

People's Perceptions on Renewable Energy Sources' Penetration Prospects in the Khorezm Province, Uzbekistan

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The traditional energy supply is receiving a great pressure in the post-soviet due to the increasing demand and diminishing resources. The role of renewable energy sources is crucial for meeting the future energy demand, especially in the residential sector. Current study reviews the perception of the current decision makers on the prospects of renewable energy penetration in the Khorezm province of Uzbekistan. It was discovered that high price of the renewable energy facilities and inability to fully replace the traditional energy supply serves as a disincentive while availability of crediting and public awareness may serve as an incentive. Avenues for renewable energy penetration in the residential sector of Uzbekistan are discussed further.

Keywords: renewable energy penetration, perceptions, decision-makers, Uzbekistan

Introduction

It is evident that the following energy sectors of fossil fuel-rich countries as Kazakhstan, Turkmenistan and Uzbekistan are heavily dependent on non-renewable resources. The copiousness of these resources functions as a retardant the process of energy diversification in the above mentioned Central Asian states. Nevertheless, the future diversification of energy sources is an inescapable process due to many reasons; man-made climate change, being the most important ones the need for transition to reliable and secure energy sources and availability of a vast potential for renewable energy generation.

We can already observed the impact of climate change in Central Asia by frequent climate anomalies such as high deviation from the historical average in precipitation levels, increased droughts and unusually harsh winters. Even more troubling problems these anomalies may cause even more

troubling problems such as energy crises during winter seasons (Laldjebaev, 2010). Moreover, they also increase energy consumption, which, as mentioned above, is highly based on fossil fuels, thus creating a closed cycle. Therefore renewable energy penetration in Central Asia is one of the central questions in energy sector reform, and hence, sustainable development.

As we analyzed that the potential of renewable energy sources is one of the less investigated matters in these fossil fuel-rich countries. When we observed about the technical feasibility study of the off-grid renewable energy resources in Uzbekistan, we had known it was carried-out by the International Resource Group (IRG) in 2005, concluded that small-scale hydropower facilities were the most feasible off-grid energy options in Uzbekistan for that period (IRG, 2005). The study was in a report form prepared for the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan and did not stress on assessing the socio-economic feasibility of individuals, household level for renewable energy application.

It was pointed out that, the worldwide experience could demonstrate a high share of renewable energy application used by the residential sector. Since that time the share of residential energy consumption is high with 39% in the total energy consumption (EarthTrends, 2005), according to our research results Uzbekistan also has an immense potential for introducing renewable energy, especially in the residential sector. The reasons of that 65% of the population in the country are living in diversely located, rural settlements with lower population density. About 1.5 million people living in the ca. 1500 remote settlements do not have access to energy infrastructure, while the maintenance costs of the existing distribution infrastructure is very high. According to our research results, renewable energy penetration did not occur in Central Asia despite of continuous energy undersupply (Komilov, 2002) and climate change induced winter anomalies. What are the factors that stifle or stimulate household level renewable energy penetration in Central Asia? What conditions have to be faced and what should be done to diversify the energy sector through residential renewable energy penetration?

The European Renewable Energy Council (EREC) signifies investment subsidies and credits as an important supporting tool for renewable energy application (EREC, 2010). As we know grants and credits are the commonly used tools all over the world. Therefore, the countries interested in expanding the share of renewable energy sources are also famous for implementing legal frameworks with supporting mechanisms that create the necessary framework to attract investments to renewable energy. Taking into consideration, that creating investment subsidies and crediting renewable energy penetration are

also an important issue for Uzbekistan.

Here, it necessary to call the attention to the list of obstacles to renewable energy penetration by Painuly (2001) such as (i) market failure; (ii) market distortions; (iii) economic and financial barriers; (iv) institutional barriers, (v) technical; and (vi) social, cultural and behavioral barriers. According to our investigations we came across that all these obstacles are present in Central Asia, where the price of energy supply is one of the lowest in the world. However, the present study concerns itself only with yet unknown aspects of residential renewable energy penetration such as social, cultural and behavioral acceptance of renewable energy sources. Having analyzed all about it we will focus on disclosing how the Uzbek people perceive the application of renewable energy sources in the residential sector.

Observing and studying of application of renewable energy sources in the residential sector in Western countries revealed that social, cultural and behavioral aspects of renewable energy source application is at least as important as other aspects. For example, Woolskin (2007) found out that citizen in European countries show high public support for renewable energy, which can be explained by the people's concern about the dependence of European economies on imported fossil fuels and their willingness to pay more for the benefit of environmental sustainability. It is obvious that the opinion of the people in developing countries, where there is a low national income and environmental awareness is less developed, is expected to be different. However, there may also be some other factors furthering renewable energy penetration in the developing countries.

