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WILLINGNESS TO PAY FOR “GREEN” ELECTRICITY

SPREMNOST NA PLAĆANJE “ZELENE” ELEKTRIČNE ENERGIJE

ABSTRACT

On the liberalised power supply market, with an ever growing development and utilization of renewable energy sources, there has been introduced a “differentiated” product, or better, the so called “green” electricity, which is either totally or partially recovered from “green resources”, that is, from renewables. Power supply companies provide consumers the opportunity to purchase “green” electricity against a higher price, in order to level off both higher production costs from the renewables and boost their further development. Based on their free will, consumers may chose to be supplied with “green” energy among any utility company and being charged an additional amount for such products, thus contributing to the further use and the implementation of renewable energy sources in the power supply sector, as well as to consumer satisfaction.

This paper aims to establish the features contributing to the consumer willingness to additionally pay for electricity obtained from renewables. Hence, it highlights the reasons behind the buyers' or households' readiness to using “green” electricity, which are found mainly in environmental concerns, altruistic attitudes and personal preferences. It should also be mentioned that consumers prefer electricity deriving from renewable resources, even when they know little about it. Higher education, environmental organisation affiliation and higher income levels are related to the greater willingness to additionally pay for a cleaner energy, since the latter is estimated to curb pollution induced by fossil fuels. Consumers may chose among the most convenient type of renewable resource in the output of “green” power as well as the amount of additional money to pay for the purchase of such energy. Although this paper presents the up-to-date situation in the research carried out by a number of authors, it may be regarded as the basis for further empiric research on the phenomenon of willingness to pay for “green” power in the Republic of Croatia.

Key words: *willingness to pay, renewable energy sources, “green” electricity, consumers, preferences*

SAŽETAK

Na liberaliziranom elektroenergetskom tržištu, sa sve većim razvojem i korištenjem obnovljivih izvora energije, pojavljuje se „diferencirani“ proizvod, tzv. „zelena“ električna energija isporučena u cijelosti ili djelomično iz „zelenih“ resursa, odnosno obnovljivih izvora energije. U opskrbi električne energije, poduzeća pružaju mogućnost prodaje „zelene“ električne energije, te se uobičajeno naplaćuje viša cijena za „zelenu“ električnu energiju kako bi se uravnotežio nastali veći trošak proizvodnje iz obnovljivih energetske resursa te potaknuo njihov daljnji razvoj. Temeljeno na dobrovoljnoj osnovi, potrošačima se ostavlja mogućnost odabira opskrbjivača i spremnost na dodatno plaćanje takvog proizvoda, čime se doprinosi iskorištavanju i primjeni obnovljivih izvora energije u elektroenergetskom sektoru, te zadovoljstvu potrošača.

Svrha istraživanja ovog rada je utvrditi motivirajuće čimbenike koji dovode do spremnosti na dodatno plaćanje električne energije koja se dobiva iz obnovljivih izvora energije. Pri tome se u radu naglašava da su individualni kupci, odnosno kućanstva voljni upotrebljavati „zelenu“ električnu energiju prvenstveno zbog ekoloških interesa, altruističkih stavova ili osobnih preferencija. Također se ističe da kupci favoriziraju električnu energiju iz obnovljivih izvora, iako o njoj znaju vrlo malo. Viša razina obrazovanja, pripadnost ekološkoj organizaciji i viši osobni dohodak povećavaju spremnost na plaćanje za ekološku električnu energiju, odnosno smanjenje onečišćenja u okoliš upotrebom fosilnih energetske resursa. Vrsta obnovljivog izvora iz kojeg se dobiva „zelena“ električna energija ili razina viška cijene po kojoj se „zelena“ električna energija kupuje također mogu implicirati različite razine korisnosti za potrošače. Iako se u radu prezentiraju dosadašnja/prethodna istraživanja brojnih autora, ono može predstavljati temelj za empirijsko istraživanje o fenomenu spremnosti na plaćanje „zelene“ električne energije u Republici Hrvatskoj.

