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# Italian Consumers' Willingness to Pay for Renewable Energy Sources§

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**Abstract** EU Directive 2009/72/CE imposes to the European Countries environmental and energy targets. The Italian goal is to attain a 17% share in electricity production from renewable energy sources (RES) by 2020. To make investment in renewables attractive, market prices must be profitable and the gap between the private and social costs of renewables must be filled using "persuasive" tools. The acceptance of such a burden may be controversial because it results in an increase in prices. It is interesting to estimate the consumer's willingness to pay (WTP) for green electricity. We based our research on a national survey conducted in November 2007 in Italy. We used a stochastic payment card (SPC) including a "certainty correction" and proposing five degrees of acceptance. An empirical analysis shows that there is a substantial willingness among Italian consumers to partially cover the cost of achieving the RES goal.

**Key Words:** *contingent valuation, interval data, stochastic payment card, renewable energy sources.*

**JEL:** Q26 Q41

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## 1. INTRODUCTION

Today's economy is mainly based on fossil fuels that are finite and polluting. In the past, substantial emphasis regarding climate action was placed on the precautionary principle; currently, the consequences regarding the use of fossil energy are seen from a different perspective because the issues related to climate change are evident worldwide. Thus, climate change[1] and resource depletion are real problems to be addressed in the context of the welfare of society. In this context, renewable energy sources (RES) are essential to reduce polluting emissions. As a result, researchers have increased their interest in the economic implications of the development of renewable energy used in electricity production. One important feature of the RES is their high supply generation cost and this characteristic has two important consequences with respect to public opinion. First, this high cost prevents the widespread uptake of renewable energy systems in spite of their environmental soundness. Consequently, if there is not sufficient consumer willingness to pay WTP, public funding is needed to support RES development. Second, if consumers take into account the environmental issues and consider that promoting RES will mitigate environmental damage, they are likely to attach a positive value to these RES. As consumers think positively of renewable energy technologies, this attitude may influence their WTP by augmenting the premiums they are willing to pay for such new technology; as a consequence, the need for public funding might be reduced over time. In accordance with this scenario, the main objective of this study is to use an SPC method[2] to estimate consumers' WTP for the development of RES use in Italy. In our framework, we measured consumer's WTP to estimate the market sustainability for meeting renewable electricity production goal in Italy. This paper is organized as follows: in section 2, we

[1] The problem of climate change is a typical public good financing trade-off problem: it requires the imposition of immediate and painful private costs in exchange for uncertain future public benefits.

[2] This method allows us to consider that consumers have a range of economic values, or a valuation distribution in their mind, instead of a single point economic value estimation. For further details, see section 5.2.

briefly describe the energy scenario and the incentive mechanism; section 3 reviews the theoretical background; section 4 focuses on the actual cost of RES in Italy; section 5 describes the methodology and presents details of the survey design and collected data; section 6 describes the empirical study and presents results from the regressions analysis; and further discussion of the empirical results and their policy implications is provided in the final section. The appendixes provide additional details on the theoretical and econometric models used and on the data collected in this study.

## 2. THE ENERGY SCENARIO AND INCENTIVE MECHANISM

Currently, the world energy demand is approximately 12 billion tons of oil equivalent per year. The future demand for energy is related to population growth and to the increase in per-capita energy consumption worldwide. It is also expected that the economic recovery over the next few years will lead to a resumption of world energy consumption along the previous growth path. In the long run, according to the International Energy Agency reference scenario (IAE, 2009), global demand for energy is expected to grow at an average annual rate of 1.5% during the 2007-2030 period, corresponding to an overall increase of energy demand at 40%. The EU Directive 2009/72/CE, known as the "Climate and energy package," sets four targets for 2020 (known as "20-20-20"): a 20% reduction in polluting emissions, the achievement of an energy portfolio with a 20% share of renewables and a 20% savings in energy consumption. EU countries share this burden in different ways; the Italian goal is to attain a 17% share of RES by 2020. To make investment in renewables attractive, the market price of energy must be higher than the price of fossil fuels because this price must also account for the "benefit shadow" of the environmental impact of nonrenewable energy. The gap between private and social costs of renewable energy must be filled with "persuasive" tools such as taxes, subsidies and a complex framework of administrative regulation. In a perfect environment with full information and no constraints on government tax policy, the optimal strategy for switching to the use of new energy resources consists in setting a Pigouvian tax, i.e., a tax levied on the use fossil fuels, which is tantamount to taxing the relative pollution produced. In this way, an incentive is created to reduce fossil fuel usage and polluting emissions; in concrete terms, this is the unpopular concept of a carbon tax. Support mechanisms for new energy resources are classified as either price-oriented[3] or quantity-oriented[4]. Economic theory has shown that if there is relatively higher uncertainty about the cost of implementing new technologies, price mechanisms are preferable; by contrast, if there is higher uncertainty regarding the benefits to be achieved, then quantity regulation is superior (Nordhaus 2001). In Italy[5], support mechanisms are mixed and in the context of the liberalization of the electricity market, these mechanisms impose a burden on the energy bills of both households and businesses. The incentive mechanisms are based both on market regimes (such as the quantity oriented mechanism, or "green certificates") and administrative regimes (such as the price oriented mechanism, or "feed in tariffs", capital incentives and tax credit incentives). In particular, these mechanisms include the following: a) incentive rates (CIP 69/2) for renewable energy and assimilated sources (before 1999); b) a system of green

[3] With regulatory price-driven strategies, financial support is given through investment subsidies, soft loans, tax credits, fixed feed-in tariffs or a fixed premium, which governments or utilities are legally obliged to pay for renewable energy produced by eligible firms (green certificates) or a premium for energy savings actions (white certificates). In Europe, most countries have adopted feed-in tariffs and Germany was the first country to adopt such a tariff. In general, feed-in tariffs decrease over the years as a result of technological learning curves. The criticisms made of the feed-in tariff scheme emphasize that a system of fixed price levels is not compatible with a free market (Meyer, 2003).

[4] With regard to regulatory quantity-driven strategies, governments define the desired level of energy generated from renewable resources. An important policy is represented by the renewable portfolio standard, the main tool for implementing green energy in the United States. The basic idea of the renewable portfolio standard is as follows: electricity suppliers (or electricity generators) are required to produce a minimum amount of green energy in their portfolio of electricity resources.

[5] Del Rio and Gual (2004) analyzed in detail the public support schemes for electricity from renewable energy sources in the European context.

certificates for renewable energy sources (since 1999); c) a system of feed-in tariffs for renewable energy installations to power less than 1 MW (200 kW for wind power) since 2005; d) a feed-in premium for solar power plants, particularly for photovoltaic systems (since 2007); and e) capital grants (local) for some renewable sources (since 2003). However, government intervention through taxes and subsidies translates into higher energy prices in the short run. In such a setting, it becomes crucial to explore the consistency of consumer's WTP for clean energy to use renewables for electricity production.

