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Socioeconomic and demographic factors that influence publics' awareness on the different forms of renewable energy sources

Spyridon Karytsas*, Helen Theodoropoulou

Department of Home Economics and Ecology, Harokopio University, 70 El. Venizelou, Kallithea 17671, Athens, Greece

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ABSTRACT

Public awareness of renewable energy sources can offer multiple benefits, as it can contribute to the social acceptance of projects based on these energy sources and to the overall improvement of consumers' energy behaviour. The objective of the present study is to examine the demographic and socioeconomic factors that determine someone's knowledge on different forms of renewable energy, based on data from a survey that took place in the summer of 2012 in Greece. The most known renewable energy forms are solar and wind energy, followed by geothermal, hydropower and biomass. The lesser known forms are tidal, wave and ocean thermal energy. Factors having a statistically significant relation with the different forms of renewable energy are gender, age, education level, head of household education level, environmentally friendly behaviour and having an occupation, studies or interests related to environment, technology or engineering.

1. Introduction

Global energy production still relies on fossil fuels [1]. This dependency on the fossil fuels, that are non-infinite, contributes to local and global level pollution, leading to climate change. The continuous increase of energy demand due to global population and income growth [1,2], may even induce the increase of the negative impacts of the extensive use of fossil fuels in the future. Renewable Energy Sources (RES) can be the solution to the problems created by fossil fuels [2—5], as they are practically inexhaustible sources of energy [3,6,7], with a much smaller impact on the environment and safer operation compared to fossil fuels, contributing to energy security and independence from external factors [3,6,8,9], being more flexible and creating a decentralization possibility [3], while creating jobs for the local population [7].

Regarding Greece and the use of RES, according to Law 3851/2010, Greece aims to increase the share of RES in gross total final consumption to 20% by 2020, which is 2 percentage points higher than that required by the EU Directive 2009/28/EC.

The participation of RES in gross final energy consumption in 2011 was 11.6% (2004:7.1%, 2007:8.0%), while the EU-27 average for 2011 was 13% [10]. Concerning total energy production from RES for 2011 in Greece, biomass and renewable wastes represent the largest proportion with 1085 ktoe (kilotons of oil equivalent), followed by hydropower (345 ktoe), wind (285 ktoe), solar (235 ktoe) and geothermal (26 ktoe) [10]. The energy sector of Greece has a high dependence on imports (solid fuels, oil, gas and electricity), as evidenced by the import of 29,997 ktoe in 2011 and 31,649 ktoe in 2010 [10].

To further promote renewable energy projects that will contribute to the achievement of the required objectives regarding energy, local public acceptance is required [9] [11—19], which can be assisted by the publics' awareness and adequate knowledge about RES [3,11,18—31]. Recent studies in Greece and other countries have focused on the issue of knowledge about RES, targeting either the general population [7,21,22,32—34], elementary school pupils [35—37], students [5,28—30,38—41] or teachers [26,42]. Some of these studies investigate the knowledge level of a specific renewable energy source [28—30,32,34,35,39], while those comparing the knowledge levels of different RES indicate that in most cases the public is most likely to know about solar and wind energy [5,7,18,21,22,26,33,35,37,43].

Level of awareness on various renewable energy sources may differ between countries, and even between different regions of the same country [21,22,29], as it may be affected by the respective installation and usage levels. Zyadin et al. [42] indicate that teachers in Jordan are correctly informed only on solar energy usage, due to the widespread use of solar water heaters in the

domestic sector of Jordan. Additionally, a UK study on RES [21] reports that knowledge about onshore wind was higher in Wales than in the total of UK and knowledge about hydro plants was higher in Scotland than in the total UK, reflecting the relatively higher numbers of installations of those technologies in the specific areas.

Based on the relevant studies, it is detected that socioeconomic factors may also affect knowledge about RES. Socioeconomic factors that are found to have a statistically significant effect on RES knowledge are gender [5,35–39,41–43], age [5,34,42], area of residence [34–37], income [34], educational level [34,39,40,42,44] and its' subject and type (general/technical) [5,38,42], as well as parents' educational level [5,38].

This study aims to examine the level of generic knowledge about each form of RES in Greece, as well as to detect the demographic and socioeconomic factors that determine this knowledge.

