



## Analysis

## Mandatory versus voluntary payment for green electricity



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## ABSTRACT

Renewable energy sources have a critical role to play in contributing to the diversity, sustainability and security of energy supplies. The main objective of the paper is to gain an understanding of the support mechanism of renewable energy sources most preferred by households in the United Kingdom. This paper analyses households' preferences and willingness to pay under a mandatory scheme where all households contribute compared to a voluntary scheme where only those who wish to pay to support renewables do so (such as the green tariffs offered by electricity suppliers in the UK). Two contingent valuation method (CVM) surveys are used to explore whether the type of payment option has an impact on households' willingness to pay (WTP) for increasing share of renewable energy in electricity generation. The paper also investigates whether the type of payment mode affects respondents' self-reported certainty of paying their stated valuations. The results indicate that the likelihood of paying a positive amount for supporting renewable energy is higher under a mandatory scheme compared to a voluntary payment option in the UK. Respondents have a higher level of certainty in paying their stated WTP under a mandatory payment scheme.

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## 1. Introduction

One of the key challenges currently facing the UK is increasing the share of renewable energy in electricity generation in order to meet ambitious energy and environmental targets. Renewable energy sources have a critical role to play in contributing to the diversity, sustainability and security of energy supplies. They are central to meeting the UK government's target of generating 15% of energy from renewables by 2020. In 2011, only 3.8% of the UK's total energy consumption and 9.4% of UK-generated electricity came from renewable sources (DECC, 2012). The government faces the formidable challenge of delivering a large increase in UK renewable electricity generation if it is to meet its targets. Due to the higher costs and investment involved in developing and applying renewable energy technology, the targets are unrealistic without regulatory support for the uptake of renewable greener electricity by UK households. With this in mind, it is crucial to consider the type of support mechanism that UK households prefer.

This paper uses two contingent valuation method (CVM) surveys, both designed by the author, to explore whether the type of payment option has an impact on households' willingness to pay (WTP) for increasing the percentage of renewable energy in electricity generation. The surveys seek to measure WTP under mandatory and voluntary

payment schemes. To date, only two studies have addressed this issue and they reach the opposing conclusions. *Wiser (2007)* finds that WTP is higher under a mandatory scheme than under a voluntary one in the United States, whereas in Queensland, Australia, *Ivanova (2005)* finds that WTP for renewable energy is higher under a voluntary scheme. No study has previously analysed household preferences and WTP under mandatory and voluntary payment schemes in the UK.

The research also seeks to add to the literature on CVM since the payment vehicle is a crucial element in contingent valuation surveys. Similar to other aspects of the CVM scenario, the type of payment method can affect the responses to the elicitation question. There have been numerous studies that analyse the effects of different valuation questions (such as open-ended compared to closed-ended or payment card versus dichotomous choice). However, there are relatively few studies that compare different payment vehicles. The aim of this paper is to add to the literature by exploring the sensitivity of CVM valuations to the selected payment mode of households with regard to valuation of electricity generated from renewables and whether these preferences change over time.

The effects of socioeconomic, demographic and attitudinal variables on willingness to pay for renewable energy are also explored. This analysis helps increase the understanding of which sections of society are and are not willing to pay for renewable energy under different payment provision contexts. The paper also investigates whether the type of payment mode affects respondents' self-reported certainty of paying their stated valuations.

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Two self-designed surveys were conducted to address the following questions:

- 1) Do UK households prefer voluntary or mandatory support mechanisms for renewable energy?
- 2) Does willingness to pay differ under a mandatory payment option compared to a voluntary one?
- 3) What socio-economic, attitudinal and behavioural characteristics affect WTP for renewables?
- 4) Does the type of payment method have an impact on the certainty of respondents paying their stated WTP?

The first survey was run in October 2008 and a follow-up survey was conducted in December 2009. For both surveys, half the sample was asked their valuation of electricity from renewables under a mandatory scheme while the other half of the sample was presented with a voluntary option.

The WTP questions in both surveys used the double bounded dichotomous choice format. There is some evidence that the responses to the follow-up bids can be based on the first bid (Bateman et al., 2001) and that the distribution underlying preferences to the first question may not be the same as those to the second bid response. However, the aim of this research is not to estimate a precise WTP value but rather analyse the divergences in WTP based on the payment method. To eliminate potential discrepancies that a randomised bid structure would introduce, the same starting bid was given to all respondents for this study.

## 2. Background and Literature Review

This paper builds on several strands of existing literature which are outlined in this section. First, the existing evidence on WTP for renewables is summarised followed by the empirical evidence on payment method effects within the CVM literature is presented. Issues of temporal variability in survey responses and how the payment mode can influence the certainty of respondents in paying their stated WTP valuations are also reviewed.

