EmPowering the World with Renewable Energy
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PROMOTION SYSTEMS FOR ELECTRICITY GENERATION FROM RENEWABLE ENERGY SOURCES REVISITED

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ABSTRACT

To increase the share of electricity from renewable energy sources (RES-E) different strategies are implemented in various countries. The core objective of this paper is to extract lessons learned from promotion schemes in Europe and to derive resulting recommendations for future.
The major results are: (i) The success stories of RES-E in Europe in recent years has been triggered by FITs; A well-designed (dynamic) FIT provides a certain deployment of RES-E fastest and at lowest costs for society; (ii) TGC systems in recent years especially in Europe have eroded gradually: they have come closer and closer to FIT (like in Italy or Belgium). The only country where certificate trading systems prevail with good performance is Sweden.

1. INTRODUCTION

Different strategies to increase the share of electricity from renewable energy sources (RES-E) are implemented in different countries. In Europe the European Union has set ambitious targets for increasing the share of renewable energy sources for electricity generation (RES-E) since the late 1990s, see e.g. EC (1), EC(2), Resch et al (3) and Johnston et al (4). To meet these targets the implementation of proper financial support systems is necessary. In this context a still controversial discussion is whether quantity-driven – like Tradable Guarantee-of-Origin Certificates (TGCs) based on quotas – or price-driven (like feed-in tariffs (FIT)) instruments lead to preferable solutions for society. Major pros and cons of support systems have been evaluated e.g. by (7),(8), (9), (10),(11), (12), (13).
The most important issue in the current discussion is the request for a more or less European wide TGC system to promote RES-E, see e.g. EWI (14). This discussion appears to be odd at least because of the following major issues:

- It interprets a quota-based trading system as the best solution simply because it is trading-based. But, the core objective has to be kept in mind which is to achieve an accelerated deployment of RES-E in an effective and efficient manner – and which is not to introduce a level playing field for trade;
- In the current discussion the measure of harmonization is often equated to (technology neutral) quota systems. This ignores the fact that there are other, potentially more favourable options, to form a harmonized support system;
- Moreover, it completely neglects the lessons learned so far which do actually not identify any success story. On contrary, most of the European success stories of promoting RES-E over the past decades in an effective and economically efficient way were driven by feed-in tariffs, which are implemented in a technology-specific manner.

The core objective of this paper is to analyze the efficiency and effectiveness and to extract other major lessons learned from promotion schemes in major European countries and to derive resulting recommendations for future. The paper builds on Haas (5) and provides updates on the developments sketched there.

2. METHOD OF APPROACH

The method of approach applied is based on analysing the costs of the programmes from societies points-of-view in comparison to the capacities deployed.

The following analysis is based on the concept of static (and further-on dynamic) cost resource curves of RES (see e.g. Haas (16), Ragwitz et al (17)). These cost curves are associated with uncertainties. These uncertainties are the higher the more we move to uncertain resources. Based on this static (and further-on dynamic) cost resource curves a TGC-based quota system works as follows: A quantity (= quota = a certain percentage of electricity to be guaranteed from renewable energy sources) is set by a government. The generators (producers), wholesalers, retailer or consumers (depending who is obligated in the electricity supply chain) are obligated to supply / consume a certain percentage of electricity from renewable energy sources. At the date of settlement, they have to submit the required number of certificates to demonstrate compliance. A FIT works vice versa: the price is set and the quantity finally generated is decided by the market.
Quota-based TGC systems as well as Feed-in tariff systems create an artificial market and cause policy costs (=additional costs to be paid typically by all electricity customers), see Held et al (7). One of the major criteria for a successful promotion system is the acceptance by the electricity customers (or in exceptional cases the society if reimbursement is done through state budget) who finally have to pay the required expenditures. This acceptance is of course strongly depending on the magnitude of over-all support. So it is important to analyze what are the additional extra costs for the electricity consumers. This is done in the next chapter.

3. MAJOR DIFFERENCES BETWEEN TGC AND FIT SYSTEMS

The major differences between TGC and FIT systems with respect to costs, producer surplus and revenues are depicted in Fig. 3
Especially, if the cost resource curve is steep – Fig. 3 – Producer surplus in TGC systems is considerable and may even be higher than generation costs! Hence the additional extra costs which finally have to be paid by the electricity consumers/tax payers rise tremendously in comparison with a technology-specific FIT. This case is by far the overwhelming one in EU-27 countries and leads straightforward, to the request for a technology-specific support system e.g. FITs as depicted in Fig. 3b.

