A market analysis and customer segmentation for residential PV applications in Northern Cyprus

Akal, U.

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A market analysis and customer segmentation for residential PV applications in Northern Cyprus

by

U. Akal

BSc Management Engineering — Istanbul Technical University 2008

Student identity number 0677335

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First supervisor:
dr. U. Konus, TU/e, ITEM
Second assessor:
dr.ir. J.J. Berends, TU/e, ITEM
TUE. School of Industrial Engineering & Innovation Sciences.

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Abstract

Context
New Product Development (NPD) processes have gained importance since the economical downturn hit the companies. Companies, who would like to survive from the harmful outcomes of the crisis, focused more on the innovation strategies and NPD process. This research is focused on the customer aspect of the NPD processes. Crawford and Di Benedetto (2008) described the NPD process as a five staged funnel. Five stages are respectively; Opportunity Identification and Selection, Concept Generation, Concept/Project Evaluation, Development and Launch. This research is connected with the launch phase of this process. More specifically, customer segmentation procedures are investigated in this research. Customer segmentation procedures are important for strategic launch decisions since segmentation procedures are likely to segment customer base and provide a segment to target. Then positioning strategies are formed according to expectation of the customers in this target segment(s).

Renewable Energy Systems (RES) are emerging in the market and adoption rate of these products is increasing for the last decade as a result of increasing environmental concerns. Photovoltaic (PV) or Solar Energy System is one of the Renewable Energy Systems (RES). PV systems are the most popular systems among other RES. They are extensively used in the residential level. Most of the studies involving the PV systems have provided substantial information about technical aspect of these systems. However, none of them have included the customer aspect into their research. These systems are purchased by individual customers thus it is crucial to understand expectations of the customers. Therefore, this research intended to segment the customer base concerning on the expected benefits of potential customers of PV systems.

Research Plan
Northern Cyprus is selected as the study field for this research since country has high solar irradiation potential. N. Cyprus market is a virgin market for the residential PV systems and these systems have not been launched to the market yet. Thus, this research employed customer attitudes towards product and expected benefits of customer as main indicators to segment the N. Cyprus market. Main aim of this research is to investigate the existence of potential adopters of this product. Then main research question is formed as;

- Do customer segments exist based on the purchasing intentions and attitude of customers towards residential PV systems in N. Cyprus market?
Along with the main indicators, psychographic and demographic factors are included to the model in order to observe correlation between segment memberships and these characteristics. Moreover, items for environmental consciousness are added since emergence of these systems is an outcome of increasing environmental concerns. Considering the expected impact of these factors on the segment membership, second research question is determined as:

- What are the factors that are correlated with the segment membership concerning residential PV systems in N. Cyprus market?

Analysis
In order to segment the customer base, a questionnaire was formed and distributed in the N. Cyprus. 300 print-out questionnaires were distributed with Purposive Sampling method by hand and an online link was published and distributed through mail groups. 281 completed questionnaires were gathered at the end of the collection period. Next phase of this study included the analysis of these 281 cases. First, factor analysis was executed to reduce the number of the multi-item measures and remove the uncorrelated items from model. Later, items with low consistency and reliability scores were dropped from the model. Finally, data set was ready to conduct the segmentation analysis.

Latent Class Clustering was utilized in this research since it allocates the cases based on the membership estimations from the constructed model of this research (Dias & Vermunt, 2007).

Results & Discussions
Latent Class Clustering (Analyzing) results revealed a 4 clustered model for optimum solution of this research. Four Segments are clearly differentiated from each other and each has clearly dissimilar profiles. These four segments are respectively labeled as Secure Conservatives, PV Enthusiasts, Impoverished Innovators and Unaware Youngsters. PV enthusiasts are determined as high potential adopters of this product as a result of their high intention to buy score and significant knowledge with awareness towards PV systems. Companies with intention to launch this product in N. Cyprus market should target this segment and position their launch strategies according to the expectations of this segment. Besides the existence of clear segments, findings of this research revealed that factors such as Innovativeness, Environmental Altruism, Financial Constraints and Price Consciousness have significant impact on the segment memberships.
Preface

This thesis marks the end of my studies for the Master Innovation Management at Eindhoven University of Technology. I have gained very valuable insights and knowledge on Innovation Management context during the two years study period. I hope this report embodies the valuable outcomes of my educational and social experiences. This report has been executed with the help of many people and I would like to mention some of them and acknowledge their contribution and support.

I would like to thank my supervisors at Eindhoven University of Technology who provided me with their support and guidance throughout the project. Dr. Umut Konus gave me advice and support from the beginning of the project. I appreciate his suggestions and constructive feedbacks. I gained insightful technical knowledge and formed this research by his guidance. Also, it was really joyful to cooperate with him. Second, I would like to thank Dr. Hans Berends for his contributions to the structure of my thesis. I valued his comments and get important benefited from his experiences.

This research is formed with notable contribution of Dr. Fuat Egelioglu who helped me for the technical aspect of the questionnaire of this research. Also, Ins. Duriye Ozcelebi Dahlameroğlu provided her feedbacks for the format and language of this report. I appreciate for the time and energy that they spent on this report.

The questionnaire of this research was executed in N. Cyprus. I would like to give my grateful acknowledgment to my family and friends for their effort. My family has always supported me in my decisions and actions. Moreover this time, they worked very hard along with me to distribute and collect the questionnaires within a 10 day period. I could not manage to finish this early if they were not there to help me.

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1. Introduction

Business markets have become more competitive in these days than ever as a result of the recent economic downturn. Business conditions have been changing very fast and companies ought to put in their most efficient efforts to survive through the recession. For last decades customer is the rising star of the market. Besides customers are not blind consumers anymore. Eventually, their decisions are highly important and their expectations are enormously valuable for companies. Consequently, customer involvement to the new product development operations is highly expected and it is the key element for flourishing innovations (Hauser et al., 2006).

Crawford and Di Benedetto (2008) described NPD process as a funnel and integrated the customer component as a significant source of information. Authors indicated that companies should find and identify their target market first. Then they should involve this customer group(s) in to their NPD process to be able to increase their sales. Therefore, they should use customer segmentation methods and reveal the customer groups based on their customer expectations from their products. Customer involvement to the innovations respectively follow this way: customer data are collected and analyzed; then segments are formed according to desired variables; later on target segment(s) is selected to be focused on; finally marketing and new product development strategies are reconsidered under the facts like customer needs and expectations. As I said above, mass marketing era is over and every customer expects different benefits from products. A well conducted segmentation and targeting strategy enables firms to collect most relevant expected benefits in a basket thus companies could provide most appropriate solutions based on target market’s opinion.

Additionally, environmental concerns have brought various solutions for ongoing global crisis. As a result of this condition, green customer/market concept is emerging in the business market. People are looking for alternative solutions on processes that caused major damage to the earth. One of these solutions is renewable energy technologies (systems), which give the opportunity to produce clean energy from natural sources. Solar energy technologies are one of these solutions which are also utilized by individual users. Primarily, these green technologies were designed with industrial and governmental usage purposes. Later on, environmentally conscious people and organizations had demand green solutions for individual level. As a consequence of this need, producers took individual users into their customer base and develop innovative products for residential use. Recently, market of these systems has been rapidly growing but fast progress has brought in some obstacles as well. Rapid development of the market is a
clear evidence for innovative nature of renewable energy systems. New developments in these systems are notable examples of incremental innovation. In every new product, R&D teams have been improving the features and capabilities of these systems (DSM’s KhepriCoat™ and Philips’ Light Blossom). In order to keep this NPD speed constant, producer companies should consider needs and expectations of customers otherwise they would not survive in the market after a while. Currently, a few studies have been made on this topic and clearly those studies will not be sufficient for the further development of this market. Therefore, customer behavior should be investigated in order to understand rationale behind customer needs and respond to them. This research intend to fill this gap in the literature by delivering valid customer segments for individual solar energy system use in Northern Cyprus where the technology is completely new to the market.

This research focuses on N. Cyprus market which is a relatively small market for this industry. However, it is a relevant start point for measuring the awareness towards Renewable Energy Systems (RES) in countries where there is neither initial investment on RES infrastructure nor technologies. Furthermore, “sustainable house” is an emerging concept in European countries which have appropriately established renewable energy policies and schemas. Various studies have been made on sustainable house concept but most of these researchers focused on the technical aspects of the application. None of them has included customer component into their research therefore, this research intends to provide valid information about the customer expectations from these applications. More specifically, previous analysis about solar energy market, which is elaborated in the further parts, showed that residential (individual) use has the highest share in the solar energy market. Combining these two previous statements and its high solar irradiation potential, N. Cyprus is an appropriate candidate to conduct this research. By including customer aspect, result of this analysis would be a guideline for the further product development processes on solar technologies. Thus, developers would have a primary idea about customer behavior towards these products especially in virgin markets.
2. Literature Review

The general research is generated under the new product development topic. Interactions between marketing related variables (i.e. marketing activities, customer characteristics and attitudes etc.) and NPD are included in order to investigate customer involvement in the NPD process. More specifically, customer, which is one of the most important components of the marketing, is the main focus of this research. In connection with this, customer segmentation methods are investigated in order to evaluate the target customer group which could be exploited in NPD processes. Customer segmentation approaches are mostly implemented by considering the innovativeness of product. Main intention of this consideration is to properly observe attitudes and intentions of potential customers towards innovative product.

2.1. Innovation & New Product Development

This chapter includes brief explanation for importance of innovation in new product development operations and elaborated information on Crawford and Di Benedetto’s five phased NPD funnel.

2.1.1. Innovation in New Product Development

Luecke and Katz (2003) provided a well-suited definition of innovation from organizational perspective in their book:

“Innovation . . . is generally understood as the successful introduction of a new thing or method . . . Innovation is the embodiment, combination, or synthesis of knowledge in original, relevant, valued new products, processes, or services.”

In addition to this, Baregheh et al. (2009) carried out an analysis on the term “innovation” within the organizational structure. They defined innovation as a multi-stage process which provides opportunities for organizations to transform ideas into new products, service or processes in order to improve their assets and compete effectively in the marketplace. Innovation is naturally linked with creativity but they are not identical concepts. Innovation means working on creative ideas and converting them into specific and tangible products or services where innovation happens. Invention of a creative idea or an insight is not enough for an innovation to occur; the insight should be put into action to create a differentiated product or service for the increasing customer needs.

Customers’ life quality has been improving day by day as a result of lowered product prices and increased service quality which are natural outcomes of the innovation (Hauser et al., 2006). Not only
innovation has provided a better market for the customers but also it has created a bunch of opportunities for the companies in order to lower the production expenses. Therefore, companies with realistic objectives have already known that implementation of a solid innovation strategy is inevitable.

During the recent economical downturn, companies had transformed their strategies in order to keep up with the fast changes that happened in the market as a result of this crisis. Nowadays, innovation strategies play more important role than before, intelligently formed strategies are the key to survive through this unstable environment. For instance, in September 2008 when recent crisis began to hit companies, Jonathan Schwartz, who was President and CEO of Sun Microsystems prior to its acquisition by Oracle, indicated in his blog that innovation loves crises (Schwartz, 2008). He emphasized that crisis environment pushes companies to connect with customers and develop low cost solutions. Moreover, George Buckley (Hürriyet Daily News, 2008), CEO of 3M, stated that;

“The crisis caused an 11 percent drop in our sales in the last quarter of 2008 but I maintain confidence in our 106-year experience and 79,000 employees worldwide that enable us to create more than 50,000 innovative solutions”

Therefore, managers are obliged to make a decision between staying in the same level and changing the innovation strategy to a more aggressive one. Consequently, NPD performance of the companies has become an important indicator for the innovation strategies. New product sales have 40% share of the overall sales which mean companies aiming at sustainability should perform high success rates in new product launches (Langerak, 2008). Henard and Szymanski (2001) noted that, there is a number of different performance driver affecting the new product performance such as market potential, meeting customer needs, product advantage, etc. Every one of those drivers has various characteristics that affect the new product performance.