## 3 GREEN ENERGY AND WTP: THE STATE OF THE ART

Measuring WTP is a method used to determine the price of a good when a market does not exist and therefore the price is unknown. This technique uses survey methods to estimate the price that people are willing to pay for a given good; in this paper, it is used to evaluate environmental benefits in financial terms when markets for environmental quality do not exist. In these cases, the necessary information for conducting cost-benefit analyses is not available, e.g., it is not possible to assess the values of renewable energy or pollution. Indeed, there is a wealth of surveys on the use of RES have been performed in the United States (Farhar, 1999; Roe et al. 2001; Vossler et al. 2003), the United Kingdom (Batley et al. 2001), Australia (Ivanova, 2005), Spain (Alvarez-Farizo and Hanley, 2002) and Japan (Nomura and Akay 2004). According to our knowledge only two surveys (Bigerna and Polinori, 2008; Bollino, 2009) have been performed in Italy and data have been collected to draw inferences about consumers' preferences with respect to energy sources. As noted in prior studies (Bigerna and Polinori, 2008; Bollino, 2009) these surveys are not readily comparable. Indeed, aspects as follow: i) country and institutional context, ii) survey typology, iii) survey period; iv) elicitation formats and v) applied methodology and the econometric techniques employed are very heterogeneous. However, it could be useful, for our purpose, to regard their results to compare the policy implications. Generally, prior studies found a moderate consumer

WTP if compared with the additional cost of each country's national policy energy targets (Bigerna and Polinori, 2008); this is the case, for instance, in Ivanova's study (Ivanova, 2005) for Queensland and in Batley et al. (2001) economic analysis for the United Kingdom. In detail, Ivanova (2005) implemented a traditional contingent variation by surveying 820 respondents in the State of Queensland (Australia) via mail questionnaire, obtaining an overall response rate of 26%. The author used the consumers' WTP to evaluate the market sustainability of the Australian federal government's renewable energy target, which sets a minimum share of electricity production from RES. The results showed that 65% of respondents are willing to pay 22 Australian Dollars per quarter to increase RES use from 10 to 12%; it follows that the Australian target would not be attainable with a purely market-based approach. Batley et al. (2001) analyzed consumers' WTP for renewables in the United Kingdom through an email questionnaire in 1997 (2,250 sent with a response rate of 27.2%). The results showed that 34% of respondents declared that they were willing to pay an additional 16.6% of their actual expenditures to have electricity from RES; according to the authors, this effort is insufficient to achieve the national target of 10% energy production from RES. Many other studies confirmed these results. Nomura and Akay (2004) investigated consumers' WTP for an increased percentage of electricity production from RES via mail questionnaire (response rate 37%) in several Japanese cities: 11 large metropolitan areas and numerous medium and small municipalities. The results estimated consumers' WTP at approximately 2,000 Yen per month, one of the highest estimates among studies conducted in Japan (Nomura and Akay, 2004, p. 462). Zografakis et al. (2010) conducted 1,440 "face-to-face" interviews in Crete using a double-bounded dichotomous-choice method to elicit consumers' WTP. The mean WTP per household was approximately 16.33 € to be paid quarterly as an additional change on consumers' electricity bills. Yoo and Kwak (2009) investigated consumers' WTP in Korea using a telephone interview (890 interviews completed, with a response rate of 95%) that incorporated contingent valuation techniques with both parametric and non-parametric methods.

The monthly WTP was found to lie between 1.8 and 2.2 USD. Concerning the case of Italy, recent estimates of consumers' WTP for RES are variable and they show a range between 24€ and 54€ yearly per household (the average Italian household size is roughly 3). This analysis has been conducted using a payment card method; the estimated WTP almost doubles when using contingent valuation methods (Bollino, 2009).

## 4 THE COST OF RENEWABLE ENERGY IN ITALY

In Italy, there has been a recent debate on the actual cost of renewable energy. One favorite "mantra" is that in Italy, the cost of electricity is significantly higher than in other European countries and that one of the possible culprits of higher electricity prices is component A3 of bills[6]. This has been a component of Italian electricity bills since 1997 (del. 70/97 AEEG) and it is the part of the bill dedicated to covering the higher cost of RES use in electricity generation. However, its revenue provides only a rough approximation of what consumers have spent on the promotion of renewables because component A3 also includes several types of tax burdens and few of these support RES development. Indeed, section A3 also includes subsidies for the production of power plants based on the use of conventional fuels with alternative production techniques (e.g., alternative fuel processing and waste processing techniques and the use of industrial production in generation); consequently, the A3 component overestimates the actual support renewable energy sources. In 2010, for example, if we consider all fee items in Italian electricity bills, the total amount is € 5,808 million, while the A3 component amounts to € 3,970 million, of which only €

[6] Few European electricity markets are comparable with the Italian one because differences exist in terms of market liquidity, fuel mix, incentive mechanisms and market segmentation due to congestion problems. All things considered, the most similar market seems to be the German one and if we consider the prices paid by domestic users with power consumptions of 2.5-5 MWh, it can be shown that Italian, German and British consumers pay very similar prices (Sileo, 2011).

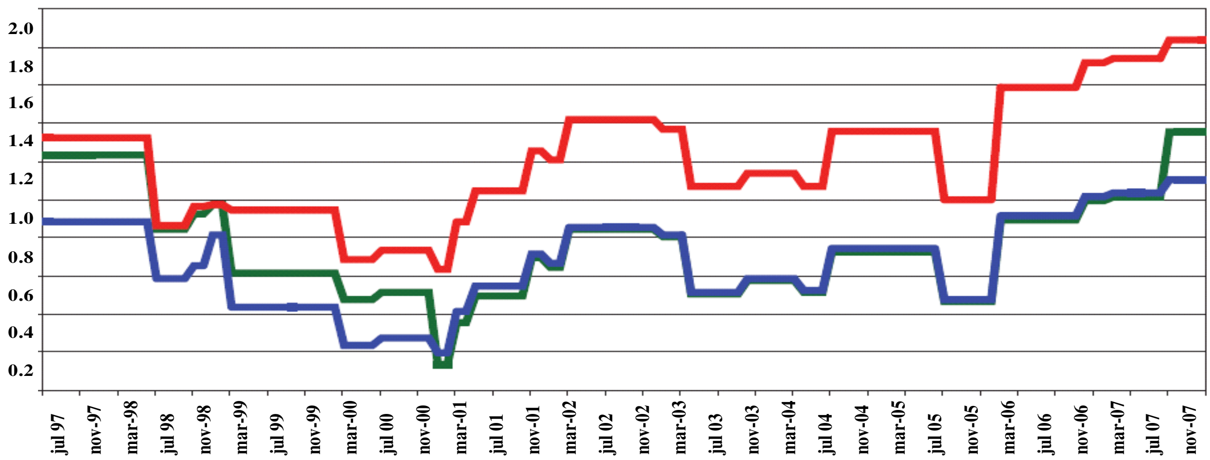
2,756 million (69%) supported renewable energy. This means that in 2010, the mean additional cost due to renewable energy sources lies between 1.4 and 2.5 € per month per household. The variability in this figure is because the magnitude of the A3 component varies among different types of consumers. A3 charges from the survey year (2007) are shown in table 1, while figure 1 shows the monthly time series of A3 rates (in full). Consistent with the aim of this paper, the following observations should be made. At the time of the survey, Italian consumers already paid for renewable (see table 3) and these payments were taken into account by informing interviewees of their status quo contributions; second, we asked them to considerer their maximum WTP independent of their current A3 contributions.