Looking into the demand for green energy in Texas, Zarnikau (2003) concluded that informed dialogue about energy alternatives results in broader interest and support for these resources. During the public discussion of decision-making process on alternative energy resources was also found to be important for certain types of alternative energy sources such as wind, biogas and biomass, the generation facilities of which affect the day-to-day lives of citizens in the neighborhood due to their appearance, noise, odor, risk of explosion, etc. People's worrying about these factors also needs to be studied.

By summing up and analyzing the ideas of the Swedish people, Johansson and Laike (2007) learnt that involving the surrounding public in the decision-making process of setting a new wind power plants is more important for the people than the benefit of these wind turbines on the quality of their daily lives. Interviewed people opposed to the installment of wind power due to its aesthetic impact on the environment and recreation, while minor importance was emphasized by them on the effects of wind turbines on their

daily quality of life. It should be signified, that the present paper also aims to survey the importance of public opinion for decision-making.

We have investigated the relationship between willingness to pay for renewable energy and three main factors, (i) environmental concern; (ii) knowledge on renewable energy; and (iii) consequences of renewable energy application, a study by Bang et al. (2000) revealed that emotionally charged decisions are more important than facts and knowledge-based decisions among US citizens. There should be questioned whether this is also the case in the developing countries, where people are not sufficiently familiar with the availability and techno-economic feasibility of renewable energy, or whether, on the contrary, lack of knowledge itself is the stifling factor for individual decision making.

As we know Kiliç et al. (2009) used a closed form questionnaire to sum up the ideas of Turkish students about the characteristics of renewable energy, its perceived advantages and disadvantages, and, their views about the importance of the characteristics of energy production, their expectation being that the combination of such beliefs could act as incentives or disincentives to the acceptability of renewable power in the future, when the generation of these students become real decision makers. Following about this closed form questionnaire the authors concluded that the belief that renewable power could produce a reliable supply of electricity and, encouragingly, that it could contribute to a reduction in global warming, would be persuasive arguments for its implementation. We think that again, it should be tested if the perception of real decision makers in developing countries is similar, or if there are other driving forces, which could serve as an incentive for residential renewable energy penetration.

We were sure to investigate these factors; a modified version of the questionnaire developed by Kiliç et al. (2009) was used to explore people's views about the characteristics of renewable energy production, its perceived advantages and disadvantages, their views about the importance of various characteristics of energy production in general. According to it we were consulted by based on the literature in this sphere, modifications were made to include key factors such as the importance of knowledge (Bang et al., 2000), consumption efficiency (Zarnikau, 2003), availability of external financial support and reliance on renewable energy (EREC, 2010) (whether renewable energy sources can fully replace both electricity and natural gas or not). As we calculated, that negative ideas about the characteristics of renewable energy are expected to serve as a disincentive while positive ideas could serve as an incentive for residential renewable energy application.

Methodology

We have done closed-form of questionnaire (see Appendix A) modified from Kiliç et al. (2009) was used to explore the prevalence of ideas of rural (n=95) and urban (n=55) inhabitants of the Khorezm Province, Uzbekistan¹ on renewable power generation. In Section A of the questionnaire we included questions on the age, gender and position in the family². Observing the questions about the respondents' willingness to pay a premium for energy from renewable sources and whether they would wish to live close to a renewable energy generation facility such as solar PV stations, small scale biogas and biomass power generators were asked in the same section. In order to add some vividness to the questionnaire some additional questions were also asked to draw a broader picture of the situation, which included the average weekly hours of electricity cut-offs in their area and whether the respondents have seen an operating renewable energy plant in their neighborhood.

We probed the respondents' ideas about various characteristics, advantages and disadvantages of renewable energy generation in Section B of the questionnaire. Having consisted of 14 items in the section, the first item is "Substantial knowledge on the application of renewable energy (solar, wind, biogas, biomass) sources is required for its successful application in the household." All the given items in this section was done in the form of a Likert-scale ('Strongly agree', 'Agree', 'Neutral' (Neither agree nor disagree), 'Disagree' and 'Strongly disagree') and the responses available for all them.

Probing the respondents' views in Section C of the questionnaire about the importance of various characteristics of power generation in general and included 11 items. The first question was "How important is it to you that people need to know more about the various aspects of the energy options they have" and the four available responses were, as for all the other items of this section, 'Very important', 'Quite important', 'Not very important' and 'Not important at all'.

We focused five items in Section D and explored people's views about global warming. The first of these items asked the respondents how worried they were about the effects of global warming on the environment. The responses available were 'I am very worried', 'I am quite worried', 'I am a little bit worried' and 'I am not worried at all'. The second item asked the respondents how much they knew about global warming, with the responses

1 The share of rural and urban people in the study region is 65% and 35% respectively, hence the share of the respondents.