**2.1.2. New Product Development Process**

New product development process is divided into five phases by Crawford and Di Benedetto (2008) in their book of “New Products Management”. Those phases are; Opportunity Identification and Selection, Concept Generation, Concept/Project Evaluation, Development and Launch. Figure 1 depicts the phases briefly. There are decision points between each phase where go/ no go decisions are made according to results of the evaluation made at the end of previous phase. Each phase has tasks to accomplish and accuracy rate of the tasks determines the choice at the end of the phase. Each phase is defined as follows:
Phase 1: Opportunity Identification and Selection

New product strategies of companies are created according to main activities occurring in the company. These activities set the ground rules for possible opportunities. Companies have assigned people to identify new opportunities and this is the phase where those assigned people come up with opportunities for a new idea. During this phase, bunch of different ideas come through but only suitable ones are picked up for the later phases. Selection process includes such steps as research, evaluation, validation and ranking.

Phase 2: Concept Generation

This phase includes the transform of the opportunity into a tangible product concept. It is a hard task to accomplish; however it can be successfully managed if the NPD team focuses on problems of people or organizations. Thereby, they can come up with various product concepts as solutions for current problems and customer involvement in NPD starts from this point. Eventually, customer acceptance rate of the innovation determines the success level of that particular product. Therefore, understanding customer needs is the key element for a successful innovation (Hauser et al., 2006). At this point, NPD team tries to collect most available data on pre-defined problem from different sources. Customer has a crucial role in this phase however it is mandatory to realize the fact that quality of data is more important than the amount of data.

Phase 3: Concept/Project Evaluation

Concept/Project evaluation is the final phase before starting for the development task. This phase consists of two steps. First step includes the concept evaluation process which is conducted by applying concept tests on potential customers. New concepts are provided to customers in order to view the
reaction of the customer. Then all these customer reactions are collected in a basket and created the “full screen”. This method uses a scoring model to evaluate the new concept whether it will be developed or not. If new concept past this evaluation, it turns into a new project so next step is the project evaluation.

**Phase 4: Development**

This is the phase where ideas become solid products or intangible services with a set of resources and activities. Also marketing plan is primarily outlined in this phase. Then, specific details slowly added on to this outline. First, NPD team managers need to allocate the sources in the most effective way. Previously made plans might be different in the real business environment. The step that includes all these operations is called resource preparation (Crawford & Di Benedetto, 2008). Next step consists of the actual development processes; multiple operations are carried out simultaneously such as prototype creation, financial analysis and market scan. Later on those operations are evaluated during the development process and managers check if the product prototype meets the customer needs and profitable for the company as well. At last, product exists and customers like the trial versions; then some companies conduct a comprehensive business analysis to cover all the financial bases.

**Phase 5: Launch**

Launch process indicates the decision of starting to market the new product in a specified time. It is the last step before the product to be presented for general use of the customers. Marketing planners have the last opportunity to conduct analysis on product, market or both. In order to conduct these analysis accurately, they should follow the guidance of strategic launch planning.

Strategic launch planning provides two sets of strategic launch decisions for product commercialization. Strategic launch decisions consist of strategic platform decisions which define limitations, directions and strategic action decisions which clarify the target customer group and how to sell the product to the target group. Tactical launch decisions are made right after strategic launch decisions and include marketing mix such as promotion and communication, distribution and pricing. Those decisions define ways for implementing strategic launch decisions as well.

The launch part is the most risky part of the new product development process. It is also the most expensive part as a result of the previously given promises in production and marketing decisions. Despite the high risks, successful launch process means high new product performance. Therefore,
Managers should focus on the strategic objectives during the launch phase. Those decisions are hard to change and expectedly it is costly to renovate those decisions. Target market decisions are one of the important decision sets in launch strategy. Thereby, aim of our research and results of the further analysis connect with the NPD process at this phase. Our analysis investigates the presence of the customer segmentation and possible existence of the target segment. In further chapters, our findings are linked with the target market decisions and launch strategies.

**Link with the Market Analysis and Segmentation**

Target market selection is a crucial part of strategic launch decisions and eventually results of this selection affect the whole NPD process. A proper target market selection would bring significant advantage to the NPD team in terms of responding customer needs. Importance of this selection process is relatively higher in the new to the market products than others. Since customers have only limited knowledge about the new product it is hard to measure future actions of the customer towards the product. Also in the later phases, tactical launch decisions would suffer because of the wrong outcome coming from target market selection. Consequently, whole launch operation would fail and all previous efforts would turn into ashes. This research aimed to conduct a customer segmentation analysis in order to identify most suitable target market to prevent that kind of failure. Analysis are carried out in an undeveloped market, which is elaborately explained in the market chapter, wherefore competitors have not been present in the market yet. Naturally, this feature will have direct impact on strategic and tactical launch decisions. Therefore, findings of our study focused on the launch phase of the NPD and results of segment analysis would be used as a guideline during the identification of these strategic and tactical launch decisions. Figure 2 clearly describes the position of this research, since it aims to segment the market and select which segments to serve then deliver this information to the positioning phase.

![Segmentation-Targeting-Positioning](image)

Specifically, I aimed to clear the fuzzy environment and stimulate adoption rate of the new product. In order to accomplish that, I investigated the existence of customer segments. I intend to find one or more
segments which have members with high adoption potential for this new product. Those members could be first adopters of this new product. Then, I could propose relevant launch phase strategies based on expectations and member profiles of this target segment(s).

2.2. Customer Segmentation

This part of the research contains the general structure of the customer/market segmentation process. Customer segmentation refers to the process dividing the market into diverse customer groups who differs in terms of needs, wants and behavior or who might demand special products and services (Kotler, 1996). Each customer has different needs and expectations thus this feature makes every customer a potential market. Therefore, many companies aim to deliver solution packages that would respond to a broad range of customer. First, they start with classifying customers in order to create relevant solution packages. Then they develop profiles according to the defined segments. Later phase is market targeting where they measure the attractiveness of the segment and decide which segment to focus on. It is useful to mention some criteria that are needed to be considered for an effective segmentation process before moving into the topic. There are four characteristics that market segments should have in their structure (Kotler, 1996).

- **Measurability:** It is the degree to which size and purchasing power of defining segments can be measured.
- **Accessibility:** Customers in the segment should be reached by proper marketing communications in order to serve the right solutions.
- **Substantiality:** The segment must be large enough to warrant consideration.
- **Actionability:** The segments resulting after the analysis must match the marketing capabilities of the company.

2.2.1. Segmentation Approaches

Market segmentation cannot be limited within a single way thus a marketer should test various variables to segment the market. Major variables used in segmenting markets are geographic, demographic, psychographic and behavioral variables (Kotler, 1996).

**Geographic segmentation** divides the market into various geographical groups such as nations, states, cities or neighborhoods. Customer needs and wants are analyzed according to these geographical differences or similarities. Postcode segmentation, which has become very important in the past decade
and different climates are included into this topic as well (Kotler, 1996). Even climate changes show substantial effects on consuming habits of customers (Marcus, 1998).

**Demographic segmentation** includes the categories which are formed regarding variables such as age, gender, family size, income, occupation, education, religion, race and nationality. In addition to that social class of the customers mostly identifies their financial condition and consuming habits (Ailawadi, et al., 2001). These variables were the most popular base point for customer segmentation processes because they are easy to collect and measure (Baines, 2008). However, companies are moving toward other segmentation methods and use demographic variables as covariates for the segmentation processes.

**Psychographic segmentation** divides customers into various groups according to the lifestyle or personality characteristics. Demographic groups include people whom have different psychographic characteristics. Psychographic segmentation contains a perception of different customer characteristic values and impact of these characteristics on customer segment memberships (Baines, 2008). Ailawadi et al. (2001) created a model in order to observe the influence of psychographic and demographic variables on behavior of customers towards store brands and national brand promotions. Their findings revealed that psychographic characteristics have significant effects on customer behavior although demographic variables do not have direct impact on this behavior. Different psychographic characteristics are introduced as follows:

- **Lifestyle**

  Marketers have been using customer’s lifestyles to segment the market for a long time. Customers purchase products as a symbol of their lifestyle moreover they see it as a reflection of their life choices. Hedonic benefits and related psychographic characteristics such as innovativeness, variety seeking, mavenism and motivation to conform could be positioned under lifestyle segmentation (Ailawadi et al., 2001).

- **Personality**

  Personality should be considered seriously in segmentation strategies. Product attributes should match with the personality of the targeted customers (Kotler, 1996). In addition Whelan and Davies (2006) noted that traditional market segmentation methods that are established on demographic variables had provide disconnected results in differentiating between customers who prefer to buy own brand products and customers who prefer national brands. Thus, they focused on human personality and established their research on the Big Five dimensions. The Big Five dimensions are personality
dimensions which are commonly labeled as Agreeableness, Extroversion, Openness to Experience, Conscientiousness and Neuroticism.

Furthermore, innovativeness of customer is a highly considerable personality characteristic. Various studies have investigated the relationship between innovativeness of customer and diffusion of innovations from different perspectives (Im, Bayus, & Mason, 2003). Goldsmith and Hofacker (1991) carried out a research consists of six studies which aimed to evaluate customer innovativeness within a specific domain of interest known by the customer. Konus et al. (2008) used innovativeness characteristic as variable to segment different customer groups.

**Behavioral segmentation** calls for dividing the customers into groups regard on their knowledge, attitudes, uses or responses to the product. Behavioral variable seem as a good starting point for creating customer segments (Bhatnagar & Ghose, 2004; Bult & Wansbeek, 1995). As a result of this importance of behavioral segments, further part includes elaborate information about behavioral variables. Different behavioral characteristics are introduced as follows:

- **Usage Rate**
  There is a common-sense that customers’ transaction reports can be used as important source for revealing customers’ behavioral patterns (Bose & Chen, 2010). As a result of high internet use rate among customers; the rapid improvement of e-business has delivered customers’ browsing and purchasing data in order to analyze customer behavior (Bhatnagar & Ghose, 2004). Especially, Recency, Frequency and Monetary (RFM) variables are most widely exploited behavioral data in marketing research (Bult & Wansbeek, 1995).

- **User Status**
  Some markets divide into customer segments into five mains users as nonusers, ex-users, potential users, first-time users and regular users of product. Company strategies are formed regarding the potential values of the customer segments. Each segment seeks for different expectation from product; therefore, a company needs to identify the values of these segments and provide solutions according to those results (Liu & Shih, 2005).

- **Loyalty Status**
  Bunch of companies intend to segment their customers according to their loyalty level towards their product(s). In order to do that, they use loyalty schemes to determine which customers are loyal and profitable for company. Markey et al. (2007) referred the most loyal customer group as “Design Target”.
Design Target is not a segment to identify; it is the epicenter of a segment whose members would gain the most benefit from the product of the company.

- **Benefits Sought**

Benefit segmentation is one of the powerful forms of segmentation which groups customers according to distinct expected benefits of customers from product (Kotler, 1996). This approach lays in the idea that company should deliver customers up exactly what they demanded. Customer benefits that they derive from the product should be focal point in this approach. Some of these benefits might look irrational but company should base its research on these not on how the company designed the product.

There are a number of examples in the market for this approach. An example for this approach is from electronic technology adoption and use; mobile phones. For instance, expected benefits from mobile phones differ amongst different socio-economic customer groups (Baines, 2008). Blue-collar trade workers seek the benefits of convenience, accessibility and handset durability; teenagers want novel games, ringtones and the latest trends in handset design; white-collar workers seek multi-functionality such as device acting like a mobile, an organizer and a storage device.

- **Attitudes towards Product**

Each customer has different stage of readiness to own a product. Some people might not hear anything about product; some of them are interested and naturally some want the product and intend to buy it. Moreover, customer attitude towards product is changeable; some people can be enthusiastic and positive whether others can be negative or hostile to the product. These kinds of perceptions are result of the previous experiences and personality of the customer. Customer characteristics directly affect the relationship between customers and launched products (Kotler, 1996). There are certain motives that directly affect attitudes of customer especially towards new products. Eventually, influence of fashion trends are another motive for customer decisions. Many people intend to catch up the most popular and latest fashion trends to keep up with life style of their community (Trueman & Jobber, 1995).