Table 1: A3 component by different types of clients (2007)

| Features | Low voltage | | | | Medium voltage | | High voltage | |
|---|---|---|---|---|---|---|---|---|
| | Household uses | | Other uses | | | | | |
| Power (KW) | 3 | 3 | 10 | 100 | 500 | 1,000 | 3,000 | 10,000 |
| Use (h/year) | 880 | 1,167 | 1,200 | 1,500 | 2,000 | 2,500 | 2,500 | 3,500 |
| Annual consumption (MWh/year) | 2.64 | 3.5 | 12 | 150 | 1000 | 2,500 | 7,500 | 35,000 |
| Average rate A3 c€/kWh) | 0.73 | 0.75 | 1.21 | 0.93 | 0.75 | 0.74 | 0.68 | 0.67 |
| Monthly expenditure (€/month) | 1.60 | 2.20 | 12 | 116 | 627 | 1,545 | 4,236 | 19,481 |
| *only RES* | *0.95* | *1.30* | *7* | *69* | *370* | *913* | *2,502* | *11,507* |
| Tax levy (million €) | 630 | | 1,228 | | 1,192 | | 279 | |
| Total (million €) | 3,329 | | | | | | | |

*Source: our elaboration on GSE data*

**Figure 1: Monthly time series of A3 components in full (cEuro/kWh)**




Legend:
red line: low voltage, 10 Kw, 1,200 h/year
blue line: high voltage, 10MW, 3,500 h/year
green line: low voltage (households), 3 kW, 1,200 h/year

## 5 METHODS AND DATA

### 5.1 Theoretical Model

In this study, we considered the Italian household as the typical consumer unit. It was assumed that households maximize their utility subject to budget constraints. The demand for "RES use" can be viewed as any other good or service and we therefore modeled consumer choice within the utility (expenditure) maximization (minimization) framework. If we allow expenditure to be a function of "RES use" services (R), private goods ($X_P$) and a composite of public goods ($X_G$) subject to the utility constraint, we obtain[7]:

$$\begin{aligned} &Min\, E\left(P_P, P_R, X_G\right) \\ &sub\ to: U = U\left(X_P, R, X_G\right) \end{aligned} \tag{1}$$

Given the utility constraint, the representative household faces expenditures for "RES use" services, private goods and the composite public goods; thus, the household will attempt to minimize the following expenditure function:

$$E = E\left(P_P, P_R, X_G, U\right) \tag{2}$$

However, given the characteristics of RES, it makes sense to think of this as a restricted demand problem where the consumer does not observe $P_R$ and choose R but rather is offered R and can then choose either to pay for these services ($R^1$) or not ($R^0$). Therefore, $P_R$ is replaced with R, and the expenditure function can then be rewritten (3) as follows:

$$E = E^*\left(P_P, R, X_G, U\right) \tag{3}$$

In such a restricted case, the WTP for "RES use" is simply the difference between two expenditure functions (with $R^1 > R^0$); the compensating surplus welfare estimate can be derived in terms of the difference:

$$CS = E^*\left(P_P, R^0, X_G, U\right) - E^*\left(P_P, R^1, X_G, U\right) \tag{4}$$

The above estimate of the compensating surplus is a measure of the households' WTP for the "RES

[7] See appendix for further details.

use" service, i.e., the amount that each Italian household is willing to give up without changing its utility level[8].

**5.2 Elicitation Format and Econometric Model**

In our format, we mainly try to deal with two issues: 1) consumers may have a range of economic values, or a valuation distribution, in their mind instead of a single point economic value estimation and 2) over-estimation of WTP typically occurs in contingent valuation studies.

To deal with the first issue, we adopted a variant of the payment card (PC) approach, a method that allows us to address the possibility that consumers may have a range of economic values in their minds. Furthermore, the PC method is consistent with important guidelines (e.g., U.K. Government guidelines) and many scholars also assert that this method could be more intensively employed in contingent valuation studies (Champ et al. 2003; O'Garra and Mourato 2007; Atkinson et al. 2005).

Referring to the second point, to mitigate hypothetical bias, an intervention designed to reduce the occurrence of *overestimation* in survey responses is often used (Cummings and Taylor 1999; Bulte et al. 2005, Nayga et al. 2007). In this approach, referred to as -*Cheap Talk*-, participants are explicitly warned about hypothetical bias and are asked to respond to the valuation question as if the payment were real. However, *Cheap Talk* may have little or no effect on some people (Samnaliev et al. 2003; Nayga et al. 2007; Loureiro et al. 2009). In this paper, we adopted a *"certainty correction method"* to reduce the overestimation risk by proposing five types of acceptance intensity[9]: "definitely yes" and "no" (DY, DN), "probably yes" and "no" (PY, PN) and "not sure or do not know" (DK). Consequently, to evaluate each citizen's acceptance and WTP for RES, we proposed a stochastic payment card

[8] Obviously, we can think of this households' WTP as a function of the socio-demographic characteristics of respondents. Note that in the previous literature, with the partial exception of Bollino (2009), this aspect has not been properly considered.

[9] For more details on the treatment of uncertainty in contingent valuation contexts, see, among others: Wang (1989), Welsh and Poe (1998), Vossler et al. (2003) and Mentzakis et al. (2009).

approach (SPC)[10] to respondents with 17 bids from 0 € up to 200 €. Table 2 shows, in detail, the structures of elicitation formats used in the survey. SPC data may be analyzed in several ways; in particular, it is possible to treat these data as interval data because respondents' maximum WTPs may lie between the value recorded on the card and the next higher value of the card. Given this elicitation format, the choice of which model to use in regression analysis is mainly determined based on the data.

Table 2: Elicitation format

| Instruct the respondent to circle an answer for each of 17 prices | | | | | |
|---|---|---|---|---|---|
| **Bid (€)** | **DN** | **PN** | **DK** | **PY** | **DY** |
| **0** | 0% | 25% | 50% | 75% | 100% |
| **0.05** | 0% | 25% | 50% | 75% | 100% |
| **0.1** | 0% | 25% | 50% | 75% | 100% |
| **0.15** | 0% | 25% | 50% | 75% | 100% |
| **0.3** | 0% | 25% | 50% | 75% | 100% |
| **0.5** | 0% | 25% | 50% | 75% | 100% |
| **0.75** | 0% | 25% | 50% | 75% | 100% |
| **1** | 0% | 25% | 50% | 75% | 100% |
| **1.5** | 0% | 25% | 50% | 75% | 100% |
| **2** | 0% | 25% | 50% | 75% | 100% |
| **5** | 0% | 25% | 50% | 75% | 100% |
| **10** | 0% | 25% | 50% | 75% | 100% |
| **15** | 0% | 25% | 50% | 75% | 100% |
| **20** | 0% | 25% | 50% | 75% | 100% |
| **30** | 0% | 25% | 50% | 75% | 100% |
| **50** | 0% | 25% | 50% | 75% | 100% |
| **100** | 0% | 25% | 50% | 75% | 100% |
| **200+** | 0% | 25% | 50% | 75% | 100% |

Three characteristic are particularly relevant in our study (Cameron and Huppert 1989; Whitehead et al. 1995; O'Garra and Mourato 2006): 1) the number of zero responses, 2) the size of the intervals and 3) the percentage of data that are point estimates. In our case, the limited number of zeros and point-estimated WTP values in combination with the small size of the intervals suggests that the use of the interval regression method is appropriate in this study. Consequently, we used a parametric interval regression method and computed the confidence interval according to Krinsky

[10] The SPC was introduced by Wang and Whittington (2005); more recently, Ichoku et al. (2009) and Fonta et al. (2010) used the same approach.

and Robb's simulation model[11]. It is also important to emphasize that this data set can also be analyzed using other models because the original dataset has been appropriately treated, recoding DK, PN and PY responses[12] to facilitate quantitative analysis; consequently, we can formally test for differences across models to verify if any of them provide significantly different estimates of the WTP.