2 The aim of the question on position in the family (head of the family or not) was to investigate the average age of decision makers and not to probe the dominance by gender.

available being 'I know a lot about Global Warming', 'I know something about Global Warming', 'I know a little about Global Warming' and 'I know almost nothing about Global Warming'. The third question in this section asked how environmentally friendly respondents considered themselves to be, with 'I am very environmentally friendly', 'I am quite environmentally friendly', 'I am a bit environmentally friendly', and 'I am not at all environmentally friendly' as available responses. At the end we gave them the final questions whether responders believed that global warming is really happening now; 'I am sure Global Warming is happening', 'I think Global Warming is happening', 'I don't know whether Global Warming is happening or not', 'I think Global Warming is not happening' and 'I am sure Global Warming is not happening' being the available responses. We conducted the questionnaire in Uzbek and both Uzbek and English versions of the questionnaire are given in the Appendix A.

As you have seen we included information in cover page about the research being carried out and the confidentiality of the respondent's individual answers. We have been conducting the survey for two weeks of March 2011, by a professional group visiting randomly selected houses of respondents who voluntarily decided to participate. And also the STATA 11 statistical package was being used by us to analyze the results.

The Likert scale method and survey based perceptions studies are criticized by some for being "general" or "vague" (White & Mackay, 1973). As we have analyzed, the number of respondent of 150 is not sufficiently large to draw best conclusions. As we have followed, that the present study should be considered as a preliminary study of renewable energy application. According to our survey we have taken more precise and implementable conclusions and we derived by surveying more participants and by applying alternative robustness techniques.

Results

To our point of view the interviewers explained the purpose of the questionnaire. We have given a brief description of the available renewable energy sources focusing on the solar, biomass, biogas and wind power generation facilities. As we have tasted the total number of respondents surveyed were 150, with 95 rural and 55 urban participants. Mostly we draw our attention to the role of the respondent in the family and only 'decision makers' available in the household were interviewed. The unequal gender share of the respondent is due to this aspect and consists 32% and 68% for female and male respondents respectively. We depicted in Table 3.1 the age of the respondents.

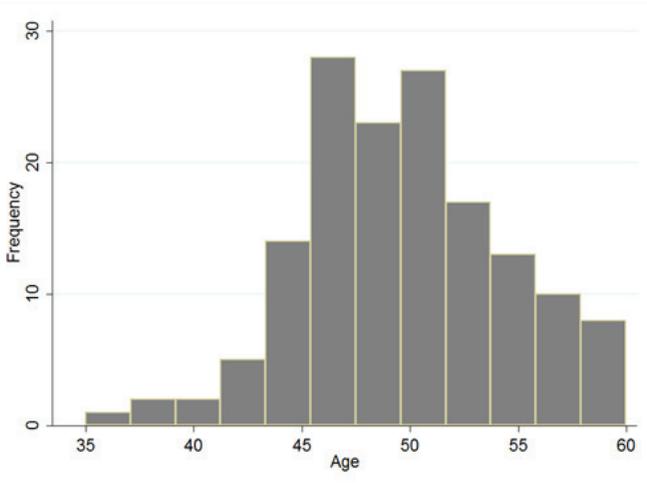


Table 3.1: Frequency histogram of the age of the respondents

We also want to add respondents emphasized the problems regarding the reliability of their residential electricity supply. Table 3.2 depicts the weekly average electricity cut-offs in the respondents' homes. Only two of the respondents indicated that they did not have systematic electricity cut-offs and 10 respondents had more than 30 hours of electricity cut-offs per week. Average daily cut-off hours corresponded to 1.5 hours a day, while maximum daily cut-offs reached 5 hours a day.

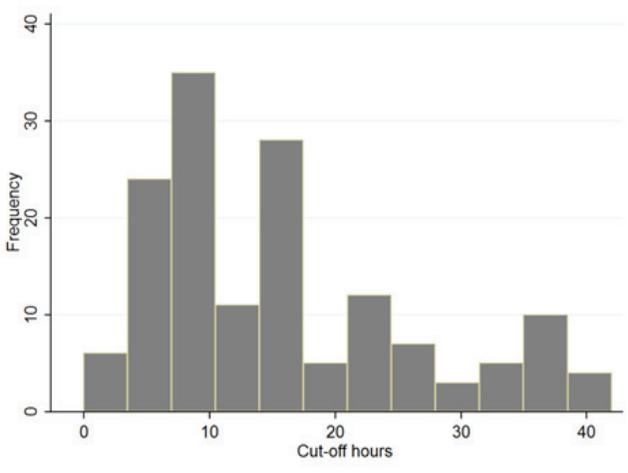


Table 3.2: Frequency histogram of weekly average electricity cut-offs

When we asked for an additional question according to the responses, about 55% of the respondents answered that they were ready to pay a premium for electricity from a renewable source and 75% of the respondents were ready to pay more for electricity from a renewable source if everyone else would be doing so. Some 60% of the respondents answered that they would not agree with the construction of a renewable energy facility close to their house; however, about 90% of the respondents admitted that they did not have any firsthand experience of how a renewable energy facility works.