Konus et al. (2008) conducted a research to segment customer attitudes toward multi shopping channels as a substitute for their browsing and buying activities. In order to do that, authors created a model which uses beneficial variables for segmenting customers. Meanwhile it includes psychographic and demographic covariates to investigate customer behavior towards multichannel shopping.

- **Environmentally Consciousness**

Green consuming is an emerging concept in the market as a result of rising environmental consciousness level. Consequently, more environmental friendly products have been launched to the market. For
example, in durable goods industry companies significantly emphasize their products environmental friendly features by putting labels that indicate the energy consumption level of that particular product (D’Souza, 2004). As a result of incidents, researchers have become more interested in this green customer concept and new studies carried out to reveal the behavior of these people.

Study of Mostafa (2009) intended to analyze customers whether their consuming decisions are affected by changing environmental facts or not. Author defined six factors that affect green customer behavior based on previous literature such as environmental concern, environmental knowledge, altruistic values, environmental attitudes, intention and skepticism towards environmental claims. Context of this paper is severely important for this research. It focused on Green Consumer concept and delivered these people’s purchasing behavior based on psychographic environmentally consciousness variables.

2.2.2. Methods of Market Segmentation

Kotler (1996) defined the market segmentation as a five staged research-based process. In reality, researchers do not always follow up these steps. For instance, qualitative methods are not a common used method as Kotler describes. Moreover, Kotler delivered two separate topics to discuss quantitative methods and data analysis which seems to be redundant. Therefore, I made some comments additional to statements of Kotler and combine some of these stages into one topic.

*Qualitative Methods*

Exploratory research techniques are used in order to find the motivations, attitudes and behavior of customers. These techniques help researcher to identify customers’ view towards both their and competitive products. Researcher could easily define the competition while customers presented their broad view about similar products (Kotler, 1996). This is a rarely used method and commonly not used if there is sufficient amount of information on the customer behavior on the market.

*Quantitative Methods*

Quantitative research identifies the dimensions of the market by gathering data through mail or personal interviews from customer. The sample size should be determined according to the desired accuracy level, statistical techniques to be used and number of segments. Structure of questionnaires is mostly formed in order to measure; attributes and their importance ratings, brand awareness, product-usage patterns, attitude towards product category and demographics.

Data collection method depends on the type of the analysis to be used. Most common processes are *factor analysis* to clean data set form highly correlated variables then *cluster analysis* to define the
segments. *Automatic Interaction Detection (AID) and conjoint analysis* are other popular techniques used by practitioners in market segmentation processes. More detailed information will be given below regarding these techniques.

- **Automatic interaction detection**
  Automatic Interaction Detection (AID) is a type of decision tree technique which breaks down a market regarding to a bunch of a priori criteria, taking one by one. AID focuses on discriminating variables and analyzes these variables one at a time in order to clarify which has highest effect on the dependent variable (Kinnear & Taylor, 1971). After clarifying the most effective discriminating variables AID splits the customers according to these findings. Then it looks for the second most effective variables and splits the new segments according to these new variables. Later on, this process keeps going until there are too few people in each segment.

- **Factor analysis**
  Factor analysis is generally used in association with cluster analysis. It determines correlated variables and trims down their cumulative effect (Stewart, 1981). Most of the researchers collect psychographic data which are usually inter-correlated. Factor analysis could match all these inter-correlated data into a single factor. Therefore, computational effort in clustering would be reduced and biased results within bunch of correlated variables would be prevented as well.

- **Conjoint analysis**
  Customers assign different values for each feature of a product or service. Conjoint analysis provides opportunity to measure these assigned weights for each element or feature. The aim of conjoint analysis is to determine the most influential attribute combination for a product. Attributes that are picked for this combination are selected based on the customer responses and choices through various product tests. As a result of conjoint analysis, producers could trade-off some features according to customer desires (Wittink, Vriens, & Burhenne, 1994).

- **Cluster analysis**
  Cluster analysis is a class of statistical techniques that can be utilized to data that show evidence of “natural” groupings. Wedel and Kamakura (2000) described the cluster analysis as a method to categorize units (individuals, animals, objects etc.) into homogenous groups based on the observed characteristics of units. Authors indicated that instead of focusing on the variables for a large number of objects, it is easier to work on variables that are limited within homogenous groups. As a result of this characteristic, cluster analysis is mostly seen as exploratory data analysis method since it has intended to more to generating hypothesis instead of testing them.
Cluster analysis starts with individuals and implements them into customer groups (Kotler, 1996). The measures of the cluster analysis can be beneficial, demographic and psychographic or a mix of these segmentations. Cluster analysis studies all discriminating variables at once. Primarily, cluster analysis looks at the set of individuals and tries to determine similar couples. Then it combines the most alike pairs into a cluster. After forming that cluster, it checks for other similar pairs in order to add them to this cluster. This process continues in the same way for the other clusters until measurements show no similarity between combined individuals or clusters. Companies have been conducting customer clustering analysis to classify customers into various groups in order to differentiate customers so that they could apply specialized pricing and branding policies for different customers’ needs (Marcus, 1998). Generally, clustering methods that are used in marketing field are gathered under two topics such as hierarchical clustering and partitional clustering.

Hierarchy clustering forms a hierarchy of clusters which are embodied in a tree structure called a dendrogram. The root of the tree contains a single cluster consists of all observations/responses and leaves represents individual observations. Single linkage clustering and conceptual clustering are examples for hierarchy clustering.

Two most popular partitional clustering algorithms are k-means clustering and fuzzy c-means clustering. The k-means clustering aims to partition $n$ observations into $k$ clusters in which each observation belongs to the cluster with the nearest mean. This method intends to define the centers of natural clusters in order to assign each point to cluster whose center is nearest.

As an example and application for fuzzy c-means algorithm, Romdhane et al. (2010) developed a three stepped approach for customer segmentation. They used a Fuzzy Clustering Algorithm method to cluster data and dig out “natural” groups of customer.

I used another technique; Latent Class clustering which is significantly different from other clustering methods since LC clustering is a model based approach (Magidson & Vermunt, 2002). LC clustering assumes that a mixture of underlying constructs in model generates the data. Since this method is employed in this research, more detailed explanation for this method is given in the methodology chapter.

**Method Selection**

The detailed explanation for LCA use is provided under methodology part. Moreover, I would like to indicate main reasons for not selecting other quantitative methods. AID is mostly used in direct
marketing and intends to reveal connection between dependent variables (Kotler, 1996). Thus, it is not relevant for this research. Conjoint analysis is generally employed in concept design phase of the product development processes. This method segments customers according to perceptions of customers towards each attribute of specific product. Conjoint analysis aims to show relationship between product functionalities and customer preferences (Srinivasan, 1988). Therefore, this method is not appropriate for this research, since this research is trying to segment customers based on their buying intentions and expectations from product. The focal point of this research is expected benefits from outcomes of product instead of a specific product attribute.

**Validation**

Validation is an important process to check the relevancy and consistency of the collected data (Kotler, 1996). Factor analysis results can be used to identify the irrelevant and unreliable components and remove them from the data set. Moreover, reliability test such as Cronbach’s alpha is a trustful statistic in order to examine the data that will be used in segmentation. Removing the unreliable variables from the construct model aims to increase the robustness level of the optimum model solution. Cross-validation is a method to test the relevance of the structure of clusters. Cross-validation validates a cluster solution by creating two sub-samples and then comparing these two sub-set’s number of clusters and cluster profiles (Hair, et al., 2010).

Other method for validation is establishing criterion based on the data from previous studies. Thus, validity of segments can be measured by examining different variables from a theoretically parallel segmentation study and checking similarities between two model’s segment profiles (Kotler, 1996). In addition to that, generalizability studies constructed on the same logic since they investigate the relationship between an observed score and a universe score (Matt, 2003).

**Labeling**

Each cluster is profiled to illustrate its dominating attitudes, behavior and demographics. Generally, clusters are assigned by a name which describes content of the cluster. Last part of the segmentation is labeling segments according to the most significant attributes of each segment. Therefore, people who would see the name of segment should perceive the profile of that customer group. Labeling is an important practical step for clustering operations since it reveals the characteristics of the particular segment and makes it easier to identify and locate that segment (Hair et al., 2010).
2.3. Creating Unique Value for the Chosen Market

Previous part provided different methods of customer segmentation for the target market decision process. Next step after selecting the target market is product positioning. This research is not going to give detailed definition of the positioning since it is a completely huge topic to discuss. Generally, product positioning determines the competitive advantage of the product against the other products that are offered to the same target group at the same time (Crawford & Di Benedetto, 2008). Hultink et al. (2000) highlighted the importance of the growth markets and noted that recent new product success stories share the same strategy for placing the product into these markets. Positioning strategies should be seen as main part of the launch strategy decisions and marketing mix elements should be consistent with the positioning strategies (Crawford and Di Benedetto, 2008). After segmenting the market, it is important to position the product according to the expectations of segments. Each segment has different expected benefits; if I depict these segments in a plot, they would locate separately as a result of different expectations. Companies should identify the optimum location to position their product according to the segment profiles (Hultink et al., 2000). They could choose to focus on only one customer group and determine the marketing mix decisions based on the demands of the target customer segment. Otherwise, they could pay more attention to the expectations of other segments and adjust their price and promotion level accordingly.

After targeting the market segment and creating the statement for the product positioning, it is time to look back to the product and improve the value of it regarding the chosen target market. Hereby, role of the customer comes forward in this value creation phase. Especially in new products, customer profiles are fuzzy in the beginning as a result of this fuzziness; companies have troubles to match attributes of new products with customer needs. Target customer segment become more important in these conditions since it will determine the future performance of the new product. Customer segmentation methods can deliver the most profitable customer group to target for the new product. Additionally, needs of those group members are also revealed themselves in the customer segmentation processes. Primarily, company should answer needs of customers in the target group. In order to accomplish that, NPD managers should reconsider the features of the product regarding to the needs of these target customers. This is the point where customer needs intercept with the new product development process. Pre-launch or post launch improvements on the product will be formed parallel to the data gathered from customer analysis. Importance of the customer data can be clearly observed in this interception point.
2.4. Gap in the Literature

Market segmentation literature includes a large number of studies (Jiang & Tuzhilin, 2006; Janga, Morrisona, & O’Leary, 2002) that based on demographic and behavioral variables. Recent studies have used psychographic characteristics as segmentation variables in order to determine segment memberships. There are a few studies (Ailawadi et al., 2001; Konus et al., 2008) that simultaneously investigate customer purchase intention and psychographic characteristics. Therefore I constructed this study on a multi-criteria approach. I carried out a market analysis and customer segmentation that involves not only usage intentions of customers but also psychographic and environmentally consciousness characteristics. I intended to segment customers by using indicators such as expected benefits of customers and attitudes towards product. Moreover, I implemented psychographic, environmentally consciousness and demographic variables as covariates. Thus this model has become in line with the multi-criteria approach.

Master thesis of Nijenmanting and Senel (2010) delivered a comprehensive analysis on design and feasibility of sustainable house usage for the Netherlands. One of their future recommendations was investigating the behavior of customer towards sustainable houses since user influence is high on the performance of the sustainable house. I expected that knowledgeable customers would gain more benefit from these applications since they would follow the necessary steps for efficient energy use. Specifically, potential customers of residential PV systems are expected to have a broad environmentally consciousness to follow same steps. Wherefore, high consciousness level brings some specific needs like concerns on the environmental friendliness levels of the product. These needs should be deeply considered during product development operations. Moreover, residential PV systems have been in the market for a short time especially in this case they have not been launched yet. Therefore, potential customers of a new to the market products are likely to have specific psychographic characteristic such as innovativeness and entrepreneurship.

In conclusion, this research aimed to investigate either or not there are customer segments in emerging residential PV system market on the basis of customer intentions and attitudes towards these systems. Additionally, I implemented items concerning psychographic, environmentally consciousness and demographic characteristics of customers. I identified these construct characteristics in order to investigate either or not they have effect on segment memberships. Considering special conditions of this case, I tried to be precise during item selection procedure and sought to pick the most relevant items for both indicator and covariate constructs. At the end, I expected to get clearly differentiated
segments basis on the purchase intention of customers. Moreover, I aimed to reveal viable relationship between segment memberships and construct environmentally consciousness with psychographic characteristics. Thus, I could provide substantial findings to the customer segmentation and residential PV systems literature.