Ključne riječi: *spremnost na plaćanje, obnovljivi izvori energije, „zelena“ električna energija, potrošači, preferencije*

1. Introduction

Within the framework of structural reforms, the electricity supply sector is facing comprehensive changes, in the form of overall market reorganisation and technical and technological operation of the public utility. Primarily, under the influence of deregulation, the electricity distribution market has opened to all undertakings operating in such sector, thus setting foot for competition on the electricity market. Competition in the electricity supply market is regarded as a triggering factor for market efficiency and electricity supply sustainability. On the deregulated electricity supply market, with a greater development and utilisation of renewable energy sources, a “differentiated” product is emerging, the so-called “green” electricity, deriving either totally, or in part, from “green” resources, i.e. from renewable energy sources.

Alongside the conventional (fossil) energy sources, renewable energy sources are becoming a significant energy-generation means put in place to meet the needs for electricity. Renewable energy sources provide additional electricity generation, thus contributing, in view of numerous multiplicative effects, to economic development and to stimulating general competitiveness in the energy management sector. Environmental sustainability shall be seen as one of the main reasons for an ever larger utilisation of renewable energy sources, because, when it comes to power generation, renewables have no share in pollution, nor in greenhouse gas emissions. Moreover, they can contribute to reducing the deployment of non-renewable fossil energy sources, thus paving the way to their further utilisation.

For nearly a century, customers were obliged to purchase electricity from a single supplier, because there had been the monopoly of a single vertically integrated utility company on the

market in charge with power generation, transmission and retailing. As a result, customers now lack any experience in choosing an electric utility provider capable of producing a renewable energy product. The electricity supply industry will eventually allow their retail customers to choose the most fitting energy supplier and to decide whether they wish to purchase a clean product. However, very few electricity consumers know where their power comes from or understand the environmental impacts of producing “green” power (Mayer et al., 1997).

Individual customers, i.e. households are willing to use “green” electricity for a variety of reasons, such as environmental concerns, altruistic attitudes, personal inclination, et al. It is therefore possible to claim a positive willingness to pay more for “green” electricity, for a number of reasons. This paper aims to establish the features contributing to the consumers' willingness to pay more for electricity obtained from renewables.

2. Key elements of renewable energy sources in the generation of “green” electricity

“Green” electricity is electricity generated from renewable energy sources and it is distinguished from conventionally generated electricity by its non-existent or relatively low pollution emissions (Kotchen, Moore, 2007). The aforementioned may be confirmed by the fact that renewable energy sources involved in electricity generation participate with zero or near-to-zero emissions of greenhouse gases and other air pollutants (United Nations Development Programme, 2000). In theory, the generation of “green” electricity from renewable energy sources may be infinite because (theoretically speaking) the latter are any energy resources which naturally restore themselves at a rate that is higher or nearly-as-high-as the consumption of such energy resources, or a long-lasting resource abundantly available in nature (van Vliet, 2012). Presumably, renewable energy sources are unlimited, that is, even if they are being consumed, their quantities are only temporarily being deployed, i.e. they can be restored or replenished (Labudović et al., 2002). Hence, sources of renewable energy include solar, wind, hydro-power, biomass (biologically-derived material), geothermal (Earth's thermal energy) and marine energy encompassing wave, tidal and marine current power (Armstrong, Hamrin, 2000). The use of renewable energy sources in electricity generation imply environmental safeguarding, that is, it contributes to environmental sustainability, given that the primary use of renewable energy sources foresees zero pollution. This feature stands out as one of the main advantages in promoting generation and utilisation of “green” electricity.

An essential shortcoming for a larger use of renewable energy sources is the relatively high production cost of “green” electricity. There is a general higher cost for the construction of “green” energy plants, than for fossil or conventional ones, partly because renewables are capital-intensive, requiring hefty initial expenditures on equipment, in exchange for lower operating costs over time (Mayer et al., 1997). The latter is true, in particular, for power plants using marine power, since their technology is highly expensive¹. The construction of photovoltaic systems also comes at a high cost owing to high technology costs and the complexity to manufacture solar panels.

