New Competition-based Support Schemes for Electricity Generation from Renewable Energy Sources[1]

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Abstract
The paper takes a closer look at the regulatory policies for the promotion of electricity generation from renewable energy sources which are currently at the center of discussion in the European Union, including competition-based support schemes, fixed feed-in tariff and fixed premium schemes. It argues that the 'success' of the policy implemented does not only depend on the basic mechanism of the incentive scheme, but also on general regulatory and external issues as well as on the specific design, as several modifications and combinations of the basic instruments are possible.

INTRODUCTION

Within the European Union (EU), most renewable energy options are still not competitive under today's national regulatory frameworks despite of the substantial technological advancements and cost reductions that have been reached over the past decade. Yet, they are politically preferred for a number of reasons. The threat of global warming and other environmental hazards might be the dominant arguments for the promotion of renewable energy sources in most countries. However, other policy goals often play an important role as well, for example energy independence, regional or agricultural development, international competitiveness (expansion of the domestic export industry sectors). Definitely, not all objectives can effectively and efficiently be achieved with just one policy instrument. But the correct use of economics can fashion policies to structure the market so that clearly defined social goals are attained most efficiently. The following analysis starts from the assumption that the main policy objective is to achieve a large(r)-scale market penetration of renewable energy technologies in the EU electricity sectors in the medium term (i.e. for example to reach the Commission's indicative target of about 20 percent renewable energy in the electricity sector by 2010 [1]). This implies that the focus of this paper is on electricity and on assessing regulatory regimes directly supporting renewables and best creating a market for those renewable energy options that are nearly competitive.

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Due to liberalizing European electricity markets, the issue of 'new' regulatory policies for electricity generation from renewable energies is on the political agenda in most of the EU Member States as well as on the EU level. In particular the European Commission has strongly encouraged ambitious targets and competition-based support schemes for a large(r)-scale market penetration of renewable energies in their recent – official and internal – documents [2] [3]. Two types of competition-based regulatory measures are usually distinguished:

- Renewables Portfolio Standard (RPS) or Quota-based systems (with Green Certificate trading) and
- Bidding or Tender-based systems.

Within the EU, the former has only been introduced in the Netherlands so far. But in spring 1999, Denmark decided to switch to such a system and to already get in under way next year, Italy implemented regulations into that direction and at least in one more country, the United Kingdom, Green Certificate trading is currently being discussed as a serious future option complementing other instruments. On the other hand, the latter type has been used in all countries of the U.K. as well as in Austria and in France for several years.

Though, in the past, fixed feed-in tariff regimes have been the predominant scheme in EU Member States. The European Commission now maintains that they should be progressively phased out, as it does not consider these price support policies compatible with liberalizing markets and free trade [2] [3]. But due to strong resistance from individual Member States and industry sectors, the final outcome of the Commission's harmonization efforts will remain unclear at least until fall of this year. For these and other reasons, feed-in tariff schemes are included in the analysis below.[2]

In a first step, the basic elements and possible modifications of the three different approaches are outlined and evaluated from an economist' point of view. Then, experiences gained in countries that have implemented competition-based systems are briefly analyzed and compared to the impacts in countries with fixed feed-in tariff regimes. Finally, some general design principles are derived that are regarded important for the incentive schemes to function successfully and efficiently.

BASIC ELEMENTS OF (SELECTED) SUPPORT SCHEMES

The support mechanisms discussed here either aim at influencing (reducing) the price level by regulating the quantity of renewable electricity (quota-based and bidding systems) or at influencing (increasing) the quantity by regulating the price level (feed-in tariff schemes).

The two basic elements of a **fixed feed-in tariff system** are the purchase/dispatch obligation on network companies or the systems operators and the legally guaranteed fixed (minimum) tariff per kWh that is produced and delivered to the grid to be paid to the renewable electricity generator. Typically, a law defines what kinds of energy resources, technologies, installations and generators are qualified to get the guaranteed price for the electricity provided. Large hydro plants and public vertically integrated electric utilities are often excluded from this type of policy. Regulatory authorities use different calculation bases to determine the price level of the tariff so that the level can vary considerably from system to system. Different time frames to provide the output subsidy for a specific renewable power project can be set in addition.

[2] Fixed premium schemes have been adopted as another possible type of mechanism to advance electricity generation from renewables in the most recent working document of the Commission [3]. They are not discussed here any further, since the idea is rather considered as preliminary and since this type of scheme has not yet been operated or debated in any Member State.

Under the German Electricity Feed Law (EFL), for example, certain percentages of the average utility revenues gained from selling electricity to consumers are paid to eligible electricity producers with no time limitation or quantity degression.

