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Crowding out or crowding in? Consumer preferences and the design of policy and products in the green electricity market case

KEY WORDS: renewable energy policy, green electricity markets, consumer preferences

Introduction

Green electricity is a term used to characterise electricity produced by renewable energy sources. Common to these sources is that there is a saving of scarce natural resources and no emission of greenhouse gases. There are basically two ways in which the generation capacity for green electricity can be expanded:

- one is to have the consumers express their willingness to pay for green electricity products on liberalised electricity markets, and
- the other is to stimulate the construction of new capacity through various forms of governmental market intervention. This can be done either by controlling the quantity (e.g. by obliging the demand to consume a certain quantity of green electricity) or the price of green electricity (e.g. by guaranteeing fixed supply prices as in the case of Feed-In regulation). In terms of building up green electricity generation capacities countries as Germany and Spain have been very successful with Feed-In legislation.

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In analysing the relationship between markets and policy normally the effects of policy measures such as taxes or subsidies are analysed in a context when policy intervenes in "free" markets. However, in the case of green electricity markets it is the market that "intervenes" into an existing policy framework, because the liberalisation of markets enabling the consumers to buy green electricity takes place when the green electricity policy framework already exists. This paper raises the question, whether and under which circumstances the relationship between policy and market mechanism becomes productive or counter-productive. Answers to this question depend on both, the room policy lefts for private green electricity market activities (analysed in section 2 and 3 of this paper) and the constitution of consumer preferences (section 4 and 5).

Green electricity policy

The German Feed-In system

Perhaps the German Feed-In system has been the most effective promotional policy, because it guarantees a market for green electricity at very favourable payback rates which are collectively financed by surcharges every consumer has to pay. Renewable energy currently is about 7% of total electricity consumption and especially in the case of *wind energy* Germany faced an accelerating growth of capacities from 42 MW in 1991 up to 8750 MW at the end of 2001, mostly based on small-scaled independent producers. At the end of 2001, about 50% of total European capacities and more than 33% of worldwide generation capacities are German. Estimations show that the additional costs electricity consumers have to pay with the surcharge are about 0.3 Eurocent/kW·h (in 2001).

The Electricity-Feed-Law (EFL) was adopted in 1991 with the backing of a cross-party consensus and against the reservations expressed by German utilities. It obliged grid operators to accept green electricity and pay for it at a fixed minimum price for plants up to 5 MW, irrespective of daily or seasonal demand fluctuations. Because of some problems with regionally unequal allocation of costs some elements of the Electricity-Feed-Law were changed and in February 2000 the renewed Feed-In-Law (Renewable Energy Sources Act, RESA) passed the German parliament. Although it seems to be a continuation of the former EFL version, some elements of this law are completely new. Price levels have risen significantly and are adjusted into the direction of *full-cost-covering-prices*. Moreover, the RESA introduces a so-called *reference model* for wind power. The Feed-In-tariffs are differentiated relative to the quality of site and move downward with time. The higher the local wind earnings are, the lower the price per kW·h will be on average. From an efficiency point of view this seems to be problematic because relative differences in natural location advantages are not exploited but compensated with the tariffs. However to prevent suppliers from realising gains or rents is the logical consequence of a collective surcharge-financed system.

Problems how to address the demand side

One element of the former EFL has been a 5-percent-cap of green electricity to be accepted by the network operators. This mechanism has been introduced in order to create a more equal distribution of additional costs between network operators. Because of the liberalisation it has been changed with the new law. This burden-sharing mechanism is at a central position in adapting the Feed-In mechanism to the new competitive framework of the market. It becomes the character of extending supply side regulations to the demand side and is about the question:

- who should pay for the green electricity,
- and how should it be passed on to the demand side of the market.

The core problem is this: As the debtor of the old Feed-In law the regional utility has had a *monopsonistic position* in buying all green electricity from the generators and a *monopolistic position* in selling its electricity to the customers on the demand side. Because liberalisation involves a separation between operating the network and electricity trading, *nobody on the demand side* will be obliged to buy a certain amount of green electricity for a fixed price. In a free market customers are free to choose their own supplier, which may not be the same as the regional utilities.