To our mind global warming, 60% of the respondents thought that they knew at least something about global warming, while people who knew 'a lot' and 'little' amounted to 25% and 15% of respondents respectively. We can admit that people who were sure that global warming is happening consisted of 54% of the sample while 41% of the respondents thought that it is happening and some 5% were not sure whether it was happening or not. As we followed about 52% of the respondents considered themselves 'quite environmentally friendly', 44% claiming to be 'very environmentally friendly', while the figures for 'a little bit' and 'not at all environmentally friendly' were 3% and 1% respectively. Consequently, 52% of the respondents were 'very worried', 45% were 'quite worried' and only 3% were 'not very worried' about the harm caused to the environment due to global warming.

Perceptions about the characteristics of renewable energy

As you have seen in figure 3.1.1 we depicted the respondents' ideas about the characteristics of renewable electricity generation. Our results are given from the highest to the lowest share of responses corresponding to respondents who 'Strongly agree' (on the right-hand side). We presented in the dark right-hand bar the share of the respondents who 'strongly agreed', the next light grey bar represents the share who 'agreed', the central white bar denotes the 'neutral' respondents (neither agreed nor disagreed), the next light grey bar corresponds to respondents who 'disagreed' with a given statement and finally, the dark left-hand bar shows the share of respondents who 'strongly disagreed'.

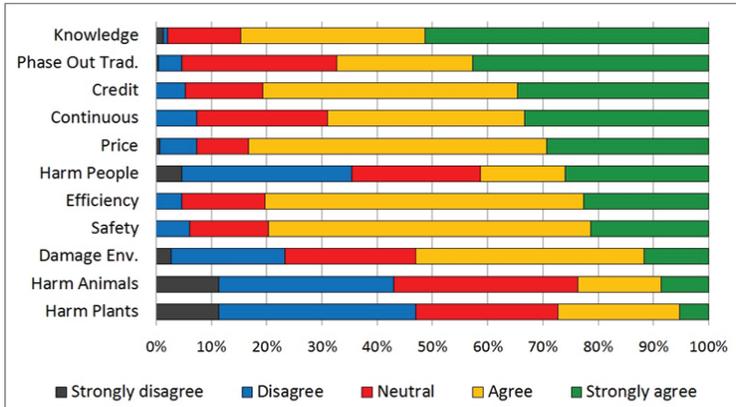


Figure 3.1.1 Khorezm people's perceptions and ideas about the characteristics of renewable energy

As we identified about 50% of the respondents 'strongly agreed' and 45% 'agreed' that knowledge of how the potential for renewable energy can be utilized is crucial for its application. According to our conducting survey some 33% of respondents 'strongly agreed' that renewable energy sources can replace both electricity and natural gas, creating independent off-grid energy generation for their neighborhoods, while 5% 'disagreed' with this point. As our calculation, approximately 31% of the respondents 'strongly agreed' and some 50% 'agreed' that public discussion is required for renewable energy application in a certain neighborhood. Some 25% of the respondents said that renewable energy application is not viable with their own funds and 'strongly agreed' that getting a loan or credit is a prerequisite, while 56% 'agreed' on this point. If we speak about respondents, about 23% of respondents 'strongly agreed' and 51% 'agreed' that renewable energy sources guaranteed a continuous energy supply. Also we identified that about 21% of the respondents 'strongly agreed' and 66% 'agreed' on the point that electricity generated with renewable energy sources is cheaper compared to the other sources. Around 16% of respondents 'strongly agreed' and 41% 'agreed' that renewable energy sources help combat global warming. According to the collecting data for the harm of renewable energy generation facilities to people, 16% 'strongly agreed', 19% 'agreed', 26% took a 'neutral' stance, 35% 'disagreed' and 5% 'strongly disagreed' with this statement. About 13% of the sample 'strongly agreed' and 63% 'agreed' on the point that they needed to increase their energy consumption efficiency to viably use renewable energy. Regarding the comparative safety of renewable energy facilities, 11% 'strongly agreed' and 63% 'agreed' that

they are safer than other types of energy generation facilities. The perception of respondents on potentially harmful effects from renewable energy sources that have not yet been discovered, was less homogenous, resulting in a 9% share for ‘strongly agree’, 51% for ‘agree’, 17% who were ‘neutral’ and 21% for ‘disagree’. The respondents’ ideas about the harm done by renewable energy sources to animals was the following: ‘9% ‘strongly agreed’, 22% ‘agreed’, 24% took a ‘neutral’ position, 35% ‘disagreed’ and 12% ‘strongly disagreed’ with the statement. Some 55% ‘agreed’ that post –use processes of renewable energy sources are hazardous. About 29% were ‘neutral’ and 33% ‘disagreed’ with the statement that renewable energy sources may harm plants.

