

Investigation of the relationship between ecological sensitivity and renewable energy investment acceptance by using the NEP scale

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Abstract. The aim of this study is to investigate the relation between ecological sensitivity and renewable energy acceptance. A questionnaire known as the NEP scale was used to measure ecological sensitivity, by using a sample of 360 respondents from the area of Evia, Greece. Statistical analysis revealed the existence of a positive relationship between ecological sensitivity and willingness to pay more for renewable energy. Furthermore, a statistical significant relation was found between ecological sensitivity and citizens' views concerning the contribution of renewable energy sources to environmental improvement.

Keywords: environment, renewable energy, ecological sensitivity, green investments, NEP scale

1 Introduction

Public perception towards renewable energy has positively changed during recent years. People are becoming more sensitive towards environmental degradation motivated by increased energy consumption, which is linked to economic development. Also there is a growing concern on the limitation of traditional energy sources and the climate change phenomenon (Tsantopoulos et al, 2014; Ntanos et al, 2015; Kyriakopoulos et. al 2010a, b; Chalikias et.al. 2010a, b; Kolovos et., al 2010; Kyriakopoulos et al., 2015; Papageorgiou et al., 2015). These facts make sustainable development an absolutely essential approach for businesses in order for them to grow and keep up with new technologies (Tsekouropoulos et al, 2015).

A noticeable shift towards green development has already been recorded, which is further motivated by broad public access to environmental information (Coburn and

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Farhar, 2004; Vasseur and Kemp, 2015). Ecological sensitivity is in the epicenter of environmental research during the last 40 years. Moreover, green marketing is of high importance and plays a crucial role in contemporary societies, since it improves the quality of products and satisfies the customers' needs (Skordoulis et al., 2013; Armira et al., 2016; Tsekouropoulos, 2016). Also, social responsibility towards the environment and ecologically conscious citizens should be integrated in marketing and economics policies (Tsekouropoulos et al, 2013). The most widely used questionnaire to measure ecological sensitivity is the New Environmental Paradigm scale (known as the NEP scale) suggested by Dunlap and Van Liere (1978) in an attempt to measure people's view towards the natural environment. The original tool includes 12 Likert type questions in an attempt to measure the degree to which people perceive themselves as part of nature and the degree of awareness concerning human impact on earth's ecosystem (ecological worldview). The NEP scale was conceptualized because of the authors' recognition that a measurable system of environmental beliefs exists among other personality characteristics (Dunlap and Van Liere, 1984). Since then, the original NEP scale was revised several times (Dunlap et al, 1992; Dunlap et al, 2000). The latest revision was performed in order to include the idea of "human exemptionalism" suggesting that humans can overcome natural constrains. The revised scale also includes questions on the possibility of an ecocrisis (Dunlap et al, 2000). The revised NEP questionnaire includes a total of 15 items that are set on the 5-point Likert scale. According to Dunlap et al. (2000), the seven even numbered items (questions 2,4,6,8,10,12 and 14) are meant to represent statements endorsed by the dominant social paradigm (DSP). The Dominant Social Paradigm (DSP) is a more anthropocentric view, supporting the ideas of economic interest, technological progress and self-government (Pirages and Ehrlich, 1974). The eight odd items (questions 1,3,5,7,9,11,13, and 15) are meant to reflect endorsement of the new environmental paradigm (NEP), therefore representing a proactive, increased ecological sensitivity of the respondents. Moreover, the scale is further broken down into five sub-scales consisting of three elements per sub-scale. These sub-scales and their respective questions are: the perception of the limits of growth (q1, q6, q11), non-anthropocentrism (q2, q7, q12) the fragility of nature, q13), non-acceptance of human supremacy (q4, q9, q14) and the possibility of ecological crisis (q5, q10 and q15).

The main research aim of this study is to estimate the NEP and DSP subscales for the island of Evia in Greece, in order to examine if there is a correlation between ecological views of people and public acceptance of renewable energy investments.

2 NEP scale applications

In a multidimensional study on environmental attitudes, including 14 countries, the revised NEP scale was used. It was found that the average reliability varied among countries, with the alpha coefficient to be between 0.47 – 0.81 with an average reliability of 0.70. The average NEP scale score was reported to range between 3.67 (United States) and 4.11 (Canada). It is mentioned that personal values like universalism and tradition influence environmental attitudes (Schultz and