Several decisive disadvantages are intrinsic in fixed price systems. Competition is not even encouraged between different renewable sources of power, let alone with fossil-fuel sources. No mechanism ensures that renewable electricity is generated at the least social cost possible (no cost-effectiveness), and possible cost reductions are not reflected in lower guaranteed or 'market' prices. The incentive for technological development and innovation is insufficient, thus, there is a lack of dynamic efficiency in such systems. Possible modifications to lessen some of these major shortcomings, in particular in the light of liberalization, include 1) the restriction of the price subsidy to a fixed period, and 2) the decrease of the guaranteed tariffs over time. Yet, in the latter case the frequency of regulatory interventions might grow what leads to higher uncertainty for potential investors. Moreover, the government is definitely not in the position to determine the optimal reduction rate of the price subsidy ?

The choice of the financing model is another crucial parameter of fixed tariff systems as some design options can make it discriminatory and intransparent. Up until another revision of the German EFL in April 1998, the electricity company that was obliged to buy the renewable electricity carried the financial burden. There was no regional balancing or compensation mechanism. Now the distribution or transmission companies can cover their additional cost by an extra charge to the transmission and distribution rates and thus make other companies and customers which use the utilities' wires pay their share. Nevertheless, in a competitive market, the inhomogeneous regional distribution of renewable energy sources may cause substantial distortions in the medium run. Acceptable solutions to this problem, as for example setting up a national fund, are currently discussed in Germany. In the 'old' Danish system, the guaranteed tariff has been supplemented with state subsidies per kWh delivered to the grid. Thus, one must acknowledge that competitively neutral financing models are available; however, such more centrally regulated solutions induce higher administrative costs.

Regardless of the specific design of a fixed feed-in tariff system, one decisive disadvantage can hardly be overcome. This type of mechanism fails to establish competition and a functioning market and thus to attain the objective of a large-scale market penetration and competitiveness of renewable energy technologies in the medium and long run. For a low-level market take-off and to reach a critical scale, guaranteed feed-in tariffs schemes might be appropriate.

In a **bidding system**, power purchase contracts are awarded to eligible investors in renewable generation technologies on the basis of competitive tenders. The bidding rounds for a politically determined level of capacity are repeated regularly on the basis of certain selection criteria. Generally, the price offered is the essential selection criterion. Planning permission and credibility are others. The investment, operation or output premiums guaranteed by the awarded contracts are financed by a competitively neutral method of creating a pool of funds, e.g. by a system benefits or grid charge. In the British system, the extra costs are funded by a percentage levy charged on all customers' electricity bills. Thus, the pool is usually centrally collected and managed. Equally, the orders are set and organized by government or a regulatory authority. Network companies are obliged to purchase the respective electricity.

The main advantages of a bidding scheme over a fixed feed-in tariff system are that it exerts downward pressure on prices and that it sets incentives for technological improvements. In theory, a determined quantity (target) of renewable generation capacity can be established cost-effectively. A time limitation of reimbursing extra costs is part of the competitive orientation of the scheme. Its main disadvantages lie in the dependence on public administration

and in the stop-go nature of successive rounds. The latter problem can be reduced by the frequency of tender procedures, but it cannot be overcome completely. The transition to a commercial market for renewable generated electricity cannot be as smooth as in the quota-based system with tradable certificates, even though the system permits a number of relevant parameters, like the definition of the growth rate over time.

EURELECTRIC has suggested modifications to a bidding scheme that allow a larger market exploitation and the international expansion of the bidding procedure [4]. The electricity generated from renewable resources would be sold to a local grid or supply company at market price, while the premium results from a call for tender on a wider basis. Hence, there would be two different products competing in two distinct markets – analogous to the Green Certificate trading scheme outlined in the following.

The primary concept of the **quota-based or renewables portfolio standard (RPS) policy** is that a minimum percentage of all electricity produced or consumed in a country should come from renewable resources. To achieve this goal, a specific group of the electricity supply industry (generators/ grid operators/ distributors/ suppliers or final customers) is obliged to generate/ transmit/ distribute/ sell or buy a specified amount of electricity generated from renewable energy sources within a certain time period. Green Labels / Credits are issued to renewable electricity producers that certify the type, date, location, quantity and optionally other characteristics of the renewable electricity they have generated. The fulfilment of the quantity obligation is demonstrated by the possession of the respective amount of Green Certificates at a fixed date.