In a system with guaranteed prices there are only a few possible answers to the crucial question how to get green electricity from the generators to the end users. One option is that the *network operator could be allowed to deal with the green electricity producer on his own behalf.* But the price he would get in the consumer market would be lower than the guaranteed price he has to pay at the supply side. Hence, the RESA prevents network operators from selling green electricity to the market: "*Electricity purchased in accordance with the first sentence* (of this law) *shall not be sold at the compensation paid..., if it is marketed as electricity*" (RESA, §11, sentence 4). Notice that this is a very logical position, because a production which is collectively financed at the supply side cannot be marketed on a private level at the demand side.

According to §11 of the RESA (Nation-wide Equalisation Scheme) the questions raised above are answered as follows: *Every user* of the network is obliged:

- to buy a certain share of green electricity from the network operator (equalisation delivery), and
- to pay a fixed price for it (equalisation charge).

The concrete level of this share (quota) will be determined ex-post and in a way, which leads to similar quotas for all network users. However, in an economic sense this solution is not consistent with functioning of markets, even under the conditions of the natural monopoly of the grid. Policy *can* decide to fix certain quotas for renewables in the portfolios of customers — and it may be reasonable to assume a superiority of such quota system compared with surcharge financed programs (see [1]) — but intervening on the market in such way is not compatible with fixing prices for suppliers at the same time. If on "free" markets policy intervenes by controlling both variables, prices and quantities at the same time, the system would become over-determined; and even under conditions of planned economy every planning authority has problems if it wants to control quantities and prices on the market simultaneously. Therefore, it is not surprising, that the current practise of regulated network operators to distribute the (financial and physical) burden from the RESA-electricity is highly opaque and attracting discriminatory policies against third parties.

Green electricity markets

Liberalisation and green electricity markets in Germany

Private or commercial marketing of green electricity offers is not completely new in Germany. Even before liberalisation a lot of utilities have tried to place green offers or green pricing products on the market[1]. These offers have been designed for those customers who are willing to pay something more for green projects on a voluntary basis. Moreover, after opening the markets in 1998 more and more new entrants and independent green traders have tried to find new customers for their green electricity products. In absolute figures the market share of green electricity products is quite modest. However, because of the structural changes in the whole market one can interpret their role as that of pioneers. The total number of green energy customers in 2001 amounted to about 280,000. Estimations of the green electricity sales (which are sold directly to the consumers) are between 100 and 700 GW·h in 2001. In spite of the growth of the green energy sales, its share of total electricity consumption in Germany is only about less than 0.1% compared to a 7% share of green electricity.

Dispute how to develop green electricity markets: direct provision vs. charity

The green electricity supplier differ in the strategy used and the products offered to the customers. Besides criteria such as the green electricity *mix*, *prices* or the *certification* the most important criterion is *the method used for accounting and delivering electricity*:

- on the one hand, some suppliers offer their customers to be directly and completely provided with green electricity. This approach is called *direct provision model*. Customers of these commercial oriented traders have to switch their supplier, to pay for the generation of electricity and for using the grid;
- and on the other, hand some companies guarantee green generation on a basis of yearly averages. However, these suppliers *do not offer the supply but only the generation of electricity*. In fact their customers are provided by their former utility with the only difference that they pay an additional amount of money to the green suppliers. This co-operative approach is called the *charity model* since green suppliers commit themselves to distribute the money collected from their customers among certain green electricity generators which otherwise would not be able to produce because the RESA-tariffs do not cover their generation costs fully. One has to notice that this model can only work in addition to a legally based Feed-In-System on a co-operative basis, because the electricity generation principally belongs to the RESA-system.

There is an ongoing debate about the right way to develop green markets. Commercial traders using the TPA and the direct provision model sometimes are hardly attacked by proponents of the

[1] Notice that these green electricity products principally are not covered by RESA.

RESA (such as politicians and "political correct" suppliers using the charity model) for endangering the success of the German Feed-In system. Their argument is that every kW·h green electricity sold for commercial purpose from a commercial green supplier to his customer releases a certain utility from its obligation, which it otherwise would have to fulfil. Direct provision of green electricity would shift the burden from the collective to some idealistic consumers without inducing a real effect.

