



Renewable electricity support systems: Are feed-in systems taking the lead?



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ABSTRACT

Support systems for renewable-energy-sourced electricity (RES-E) can be classified into price- and quantity-based systems. Their most representative instruments are feed-in systems (price-based) and quota systems, e.g. green certificates or a Renewable Portfolio Standard (quantity-based). The origins of these support systems are quite different and are motivated by different political and economic needs. Likewise their geographical distribution and effectiveness also differ. Worldwide feed-in systems are the most widespread RES-E support system. In recent years, some classical quota countries have partially (or even totally) changed to feed-in systems. Feed-in systems seem to encourage higher RES-E deployment, technology diversity and investor security. Although the manufacturing capacity for certain RES-E technologies has been more developed in some feed-in countries, lately this has changed to some extent due to the incorporation of emerging countries in the RES-E industry. Traditionally, quota systems appeared to be more compatible with liberalisation of the electricity market. However, since the introduction of the premium system, this argument can be countered, since feed-in premiums can be considered compatible with the electricity market as quota systems. Regarding the price paid for RES-E in quota-countries, higher green certificate prices have not led to higher RES-E quantities. Moreover, the relative support levels in quota-countries are higher on average than in FIT-countries, contradicting the common argument that quota systems are more cost effective. Additionally, feed-in systems, especially if stepped tariffs are designed, encourage higher RES-E geographical dispersion; avoiding the concentration of RES-E facilities in just a few locations, which can lead to NIMBY –Not In My Back Yard– syndrome. All these factors may explain the steady spread of feed-in systems worldwide. The purpose of this paper is to assess the performance of quota and feed-in systems, thereby contributing to the worldwide debate on the suitability of the different RES-E support systems.

1. Introduction

Over the last few decades, different support systems have been applied to stimulate RES-E investments. Two support systems in particular have been applied the most: feed-in systems and quota systems (green certificates or RPS –Renewable Portfolio Standard–).

In feed-in countries, the distribution network has to accept RES-E fed into their networks. RES-E generators are paid a price, fixed or variable, for their electricity production [1–6]. Feed-in tariffs are currently the most common system in the European Union. The cost of the feed-in system is covered by the electricity consumers, by taxpayers via government budgets or through a combination of both systems [7].

Based on the experience in feed-in countries, several assessments of the efficiency and effectiveness of feed-in tariffs have been published [6–15]. The main advantage of this system, as described in these assessments, is its effectiveness in promoting technology development and in achieving higher RES-E production [4].

In tradable green certificate systems (TGCs), RES-E is sold at the market price and this income is complemented by the certificate price. These certificates are sold in a parallel market for green certificates. Certificates are bought by electricity suppliers or consumers, who must buy certificates up to a certain amount (percentage) of their total electricity production or consumption. Countries like Belgium (Flanders), Sweden and the UK have been early adopters [4]. According to the existing academic literature (most of which is based on either theoretical analyses or simulation approaches), the expected main advantages of TGCs are: cost-efficiency, stable development (the quotas have to be met within a timeframe) and cost-reduction [7,11,13,15,16]. However, due to the absence of long-term market experience, it was still unclear whether certificate systems could meet these expectations. However, there is now enough available data to make an assessment of the performance of green certificate systems.

The purpose of this paper is to assess the performance of quota systems and feed-in systems, thereby contributing to the worldwide debate on the suitability of the different RES-E support systems.

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2. Main RES-E support systems

Nowadays, there are three main instruments to promote electricity produced from renewable energy sources (RES-E). These instruments are: feed-in systems, quota systems and tendering systems, of which feed-in and quota systems are the most widespread. Besides these three main instruments, there are other complementary mechanisms, including investment subsidies and tax incentives.

Different approaches have been used to classify RES-E support schemes. However, the most common categorization is the one that distinguishes between price-based and quantity-based systems.

Categorization of price- versus quantity-based systems:

Price-based instruments

1. Feed-in systems: feed-in tariffs (FIT) and feed-in premium (FIP)
2. Investment subsidies
3. Fiscal incentives

Quantity-based instruments

1. Quota systems
2. Tendering or bidding systems

The main difference between these two sets of instruments is the way they stimulate demand: by setting the RES-E price (price-based) or by setting a percentage of RES-E to be fulfilled (quantity-based). In general, price-based instruments set the price of the RES-E unit and thus leave the determination of the RES-E quantity to the market. On the other hand, quantity-based instruments set an obligation upon consumers or utilities to consume/generate a certain amount of RES-E, leaving the determination of its price to the market.