Views about the importance of various characteristics of electricity generation

And if we speak about the Figure 3.1.2, it is depicted the respondents’ views about the importance of several characteristics of energy generation. Given results are presented from the highest to the lowest share of responses corresponding to ‘Very important’ (on the right-hand side). We clarified in the dark right-hand side bar the share of the respondents who rated the given characteristics ‘very important’, the next grey bar represents the share of ‘quite important’ and the white bar denotes those who thought the statement ‘not very important’. We are corresponding to those respondents in the left-hand grey bar judging the statement to be ‘not important at all’ and the dark left-hand bar denotes the share of respondents who ‘strongly disagreed’ with it. A very high share of respondents found the characteristics they were asked about to be either very important or quite important.

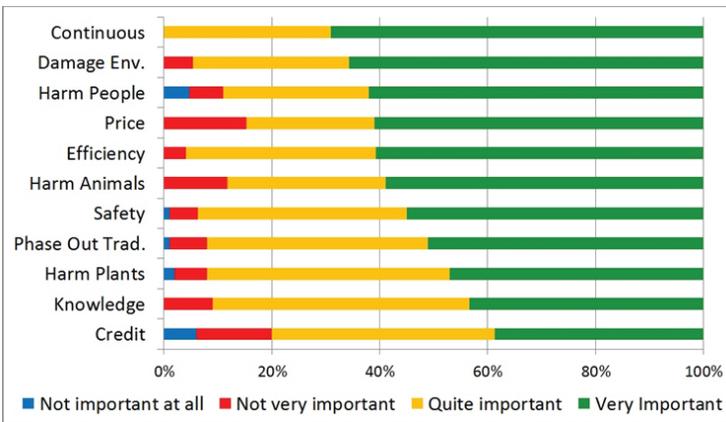


Figure 3.2.1: Khorezm people’s views about the importance of various characteristics of general energy production

We identified, that continuous supply seemed to be the most important characteristic to many respondents, with scores of 80% for 'very important and 19% for 'quite important'. We are sure that they also seem to be concerned about the potential environmental damage that renewable energy sources might cause, with some 73% judging this to be 'very important' and 24% 'quite important'. Analyzing for the threat from renewable electricity generation to people, 72% thought it was 'very important' and 22% thought that it was 'quite important' to have energy sources that would not harm people. Given statement that electricity should be cheap was judged to be 'very important' by 72% and 'quite important' by 21% of the respondents. Regarding efficient use of electricity, 71% of the sample thought it to be 'very important' and 29% 'quite important'. Causing the harm generation to animals by electricity, it was found to be 'very important' by 67% of the people polled and 'quite important' by 26%. The safety of electricity generation was found to be 'very important' by 66% of respondents and about 33% said it was 'quite important'. Having switched to sustainable energy sources in the households was 'very important' for 66% of the respondents. 58% of the people polled thought it 'very important' and 38% 'quite important' that electricity generation should not harm plants. We have given the statement concerning to the knowledge of the availability and sustainability of energy sources and it was analyzed by 57% of the respondents to be 'very important and 43% thought it 'quite important'. According to our given statement, the availability of credit and loans for making the switch to sustainable energy sources; respondents judged this statement to be 'very important' by 47%'quite important' by 42% and 'not very important' by 12% of the respondents.

Homogeneity of responses

Having explored the degree of homogeneity, respondents' answers for Section B and C we subjected to a cluster analysis by means of the Ward method. As our observation the Ward method tables a dendrogram of homogeneity linkage between the results for discovering the level of similarity in the responses. We investigated that dendrogram clusters the responses into a different level sub-groups based on the similarity of the responses. As our scientific research dendrogram carrying-out a detailed analysis of the responses, emphasizing more importance on the properties of the clusters. At present case, it assumed that people's perceptions about renewable energy application might vary depending on the exploitation factors such (Figure 3.3.1) and their livelihoods (Figure 3.3.2). The above analyses give an idea that the respondents' period and livelihood do not largely affect the homogeneity

of their choices. Currently unknown factors that lead to a similarity and dissimilarity of given responses.