Next chapter of this research includes an overview of product features and market conditions of residential PV systems. Then I presented the research organization and objective of this research. Later, I explained the customer segmentation analysis method and data collection operations. After that, results of the analysis and discussions regarding these results are provided.
3. Product and Market analysis for Residential PV Applications

This chapter consists of technical and economical features of solar energy systems and their use in various countries. Moreover, current condition of the Northern Cyprus renewable energy market is included in this chapter and it is deeply elaborated.

3.1. Photovoltaic (PV) Technology

Renewable energy use has been a hot topic for recent years in search for new ways to produce electricity. Since fossil fuel prices and greenhouse gases are ascending, concerns about global climate changes are climbing. Therefore, development of renewable energy technologies is seen as potential solution for environmental concerns and increasing energy demand as well. European Union countries have encouraging the investments for improving renewable energy technologies. EU leaders put a compulsory objective of 20% share for renewable energy sources in energy market by 2020. Solar photovoltaic (PV) technology is one of such solutions for these increasing needs (EC, 2005). PV provides various opportunities to balance the demand and the supply of electricity by producing electricity during the day time when the demand and prices are both higher.

PV technology has particular advantages compared to other electricity generating technologies such as;

- Low maintenance cost and long operation period.
- PV promotion programs have been already positioned in electrification plans of many countries.
- PV technologies are useful where there is no national grid
- Solar cells are also totally silent and non-polluting
- There is no need for people to remote the system

There will be some country examples of PV technology use and market condition in further chapter. Before that, I would like to present a general description of PV panels with its technical features.

Figure 3 Photovoltaic panel
“A solar panel (photovoltaic module or photovoltaic panel) is a packaged interconnected assembly of solar cells, also known as photovoltaic cells (Figure 3). Solar panels use light energy (photons) from the sun to generate electricity through the photovoltaic effect. The structural (load carrying) member of a module can either be the top layer (superstrate) or the back layer (substrate). The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications.”

A single solar panel has a limited capacity to produce power thus many installations are a combination of several panels. This is known as photovoltaic array. Recyclable materials are used in the production of PV panels and each panel has 36/40 PV cells and each array has generally 10 modules. A wide range of semiconductor materials (crystalline silicon, polycrystalline thin films and single-crystalline thin films) can be used in production process of PV cells (Figure 4).

![Solar Electricity Diagram](image)

**Figure 4 PV technologies (Raugei & Frankl, 2009)**

PV cells convert solar radiation into electricity through their half-conductors so each cell converts about one-sixth of sunlight it absorbs into electricity which means efficiency of around 15%. Amount of the converted electricity depends on the size of the panels, having bigger panels means more electricity in less time. The installation costs are considerably high however investment turns over pays off after a few years use of product and huge amount of energy is saved as well. Moreover, it has no moving parts and maintenance operations consumes little time and money.

As it is mentioned before, these systems can be applied both in commercial and residential use. This study specifically focuses on the residential applications therefore, two solutions for home use of these systems are provided in the next page.
The Grid-connected System

The grid-connected system operates with main electricity grid. The connection with national grid works for two ways such as; when the PV system is not able to meet the energy requirement of the house, needed amount is received from main grid. Furthermore, when there is an excess amount of electricity, on-grid system feeds this amount to main grid.

The Stand-alone System

The stand-alone system is an independent design which operates independently from the main electric grid. It is mostly implemented to the houses in order to supply certain DC and/or AC for particular electrical appliances. It is generally installed areas where it is difficult to use another source of power supply and places with inexistent electricity network.

The grid-connected system has an advantage over the stand-alone system in particular situations. Since the stand-alone system needs batteries to charge the electricity and distribute it when needed, cost of batteries raise the investment amount and make it less attractive. However, it is inevitable to use the stand-alone system if there is neither main grid connection nor smart meter that manages the electricity transfer between house and main grid. In this case, this research focused on the grid-connected system since Northern Cyprus has designed EU funded smart meter technology integration plan for every resident in immediate future. Another reason for selecting the grid connected system is substantial results of the European Photovoltaic Industry Association (EPIA, 2008) report regarding feed-in-tariff arguments. EPIA report delivered comparison analysis of different support mechanisms for PV systems and feed-in-tariff mechanism received the highest scores from all five evaluation factors (Appendix 1).
3.2. PV Production Market

PV production market had a breakthrough in the 1980s after multi-megawatt PV plants emerged for power generation. Since then, PV market grows in a rapid way and the present market growth rate is around 30-40%. Major market segments of PV applications are consumer applications, remote industrial systems, developing systems and grid-connected systems. Residential grid-connected applications dominated almost the half of the PV market (Razykov et al., 2011).

Figure 7 Evolution of world PV cell/module production through 2009 (Razykov et al., 2011)

PV applications are diffusing to various markets especially in the United States, Japan, and the European Union and China. World total PV production for 2009 was 10.66 GW (Figure 7). The annual production of PV cells and modules in 2009 was 595MW (Mega Watt) in the USA, 1.5 GW (Giga Watt) in Japan, 1.93 GW in the European Union (mostly Germany) and 5.19 GW in China. Even more, the current trend shows that growth in PV use will evolve into higher levels. Raugei and Frankl (2009) stated that twofold increases in production come with a 20% cost decreases each time. If this ascending curve continues, PV production could compete with peak generation between 2010 and 2020 with preset subsidies. Then, Incentive policies could be eliminated when PV technology reaches to mature level (Clastres et al., 2010).

As mentioned above, grid-connected residential systems are holding more than 40% share of the market. Razykov et al. (2011) provided the price range for the PV module and system for residential applications in US. Module and system prices are in the range of US$ 3.0-4.5/Wp and US$ 5-7/Wp respectively. Since Northern Cyprus is the research field, it is favorable to focus on European PV market and especially applications in the Mediterranean. Therefore, next part contains information about PV diffusion rate, market conditions and price ranges for particular countries.
3.3. PV Applications in Europe

Research activities related to PV system are supported by European and national programs in European Union. PV research programs in Europe emerged in the late eighties or early nineties at most. These research activities are now managed in two different ways:

- Most of the member states are included PV in a sub-program of a larger renewable energy program. Naturally, share of PV technologies in renewable energy programs is differentiating across Member States.
- Other remaining Member states have positioned PV researches into the core of their technology development programs.

PV researches in national level are generally run coordinated by governmental institutions. Many of these activities are co-financed by the EU based on the Framework Program which has slight research and development coordination at European level (EC, 2005).

In order to get more detailed information, particular countries, which lead the European market, will be investigated. PV installation data in European Union for 2009 is represented in the Appendix 2. That figure includes cumulative PV installation capacity at the end of 2009 as well.

3.3.1. Germany

Germany is the market leader of PV applications in Europe. Not only they lead the European PV market, but also have a significant share in the world market (Bhandari & Stadler, 2009). Eurobserv’er Photovoltaic Barometer (April, 2010) noted that Germany has kept its world solar electricity producing leadership position with production of 6.2 TWh (Terawatt hour) with a 40% annual increase according to the BMU (German Environment Ministry). Apparently, Germany has the most complex and well established feed-in-tariff policy across European countries (Appendix 3). However, government aims to cut the feed-in-tariff rates by 15% as an outcome of the big leap in 2009. It is still in proposal level but already caused a lot of inconvenience between industry and government.

3.3.2. Spain

Spain was the world leader in 2008 with 2600 MW installed PV systems but they had a downturn in 2009 with 69 MW installations. Economic slowdown also affected the electricity demand and eventually this caused overcapacities in PV power generation in Spain. Although Spain has high sun irradiation and PV potential, government ought to cut some of the opportunities for PV and other renewable energy
sources as well. This reduction is expected to limit the future investments in the PV market (De la Hoz et al., 2010).

3.3.3. Italy

After Germany and Spain, Italy is the third EU country to pass the 1000 MW installed mark. Not only high sun radiation, but also Italy provides a very attractive support scheme, mixing net-metering and a well segmented feed-in-tariff. Italy had a good year in 2009 and mostly it is because of the full implementation of its “Nuovo Conto Energia” incentive program which authenticates a feed-in-tariff system for capacity capped at 1200MW (Eurobserv’er, 2010).

3.3.4. Greece

Greece has a tremendously high potential for PV applications due to having highest insolation among Europe all year round. Moreover, islands are covering their electricity need by diesel/heavy oil generation units thus they suffer from high operation costs and problems such as pollution. In addition, tourism season brings a 100% increase in electricity demand during summer consequently energy demand and PV power generation become correlated for each season (Tsoutsos et al., 2004). As a result of very good irradiation, Greece obtains substantial amounts from one of the most encouraging feed-in-tariff across Europe which provides more than 3.5 GW of PV projects in the pipeline.

3.4. Cyprus

Cyprus has been separated into two since the war in July 1974. In current situation there are two parts; south part as known as Republic of Cyprus, which is a member of European Union, is the legal government recognized by all international institutions. On the other hand Northern part, which is under the control of Turkish government, is named as Turkish Republic of Northern Cyprus.

<table>
<thead>
<tr>
<th>Table 1 Comparison for two parts of Cyprus</th>
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<tr>
<td><strong>Republic of Cyprus</strong></td>
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</table>
| Economy | • Prosperous and diversified economy  
• Base for several offshore businesses  
• Well developed tourism sector |
| | • Free-market basis  
• Handicapped by the lack of private and public investment  
• High freight costs and shortages of skilled labor. |
| RSE Laws | • Enacted in line with EU legislations |
| | • A draft had been prepared but not enacted yet |
| PV Adoption | • Installations started from 2006  
• Feed-in-tariff policy exist  
• PV panel production facilities exist |
| | • No feed-in-tariff policy  
• A few individual installation |
This research is conducted in the northern part of the island and it will be referred as “Northern Cyprus” in this study. After the separation, two parts have followed different paths in economical and technological issues. A brief comparison of two parts is given in the Table 1.

### 3.4.1. Republic of Cyprus

Republic of Cyprus is a European Union member state since 2004. As a member state, Cyprus enacted all the laws and legislations about Renewable Energy Sources (RES) coordinated with EU units. Cyprus is almost completely dependent on the imported fossil fuels for energy production. Almost 90% of the individual houses are equipped with solar heating systems which is making Cyprus as the leader country in the world with installed solar heating systems per habitant. RES technologies are determined as a potential solution to meet the increased energy demand. In particular, Cyprus has one of the highest solar irradiation rates in Europe. The country has sunny weather more than 300 days of the year and has an annual radiation around 2000kWh/m². The high solar resource of island definitely advises the use of PV technologies which have major potential as alternative energy source (Makrides et al., 2010).

Number of PV systems installed in Cyprus had not reached the expected level and a total of 1290kW distributed PV systems has been implemented until October 2007. Then, an obvious jump has occurred since 2008. Photovoltaic barometer of EPIA provided PV installed capacity numbers for years 2008 and 2009. Numbers reveal the incremental progress in the installed PV capacities during recent years.

<table>
<thead>
<tr>
<th>Table 2 Photovoltaic capacity installed in Cyprus during 2008 and 2009* (in MW).</th>
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<tr>
<td>2008 On-Grid</td>
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<td>Cyprus</td>
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I provided the table of different options of feed-in-tariffs and subsidies for grid-connected systems which are formed by RES National Fund for RES promotion purpose (Appendix 3). Generally, utilization of PV technologies in Cyprus holds a benefit such as ability to provide power to meet peak demand of electricity. This advantage of PV technologies overtops other RES technologies especially it generates max electricity in the summer period when maximum electricity demand reaches peak values as a result of air-condition use in hot summer months of Cyprus.