Depending on the factors involved in the price determination of electricity generation from either renewable or non-renewable sources, different estimates can be drawn. For example, should electricity generation costs of power plants be included in the carbon dioxide (CO₂) emission trading price, the latter being the harmful emissions produced as a by-product of electricity generation, the competitiveness of renewable energy sources would be improved over the fossil-fuel, conventional, power plants (cf. Tarjanne, Kivistö, 2008). Regardless of the afore stated, the literature on this subject indicate that “green” electricity is marketed at prices ranging from 10% to 30% above the price of conventional electricity (Kotchen and Moore, 2007). Therefore, taking into

¹ Due to expensive technology, specific location requirements and other factors, the ratio of maritime energy used by renewable resources in world's generation of green electricity is minimal.

account the current technology involved and the technical and technological progress, it is common to charge a premium for “green” electricity, in order to compensate for higher production costs and encourage further research in renewable energy sources.

The investment in renewable energy technologies and the utilisation of the renewable energy sources from nature, entail a number of economic outcomes. Furthermore, there is a multiplier effect in spurring the economy and the development of, not only, the energy sector, but also, of any supporting activities related to such industry. Supposedly, the greatest benefit from adopting “green” energy, i.e. renewables, is innovation, which is likely to promote technical and technological changes (Fankhauser, Sehlleier, Stern, 2008). In the long run, technological change, innovation and the development of renewable energy sources create new jobs and increase the demand for labour. Furthermore, “green” electricity may bring numerous management advantages to utilities supplying electricity to both legal entities and physical persons, and it can affect other companies as well, which choose to use the afore mentioned input, thus, presumably, improving customer satisfaction (Pérez-Plaza, Linares, 2009). “Green” energy can help electric utilities improve their impact on the environment, increase the company's goodwill, differentiate from competitors, focus on specialised market niches, retain existing and acquire new environmentally aware consumers, et al. Companies willing to pay more for “green” electricity used in their own production processes openly demonstrate not only their interests in a sound environment, but also in community development – for the benefit of the whole society through the use of clean energy (Fouquet, 1998). Clean energy can help achieving corporate and institutional goals in connection with social responsibility of businesses.

Distinct policy instruments promoting the development of renewable energy sources are being applied by public authorities. Such instruments aim at providing support for a particular segment of renewables, however, at the same time, their implementation scope may be limited. For example, subsidies/taxes, as fiscal instruments to reduce costs/increase the prices of “green” electricity generation/consumption, provide public authorities with special opportunities concerning renewable energy management, which does not necessarily have to be cost-effective. The following instrument, the *renewable energy fund*, also carries a financial dimension in supporting “green” energy development, whether in research and development sector, fund transfer or market-based applications. The “green” *certificate scheme* represents the obligation for consumers to use/purchase (a portion of) “green” electricity, the generation of which is proved by the certification of “green” production. The advantage of the implementation of this instrument is the fostering of competition, whereas the lack of it may be found in high-cost renewable technologies. A widely spread investment programme in renewable energy sources is represented by *feed-in tariffs* ensuring a premium payment for eligible “green” electricity production. On the one hand, feed-in tariffs can ensure long-term return for investors, where certain power plants/power utilities on the market are being favoured, but, on the other hand, such instrument does not necessarily have to meet the long-term goal of using a greater share of renewables in “green” electricity output. Nonetheless, these motivating schemes have led to a surge in the use of renewables in certain EU Member States. The instrument mobilising consumer's interest and support for a greater use of renewable energy sources is the *voluntary “green” electricity scheme*. Its key feature relies on the voluntary purchase basis, ensuring a flexible and simple implementation. The advantages of such scheme are securing a pool of financial means from interested consumers, less state involvement, reduced spending from the already restricted public authority funds and the opportunity for participation from both the private and the public sectors. The absence of “green” energy voluntary purchase implies the lack of guarantee measures ensuring quantity goals for the utilisation of renewable energy sources, thus failing to be cost-effective, and the effectiveness of which depends on electricity prices and consumers' access to information and awareness (Gan, Eskeland, Kolshus, 2007). Other factors of this scheme, as well as the interests of consumers in purchasing “green” electricity, shall be analysed in the subsequent part of the paper.

3. Voluntary purchase of “green” electricity

Consumers' voluntary-based decision to choose the most fitting “green” electricity supplier and to purchase a “green” product foster utilisation of renewable energy sources in the electricity-generation sector. Ultimately, with the choices they make, consumers have the power to trigger change in the role of electric utilities, by shifting the latter's focus on alternative energy resources, thus to have leverage on the community to act in line with their (ethical) principles.

