

A segmentation analysis: the case of photovoltaic in the Netherlands

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Abstract The paper presents the results of a survey analysis into the adoption and non-adoption of solar PV in Dutch households. It is based on a survey under 817 households undertaken in 2012. Households are aggregated into 4 groups based on whether the adoption is voluntary or involuntary (when people buy a house with solar panels) and whether or not the household can be considered a potential adopter or rejecter. For these four groups, we study and compare the characteristics of adopters and nonadopters of solar PV. Non-adopters are broken down in two groups: rejecters and potential adopters. The segmentation analysis gives more specific insight in the adoption of PV but can also be used to insight in the adoption of other technologies and/or in other countries.

Keywords Technology adoption · Photovoltaic (PV) · The Netherlands

Introduction

Solar energy systems, i.e., photovoltaic (PV), continue to gain attention in the Netherlands as consumers seek alternatives to increasingly expensive conventional energy sources. Concerns about energy usage and energy

costs are expected to further the consumer demand for PV, accompanied by a rapid expansion in the acceptance of these systems in the future years. The adoption of PV is driven by this consumer demand and is characterized by the number of individuals or households that decide to adopt or reject this technology. We are interested in the pioneers who have adopted a PV system, which kind of people adopt it and what are for example their demographic characteristics. But, also the people who rejected a PV system are of importance. What kind of people are they? Given the current activity and interest in solar energy and the future growth expected in this industry, it is important that we are able to identify these people to create insight in the adoption process. Little scientific research is presently known concerning the individuals adopting a PV system.

To our knowledge, there are some studies which investigate how and why consumers may transition toward adopting sustainable energy technologies. Most interesting is the study of Axsen et al. (2012), who grouped their sample into the greens that are “engaged,” those who are “aspiring” and those who are “low-tech,” and the non-environmental groups, whereby it is distinguished between the “traditional” and the “techies.” However, in our opinion, it highly depends on the technology in question whether people are willing to adopt, even within a group “green-engaged” it is impossible to predict the decision. A study by Pedersen (2000) showed that even inconsistency in the purchase of various green products and/or technologies exists. He contends that the purchase of a green product cannot be predicted based on the purchase of another green product (Faiers and Neame

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2006). Thus, it is not because, for example, buying an electric vehicle that one will also buy solar panels for example. The opposite is obviously also true: It is not because a polluted product (e.g., a plane trip) that one does not buy green products (e.g., solar panels).

Drawing on the theory of market segmentation, we introduce a typology which can be used for analyzing the adoption of technological innovations, in particular PV. Different typologies to classify people exist. Some researchers prefer to highlight the connectedness of different subtypologies within a typology; then, the term segmentation instead of typology is often used. Segmentation is defined as a process of dividing one population into smaller subpopulations (i.e., segments or groups), which are characterized by different needs, characteristics or behaviors, including their response to the way they are approached and affected (Geest et al. 2008). In this research, we are interested in the different ways of thinking, beliefs, and perception of people which make the concept of segments more practical as it highlights the interconnectedness of parts related to a larger populace (the Dutch population). So, the objective of this study is to introduce a segmentation model which allows us to answer the question whether adopters and rejecters of a PV system consider the same or different values/attributes. Moreover, the research method is accessible and workable for other researchers who such to gain insight in adoption processes.

Section 2 offers a theoretical background, we discussed the theory of market segmentation. Section 3 offers the research method and data collection. Based on the gained insights in segmentation literature, we introduce a new model in section 4 which can be used for analyzing the diffusion and adoption of PV in the Netherlands. The overall purpose of this section is to determine empirically how the groups differ from each other. We take the demographic characteristics, geographical characteristics, physiographical characteristics, and behavioral characteristics into account. Section 5 offers a reflection of our segmentation model, and we analyze how the model met different criteria for good segmentation. Finally, section 6 provides a discussion and conclusion.

Theoretical background

Technology adoption cycle

Consumers have different personal characteristics and traits and do not all adopt innovations (a new technology)

at the same time (Beal and Bohlen 1957). Beal et al. (1957) divide the diffusion of new ideas into five stages: awareness, interest, evaluation, trial, and adoption. Interesting in Beal and Bohlen's discussion of these five stages is how the most common way for people to learn about new technologies change at each step in this process. When it comes to individuals, Beal et al. (1957) introduced a technology adoption lifecycle which divided people into categories that are determined by how soon they adopt new technologies. This is where they divided people into the categories of innovators, early adopters, early majority, (late) majority, and laggards or non-adopters. The innovators, early adopters or early majority are individuals or firms investing at an early stage of the diffusion of new technologies. They have a large network, access to information, investment capital, an educational level, or experience above average. The (late) majority and non-adopters or laggards are people investing on a later stage, they are older than people investing at an early stage of the innovation diffusion and they have a smaller network and are less educated. See Table 1 for a more elaborated description of the different categories.

The technology adoption cycle should be viewed as a relative concept. It seems to be straightforward that the group of innovators depends on the technology in question, and it does hardly account for differences in the circumstances of users and difference of the preferences.

Market segmentation

Market segmentation is a marketing strategy which refers to the process of dividing a potential market into distinct subsets of consumers who have common needs and priorities and selecting one or more segments as a target market to be reached with a distinct marketing mix. The basic idea behind market segmentation is that consumers are not all the same and that one strategy will not work for all customers. This has led to break down large markets into smaller segments, each of which is more narrowly defined than the overall target market. Different authors have discussed market segmentation, e.g., Abell and Hammond (1979), Gankema and Wedel (1992), Hessing and Reuling (2003), and Schiffman and Kanuk (2010). It is a common view that a good segmentation has to comply with seven criteria (Abell and Hammond 1979; Gankema and Wedel 1992; Hessing and Reuling 2003; NetMBA 2010).

Table 1 Categories of technology adoption cycle

Name	Description
Innovators—2.5 %	First, to adopt in a very early stage of the innovation process. They are willing to take risks, often have substantial financial resources and a technical knowledge
Early adopters—13.5 %	Role model for other members of the social system. They are aware of their important position and try to maintain this position by making quick judicious decisions which will trigger the mass to adopt an innovation
Early majority—34 %	Adopts a new technology when they see that the implementation was successful in the early adopters group. This group takes its time to make a deliberate decision in order to avoid the start-up problems of an innovation
Late majority—34 %	Adopts an innovation when there is a pressure from the environment or when the innovation has proven higher performance. This group has a lower socioeconomic status
Laggards/non-adopters—16 %	Last to adopt an innovation, for who technology is unattractive. They are very conservative, isolated from the rest of the social system, and often have limited resources

From Beal et al. 1957; Rogers 2003

- Identifiable. It should be clear to which segment somebody belongs.
- Accessible. People should have the opportunity to move to another segment.
- Substantial (size). The segments should be sufficiently large and there should not be too much groups consisting of only a few people.
- Unique needs/heterogeneous. The segments should differ clearly and with clear differences between the segments.
- Stable (durable). The segments should be relatively stable (minimize often and/or easily changes between segments).
- Homogeneous response. Members within a segment should react in a comparable way to arousals, e.g., advertising and information.
- Conducive to steering/affecting behavior (influential). The typology should offer ideas on how human behavior within each segment can be steered.

With these criteria in mind, there are many conceivable ways in which a market can be segmented. Think about where consumers are located, who is purchasing a product or service, why consumers buy what they do, and so on. However, the segmentation itself is based on a limited number of characteristics. Four commonly seen characteristics are found in the market literature¹, e.g., Beane and Ennis (1987), Wedel and Kamakura (2000), Doornbos (2004), and Schiffman and Kanuk (2010). Demographic characteristics² refer to age, gender, family composition, education level, housing type, and income. Understanding who consumers are (middle aged woman, high educated) will enable you to more closely identify and understand their needs, product, and services usage rates and wants. Geographical characteristics divide the total potential market into smaller subgroups on the basis of geographic variables (e.g., city, region, province, postal code, and population density). Psychographic characteristics, or lifestyle characteristics, refer to activities, interests, opinions, attitude, and values. Segmenting consumers into lifestyles is based on the notion that a person's lifestyle has a direct impact on their interests in products and services. Behavioral characteristics divide consumers into groups according to their motive to buy/benefits sought (price, esthetic, functionality, idiosyncratic preferences), readiness to buy, and occasions (event that stimulate the purchase).

