E.Moula, Md Munjur; Maula, Johanna; Hamdy, Mohamed; Fang, Tingting; Jung, Nusrat; Lahdelma, Risto

Researching social acceptability of renewable energy technologies in Finland

Published in:
International Journal of Sustainable Built Environment

DOI:
10.1016/j.ijsbe.2013.10.001

Published: 01/01/2013

Document Version
Publisher's PDF, also known as Version of record

International Journal of Sustainable Built Environment (2013) **2**, 89–98

Gulf Organisation for Research and Development

International Journal of Sustainable Built Environment

ScienceDirect
www.sciencedirect.com

Researching social acceptability of renewable energy technologies in Finland

Md.Munjur E. Moula [a,*], Johanna Maula [b], Mohamed Hamdy [a], Tingting Fang [a], Nusrat Jung [a], Risto Lahdelma [a]

[a] *Department of Energy Technology, Aalto University, Finland*
[b] *UNESCO Commission, Finland*

Received 11 July 2013; accepted 1 October 2013

Abstract

While there are ambitious targets to increase the share of renewable energy technology implementations in the different EU-states, it is increasingly recognized that social acceptance may form a factor constraining the expansion of their implementation and use. In order to investigate the Finnish social acceptance towards renewable energy technology implementations, a multiple choice questionnaire was designed with three groups of questions: background information, awareness of renewable energy technologies (RETs), and willingness to invest in RETs. The answers showed that the long-term economic feasibility of using RETs locally in homes was not obvious to 33% of the fifty interviewees. In general, 62% of the interviewees were willing to pay extra cost to obtain green energy. More than half (52.4%) of the interviewees think that public sector should take the first step towards renewable energy production. Likewise, in the respondents' view, the public sector should take the initiative for implementing RETs by providing business models and incentives to encourage citizens to implement RETs in their houses.

Keywords: Social acceptance; Renewable energy technologies; Economic feasibility

1. Introduction

From 1992 onwards, renewable energy has become a top priority for the governments in all the European countries due to the increasing global concerns about climate change and scarcity of fossil fuels (Smith, 2013; Krupp, 2007). Concerns about energy security and climate change are enforcing significant changes in how energy and electricity specifically, is generated, transmitted and consumed. Since then, a series of formal and informal policies, directives, legislations, etc. have been developed to encourage use of renewable energy in order to reduce emissions of greenhouse gases, to decrease the energy consumption throughout the European Union (Tol, 2012; European Parliament and Council, 2010), and to increase the energy efficiency. This means that the European countries are already aware of the consequences of using fossil energy sources. For instance, in the UK the 2003 'Energy White Paper' contains a commitment to reduce carbon emissions by 60%

* Corresponding author. Tel.: +358 (0) 505993619.
E-mail address: munjur.moula@aalto.fi (M.M.E.Moula).

Peer-review under responsibility of The Gulf Organisation for Research and Development.

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.ijsbe.2013.10.001

by 2050, in comparison to 1990 levels, and aims for 20% of total electricity generation to be generated by renewable resources by 2020 (Department of Trade and Industry, 2003; OECD, 2002). Such targets require that low carbon technologies for generating energy, (including renewable energy technologies that generate electricity from wind, sun, biomass and sea thermal), become commonplace, rather than 'alternative', as is currently often the case.

Nevertheless, many studies show that in dire contrast to the political discourse, the energy consumption in majority of the European countries is mainly based on fossil fuel use which is increasing steadily (Smith and Urpelainen, 2013; Owusu, 2008; Monstadt, 2007; Dalgaard et al., 2000). Hence, this article argues that the European countries are only slowly progressing towards the implementation of various approaches to save energy by using renewable energy technology. Thus, a mission to create public awareness is not only important but even necessary in this regard.

The targets of the European Council are strict and stipulate increasing the use of renewable energy by 20% and reducing gas emissions at least 30% below the level of 1990 by 2020 (Deane et al., 2012). According to the European Council, Finland should increase the share of renewable energy to 38% of end-use consumption by 2020 (Valkila and Saari, 2013; IEA, 2012). In addition to this, Finland aspires to reduce greenhouse gas emissions by 80% by 2050 (CORDIS, 2012). In order to achieve these targets, Finland has already been taken many steps on renewable energy in general (Kareinen, 2013; Saundry, 2012; Ervola, 2010). Hence, in near future we may have strong country specific energy targets and stringent regulations which will compel the society and will bring dramatic changes in everyday use of geothermal energy.

The renewable energy technologies for energy generation are diverse, encompassing solar photovoltaic panels; wind turbines of different scale, designs and on offshore location; energy from waste plants; biomass fuelled plant at scales from small combined heat and power plant to large scale power stations; hydro schemes and ocean technologies (e.g. tidal and wave devices). Since each technology captures different natural resources in different ways, the environmental, economic and social impacts of each technology vary (Devine-Wright, 2008). Thus, the need of assessing social acceptability of renewable energy technology is fundamental for understanding a community's social perspectives in terms of using renewable energy technology and climate change issues (Batel et al., 2013).

The aim of this study is to analyse the level of awareness of energy efficiency in terms of renewable energy sources, technologies and climate change in the Finnish Society. Additionally, this study also addressed how the thinking and acceptance rate of renewable energy technologies vary especially for the respondents' own use in their households or near environment. In this study we placed emphasis on participant's awareness and opinion about the cost of renewable energy applications, willingness to pay for clean energy, and renewable energy acceptability.