Zelezny, 1999). In an interesting review paper on the NEP scale, results from 139 studies (58,279 participants) were normalized and compared. It is reported that the NEP scale may be used in various formats, including 5-point scale, 7-point or 10-point and also 12-point versions. It concludes that although the NEP Scale has been widespread used, this has not been done systematically but in varying ways (Hawcroft and Milfont, 2010). A recent research review by Krosnick et al. (2005) suggests that data quality improves when 7-point scales are used. In a study performed on students a positive relationship was found between environmental knowledge and environmental attitudes of the students (Pe'er et al., 2007). In another review paper for the period 1988-1998 reports that women exhibit stronger environmental attitudes than men (Zelezny et al, 2000). In a recent study using the NEP scale on urban design professionals, the mean score was 3.68/5. It is mentioned that age, gender, and profession did not correlate with ecological view (Wallhagen and Magnusson, 2017). In an interesting study concerning the use of NEP scale in Nigera, a test of reliability was conducted and Cronbach's alpha value of 0.61 was obtained. In the same study, it is reported that a NEP score of 3 out of 5 is the boundary between an anthropocentric and a pro-ecological worldview (Ogunbode, 2013).

3 Methodology

The survey was conducted in the Greek island of Evia during the period of September 2016 to October 2016, using random stratified sampling. For the calculation of the sample size, a pre-study was conducted in the area with a sample of size $n = 50$ subjects. By using this pivot sample, the standard deviation (s) was calculated for each quantitative variable, and the ratio (p) for each qualitative variable research. Appropriate sample size was estimated at 360 respondents, by using the proportions equation, with an error $e = 0,05$. The questionnaire is divided into two sections. The first section contains the revised NEP scale questionnaire, under the 7-point form. The mean scores on the subscales of the dominant social paradigm (DSP) and the new ecological paradigm (NEP) were calculated. The second section of the questionnaire contains questions about renewable energy sources. The questions concentrate on the degree of public knowledge and acceptance for various forms of renewable sources. The questions were drawn from similar surveys on social acceptance of RES (Arabatzis and Myronidis, 2011; Chalikias 2013; Chalikias and Kolovos 2013; Kyriakopoulos and Chalikias, 2013; Arabatzis and Malesios, 2013; Zografakis et al. 2010). Research hypotheses to be tested include: 1) statistical significance of relationship between willingness to pay for renewable energy and mean score on the NEP scale and 2) RES contribution to environmental protection and mean score on the NEP scale. Statistical analysis includes descriptive statistics, independent samples t-test and one-way ANOVA.

4 Analysis

The average age of the sample is 38.6 years and the predominant age group category is 41-44 years, including 30.0% of the respondents. The predominant level of education is high school (43.3%). A percentage of 48% of the sample declared an individual annual income up to € 10.000, while it should be noted that about 1/5 of the sample has an annual income below € 5000. Concerning occupational status, employees in both public and private sectors account for 51.4% of the sample, while a percentage of 22.5% is occupied by the categories of unemployed, students and housekeepers. With regard to the area of residence, the majority of the sample (40.1%) resides in suburban areas, a percentage of 32.8% in urban areas and the remaining 27.1% in rural areas. As described in the introduction section, the NEP scale is used to measure environmental and ecological sensitivity of the respondents. The scale is divided into two subscales, measuring ecological sensitivity of the respondents (variable NEP proactive) and the more anthropocentric view of the dominant social paradigm (variable DSP dominant), supporting the belief of human superiority over all other species, the belief that the earth can offer unlimited resources and that progress is an inherent part of human history.

As we can see from the mean scores in Table 1, the sample exhibits a proactive attitude since the mean score of the NEP scale (5.3 out of 7) is significant higher than their score on the anthropocentric approach DSP dominant (4.24 out of 7).

Table 1. Mean score on the NEP scale, depicting the subscales of the new ecological paradigm (NEP Proactive) and the Dominant Social Paradigm (DSP dominant)

| Mean score of the two dimensions of the NEP scale (proactive/dominant) | | | | | |
|------------------------------------------------------------------------|-----|---------|---------|------|----------------|
| | N | Minimum | Maximum | Mean | Std. Deviation |
| NEP proactive | 360 | 2.63 | 7.00 | 5.34 | 0.78 |
| DSP dominant | 360 | 1.29 | 6.57 | 4.25 | 0.99 |

Concerning the contribution of renewable energy systems, there is a positive public attitude as about 51% responded that renewable energy sources contribute to the improvement of living standards while 65.5% answered that they contribute to environmental improvement. Approximately 30% of the sample agreed or strongly agreed on the statement that renewable energy is an economically efficient and socially acceptable investment area. When asked about factors contributing towards the spread of renewables, 71% of the respondents agreed on the increasing need for environmental protection.