The asymmetrical situation of "political correct" and "commercial" suppliers

Analysing the development of the green electricity markets and policies leads to the conclusion that there is an asymmetrical relationship between the "political correct" and the "commercial" segment of the market. This is due to the structure of guaranteed RESA-tariffs, which become a certain kind of opportunity costs for selling to the private market. If the Feed-In tariffs are relatively low, it becomes more attractive for the generators to sell to the commercial market suppliers, and if the tariffs are relatively high (as in the case of the RESA) the conditions for the commercial suppliers get poorer.

Primacy of policy? The additionality criterion

In order to secure the primacy of policy against markets from a normative perspective, this relationship often is expressed as the additionality criterion: Commercial green electricity should lead to *real* additional environmental effects. Only those plants that are unable to produce for the fixed legal tariffs alone, should offer their products on the commercial market and realise supply prices higher than the Feed-In-Tariffs[2]. Due to this normative assumption competitive actors are allowed to earn money by supplying green electricity to the market if (and only if) their activities are accompanied by an improvement of the economics of those technologies which are too expensive for the Feed-In-System, or if they address technologies and plants, which are not covered by the RESA. There should be a clear division of labour: The policy Feed-In mechanism has to be related to the "economic" plants while the commercial market should help uneconomic plants to improve their situation. To express this in a different way: A true "green" electricity consumer should prefer uneconomic plants and paying higher prices instead of lower.

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[2] Note that the question of additionality is raised in the Article 6.1b of the Kyoto Protocol which prescribes environmental benefits "*that must be additional to any that would have occurred in the absence of the project activity*". The additionality criterion as defined for the Kyoto-Mechanism is about the *fair distribution of burden* between different obliged entities. However, this notion of obligation cannot belong to private and voluntary market activities.

Green electricity demand

Implicit assumptions

This asymmetrical effect is mainly to be legitimated by *two implicit assumptions about demand:*

1. *Consumers willingness to pay is too small* (compared to the generation costs), which means that one cannot expect a significant market share of green electricity due to voluntary market activities. Green electricity *cannot* be provided privately because there will be no substantial private willingness to pay for. It has to be interpreted as some kind of public good: its positive effects are not private but consumed jointly by all individuals. Alternatively, one could state that green electricity *should not* be provided privately, because this would contradict the primacy of policy by shifting the burden from the collective to some idealistic private consumers.

2. Maybe there are customers who want to pay for green — but they have *a strict preference for products, which fulfil the additionality criterion.* In buying green products they want to be sure that there is a positive net effect on the environment which is additional to the political measures. Their demand is complementary to the legal supporting system.

The validity of these assumptions is of high relevance for both, the effects of green electricity regulation and the market success of green electricity products. Therefore, they are to be questioned in the light of empirical and analytical studies about individual preferences.

Is private green electricity demand a substitute or a complement to political measures?

The question why people voluntarily contribute to privately provided public goods has a long tradition in economics. The classical literature (see, for example, [2]) implicitly assumes that individuals follow pure altruism in private spending for public goods and shows that the privately achieved level of the public good may be inefficient. Hence, public spending should be used to increase the level of the public good. However, it is a well-known result that, under pure altruism, rational individuals cut their donations when they get aware that the state subsidises the supply of the public good and this is financed by individual tax-payments. Private and public activities become *perfect substitutes*. If the public intensifies its measures the private activities decrease, there will be a *crowding out of private activities* and only distribution effects. This has been labelled the *neutrality hypothesis* [3]. To express it in a different way: There can be no measurable impact of private activities if policy wants to support the private supply of public goods on a certain level.