A uniform European TGC price for all RES-E would be ~~set by the~~ marginal price of the most expensive technology sold (analogous to current quota systems). If the marginal price is set by a medium or high cost technology, this would lead to windfall profits for low cost technologies (this is one reason why the UK government has introduced technology banding for the UK ROCs market).
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TRADABLE GREEN CERTIFICATES

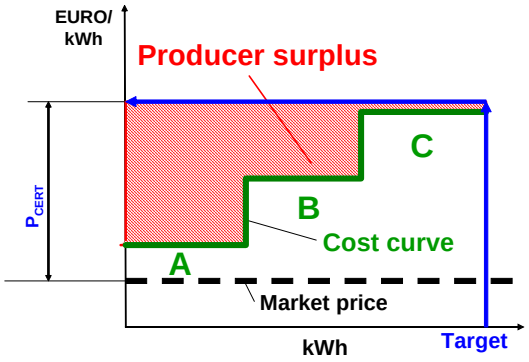

Fig. 3a: Differences in transfer costs due to higher Producer surplus of TGC systems in comparison to FIT

(PREMIUM) FEED-IN TARIFFS

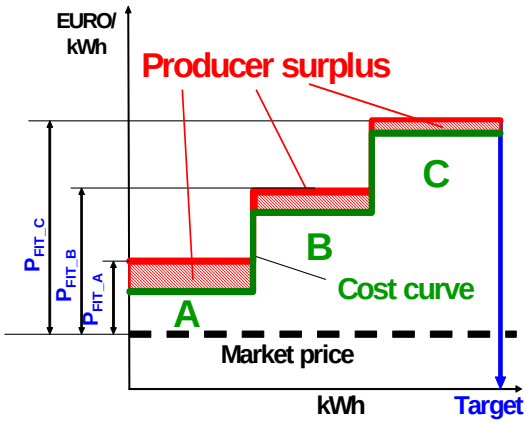

Fig. 3b: Differences in transfer costs due to higher Producer surplus of TGC systems in comparison to FIT

In addition, it has to be born in mind that in a trading system the risk to recover investments leads to the effect of an additional risk premium, see Fig. 4. This Figure finally explains why the support costs in most trading schemes tend to be higher than in FIT countries.

Kommentar [A1]: In DE werden für 2010 sehr hohe Förderkosten erwartet, da der PV-Ausbau so stark ist….das führt auch zu hohen Kosten

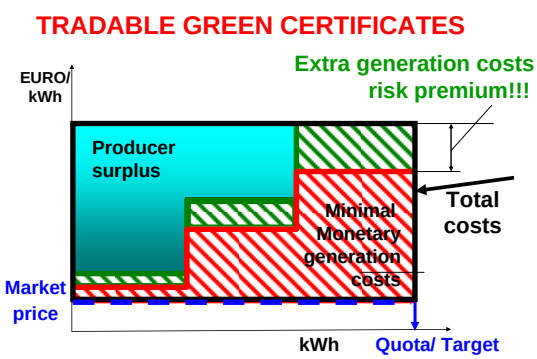

Fig. 4: Possible producer surpluses when the cost resource curve is steep

4. COUNTRY-SPECIFIC LESSONS LEARNED FROM PROMOTING RES-E

This section summarises the major lessons learned from trading systems implemented in specific countries. Quota-based systems are now in place in the UK, Sweden, Italy, Belgium, and Poland, see Haas (5). Analyses on the effectiveness of TGC systems have been conducted e.g. by van der Linden (18], Jacobsson et al (19), Ragwitz et al (20), Toke (21). Fig. 5 shows the premium support level in selected countries. As can be seen the requirement of a noticeable dynamic decrease in the promotion costs is not met for TGCs despite increasing market prices for conventional electricity.

In Sweden, certificate prices are still lowest – see Fig. 5 – although prices have been rising in recent years. In Sweden some old capacity were also allowed to participate in the Swedish quota system. This resulted in the situation that more certificates were produced than redeemed until 2006. In 2007 it was the first time that more certificates were redeemed than issued (see Fig. 7). Moreover, additional investment subsidies for wind power plants were available, improving further the economic incentives for wind power investments. which led to lower marginal costs in the TGC system.

In the UK, the major problem – aside from high certificate prices – is that the quota has never been fulfilled so far. In the accounting period 2007/2008 4.9 % of electricity was generated from "new" RES while the quota was 7.65 % (see Fig. 8) resulting in a quota fulfillment of 64% (see Fig. 9). One main reason for this failure is the intrinsic deficit in the case of ambitious RES targets and a non-mature market environment, where besides policy-driven investor's uncertainty (e.g. on future certificate prices) several administrative barriers appear to be of relevance. There is a similar situation in Italy. Certificate prices here are high (see Fig. 7) and quota fulfilment is moderate (about 90 % of the quota of 3 % was fulfilled in 2007).