### 5.3 Survey Design and Data Collection

In a typical contingent valuation analysis, a policy scenario is proposed to interviewees and their WTP for attaining national goals is then elicited. As with any contingent valuation study, there is always a risk of incurring bias. However, it has also been shown in the literature that a well-designed and carefully administered survey[13] provides consistent, coherent, and credible information on willingness to pay. To derive estimates of households' WTP, a national survey with 1019 interviews was administrated at the end of November 2007. This is a period of particular interest because during the

[11] See appendix for further details on econometric model.

[12] Model A: DY as yes - PY, DK, PN and DN as no. Model B: DY and PY as yes; others as no. Model C: DY, PY and DK as yes; others as no.

[13] The Survey Company used the CAWI (Computer Aided Web Interviewing) method to conduct a routine weekly survey and specific questions on the environment were added to this survey; this last feature shows the high degree of accuracy in estimating Italian population socio-demographic characteristics because of the extensive experience of interviewers. The survey was not performed ad hoc, but authors were able to interact with the survey staff to define the language of the questionnaire. The full raw data set was transferred to the authors for this study, so in principle, no hidden non-stochastic distortions (such as recoding mistakes) should affect the results. A preliminary analysis was conducted by focus groups to define the price vector. These groups included energy managers, experts, members of energy authorities and academics. For more details on the potential bias associated with the payment card method, see Rowe et al. (1996), while for details on the use of internet surveys in contingent valuation methods, see Lindhejem and Navrud (2011). According to the results of these authors, our WTP could be 20% lower than the hypothetical WTP obtained by a counterfactual survey conducted with face-to-face interviews.

two-year period from 2008-2009, financial crises significantly altered consumers' long-run perception[14]. The stratified sample is representative[15] of 46.8 million residents of Italy and the survey was conducted by the *Istituto Piepoli*. In our study, respondents were asked to consider the benefits they obtained from developing RES use in Italy. Each respondent was confronted with a range of (i) general questions concerning RES and their potential development, (ii) questions on knowledge about the Italian energy system and (iii) WTP amounts (bids) to support RES development in Italy. First, respondents were asked whether they were aware of RES and were then asked whether or not they believed that RES could play an important role in the Italian energy scenario ("Not sure" and "do not know" options were also available) as follows:

*"Today, there is a heated debate on the opportunity to develop renewable energy sources. Are you for or against RES?"*

*"In your opinion, what is the Italian situation with regard to the need for energy (electricity, heating and transport) production activities?"*

*"In your opinion, can the development of renewable energy sources in Italy improve / worsen the current energy situation in the country?"*

*"Italy has committed to increase the production of energy from renewable sources by 2020, bringing the ratio of RES to 17%. How much do you support this commitment?"*

Afterwards, respondents were asked if they would contribute to RES use in electricity production for environmental reasons according to SPC method[16].

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[14] A previous survey was conducted at the end of November 2006 by the same institution using the CATI method. Preliminary results are discussed in Bollino (2009) and Bigerna and Polinori (2008).

[15] In appendix A3, table A1 fully provides sample characteristics and shows that the sample is highly representative of the Italian population in terms of the male-female ratio, geographical and urban locations, demographic characteristics, education and income distribution.

[16] To construct a reliable WTP scenario, respondents were first asked to state the amount of their last three bills and then they were informed of the A3 component according to the above section 4.

*"For the scenario described, what is the maximum amount that you are willing to pay to support RES as a surcharge on your bill? Please be careful about your degree of certainty."*

In our sample, more than 80% of households professed to have a "good" knowledge of RES issues, while 10-12% reported that they were not aware of these issues. It is important to emphasize that the respondents affirmed having accurate knowledge of RES issues and were able to correctly identify different types of renewable energy sources in more than 80% of cases. Among respondents, there was a good knowledge of solar power, hydro and wind power, while there was less knowledge about biomasses and geothermal power. Respondents showed a favorable attitude with regard to RES, even in terms of strategic opportunities for RES in the Italian energy sector under uncertain scenarios. Finally, table 3 shows the location and scale parameters of several important variables.

The profile of the typical interviewee is a highly educated, married 47-year-old man who lives in a family with one child. The typical family income is approximately 35,000 € and the typical family owns its own home. The dummy variables in this survey show that interviewees believe that the Italian energy scenario will worsen in the next ten years, most interviewees are aware of RES issues, their knowledge is quite accurate and they consider RES to represent a strategic opportunity for Italy.

## 6 EMPIRICAL FINDINGS

Details of the WTP responses are presented in table 4. The first column labeled "WTP" refers to the amount (from lowest to highest) that consumers would be willing to pay to use RES, while the second column, labeled "frequency", provides detailed information on how much consumers are willing to pay to achieve the 20-20-20 target. The third column, labeled "cumulative", reports the number of consumers who are willing to pay at least the indicated amount. The forth column, "survival", describes the percentage of the sample for each value of the payment card that is willing to pay at least the indicated amount. As expected, the results show that the proportion of respondents willing to pay a given amount decreases with the amount submitted and that the proportion is larger when the "yes category" also includes PY and DK responses.

Table 3: Descriptive Statistics RHS variables

| Description of variable | | National sample | | | |
|---|---|---|---|---|---|
| | | Mean | St. Dev. | Min | Max |
| Income (000) | *Continuous variable: household yearly income* | 34.82 | 12.00 | 0.15 | 77.46 |
| Geo5 | *Categorical variable: 1 = NW; 2 = NE; 3= Center; 4 =South; 5 = Islands* | 2.75 | 1.39 | --- | --- |
| Geo5D | *Dummy variable: 1 if GEo5 <4* | 0.49 | 0.44 | --- | --- |
| City | *Dummy variable: 1 if municipality greater than 100,000 inhabitants* | 0.35 | 0.09 | --- | --- |
| Sex | *Dummy variable: 1 if male* | 0.52 | 0.50 | --- | --- |
| Age | *Continuous variable: age of a respondent* | 46.30 | 17.91 | 20 | 78 |
| Professional Category | *Categorical variable: from 1 to 10* | 6.03 | 3.24 | --- | --- |
| Professional Status | *Dummy variable: 1 if Professional Category = Enterprises or Professional class;* | 0.22 | 0.45 | --- | --- |
| Education | *Continuous variable: number of years a respondent attended school* | 12.02 | 3.98 | 5 | 21 |
| Higher Education | *Dummy variable: 1 if Education >13* | 0.46 | 0.50 | --- | --- |
| Scenario | *Dummy variable: 1 if response <3 [In your view the current Italian energy situation will worsen in the next 10 years? (1= a lot .... 4= not at all; 5= DK]* | 0.24 | 0.19 | --- | --- |
| KnowRES | *Dummy variable: 0 = wrong; 1 = correct. General knowledge of RES* | 0.83 | 0.18 | --- | --- |
| KnowRESA | *Dummy variable: 0 = wrong; 1 = correct. Accurate knowledge of various RES* | 0.74 | 0.35 | --- | --- |
| Household Size | *Discrete variable: number of family members* | 3.13 | 1.22 | 1 | 6 |
| Child | *Discrete variable: number of children* | 1.35 | 1.04 | 0 | 4 |
| House | *Dummy variable: 1 if family owns his house* | 0.67 | 0.34 | --- | --- |
| Consistency | *Dummy variable (see footnote 17)* | 0.33 | 0.47 | --- | --- |
| | | N. = 1,019 | | | |