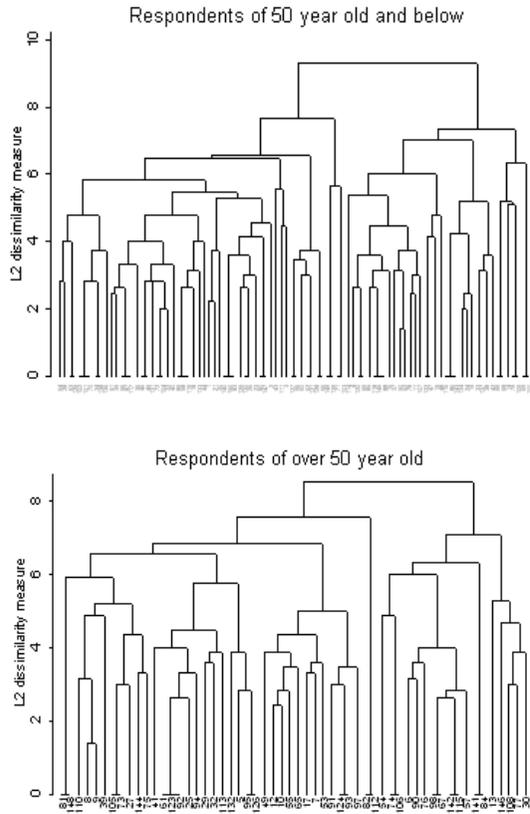
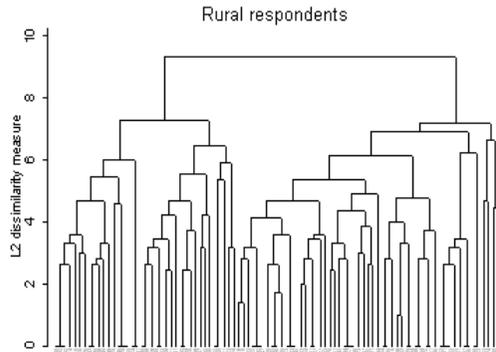


Figure 3.3.1: Homogeneity dendrogram based on the respondents' ages



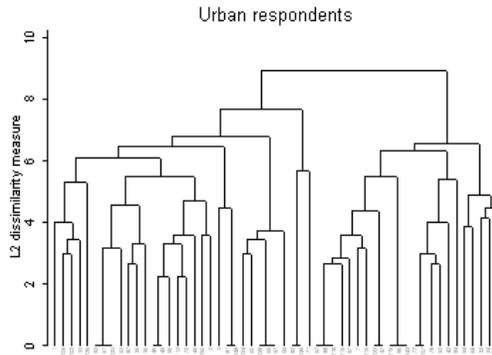


Figure 3.3.2: Homogeneity dendrogram based on respondents' livelihoods

We can be categorized the respondents according to the homogeneity test into two groups with distance eighteen Ward method linkage from the given 22 questions of the Section B and C. 80 respondents includes Group 1 respondents and Group 2 includes 70 respondents. The available age of Group 1 is one year less than that of Group 2, while Group 2 also has 10% more female respondents than Group 1. Group 2 also has slightly more respondents living in a rural area. We clarified that the respondents in Group 1 experienced an average of 11.5 hours of electricity shortages during a week, while those in Group 2 reported an average of 10 hours of weekly electricity cut-offs. The share of respondents willing to live close to a renewable energy facility was 6% higher in Group 2; however, the share of people who have seen an operating renewable energy facility was higher in Group 1. Also, respondents in Group 1 considered themselves to be more concerned and informed about global warming.

As we have observing the respondents' views about the importance of various characteristics of energy generation in general were highly homogenous, while their perceptions and expectations about renewable energy sources varied significantly in some cases. We were also considered that the overall results demonstrated people's high interest and belief in renewable energy, relative deviations from the trends.

When we watched, some 9% of the respondents in Group 1 disagreed with the statement about the role of knowledge in renewable energy penetration, while Group 2 did not contain any such respondents. As we know, some 80% of Group 1 considered renewable energy sources to deliver uninterrupted electricity supply, while in Group 2 72% of people thought so. Some 70% of the respondents in Group 1 were concerned about possible harm

from the renewable energy sources while only 50% percent voiced concerned in Group 2. Some 94% of Group 1 believed that renewable energy sources could phase out traditional energy sources in the households while this belief was shared by 82% of respondents in Group 2. As for the post-use utilization complexity of the renewable energy sources, 20% of the respondents do not agree and 39% agree in Group 1 28% people disagree and 34% agree on the point.

We analyzed that, group 2 seems to be more environmentally concerned and hence cautiously optimistic (or pessimistic), while Group 1 seems to be significantly more optimistic based on their responses.

Discussion

We analyzed that the introduction of renewable energy sources in residential electricity generation in developed countries are one of the most central questions of emissions reduction and combating global warming. As above mentioned, Central Asian countries, with relatively higher technical potential (Dorian, 2006), have more favorable prospects for renewable energy implementation compared to most Western European countries, where the share of renewable energy in total energy generation is already the highest in the world. It should be pointed out that, while Central Asian countries continue to expand their energy sector with vastly available traditional energy sources, global warming and the need for decreasing anthropogenic emissions place the necessary gradual transition to sustainable energy sources in the close future. As we know that with a significantly high share in energy consumption, residential consumers would be a good starting point for this transition. Our aim is to explore the people's perceptions about the characteristics of renewable energy and their importance, with its objectives of determining the possible incentives and disincentives for renewable energy penetration.