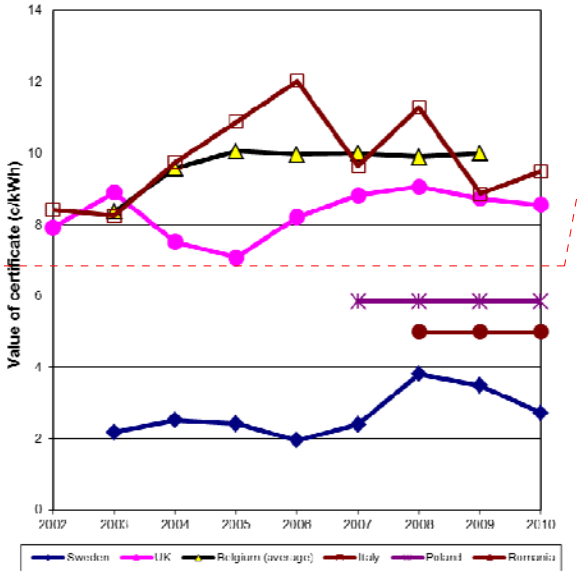

Fig. 5. Value of certificate in different European TGC markets 2002-2010, Figures for 2009 and 2010 preliminary)

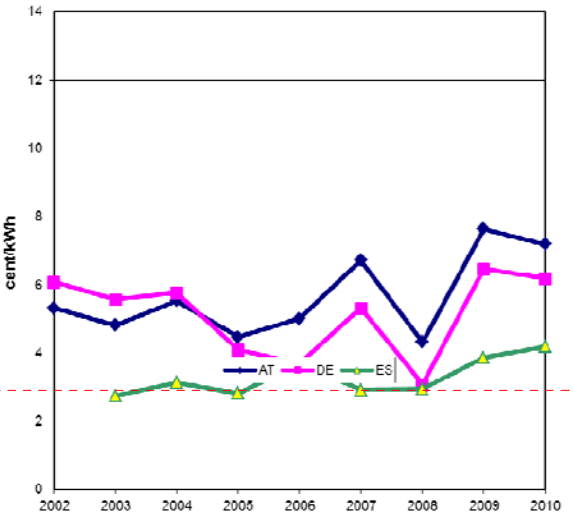

Fig. 6. Magnitude of support in different European countries with FITs 2002-2010, (Figures for 2009 and 2010 preliminary)

In Belgium there are two parallel TGC systems in Flanders and Wallonia. The TGC prices in Flanders are among the highest in Europe and as reported in Verbruggen (22) and

Kommentar [A2]: Diese Grafik hat im Vergleich zu 5a nicht so viel zusätzliche Information. Könnte evtl. gelöscht werden.

Kommentar [A3]: Die Kosten der Windstromerzeugung verringern sich nicht, sondern die ökonomische Anreizwirkung für Investoren

Kommentar [A4]: Was meinst Du mit dem ersten Teil? Intrinsic deficit of ambitious RES targets??? A non-mature market environment erscheint mir zu allgemein. Was meinst Du genau?

Verbruggen (23) the associated policy effectiveness has been very low until 2008 and appears to be on a rising trend starting in 2009.
Fig. 6 shows the corresponding figure for FIT-countries. It is important to note that support is calculated as the difference between FIT and the wholesale electricity market price. This explains to some extent the volatility in Fig. 6.

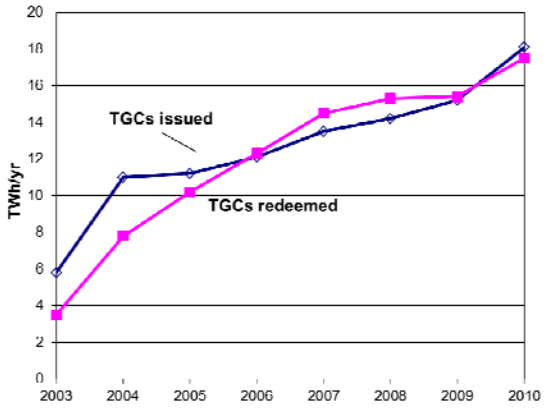

Fig. 7: TGC's in Sweden issued and redeemed (2003-2010, Figures for 2009 and 2010 preliminary)

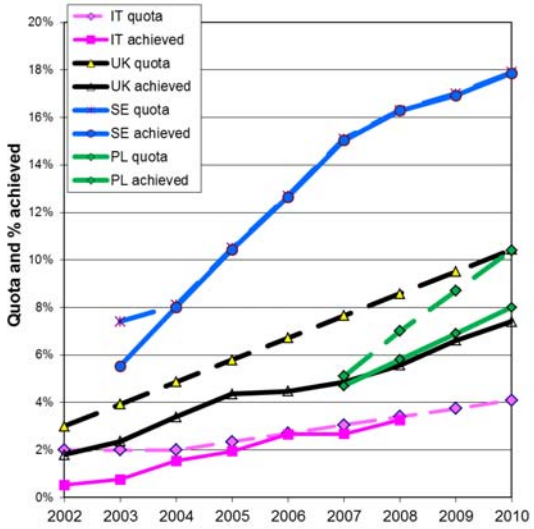

Fig. 8: Quotas and actual shares achieved in different European TGC markets

5. EFFECTIVENESS AND EFFICIENCY OF PROMOTION SCHEMES IN EU-COUNTRIES

A comparison of the different support schemes has been conducted in several projects and investigations see e.g. RWI (24), Haas et al (6).