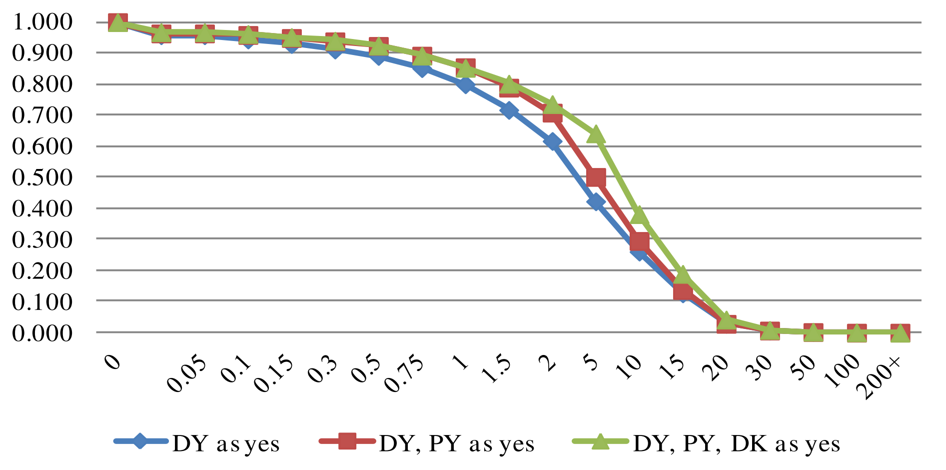
This is especially evident at the rightmost end of the tail for amounts greater than €10 (Figure 2). Finally, in the present study, the sample does not report a large percentage of zero WTP bids. Table 5 contains the results of the econometric model, which confirm prior expectations. A relevant finding is that knowledge of RES affects both the WTP and the conviction that RES could play an important role in the Italian energy scenario; both parameters of the variables "KnowRES" and "Scenario" are indeed highly significant according to the results of the first two models.

Table 4: Details of payment responses

| WTP (€) | DY as yes | | | DY and PY as yes | | | DY, PY and DK as yes | | |
|---|---|---|---|---|---|---|---|---|---|
| | Freq. | Cumul. | Surv. | Freq. | Cumul. | Surv. | Freq. | Cumul. | Surv. |
| *0* | *43* | *1,019* | *1.000* | *37* | *1,019* | *1.000* | *33* | *1,019* | *1.000* |
| | | *976* | *0.958* | | *982* | *0.964* | | *986* | *0.968* |
| 0.05 | 0 | 976 | 0.958 | 0 | 982 | 0.964 | 0 | 986 | 0.968 |
| 0.1 | 14 | 962 | 0.944 | 5 | 977 | 0.959 | 6 | 980 | 0.962 |
| 0.15 | 15 | 947 | 0.929 | 10 | 967 | 0.949 | 10 | 970 | 0.952 |
| 0.3 | 18 | 929 | 0.912 | 11 | 956 | 0.938 | 12 | 958 | 0.940 |
| 0.5 | 21 | 908 | 0.891 | 15 | 941 | 0.923 | 16 | 942 | 0.924 |
| 0.75 | 40 | 868 | 0.852 | 32 | 909 | 0.892 | 33 | 909 | 0.892 |
| 1 | 53 | 815 | 0.800 | 38 | 871 | 0.855 | 40 | 869 | 0.853 |
| 1.5 | 84 | 731 | 0.717 | 67 | 804 | 0.789 | 52 | 817 | 0.802 |
| 2 | 102 | 629 | 0.617 | 82 | 722 | 0.709 | 67 | 750 | 0.736 |
| 5 | 198 | 431 | 0.423 | 211 | 511 | 0.501 | 96 | 654 | 0.642 |
| 10 | 165 | 266 | 0.261 | 210 | 301 | 0.295 | 265 | 389 | 0.382 |
| 15 | 137 | 129 | 0.127 | 161 | 140 | 0.137 | 196 | 193 | 0.189 |
| 20 | 100 | 29 | 0.028 | 111 | 29 | 0.028 | 150 | 43 | 0.042 |
| 30 | 22 | 7 | 0.007 | 22 | 7 | 0.007 | 34 | 9 | 0.009 |
| 50 | 5 | 2 | 0.002 | 5 | 2 | 0.002 | 6 | 3 | 0.003 |
| 100 | 2 | 0 | 0.000 | 2 | 0 | 0.000 | 2 | 1 | 0.001 |
| 200+ | 0 | 0 | 0.000 | 0 | 0 | 0.000 | 1 | 0 | 0.000 |

*WTP = the highest amount the respondents would be willing to pay*
*Freq. = frequency; Cumul. = cumulative frequency; Surv. = survival probability*

Figure 2: WTP Survivor function




Higher levels of education and "better" employment, which serve as proxies for higher income, are associated, *coeteris paribus*, with a higher WTP. We notice that there exists a clear gender difference in WTP; specifically, men are willing to pay less compared with women. The same marked difference holds for older respondents compared to younger ones: the latter category exhibits a higher WTP with respect to the former.

| Table 5 Interval data for WTP support introduction of RES in Italy | | | | | | |
|---|---|---|---|---|---|---|
| Variables | DY as yes | | DY-PY as yes | | DY-PY-DK as yes | |
| Income (000) | 0.0636 | | 0.0499 | | 0.0479 | |
| | *(0.0081)* | *** | *(0.0086)* | *** | *(0.0090)* | *** |
| Geo5D | 0.1620 | | 0.1219 | | 0.1522 | |
| | *(0.0469)* | *** | *(0.0500)* | ** | *(0.0532)* | *** |
| City | -0.0755 | | -0.0928 | | -0.1251 | |
| | *(0.0498)* | | *(0.0522)* | * | *(0.0544)* | ** |
| Sex | -0.2879 | | -0.2651 | | -0.3159 | |
| | *(0.1180)* | ** | *(0.1246)* | ** | *(0.1307)* | ** |
| Age | -0.2660 | | -0.2029 | | -0.2281 | |
| | *(0.0458)* | *** | *(0.0497)* | *** | *(0.0518)* | *** |
| Professional Status | 0.1062 | | 0.0933 | | 0.0725 | |
| | *(0.0221)* | *** | *(0.0241)* | *** | *(0.0250)* | *** |
| Higher Education | 0.1915 | | 0.0661 | | 0.0689 | |
| | *(0.0961)* | * | *(0.1229)* | | *(0.1292)* | |
| Scenario | -0.6978 | | -0.6232 | | -0.1382 | |
| | *(0.3292)* | ** | *(0.3090)* | ** | *(0.3185)* | |
| KnowRES | 0.5772 | | 0.6877 | | 0.4341 | |
| | *(0.3366)* | * | *(0.3485)* | ** | *(0.3732)* | |
| Household Size | -0.2689 | | -0.1922 | | -0.2298 | |
| | *(0.0628)* | *** | *(0.0686)* | *** | *(0.0726)* | *** |
| Consistency | -0.3039 | | -0.3134 | | -0.2324 | |
| | *(0.1263)* | ** | *(0.1292)* | ** | *(0.1355)* | * |
| Constant | 0.6994 | | 1.2600 | | 2.0909 | |
| | *(0.4311)* | | *(0.4497)* | *** | *(0.4619)* | *** |
| /lnsigma | 0.5640 | | 0.4885 | | 0.5725 | |
| | *(0.0228)* | | *(0.0254)* | | *(0.0244)* | |
| sigma | 1.7577 | | 1.6299 | | 1.7727 | |
| | *(0.0400)* | | *(0.0414)* | | *(0.0433)* | |
| Obs. | 1019 | | 1019 | | 1019 | |
| McKelvey and Zavoina's R2 | 0.106 | | 0.094 | | 0.118 | |
| LR chi2(11) | 117.49 | | 103.83 | | 134.25 | |
| median WTP | 5.05 | | 7.06 | | 9.95 | |
| [95% Conf. Interval] | *[3.12 - 6.34]* | | *[5.42 - 8.39]* | | *[8.23 - 11.79]* | |
| mean WTP | 12.16 | | 15.95 | | 24.14 | |
| [95% Conf. Interval] | *[10.25 - 13.94]* | | *[13.72 - 18.39]* | | *[22.23 - 26.79]* | |