### 2.1. WTP for Electricity From Renewable Sources

Electricity can be generated from a number of sources such as coal, natural gas, oil and nuclear power as well as renewable sources including wind, solar and biomass. The UK generates its electricity primarily from coal, natural gas and nuclear power. These traditional sources for electricity generally have a higher true social cost compared to their market prices due to the pollution generated in the process. Green electricity is generated from renewable energy sources such as solar power, wind power, hydroelectric power, tidal power and biomass power. Electricity produced from these green sources has a number of public benefits.

Renewable energy sources do not produce pollutants and are considered environmentally friendly. Moreover, they increase fuel diversity and increase energy security by reducing dependence on imported sources such as natural gas, which are vulnerable to political instabilities and trade disputes (Menegaki, 2008). Despite these benefits, renewable energy sources constitute only a small part of the UK's electricity fuel mix, just under 10%. One of the main inhibiting factors in the uptake of renewable sources is that the market cost of "green" electricity is higher than the traditional sources although they have lower social costs. This therefore hinders the wider usage of renewable energy.

There are two mechanisms currently in place that support investment in renewable generation capacity in the UK. These are the renewable obligation scheme and the payment of a voluntary "green" premium by individual customers.

The Utilities Act (2000) created the Renewables Obligation (RO) scheme and came into effect in the UK in April 2002. The RO is essentially a financial support mechanism to provide commercial investments to

increase the uptake of renewable electricity generation technologies. Under the RO, all licensed electricity suppliers are required to purchase a certain amount of renewable electricity. The suppliers meet their obligation by acquiring renewables obligation certificates (ROCs) for each megawatt hour of renewable energy they purchase or by paying a pre-specified buy-out price which is then passed on to the end-consumer tariffs. The Government's Electricity Market Reform (EMR) has now proposed to replace ROCs with a feed-in tariff system from April 2017 onwards. Both the ROC and feed-in tariffs are a type of mandatory payment scheme as the costs are passed on to all end consumers.

The deregulated market in the UK also allows consumers to reveal preferences for "green" electricity by offering consumers the option to pay a voluntary premium through green tariffs. However, it is indistinguishable to consumers whether the electricity they receive is generated through traditional energy sources or from renewables. Electricity is homogenous, in that it does not differ by the sources used to produce it. However, consumers can regard electricity as a heterogenous product based on its production source. For example, consumers can have preferences for environmentally friendly energy production. These preferences could lead some consumers to regard electricity produced from sources that are carbon neutral, such as wind power, as different from electricity produced from coal. Although these "green" options do not imply that the electricity received by the specific customer are produced solely from renewables, it does guarantee an increase in renewables used in electricity production as a whole.

Existing research generally supports that people are WTP extra for green electricity (Bigerna and Polinori, 2014; Borchersa et al., 2007; Rowlands et al., 2001; Nomura and Akai, 2004). There has been some research on WTP and support for renewables in the UK. Longo et al. (2008) used choice experiments on a sample of Bath residents to assess their WTP for a hypothetical programme to support renewable energy sources. They find positive support from the respondents for the renewable energy programme, especially in the view that it will benefit the public in terms of increasing energy security and reducing the impact of climate change.

The literature indicates that there is a consumer demand for green electricity which in most studies has been viewed as electricity generated from renewable sources although a few have extended the definition to include nuclear. All the studies reviewed in this paper, despite their differences in designs, find that consumers generally have a positive WTP for renewable energy policies.

### 2.2. Stated Valuations and Green Tariffs

While existing research has identified a positive WTP for green energy in general, there is a disconnection between the stated WTP reported in these studies and the actual participation in green electricity programmes (Byrnes et al., 1995; Wisser, 2007; Holt, 1997). Byrnes et al. (1995) have compared WTP surveys with market simulations or real tariff schemes and found that only between 12 and 15% of those who state a positive willingness to pay actually pay the premium when given the opportunity.

In the UK, it is estimated that only 1% of households have opted for green tariffs (Bird and Brown, 2005). The same low uptake has also been observed in other countries with a deregulated electricity market. An example is Finland, where green electricity options have been available since 1998 but their uptake has remained low. This discrepancy between stated and actual WTP could be due to a number of factors including bias in the stated preference surveys which could lead to overestimation of WTP premia. Alternatively, it may be that households are simply not informed about the green energy alternatives.

Borchersa et al. (2007) explore an alternative explanation by investigating whether consumers have preferences for specific renewable energy sources compared to "generic" green electricity. They find that respondents have positive WTP for "green" electricity but also WTP differs by green energy source. For example, respondents had a higher

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