Other consumer-rooted characteristics used to segment markets are personality traits and sociocultural values and beliefs. The key consumption-specific segmentation factors are usage behavior (including usage rate and situation), benefit segmentation, and brand loyalty and relationship (Schiffman and Kanuk 2010).

The most common category used in market segmentation is demographics. However, this group does not probe into why consumers buy what they do; hence, it does not offer an understanding of what motivates consumers to buy certain services or what types of personalities favor a product or brand over another. Answers on these question combined with demographic data are even more valuable. That is also the reason why a single characteristic is almost never used alone. Practically, all

¹ It is important to note that sometimes, textbooks classify the characteristics differently. For example, we integrate “benefits sought” as being a “behavioral characteristic,” while some textbooks reported that they should be separated out. And, some textbooks will list geo-demographics—a combination of geographic and demographic measures—as a separate category.

² Socioeconomic characteristics are covered by this group.

segmentation models are in the form of hybrid segmentation. Hybrid segmentation, also referred to as multi-variate segmentation, refers to using multiple segmentation characteristics in order to determine the market segment (Schiffman and Kanuk 2010). Below some primary examples of hybrid segmentation models are described. Important to keep in mind, it is not our purpose to be exhaustive but rather to broaden insight in combining different segmentation categories.

Geo-demographic segmentation—PRIZM

Geo-demographic segmentation involves a combination of geographic and demographic factors. This segmentation is based on the notion that people who live close to one another are likely to have similar financial means, tastes, preferences, lifestyles, and consumption habits (Schiffman and Kanuk 2010). Jonathan Robbin, the founder of Claritas Inc., is seen as the father of geo-demographic segmentation and introduced in 1974 the PRIZM (Potential Rating Index for ZIP Markets) segmentation system. PRIZM divides the US population into 15 social groups (e.g., Landed Gentry, 2nd City Centers, Urban Cores) based on differences in socioeconomic status and urbanization. Those 15 groups are further subdivided by measurable differences in household composition (e.g., family structure), mobility, ethnicity, and housing. It defines every US household in terms of 66 segments to help marketers discern those consumers' likes, dislikes, lifestyles, and purchase behaviors (Heitgerd and Lee 2003; Wedel and Kamakura 2000). The segment names are meant to catch interest and convey a general sense of the character of an area; however, they should not be interpreted literally.

Psychographic/lifestyle segmentations—VALS and LOV

One of the most widely popularized approaches to lifestyle research for market segmentation is the values and lifestyles (VALS) segmentation model developed at Stanford Research Institute (SRI) by Mitchell (1983), drawing on the theoretical base of Maslow's (1954) needs hierarchy and the concept of social character (Reisman et al. 1950). The VALS model is developed to determine different classes of people who had varying values, attitudes, and lifestyle. This typology classifies the American adult population into eight distinct sub-groups based on a specific set of attitudinal and demographic questions that drive consumer behavior. The

model illustrates two critical concepts for understanding consumers: primary motivation and resources (e.g., income, education). The combination of motivations and resources determines how a person will express himself or herself in the marketplace as a consumer (Schiffman and Kanuk 2010; Kahle et al. 1986; Wedel and Kamakura 2000). The eight VALS segments are innovators, thinkers, believers, achievers, strikers, experiencers, makers, and survivors.

One alternative to VALS is the list of values (LOV) which was developed by researchers at the University of Michigan Survey Research Centre (Kahle et al. 1986). LOV was developed from a theoretical base of Feather's (1975), Maslow's (1954), and Rokeach (1973) work on values in order to assess adaptation to various roles through value fulfillment. A list of nine values is used to classify consumers, including self-respect, security, warm relationships with others, sense of accomplishment, self-fulfilment, sense of belonging, being well respected, fun and enjoyment in life, and excitement. These values are used to classify people on Maslow's hierarchy, and they relate more closely to the values of life's major roles than the values in Rokeach Value Survey (ordered value system). Respondents have been asked to identify their two most important values or to rank the values (latent value system) (Kahle et al. 1986; Schiffman and Kanuk 2010).

Some similarities are found between both segmentation models: (1) VALS segmentation of achievers and the LOV segmentation of sense of accomplishment, and (2) VALS classification of believers and the LOV classification of sense of belonging. Whereas in VALS, the individual is viewed as going from worse to better, within the LOV framework, no such expectation exists. Comparisons of the VALS and LOV model of segmenting consumer markets have indicated that the LOV method has certain advantages over VALS, and the LOV has been found to predict consumer behavior more often than VALS across a range of brands (Kahle et al. 1986).

MindBase

The segmentation methodology, MindBase, is created by Yankelovich researchers who examined four years of in-depth data on American values and attitudes from its annual monitor surveys comprehensive study of American opinions on topics such as government, health, sex, business, and religion, which it has carried

out since 1971. From this data, Yankelovich identified eight major consumer groups with shared life attitudes and motivations: up and comers, aspiring achievers, realists, new traditionalists, family centereds, individualists, renaissance masters, and maintainers. These eight groups were further divided into 32 distinct subsegments for greater differentiation and clarification (Hawkins et al. 2007).

Commercial segmentation models

In the Netherlands, six major research centers have each developed a segmentation model based on personal values and lifestyle. The different segmentation models are valuebox model of NFO-TrendBox, mentality model of motivaction, mosaic model of Experian, win model of TNS/NIPO, censitydiam model of synovate, and BSR model of SmartAgent Company. Every segmentation model is already used in a case related to the building market, e.g., municipality Almere by Experian. These research centers used the models to help their customers with the segmentation. In the past, a disadvantage of these models was that there was almost no connection possible to reach segments of the market. In recent years, research centers have coupled their segmentation model with large address files or large self-made databases. In this way, the translation of the results to reach potential customers is easier. However, the research methods are not communicated since this is confidential; therefore, we include in the underlying idea of these models as an appendix (see Appendix).

To sum up, market segmentation is all about identifying specific groups of people based on common characteristics. There are virtually dozens of ways that a market might be segmented and the segments chosen will depend on the products or services it offers. It is important to keep in mind that with the identified segments, one will decide which strategy is best for a given product or service, and now and then, the best option arises from using different strategies in conjunction.

Research method and data collection

With the theoretical background of market segmentation in mind, it is intended to introduce a segmentation model which can be used for analyzing the adoption of technological innovations. We focus on PV as it is one of the most promising low carbon energy sources. While

the worldwide application of PV is growing fast, the Netherlands is lagging behind which clearly constitutes a case of slow diffusion. By studying this case, we find out which kinds of people use the technology already and which kind of people rejects the technology.

Empirically, our research is based on original data on the perception on solar energy in the Netherlands collected via an internet questionnaire. The data gathering took place in September 2011, and the response consisted of 817 completed and usable questionnaires. The data is used to determine empirically a new segmentation model for technological innovations.

After some trial and error, we figured out that it is impossible to group our sample into different lifestyle groups based on VALS, PRIZM, or the like. For that, a much bigger sample and much more questions on attitudes and values would be required. But, the strength of the survey that could be exploited in more detail is that it measures the environmental attitudes and concerns of adoption/non-adoption of PV of the respondents pretty well. We explored the use of a factor analysis, a cluster analysis, a principal components analysis, and chi-squared automatic interaction detection (CHAID) analysis. All techniques are used not only (1) to see the relationship between the items in the questionnaire and underlying dimensions but also (2) to reduce a larger set of variables to a smaller set of variables that explain the important dimensions of variability. A factor analysis aims to find underlying latent factors³, whereas principal components analysis aims to summarize observed variability by a smaller number of components. Cluster analysis divides people into groups that are meaningful and interesting; however, these groups are not associated either with an outcome measure such as likelihood of purchasing a product or with background data that would allow them to be identified so that specific messages can be addressed to them. Finally, CHAID identifies segments that are related to an objective and easily identifiable. However, this method does not work very well with attitudinal data, as the segments tend to lack depth and complexity, or their complexity is uninterpretable. As such, we observed that these analyses are not useful for the aim of our research, as we will gain specific insights into the adoption and non-adoption of solar PV in Dutch households. Therefore, we decided to

³ Doing the factor analysis to group the different behaviours and thereby increase the reliability is very difficult given that correlations are fairly low between behaviours.

cluster some specific questions in order to reduce the large set of items into a smaller number of dimensions.