The study results provide a treasure trove of knowledge in many ways. For example, (1) they provide us an important avenue to know how and what kind of steps have already been taken to create awareness about the climate change and renewable sources of energy so far in Finland, and (2) they help us to analyse the public attitudes towards renewable energy applicability in detail, and to acquire knowledge about what different kinds of renewable sources and technologies they are aware of.

2. Theoretical overview of the topic

Social acceptance is recognized as an important issue shaping the widespread implementation of renewable energy technologies and the achievement of energy policy targets. Furthermore, it is commonly assumed that 'social attitudes' need to change to make more radical scenarios about the implementation of renewable energy technologies feasible. Devine-Wright (2008), for example, critically summarizes existing social research on the acceptance of renewable energy technologies, and provides a novel classification of personal, psychological and contextual factors that combine to shape public acceptance. He argues the need for more systematic research on public acceptance driven by coherent theoretical frameworks drawn from psychology and other social science disciplines, explicit definitions of concepts, the use of innovative methodological tools and a greater emphasis upon symbolic and affective aspects (Assefa and Frostell, 2007; Dowd et al., 2011).

Many studies show that there are several indicators that can be used to measure social acceptance in a particular context (Hall et al., 2013; Venkatesh and Bala, 2008; Devine-Wright, 2008; Venkatesh et al., 2003; Bagozzi et al., 1992). Among these are the participants, socio-economic background, age group, political beliefs, attitudes and behaviour. In addition, the perceived usefulness, intention to use, facilitating conditions, cost, trust, place, participant's position in relation to the renewable energy all play a vital role. These indicators have been discussed below. It is important to mention here that this study has used these variables to test how aware people in Finland are about the climate change and renewable energy source/technology issues. Other social acceptance measurable variables like, time, anxiety, perceived adaptability, perceived enjoyment, perceived sociability, social influence, culture, perceive case of use, system's reliability are left for a future study. Additionally and more importantly, despite the studies on public attitudes towards renewable energy technologies, genuine understanding of the dynamics of public acceptance remains elusive. According to Devine-Wright (2008) one reason for this is the fact that the determinants of public acceptance are rarely considered as a whole, taking account of the multiple personal, psychological and contextual factors involved.

Assefa and Frostell (2007) discuss an approach for assessing indicators for the social sustainability of technical systems developed within a Swedish technology assessment tool. The research took the form of a case study on energy technologies conducted in the municipality of Kil in west central Sweden. Three indicators—knowledge, perception, and fear associated with four chains of energy technologies—were assessed using a questionnaire. The questionnaire results indicated that respondents had such a low level of information and knowledge about new energy technologies that they were unable to discriminately rank them. This was found to hamper participation in discussions and decision making about technologies for which public funds would be spent. The importance of assessing social indicators by engaging members of society was discussed, and an assessment approach was developed. Assefa and Frostell (2007) also emphasize the need to present results together with ecological and economic indicators.

A variety of potential explanations can be identified in the literature for varying levels of public acceptance of different renewable energy technologies (McGowan and Sauter, 2005; Wolsink, 2000; Guagnano et al., 1995). According to Devine-Wright (2008) a range of potential explanations can be identified at three levels of analysis. These include personal (age, gender, class, income), social-psychological (knowledge and direct experience, perceived impacts, environmental and political beliefs, place attachment) and contextual.

For instance, in the UK, some regional surveys have found both higher levels of awareness and opposition towards renewable energy among older respondents (Somerset County Council, 2004). In contrast, a national study there found levels of awareness and opposition to be lower in younger and older cohorts (ages 16–24 and 65+) in comparison with middle-aged respondents (ages 35–44 and 55–64). Levels of support for nuclear energy seem to correlate with age, with older people being more supportive than young people (Urban and Ščasný, 2012; Populus, 2005) less likely to install them, in comparison to younger respondents (London Renewables, 2003).

In terms of social class, there seems to be a positive correlation between income and class, and levels of support for both renewable energy and nuclear power (ICM Research for BBC Newsnight, 2005). Also in Finland, men and high income earners have in recent studies been more supportive of nuclear power (Syri, 2012; SCI, 2011). Although some studies assume that negative perceptions towards renewable energy are caused by the lack of knowledge and public understanding, there is limited evidence that more informed individuals are accepting renewable energy technologies (DTI, Scottish Executive et al., 2003).

Empirical findings from the UK suggest that political beliefs are correlated with social acceptance of different low carbon technologies (Devine-Wright, 2008). Populus (2005) indicated that 37% of individuals indicating support for the Conservative party were supportive of new nuclear power stations (in comparison to only 12% of labour supporters and 14% liberal democrat) while being less significantly supportive of new renewable energy developments (62% as against 86% and 84% respectively). Likewise, in Finland, voters of the green party and the left league have consistently opposed to nuclear energy (SCI, 2011) than those who vote for other parties.

Devine-Wright (2011) has noted that high levels of place attachment (Smith et al., 2010) – that is, positive emotional bonds between people and valued environments – can serve to motivate both public support and opposition to proposed technology developments, depending upon whether the technological development was evaluated as posing a threat or an opportunity to the individual and/or locality/community more generally. A Norwegian study indicated how support for a large-scale hydropower development was positively explained by the strength of attachment to affected areas, and that this factor was more significant than socio-demographic characteristics such as age or gender in explaining public acceptance (Vorkinn and Riese, 2001).