The obliged party has a rather high degree of freedom to accomplish the requirement. It can

- invest in/ use its own renewable facilities and then have the kWh produced certified,
- purchase contracts for both electricity from renewable energy and Green Certificates, or
- just buy Certificates, either directly from a generator or from a broker.

Two markets are created, one for electricity generated from renewable sources and one for the Green Certificates, i.e. the 'greenness' or other additional benefits of renewables. The two products can be sold separately or as a package. Such a regime facilitates the attainment of (a) minimum level(s) of renewable electricity generation at least cost by creating a protected and guaranteed, but commercial market for near-market renewable technologies. Competition is stimulating innovation processes and keeping a productive dynamic in the market, if the quota is not set too low and intermediate and long-term targets are clearly defined as well. Government involvement can be limited to determining the (renewable portfolio) standards, certifying the labels on the supply side and monitoring compliance on demand side. Yet, other institutional bodies are necessary for a functioning certificate trading market, as an issuing authority, a trade registrar etc. [6]. Therefore, a quota-based system involves comparatively high administration costs. Likewise, investment risks (and opportunities) can be higher than under the two other types of schemes analyzed, for example due to fluctuating prices.[3]

A variation of the RPS policy just outlined is under discussion among Germany electric utilities, the main difference being that isolated trade of electricity and Green Labels would not be allowed. With that restriction, the so-called 'Handelsplatzmodell' rejects a central element of the market-based, competition-oriented Tradable Green Certificates system [9]. The question of grid access and electricity price for renewable electricity is closely linked to their reasoning. So far most of the RPS schemes implemented and proposed run on a dispatch obligation for systems operators and a fixed 'market' price for electricity from small renewable facilities!

[3] Refer e.g. to [6] [7] [8] for more information and detailed analyses.

(SELECTED) NATIONAL EXPERIENCES

In EU Member States, the only renewable source of energy which had been exploited on a significant scale before 1990 was (large) hydropower. During the nineties, growth rates have generally been two-figure for non-hydro renewables due to a diverse range of renewable electricity promotion policies by all national governments and the European Community. Not all countries and systems can be examined here.

The **German Electricity Feed Law**, chosen as example for a fixed feed-in tariff scheme, in combination with other national and state programs, has brought Germany into the number one position world-wide in wind energy generating capacity (cf. Table 1). In 1998, some 1,000 new wind turbines with an overall electrical power of some 800 MW were set up. So the total capacity installed almost reached 3,000 MW (2,875 MW) at the end of 1998. Already in the first 6 months of 1999, more than 500 additional MW of wind power were installed – a new record. However, wind power plants still only accounted for about 1% of total electricity generation in 1998. It is still a long way to go before the unofficial, indicative political target of a 10% share of renewables in electricity supply by 2010 can be reached.

On the other hand, Denmark has already arrived at this 10% share. Looking at the numbers from this perspective, Denmark is the European leader in electricity generation from renewable sources; the renewable share increased more than in other countries over the last decade. Yet, both regulatory schemes have been rather expensive, since the independent producers have received an above average subsidy per kWh supplied to the distribution network for many years. Economic theory can also be maintained with respect to price reductions. In the U.K., the guaranteed feed-in tariff has decreased by more than 50% from the first bidding round (NFFO1) in 1990 to the fourth (NFFO4) in 1997. So the competition-based system seems to have succeeded in driving down the price of renewable electricity, whereas the fixed feed-in tariff systems in Denmark and Germany have not (cf. Table 1 and Footnote 4).

Table 1: Electricity from Renewable Resources – Some Data*

	Denmark	Germany	The Netherlands	United Kingdom
Installed Capacity of Wind Power (in MW)				
1990	340	48	57	10
1992	460	180	110	50
1995	620	1100	260	200
1997	1100	2100	340	310
1998	1500	2900	375	540
Electricity generated from renewables (in % of total) (excluding large hydro, incl. waste incineration)				
1990	2.4	0.9	1.4	
1994	5.6	2.2	2.0	
1997	8	2.4	3.5	0.9
1998	10	2.7		2
Average prices paid for wind power in Euro/kWh				
1990	0.08 – 0.09	0.07 – 0.09		0.58-0.10**
1991	[price has re-	[price range has		0.097**
1994	mained in this	remained stable		0.044**
1997	range since 1991]	over last years]		0.036**

Sources: [2], [5], [9]