In this research, we propose a hybrid segmentation model which we introduce in the next section to analyze whether PV users are identifiable as small number of relatively homogeneous groups of technological users, based on their adoption or rejection of a specific technological innovation. The introduced model is tested with the criteria of o.a. Gankema and Wedel (introduced in “[Theoretical background](#)” section), namely identifiable, accessible, size, unique needs (heterogeneous), stable, homogeneous response, and conducive of steering. Our focus is placed on demographic, geographic, and psychographic characteristics and motivations (behavior characteristics) rather than on feelings or intentions. We are interested in the personal characteristics of Dutch citizens in relation to sustainable energy sources and in particular PV. In order to gain insight in PV users, the following dimensions are important.

- Demographic characteristics. In our questionnaires, we included questions about age, possibly income, education, and gender to analyze if some characteristics occur more often in a specific group.
- Geographic characteristics include the housing type, housing situated, ownership, and number of residents per dwelling as these characteristics influence where PV systems appear. The domestic sector in the Netherlands is divided over three types of ownership. Each represents a different type of decision maker with respect to the purchase of PV: (1) owner-occupied sector in which the residents themselves are the decision makers, (2) private rental sector in which private landlords make the investment decision, (3) public rental sector in which housing associations make the investment decision. Broadly five types of houses can be distinguished in the Dutch domestic sector: (1) detached (free standing), (2) middle of a row, (3) semi-detached, (4) apartment, and (5) farms. Furthermore, a house can be situated in a city, village, or countryside.
- Psychographic characteristics include activities, opinions, and values in our questionnaire. Activities give an insight into attitudes, norms, and values of people. More specifically, it attempts to predict specific buying habits and preferences of consumers. Often, there is a discrepancy between what people say they wish to do and their actual behavior. Activities used in this research are

recycling of paper, avoidance of unaddressed advertising, energy efficient equipment (A-label), and avoidance of car use and water conservation. We asked the respondents to indicate their contribution with regard to sustainability within their own lifestyle with a number of indicators using 4-point Likert scale ranging from (almost) always to never. The respondents which answer the question with (almost) always or regularly are seen as people who behave sustainable on that question. Opinions and attitude include the reliance on other people’s advice and approval. To what extent people make decisions alone or dependent of others, have neighbors, family, or friend, is an important role in decision making and/or in their behavior. It also includes to what extent behavior is determined by habits that exist for decades. Another characteristic is being traditional or modern. Traditional means that people conform themselves to habits, rules, and expectations from a group. The opposite, modern, refers to societies in which not a lot of habits, rules, and expectations exist. Nineteen questions regard personal preference were asked. Answering each question implied making a choice between two opposite possibilities, agree, or disagree. Finally, values can pertain to how a group of individuals feels about certain characteristics/attributes. Depending of these attributes, people decide to adopt or not adopt a PV system; therefore, it is interesting to know what people consider as important product attributes for a PV system and how these attributes are ranked. Based on focus group discussion⁴, we proposed that a PV system have five predominant attributes. These are price, efficiency, lifetime, integration, and attractiveness. We asked the respondents to rank, from very important to not important, these attributes which are important in the decision process to adopt or not adopt a system.

- Behavioral characteristics include the motivations and the barriers to adopting a PV system. We asked the respondents who have adopted a PV system themselves to rate several aspects in deciding to

⁴ Within the Organext project, expert interviews with members of the project amongst which are R. Kemp (Maastricht University) and J. Manca (Hasselt University) were conducted led by S. Lizin (Hasselt University).

adopt a PV system by importance, maximum three answers were possible. There is also a section in the questionnaire which aimed to find out which aspects non-adopters of PV find important in order to observe the barriers for and during adopting a PV system. Different product benefits and costs are taken into account.

A segmentation model for PV in the Netherlands

At the moment, an investment in PV requires a considerable run of money. Citizens need an average to above average income for the purchase of PV. The payback of PV is around 10 years, and the ideal situation is that the citizen has this time still in prospect. The dimension life situation is not straightforward, and in both situations, you can buy a system. However, the context of being single or having a family can make a difference, for example, a well-educated single can afford a system while a single earner family man cannot afford the same system. Also, the other way around is possible. As a citizen has a home in the private or public rental sector, it is likely that these people do not buy PV panels by themselves, while for an owner of a house, it can be profitable. The difference in type of citizen has an influence on the purchase of such innovative technologies; a modern citizen shall easier buy an iPOD than a traditional citizen.

To reduce the large set of items in our questionnaire to a smaller number of dimensions and components (groups), we explored the use of different analysis (see “[Research method and data collection](#)”). We observed that these analyses are not useful for the aim of our research as we will gain specific insights into the adoption and non-adoption of PV in Dutch households. The purchase of a green product cannot be predicted based on the purchase of another green product; therefore, we decided to cluster some specific questions in order to reduce the large set of items into a smaller number of dimensions. In order to understand the meaning of technology for an individual, it is not sufficient to only look at the abovementioned dimensions (e.g., income, age); more important is to obtain insight into the usage of sustainable technologies and the sustainable mindedness of people. Therefore, the attitude of the citizens we are dealing with is a strong determining dimension in this research, vertical axis in Fig. 1. This dimension refers

to the attitude citizens have on the technology, positive versus neutral or negative, while the abovementioned dimensions are largely influenced by external circumstances in which the attitude plays no role. Income, life phase, and home ownership may in itself be decisive factors. The second determining dimension in this research refers to the decision-making process of major technological innovations, see horizontal axis in Fig. 1. An important aspect is the consideration of the adopters and non-adopters.

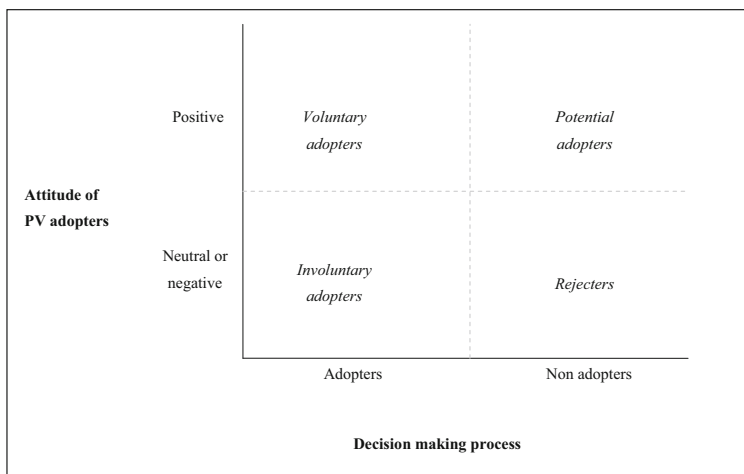
In this research, the attitude of PV adopters and individual preferences (adoption or not) is determined by using different questions. First, we asked whether the respondents have a PV system in their possession. If they have, then we asked who the purchase of the system has decided. If the respondent decided the purchase by themselves, we label this respondent with a positive attitude; if not, we label this respondent with a neutral or negative attitude. If they have not a PV system in their possession, a distinction is made between respondents who are willing to purchase a system (they indicated that they are in the orientation phase or that they will consider the purchase when more people decided to opt for a system) or not; we label these respectively as non-adopters with a positive attitude and non-adopters with a negative/neutral attitude.

Taking these dimensions together, we constructed a segmentation model for PV in the Netherlands, see Fig. 1. The number of segments is determined by the number of axis used which corresponds with segmentation literature. The figure shows that different attitudes and individual preferences (adoption or not) can be distinguished in four groups: voluntary adopters, involuntary adopters, potential adopters, and rejecters.

Better understanding of the adopters (voluntary and involuntary)⁵ and non-adopters (potential adopters and rejecters) allows us to determine how the groups differ from each other. In this way, we can compare the choices and considerations for the different adopters. In the section below, the different adopters are discussed according to the characteristic groups. An overview of the characteristics is also given.