The relevance of the concept of 'place' has been recognized in the literature on wind energy conflicts. Simmons and Walker (2003) argued that 'a focus upon a sense of place enables us to develop a richer understanding of how technological activities and their associated risks can encroach upon people's feelings about where they live and compromise associated place values' (Haggett and Smith, 2004).

Several recent studies have illustrated how perceptions of fairness and levels of trust are implicated in the public acceptance of renewable energy developments. For example, Zoellner et al. (2005) used a questionnaire to study the attitudes of 291 Germans towards wind energy development decision-making, drawing upon an extensive literature within the field of political science literature on theories of equity and justice. Their results indicate that procedural justice- the subjectively perceived fairness of a distribution process, was significant in explaining people's negative attitudes towards wind energy, particularly concerning zoning, planning and licensing decisions. Similar results were found by Upham and Shackley (2006). All these studies suggest that 'how' renewable energy technologies are sited, in addition to 'what' technologies are sited, are important factors shaping public acceptance and responses (Devine-Wright, 2008). It has been argued that the key to gaining local community support is to use compensation of a financial or other form to redress imbalances in the distribution of costs and benefits (MORI Scotland for BBC Scotland, 2005).

Devine-Wright (2008) has noted a general assumption in the literature on wind energy that those living most proximate to developments are likely to have the most negative attitudes. In the same vein, Hubner and Meijnders (2004) found that those living close to biomass power plants had more negative attitudes towards purchasing biomass electricity. However, the empirical literature is inconclusive and several studies suggest the opposite (Warren et al., 2005).

The search for an effect of proximity on public acceptance links to one of the most common explanations for

public opposition – NIMBYism ('Not in My Backyard'). In a critical review of the literature on public attitudes towards wind energy, David-Bidwell (2013), for example, concluded that there was limited empirical support for the NIMBY hypothesis, given that many studies indicate higher levels of support for development in their locality in comparison to regionally or nationally (Papermans and Loots, 2013; Warren et al., 2005). On the other hand, some academics have been critical of the ways in which the NIMBY concept has been rhetorically applied, both by researchers and in practice (Owens and Driffil, 2006; Wolsink, 2006).

Again, according to Devine-Wright (2008) those studies that have attempted to identify levels of public understanding and awareness of different forms of energy technology and their impacts have produced a rather mixed set of findings, in part due to the varied nature of questions asked. Furthermore, although individuals are aware of different energy sources, results suggest that more in-depth understanding of these sources vary markedly, and that terms used by experts to refer to different kinds of fuels or resources are not always familiar to members of the public. The term 'renewable energy' itself seems to be ambivalent (Curry and Reiner, 2005; MORI Social Research Institute for Regen South West, 2004).

3. Methodology

To measure the public understanding level of social acceptability of renewable energy technologies (RETs) and climate change issues in Finland, we decided to use survey questionnaire type of methodology for this study. This methodology helped us to include people from different ethnical backgrounds to enrich the sample space in order to make the research results more substantial, reliable and objective (Moula, 2012a).

To ensure a valid survey, we organized some group meetings in early September 2012. In the group meetings, we discussed the questions that should appear in the questionnaire, we took into consideration the people's understanding and eliminated our professional bias to the questions, because we will have no idea what educational background they are from before they provide their background information during interviews. On the other hand, since most of us are working on the research which is related to energy technology, this could result in posing too technical or professional questions. However, we should avoid applying unconsciously the same standard of understanding we use at work to the interview. As too technical and professional questions will confuse interviewees and make them feel too frustrated to answer; this may cause very meaningless communication and results. For example, use of the term 'global warming' instead of asking specific question regarding biomass generation in Finland which they may or might not be aware of. For this study, our survey questions consisted of 14 multiple choice questions, which covered various issues that can be seen from the following section, for example, an open ended questionnaire schedule for the survey participants has been prepared to include two parts.

Part A of the survey schedule elicits information relating to participants' background variables like participants' age, job situation, etc. Part B was concerned with people awareness of RETs and the people willingness to invest in RETs. This included related information such as: perceptions, attitudes, usefulness, intention to use, facilitating conditions, culture, cost, participant's position about the renewable energy technology, its applicability and climate change, etc.

Additionally, we wanted to see the percentage of the selections for each question; most questions were set to be closed but not open-ended. The goal was to isolate and define categories precisely before research process. The respondents recruited for the investigation come from randomly different age groups. However, participants for the study were divided into three groups (15–25; 26–40 and 41–60). A total number of 50 people responded to the survey, 20 from (15 to 25), 10 people from (26 to 40) and 20 people from (41 to 60). These age groups were chosen specifically to understand the role of age condition on social acceptability of renewable energy technologies. Majority of the participants were employed (67.7%), whereas the second largest group of participants were students (28.6%), and few of participants were unemployed (4.7%). The survey activities were carried out from September 2012 to December 2012. We conducted this survey in the capital region (Helsinki, Espoo and Vantaa) of Finland. The selected areas are more multicultural than other cities in Finland. Besides, the selection of these three cities forms also a more cost- and time effective way to conduct this survey. The survey represents 19% of respondents from Vantaa city, 46% from Espoo city while the remaining 35% of them from the city of Helsinki.

