

Residents' information about renewable forms of energy in the island of Cyprus

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Abstract. In recent years, a shift has been observed in several countries towards the exploitation of Renewable Energy Sources (RES) for socio-economic and environmental purposes. The present research was conducted on the island of Cyprus, where five wind parks have been in operation since 1992, with a total annual capacity of 4,740 MW. The data collection was carried out in 2015 using a structured questionnaire, and involved the residents as electrical energy consumers. In particular, their views were studied regarding their disposition towards the installation of RES systems in their island, and its importance in the protection of the environment. Also they were asked about the most important means and the level of information they derive for RES, their willingness to pay more for the production of 20% more RES energy and the use of energy performance measures for buildings.

Keywords: Renewable Energy Sources (RES), Public perceptions, means and degree of information, willingness to pay, Cyprus Island

1 Introduction

The economic growth of any country is closely related to the availability, export, distribution and use of energy (Tsantopoulos et al. 2014; Wolsink 2007). At the same time, the increased global rate of energy consumption puts development at risk, as well as any effort to safeguard our living standards into the future. An accelerate integration of RES is considered to be imperative for Cyprus in order to fulfill its goals for 2020 which state that 20% of its gross national energy consumption and 40% of its gross electricity consumption must be covered by RES (Kaldellis et al., 2012). The problem of identifying alternative forms of energy becomes even greater in the case of island regions, whose connection to the national grid is often either impossible or very problematic in its operation (Kaldellis and Zafirakis 2007). The problem of energy efficiency in island regions has two aspects. On the one hand, most islands present a major population increase during the summer (Tampakis et al., 2013), thus necessitating an uninterrupted, reliable electricity supply. On the other hand, the installation of alternative energy forms must not cause any distortion to the

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landscape, which may impact on the development of tourism. As regards the Cyprus Island, there is a constant and rapid increase in electricity consumption, which in some cases exceeds 10% on an annual basis. The increase in the demand for electricity, especially during the summer months, has been addressed to date through the installation of additional thermal units for electricity generation, in order to avoid any major failures of the electricity grid, which requires particular support during the tourist season. The absence of an integrated plan for dealing with the electricity supply problem results in minimally reliable solutions.

At this point the public positively views the framework 'Renewable Energy Sources' on an individual level, but do not have sufficient information on the topic. What is noted, is the fact that the public expects more interventions by the State and more information from the Mass Media, while expecting less from the local community; another important parameter is the cost and financing of technologies and investments (Tampakis et al. 2017; Mirza et al. 2012).

The above observations point to the necessity of a national public awareness strategy in Cyprus, which will include campaigns from the mass media and the press, along with information on RES technologies that can be applied on an individual, local and national level. The present survey also has a similar focus, its aim being to present the views of the citizens of Cyprus, on a series of issues related to their intend to pay more many in order to product alternative forms of energy.

The conclusions of the survey will comprise an important tool both for its continuation and for policy-makers in order for them to map out a more effective policy on a local and national level. The study of citizens' views in the present survey can constitute a starting point and an essential tool for authorities, so that they adapt their decisions to the new state of affairs in accordance with the protection and development of energy resources.

2 Materials and Methods

The study area was the island of Cyprus, the third biggest island in the Mediterranean basin (9,251 km²) where live 840, 407 residents. The sampling method used was simple random sampling. In order to estimate the size of the sample, a pre-sampling was conducted on a sample size of 50 persons. Thus, the variance or standard deviation was estimated for each quantitative variable, and the proportion for each qualitative variable. The size of the sample was estimated according to the formulae of simple random sampling with replacement. The finite population correction can be ignored since the sample size n is large compared to the population size N ($n/N = 50/10,009 = 0.00499$ i.e. approximately 0.5). If the estimated sample sizes are similar and the size of all lies within the financial means of the sampling, then the sample size selected is the largest one. In this way, the variable with the highest variance is estimated with the desired accuracy and the rest with a higher accuracy than originally determined. Thus, the sample size was set at 385 people. The residents in the sample were then identified using random numbers we obtained from random number tables. Face-to-face interviews were carried out. The data collection took

place in 2016. The specific research was conducted using a structured questionnaire and face-to-face interviews.

To the group of variables frequency analysis with more than two criteria was carried out. The hierarchical loglinear analysis was also applied. Prior to the initiation of the loglinear analysis (in particular of the hierarchical) it is intentional to examine the size of the expected frequencies in the crossing table. Large number of the expected frequencies (higher than 20%) with rate lower than 5 – but not lower than 1, run the risk of leading to the power loss of the applied analysis . This examination is carried out with control of double-sided crossing tables through the SPSS program.