However, more recent theoretical and empirical research has shown that this neutrality hypothesis does yield only under certain circumstances. There are a lot of empirical investigations that contradict neutrality (see, for example, [4]). It can be shown that the behavioural assumptions that are necessary for crowding out are contradicted in laboratory experiments. Moreover, Andreoni [5] has shown that the assumption of people having a taste for giving, perhaps because

they receive a "warm glow of giving" from "having done their bit" leads to the result of *non-neutrality*. He assumes *impure altruism*. If people derive some utility from giving, neutrality breaks down in an intuitive way: private gifts become imperfect substitutes for public gifts [6]. *If* people feel some kind of private "warm glow", they treat public support for green electricity as imperfect substitute for private green electricity activities and have an incentive for paying for it. Hence, the question whether private activities such as green electricity demand are perceived as perfect or imperfect substitutes, or even as complements to political measures such as Feed-In regulations is constitutional for the co-existence of green electricity markets and political support systems and has to be answered empirically.

Experimental investigation of green electricity demand

Experimental design

In two German cities (Kiel and Düsseldorf) Menges, Traub and Schröder [7] conducted experimental investigations of green electricity consumer behaviour. An objection that can be raised against most empirical approaches of green electricity consumer analysis is, that in these studies customers may have a tendency to de-emphasize price, since they do not have to pay the price [8] resulting in an upwards bias of stated Willingness-To-Pay (see also Roe *et al.*[9]). The functioning of this method was based on a well-designed incentive mechanism that compensates the subjects for their cognitive effort and induces them to pay "real" prices and to state their true preferences as if they were making their choices on real electricity markets. Based on a realistic base budget, which a German average household uses for annual (conventional) electricity consumption, participants were actually endowed with an additional monetary budget for free disposal that was to be allocated to private consumption and expenditures for green electricity on a 1 year contract basis.

Basically, the experimental design distinguished between three groups of electricity supply: electricity generated from *fossil* sources (coal, oil, gas), *nuclear* electricity, and electricity generated from renewable sources (*green* electricity) such as wind, solar energy, and waterpower. At the beginning subjects had to state their household size. Then, they where shown computer screens like the one displayed in figure 1. The contracts were displayed as cake diagrams.

The annual costs of a reference contract ("Kosten A") were determined by the average electricity consumption in kWh attributed to the household type as stated by the subject at the beginning of the experiment, multiplied by a base price of 0.229 deutschmarks per kWh. Every subject was assigned a total budget ("Budget") amounting to the annual costs of the reference contract plus a remainder of 500 deutschmarks ("Rest") for free disposal. At the right top of the screen a comparison supplier was given ("Anbieter B") who offered a contract in which 25 percent points of the share of fossil electricity in the reference contract were replaced by green electricity ("öko").

Now, the subjects were asked to state the maximum amount of their annual electricity bills they would be willing to pay for contracting the comparison supplier, where the minimum answer