We collected the survey results from all the group members by filling our questionnaire data in tables. After that, we started conducting the quantitative analysis by summarizing all the data and calculating the percentage of the choices for each question. Besides, in this study content analysis was also used to determine the presence of certain concepts, topics and, 'identifying unique themes within texts or sets of texts' (Katri, 2010; Berg, 2009). The content analysis provided us an avenue to understand the social reality in terms of public acceptance of renewable energy technologies in a subjective but scientific manner (Moula, 2012b). In the following paragraphs we have discussed about how we arranged collected survey data for this study.

In this research, 3 questions (in part-A) were addressed to know the background information of all the interviewees including age group, occupations and locations of the interviewees as mentioned earlier. The ratio of the interviewees for the above mentioned information is shown in Figs. 1–3 respectively. In part-B, 11 questions were asked to see how acceptable the renewable energy technologies (RETs) in Finland are. The 11 questions are classified into two groups from 1 to 6 (Table 1) and from 7 to 11 (Table 2)

to measure the interviewees' awareness of RETs and the interviewees' willingness to invest in RETs, respectively. Additionally, we can also draw some qualitative conclusions based on the quantitative analysis, as the percentage will indicate some problems and truth for the survey. In this study, the size of the interviewee sample was small but diverse. Such a sample cannot represent the voices and attitudes of all the Finnish society about social acceptability of renewable energy technologies. However, it can be considered as a good starting point for extended future surveys.

4. General findings

4.1. Background information of the interviewees

As shown in Fig. 1, we chose the participants from different age groups in order to have an idea of the impact of age on the results. In contrast to many earlier studies, in this survey we found that the level of support for renewable energy technology towards better environment seems to correlate with age, with older people being more supportive than others. Fig. 2 shows that we made more interviews in Espoo and in Helsinki than in Vantaa. As there is a higher share of technology students in Espoo than in the two other cities, this might explain some of the differences in experiences and acceptance of renewable energy technology. Fig. 3 shows that most of the interviewees come from the employed group. This reflects the current socio-economic situation in Finland. More generally, in respondents' current situation in terms of employed, unemployed and students, there seems to be a positive correlation between income, and levels of support for different renewable energy technologies.

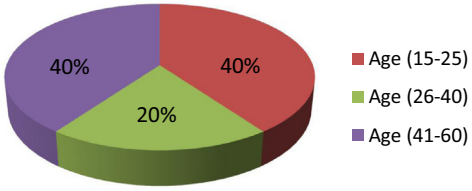


Fig. 1. Part A: background information of the interviewees. Age group of the interviewees.

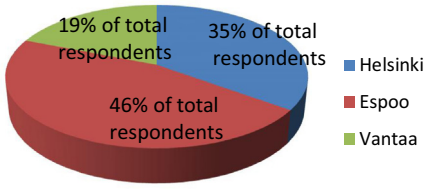


Fig. 2. Part A: background information of the interviewees. Location of the interviewees.

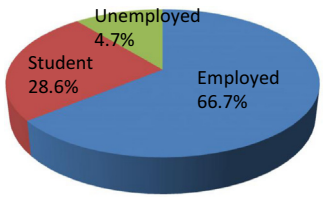


Fig. 3. Part A: background information of the interviewees. Profession of the interviewees.

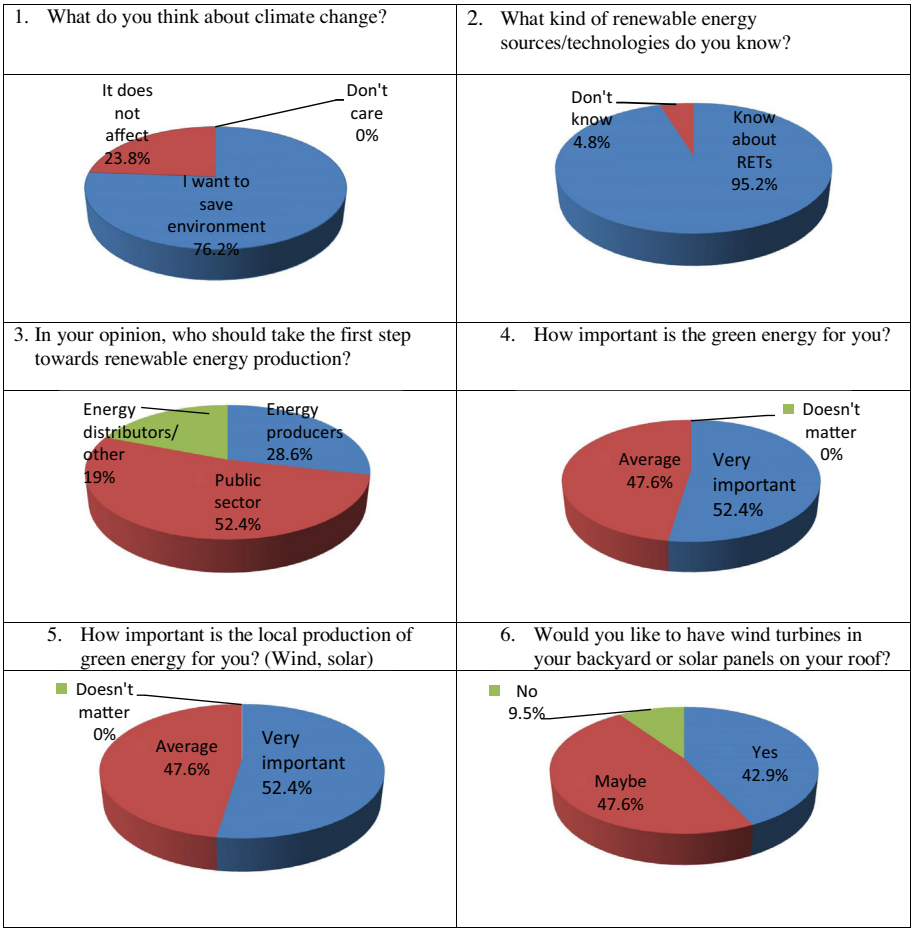
4.2. Interviewee's awareness of renewable energy technologies