The classes of variables were grouped in order to satisfy the above mentioned conditions. Our data are classified in accordance with 4 criteria and express frequencies. The assumption H_0 is: H_0 : 4 criteria are fully independent from each other. It is unlikely for this assumption to be accepted, but the analysis will allow the precise level of various interrelations and will be included in a model that expresses the data interrelations.

Statistic controls of optimum adjustment are used for the estimation of the correspondence degree between the model and the data. Statistical significance shows that the examined model does not represent the observed frequencies perfectly, whereas the statistical non-significance means that the examined model is adjusted to the observed frequencies respectively. X^2 test is applied.

Loglinear analysis forms a special case of multiple regression analysis according to which one or more variables relate to others, in the framework of a multidimensional crossing table. During this analysis, all homographs are considered independent and any recess of the crossing table dependent.

3 Results and Discussion

First the demographic characteristics recorded and according to the data of the questionnaire there is predominance of women (52%). The majority is in the age group of 31-40 years (34%) and has higher education either in University (32%) or at a Technological Education Institute (15%). Most of them are public servants (25%) or self-employed (23%) with annual income 15-20.000euros (27%).

The primary data collected and presented in this research related to the socio-demographic characteristics of the respondents and attitudes on the degree of information regarding RES and willingness to pay more for the production of 20% RES more energy and the use of energy performance measures for buildings.

Then the respondents were asked about the importance of the installation renewable forms of energy in their island as a mean to the protection of the environment. According to the results of the survey 34.2% ($s_p=0.0237$) of the respondents stated that it is very important and 42.8% ($s_p=0.0247$) important 22.2% ($s_p=0.0206$) unimportant and 0.8% ($s_p=0.0043$) very unimportant. The above attitude of the

residents is always correlated to the proper information they must have. So the respondents were asked then about how informed they were about renewable energy systems can be used in homes for the production of electricity: 36.0% ($s_p=0.0239$) of the residents were absolutely informed, while 41.2% ($s_p=0.0246$) were sufficiently informed. Only 19.8% ($s_p=0.0197$) have adequate information and only 3% ($s_p=0.0078$) of them were not at all informed. Regarding the evaluation of the sources of information on RES citizens stated that they are mainly informed by the Media. More specifically they draw information from internet, TV, radio, leaflets, newspapers also from their family and friends (Table 1).

Table1. Information about the Renewable Energy Sources

Variables		Very important	important	Mediocre	unimportant	Very unimportant
Family and friends	%	36.0	45.8	18.0	0.2	
	s_p	0.0240	0.0249	0.0190	0.0025	
Education	%	26.2	62.5	11.2		
	s_p	0.0220	0.0242	0.0158		
TV- Radio	%	50.0	41.5	8.5		
	s_p	0.0250	0.0246	0.0139		
Newspapers	%	40.0	49.8	10.2		
	s_p	0.0245	0.0250	0.0152		
Books and encyclopedias	%	27.5	54.2	17.5	0.5	0.2
	s_p	0.0223	0.0259	0.0188	0.0035	0.0025
Internet	%	57.8	30.0	12.0	0.2	
	s_p	0.0247	0.0229	0.0162	0.0025	
leaflets	%	49.0	38.8	11.8	0.2	0.2
	s_p	0.0250	0.0244	0.0161	0.0025	0.0025
Personal contact with the companies	%	17.2	21.5	45.8	14.5	1.0
	s_p	0.0189	0.0205	0.0249	0.0176	0.0050
Voluntary organizations	%	23.5	17.0	39.5	18.5	1.5
	s_p	0.0212	0.0188	0.0244	0.0194	0.0061

It is important to clarify whether this positive attitude expressed by the respondents concerning RES involves a general attitude to life. Thus, they were asked whether they would be willing to pay more in order for 20% more of generated power to be produced by RES. Fig. 1 shows that with the exception of 12.2%, of the respondents who do not agree to pay for such an increase, the other respondents agree to an increment in the price of electricity ranging from 5% to 20%.