Residents in northern and central Italy exhibited a higher WTP to support renewable energy diffusion. People living in municipalities with more than 100,000 inhabitants were willing to pay less to achieve the same aim compared with the residents of small towns. The household size negatively influenced WTP in all the models considered. Finally, the variable labeled "acting consistently"[17] in the

[17] The dummy variable "Consistency" is defined to compare responses to the two questions on the degree of knowledge about RES. If the interviewee answers yes (or no) to the first question and correctly (or incorrectly) identifies the different types of RES in the second question, the dummy variable is equal to one (zero otherwise).

questionnaire response procedure had a negative influence on the WTP. This is an interesting result that captures unobservable individual characteristics that may be related to the honesty of respondents. Based on the estimated parameters and on equations (10) and (11), it is possible to compute the mean and median WTP of the sample. In table 6, we show the individual household mean WTP and we compute the total WTP for Italy, comparing it with an estimate of the total annual subsidy needed in Italy to comply with the EU climate change package goals by 2020[18].

Table 6: Policy implications

| Mean/Median WTP (Euro) | | Annual electric bill (Nr.) | Households (Nr.) | Total annual WTP (Euro) | Annual subsidy cost (Euro) [(a)] | Market sustainability of RES (%) |
|---|---|---|---|---|---|---|
| *No parametric computation [Lower Bound mean - Turbull]* [19] | | | | | | |
| LBM (I) model | 3.23 | | | 422,690,901 | | **12.08%** |
| LBM (II) model | 3.63 | | | 475,036,523 | | **13.57%** |
| LBM (III) model | 4.15 | | | 543,085,832 | | **15.52%** |
| *Parametric estimation (median)* | | | | | | |
| Interv. Data Regr. (I) model | 5.05 | **6** | **21,810,676** | 660,863,483 | **3,500,000,000** | **18.88%** |
| Interv. Data Regr. (II) model | 7.06 | | | 923,900,235 | | **26.40%** |
| Interv. Data Regr. (III) model | 9.95 | | | 1,302,097,357 | | **37.20%** |
| *Parametric estimation (mean)* | | | | | | |
| Interv. Data Regr. (I) model | 12.16 | | | 1,591,306,921 | | **45.47%** |
| Interv. Data Regr. (II) model | 15.95 | | | 2,087,281,693 | | **59.64%** |
| Interv. Data Regr. (III) model | 24.14 | | | 3,159,058,312 | | **90.26%** |
| *Market sustainability considering only low voltage share (see table 2)* | | | | | | |
| *Parametric estimation (median)* | | | | | | |
| Interv. Data Regr. (I) model | 5.05 | **6** | **21,810,676** | 660,863,483 | **1,953,439,471** | **33.83%** |
| Interv. Data Regr. (II) model | 7.06 | | | 923,900,235 | | **47.30%** |
| Interv. Data Regr. (III) model | 9.95 | | | 1,302,097,357 | | **66.66%** |

(a) The figure is an estimate of the additional costs necessary to achieve 17% of energy produced from renewables.

We can see that, according to a conservative analysis, the measured market sustainability of RES, i.e., the coverage capacity range, lies between 12% and 37% according to different estimation models, but a

[18] A wide "cost range" for RES characterizes the Italian debate on the onerousness of the National 2020 target. The total cost goes from the high value of 50 billion € provided by the Ministry of the Environment to the more realistic estimates provided by several research centers. In this study, we used the estimate provided by IEFE (2009).

[19] A substantial amount of literature has emerged concerning how to calculate the overall WTP. Turnbull (1976) originally utilized a measure that provides a lower bound mean (LBM) estimate of WTP that, given $\pi_i$ (percentage that accept $bid_i$) and $K$ bids, is calculated as follows: $LBM = \pi_0 \left(bid_0\right) + \Sigma_{k=1}^{K} \pi_k \left(bid_k - bid_{k-1}\right)$.

typical result is approximately 19-20% of the annual cost. It is interesting to notice that the difference between the third model and the conservative model (only coding DY as yes) is 19% of the coverage capacity of the annual subsidy cost. Finally, up to now, we have assumed that the full incremental cost would be arbitrarily ascribed entirely to “small consumers” (e.g., low-voltage clients). However, if we consider all the clients, market sustainability could noticeably increase. In fact, it is quite difficult to unbundle the additional burden that would apply to each “household”; however, simplifying and using the tax levy shares of the A3 components of energy bills in 2007 (see table 3), it can be observed that market sustainability noticeably increases when non-residential consumers are included. Indeed, low-voltage clients count for 56% of A3 levies; thus, using this figure and assuming that the estimated median WTP also applies for other clients, we find that households could support 34% to 67% of the cost of achieving the “pertinent target”.

## 7. CONCLUSIONS

The analysis of attitudes toward renewable energy in the Italian context to date (Bollino, 2009) shows that in Italy, there is a consensus for the development of renewable energies. We found that, in terms of monetary value, the willingness to pay for measures in accordance with this consensus is estimated to lie in the range between 19% and 67% of the total subsidy cost, depending on assumptions regarding to the different degrees of uncertainty of responses and non-residential client participation. In this paper, we used SPC procedure to obtain more robust statistical results to be used for policy consideration. Based on these procedures, first, we find a substantial willingness of consumers to partially cover the cost of RES. Second, uncertainty plays a crucial role, accounting for 8% to 33% of the annual goal. Third, we initially assumed that the full incremental cost would be arbitrarily ascribed entirely to the “small consumers” (e.g., low voltage clients), but if we include all client types, we obtain a more consistent estimate of the market sustainability of the national target. Finally, the analysis of the A3 burden shows that the actual additional cost to consumers due to the support of renewable energy is less than the WTPs obtained in our models. This means that a further margin could exist in the Italian context and that Italians are ready to pay more for RES to achieve the European target. Italian citizens need appropriate information and education campaigns to better explain all the advantages linked with renewable energy use. Greater public awareness of the benefits of renewable energies will reduce erroneous evaluations of the costs of renewable energies.