The first question deals with the very general question about the awareness regarding climate change as a global issue. This question was set deliberately to help participants by introducing the concept and need of using renewable energy technology towards better environment. Approximately 76.2% as majority of respondents wants to save environmental resources, whereas 23.8% of respondents believe that it does not affect them personally. However, no negative answers such as 'I do not care' were received. This suggests that people are generally aware of climate change and do want to prevent it. It should be noted that the other 23% of respondent are the youngest generation who basically believes that they alone cannot contribute to help prevent global warming. Thus they are leaving the scope for researchers and other responsible parties to emphasize this issue and disseminate related information at larger scale for awareness purposes.

The second question tests the respondents' knowledge about the different kinds of renewable sources and technologies that they are aware of. As it can be noted the question itself provided them with five different options, namely hydropower, wind power, solar biomass, biofuel and geothermal energy. Approximately 95.2% of respondent were aware of at least one or two options of renewable energy technologies. However 4.8% of respondent were aware of other technologies as well. This question was more of an informative type, which educated at least 50 people about the existing technologies while testing their knowledge. Notably, it was not very properly formulated to be able to extract awareness of particular renewable technology among participants.

The third question was more focused on and tested the respondent answers based on who should take the first step towards renewable energy production. 52.4% of respondents suggested that it should be the responsibility of the public sector. Whereas there were varied opinions as 28.6% of respondents suggest it as responsibility of the energy producer, at the same time 19% suggesting energy distributors. So perhaps this should be initiated by the public sector, but the energy producers and suppliers should be involved in the chain management of green energy production. This is a difficult question to answer, as this is more of a political decision involving high level lobbing of energy producers, investors and energy suppliers. As for this

Table 1
Part B: Questions. The results of survey questions 1–6 (interviewee's awareness of RETs).



question, the public opinion is not enough to justify the role of involved parties in the energy generation chain. The change has to begin from the top tier.

The question four is more of repetitive type; it just uses another highly marketed key word 'green energy'. It is possible that respondents relate more to the 'green energy' concept than 'renewable energy technology' concept or vice versa. Here, we can notice the difference of opinion where 52.4% of respondents suggest '*very important*' and 47.6% as '*average*'. When we compare these data with the first question (e.g. what do you think about climate change), 76% of respondents answered as '*I want to save environment*' whereas only 23% of respondents suggested '*it does not affect me personal*'. The difference between these two questions is basically the term as '*green energy or renewable energy sources*' and also in the *choices* provided. The choices for answer in question one are kind of straight forward; however the choices provided for answering question four are mild with options like *very important, average* etc. Here we see the effect and need of considering the language formulation and providing the right choices to answer the question itself, which is a very important factor while conducting surveys.

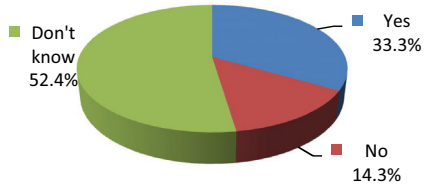
The fifth question is more focused on the importance of local energy production. 52.4% of respondents considered this as very important, whereas for 47.6% of the respondents it had average importance. This conflict may be due to the awareness or non-awareness of widely used district heating systems in Finland. The respondents who are aware of district heating benefits have surely responded positively, as it is the cheapest and most energy efficient way of producing heat and hot water. However it is difficult to understand why 47% of respondents have noted it as average, this may be due to unawareness or other factors. According to study results, respondents do not care whether the applications for green energy are on local, regional or national level since the results are exactly same as in the four questions where only the green energy was asked without considering the implementation level.

4.3. Interviewee's willingness to invest in renewable energy technologies

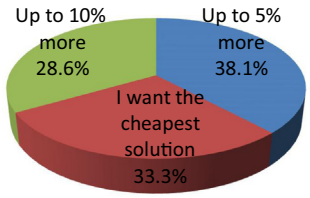
The sixth question is trickier. It is often noted in the research and implementation projects that people/societies resist having micro wind turbines in their backyard or solar

Table 2
Part B: Questions. The results of survey questions 7–11 (interviewee's willingness to invest in RETs).

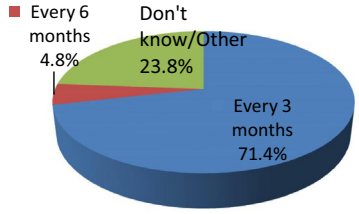
7. Do you think using existing renewable energy technologies is more or less expensive?