⁵ The number of voluntary adopters is very small, and therefore, it may be quite difficult to make conclusions about the whole population; however, the data is suitable to determine how the groups differ from each other.

Fig. 1 Segmentation model for PV in the Netherlands



Demographical characteristics

The age spider diagram (see Fig. 2) suggests that the majority of the voluntary adopters are located in the category of 50–59 years, while the involuntary adopters are concentrated around age 40. Non-adopters appear more concentrated from categories 40 to 59.

Concerning income, the majority of the respondents have an income between 15,000 and 36,000 euro per year. As expected, the respondents with an income less than 15,000 euro per year are respectively represented by the group rejecters, involuntary adopters, potential adopters, and finally voluntary adopters. So, the attitude of the people with the lowest income is more negative or neutral than the people with an income between 36,000 and 60,000 euro per year. This latter group is more represented by the respondents who have a positive attitude for PV, the group voluntary and potential adopters. These results show that voluntary adopters of PV have higher income than the average population. This is in line with the results of Labay and Kinnear (Labay and Kinnear 1981), who examines PV within an adoption and diffusion of innovation frameworks in the State of Maine. A case study on the city of Groningen from Jager (2006) comes also to similar findings. This study analyses factors that lead to a faster diffusion of PV in society from a behavioral perspective.

With regard to education, we found that adopters, especially voluntary adopters, have a higher education than the non-adopter. Potential adopters and rejecters appear to be very similar. In gender, the adopter and non-adopters appear to be also very similar.

Geographical characteristics

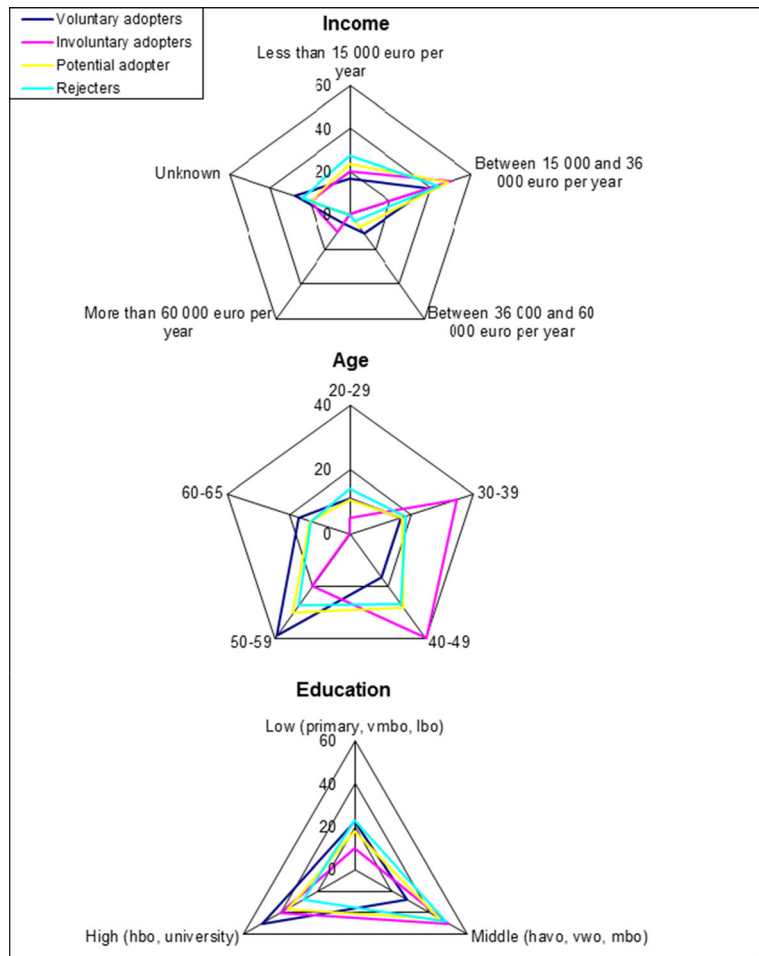
In Fig. 3, the spider diagram of the different geographical characteristics is given.

We see that the respondents who have an own house have a more positive attitude than the respondents who rent (public or private). The majority of the home-owner is voluntary or potential adopter. The majority of the group of adopters (voluntary and involuntary) lives in a village, while the group of non-adopters (voluntary adopters and rejecters) lives in a city. Concerning housing type, the majority of the respondents in every group lives in a middle of row dwelling (non-detached dwelling). But, detached dwellings are even popular for the group voluntary adopters, and semi-detached dwellings are almost even popular for the group involuntary adopters. The second selected housing type of the group rejecters is the apartment which can be identified as physical barrier, as it is assumed that this group of people does not consider the option of solar PV panels individually. The last characteristic we discuss is the number of residents. The majority of the voluntary adopters live with two people in a dwelling, while the group of involuntary adopters lives with three or four people. Potential adopters and rejecters appear to be also very similar.

Psychographic characteristics

The opinion spider diagram (Fig. 4) suggests that climate change is a concern for people with a positive attitude for PV; thus, the voluntary and potential

Fig. 2 Age, income, and education of all respondents divided over the different adopter groups



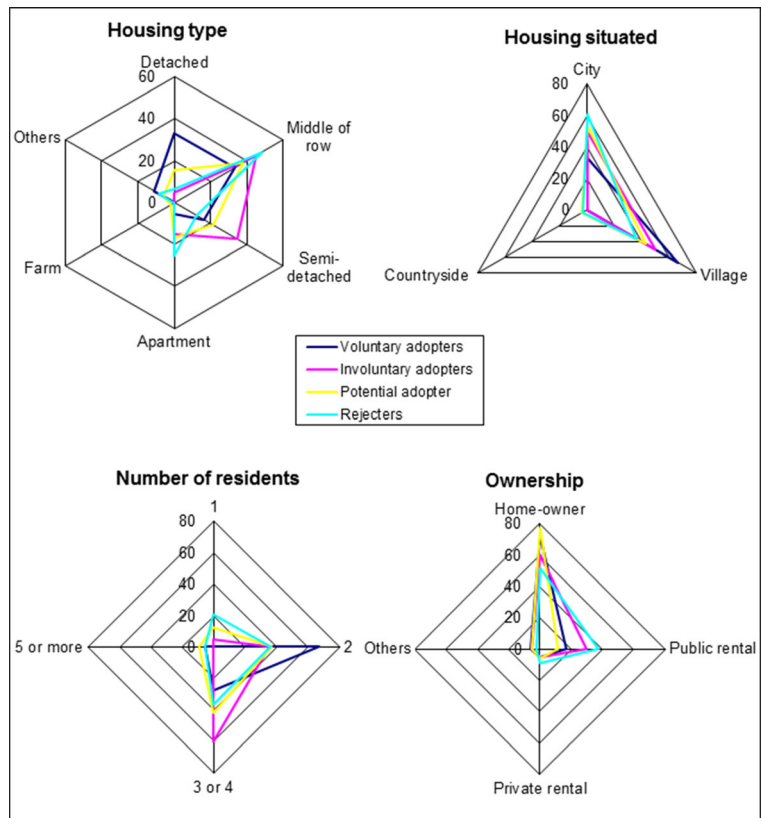
adopters seem fairly similar to each other and fairly different from the involuntary adopters and rejecters. Comparing the decision-making process of adopters with non-adopter, we see that voluntary adopters take big decisions independent of others and that this group of adopters does not take considerable time for big decisions yet quits differently from the other three groups. Finally, all the respondents answered that rules are necessary in daily life, but the adopters with a positive attitude score a little bit higher than the respondents with a neutral or negative attitude. The majority of the respondents answered that traditional norms and values are important.

Furthermore, the findings in the activity spider diagram indicate that recycling paper, buying energy efficient equipment (A label), and use water wisely are major activities performed by all the respondents. Remarkable, the avoidance of unaddressed advertising

is notified as not common by the majority of the respondents. With regard to the different adopter groups, we see that the adopters are more sustainable minded than the non-adopters. Within the group of non-adopters, rejecters have indicated that they are less sustainable minded on all the analyzed characteristics than the potential adopters. In conclusion, the adoption of PV did not appear to vary between the respondents based on their level of environmental consciousness.