To test research hypothesis, the NEP proactive scale mean score was used. Before the hypotheses tests, a test of normality was performed to variable "NEP proactive" by using 1-sample Kolmogorov-Smirnov test. Variable "NEP proactive" was found to be normally distributed. In a dichotomous question concerning willingness to accept a higher electricity cost for renewable energy, a percentage of 40% of the sample gave a positive answer (145 out of 356 respondents), while 60% gave a

negative answer. Those who answered positively, exhibit a higher mean score (5.46 out of 7) in the NEP scale of ecological sensitivity than those who do not want to share the extra cost, as can be seen in table 2. By using the Independent Samples t-test, this difference between the mean score was found to be statistically significant at the 99.9 % level, meaning that ecological sensitivity is positively associated with willingness to pay for more for electricity coming from renewable energy sources, as can be observed in table 3.

Table 2. Difference of mean score on the NEP proactive scale, for the categories of people who are willing to pay more for RES (yes) and those who are not willing to pay more (no).

| Willingness to pay more for Renewable Energy | N | Mean score (NEP proactive) | Std. Deviation | Std. Error Mean |
|----------------------------------------------|-----|----------------------------|----------------|-----------------|
| yes | 145 | 5.46 | .69 | .058 |
| no | 211 | 5.24 | .82 | .057 |

Table 3. Independent samples t-test for the statistical significance of the mean difference on the NEP scale score between the categories yes/no on variable WTP, as depicted in table 2.

| Levene's Test for Equality of Variances | | | t-test for Equality of Means | | | |
|-----------------------------------------|-------|------|------------------------------|-------|-----------------|-----------------|
| | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference |
| nep_proactive | 4.889 | .028 | 2.612 | 354.0 | .009 | .218 |
| | | | 2.695 | 339.4 | .007 | .218 |

On a question about the contribution of renewable energy sources on environmental improvement, the majority of the sample also answered positively. A hypothesis test was performed between this question and the NEP scale score by using the one-way ANOVA. As it can be seen in table 4 and fig. 1, a statistical significant relation was found at the 95% level. As the score on the ecological sensitivity scale increases, a person seems to be more positive towards RES contribution to the environment.

Table 4. One-way ANOVA hypothesis test for the relationship between the variables of NEP proactive and public perception on the contribution of RES to environment

| Hypothesis test between NEP proactive mean score and RES contribution to environment | | | | | |
|--------------------------------------------------------------------------------------|----------------|-----|-------------|-------|-------------|
| | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 7.677 | 5 | 1.535 | 2.546 | .028 |
| Within Groups | 174.906 | 290 | .603 | | |
| Total | 182.583 | 295 | | | |

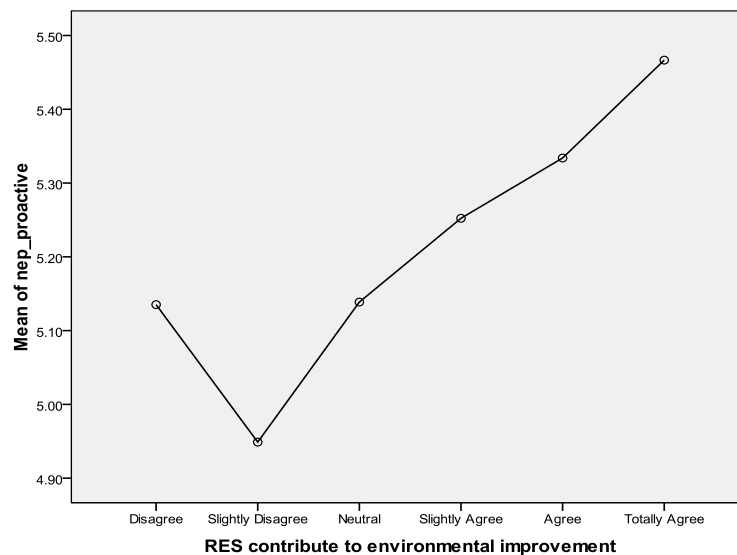


Fig. 1. Mean plots between the NEP scale and respondents opinion on the contribution of renewable energy systems to environmental improvement, depicting a positive relation

5 Conclusions

Ecological sensitivity was estimated by using the NEP scale for the region of Evia in Greece. The results revealed a positive ecological attitude among the respondents and are comparable to similar samples from other countries as the UK and Turkey (Pahl et al, 2005; Erdoğan, 2009). Hypothesis tests were performed in order to investigate the relationship of ecological sensitivity and acceptance of renewable energy sources. A statistical significant relationship was found between willingness to pay for RES and ecological sensitivity as measured by the NEP scale. Also a

positive relation was found between the NEP scale mean score and public perception on renewable sources contribution to environmental improvement. It therefore appears that public attitude towards green investments becomes more positive as ecological sensitivity increases. The results of this study suggest that an evaluation of the ecological sensitivity between the residents of local communities, amongst other personality characteristics, may be useful in order to determine the degree of public acceptance in the area of renewable energy investments.

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