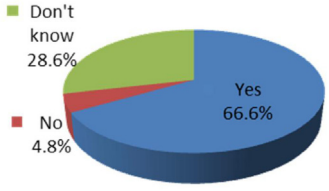
8. Are you willing to pay some extra cost to obtain green energy for you?



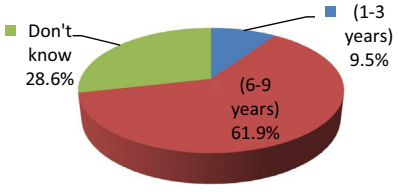
9. How do you pay your energy bills? (Payment model)



10. Do you think that using renewable energy technology can reduce the energy costs in the future?



11. If you invest in renewable energy for your use then what should be the payback period?



panels on their roof as they disturb the view and the possibilities of noise are high. Thus we framed this question to know what people think about having these as part of their backyard. The majority of answers are interestingly divided among 'yes by 42.9% of respondents' and 'May be by 47.6% of respondents'. However, 9.5% respondents have refused to have solar panels on their roofs and turbines as part of their backyard. Thus we can see that people are really not sure about accepting them as part of everyday scenery. The hesitance may be as they have not seen it as a common practice in their own neighbourhoods so far. This picture indicates how perceptions of fairness and levels of trust are implicated in the social acceptance of renewable energy developments. To increase the surety among people, governmental authorities should highlight and introduce/build at least one passive house in each region. Such practice will advertise and help develop confidence among people to accept renewable technologies easily.

It was expected that some people are not sure of having renewable technologies in their backyard, which may be due to cost factor. Therefore, the seventh question was deliberately placed after the fourth asking if respondents think that the existing renewable energy technologies are more expensive. The results were surprising, as 57.1% of respondents do not know the cost factor involved with renewables. However, 28.6% respondents did suggest that they believe it is expensive, whereas 14.3% suggested otherwise. Based on these results the government or the public sector should provide clearer business model information to the citizens. These business models should inform and guide citizens about the life cycle benefits, long term saving and high initial costs involved with renewable energy technologies.

The answers of question eight are mixed-set opinions, around 38% of respondents are prepared to pay up to 5% more of extra cost for using green energy, 33% want the cheapest possible solution and around 29% are willing to pay up to 10% of extra costs. In these answers we clearly see the noticeable change of opinions. The respondents do care about environment, they are informed and want to save environment. However it is possible that they do not really have the resources to invest in renewable energy. This is a very important aspect of renewables, generally everyone really wants to avail the cheapest option. The government must work towards the possibilities to suggest such business models which are equal in cost with today's expenditure on energy. If we can overcome the cost barrier, it is likely that the acceptance ratio of green energy will increase among citizens.

The ninth question focused on the payment model of monthly energy/electricity/water bills of the respondents. Approximately 71.4% of the respondents are aware of their payment models and pay their bill every three months, whereas around 23.8% do not know. The 23% of respondents may include the younger generation which majorly lives in student dormitories or shared apartments. In this case the rent of the rooms usually includes the water and electricity costs because of which the respondents may be uniformed about their payment model. Here, it can be noted that today energy efficiency has become a part of younger generation's education; however the lifestyle of the youth does not really support the proper understating of energy consumption patterns, which really affects negatively when they plan to buy new apartments and houses later on.

The tenth question was whether the use of renewable energy technology can reduce the energy costs in the future. About 66.6% of respondents believe that it is possible to reduce costs by using renewable energy technologies, and around 28.6% respondents are not sure if it can or cannot. Around 4.8% respondents acknowledge that they do not know about it. These answers provide a positive feedback towards the use of renewable technologies.

The last question concluded the questionnaire asking the respondents' opinion on the above questions that if they really will invest in renewables then what the expected pay back period should be. It was unexpected to know that 61.9% of people are prepared to make a long term investment of up to 6–9 years, which is very positive and demonstrate the commitment of respondents towards accepting renewables. Additionally, 28.6% of respondents either did not understand what the payback period means. About 9.5% of the respondents as minority suggested a payback period of 1–3 years, which is not very practical when considering the high initial costs involved with installation and periodic service process.

5. Conclusions

Besides the quantitative results, it became obvious while conducting the interview that the individual situations vary. For instance, people from the lower age groups were more conscious of the concept of renewable energy technology, and more concerned about the environmental problem and the development of renewable energy technology in Finland, as they were answering the questionnaires, they asked some questions regarding the choices of the questions, importantly, the older and employed people take this issue rather seriously. For the young people, particularly teenagers (aged between 15 and 19 years), 23% of them do not even know how often they pay their electricity bills, because their parents are in charge of such issue in the family. They do not learn about the renewable energy in Finland to some extent. It is related to the social experience, common sense and the educational level as well as the home environment; they will accumulate more knowledge and common-sense experience as they grow older, better yet, the government should take measures to broaden teenagers' vision on environmental protection and renewable energy technology.

Based on our study, we would argue that involvement of the teenagers in the house energy issues would also increase their awareness of the potential of RETs in energy saving. Additionally, the study results also show that levels of public understanding and awareness of different forms of energy technology and their impacts have produced a rather mixed set of findings, in part due to the varied nature of questions asked, and to respondents different background information, e.g. socio-economic, social-demographic characteristics, etc.