Finally, the value spider diagram suggests that the price of a system is a major issue perceived by all the respondents. Remarkable, the efficiency is mentioned as more important for the voluntary and potential adopters, thus, for PV respondents who have positive attitude, while the visual representation is mentioned by the involuntary adopters and rejecters, the group respondents with a neutral or negative attitude on PV. The integration is more important

Fig. 3 Housing type, housing situated, ownership, and number of residents of all respondents divided over the different adopter groups



by the group involuntary adopters and quite different from the other groups.

Behavioral characteristics

Figure 5 gives an overview of the behavioral characteristics, and important aspects for this group of characteristics are particularly asked to adopters or non-adopters (see “[Research method and data collection](#)”), and therefore, it was not possible to include all adopter groups in this analysis; nevertheless, we can describe these characteristics. Both spider diagrams consist of the most important barriers and motives, and more aspects are included in the questionnaire, but the results indicated that these aspects have not a role for the adoption or rejection of PV.

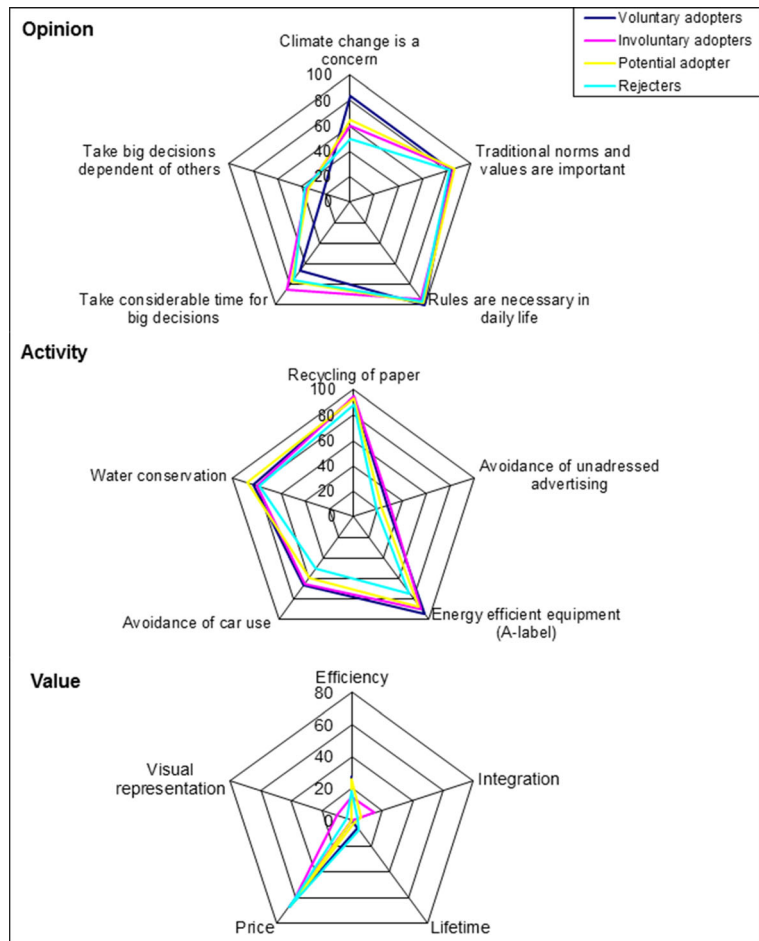
The barrier spider diagram suggests that for the vast majority of non-adopters (potential adopters and rejecters), the high investment costs of PV is the most important aspect followed at a large distance with low energy yield. With regard to the

efficiency of a PV system⁶, we see that potential adopters have more fear for gaining promised efficiency than the group rejecters. In line with our expectations, many rejecters indicated that they are not interested in adopting a PV system.

Concerning motivation of adoption of PV, for the majority of the voluntary adopters, the saving of electricity costs is the most important aspect together with the costs of a PV system. The possibility to be self-sufficient and the contribution to a better natural environment are also important motivations for adoption. The visual representation and innovativeness of the system are not seen as an important aspect. This is against our expectations because the visibility of the technology can function as a status symbol or serve as a symbol to communicate a certain identity or value orientation. An elegant and aesthetically integrated system should be

⁶ The PV technology keeps on developing, and its main component, the PV cells, is expected to become more efficient in converting solar energy into electricity (IEA 2010). The performance ratio, related to the efficiency of a PV system, is also expected to grow in the future (Jahn and Nasse 2004).

Fig. 4 Psychographic characteristics of all respondents divided over the different adopter groups



used to convince neighbors, friends, and family of the positive role that PV can play.

Finally, discussion with other adopters to convince adoption is not an issue; the non-adopters do not feel pressure from their social environment.

Overview of the characteristics

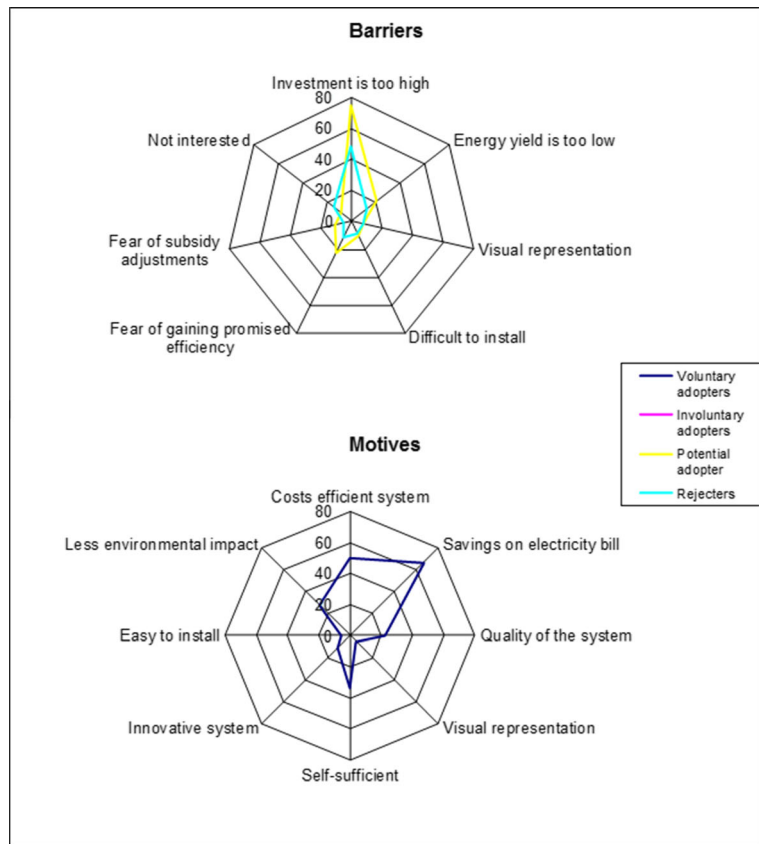
Table 2 gives an overview of the demographic characteristics, geographic characteristics, psychographic characteristics (cultural beliefs and the importance of the different attributes for PV of the different lifestyles), and behavioral characteristics (motives and barriers to adopt PV).

Results show that voluntary adopters are on average middle-aged, highly educated, take big decision independent of others, and take care of the environment by for example recycling paper and avoiding the car on a regular basis. The opposite are the rejecters who have on

average a lower income, take big decisions dependent on others, and need also considerable time for big decisions. These characteristics help to construct a picture of which kind of people adopt or reject a system; however, we cannot do predictions based on these characteristics. Therefore, we indicate some determining factors which correspond with some psychographic and behavioral characteristics. Especially characteristics regarding the cost and benefits of adoption are of importance. In this research, the price of a system is indicated as the most important issue perceived by the different groups⁷. It is not only the most important motive to adopt but also the most important barrier to reject (potential adopter and rejecter). The financial arguments for PV are

⁷ Since the questionnaire have not asked people about the relative importance of the several aspects of this price (purchase, operating costs, maintenance costs, and insurance rates), it is impossible to determine which are perceived as most important.