### 3.4.2. Northern Cyprus

Only similarity between northern and southern part is their geographic position and natural resources. Economical and technological comparison was briefly represented in the Table 1. N. Cyprus is dependent on imported oil and petroleum products to generate electricity as well. Cyprus Turkish Electricity
Authority (KIB-TEK), which is a public institution, is responsible for the generation, distribution and selling electricity to all sectors. Currently, the company is using oil fired steam power plants which normally use an expensive diesel fuel to operate. Due to financial concerns plants are using cheap fuel oil no.6 to generate power. High sulfur rates in this product make it hazardous for the environment; however, it is not an obstacle in the Northern Cyprus since there are no strict laws and legislations to prevent use of environmentally dangerous materials (Ilkan et al, 2005). Total generation capacity of KIB-TEK is 362.5 MW according to their annual report in 2007. This capacity is not sufficient for current energy demand and demand is increasing due to the raise in the population. Ilkan et al. (2005) represented the annual energy consumption rates in the Figure 8.

![Figure 8 Actual and projected annual energy consumption (Ilkan et al., 2005)](image)

Condition of energy market clearly shows a need for alternative energy generation technologies. Electricity price in N. Cyprus is considerably high as 0.20€/Wh while it is 0.15€/Wh is in the southern part. Last decade, authorities had realized this need and they have conducted noteworthy researches and projects regarding the use of renewable energy sources in N. Cyprus. PV technologies are most suitable and feasible systems among other renewable energy systems. However, there are very little cases where small off-grid PV system installed for residential use. Since, there is no such feed-in-tariff policy in N. Cyprus and metering technology does not allow to fed the main grid, all systems are stand alone. KIB-TEK; however, intends to change all the electrical meters and implement smart meters in every house. By doing so, electricity consumption and demand values could be measured more consistently and production plans could be formed according to these values. To sum up, installed PV capacity in N. Cyprus is negligibly low and under these economical conditions it is not recommended to install PV system to houses as a result of existing primitive technology and high installation costs.
4. Customer Segmentation on Residential PV use in N. Cyprus

This chapter focuses on the general overview of the research field and I also presented main research questions and sub-questions of this study respectively.

4.1. Overview of the Research

Main aim of this research is analyzing potential customer base and defining a target customer segment which can be the first adopters of these systems during the adoption and diffusion process of residential PV applications in N. Cyprus. In order to achieve that goal, Latent Class Cluster Analysis is conducted to segment customers by using behavioral, attitudinal, psychographic, environmentally consciousness and demographic variables. Details of Latent Class Clustering are elaborated under methodology part.

Despite the unfavorable conditions presented above, Cyprus dispute is still a hot topic in United Nation calendar. In addition, European Union has been funding individual and commercial installations of RES based energy generation systems in N. Cyprus although northern part is not an EU member yet.

As it mentioned before irradiation rate of the island prove that most valid RES system is PV technology. Republic of Cyprus has already adapted the EU laws regarding RES and PV. N. Cyprus is not able to follow this progress nevertheless; these conditions are not going to stand still in further years. Current position of N. Cyprus PV market could be seen as an opportunity for future investments. The southern part already has an open energy market with high competition but the northern part is a virgin market for PV technologies.

Therefore, this research aims to analyze current condition of the N. Cyprus PV market by utilizing customer segmentation analysis on residential units. Electricity coming from main grid is too expensive and keeps increasing due to the oil prices. Residential units almost occupied the half of the energy consumption in N. Cyprus and latest RES technologies started to focus on more environmental friendly houses. In the N. Cyprus, 71.45% of the dwellings have a solar thermal heating system installed according to State Planning Organization (DPÖ). This technology might not be the same with PV systems but at least it gives an idea to people how to convert solar radiation to energy and create a little awareness towards PV systems.

Finally, this research is established on a conditional assumption. Current socio-economical conditions of N. Cyprus is ignored in this study and it based on assumptions; first, renewable energy laws will be enacted and EU legislations will be followed in N. Cyprus and second, smart meter technology will be
integrated to the houses. Otherwise, installation costs are too high for current conditions. To sum up, this project is a forecasting study based on possible optimistic PV market scenario for future market entries and investments.

4.2. Research Questions

The aim of this research is to have a better understanding of the potential adopters of residential PV systems in N. Cyprus by segmenting them on the basis of their purchase intention and attitude towards these systems. Results of this research could help the targeting and product positioning decisions of companies. Besides, customer expectations, which are supposedly in line with customer characteristics, could be used in product development process of companies. Therefore the two main research questions of this research are:

- Do customer segments exist based on the purchasing intentions and attitude of customers towards residential PV systems in N. Cyprus market?
- What are the factors that are correlated with the segment membership concerning residential PV systems in N. Cyprus market?

Additional to these main research questions, the following additional sub questions should be considered in this research:

- What are the factors that are correlated with the purchase intention and segment membership?
  - What are the behavioral factors that are correlated with purchase intention and segment membership?
  - What are the psychographic factors that are correlated on purchase intention and segment membership?
- What are the factors that are correlated with the negative intention to purchase and customer segment membership?
  - What are the effects of behavioral factors on negative intention to purchase and customer segment membership?
  - What are the effects of psychographic factors on negative intention to purchase and customer segment membership?
5. Methodology

This chapter presents all the steps that are taken in order to conduct analysis. First, I described data collection method and construction of the questionnaire. Then, I delivered the reasons of Latent Class Analysis use. Last, I provided information on variable selection and integration to the model.

5.1. Data Collection

PV technology for residential use is a new concept for Northern Cyprus market. There are a few installations at very low capacity. Since previous preference data does not exist for this case, I cannot use the actual customer behavior and previous preferences. Therefore, I used questionnaire method as data collection instrument in this research. Questionnaires are among commonly used techniques to gather data from customers. Mullins (2007) presented some advantages of questionnaires over some other types of surveys; first they are cheap. Second comparing with the verbal or telephone surveys, they do not require that much effort from the questioner. Last, they often have standardized answers that make it simple to evaluate.

The questionnaire of this research is constructed by considering participant profile. All of the questions are close ended and includes various types of close ended questions such as Yes/No questions, multiple choice and scaled questions. A five level Likert Scale is used in construction of scaled questions in order to obtain higher mean scores.

Structure of the questionnaire follows this way: Introduction of the questionnaire contains a brief explanation of future of N. Cyprus PV market assumption that forms the basis of this research. First part consists of questions about residential status of respondent. Second part includes questions related with product feature, specifications and customer attitudes toward product. A short description on the investment return rate and average cost values are presented in this part. Simple payback method is utilized in order to calculate these values. It is assumed that 2.5kWh grid connected residential PV system with a 13.75kWh/day (daily average sun irradiation = 5.5 hours) average energy capacity is installed. The average PV system price in Europe is changing between 0.30€/W and 0.40€/W thus average installation cost is between the range of 7500€ (2500W*0.30€/W)-10000€ (2500W*0.40€/W).

PV production costs have been continuously declining for recent years and this research is a forecasting analysis for the near future when PV system prices will be even lower than now. Therefore, average installation cost for a residential PV system in N. Cyprus is defined as 8000€. Moreover, investment return rate is calculated under the assumption that electricity provider organization (private or national)
would provide feed-in-tariff opportunity. Assumption also includes that the electrical energy generated by the PV system is purchased at a price of 0.25 €/kWh. According to these values investment return rate is calculated as following $8000€ / (13.75kWh/day * 365 day) * 0.25 €/kWh ≈ 6.4$ years. Investment return rate of 6.4 years is rounded down to 6 years as it included into the questionnaire with emphasis that value is an average rate for investment return.

Next part, I designed all questions in a five level Likert scale and aimed to measure the psychographic characteristic of the participant. I also formed the following part with a five level Likert scaled questions which aimed to reveal the environmental consciousness level of the participant. Last part contains demographic information related questions. Final version of the questionnaire is presented in the Appendix 4.

5.2. Sampling

Scope of the problem consists of all house owners, tenants and people whose house is still in construction period. Participants of this research are limited within the residents living across the N. Cyprus. In addition, I expected all of the participants to be financially self-sufficient and to be influential in economical decisions of their house. I employed a question (A3) to the questionnaire in order to cross-check whether participant is a decision-maker or not. Then, I dropped the cases which gave negative response to this question.

I used a non-probability method; Purposive Sampling to select the participants. Purposive sampling is used when there is a purpose in the mind of researcher (Nonprobability Sampling, 2006). In this case, I have specific predefined groups that I was seeking to distribute questionnaires and conduct analysis. Van Ryzin (1995) noted that purposive sampling method could be used in cluster analysis since results of cluster analysis can be integrated to the judgmental criteria that deliver additional information about respondent selection. Wherefore, I clearly presented two judgmental criteria of this research above.

This research aimed to collect 300 questionnaires by purposive sampling method. Again, target population of this research is the house owners thus; I have determined house ownership status of respondent as a selection criterion. February 2011 is decided for questionnaire collecting period. I personally went to Cyprus and distributed the questionnaires within a 10 day time period. 300 questionnaires were distributed by hand in a print out format. Also I created an online survey link and distributed it through formal networks and e-mail groups.
203 of 300 respondents had returned with completed questionnaires which brings us 67% survey response rate. Moreover, online version of the questionnaire was published online simultaneously with the print-out version and remained online for 20 days. Online version had delivered 78 completed questionnaires at the end of 20 days. Since distribution of online version is made through formal networks, it is not possible to estimate how many users had received the link of the survey. Therefore, calculation of survey response rate is not applicable for this option. At the end of the day, 281 completed surveys were collected for the further analysis.

5.3. Latent Class Cluster Analysis

I used Latent Class Cluster analysis in order to define the customer segments in this research. Generally, clustering methods that are used in the marketing field can be classified into two groups such as hierarchical clustering and non-hierarchical clustering. I provided brief information on hierarchical and non-hierarchical clustering methods in literature review chapter.

Non-hierarchical clustering methods are used in this research to prevent from disadvantages of hierarchical clustering method. Hair et al. (2010) noted that hierarchical methods might create unexpected early combinations which could mislead the analysis with false results.

I stated that k-means clustering and fuzzy c-means clustering are popular methods for hierarchical clustering. Instead of these hierarchical clustering methods; I selected Latent Class (LC) analysis, which is neither hierarchical nor non-hierarchical method, to perform cluster analysis. Reasons of this decision are generally explained in items below which are directly cited from a paper by Magidson and Vermunt (2002). Such as;

- **LC is a probability-based classification.** LC approach permits cases to be classified into clusters using model based posterior membership probabilities estimated by maximum likelihood methods. While K-means uses an ad hoc approach for classification.

- **Determination of number of clusters.** K-means provides no assistance in determining the optimum number of clusters. In contrast, LC clustering provides various diagnostics such as the BIC (the Bayesian information criterion) statistic, which can be useful in determining the optimal number of clusters.

- **No need to standardize variables.** Before performing K-means clustering, analysts must standardize variables to have equal variance to avoid obtaining clusters that are dominated by variables having the most variation.
- **Inclusion of variables of mixed scale types.** K-Means clustering is limited to interval scale quantitative variables. In contrast, extended LC models can be estimated in situations where the variables are of different scale types.

Latent class analysis offers some advantages that are compatible with the aim of this research:

- Determines market segments and delivers unbiased market segment profile estimations
- Offers means to picking the number of segments and it is possible to handle different measurement levels
- Demographic and other covariates can be used in describing the segments and instead of using ad-hoc definition of “distance”, it positions cases into segments according to membership probabilities estimated and retrieved from the model (Fonseca, 2009).

Corresponding to the features of LC analysis above; this research is conducted in a fuzzy environment where no previous market entries have been noted yet. Furthermore, main aim is to measure the awareness towards a new to the market product. Thus, unbiased market segments and segment membership estimations are highly valuable. Moreover, questionnaire of this research consists of various types of questions measuring behavioral, demographic and psychographic characteristics with different measurement levels such as yes/no, multiple choice and scale. Behavioral variables are identified as main indicators in this research and other variables such as demographic and psychographic are used as covariates. Not only LC analysis is able to deal with these different variables, but also it allocates the cases based on the membership estimations from the constructed model of this research (Dias & Vermunt, 2007).