As we know, transition to sustainable energy sources is important in the context of global warming and reducing anthropogenic emissions. We have identified ,about 25% of respondents claimed to know a lot about global warming and 60% indicated that they possessed some knowledge of global warming, which very reasonable bearing in mind the immense worldwide attention is given to the subject. Kiliñç et al. (2009) have also observed that at least two-third of the population in most other studies claimed knowing at least something about global warming. In our research study, about 55% of the respondents agreed that they were ready to pay a premium for electricity from a renewable source and 54% of the respondents claimed that they were

confident that global warming is actually happening, which also supports their claim of having some knowledge of the latter.

We have conducted the analysis of the survey and results revealed that in Uzbekistan, where traditional energy prices are quite low, the desire for individual energy independence could serve as the foremost driving force behind residential renewable energy penetration. We know that electricity cut-offs or shortages persist in Uzbekistan due to old distribution infrastructure in remote rural areas, or in places where there is a need for reduced energy consumption due to high distribution losses, poor distribution management and illegal energy tapping. We have informed that since the same problem exists with the centralized gas supply, people seek individually independent energy systems. In our survey the respondents strongly agreed that renewable energy sources could phase out traditional sources and it was very important to them that renewable energy sources could completely meet all of their household energy needs. Renewable energy sources are therefore especially preferred when they can replace both centralized natural gas and electricity supplies in households. However, everybody knows that creating such an off-grid independent energy system requires much higher capital investment, especially in the case of windmills or photovoltaic systems, since they produce only electricity while apart from electricity, households need energy for heating and cooking.

We know, although most of the people have no firsthand experience with any renewable energy sources, they assumed that renewable energy source installation is not affordable for them. Therefore people considered the availability of credit or loans for renewable energy source installation to be very important. Having considered the fact that residential renewable energy installations are credited everywhere, including in Western economies with the highest per capita gross national income, the concern of the Uzbek people seems to be appropriate.

We should be pointed out that, although respondents did not have firsthand experience with renewable energy sources, they held quite prominent views about various renewable energy sources. Again we want to declare that they had both negative and positive perceptions towards certain aspects. According to the questionnaire, most respondents were positive about the characteristics of "knowledge" (or education about the available sources), ability to phrase out traditional sources, and effect/role of public opinion in renewable energy application, and credit (availability of external financing). Negative characteristics were potential threat to plants and animals and need for special post-use disposal (post-use utilization). We admit that, the

respondents were confident that renewable energy in general is safer than other types of energy sources. However, they were concerned about any potential environmental impact of renewable energy sources that has not yet been discovered due to mankind's shorter experience with them, as opposed to traditional energy sources.

As for the harm caused by renewable energy sources to animals and plants, it was very important for the respondents that their energy should be produced in a way that does not harm both categories, but they disagreed with the statement that renewable energy sources harm either of them. As for the harm caused by renewable energy sources to people, respondents neither agreed nor disagreed with the statement.

Having discussed about the importance of price, it was very important for the respondents that their electricity be cheap and they strongly agreed that electricity produced with renewable energy sources is cheaper compared to other sources. Of course it can be argued that renewable energy sources require higher capital investment and hence, the electricity produced with them cannot possibly be cheaper than that produced by traditional sources. We can explain by the fact that according to the popular idea, once installed renewable energy sources require almost no operation and maintenance costs and hence, produce "free energy". This is to some extent true only for solar and wind sources while biogas and biomass resources involve costs.

According to our survey the respondents thought it very important that their electricity consumption would be more efficient and agreed that application of renewable energy source requires higher efficiency for smaller investment costs and improved cost-recovery. We analyzed that energy efficiency, for example the use of fluorescent bulbs, has been promoted in Uzbekistan through the mass media for the last two years and people are aware that there is an enormous energy saving potential in their households.

We are sure that regarding the need for sufficient knowledge on application and utilization of renewable energy sources, people are interested to find out what renewable energy sources are available to them, how are the technical feasibility of these resources and which of these renewable sources can best meet their needs without creating unexpected environmental problems. In our studying paper respondents' views on the need for sufficient knowledge might also be explained by their concern about whether there are enough skilled technicians that can install and maintain these sources properly. We signify it might especially be appropriate for biogas facilities, where higher standards of professionalism and technical safety are required (Amon et al., 1999).