Fig. 5 Behavioral characteristics of all respondents divided over the different adopter groups



complicated by amongst others the uncertainty of electricity prices over the 20- to 30-year system life. Many respondents felt that prices would inevitably rise, and therefore, PV could provide a good option and a degree of self-sufficiency. While self-sufficiency is an important part of owning a PV system, PV did not provide the level of independence that we expected (see “[behavioral characteristics](#)”, only $\pm 30\%$ of the adopters citing the importance of self-sufficiency). The motive to contribute to a better natural environment appeared to be more important for the group voluntary adopters than the symbolic investment. Regarding the non-adopters, we can conclude that for the potential adopters next to the costs of a PV system, the efficiency and energy yield are important determining factor. This is different for the group rejecters; they indicated the visual representation as a barrier for the adoption of PV, while this aspect is pointed out as an important aspect by analyzing the psychographic characteristic. These findings suggest that the visual representation is not a determining factor for this group of adopters. As a barrier, they indicated next to the costs and the energy yield that they are not

interested. To conclude, PV-specific characteristics are more important for the analysis of the adoption or rejection process of a PV system than characteristics regarding demography and geography. Interestingly, other than demographic and geographic characteristics, the different groups exhibit more similar psychographic characteristics. These similarities show us how intertwined or entangled self-concept and personal interest is with actual and perceived knowledge and competence and the actual and reported performance of a practice.

Our results are different in several ways from those found in classic diffusion research such as the theory of Beal and Bohlen (1957) and Rogers (2003). People with the highest socioeconomic status who are the least guided by others in their decision making do not necessarily fall into the first groups of adopters (innovators) as defined by Rogers. In this research, the group of voluntary adopters is in line with this thought, but the involuntary adopters not. Also, Rogers’ group of households that never will adopt a system (laggard/non-adopters) is not in line with our research. This group should have a

Table 2 Characteristics of the different lifestyles

	Adopters		Non-adopters	
	Voluntary	Involuntary	Potential adopters	Rejecters
Demographic characteristics				
Age	50–59	30–49	40–59	40–59
Income	On average higher	On average higher	On average lower	On average lower
Education	High	High-middle	Middle	Middle-low
Gender	Similar	Similar	Similar	Similar
Geographic characteristics				
Home-owner	Me	Rental	Me	Rental
Housing situation	More in a village	More in a village	More in a city	More in a city
Housing type	Middle of row/detached	Middle of row/semi-detached	Middle of row/semi-detached	Middle of row/apartment
Number of residents	2	3 or 4	Similar	Similar
Psychographic characteristics (opinion)				
Climate change	More important	Less important	More important	Less important
Traditional norms and values	Important	Important	Important	Important
Rules	Necessary in daily life (100 %)	Necessary in daily life (98 %)	Necessary in daily life (95 %)	Necessary in daily life (96 %)
Time needed for making big decisions	Less considerable	Considerable	Considerable	Considerable
Taking big decisions (in)dependent of others	Independent	More dependent	More dependent	More dependent
Psychographic characteristics (activity)				
Recycling of paper	(Almost) always	(Almost) always	(Almost) always	(Almost) always
Avoidance of unaddressed advertising	Occasional	Occasional	Occasional to a lesser extent	Occasional to a lesser extent
Energy-efficient equipment	(Almost) always	(Almost) always	(Almost) always	Regularly
Avoidance of car use	Regularly	Regularly	Regularly to a lesser extent	Regularly to a lesser extent
Water conservation	(Almost) always	(Almost) always	(Almost) always	(Almost) always
Psychographic characteristics (value)				
Efficiency—amount of energy	More important	Less important	More important	Less important
Integration	Not important	More important	Less important	Less important
Lifetime of the system	Less important	Not important	Less important	Less important
Price	Most important	Most important	Most important	Most important
Visual representation	Not important	Important	Not important	Important
Behavioral characteristics (motive)				
Costs efficient system	Most important	—	—	—

Table 2 (continued)

	Adopters		Non-adopters	
	Voluntary	Involuntary	Potential adopters	Rejecters
Savings on electricity bill	Most important	–	–	–
Quality of the system	Less important	–	–	–
Visual representation	Less important	–	–	–
Self-sufficient	More important	–	–	–
Innovative system	Less important	–	–	–
Easy to install	Less important	–	–	–
Less environmental impact	More important	–	–	–
Behavioral characteristics (barrier)				
Investment is too high	–	–	Most important	Most important
Energy yield is too low	–	–	More important	More important
Visual representation	–	–	Less important	Less important
Difficult to install	–	–	Less important	Less important
Fear of gaining promised efficiency	–	–	More important	Less important
Fear of subsidy adjustments	–	–	Less important	Less important
Not interested	–	–	Less important	More important

low socioeconomic status which are set to belong to the group of households that is least guided by others in their decision-making. In this research, the group of rejecters is more guided by others in their decisions and has middle to low socioeconomic status, compared to Rogers' middle groups (early and late majority).

Reflection

To test whether the introduced segmentation models can be used as a good segmentation for technological innovations, we analyze how the segmentation model met the seven criteria of Gankema and Wedel (identifiable, accessible, size, heterogeneous, stable, homogeneous response, and conducive of steering). The typology scored well on most of the criteria. It is clear to which segment somebody belongs, the segments were easy to distinguish (heterogeneity) and stable, and the groups are big enough and gave in general homogenous responses in the questionnaire. The criteria which was met least, was the criteria of accessible, which says that people should have the opportunity to move in and move out a certain group. It is obvious that it is not logical to move from the group voluntary adopter to the group potential adopters, except when you moved to another dwelling. However, to a certain extent, it is possible to move in another group. Potential adopters, for example, can become adopters of the technology, and rejecters of the technology can also become potential adopters which in turn can become adopters of the technology, see Fig. 6. Moreover, it is also possible to move from involuntary adopters to voluntary adopters. Involuntary adopters, who do not decide the purchase of

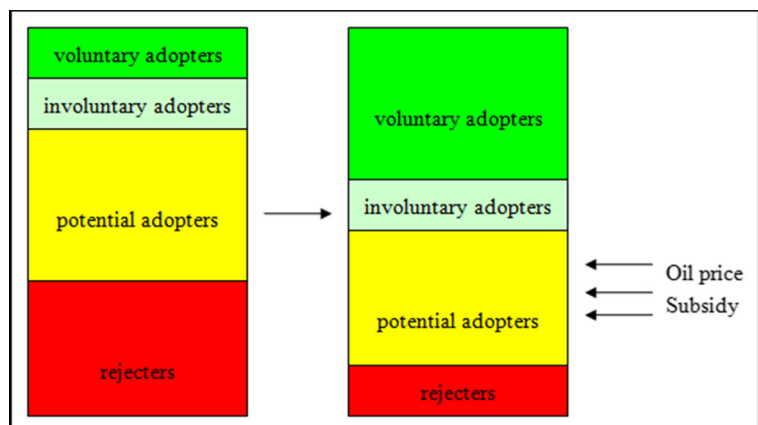
the system themselves, can be very positive of the system and can decide to adopt more panels and in this way become a voluntary adopter. The other way around is less obvious (from voluntary to involuntary adopters) as the purchase decision of the panels cannot be changed from themselves to another person who decided.

The last criterion, conducive of steering, is more or less connected to the accessibility of the typology. Every group should give a description about preferred policy options and/or aspects where people in the group strive for. A favorable grant, for example, can have an influence on the behavior of people within a certain group. The grant can stimulate potential adopters to become voluntary adopters.

Our segmentation model is constructed on survey research and on scientific insights and offers opportunities for analyzing, exploring, and visualizing beliefs and perspectives of people who are in the adoption process of PV. It gives more specific insight in the different beliefs and perceptions of the adoption of PV. The segmentation method can be used to classify, interpret, and analyze these different beliefs and perspectives. In this way, they can be used to analyze the response in order to contribute to the Dutch energy system in the years ahead and the future social acceptance of different technological innovations. By doing this, insights can be provided how the government's policy or service can align the needs of the customer (citizen) as well as how suppliers of this technology can optimize their product based on identified consumer beliefs and preferences.