## APPENDIX 1: THEORETICAL MODEL

Let us consider a household's direct utility function:

$$U = U\left(X_P, X_G, R\right) \tag{A1}$$

This function is positively related to the private goods $X_P$ ($X_{P1}$, ...., $X_{PN}$), the composite public good $X_G$ and the public good R (RES services). $X_G$ is a composite commodity of all public goods with unit prices and value equal to the tax charged to the household. Households maximize U subject to their budget constraints, that is:

$$M = X_P P_P + X_G \tag{A2}$$

where M is the nominal income and $P_P$ is a price vector of private goods. Each household spends all its disposable income by purchasing private goods:

$$Md = M - X_G \tag{A3}$$

A maximization framework provides a set of conditional demand functions:

$$d_i^* = d\left(P_P, P_R, X_G, Md\right) \tag{A4}$$

By substituting $d_i^*$ into U, we obtain a conditional indirect utility function:

$$V = V\left(P_P, P_R, X_G, Md\right) \tag{A5}$$

Inverting V for Md, we obtain the conditional expenditure function:

$$E^* = Md = E^*\left(P_P, P_R, X_G, U\right) \tag{A6}$$

Minimizing expenditures on both private and public goods subject to the utility level, we obtain the restricted expenditure function:

$$E = E\left(P_P, P_R, X_G, U\right) \tag{A7}$$

The conditional expenditure function and restricted expenditure function are related as follows:

$$E\left(P_P,P_R,X_G,U\right)=E^*\left(P_P,P_R,X_G,U\right)+X_G \tag{A8}$$

We assume that the consumer does not observe $P_R$ and choose R, but rather is offered R and can choose to pay for it or not. Therefore, $P_R$ is replaced with R, and then we can rewrite the relationship as follows:

$$E\left(P_P,R,X_G,U\right)=E^*\left(P_P,R,X_G,U\right)+X_G \tag{A9}$$

By changing the energy scenario, we assume that the restricted expenditure function varies according to R: $R^0$ = scenario without RES in the energy portfolio and $R^1$ = scenario with RES in the energy portfolio. By holding M as a constant, we find that the WTP for the use of RES is given by the compensated surplus (CS):

$$CS=E\left(P_P,R^0,X_G^0,U^0\right)-E\left(P_P,R^1,X_G^0,U^0\right) \tag{A10}$$

$$CS=\left[E^*\left(P_P,R^0,X_G^0,U^0\right)+X_G^0\right]-\left[E^*\left(P_P,R^1,X_G^0,U^0\right)+X_G^0\right] \tag{A11}$$

$$CS=E^*\left(P_P,R^0,X_G^0,U^0\right)-E^*\left(P_P,R^1,X_G^0,U^0\right) \tag{A12}$$

where $U^0$ is the utility level of the household without the RES program. This estimate of compensating surplus is a measure of the WTP for the "RES use" service.

## APPENDIX 2: ECONOMETRIC MODEL

Following Cameron and Huppert (1989), the WTP probability associated with the choice of the respondent is:

$$P\left(t_i\right)=P\left(t_{li}<WTP_i\le t_{ui}\right) \tag{A13}$$

Because WTP is non-negative and its distribution is skewed, we use a lognormal conditional distribution:

$$\log WTP_i=x_i^T\beta+\varepsilon_i \tag{A14}$$

where $\varepsilon_i$ is distributed normally, with zero mean and standard deviation σ. The probability of choosing $t_i$ can be written:

$$P(t_i) = \Phi\left(\left(\log t_{ui} - x_i^T \beta\right)/\sigma\right) - \Phi\left(\left(\log t_{li} - x_i^T \beta\right)/\sigma\right) \quad \text{(A15)}$$

where $\Phi$ is the standard normal cumulative density function. The corresponding log likelihood function can be written:

$$\log L = \sum_{i=1}^{T} \log\left[\Phi\left(\left(\log t_{ui} - x_i^T \beta\right)/\sigma\right) - \Phi\left(\left(\log t_{li} - x_i^T \beta\right)/\sigma\right)\right] \quad \text{(A16)}$$

We estimate the optimal values of $\beta$ and $\sigma$ and the mean and median WTP (Cameron and Huppert, 1989; Hanemann and Kanninen, 1999):

$$median\, WTP = \exp\left(x_i^T \beta\right) \quad \text{(A17)}$$

$$mean\, WTP = \exp\left(x_i^T \beta\right) \exp\left(\sigma^2/2\right) \quad \text{(A18)}$$

and we compute the confidence interval according to Krinsky and Robb's simulation model.

## APPENDIX 3: STATISTICAL DETAILS

Table A1: Survey respondent (1019 Obs.) and Country (Italy) resident characteristics

| Variables | Survey Respondents | Country Residents |
|---|---|---|
| - Gender [(a)] | | |
| Male | 47.78% | 48.40% |
| Female | 52.22% | 51.60% |
| - Macro regions [(a)] | | |
| Northwest | 26.11% | 26.21% |
| Northeast | 19.69% | 18.66% |
| Center | 19.64% | 19.14% |
| South (with Sicily, Sardinia) | 34.55% | 36.00% |
| - Municipality size[(a)] | | |
| ≤ 5000 | 17.47% | 18.58% |
| 5001- 10000 | 13.67% | 14.11% |
| 10001 - 30000 | 23.69% | 22.81% |
| 30001 - 100000 | 21.96% | 21.29% |
| 100001 - 500000 | 11.65% | 10.98% |
| > 500000 | 11.55% | 12.23% |
| - Age[(a)] | | |
| 15-17 | 3.55% | 3.54% |
| 18-24 | 9.92% | 9.53% |
| 25-34 | 16.78% | 17.98% |
| 35-44 | 18.85% | 17.77% |
| 45-54 | 16.68% | 15.52% |
| 55-64 | 14.36% | 13.89% |
| > 64 | 19.84% | 21.77% |
| - Marital status[(a)] | | |
| Single | 27.99% | 27.76% |
| Divorced | 1.14% | 1.23% |
| Separated | 1.58% | 1.92% |
| Married or Cohabiting | 61.75% | 61.19% |
| Widowed | 6.71% | 7.90% |
| Status not response | 0.84% | --- |
| - Education[(a)] | | |
| None and Primary School | 33.50% | 31.16% |
| Secondary School and Professional training | 35.60% | 32.50% |
| High School | 23.90% | 29.30% |
| University or /and higher degree | 7.00% | 7.04% |
| - Income (€)[(b)] | | |
| Mean | 28658.80 | 24893.70 |
| Centili - 10% | 9822.22 | 8918.90 |
| 25% | 14801.18 | 13175.46 |
| 50% | 24682.57 | 20152.32 |
| 75% | 34088.30 | 30998.86 |
| 90% | 47981.99 | 44049.82 |
| - Professional status[(a)] | | |
| Entrepreneurs | | 1.36% |
| Professional class | 6.32% | 1.83% |
| Cooperative members | | 1.36% |
| Self employed | 5.70% | 6.92% |
| Civil servant and earning employee | 33.27% | 31.45% |
| Unemployed workers | 4.05% | 5.62% |
| Students | 12.44% | 11.34% |
| Housewives | 13.38% | 15.30% |
| Pensioners | 23.89% | 20.64% |
| Others | 0.96% | 4.17% |
| - Household size[(a)] *(members)* | | |
| 1 | 10.71% | 24.89% |
| 2 | 23.20% | 27.08% |
| 3 | 23.74% | 21.58% |
| 4 | 32.03% | 18.96% |
| 5 | 8.49% | 5.80% |
| 6 or more | 1.83% | 1.69% |

## REFERENCES


Alvarez-Farizo, B. and N. Hanley, (2002), "Using Conjoint Analysis to Quantify Public Preferences over the Environmental Impacts of Wind Farms. An Example from Spain." *Energy Policy,* 30(2): 107-116.

Atkinson, G., A. Healey, and S. Mourato, (2005), "Valuing the Cost of Violent Crime: A Stated Preferences Approach." *Oxford Economic Papers,* 57(4): 559 – 585.

Batley, S.L., D. Colbourne, P.D. Fleming, and O. Urwin, (2001), "Citizen versus Consumer: Challenges in the UK Green Power Market." *Energy Policy,* 29(15): 479-487.