The target of this study was to learn about the extent to which the renewable energy technology is understood and acceptable in Finland. We can have some qualitative conclusion based on the quantitative analysis. Results suggest that more in-depth understanding of renewable energy technologies varies markedly. About 53% respondents have realized that it is important to develop the renewable energy technology at the moment, and about 43% of the interviewees would like to take practical steps for the renewable energy developments, for example, installing wind turbines in their backyard or solar panels on their roof. However, in this survey we have seen respondents are not always familiar with the real meaning of payback period.

The results also show that all respondents are willing to pay extra cost to obtain green energy; 33% want the cheapest possible solution in this regard. However, they showed a mixed-set of acceptance regarding the local production of the renewables. Knowledge, perception, fear and political beliefs are correlated with social acceptance in this regard. For example, a large number of respondents think that public sector should take the first step towards renewable energy production. The government will play a very important role in promoting green energy and developing the concept to practical solutions in the near future. More specifically, the study results indicate that Finnish people do expect more from the public sector about renewable energy production. The relationship between expectations of the

Finnish society and government is important to take some actions to build some trust on renewable energy technologies and their applications in real field. Thus, this step enables us to understand how knowledge, perception and levels of trust are structured in the public acceptance responses about renewable energy technology issues.

In summary, the general public does not have the same perspective on renewable energy technology issues as energy technologist do. For the development of renewable energy technology, future work is needed to shed light on people's in-depth knowledge about the importance of using existing renewable energy technology and we need to consider all variables related to social acceptability of renewable energy. The general public should be allowed to learn more about the advantage of using renewable energy technology.

References

Assefa, G., Frostell, B., 2007. Social sustainability and social acceptance in technology assessment: a case study on energy technologies. Technol. Soc. 29 (1), 63–78.

Bagozzi, R.P. et al., 1992. Development and test of a theory of technological learning and usage. Hum. Relat. 45 (7), 660–668.

Batel, S., Devine-Wright, P., Tangeland, T., 2013. Social acceptance of low carbon energy and associated infrastructures: a critical discussion 58, 1–5.

Bidwell, D., 2013. The role of values in public beliefs and attitudes towards commercial wind energy. Energy Policy 58, 189–199.

Berg, Bruce L., 2009. Qualitative research methods. Allyn & Bacon, USA.

CORDIS, 2012. Low Carbon Finland 2050 – VTT clean energy technology strategies for society'. Available at: http://www.vtt.fi/inf/pdf/visions/2012/, as of February 26, 2013.

Curry, T.E., Reiner, D.M., 2005. A survey of public attitudes towards energy and environment in great britain. Available at: www.lfee.mit.edu/metadot/index.pl, as viewed on 12 December, 2013.

Dalgaard, T., Halber, N., Porter, John.R., 2000. A model for fossil energy use in Danish agriculture used to compare organic and conventional farming. Agric. Ecosyst. Environ. 87, 52–53.

Deane, J.P. et al., 2012. Modelling the economic impacts of 500 of wave power in Ireland. Energy Policy 45, 614–615.

Department of Trade and Industry, 2003. Energy white paper: our energy future – creating a low carbon economy. Department of Trade and Industry, London.

Devine-Wright, P., 2011. Place attachment and public acceptance of renewable energy: a tidal energy case study. J. Environ. Psychol. 31, 336–343.

Devine-Wright, P., 2008. Reconsidering public acceptance of renewable energy technologies: a critical review. In: Delivering a Low Carbon Electricity System: Technologies, Economics and Policy. In: Jamasb, T., Grubb, M., Pollitt, M. (Eds.), . Department of Applied Economics Occasional Papers (No. 68) July 2008. Cambridge University Press.

Hall, N., Ashworth, P., Devin-Wright, P., 2013. Societal acceptance of wind farms: analysis of four common themes across Australian case studies. Energy Policy 58, 200–208.

Dowd, A.-M. et al., 2011. Geothermal technology in Australia: investigating social acceptance. Energy Policy 39, 6301–6307.

Ervola, Asta, 2010. Climate change and agriculture: theory and application of mitigations policies. Department of Economics and Management, University of Helsinki, Finland.

European Parliament and Council, 2010. Directive 2010/31/EU of the European parliament and of the council of 19 May 2010 on the energy performance of buildings. Off. J. Eur. Union L153, 13–35.

Guagnano, G. et al., 1995. Influences upon attitude-behavior relationships: a natural experiment with curbside recycling. Environ. Behav. 27, 699–718.

Haggett, C., Smith, J.L., 2004. Tilting at windmills? Using discourse analysis to understand the attitude–behaviour gap in renewable energy conflicts. Paper Presented at the British Sociological Association Annual Conference, March 22–24, University of York.

Hubner, G., Meijnders, A., 2004. Public acceptance of electricity from biomass: impact of direct experience on attitudes. Paper Presented at the International Association for People-Environment Studies Bi-Annual Conference, Vienna, July. ICM Research for BBC Newsnight (2005) Nuclear Power Survey. Available at: www.icmresearch.co.uk/reviews/2005/, as viewed on 22 November, 2012.

IEA, 2012. CO_2 emissions from fuel combustion. Available at: http://www.iea.org/co2, as of January 16, 2013.

Katri, J., 2010. Teachers Intercultural Learning and Competence. University of Oulu, Finland.