Furthermore, a first attempt is made to include innovation-specific characteristics during the segmentation of a larger populace. Characteristics (more in particular psychographic and behavioral) related to the cost

Fig. 6 Accessibility and influentially of the different groups



and the benefits are taken into account. The benefits of an innovation obviously refer to the positive consequences (e.g., environmental benefits), while the costs refer to the negative consequences (e.g., financial uncertainty). In this way, our segmentation model can be distinguished from the segmentation models we compared from the different research centers, as their segmentation is not product or service specific.

Conclusion and discussion

The overall purpose of this paper was to introduce a segmentation model which can be used to determine empirically groups of PV technology adopters. The use of questions about beliefs and attribute preferences helped to group people into different groups and compare the choices for such groups. The empirical analysis, based on a questionnaire among 817 Dutch households, resulted in new introduced segmentation model. The model consists of four segments which is determined by two axes: the view citizens have on the technology (positive versus neutral or negative) and the decision-making process of major technological innovations. The four segments are voluntary adopters, involuntary adopters, potential adopters, and rejecters. The groups (segments) met the set criteria for good segmentation and differ from each other with respect to the demographical, geographical, physiographical, and behavioral characteristics. We split our results in non-determining and determining factors to explain how the groups differ from each other. Regarding the determining factors, the costs of a PV system are included as a benefit of having PV for voluntary adopters which obviously refer to the positive consequences of having a system (e.g., self-sufficiency and environmental benefits), while for non-adopters, the benefits of PV which also refer to the positive consequences of having a system do not outweigh the costs of a system which refer to the negative consequences (e.g., price and financial uncertainty). Regarding the non-determining factors, voluntary adopters are on average middle-aged, highly educated, take big decision independent of others, and take care of the environment by for example recycling paper and avoiding the car on a regularly basis. The opposite are the rejecters who have on average a lower income, take big decisions dependent on others, and need also considerable time for big decisions.

Because of the groups dynamic nature, the interpretation of beliefs and attribute preferences may change

over time, as well as the distribution between the different groups (see also Fig. 6). The distribution between the groups change due to events (e.g., air pollution, global warming), developments (e.g., price of the technology or technical performance), and occurrences (possibly catalyzed by people or the media). For example, the symbolism of PV may change over time, as has been seen with perceptions of the automobile (Sachs 1983). An accumulation of these events, developments, and occurrences may lead to a changing dominant group (e.g., voluntary adopters instead of rejecters), and the support for a given strategy may also change. Hence, the segmentation model, including the used method, remains the same, but results may be different as different scores on indicators (characteristics) may be found. Although it seems that these characteristics play a role in segmentation, it is not clear what role they exactly play. One possibility is that they do have a direct influence (demographic and geographic characteristics) on people's perspectives; another possibility is that they have an influence on people's taste, preferences, and values, which are on their turn determining for one's group. Psychographic characteristics may also increase our understanding of group change as change may then be related to changing demographic distributions and population characteristics. These changes and the effect on adoption should be subject of further study.

After this analysis, it becomes clear that for the breakthrough of technologies, the innovation-specific characteristics are more important than characteristics regarding demography and geography. However, the cost and benefits we used in this analysis is a first attempt and can be extended. For example, we do not ask people about the relative importance of the several aspects of the price, for example, purchase price, operating costs, maintenance costs, and insurance rates. Also, the expected future price of electricity has to be taken into account. Including these, aspects make it possible to determine which costs are perceived as most important. Furthermore, the social influence and the effort people must do to adopt a system are not thoroughly considered in this research. Thus, further research remains necessary on how to further integrate this cost-benefit dimensions and the social influence in segmentation analysis and on how and when to include these aspects.

Insights regarding both adopters (voluntary and involuntary) and non-adopters (potential adopters and rejecters) of PV are provided in this research. Four major

groups of characteristics are taken into account: the demographical characteristics, the geographic characteristics, the physiographical characteristics, and the behavioral characteristics. Overall, the link between the characteristics/attitudes we see in this research and the actual adoption behavior is found not to be strong enough. Therefore, it would be beneficial to study the fourth group, behavioral characteristics, in more detail to better understand their motivations to (not) purchase a system. Not only the perceived advantage a PV system have but also the complexity people perceive are two example concepts which have to be taken into account to help gauge people perception of PV which shape the adoption process. By doing this, insights can be obtained about useful government's policies fitting in with the needs of the customer (citizen) and how suppliers of this technology can optimize their product based on identified consumer preferences and frames.

It is important to notice that the case analyzed in this paper deals with a particular sustainable energy technology. The behavioral response related to this technology might be quite specific, and response related to other sustainable energy technologies may be quite different. Also, the composition of the respondents may be quite different. In the case of PV, we expect that the potential adopters may become less common in the near future, particularly as the government and municipalities encourage installation of PV in social housing or other large development. As such, the potential adopters may have markedly different socioeconomic, attitudinal and value characteristics, and hence, behavioral responses. Nevertheless, describing segments in a systematic way allows us to compare different cases and to identify typical responses that may be associated with success or failure. This provides insights regarding the adoption of a technology and provides insights for policymakers especially when considering the implementation of market formation policies for sustainable technologies. Further research is therefore necessary to expand the empirical cases not only to different technologies but also to different sectors and countries. In order to generalize research findings, it is important to use the same segments and take the different characteristic groups into account.

It is possible that a small number of the respondents who do not adopt a system have for example not enough knowledge to fill in the questionnaire, because they do not want it, cannot afford it, or do not understand it. These people are also included in this research and

impossible to omit. This is seen as a limitation to this research.

Appendix

Valuebox model of NFO TrendBox

TrendBox is a strategic market research agency, specializing in qualitative and quantitative research on brands, people, and their motives. In 1990, TrendBox started the Life & Living project, an ongoing study where the attitudes, behavior, and mentality of the Dutch are tracked over time. Because of the continuous nature of Life & Living, NFO TrendBox is able to identify the status quo, recognize, and analyze coming trends and translate the findings to the future. TrendBox distinguish six clusters of segments (order and decency, purposeful adventure, center, uncomplicated beneficiary, sober philosophy, spiritual) in which social groups of the Dutch population are classified, called the valuebox model (de Wit 2003; Meijer et al. 2008; Trendbox 2011).

Mentality model of Motivaction

Motivaction, a Dutch research centre, developed the mentality test which is a value and lifestyle research method and focuses on marketing and policy questions. Results are applicable to, e.g., sustainability issues, mobility, media, and politics. Within the typology, eight social environments are distinguished (traditional citizens, comfort oriented, modern citizens, new conservatives, cosmopolitans, upward mobiles, postmaterialists, postmodern hedonists) which differ in terms of status (low importance, middle importance, and high importance) and values (traditional, based on conservation; modern, based upon possession and spoil; or postmodern, based on self-development and experience) (Motivaction 2010a, b).

Dutch society is highly individualized, and there is a wide variety of lifestyles; citizens are also more mature and become more critical. How can you as a policymaker, advisor, or manager keep in touch with what people moves? In order to deal with this question, Motivaction introduced four styles of citizenships (dutiful, responsible, pragmatic, and outsiders) in collaboration with the Commission Future Government Communication and Scientific Council for Government Policy. The citizenship styles are based on the Mentality

test of Motivaction which is conducted since 1997 in the Netherlands among Dutch people between 15 and 80 years old. The citizenship styles do not only provide insights into the opinions of people and the activities they undertake but they also give insight into the motivations, the needs they have, how they can be involved in the public domain, and how they can be most effectively addressed (Motivaction 2010a). So, the different styles of citizenship can represent the attitude toward government and politics.

Mosaic model of Experian

MOSAIC is a geo-demographic segmentation system developed by Experian and marketed in over 20 countries worldwide. In the Netherlands, Mosaic has divided 16 million Dutch people into 10 groups and is classified into 44 segments (different types of consumers). The 10 groups are free spirited, the developed urban dweller, go-getter, dynamic families, modal citizens, successful families, traditionalists, rural family life, well-off people, and pension beneficiary. This classification has been based on sociodemographic and socioeconomic data, lifestyle, preferences, and (buying) behavior (Experian 2012; Meijer et al. 2008).