In addition, consumers are inclined to pay more in order to be able to use “green” electricity. Such premium on the standard price of “green” electricity is the result of investments made in renewable energy sources, in their further improvement and development as well as in exploring the capacities of renewable resources in electricity generation structure, which leads to higher energy independence, lower combustion of fossil fuels and their harmful impact on the environment.

The willingness to pay technique uses survey methods to estimate the price that people are willing to pay for a given good (Bigerna, Polinori, 2011). Given this paper's topic of research, the willingness to pay is used to evaluate environmental benefits and consumers' preferences in financial terms. Most “green” consumers want to purchase well-defined products that have a clear role in tackling environmental issues. Consumers want to feel good about the purchase, therefore, they want to see a positive impact of their actions. At the same time, consumers also tend to seek “green” products that are convenient, relatively inexpensive, and that perform as well or better than the alternative (Mayer et al., 1997). “green” electricity, although having public good characteristics², shows a certain attractiveness to consumers, which are willing to pay a premium over normal electricity prices (Pérez-Plaza, Linares, 2009). The willingness to pay depends on altruistic attitudes and preferences of consumers; their environmental concern, i.e. lower levels of exploitation and combustion of fossil fuel energy sources; the socio-demographic characteristics of consumers, such as age, education and income; the extent of the premium for “green” electricity, and the portfolio of “green” electricity products; a package of a diversified services/products for the purchase of “green” electricity, among which it may include non-energy services/products; the type of renewable energy source used to produce “green” electricity; et al. In addition, it is worth noting that there is a positive relationship between customer satisfaction and the willingness to pay, since satisfied customers are willing to pay more for “green” products or services. In fact, when customers are clearly satisfied, they perceive a high outcome of an exchange and therefore are willing to pay more (i.e. more than less satisfied customers) because this still results in a beneficial ratio of outcome to money spent. Similarly, when satisfaction is low, customers perceive a low payment as adequate to establish a fair exchange (Homburg, Koschate, Hoyer, 2005).

Finally, it should be noted that, in reality there is no obligation of ensuring and delivering “green” electricity to customers, even when they have decided to voluntarily and additionally pay for it.

4. Empirical review of the willingness to pay for “green” electricity

A number of studies have been carried out and extensive pieces of information have been collected in order to estimate the preferences of customers regarding their willingness to pay a premium for “green” electricity.

² Depending on the instrument promoting the development of renewables, there are slight differences of green electricity as a public good. A voluntary contribution mechanism, whereby households simply donate money to finance the capacity for generating green electricity, is consistent with theory on private provision of a pure public good. Otherwise, green tariff mechanism, whereby households must pay a fixed tariff per kilowatt-hour of consumption, is consistent with theory on private provision of an impure public good (Kotchen, Moore, 2007).

Batley et al. (2001) investigate the potential advantages and disadvantages of “green” power products in the United Kingdom and, analyse the willingness to pay for “green” electricity. Results showed that 34.86% (N=667) of respondents were willing to pay more for electricity generated from renewable sources. Also, results indicate that the willingness to pay increase with social status, awareness of energy efficiency and income, implying that the higher the individual's income the more probable they will pay extra for renewably generated electricity. It is concluded that the “green” citizen must continue to co-exist with the “green” power purchaser if the UK is to make any significant improvement in the contribution of renewable energy to electricity demand.

In their study Roe et al. (2001) argue that a higher personal income, higher education levels and the affiliation to an environmental organisation increase the willingness to pay for environmentally-friendly electricity and the reduction of pollution. Such attitudes, in line with the research carried out by Rowlands, Scott, Parker (2003) identify the combination of the following common features among customers willing to pay a premium for “green” electricity: a drive for environmental issues, more open-minded attitudes, altruism, education, age (younger customers show more willingness to pay), income, involvement in the community or environmental organisations.

According to Zarnikau (2003), the respondents are willing to pay more money for investments in renewable energy sources and energy efficiency, where 50% of respondents are willing to pay 1 extra dollar for “green” electricity and more energy efficiency, 40% are likely to pay 5 or 6 dollars more, while 19% and 12% respectively are willing to pay 12 dollars more for clean electricity and a more efficient electricity production. Another study (Wüstenhagen, Markard, Truffer, 2003) points out that 20% of respondents across Germany, the United Kingdom and Sweden were willing to pay a 15% price increase for “green” electricity, whereas almost none of the respondents would pay a 40% price rise (it is also explained that the willingness to pay more for “green” electricity is much higher in Switzerland, due to its higher household income).

