



# Public preferences for electricity contracts including renewable energy: A marketing analysis with choice experiments



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## ABSTRACT

This study aims to understand people's preferences concerning different energy sources with a particular focus on renewables. Households' preferences were assessed by means of a choice experiment on a sample of people living in Veneto (north eastern Italy). The analysis considered real marketing scenarios, presenting different choice options inspired by real market offers by different companies on the Italian market. The energy packages were differentiated considering the monthly price, the source of the energy package (solar, biomass from agriculture and biomass from forestry), the size of the power plants, the minimum distance from houses, and, for biomass only, the certification of the origin. According to our results, there is a wide market for expanding "green" electricity contracts: 86% of the respondents stated that they are willing to pay more for them. People prefer electricity produced from photovoltaics, followed by forest biomass and by agricultural biomass. According to our results, the possibility to choose the renewable energy source matters: the willingness to pay for photovoltaic is 3.4 times that for forest biomass and 5.4 times that for agricultural biomass.

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## 1. Introduction

According to Ref. [1], the worldwide total energy supply has grown from 6109 Mtoe in 1971 to 13113 Mtoe in 2011. In the same period, the contribution of the RESs (renewable energy sources) to the total energy supply increased from 12.6% to 14.3%. Electricity contributed 17.7% to the final energy consumption (8918 Mtoe) in 2011. The contributions of the different RESs to the total electricity production relative to 2010 can be subdivided as follows: 16.6% hydro-power, 2.56% wind, 1.95% biomass, 0.67% geothermal, 0.13% solar (both photovoltaic and thermal) and 0.01% marine [2]. Ref. [3], p 46] reports that solar PV (photovoltaics) was the fastest growing in the last decade (2000–2010). In 2012, in Italy, 31% of electricity production came from RESs, of which approximately 50% were produced by hydroelectric power plants. Because 13.1% of electricity consumed is imported, it is not possible to calculate exactly the amount of electricity consumed in Italy produced using RESs, but it is possible to suppose that, on average, the source mix of imported electricity is similar to Italian-produced electricity. Given the growing contribution of RESs to the total energy supply, in last

decade, there has been growing attention paid to RESs. For example, in Italy from 2011 to 2012, photovoltaic electricity increased by 74.7%. The need to reduce GHG (greenhouse gasses) and, in particular, CO<sub>2</sub> emissions combined with energy security (self-sufficiency) has increased the general awareness about the importance of relying on RESs for energy production. Several policies have been implemented in order to drive the change from fossil fuel based to clean energy production technologies, such as Directive 2009/28/EC (23rd April 2009, also known as the "20–20–20 European Directive").

In recent years the crisis undermined some European policies that relied heavily on subsidies like those of Spain, Germany, UK and Italy. At the same time some technologies, like for example the production of solar photovoltaic modules, became much cheaper. One strategy to foster the adoption of RESs in the electricity market in the EU can be to exploit the liberalization of the energy market. In a liberalised energy market consumers have the freedom to choose their energy provider and contract. Opting for contracts that include electricity from RESs, people can influence the diffusion of RESs "voting with their wallet" [4].

According to Ref. [5], "market-acceptance" of RESs is one of the most under-researched topic in the field of RESs acceptance. Green power marketing isolates market adoption from other acceptance

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issues: final buyers are interested in the final product rather than in other issues that could limit the diffusion of RESs [5]. It is therefore important to understand if it possible to rely on the private market to enhance the diffusion of RESs for electricity generation. While private companies in Italy already offer electricity contracts to buy 100% green energy, our paper wants to investigate whether it is possible to have a better penetration of the market letting costumers choose the specific RES. Such marketing strategy would further empower people reducing the potential opposition to some specific energy sources that might have side effects if the power plants are built locally.