### 5.4. Variables

To define the variables, I benefited from the previous literature in customer segmentation field and I used beneficial variables as main indicators and psychographic characteristics as covariates along with demographic variables. Since this research has an environmental component, researches regarding environmental consciousness are investigated in order to find relevant variables for segmentation. Moreover, I investigated several papers to calculate average values for PV installation costs (Table 3).
Table 3 Overview of previous researches

<table>
<thead>
<tr>
<th>Author</th>
<th>Beneficial</th>
<th>Psychographic</th>
<th>Environmentally Consciousness</th>
<th>Demographic</th>
<th>PV attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Konus et al. (2008)</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mostafa (2009)</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ailawadi et al. (2001)</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D’Souza (2004)</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Ilkan et al. (2005)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Poullikkas (2009)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>this research</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

5.4.1. Benefits

The segmentation process of this research is aimed to segment customer base on the basis of the expected benefits and customer attitude towards PV systems. Konus et al. (2008) based on the expected benefits of customers in order to measure the behavior of customer in multichannel shopping. Expected benefits of the customer base of PV systems are generally economic and environmentally related. Economic benefits mostly concern on the amount of the energy expenses of customers. PV systems offer long term solutions for high electricity bills although they have considerably high installation cost. Environmentally consciousness customers are hoping to reduce their carbon footprints by utilizing PV systems into their houses (Nijenmanting & Senel, 2010). Considering these expected benefits, variables related with residential electricity expenses are included in order to measure the economical concerns of customers. Moreover, environmental expectations are measured by the variables concerning the customer awareness and knowledge about RES systems and PV technologies. Then, customer intention to buy the product part is aimed to be measured by giving approximate information about economical costs and returns of the product. In addition, high cost of the PV system is predicted as a reason for customers with no intention to purchase the product. Thus, high installation cost concern related variables added in to the research.

5.4.2. Psychographic

Psychographic characteristics such as innovativeness, price conciseness, mavenism and motivation to confront are covariant variables for this segmentation process. In order to select relevant construct psychographic factors for this research, I had investigated previous studies made in market segmentation
literature. I mostly employed the variables that Ailawadi et al. (2001) and Konus et al. (2008) used in their analysis. One of selection criteria of this research is based on the economical saving expectations which bring variables with financial and economical characteristics. Additionally, exploration expectations are considered as highly relevant for this research since PV technology is a new to the market product. Furthermore, I took human characteristics into account. For instance measures for innovativeness level, which is a significant indicator for customer adoption towards new product, are implemented. These construct characteristics are necessary to understand what customer characteristics are correlated with segment membership.

5.4.3. Environmentally consciousness
Green marketing is a new concept in the market and it is an indicator of customer’s intention to purchase environmental friendly products. One of the expected benefits from PV system is clear energy generation, Mostafa (2009) provide valid results for this expectation. As I said before, environmentally conscious customers want to reduce their carbon footprint by implementing PV solutions in their residences. Moreover, these customers have concerns on future effects of the current environmental events. I supposed that their environmentally consciousness level is an important indicator to measure their altruistic characteristic and awareness on environmental changes. Thus, I intended to reveal correlation between the environmentally consciousness level and segment membership. In order to accomplish that, I employed variables of Mostafa (2009) as items for environmentally consciousness part. Then, green consuming variables are used as covariates and it is expected that they would present a relationship between green consuming and segment membership.

5.4.4. PV attribute
In the questionnaire design part, I explained the steps of the calculation of average values for installation costs and investment return rate of a residential PV system. During that, I used help from the data given in studies of Ilkan et al. (2004) and Poullikkas (2009). These two papers delivered substantial data about technical and financial attributes of residential PV system use in N. Cyprus and Republic of Cyprus respectively.

5.4.5. Demographic
Traditionally demographic variables such as age, sex and income are other covariates of this segmentation process (Kotler, 1996). Additionally, couple of variables, special for this case, included in order to observe house ownership status and residential electricity expense rate of customer.
6. Results

This chapter starts with the data collection process. Then it continues with the results of the principal component analysis on the indicator and covariate variables. Next, descriptive analysis of the collected data is presented. Later on, indicator and covariate selection for Latent Class Analysis (LCA) is delivered with analytical explanations. Finally, general findings of Latent Class Analysis are presented for further discussion part.

6.1. Questionnaire Results

The initial number of cases that are used in the beginning of this analysis is 281. It is the number of the fully filled and returned questionnaires. Results of the further analyses had changed this number and I presented case amount and every reduction with reasons as well.

6.1.1. Dimension Reduction (Principal Component Analysis)

I executed a factor analysis to check whether underlying constructs of the questionnaire are represented by the corresponding items. There are 63 items (Appendix 5) in the questionnaire and a factor analysis was inevitably needed since some of the constructs are measured by multiple items. Reduction of multiple variables is also healthy for the Latent Class Analysis since it strengthens the robustness of the model. Moreover, results of the factor analysis show whether underlying constructs of the questionnaire are consistent with the data or not. First principal component analysis (PCA) is applied on psychographic and environmentally consciousness variables with Varimax rotation method. Results and the summary tables of the analysis with KMO-Barlett statistics are represented in the Appendix 6a. Factor analysis results revealed a six factor solution which represents 63.4% of the variation. The factor analysis shows that items of the constructs Innovativeness (1), Altruism (1), Skepticism (1&2) and Motivation to Conform (2&3) score below .5. These items that do not perform well in the construction of multi-item based factors are dropped for the further analysis. Another PCA was conducted after these changes and regression scores are saved as variables to be used in LCA. Results of this analysis showed that a six-factor solution represents 67.7% of the variation (Appendix 6b). Regression scores for each variable are saved and cases without regression scores removed from the data set thus new set had 224 cases.

Finally, six psychographic and environmentally consciousness factors are defined as Innovativeness, Motivation to Conform, Price Consciousness, Financial Constraints, Altruism and Environmental Concern according to the PCA results. Before implementing these factors into the model, a reliability analysis is conducted and results are presented under reliability part.
I conducted another dimension reduction however this time it is conducted on the variables that are intended to be used as indicators. Factor analysis includes predefined factors with multiple variables such as electrical cost concerns, awareness of Renewable Energy Systems, and awareness of PV systems.

Principal component analysis results, presented in the Appendix 7, showed some unexpected however consistent results. Variables for awareness of RES and PV systems are distributed under three factors according to the results of analysis. After checking these variables, the relationship between these variables can be seen easily. Consequently, variables for these two predefined factors are reconstructed under new three factors. First group of variables including PV Awareness 4&5 and RES Awareness 4 is named as Feasibility since those variables generally intend to measure the awareness towards feasibility level of RES and PV systems. Second group contains PV Awareness 2&3 and RES Awareness 2&3; these variables aimed to measure the awareness of the respondents about the potential of RES and PV systems in energy generation. Thus this factor is called as Awareness. Last factor includes PV Awareness 1 and RES Awareness 1 which are directly aimed to measure the knowledge level of respondents about RES and PV technologies. Eventually, this factor is named as Knowledge.

Consequently, PCA results delivered a four factor solution for 71.7% of the variance. These four factors are: Electricity Cost, Feasibility, Awareness and Knowledge. Factor regression scores for each variable are saved as well for further use in Latent Class Analysis. Cases without regression scores were removed from the main data set and final set has 194 cases.

6.1.2. Reliability

I conducted a reliability analysis both indicator and covariate factors and results are presented in Table 4. I used Cronbach’s alpha to measure the internal reliability of the constructs in the questionnaire. Since inter-correlations among questionnaire items are maximized when multiple items measure the same construct, Cronbach’s alpha is commonly accepted to indirectly indicate the degree to which a set of items measure a single one-dimensional latent construct (Hair et al., 2010). Motivation to Conform factor is excluded from the analysis as a result of low Cronbach’s α score. Table 4 displays the Cronbach’s α values of the final factors to be used in the model of this research.
Table 4 Reliability analysis for all factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicators</strong></td>
<td></td>
</tr>
<tr>
<td>Electricity Cost Concerns</td>
<td>0.890</td>
</tr>
<tr>
<td>Feasibility</td>
<td>0.759</td>
</tr>
<tr>
<td>Awareness</td>
<td>0.739</td>
</tr>
<tr>
<td>Knowledge</td>
<td>0.818</td>
</tr>
<tr>
<td><strong>Covariates</strong></td>
<td></td>
</tr>
<tr>
<td>- Psychographic</td>
<td></td>
</tr>
<tr>
<td>Innovativeness</td>
<td>0.810</td>
</tr>
<tr>
<td>Price Consciousness</td>
<td>0.683</td>
</tr>
<tr>
<td>Financial Constraints</td>
<td>0.878</td>
</tr>
<tr>
<td>- Environmentally Consciousness</td>
<td></td>
</tr>
<tr>
<td>Altruism</td>
<td>0.787</td>
</tr>
<tr>
<td>Environmental Concerns</td>
<td>0.739</td>
</tr>
</tbody>
</table>

6.1.3. Descriptive Statistics

After I conducted two factor analyses, I checked the regression scores for each case and removed cases without regression scores from data set since I needed the cases with factor regression scores for the Latent Cluster Analysis. Final data set has left with 194 cases. I checked the descriptive to have an initial picture of the data. Before that, responses towards the demographic and residential variables are investigated. Distribution of the responses showed that there is a need for narrowing down the options of the nominal and ordinal variables. Therefore, values for selected variables are recoded by combining two or more of them into new values. Recoded variables and new dummy coded values are represented in the Table 5.

After recoding these demographic and residential variables, I conducted a descriptive analysis. Results revealed that, 76.3% of the respondents are house owner and 16% has a house in construction period. 35.8% of them are female where 64.2% is male moreover, 35.6% of them are under 35 years old where 64.9% is above 35 years old. Education level results showed 70.5% of respondents are graduated from a University program where 29.5% is graduated from lower degrees. 9.9% of the respondents are not employed either retired or student but 23.6% of them is self-employed and 66.5% is salaried employed. 39.7% of respondents belong to low income level which is below 3000TL (Turkish Lira), average income level, between 3000 and 4500, has 32.3% of population and 18% is in high income level, above 4500TL.
Table 5 Recoded Variables

<table>
<thead>
<tr>
<th>Label</th>
<th>Variable</th>
<th>Values</th>
<th>Recoded Label</th>
<th>Recoded Variable</th>
<th>Recoded Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>House Ownership</td>
<td>A1</td>
<td>{1, Yes}, {2, No}, {3, Neither owner nor paying rent}</td>
<td>House Ownership Recoded</td>
<td>A1R</td>
<td>{0, Owner}, {1, Not Owner}</td>
</tr>
<tr>
<td>House Electricity Bill</td>
<td>A5</td>
<td>{1, 0-50}, {2, 50-100}, {3, 100-200}, {4, 200-250}, {5, More than 250}</td>
<td>House Electricity Recoded</td>
<td>A5R</td>
<td>{0, &lt;100}, {1, 100&lt;x&lt;200}, {2, &gt;200}</td>
</tr>
<tr>
<td>Age</td>
<td>E2</td>
<td>{1, 18-25}, {2, 26-35}, {3, 36-45}, {4, 46-55}, {5, more than 56}</td>
<td>Age Recoded</td>
<td>E2R</td>
<td>{0, age&lt;35}, {1, age&gt;35}</td>
</tr>
<tr>
<td>Education</td>
<td>E3</td>
<td>{1, Primary School}, {2, High School}, {3, Lycée}, {4, University (2 y)}, {5, University (4 y)}, {6, Advanced Degree}</td>
<td>Education Recoded</td>
<td>E3R</td>
<td>{0, No University}, {1, University}</td>
</tr>
<tr>
<td>Employment</td>
<td>E4</td>
<td>{1, Unemployed}, {2, Retired}, {3, Student}, {4, Self-Employed}, {5, Salaried Employed}</td>
<td>Employment Recoded</td>
<td>E4R</td>
<td>{0, Unemployed}, {1, Self-Employed}, {2, Salaried Employed}</td>
</tr>
<tr>
<td>Income</td>
<td>E5</td>
<td>{1, less than 1500}, {2, 1500-3000}, {3, 3000-4500}, {4, 4500-6000}, {5, 6000-7500}, {6, more than 7500}</td>
<td>Income Recoded</td>
<td>E5R</td>
<td>{0, Low Income(&lt;3000)}, {1, Average Income (3000-6000)}, {2, High Income (&gt;6000)}</td>
</tr>
</tbody>
</table>

6.2. Estimation of Customer Segments

This chapter includes selection procedure of LCA variables. Then, LCA analysis results are provided with details of optimum solution. Later I presented interpretation and labeling processes which are utilized according to the LCA results.