In this chapter the relation between quantities deployed and the level of support is analysed for some trading and some FIT systems in recent years. It is often argued that the reason for higher capacities installed is a higher support level. Paradoxically, countries with highest support levels – Belgium and Italy for example – are among those with the lowest specific deployment (Figure 10). On the other hand, high FITs especially in Germany and Spain are often named as the main driver for successful investments especially in the area of wind energy. However, the support level in these countries is not particularly high compared with other countries analyzed here.

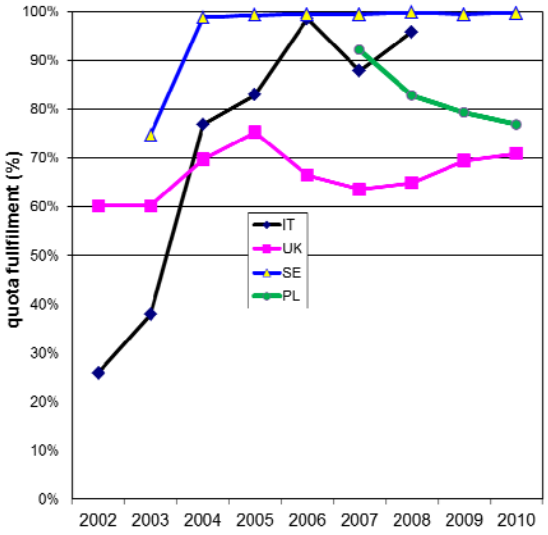

Fig. 9: Quota fulfillments in different European TGC markets

Kommentar [A5]: Belgien hat in 2009 auch ein bisschen aufgeholt mit 200 MW Wi-On. insgesamt über 500 MW.

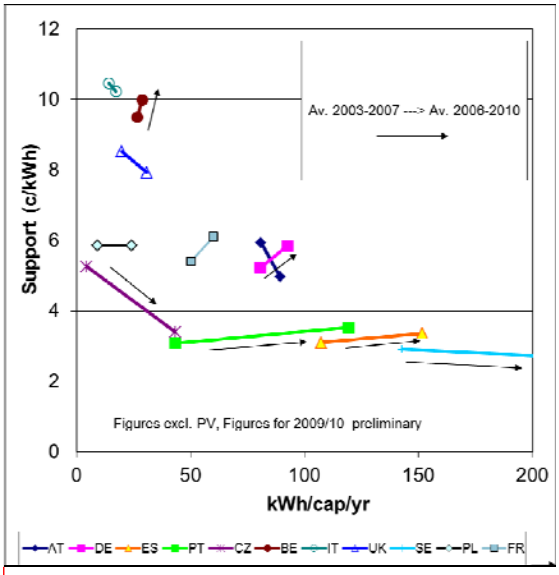

Fig. 10: Effectiveness vs costs of promotion programmes for electricity from RES in selected countries 2003-2009 without PV and large hydro power (Source: own investigations)

6. CONCLUSIONS

The major result of our analyses is that the investigated FIT systems are effective at a relatively low producer profit. A well-designed (dynamic) FIT system provides a certain deployment of RES-E in the shortest time and at reasonable costs for society.

The most important conclusions are: (i) The success stories of growth in RES-E in EU member states in recent years has been triggered by FITs. A well-designed (dynamic) FIT provides a certain deployment of electricity generated from Renewable Energy Sources (RES-E) fastest and at lowest costs for society; (ii) RPS or TGC systems are only successful in countries like in Texas and Sweden with abundant cheap additional RES (e.g. biomass waste co-firing) and if accompanying rebates are provided for the more costlier technologies (like Wind and PV); (iii) certificate-based trading systems in recent years have eroded gradually: they have come closer and closer to FIT (like in UK or Belgium) or lost some of their attractiveness due to continuously lower performance as in Sweden; (iv) one major reason for this is that promotion strategies with low policy risk lead to lower profit requirements by investors and, hence, cause lower costs for society.

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Kommentar [A6]: Für welches Jahr ist der indikator kWh/cap/yr aufgetragen. Ist das die gesamte RES-E Erzeugung? Oder Wind? Support level ließe sich für all RES-E nicht auf einen Punkt konzentrieren.

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