Many are the benefits of RESs and people are attracted by the concepts of sustainable energy production, energy neutrality and impact minimisation from the living of their communities. However, the implementation of policies in favour of the diffusion of RESs poses several challenges to decision makers [6,5], especially in the case of electricity production. In fact, the different RESs may have non-negligible drawbacks because they could generate some negative externalities. For example, solar power plants mainly have negative aesthetic externalities, especially when placed on the ground, and might affect the traditional rural landscapes. They also take land away from cultivation uses. The solar panels placed on roofs may also affect the landscape, but this has a lower visual impact, especially when placed on industrial buildings. Some of the main externalities of wind power plants include their impact on the landscape, noise, and their impact on avifauna, especially when placed in migratory routes. Energy production from biomass has many benefits but again might bring some impacts on the environment. Considering the agricultural ones, in some cases the cultivation of dedicated crops for energy purposes might imply the use of fertilisers and pesticides, which can have negative effects on the environment. The latter is not the case of biomass derived from residuals or waste from agricultural crops [7]. Another problem related to the “intensive” production of biomass from agriculture is the fact that agricultural resources are diverted from food production to energy production,<sup>1</sup> potentially contributing to increases in food prices. The latter problem does not occur for forest biomass, but forests biomass may lead to the disappearance of important natural ecosystems especially in less developed countries. It should also be considered that if the harvest area is located far from power plants, a non-negligible quantity of carbon dioxide will be emitted for transport. If this occurs, the production of energy from biomass is no longer carbon-neutral. Finally one has to consider that to transform biomass into energy, the biomass needs to be burnt, which can reduce the air quality and damage the health of the people living near the plants. Obviously this depends on the characteristics of the power plants, their dimension and localisation. People generally seem to be in favour to the adoption of RESs, but their attitude can change deeply when there is a possibility that power plants will be constructed near their homes. All these problems may influence the social acceptability of energy production with RESs.

Several studies have been done in the last decade focussing on the monetary estimation of the positive and negative externalities accruing from the adoption of RESs and people's attitudes toward RESs. Both CV (contingent valuation) and CE (Choice Experiments) have been used to this aim [8,9]. Some studies considered only generic RESs preferences [10,11]. Others considered a specific RES such as wind energy [12–19], solar photovoltaics [20], hydropower [21], tidal power plants [22] or biomass [23,24]. Others still made a comparison among RES preferences considering them

<sup>1</sup> This does not happens if biomass is produced on “fallow land and marginal lands, the latter being largely unsuited for food crops” [7].

simultaneously. Despite the differences between the approaches used by the scholars and the achieved results, all these studies highlight the complexity of the analysis of people's RES preferences and the necessity to collect more information about the factors affecting their social and economic value.

The aim of our paper is to investigate the market acceptance of RESs by studying the demand for electricity contracts for energy generated by RESs. As stated by Ref. [5], this topic is one of the most under-researched in the field of RESs acceptance and our study wants to contribute to this branch of literature collecting new data and investigating whether letting people choose a specific energy source might result in a good marketing strategy to enhance the acceptance – and consequently diffusion – of RESs at a local level. An innovative aspect of our study is that we compared the preferences of people regarding the expansion of RES power plants to produce electricity on a local level considering solar photovoltaic plants installed on agricultural fields, biomass plants using biomass from agriculture and biomass plants using biomass from forests, which are the only RESs that can be exploited in the study area efficiently. In this way, people are expected to enjoy the benefits of energy production locally (energy self-sufficiency) but at the same time to bear the negative externalities of the power plants directly. The local nature of our scenario should help in making the study more realistic and limiting free-riding behaviour. With reference to biomass, as far as we know, the current literature on the valuation of the monetary benefits of RESs has never investigated the differences among various types of biomass. In this respect our paper aims to contribute to the RES valuation literature by applying a choice experiment to try to understand whether people's preferences are affected by the type of biomass considered, namely, from either agriculture [25] or forests [26,27].

In this respect, a CE has been undertaken in the Veneto Region,<sup>2</sup> addressing some of the controversial aspects of the results obtained by the previous studies.

Given that we studied a scenario where power plants are supposed to be built locally, to face the so called NIMBY (Not In My Backyard) effect [28] we analysed three aspects (attributes) in our experimental design (apart from the renewable energy source): the distance of the power plants from the place of living, the area where the biomass is produced and the dimensions of the power plant. Our experimental design was developed considering the real market policies of some Italian electricity companies. This process made it possible to not only quantify the premium price derived from the adoption of RESs but also give some insight into market strategies that could realistically be adopted to improve the diffusion of the sustainable electricity market.

The rest of this paper is organised as follows. Section 2 presents a synthesis of the studies that applied CE for the estimation of the benefits of different RES sources. Section 3 presents the methodological aspects of our study along with a brief introduction to the CE methodology. The results are illustrated in Section 4 and discussed in Section 5.

## 2. Previous applications of choice experiments to renewables

Among the studies focussing on the estimation of the positive and negative externalities accruing from the adoption of RESs, in

<sup>2</sup> The Veneto Region is located in the north eastern Italy. It has a surface area of 18.390 square kilometres and a population of 4.9 million. Plains cover 56.4% of the surface, with the remaining portion covered by hills (14.5%) and mountains (29.1%). In 2012, the gross domestic product (GDP) was equal to 146.605 million € and the GDP per capita was approximately 30,031 €. The GDP of the Veneto Region was slightly lower than that of Ireland and higher than that of the eastern European Union countries.

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