Bigerna, S. and P. Polinori, (2008), "The Willingness to Pay for Renewable Energy Sources (RES): The Case of Italy with Different Survey Approaches and Under Different EU "Climate Vision." First results", *Quaderni del Dipartimento di Economia, Finanza e Statistica,* 58.

Bollino, C.A. (2009), "The Willingness to Pay for Renewable Energy Sources: The Case of Italy with Socio Demographic Determinants." *The Energy Journal,* 30(2): 81-96.

Bulte, E., S. Gerking, J.A. List and A. de Zeeuw, (2005), "The effect of varying the causes of environmental problems on stated WTP values: Evidence from a field study." *Journal of Environmental and Economic Management*, 49(2): 330-342

Cameron, T.A. and D.D. Huppert, (1989), "OLS versus ML Estimation of Non-market Resource Values with Payment Card Interval Data." *Journal of Environmental Economics and Management*, 17(3): 230246.

Champ, P.A., K.J. Boyle and T.C. Brown, (Eds.), (2003), *A Primer on Nonmarket Valuation.* Dordrecht: Kluwer Academic Publishers.

Cummings R.G. and L.O. Taylor (1999), "Unbiased value estimates for environmental goods: A cheap talk design for the contingent valuation method." *American Economic Review*, 89(3): 649-665

Del Rio, P. and M. Gual, (2004), "The Promotion of Green Electricity in Europe: Present and

Future." *European Environment,* 14(4): 219-234.

Farhar, B.C. (1999), "WTP for Electricity from Renewable Resources: A Review of Utility Market Research." *NREL WP,* 550.26148.

Fonta, M., H.E. Ichoku and K.K. Ogujiuba, (2010), "Estimating Willingness to Pay with the Stochastic Payment Card Design: Further Evidence from Rural Cameroon", *Environment, Development and Sustainability*, 12(2): 179-193.

Hanemann, W. M. and B.Kanninen, (1999), "The Statistical Analysis of Discrete-Response CV Data", in Bateman, I.J. and K.G. Willis, (Eds.), *Valuing Environmental Preferences: Theory and Practice of the Contingent Valuation Method in: the US, EU, and Developing Countries*, Oxford: Oxford University Press.

Ichoku, H.E., W.M. Fonta and A. Kedir, (2009), "Measuring Individuals' Valuation Distributions using a Stochastic Payment Card approach: Application to Solid Waste Management in Nigeria", *Environment, Development and Sustainability*, 11(3): 509-521.

IEFE -Center for Research on Energy and Environmental Economics and Policy- (2009), "Prospettive di sviluppo delle energie rinnovabili per la produzione di energia elettrica. Opportunità per il sistema industriale nazionale." *Research Report Series -Research Report n. 3-, http://portale.unibocconi.it/wps/allegatiCTP/Research%20Report%203_1.pdf* [last visit June 8th, 2010].

International Energy Agency (2009), World Energy Outlook, OECD/IAE.

Ivanova, G. (2005), "Queensland Consumers' Willingness to Pay for Electricity from Renewable Energy Sources." *WP of the Australia New Zealand Society for Ecological Economics*; Paper presented in the Ecological Economics in Action Conference in Massey University, Palmerston North, New Zealand, December 11-12, 2005.

Lindhejem, H. and S. Navrud, (2011), "Are Internet Surveys an Alternative to Face-to-Face Interviews in Contingent Valuation?" *Ecological Economics*, 70(9): 1628-1637.

Loureiro, M.L., J.B. Loomis and M.X. Vazquez, (2009), "Economic valuation of environmental damages due to the prestige oil spill in Spain." *Environmental Resources Economics*, 44(4): 537-553.

Mentzakis, E., M. Ryan and P. McNamee, (2011), "Incorporating Uncertainty into Payment Card Contingent Valuation." *(Mimeo).* http://www.economics.mcmaster.ca/faculty/mentzak [last visit May 2nd, 2011].

Meyer, N. (2003), "European Schemes for Promoting Renewables in Liberalised Markets." *Energy Policy*, 31(7): 665-676.

Nayga, R.M. and X. Wu and R.G. Brummett, (2007), "On the use of cheap talk in new product valuation." *Economic Bullettin*, 2(1): 1-9.

Nomura, N. and M. Akay, (2004), "WTP for Green Electricity in Japan as Estimated through Contingent Valuation Method." *Applied Energy,* 78(4): 453-463.

Nordhaus, W.D. (2001), "After Kyoto: Alternative Mechanism to Control Global Warming." AEA meeting, Atlanta, 2001. http://nordhaus.econ.yale.edu/ PostKyoto_v4.pdf [last visit August 10th, 2011].

O'Garra, T. and S. Mourato, (2007), "Public Preferences for Hydrogen Buses: Comparing Interval Data, OLS and Quantile Regression Approaches." *Environmental & Resource Economics*, 36(4): 389–411.

Roe, B., M.F. Teisl, A. Levy and M. Russel, (2001), "US Consumers' WTP for Green Electricity." *Energy policy,* 29(11): 917-925.

Rowe, R.D., W.D. Schulze, and W.S. Breffle, (1996), "A Test for Payment Card Biases", *Journal of Environmental Economics and Management*, 31(2): 178-185.

Samnaliev, M., T.H. Stevens and T. More, (2003), "A comparison of cheap talk and alternative uncertainty calibration techniques in contingent valuation." Department of Resources Economics WP 2003-11, University of Massachusetts Amherst, http://nrs.fs.fed.us/pubs/jrnl/2003/ne_2003_ samnaliev_001.pdf [last visit September 21st, 2011]

Sileo, A. (2011), "Dentro i Prezzi dell'Energia Elettrica in Italia. Crescita Libera Senza Limite?" *(Mimeo)* The Adam Smith Society, Milano, Settembre 2011.

Turnbull, B.W. (1976), "The Empirical Distribution Function with Arbitrary Grouped, Censored and Truncated Data." *Journal Royal Statistics Society, Series B,* 38(1): 290-295.

Vossler, C.A., R.G. Ethier, G.L. Poe and M.P. Welsh, (2003), "Payment Ccertainty in Discrete Choice Contingent Valuation Responses: Result from a Field Validity Test." *Southern Economic Journal,* 69(4): 886-902.

Wang, H. (1989), "Treatment of "Don't know" Responses in Contingent Valuation Surveys: A Random Valuation Model." *Journal of Environmental Economics and Management*, 32(2): 219-232.

Wang, H. and D. Whittington, (2005), "Measuring Individuals' Valuation Distribution Using Stochastic Payment Card Approach." *Ecological Economics,* 55(2): 143-154.

Welsh, M.P. and G.L. Poe, (1998), "Elicitation Effects in Contingent Valuation: Comparisons to a Multiple Bounded Discrete Choice Approach", *Journal of Environmental and Management*,. 36(2): 170-185.

Whitehead, J.C., T.J. Hobant, and W.B. Cliffordt, (1995) "Measurement Issues with Iterated, Continuous -Interval Contingent Valuation Data." *Journal of Environmental Management*, 43(2):129-139.

Yoo, S.H. and S.Y. Kwak, (2009), "Willingness to Pay for Green Electricity in Korea: A Contingent Valuation Study." *Energy Policy*, 37(12): 5408-5416.

Zografakis, N., E. Sifaki, M. Pagalou, G. Nikitaki, V. Psarakis and K.P. Tsagarakis, (2010), "Assessment of Public Acceptance and Willingness to Pay for Renewable Energy Sources in Crete." *Renewable and Sustainable Energy Reviews*, 14(3): 1088-1095.