WIN model of TNS/NIPO

The WIN model is a value and sociodemographic characteristics based segmentation of the Dutch population. The different values that people find important in their lives seem to be related to different ways of life, housing, dress, think, consume, and vote. Scores on a vertical (focused on others) and horizontal (exploring possibilities) axes are used to determine the classification of segments (Hessing and Reuling 2003; TNS-NIPO 2011). The model distinguishes eight groups in society, which are very different in terms of lifestyle, attitudes, motivations, and behavior. The groups are engaged, care takers, conservatives, hedonists, luxury seekers, professionals, broad minded, and balanced (TNS-NIPO 2011).

Censydiam model of Synovate

Censydiam model is based on consumer motivation studies, including decision to buy. Motivations are

fundamental human desires that drive behavior. The model is a basis for systematical understanding of people motivation in their connection with brand positioning and communications. The model is built around two main axes: personal dimension (how they feel in relation to themselves) and social dimension (how people feel in relation to other people). Around these axes, life values are placed. The segments are vitality, enjoyment, conviviality, belonging, security, control, recognitions, and power (Censydiam 2011).

BSR model of SmartAgent Company

SmartAgent is a perception and consultancy center. SmartAgent gains experiences of people using the social-psychological model, Brand Strategy Research (BSR) model, which is applied in qualitative and quantitative research. The BSR model explores and structures the underlying values, needs, and motivations of people within a particular domain. The model is visualized by two behavioral dimensions: the sociological (x -as) and psychological dimension (y -as). In this way, four quadrants emerge, in other words, four experiences from which people think and act (Coppens and Oosterlynck 2008; Smartagent 2011).

In cooperation with MarketResponse-Amersfoort (market research center) and Kolpron Consultans-Rotterdam (focuses on market research and advice in the areas of the built environment), two living experiences are investigated by SmartAgent. The studies, conducted in 1998 and 2000, form the basis for a subdivision into six experience profiles (living together, withdrawals, dynamic individualist, anchored, quiet luxury, and unattached). Each profile describes a social group with a similar set of values and behaviors related to housing behavior and housing preferences. People score on all clusters in a given ratio. Based on such profiles, the preference for specific living environments can be established. In this way, there is a direct relation between lifestyle and living environment (Coppens and Oosterlynck 2008; Smartagent 2011).

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References

- Abell, D. F., & Hammond, J. S. (1979). Strategic market planning, problems and analytical approaches. Prentice-Hall.
- Axsen J, TyreeHageman J, & Lentz A (2012). Lifestyle practices and pro-environmental technology. *Ecological Economics* (82), 64-74.
- Beal, G. M., & Bohlen, J. M. (1957). The diffusion process. *Special Report No. 18* (Vol. (reprinted 1-67, 10-71, 5-75, and 11-81)). Ames, Iowa: Cooperative Extension Service, Iowa State University of Science and Technology.
- Beal, G. M., Rogers, E. M., & Bohlen, J. M. (1957). Validity of the concept of stages in the adoption process. *Rural Sociology*, 22(2), 166–168.
- Beane, T. P., & Ennis, D. M. (1987). Market segmentation: a review. *European Journal of Marketing*, 21(5), 20–42.
- Censydiam (2011). The Censydiam model explained. <http://www.censydiam.com/modelexplained.asp>. Accessed October 4 2011.
- Coppens, A., & Oosterlynck, S. (2008). *Leefstijlbenaderingen en ruimtelijk gedrag. Een literatuurstudie naar uitdagingen voor het ruimtelijk beleid. Rapport Globale Maatschappelijke Dynamiek I - Leefstijlen*. Heverlee: Steunpunt Ruimte en Wonen.
- de Wit, M. (2003). *Segmentatie: Hoe doe je dat?* Amsterdam: Kluwer.
- Doornbos, L. (2004). *Vraaggestuurd werken en segmentatie. Veranderd ondernemen in de non-profitsector*. Maarssen: Elsevier Gezondheidszorg.
- Experian (2012). Mosaic Huishouden: Van database naar klantgesegmenteerde communicatie Den Haag: Experian Nederland B.V.
- Faiers, A., & Neame, C. (2006). Consumer attitudes towards domestic solar power systems. *Energy Policy*, 34(14), 1797–1806.
- Feather, N. T. (1975). *Values in Education and Society*. New York: Free Press.
- Gankema, H. G. J., & Wedel, M. (1992). *Marktsegmentatieonderzoek in theorie en praktijk. In Recente Ontwikkelingen in het Marktonderzoek (Vol. Jaarboek 1992-'93, pp. 207-222)*. Haarlem: De Vrieseborch.
- Geest, T., Jansen, J., Mogulkoç, E., Vries, P., & Vries, S. (2008). Segmentation and E- Government; a literature review. Universiteit Twente & Telematica Instituut.
- Hawkins D, Mothersbaugh D, & Best R (2007). *Consumer Behavior: Building Marketing Strategy* (10th ed.).
- Heitgerd, J. L., & Lee, C. V. (2003). A new look at neighborhoods near National Priorities List sites. *Social Science & Medicine*, 57(6), 1117–1126.
- Hessing, E., & Reuling, A. M. H. (2003). Waarden in Nederland: segmentatie van doelgroepen. In *MarktOnderzoekAssociaties Jaarboek 2003* (pp. 163- 175).
- IEA. (2010). *Technology Roadmap. Solar photovoltaic energy*. Paris: International Energy Agency.
- Jager, W. (2006). Stimulating the diffusion of photovoltaic systems: a behavioural perspective. *Energy Policy*, 34, 1935–1943.
- Jahn, U., & Nasse, W. (2004). Operational Performance of Grid-connected PV Systems on Buildings in Germany. *Progress in Photovoltaics: Research and applications*, 12(6), 441–448.
- Kahle, L. R., Beatty, S. E., & Homer, P. (1986). Alternative measurement approaches to consumer values: the list of values (LOV) and values and life style (VALS). *Journal of Consumer Research*, 13(3), 405–409.
- Labay, D. G., & Kinnear, T. C. (1981). Exploring the consumer decision process in the adoption of solar energy systems. *Journal of Consumer Research*, 8(3), 271–278.
- Maslow, A. H. (1954). *Motivation and Personality*. New York: Harper.
- Meijer, E., Waning, E., & Dubbeldam, B. (2008). *Klantsegmentatie: Nederlandse openbare bibliotheken*. Rotterdam: Cultuur onderzoeken, de kunst van cultuurmarketing.
- Mitchell, A. (1983). *Nine American lifestyles: Who we are and where we are going*. New York, NY: MacMillan.
- Motivaction (2010a). Mentality™-model. Accessed February 7 2010.
- Motivaction (2010b). Burgerschapstijlen. Accessed February 7 2010.
- NetMBA (2010). Market Segmentation. <http://www.netmba.com/marketing/market/segmentation/> Accessed 26 October 2012.
- Pedersen, L. (2000). The dynamics of green consumption: a matter of visibility? *Journal of Environmental Policy & Planning* 2(3), 193–210.
- Reisman, D., Glazer, N., & Denney, R. (1950). *The Lonely Crowd*. New Haven: Yale University Press.
- Rogers, E. M. (2003). *Diffusion of innovations* (Fifthth ed.). New York: The Free Press.
- Rokeach, M. (1973). *The Nature of Human Values*. New York: Free Press.
- Sachs, W. (1983). Are energy-intensive life-images fading? The cultural meaning of the automobile in transition. *Journal of Economic Psychology*, 3(4), 347–365.
- Schiffman, L. G., & Kanuk, L. L. (2010). *Consumer Behavior - Global Edition* (tenthth ed.). New Jersey: Prentice Hall.
- Smartagent (2011). Het BSR-model. <http://www.smartagent.nl/>. Accessed October 4 2011.
- TNS-NIPO (2011). Het WIN- model. <http://www.tns-nipo.com/expertise/business-solutions/win2/>. Accessed october 4 2011.
- Trendbox (2011). Trends: life & living. <http://trendbox.nl/>. Accessed October 4 2011.
- Wedel, M., & Kamakura, W. A. (2000). *Market segmentation: conceptual and methodological foundations*. Dordrecht: Kluwer.