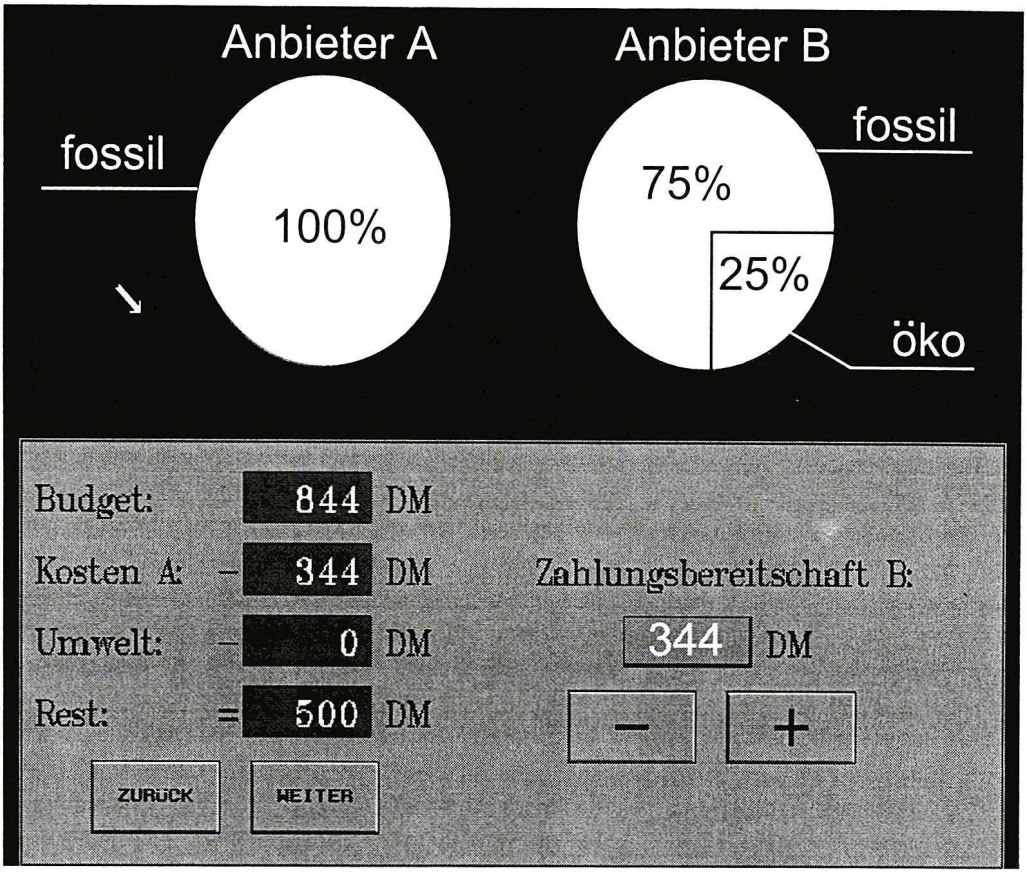

Fig. 1. Sample Screen (scenario A, 1-person household)

Rys. 1. Przykład wyglądu ekranu. (scenariusz A, jednoosobowe gospodarstwo domowe)

was restricted to the costs of the reference supplier, and the maximum was limited to the total annual budget. The subjects could enter values by clicking on the "plus" and "minus" buttons located at the right bottom of the screen, and the amounts were displayed in a prominent box ("Zahlungsbereitschaft B"). Accordingly, when a subject entered an amount higher than the costs of the reference supplier, the budget was reduced by the difference between the amount stated and the costs of the reference supplier. The difference appeared in a box on the left-hand side of the screen ("Umwelt"), and was labelled "contribution to the environment". As soon as a subject was satisfied with his answer, he could press a button ("weiter") to proceed to the next screen. After proceeding to the next screen, the former comparison supplier became the new reference supplier, and on the next screen the subjects were offered another comparison supplier which had an additional share of 25 percent points of green electricity in his contract, replacing 25 percent points of fossil electricity.

An essential goal of this experiment was incentive compatibility. Therefore, a pay-off mechanism that involved relatively high monetary consequences for the subjects was employed,

depending on their preferences. Since there was no possibility to offer "real" electricity contracts exhibiting real effects on the environment to the subjects, the subjects' contributions to preserving the environment were used as a proxy. Subjects' payments for green electricity contracts were cumulated with the "Umwelt" account and the reduced rest budgets. Every participant was told that there is a 10-percent chance that he will be paid off with the rest budget (random lottery incentive mechanism). In this case the money from the "Umwelt"-Konto was paid to a certain environmental association he was able to choose.

Results

The results of this experimental investigation show that there is considerable market potential for green electricity even on liberalised electricity markets. *Most subjects* (between 57% and 95%) were willing to pay significant price mark-ups for replacing fossil electricity by green electricity in the different scenarios. Although depending on several factors such as the presence of nuclear electricity in the generation mix, aggregated demand curves for green electricity generally exhibited a non-linear, convex shape. This result of non-linearity is of high relevance for interpreting the results. It is supported by several empirical studies on international markets.

In a review of utility market research in the US Farhar [10] found strong preferences for green electricity when compared with other energy sources. Across the surveys reviewed majorities of consumers between 52% and 95% of total residential customers express their willingness to pay at least a modest amount more per month on their electricity bills for green electricity. The derived aggregated willingness to pay curve suggests a non-linear, exponential fit of the data.

Goett *et al.* [8] used data from conjoint experiments to examine customers preferences. Regarding the preference for green electricity their data suggest that the willingness to pay for green electricity is *highly non-linear in the percent of energy that is generated with renewables*. They conclude that customers are more concerned about the concept of green electricity than the actual environmental impact. The results show that the decision to buy green electricity is not so much motivated by political issues but by an *intrinsic individual motivation*, because the willingness to pay does not react on an increase of environmental impacts of products.