2.1. Feed-in system

Feed-in systems are the most common policy instrument for RES-E support. They are in use in the majority of the EC Member States and in most countries in South-America, Asia and Africa.

The term feed-in system is used for two different systems: the feed-in tariff (FIT) and the feed-in premium (FIP). The feed-in tariff (FIT) consists of a fixed price paid to RES-E producers per unit of electricity. The tariff amount changes depending on the technology. The feed-in premium (FIP) system consists of a payment (called premium) on top of the electricity market price. The premium amount is also technology dependent [6]. The FIP is a more market-oriented variant of the FIT [17]. The premium system is in use in Denmark, Spain, Czech Republic, Estonia, Finland, Germany, Italy, the Netherlands, Slovakia and Slovenia, in combination with other support instruments or as the main support system [18].

The tariff is usually set for a number of years, to provide security to investors for a substantial part of the project lifetime [19]. There have been different adaptations of the feed-in system over time.

The additional cost of this system is usually paid by end-consumers, although in some cases, like in Denmark, the cost has been assumed by the government [20].

2.2. Quota system

Quota obligations are used to impose a minimum production or consumption of RES-E [19]. Consumers (or electricity utilities) have to acquire a number of green certificates from RES-E producers according to a consumption percentage –quota– (in case of consumers) or production percentage (in case of electricity utilities).

Quota systems include two different concepts: the quota, which is the percentage of RES-E electricity to be supplied obligatory, and the physical certificate generated per RES-E unit, which guarantees that

the electricity produced comes from RES. Quota obligation and Green Certificates or Tradable Green Certificates are the most common terms used in Europe for these two concepts. In other countries the terms used are different. For example, in Great Britain the term used for the quota is Renewable Obligation (RO). In the U.S. the term used for the certificates is Renewable Energy Credits (REC) and the quota is determined by the Renewable Portfolio Standard (RPS). In Australia the quota is determined by the Mandatory Renewable Energy Target (MRET) and the certificates are called Renewable Energy Certificates (REC). In this article, the terms quota and green certificates will be used for the quota obligation and the certificates, respectively.

2.3. Bidding systems

Tendering or bidding systems are not as common as the previous two systems, although lately they have been gaining some ground worldwide [21]. They have been used in a small number of countries for some periods but, in most of the cases, the system has been replaced. In the EU, this system was used in two countries [17], both of which have now changed to other instruments.

Tendering systems are based on public call for tenders. Potential investors have to compete in public bidding. The Government opens bidding rounds offering a certain quantity of RES-E. In each bidding round, the lowest offers are selected until the pre-determined amount of RES-E is reached. Once tenders are resolved, RES-E electricity is paid at the marginal bidding price. The additional cost is usually passed to consumers through a specific charge.

Bidding systems have a stop-and-go nature that does not lead to stable conditions. This support system involves the additional risk of marginal bids being too low, resulting in the possibility of projects not being implemented [17], as has occurred, for example, in several bidding rounds in the UK [22,23].

This system is usually also technology dependent. This means that wind projects compete against other wind projects but not against, for example, biomass projects. The marginal accepted bid usually sets the price for the whole technology band [19].

2.4. Complementary measures

Besides these three main instruments, there are other complementary mechanisms, including investment subsidies and tax incentives. These mechanisms are usually an additional policy tool.

2.4.1. Tax incentives/Fiscal measures

Pure tax incentives are usually not implemented alone. They were used alone in the past in two EU countries but, in most cases, this instrument is used as an additional policy tool [17]. This mechanism may take different forms, from rebates on general energy taxes, rebates on special emission taxes, proposals to lower VAT rates, tax exception for green funds, to attractive fiscal depreciation schemes [19].

2.4.2. Investment subsidies

Investment subsidies can help to overcome barriers of high initial investment costs, usually associated with renewables. This type of subsidy is used to stimulate investments in more expensive renewable energy technologies. Loans with low interest rates can also be included within this scheme. This incentive was used more often in the past than nowadays.

3. RES-E support systems: the origins

3.1. Why is government intervention needed?

Governmental support for renewable energies has a long history, particularly in Europe and North America, the first continents to implement RES-E support systems. The ulterior motive that led to the

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