designed to make it possible for *efficiently operated* RE installations to be cost-effectively developed (RES Act, 2000; Fell, 2009).

By basing the payment levels on the costs 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 conducive to rapid market growth (Lipp, 2007; IEA, 2008). This structure provides a high degree of security over future cash flows, and enables investors to be remunerated according to the actual costs of RE project development. This security is particularly valuable for financing capital-intensive projects with high upfront costs, and a high ratio of fixed to variable costs (Guillet and Midden, 2009; see also Harper et al., 2007).

Ensuring that the FIT payments are adequate to recover project costs over the life of the project, while allowing for a reasonable

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[1] Feed-in tariffs (FITs) are also known as Standard Offer Contacts, Feed Laws, Minimum Price Payments, Renewable Energy Payments, and Advanced Renewable Tariffs.

[2] Successful here means that substantial amounts of renewable energy deployment have taken place, in relation to the existing electricity supply portfolio. Examples of such jurisdictions include Germany, Spain, Portugal, and Denmark (REN21, 2009; BMU, 2009).

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return, remains one of the central challenges of a successful FIT policy (Klein et al., 2008; Mendonça, 2007).

2. FIT policy design: focus on remuneration models

Beyond ensuring the FIT payments are adequate to cover project costs, experience has shown that the specific design and stability of the remuneration scheme is essential to efficient and well-functioning FIT policies, and crucial to maintaining investor confidence (Ragwitz et al., 2007; Held et al., 2007; European Commission, 2008; Dinica, 2006). However, a survey of the different jurisdictions that currently employ FIT policies for renewable energy development reveals that there are many different ways to structure the remuneration of a feed-in tariff policy, and that different jurisdictions have had varying degrees of success (European Commission, 2008; Langniss et al., 2009; Klein et al., 2008; REN21, 2009). This paper focuses on seven models that are in use in different jurisdictions around the world, with a particular focus on their impacts on overall renewable energy investment risk. Each subsection explores a different policy design option, drawing on particular examples to show where each particular design has been, or is being, used.

It is important to note that these policy design options are not mutually exclusive; they can be used in conjunction with one another as policies are tailored to a jurisdiction's specific context and needs. These different policy options represent different ways of structuring the way in which feed-in tariff policies remunerate renewable energy developers for the electricity they produce. Properly designing the remuneration scheme so that it offers sufficient investment security, and a reasonable return on investment, is essential to leveraging significant amounts of capital for renewable energy development (see IEA, 2008; Dinica, 2006).

As renewable energy continues to develop to meet the combined challenges of mitigating climate change, increasing energy security, and reducing exposure to fossil fuel price volatility, it is expected that FIT policies will continue to be used as a policy option to drive renewable energy development. This focus on the design of FIT payment models provides a focused perspective on FIT policy design, one that sheds light on the way FIT payments can change over a project's lifetime, and the way in which these changes can influence investor confidence and the pace of RE deployment.

3. Market-dependent vs. market-independent FIT models

A central difference between feed-in tariff policies is whether the remuneration they offer to renewable energy developers is *dependent* or *independent* from the actual electricity market price (Klein et al., 2008). Market-independent FIT policies are generally known as fixed-price policies, since they offer a fixed or minimum price for electricity from RES delivered to the grid (Mendonça, 2007; IEA, 2008). Market-dependent FIT policies are generally known as premium price policies, or feed-in premiums, since a premium payment is added above the market price (Mendonça, 2007; IEA, 2008). This premium can be designed either to represent the environmental and social attributes of renewable energy, or to help approximate the generation costs of different RE technologies (Ragwitz et al., 2007).

The most commonly employed feed-in tariff policy option is the market independent, fixed-price option (European Commission, 2008; Klein et al., 2008). Fixed-price FITs typically offer a guaranteed minimum payment level based on the specific development cost of the technology for every kWh of electricity sold to the grid. Note that the final determination of the FIT payment can also be influenced by the public policy objectives of the jurisdiction.[3] Furthermore, fixed-price FIT policies are generally accompanied by a purchase guarantee (Mendonça, 2007; Fouquet and Johansson, 2008).

In contrast, market-dependent FIT policies require that renewable energy developers provide their electricity to the market, effectively competing with other suppliers to meet market demand (IEA, 2008); they then receive a premium above the spot market price for the electricity sold (Langniss et al., 2009; Mendonça, 2007).[4] Under market-dependent FIT policies, payment levels tend to rise in step with rising retail prices, and vice versa. In order to avoid windfall profits when average market prices rise, some jurisdictions have begun to implement caps and floors on FIT premium amounts to ensure that overall remuneration remains within a reasonable range without placing undue burden on ratepayers when market prices increase. For instance, Spain has recently adopted both a cap and a floor for its premium amounts (Spanish Royal Decree 661/2007), and similar proposals have been made for Germany, though they have not yet been adopted (Langniss et al., 2009; Diekmann, 2008).

In order to allow greater investor choice, some jurisdictions offer both the fixed price and the premium price option to renewable energy developers, leaving them the choice to decide which policy option is best suited to their individual risk appetite and investment model.[5] However, the added transaction costs of marketing one's electricity on the spot market arguably make the premium price option better suited to larger market participants, rather than individual homeowners or community-based investors.

4. FIT policy design options

Seven different ways to structure market-independent and market-dependent remuneration schemes are examined here, discussing four in the former category and three in the latter category, on the basis of experience from a number of jurisdictions across Europe and North America. A brief analysis will accompany each model, focusing in particular on each model's impact on investment risk, analyzing the main strengths and weaknesses of these different ways of structuring FIT policies.

4.1. Market-independent FIT policies

In market-independent FIT policies, the first and most basic option is to establish a fixed, minimum price at which the electricity generated from RES will be bought for a contracted period of time, and to leave that price fixed for the duration of the contract, irrespective of the retail price of electricity (Fig. 1). The *fixed price model* therefore remains independent of other variables, such as inflation, the price of fossil fuels, etc. and can be determined in a project-specific manner in relation to the cost of developing each renewable energy resource.[6]

[3] For instance, this could include consideration of what the targeted rate of return should be, or whether the FIT payments should be designed aggressively or conservatively. For instance, Fell (2009) states that Germany targets a rate of return of 7%, while Gonzalez (2008) refers to Spain targeting returns of 5–11% depending on the technology type.

[4] The possibility of signing bilateral contracts is also allowed in jurisdictions like Spain.

[5] Spain, the Czech Republic, and Slovenia each offer both the premium and the fixed tariff option (Klein, 2008).

[6] In these projections, it is assumed that retail prices for electricity will trend upward due to increases in the prices of commodities, fossil fuels, and the