* numbers are rounded (to two significant digits), ** in p/kWh

Five Orders of the **Non-Fossil Fuel Obligation (NFFO)** have been the main mechanism for the development of renewable electricity in England and Wales. The proclaimed target was to build 1,500 MW generation capacity by 2000. In June 1998, NFFO had resulted in the construction of some 490 MW of new renewable energy projects out of 2,100 MW which had been awarded contracts, that means that only about a quarter of the successful tenders were actually realized.[4] The main reasons for projects not proceeding have been 1) the failure to receive the planning permission and to secure local planning consent. Yet, it must be emphasized here that this issue is in general not linked to the type of support scheme. 2) There was a contract barrier in the first two NFFO rounds. Contracts were only guaranteed up to 1998 (or for maximal 6 years). Nevertheless, most of the NFFO1&2 projects, representing some 315 MW capacity, have now entered the open market successfully after their contracts expired in December 1998. In subsequent rounds, successful bidders have got five years to commission the project and have received their Power Purchase Agreements for up to 15 years from commissioning. Present assumptions about completion rates suggest an overall completion rate of 65 to 70% for NFFO3&4 what equals an additional 800 to 900 MW capacity.

In 1996, the **Dutch** energy distribution companies signed a voluntary agreement, in which each electricity distribution company committed itself to fulfil a share of the overall sector obligation of 1.7 TWh renewable electricity (3.1% of sales) to be reached by the end of 2000. In order to take into account the different regional costs and simultaneously minimize the total cost for all distributors, a system of **tradable Green Labels** was introduced on January 1, 1998 – the first scheme of its kind in Europe[5].

Since the first binding target is set for end of 2000, it is just first experiences that can be summarized here. The Dutch Green Label system has earned a lot of attention in the electricity industry all over Europe, and some governments have already decided to follow the Dutch pattern. At the end of 1998, the distribution companies were about 40% short of their obligation. Most Green Labels have been bought on the basis of bilateral and long-term contracts. Separate trade of electricity and labels seems to have been the exception. The market transparency is not satisfying yet. Trading might get a push, though, when the deadline for meeting the obligation is approaching. Also the infrastructure for the certificate exchange has to be established and improved. It may be implemented either attached to the Amsterdam Power Exchange (APX) or as an independent institution. Planning procedures and uncertainty about the post-2000 regime have so far turned out to be the main barriers for a larger investment in renewable energy capacities.

COMMON ISSUES

For sustainable energy systems to become an interesting area of business activity for the market players, long-term political targets and commitment on behalf of governments and politicians are needed. But intermediate goals are necessary as well, they are more or less intrinsic to a quota-based as well as a bidding system. Otherwise it is very unlikely that any support mechanism will be successful. It is general consensus that the regulatory framework in the U.K. has been too uncertain in the past. In both countries, the U.K. and the Netherlands, potential investors complain about the uncertainty about what happens after NFFO5 and 2000 respectively. In Germany, new investments in wind turbines dropped dramatically in 1996

[4] These figure do not include the fifth Order made in 1998. NFFO5 has attracted bids from 408 projects with a total capacity of ca. 2,580 MW. The average bid price is 2.86p/kWh, that means a 22% reduction in comparison to the average contract price under NFFO4 in 1997. (cf. http://ww.open.gov.uk/offer/offerhm.htm)

[5] Refer e.g. to [6] [7] [8] for more information and detailed analyses.

when the future was unclear due to pending court decisions and law amendments.

Another issue to be settled for all renewable energy policies alike is the definition of renewable energy sources and technologies (e.g. whether to include waste incineration or not). Moreover, policy objectives have to be clear and based on that a decision can be made whether large hydropower plants and 'old' plants are qualified for participation or not. Technology diversity and bands, sanctions for non-compliance, and international expansion are further keywords important for the design of all support schemes.

Finally, planning procedures and barriers relating to the siting of the installation as well as of grid access and tariff regulations should absolutely be taken into account when implementing a regulatory framework for the electricity sector, since they can be essential factors for the 'failure' of any incentive scheme.

CONCLUSIONS

A delayed EU draft directive on electricity from renewable energy sources is now expected in fall of this year. It is unclear whether the proposal will still contain nationally binding targets for the electricity share generated from renewable energy sources. Most probably the directive will emphasize the subsidiarity principle that gives national governments a high degree of freedom for their national renewable energy policies.

Against the background of liberalizing electricity markets and existing ambitious targets for the market penetration of renewable energies, support schemes that are based on competition and contribute to creating a level playing field should be clearly favored. Setting market standards for renewables and facilitating Green Certificates trading is a promising policy approach for addressing these and future concerns (if carefully designed). A system with Green Certificates trading has the advantage to be very flexible; it might be more easily extended to other energy sectors or merged with the European bubble approach to CO_2 reductions and emissions trading. The issues just addressed remain to be studied in depth, however.

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