6.2.1. Indicator and Covariate Selection

Focal point of this research is customer awareness and intention to purchase it. Therefore, variable B7 (intention to buy PV) is the focal variable to detect the customer behavior in terms of buying intention. Other variables, which were constructed as indicators in the questionnaire, are combined under factors such as Electricity Cost, Feasibility, Awareness and Knowledge. These factors are included to the indicator set. Variable B9 (Subsidy option) and variable sets B8 (Attitude towards PV system) and B10 (High Cost Concern) are not included to the analysis for the sake of reliability since many cases have missing values for these variables.

Psychographic and Environmentally Consciousness variables were constructed to be used as covariates of the model. Since these variables are analyzed and collected under factors, factor scores are integrated to the model. Therefore, psychographic factors; Innovativeness, Price Consciousness and Financial
Constraints and Environmentally Consciousness factors; Altruism and Environmental Concern are utilized as covariates.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Factor for PV and RES Knowledge</td>
<td>Ordinal</td>
</tr>
<tr>
<td>Awareness</td>
<td>Factor for PV and RES Awareness</td>
<td>Continuous</td>
</tr>
<tr>
<td>Feasibility</td>
<td>Factor for PV and RES Feasibility</td>
<td>Continuous</td>
</tr>
<tr>
<td>Electricity Cost</td>
<td>Factor for Electricity Cost Concerns</td>
<td>Continuous</td>
</tr>
<tr>
<td>B7</td>
<td>Intention to buy PV systems</td>
<td>Continuous</td>
</tr>
</tbody>
</table>

**Covariates**

| A1R | House Ownership Recoded | Nominal |
| A5R | House Electricity Recoded | Nominal |
| E2R | Age Recoded | Nominal |
| E3R | Education Recoded | Nominal |
| E4R | Employment Recoded | Nominal |
| E5R | Income Recoded | Nominal |
| A2 | House in Construction | Nominal |
| Innovativeness | Factor for Innovativeness | Numeric |
| Altruism | Factor for Altruism | Numeric |
| Price Consciousness | Factor for Price Consciousness | Numeric |
| Financial Constraints | Factor for Financial Constrains | Numeric |
| Environmental Concern | Factor for Environmental Concern | Numeric |

Demographic variables such as Sex (E1), City (E6) and Marital Status (E7) are not used supposedly these variables do not create a differentiation in the customer behavior towards PV systems purchase. House Economical Decision (A3) and House Type (A4) are residential variables that were neglected from the covariate set as well. All of the demographic and two of the residential variables, which are selected as covariates, are recoded and they are added into the analysis with their recoded values. Final indicator and covariate sets are presented in the Table 6.
6.2.2. Latent Class Analysis

I used one to six clusters and considered Bayesian Information Criterion (BIC) statistic as leading in selecting the optimum model. Konus et al. (2008) stated that the BIC is delivering more effective model estimations in selecting the optimum model in LCA than other criteria. I also used classification error, which delivers the rate of the misclassified case as a secondary criterion similar with the Konus et al. (2008). Moreover, Akaike Information Criterion (AIC) was added as well in order to double check the consistency of the model. Table 7 shows the result of the 1-6 estimation (N=194).

Table 7 Log-likelihood, BIC, AIC, AIC3 and Class Error statistics for model selection

<table>
<thead>
<tr>
<th>Model</th>
<th>Clusters</th>
<th>LL</th>
<th>BIC(LL)</th>
<th>AIC(LL)</th>
<th>Classification Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>1-Cluster</td>
<td>-1328.33</td>
<td>2719.871</td>
<td>2680.657</td>
<td>0</td>
</tr>
<tr>
<td>Model 2</td>
<td>2-Cluster</td>
<td>-1270.88</td>
<td>2736.678</td>
<td>2615.767</td>
<td>0.0261</td>
</tr>
<tr>
<td>Model 3</td>
<td>3-Cluster</td>
<td>-1231.04</td>
<td>2788.694</td>
<td>2586.087</td>
<td>0.0243</td>
</tr>
<tr>
<td>Model 4</td>
<td>4-Cluster</td>
<td>-1155.05</td>
<td>2768.394</td>
<td>2484.091</td>
<td>0.0153</td>
</tr>
<tr>
<td>Model 5</td>
<td>5-Cluster</td>
<td>-1153.32</td>
<td>2896.647</td>
<td>2530.647</td>
<td>0.0385</td>
</tr>
<tr>
<td>Model 6</td>
<td>6-Cluster</td>
<td>-1106.27</td>
<td>2934.242</td>
<td>2486.545</td>
<td>0.0325</td>
</tr>
</tbody>
</table>

Results revealed that one cluster model has the lowest BIC value (2719). Since one cluster model is not expected outcome, I checked the second criterion for the cluster estimation. Thereof, the four-cluster model has the lowest Classification Error value among other models. Additionally, AIC value of the four cluster model is the lowest one as well.

Classification error statistic indicates that 1.5% of the cases in the model 4 could be wrongly classified. It is an acceptable value comparing with the other models. Furthermore, model 4 has clear segments that are in line with expectations during the model design. Also, I observed that segment profiles for this model is split divergently where it makes interpretation easier. Model 4 is selected considering the conditions above and the optimal number of segments for this research can be identified as four.

6.3. Interpretation and Labeling the Segments

Previously, I found that optimum model for this research is the four segmented model based on the Classification error and on the interpretability of the segments. Profile of the indicators for the four segmented model can be seen in the Table 8.

Descriptive statistics results for indicators showed us that there is a clear split between each segment in terms of attitude towards PV systems. One of the segments displays a high level of intention to purchase the product (Cluster 2). On the other hand, other segment shows lower buying intention (Cluster 4). Two
segments deliver similar buying intention level (Cluster 1&3), they are likely to purchase this product but they differ in terms of electricity cost concerns and feasibility of PV systems. One of them has the highest scores for Electricity Cost and Feasibility of PV systems (Cluster 3); I could link this segment’s high intention score with their economical expectations from PV systems. On the contrary; other one (Cluster 1) has the lowest score for Electricity Cost concerns which means members of this segment do not have a significant problem with the monthly electricity bill moreover, they are not enthusiastic about the feasibility level of the PV systems.

| Table 8 Profile of the final segments |
|-------------------------------------------------|-------------|-------------|-------------|-------------|
| Clusters                                      | Cluster 1   | Cluster 2   | Cluster 3   | Cluster 4   |
| p value                                       | 33.14%      | 26.83%      | 25.45%      | 14.58%      |
| B7 (Intention to buy)                         | 3.8322      | 4.3765      | 3.9579      | 3.4791      |
| Electricity Cost                              | -0.6948     | -0.0632     | 0.9289      | 0.0766      |
| Feasibility                                   | 0.0750      | 0.2763      | 0.3460      | -1.2881     |
| Awareness                                     | 0.0356      | 0.3831      | -0.1602     | -0.5086     |
| Knowledge                                     | -0.4299     | 1.0085      | -0.4513     | -0.091      |

Segment with the highest buying intention level (Cluster 2), also has high scores from other indicators except Electricity Cost, it appears to be the most involved segment with the PV systems. On the contrary, segment with the lowest intention score (Cluster 4), has lower results in terms of attitudinal variables.

Before labeling the segments, I examine effects of the covariates on the customer segment differentiation in terms of attitudinal decisions of segment members.

6.3.1. Covariates Evaluation

I delivered the results for the psychographic, environmentally consciousness and demographic covariates in Table 9. These coefficients display covariates’ impact level on segment memberships. A strong positive coefficient indicates that customers with high scores on that covariate are more likely to be a member of that segment where a significantly negative coefficient indicates customers with low chance to be a member of that segment (Konus et al., 2008).

I find significant coefficients for all of the covariates in .5% significant level except income level where it is found significant in .10 significance level (p=0.07). Individually, Innovativeness has a strong association with Segment 2 and Segment 3 where it has a strongly negative association with Segment 1 and Segment 4. It is expected to be this way since innovative customers are more open for new products and these
two segments has highest values of the intention to buy PV systems. Altruism strongly determines the membership in Segment 2 but it is less likely to define members of Segment 1 and 4. It makes sense because environmentally altruistic people expected to adopt this product faster than others.

Table 9 Covariates of PV buying behavior

<table>
<thead>
<tr>
<th>Covariates</th>
<th>Cluster1</th>
<th>Cluster2</th>
<th>Cluster3</th>
<th>Cluster4</th>
<th>Wald</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovativeness</td>
<td>-2.1644</td>
<td>1.8335</td>
<td>2.0668</td>
<td>-1.7359</td>
<td>12.4628</td>
<td>0.006**</td>
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<tr>
<td>Altruism</td>
<td>-4.6794</td>
<td>8.6462</td>
<td>0.2214</td>
<td>-4.1883</td>
<td>15.5965</td>
<td>0.0014**</td>
</tr>
<tr>
<td>Price Consciousness</td>
<td>-3.0599</td>
<td>0.3467</td>
<td>4.2626</td>
<td>-1.5494</td>
<td>12.6173</td>
<td>0.0055**</td>
</tr>
<tr>
<td>Financial Constraints</td>
<td>-4.2666</td>
<td>0.3177</td>
<td>2.4663</td>
<td>1.4825</td>
<td>13.9431</td>
<td>0.003**</td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>3.0874</td>
<td>-1.8632</td>
<td>-1.876</td>
<td>0.6518</td>
<td>11.0968</td>
<td>0.011*</td>
</tr>
<tr>
<td>Age</td>
<td>7.8119</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age&lt;35</td>
<td>-2.4483</td>
<td>1.4217</td>
<td>-0.5064</td>
<td>1.533</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education Level</td>
<td>13.4964</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>1.0463</td>
<td>2.2743</td>
<td>-4.8333</td>
<td>1.5127</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>14.3493</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>6.5193</td>
<td>-4.0576</td>
<td>2.8131</td>
<td>-5.2749</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self Employed</td>
<td>-9.9272</td>
<td>3.565</td>
<td>-0.9628</td>
<td>7.3249</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salaried Employed</td>
<td>3.4079</td>
<td>0.4926</td>
<td>-1.8504</td>
<td>-2.0501</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incom</td>
<td>11.496</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Income</td>
<td>-5.4442</td>
<td>2.1835</td>
<td>1.6601</td>
<td>1.6006</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Income</td>
<td>-0.7579</td>
<td>-2.0715</td>
<td>-2.3899</td>
<td>5.2192</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Income</td>
<td>6.2021</td>
<td>-0.1121</td>
<td>0.7298</td>
<td>-6.8198</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Electricity Bill</td>
<td>16.5041</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;100</td>
<td>6.559</td>
<td>6.3685</td>
<td>-11.9999</td>
<td>-0.9276</td>
<td></td>
<td></td>
</tr>
<tr>
<td>250&gt;x&gt;100</td>
<td>0.4166</td>
<td>0.0371</td>
<td>0.9009</td>
<td>-1.3545</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;250</td>
<td>-6.9755</td>
<td>-6.4056</td>
<td>11.099</td>
<td>2.2821</td>
<td></td>
<td></td>
</tr>
<tr>
<td>House Ownership</td>
<td>12.7679</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owner</td>
<td>1.774</td>
<td>2.6261</td>
<td>-2.6798</td>
<td>-1.7202</td>
<td></td>
<td></td>
</tr>
<tr>
<td>House in Construction</td>
<td>9.9846</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>-1.1728</td>
<td>0.8211</td>
<td>-1.806</td>
<td>2.1578</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Significance levels: **1% and *5%

Price consciousness is strongly associated with Segment 3 and negatively associated with Segment 1 and Segment 4. Financial constraints strongly identify the membership of the Segment 3 and Segment 4 but it has a negative effect on the membership of Segment 1. Environmental concern reveals strong relationship with Segment 1 and negative relationship with Segment 2 and Segment 3. Age below 35 years old is a strong determinant for Segment 2 and Segment 4 but it has negative impact on Segment 1. It also makes sense for Segment 2; younger customers seem to be more enthusiastic to try PV panels in
their houses. University level education has strong association with Segment 2 and to a lesser extent with Segment 1 and Segment 4; on the other hand it strongly exclude the Segment 3. Unemployment is strongly determining membership of the Segment 1 and Segment 3 on the contrary self employment is strongly associated with the Segment 2 and Segment 4. Low level monthly electricity bill is strongly connected with Segment 1 and Segment 2, on the other hand high level monthly electricity bill reveals strong effect on Segment 3 and to a lesser extent on Segment 4. House owning determines the membership of Segment1 and Segment 2 but keeps away customers from Segment 3 and Segment 4. Finally, house in construction period provides strong connections with Segment 4.