2. Material and methods

An online questionnaire survey was conducted during July and August 2012. The questionnaire, which was distributed through the use of electronic mailing lists, aimed at the general public without any demographic restrictions and included questions on demographic and socioeconomic characteristics, generic knowledge about RES, attitudes and perceptions on environmental and RES issues and questions about residential heating/cooling. Internet surveys do not create a sample as representative as a telephone or a face-to-face sample [45,46]. Although this sample is not totally representative of the population, it can provide a good basis in order to study the factors that influence public awareness of RES.

Once a database including replies from 533 respondents was created, the statistical package SPSS 20.0 was used to conduct simple descriptive statistics as well as different statistical procedures as chi-square, odds ratios and binary logistic regressions, in order to examine the respondents' knowledge on RES and the factors influencing this knowledge. In order to calculate odds ratios for scale and ordinal variables (e.g. age), new dichotomous variables were created. It should be mentioned that although many different demographic and socioeconomic factors were examined, in the following analysis only statistically significant results are presented (p-value ≤0.005).

3. Results

3.1. Descriptive statistics

A total of 533 people participated in the online questionnaire survey, with 59.5% of the respondents being women. Average age of the respondents is 31.66 years (median:30, min:18, max:73), with the majority of respondents living in Attica (79.9%), and the rest in other regions of Greece. Regarding educational level, the majority of the respondents are postgraduates (38.5%), followed by university (31.5%) and senior high school graduates (15.4%). As for occupation, 63.4% of the respondents were working when the survey was conducted (public and private employees, self employed), while the remaining 36.6% were not (retired, students, housewives, unemployed). Also, 52% of the respondents stated that they have an occupation, studies or interests related to environment, technology or engineering. Concerning the educational level of the Head of the Household (HoH), 30.2% are postgraduates, 27.8% university, 13.9% senior high school and 11.8% Vocational Training Institute (VTI) graduates. As for the monthly family income, 36.3% reported having an income up to 1000€, 34.2% between 1001€ and 2000€ and 29.5% over 2001€ ($n = 532$).

A set of questions related to environmentally friendly behaviour and energy saving actions were included in the questionnaire. These questions dealt with topics such as recycling, domestic energy saving, habits during transportation, participation in environmental organizations, while its answering scale was dichotomous (yes/no). Summing up all the positive answers that a respondent gave, an index of environmental behaviour was created, which indicates that the average respondent performs 9.17 of these actions (median:9, min:0, max:16). Next, a dichotomous variable that distinguishes respondents with a score of 0–9 actions, from those with a score of 10–16 was created, assuming that people with a higher score have a relatively better (friendlier) environmental behaviour.

The types of RES with the highest levels of generic knowledge, based on the respondents' answers, are wind and solar energy, followed by geothermal energy, hydropower and biomass, while wave, tidal and ocean thermal energy are the least known (Table 1). Regarding how many types of RES respondents know about, only 0.6% is unaware of any of them, the most common number of technologies known is five types (17.8% of the respondents), while 15.9% stated that know all eight types included in the questionnaire.

3.2. Chi-square tests, odds ratios and binary logistic regressions

In order to identify the factors that have a statistically significant impact on the knowledge of different renewable energy sources, as well as the level of this impact, chi-square tests and binary logistic regression models were used, with their results being presented in Tables 2 and 3. Variables being examined were gender, age, education level, occupation, income, education level of HoH, environmental behaviour and having an occupation, studies or interests related to environment, technology or engineering. Results for each RES are the following:

- *Biomass*: Through the chi-square tests (Table 2) it is indicated that knowing about biomass was found to be related in a statistical significant level of 1% with three variables, and in a level of 5% with one. The variable that seems to have the greatest influence on knowledge of biomass is having an occupation, studies or interests related to environment, technology or engineering, as someone that belongs in this category is 3 times more likely to know biomass. Regarding gender, men have a higher possibility in relation to women to know this energy source. Someone with a comparatively environmental friendlier behaviour is about 2 times more likely to know biomass, while someone who's HoH is a postgraduate is also more likely to know about this type of energy. The regression model presented in Table 3 does not include the variable "HoH is a postgraduate", as the specific variable was not statistically significant, but it includes all the other variables, mostly confirming results of chi-square analysis.
- *Geothermal energy*: According to the chi-square tests (Table 2), someone having an occupation, studies or interests related to

Table 1
Respondents' generic knowledge about RES ($n = 533$).

Solar energy	98.5%
Wind energy	96.2%
Geothermal energy	71.1%
Biomass	67.7%
Hydropower	67.7%
Wave energy	45.0%
Tidal energy	29.6%
Ocean thermal energy	22.5%