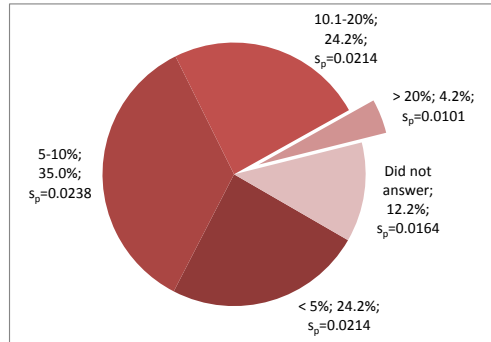


Fig.1. Acceptance of increase electricity price for the production of 20% RES energy

In addition, 47.2%, $s_p=0.0250$ agree with the use of energy performance measures for buildings, i.e. with the need for an energy performance certificate for houses to be rented out or sold. 27.2% ($s_p=0.0223$) of the respondents are opposite to this and 25.5% ($s_p=0.0218$) of them neither agree nor disagree.

Following the application of hierarchical loglinear analysis to the above variables, we have interaction per 3 criteria, because the X^2 for Pearson's test is 5.910 with probability (p)=0.315 and because the X^2 likelihood ratio is 7.938 with probability (p)=0.160. The above-mentioned results are confirmed by the zero/"null" controls for the interaction of the k terms and the terms of higher degree, as well as the "null" controls for the interaction of the k terms (Norusis 1994). In fact, for three pairs of variables there is a statistically significant interaction:

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The residents stated as very important for the protection of the environment, the installation of renewable forms of energy in their island, were absolutely or sufficiently informed about the installation of RES. Also they agree with the use of energy performance measures for buildings and the increment of the electricity price more than 10%. Oppositely the residents were of the opinion that the installation of RES in their houses does not correlate to the protection of the environment and they were adequate informed about RES. Also they are negative to the adoption of energy performance measures for buildings and the increment of the electricity price more than 10%.

4 Discussion - Conclusions

Renewable energy systems can be a solution to provide dependence for small communities (Neves et al 2014) and Cyprus Island can be a good application to this. As revealed by the statistical analysis, the questionnaire constitutes a valid and reliable tool. Therefore, except for its use in the current research, it can be used as such or with some modifications or be the basis for the collection, recording and evaluation of knowledge, attitudes and perceptions of people in other islands of the Mediterranean region (Ntona et al.2015).

According to the results, the vast majority (36.0% and 41.2%) of the residents of Cyprus are absolutely or sufficiently informed about the use of renewable energy systems in their homes).

About one third of the Cypriot respondents (4.2% and 24.2%) are willing to pay 10% or more increment to the electricity price in order for 20% of generated power to be produced by renewable energy sources. In a similar research (Tampakis et al 2017) conducted in Andros Island in Greece, a more negative attitude recorded (only 9.9% and 5.2%) are of the same opinion.

Regarding the evaluation of the sources of information on RES residents of Cyprus and the residents of Andros Island have about the same attitudes, more specifically they draw information from internet, TV, radio, leaflets, newspapers and from family and their friends. Also the Cypriots and Greek residents are rather negative to the adoption of energy performance measures for buildings and the increment of the electricity price more than 10%.

References

1. Tsantopoulos G., Arabatzis G., Tampakis S. (2014). Public attitudes towards photovoltaic developments: Case study from Greece. *Energy Policy Journal* 35(9), pp 94-106.
2. Wolsink, M. (2007), Wind power implementation: The nature of public attitudes: Equity and fairness instead of 'backyard motives'. *Renewable and Sustainable Energy Reviews*, 11 (6), pp. 1188-1207.
3. Kaldellis, JK. (2005). Social attitude towards wind energy applications in Greece. *Energy Policy*, 33, pp. 595–602.
 4. Kaldellis JK, Zafirakis D. (2007) Present situation and future prospects of electricity generation in Aegean Archipelago islands. *Energy Policy Journal* 35(9), pp 4623-4639.
5. Tampakis S., Tsantopoulos G., Arabatzis G., Rerras I. (2013). Citizens' views on various forms of energy and their contribution to the environment. *Renewable and Sustainable Energy Reviews* 20, 473-482.
6. Tampakis S., Arabatzis G., Tsantopoulos G. (2017). Citizens' views on electricity use, savings and production from renewable energy sources: A case study from a Greek Island.

7. Mirza U, Harijan K, Majeed T. Status and need of energy education: the case of Pakistan. In: Uqaili Mohammad Aslam and Harijan Khanji, editors. *Energy, Environment and Sustainable Development*; 2012; 39-47.
8. Neves D., Silva C., Connors S. (2014). Design and implementation of hybrid renewable energy systems on micro- communities: A review on case studies. *Renewable and Sustainable Energy Reviews* 31, 935–946.
9. Ntona E, Arabatzis G, Kyriakopoulos G. (2015). Energy saving: Views and attitudes of students in secondary education. *Renewable and Sustainable Energy Reviews* 46, 1-15.