Kareinen, Timo, 2013. Finnish greenhouse gas emissions fall below Kyoto level. Helsinki-Sanomat, 3 May 2013, Finland. Available at: www.hs.fi/english/article/Finnish.

Krupp, Corinee, 2007. Electrifying rural areas: extending electricity infrastructure and services in developing countries. Pacific Basin Research of Centre, Soka University America, California.

London Renewables, 2003. Attitudes to renewable energy in London: public and stakeholder opinion and the scope for progress, London.

McGowan, F., Sauter, R., 2005. Public opinion on energy research: a desk study for the research councils. SPRU, University of Sussex, Sussex Energy Group.

Monstadt, J., 2007. Urban governance and transition of energy system. Int. J. Urban Reg. Res. 31, 335–340.

MORI Scotland for BBC Scotland, 2005. Hebridean Windfarm Plans. Available at: www.ipsosmori.com/polls/2005/bbcscotland.shtml, as viewed on 22 November, 2012.

MORI Social Research Institute for Regen South West, 2004. Attitudes towards renewable energy in devon. Available at: www.regensw.co.uk/content-download/, as of February 13, 2013.

Moula, M., 2012a. Street children and services: a qualitative study of street children in the context of service delivery system in Bangladesh, department of social sciences. University of Helsinki, Finland.

Moula, M., 2012b. Street children and services: a qualitative study of street children in the context of service delivery system in Bangladesh. Pattern of Data Analysis, Department of social sciences, University of Helsinki, Finland.

OECD, 2002. Strategies to reduce greenhouse gas emissions from road transport: analytical methods. OECD Publications' service, France. Available at: www.internationaltransportforum.org/, as viewed on 19 October, 2012.

Owens, S., Driffil, L., 2006. How to change attitudes and behaviors' in the context of energy: state of science review. Paper commissioned by the Office of Science and Innovation, London.

Owusu, G., 2008. The role of small towns in regional development and poverty reduction in Ghana. Int. J. Urban Reg. Res. 32, 453–472.

Papermans, Y., Loots, I., 2013. Wind farm struggles in Flanders fields: a sociological perspective, in press.

Saundry, Peter, 2012. Overview of greenhouse gas control policies in various countries. The Encyclopedia of Earth. Available: www.eoearth.org/article/, as viewed on 12 December, 2012.

Populus, 2005. Energy Balance of Power Poll. Available at: www.populus.co.uk/Poll/Energy-balance-of-power, as of February 11, 2013).

Syri et al., 2012. Increasing nuclear power at liberalized energy markets-case Finland. EPJ Web of Conferences 33, 03007, EDP Sciences. Available at: www.epj-conferences.org/articles/epjconf/pdf (Viewed on 31 May, 2013).

SCI, 2011. Energia Asenteet. Tutkimusraportti 29.08.2011 Energiateollisuus. Yhteiskuntatieteellinen tutkimus Oy, Tampere.

Smith, M.G., Urpelainen, J., 2013. Why has public R & D on alternatives to fossil fuels decreased in industrialized countries? Environ. Sci. Policy 25, 127–129.

Smith, W.J., 2013. Projecting EU demand for natural gas to 2030: a meta-analysis. Energy Policy 58, 163–176.

Smith, J.W. et al., 2010. The effects of place attachment, hypothetical site modifications and use levels of recreation behavior. J. Leisure Res. 42 (4), 621–640.

Somerset County Council, 2004. Somerset Environment & Quality of Life Questionnaire 2004. Available at: www.somerset.gov.uk/somerset/ete/sustdev/, as viewed on 6 February, 2013.

Tol, R.S.J., 2012. A cost-benefit analysis of the EU 20/20/2020 package. Energy Policy 49, 288–295.

Upham, P., Shackley, S., 2006. Stakeholder opinion of a proposed 21.5MWe biomass gasifier in Winkleigh, Devon: implications for bioenergy planning and policy. J. Environ. Planning Policy Manage. 8 (1), 45–66.

Urban, J., Šćasný, M., 2012. Exploring domestic energy-saving: the role of environmental concern and background variables. Energy policy 47, 69–80.

Valkila, N., Saari, A., 2013. Experts' view on Finland's energy policy. Renewable Sustainable Energy 17, 283–290.

Venkatesh, V., Bala, H., 2008. Technology acceptance model 3 and a research agenda on interventions. Decis. Sci. 39 (2), 273–315.

Venkatesh, V., Morris, C., et al., 2003. User acceptance of information technology: toward a unified view. MIS Q. 27, 425–478.

Vorkinn, M., Riese, H., 2001. Environmental concern in a local context: the significance of place attachment. Environ. Behav. 33, 249–263.

Warren, C.R. et al., 2005. Green on green: public perceptions wind power in Scotland and Ireland. J. Environ. Planning Manage. 48, 853–875.

Wolsink, M., 2006. Invalid theory impedes our understanding: a critique on the persistence of the language of NIMBY. Trans. Inst. Br. Geogr. NS31, 85–91.

Wolsink, M., 2000. Wind power and the NIMBY-myth: institutional capacity and the limited significance of public support. Renewable Energy 21, 49–64.

Zoellner, J., et al., 2005. Perceived procedural justice as a conflict factor in wind energy plants planning process. Paper Presented at the 6th Bi-annual Conference of Environmental Psychology, University of Ruhr, Bochum.