Conclusions

Having concluded we can say that the results of the research revealed that any need for renewable energy sources at the present exists mainly due to the cut-offs or shortages in the traditional energy supply. We know that cut-offs and shortages in the system are caused by old infrastructure, high distribution losses and poor distribution management as well as illegal energy tapping. We must point out that the solution for these problems requires significant investment and time. Therefore, we think that the state could focus more on crediting residential renewable energy applications, which was found to be another important incentive for renewable energy penetration.

Boosting public awareness concerning to the renewable energy sources and their potential was found to be another aspect of creating favorable preconditions for their application. The acquisition of sufficient knowledge was found to be the most important aspect respondents agreed on. Furthermore, capacity building and availability of qualified technical personnel seems to be very important.

Actions towards increasing public awareness of the potential of energy conservation also create favorable conditions for renewable energy penetration. Having increased in public awareness on the safety of renewable resources, when compared to other types of energy generation facilities in term of emissions, would also serve as an incentive.

Bearing in mind the fact that energy transition is inevitable for Uzbekistan during the next two decades and also the need for reforms in energy generation, distribution and consumption, it seems to be a most appropriate time to launch a transition to renewable energy sources in the residential sector, where most of the characteristics of renewable energy promise to serve as an incentive. We think that there should be creating in a line of continuous supply and transition to sustainable energy generation with a promising future, this switch would also help in reducing anthropogenic emissions and combating global warming.

Appendix A - The Questionnaire

The front-page of the questionnaire included some brief information about the study. The confidentiality of the data gathered was also mentioned. The respondents filled out the questionnaire under the supervision of the interviewer.

QUESTIONNAIRE IN ENGLISH

Section A. General Information

- A1. Age: A2. Sex: (M) Male (F) Female
A3. Location of home: (1) Urban (2) Rural
A4. Would you be willing to pay more for electricity from a renewable source (solar, wind, biomass or biogas)
(1) Yes (0) No
A5. Would you be willing to pay more for electricity from a renewable source if everyone else did?
(1) Yes (0) No
A6. Would you be willing to live close to a renewable energy power plant (photovoltaic power plant, wind turbines, biomass or biogas power plant)?
(1) Yes (0) No
A7. How many hours a week do electricity cut-offs occur in your neighborhood?
____ hours/week
A8. Have you ever seen an operating renewable energy facility in your neighborhood?
(1) Yes (0) No

Section B. Perceptions about various characteristics, advantages and disadvantages of renewable energy generation.

Answers: (1) Strongly disagree (2) Disagree (3) Neither agree nor disagree

(4) Agree (5) Strongly agree

- B1. Substantial knowledge on the application of renewable energy (solar, wind, biogas, biomass) is required for its successful application in the household.
B2. Electricity generated with renewable energy sources is cheap compared to other sources.
B3. Credit/loans are necessary for household renewable energy application.
B4. Electricity from renewable sources is more reliable in terms of continuous supply.
B5. Renewable energy facilities harm/disturb the people in their surroundings.
B6. Renewable energy facilities harm/disturb animals in their surroundings.
B7. Renewable energy facilities harm/disturb plants in their surroundings.
B8. Renewable energy facilities are safer compared to other types of power stations.
B9. Since renewable energy sources are a relatively new type of energy, we do not have enough experience to come to a conclusion about the long term impact of renewable energy sources on the environment.
B10. For higher cost effectiveness, renewable energy requires improved energy conservation measures.
B11. Renewable energy sources are capable of phasing out the traditional energy sources in households in the future.

Section C. Perceptions about the importance of various characteristics of power generation in general.

Answers: (1) Not important at all (2) Somewhat important
 (3) Important (4) Very important

C1. How important is it to you that people need to know more about the various aspects of the energy options available to them?

C2. How important is it to you that electricity does not cost too much?

C3. How important is it to you that the state/bank supports your energy supply/transition decision?

C4. How important is it to you that your electricity supply is reliable and continuous?

C5. How important is it to you that the energy facility supplying you with energy would not harm/disturb the people in their surroundings?

C6. How important is it to you that the energy facility supplying you with energy would not harm/disturb the animal in their surroundings?

C7. How important is it to you that the energy facility supplying you with energy would not harm/disturb the plants in their surroundings?

C8. How important is it to you that your energy supply is from a technically safer source? (hydro instead of nuclear)

C9. How important is it to you that all possible environmental threats of your energy supply be clear in advance without any uncertainty?

C10. How important is it to you to apply energy saving measures in your household?

C11. How important is it to you to switch to sustainable energy sources?

Section D. Perceptions about Global Warming

D1. How worried are you about what global warming might do to the environment?

D2. How much do you think you know about global warming?

D3. How 'environmentally friendly' do you think you are? (How much do you think you 'take care of' the environment by the things you do?)

D4. Do you think that global warming is really happening now?

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