Interestingly the results of these studies are consistent with contingent valuation studies from the theory of public goods. They have found that the *amount that customers are willing to pay to prevent environmental damage is independent of the amount of damage that is prevented* [113]. Boyce et al. [12] conjectured that "individuals may want to preserve a natural resource for moral or other motives even if they will never receive direct consumption benefits (use value) from it" (p. 1366). In the contingent-valuation literature, these phenomena are discussed under the labels of "embedding effects" and "intrinsic values". With an interesting experiment Kahneman and Knetsch [13] showed that individual willingness to contribute to public goods is reflected by the purchase of moral satisfaction that is induced by the contribution. These arguments can be reduced to Andreoni's [5], [6] "warm glow of giving" which implies a non-linear demand curve. Ultimately, these results contradict the above mentioned assumptions that private green electricity demand is not existent on considerable level (1), and/or primarily driven by pure altruism and a motivation to induce "additional" environmental effects (2).

Conclusion

The current German political system to support renewable energy with guaranteed Feed-In tariffs has been very successful in establishing a public market segment, but it tends to behave asymmetrically to the private segment and to crowd-out activities on this emerging commercial market. To legitimate such kind of opportunity costs resulting from market intervention, energy policy has an incentive to underestimate private demand. On the opposite, several studies show that there is a potential demand for green electricity, but that consumers are primarily driven by some kind of impure altruism and the wish to receive a moral satisfaction. Hence, the question is *not*, whether individual demand can substitute policy in the green electricity case (of course it cannot), but the question should be raised, how policy can help to realise the private demand potential for the market instead of restricting it.

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Abstract

Due to the liberalisation of energy markets the success of Electricity-Feed regulation as practised in countries as Germany and Spain leads to opportunity costs in terms of crowding-out the potential for private green electricity market activities. This may be justified by the empirical assumption, that actually demand for green electricity is neither stable, nor reliable. On the other hand, this assumption is contradicted by several studies, which show that indeed there is a potential demand for green electricity. The political impact of this demand, however, is not so clear, because consumers are not so much interested in (objective) environmental effects, but more in receiving a (subjective) moral satisfaction. Hence, the question is *not*, whether individual demand can substitute policy in the green electricity case (of course it cannot). But because on liberal markets policy and products have to be compatible with individual preferences, policy should search for alternatives leading to a crowding-in of private market activities.

Roland MENGES

Kupić, nie kupić? Preferencje konsumentów oraz kreowanie polityki i produktów na przykładzie rynku energii elektrycznej ze źródeł odnawialnych

SŁOWA KLUCZOWE: polityka energetyczna, odnawialne źródła energii, rynek energii

Streszczenie

Uregulowania dotyczące źródeł wytwarzania energii, jakie z sukcesem ukształtowały się w takich krajach jak Niemcy i Hiszpania w związku z liberalizacją rynku energii, prowadzą do stworzenia warunków dla rozwoju prywatnej działalności w zakresie energii odnawialnej. Można to uzasadnić przyjmując empiryczne założenie, że zapotrzebowanie na energię ze źródeł odnawialnych nie jest ani stałe ani wiarygodne. Z drugiej strony to założenie jest sprzeczne z kilkoma badaniami, które pokazują, że istnieje potencjalne zapotrzebowanie na energię odnawialną. Nie jest jasne dlaczego, gdyż konsumenci nie są bardzo zainteresowani (obiektywnie) efektami w naturalnym środowisku, lecz raczej uzyskaniem satysfakcji w sferze moralnej (subiektywnie). Z tego powodu pytanie nie brzmi czy indywidualne wyrażane zapotrzebowanie może zastąpić politykę w przypadku energii ze źródeł odnawialnych (bo oczywiście nie może). Ponieważ na rynkach liberalnych polityka i produkty muszą być zgodne z indywidualnymi preferencjami, polityka powinna znajdować sposoby, by stworzyć potrzebę działania ze strony prywatnego rynku.