Through the contingent valuation method, Nomura and Akai (2004) explore the willingness of Japanese households to pay more, in the form of a flat monthly surcharge (500, 1000 and 2000 yen) for renewable energy, i.e. photovoltaic and wind power. Customers are willing to pay a premium which is estimated at about 2000 yen (around 16 EUR with the exchange rate 123 yen/EUR) per month per household. They also indicate that people willing to pay more want renewable energy technologies to be used in the future.

Borchers, Duke and Parsons (2007) denote that the versatility of renewable energy sources may prove to be useful for consumers, under a number of aspects. Preference and higher willingness to pay is given to solar energy over wind power and, in general, over other renewable energy sources, while biomass and methane are regarded the least desirable energy resources, the willingness to pay level of which stands at the lowest points.

An experimental investigation of individual preferences regarding the consumption of “green” electricity against an alternative method of payment for the promotion of renewably energy have been presented by Menges and Traub, (2009). The study explores the extent of free-riding in the survey, the effects that different payment methods have on the participants’ willingness to pay, and crowding-out effects of private willingness to pay due to public promotion of “green” electricity. Under the public choice treatments, participants were willing to pay far higher contributions to “green” electricity than under the individual choice treatments. On the one hand, this observation highlights the large extent of free-riding in the private provision of the public good of “environmental quality”. On the other hand, it also demonstrates that many households are willing to contribute voluntarily even if free-riding is possible. A general explanation for this result is altruism.

In the Republic of Korea, also by means of the contingent valuation method, Kim et al. (2012) examine the willingness of Korean households to additionally pay for electricity generated by wind, photovoltaic and hydropower. Empirical results show that, although the willingness to pay was highest for wind power and lowest for hydropower, the differences in the willingness to pay among renewable sources were statistically insignificant. This shows that Korean consumers chose a combination of renewably-generated electricity against the lowest price increase. The average willingness to pay for all three energy types was 1562.7 KRW (Korean Won) (around 1.19 EUR with the exchange rate 1313 KRW/EUR) per month per household, which was approximately 3.7% of the average monthly electricity bill in 2010. This amount represents only 58.2% of the Korean government's budget allocations to the new and renewable energy dissemination program in 2010. Thus, results imply that the promotion of the renewable energy dissemination program may be difficult only with the willingness to pay for "green" electricity generated from renewable sources.

Without further analyses of case studies and research results, it is clear that during the period under scrutiny, of almost fifteen years, regardless of the time/place of research, or the "green" energy source in question, the presented data point at either a higher or a lower willingness to pay of any sample group, where willingness to pay shrinks as the "green" energy premium rises, and is (among other features) directly associated to the respondents' age, income and education levels.

5. Conclusion

This paper analyses both in theory and empirically the willingness to pay more for "green" electricity generated from renewable energy sources based on the data previously gathered. The willingness to pay represents one of the policy instruments to encourage the development and a higher scale utilisation of renewables, and can be defined as the highest amount of money a consumer is willing to spend for a product or service. Thus, the willingness to pay may be determined as the value in money that a person assigns to the consumption or usage of a certain good or service.

Empirical research from a number of authors highlight a proactive voluntary willingness to pay for "green" electricity, where such willingness to pay is based on a number of following features not listed in order of importance: climate change mitigation, environmental safeguard, altruistic attitudes, personal preferences, socio-demographic characteristics of consumers, type of renewables offered, the premium at which the "green" electricity is sold, etc.

Undoubtedly, through willingness to pay - this particular policy "financial release" instrument, both supply and demand of "green" electricity enable any interested parties, producers and distributors, on the one hand, and consumers, on the other, to take part in furthering clean renewable energy sources, and, consequently, in safeguarding the environment and in reducing harmful emission output into the atmosphere, thus putting into practice the model of an acceptable financial satisfaction (producers) and sacrifice (consumers) of market participants.

Finally, this paper opens the way for new research, and may be regarded as the basis for further empiric research on the occurrence of willingness to pay for "green" electricity in the Republic of Croatia.

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