6.3.2. Labeling

Subsequent to the indicator profile and covariate analyze, I can start to label segments of this study. The detailed segment profile values can be seen from Appendix 8.

6.3.2.1. Cluster 1: Secure Conservatives

In terms of segment size, this one has the most significant share (33.14%) amongst other segments. Their intention level to buy the product is not very high, it can be seen that they do not have any concerns about monthly electricity cost since this segment members have strong association with low level monthly average electricity bill. Another specific characteristic for this segment is their secure income level. High income level is a strong determinant for this segment and it is supposedly affecting Financial Constraints and Price Consciousness characteristics of members and causes the low scores. Members are highly educated and over 35 years old (%77) but they might be conservative in terms of Innovativeness and Altruism. Moreover, parallel with the behavior towards RES and PV systems, their knowledge and awareness towards environmental changes are clearly low. On the contrary, they are pessimistic about the current environmental conditions and worried about declining natural sources.

6.3.2.2. Cluster 2: PV Enthusiasts

The 26.8% of sample is forming this segment and members of this segment are more likely to adopt PV technologies. Awareness and Knowledge level towards RES and PV system is significantly high for this segment, members are positive about the feasible electricity generation capacity of PV systems as well. High altruism level shows their high care towards environmental changes and it is consistent with their monthly electricity bill. It is highly expected that members of this segment purchase green products and avoid of inefficient electricity use in their house. Eventually, their environmental concern level is considerably low since they believe that natural sources can be managed more elegantly. High
innovativeness level is in line with the earlier expectations and their education level is significantly high. Considerably, they are self-employed but their income is in a low level which might be the reason for their not significant but notable financial constraints and price consciousness characteristics.

6.3.2.3. Cluster 3: Impoverished Innovators

This segment consists of members that are likely to purchase PV systems for their houses (segment size: 24.5%). However, members of this segment have economic and financial constraints. This segment has the lowest house ownership value which could explain members’ high price conscious and financially constrained characteristic. Concerns against monthly electricity bill costs have the highest score within members of this segment. Despite their low income level, which might be a result of their low education profile, their monthly electricity bill values have strong connections with high level electricity expenses (60% pays more than 250TL). Low altruism scores confirm the high electricity costs since they do not feel obligated to pay attention to reduce their inefficient electricity use. Members have low scores in Awareness and Knowledge about RES and PV systems although they believe that PV systems are in a sufficient level to generate economical power. Their highly innovative characteristic is a relevant indicator for their purchase intention towards PV systems in spite of economical problems they have had.

6.3.2.4. Cluster 4: Unaware Youngsters

This segment is the smallest one including only 14.58% of the samples. Furthermore, this segment has the lowest score for intention to buy PV systems. Behavioral indicator values reveal that members of this segment have the weakest attention and knowledge about RES and PV systems. Financial constraints seem to be moderately important for this segment. This characteristic can be linked with the high house in construction value of this segment. Naturally, various expenses keep popping out during the construction of a new house. Another notable characteristic of this segment is the age interval since it is the youngest segment amongst others. Also, considerably high number of members has gained higher education diplomas and they mostly have their private jobs.
7. Discussions

The results of the data analysis and answers to the research questions will be discussed and presented in this chapter.

7.1. Segments in N. Cyprus Residential PV Market

First of all, I focused on the main research question by finding four clear segments with different purchase intention levels for PV systems. Then, I found that each segment has specific factor characteristics based on the purchase intention level. Later on, I discussed the presence of the target segment then, I explained which factors affect the membership structure of the target segment in which ways.

7.2. Target Segment: PV Enthusiasts

Considering the purchasing intention levels of segments, I made relatively easy selection for the target segment. I picked Segment 2: PV Enthusiasts as target segment of this research since members of this segment show a very likely intention to buy residential PV systems thus I can describe them as potential first adopters of this product. Moreover, member profile and indicator scores of Segment 2 are in line with the benefits provided by the PV systems. Segment 1 and Segment 3 are likely to adopt PV systems faster than Segment 4 but these two segments do not provide sufficient profiles in other behavioral indicators.

During the construction period of this research, I emphasized two main expected benefits for customers of residential PV systems. First expectation that I defined was economical benefit due to the high energy prices in N. Cyprus. I proposed that residential PV systems offer a long term solution for the elevated electricity generation expenses despite the high installation costs. However, target segment reveals that the high amount in their monthly electricity bill is not their main problem. Values of the monthly electricity cost concerns are moderately low for the members of this segment. On the other hand results for the Feasibility factor, which indicates the economical energy generation potential of PV systems, is highly positive. Therefore, target segment members expect economical advantages in return when they will implement the residential PV system in their houses. Furthermore, environmental benefit was identified as second expectation. It is presumed that adopters of this product show interest in changing environmental conditions and they are aware the role of the RES and PV systems in current situation. Our segment delivered significantly positive results in indicators regarding the Knowledge level and Awareness of the usage areas and the environmental benefits of PV systems. Especially, Knowledge
factor score is incomparably elevated than other segments. It is the most important incentive for optimistic purchasing intention of target segment. Environmental Altruiism is another factor that has a heavy impact on target segment members in terms of environmental expectations. Regarding the environmental changes topic, target segment members provide a sophisticated profile. Moreover, innovativeness level of the target segment members is considerable. Consequently, combination of all these characteristics and expectations of customers clearly explain the rationale behind the purchase decision of the target segment. The target segment has a high environmental consciousness and substantial knowledge and awareness towards RES and PV systems. I can clearly state that positive attitude of segment members toward PV systems is mostly relies on their environmental expectations. Even though they do not have any significant concerns on electricity bills, they do have a high environmental altruism that makes them to think about economical and environmental conditions of future generations.

7.3. Dealing with the Indecisive Customers
One of the secondary aims of this research is investigating the presence of a segment that consists of members with low intention to purchase PV systems. However, there is no such segment that expresses an unsympathetic attitude towards PV system purchase. Only the Segment 4 shows an undecided manner whether adopting PV or not. Thereof, I will investigate the motives that decision of Segment 4 relies on. After investigating the profile of Segment 4, negative relationship between segment membership and attitudinal factors such as Knowledge, Awareness and Feasibility can be seen obviously. Low scores in these factors are clear evidence for reasons of undecided purchase intention. Also negative relationship between innovativeness and altruism factors are additional psychographic and environmentally consciousness factors that determine this segment membership and undetermined buying intention. Rogers (2003) delivered complexity as one of the factors that affects the diffusion of innovation. PV systems are working relatively complex way to generate energy. This complexity might be a factor on intention level of this segment. I observed that knowledge and awareness level for members of this segment is very low. Therefore, I concluded that members of this segment could not able to solve the complexity of PV systems since they do not have enough knowledge about PV systems. Thus, I presented this conclusion as one of the main reasons for their indecisive intention to buy PV systems.

7.4. Creating Unique Value for residential PV Market
Previous two topics investigated factors that have impact on segment memberships of segments with both positive and indecisive buying intention. Outcomes of this investigation provide substantial
information about rationale behind the purchasing decision of residential PV systems in N. Cyprus. After selecting target customer segment, next move is determining the positioning strategies for launch of the product (Crawford & Di Benedetto, 2008). This research will not deliver detailed information about positioning strategies but useful outcomes are highlighted for the further steps of the launch process. Specifically in this case, previous findings showed us the importance of the attitudinal factors such as general knowledge about RES and PV system; awareness of broad use of RES and PV systems and economical potential of PV systems for feasible energy generation. The target segment which is very likely to adopt PV systems, revealed a strong connection with all of these factors. On the contrary, segment with undecided members has very limited knowledge and awareness about PV systems. This situation points out the core topic that companies should focus on while determining their launch strategies. Psychographic characteristics are important as well and they should be involved in strategy identification processes. Psychographic characteristics’ of customers are mostly concrete and cannot be changed however, behavior towards product awareness and knowledge can be improved by accurate launch strategies (i.e. advertising through various channels). Therefore, focusing on attitudinal factors and determining strategies based on customers behavior is in favor of the companies in this field.

7.5. Theoretical Contributions

As I mentioned in the Literature Review chapter, this research aims to extend the usage of attitudinal, behavioral and psychographic variables in customer segmentation literature. Contrarily with the traditional segmentation studies, this research used demographic variables as covariates of the model instead of main indicators. Moreover, frequency of studies that integrate behavioral, attitudinal and psychographic variables is considerably low and this research intend to broaden the literature a little bit more by employing environmentally consciousness variables which represent green consuming habit of customers.

Next, studies (Ilkan et al., 2005; Makrides et al., 2010; Poullikkas, 2009; de la Hoz et al., 2010) regarding residential PV technology usage are mostly conducted on technical attributes and average installation costs of the product or PV market conditions in various countries are investigated. This research aims to supply information about customer aspect of the residential use PV Systems. Potential customers and their expectations should be considered during the product development processes as well. Therefore, infrastructure of this research is constructed up on the basis of customers’ expected benefits from PV systems.
Results of this study are in line with previous studies (Ailawadi et al., 2001; Konus et al., 2008) and reveal a strong connection between psychographic factors and segment membership. More specifically, this study has its own special psychographic characteristics that have much more effect on segment memberships. Innovativeness, Environmental Altruism, Price Consciousness and Financial Constraints have very strong effect on segment memberships. Thus these factors should be considered as main psychographic factors for future studies in this field. On the other hand, results of this study showed that Motivation to conform, which was employed from previous studies, is one of the construct psychographic factors that I could not receive any significant correlation with segment membership. Another example for uncorrelated characteristic is “skepticism towards environmental claims” (Mostafa, 2009). Two items were provided for this construct factor and results were highly uncorrelated. To sum up, findings of this research showed clear relationship between most of the construct factors and delivered substantial information about which psychographic factors should be involved in this type of a study.

7.6. Managerial Implications

Current condition of PV panel production industry and the latest progress in residential PV market is investigated in the previous chapters. I found strong evidences regarding the rapid growth in the residential PV market in line with the decreasing PV panel production costs. Furthermore, most of the developed countries have been offering subsidies and incentive schemas in order to fasten up the diffusion of PV systems. European countries especially Germany enacted laws regarding the Renewable Energy Use to stimulate the speed of adoption in individual level. Again in Europe, researches and developments are continuously progressing in the Sustainable House concept. It is an emerging concept which aims to offer lesser independent “Green Houses” in terms of energy demand. Considering the brief explanation of PV market above, findings of this research have several managerial implications.

First, residential PV systems are most commonly used RES technology that makes houses more independent in terms of electricity. Thus, structure and the results of this study could lighten the future customer and market investigations regarding Sustainable Houses.

Second, this research is conducted in N. Cyprus where sun irradiation potential is one of the highest countries in Europe. Since there is neither infrastructure nor any RES laws had been enacted yet, conditions are assumed as same as the European countries. Then, outcomes of this research display general behavior of customers in a country with high potential of residential PV system use. Therefore,
companies could use segment profiles of this research while establishing their customer segmentation operations.

Third, companies which have intention to enter the N. Cyprus renewable energy market would use this research as a guideline while forming their launch strategies for residential PV systems. Moreover, this research can be used as a source for countries with lack of RES technology and same potential as N. Cyprus.

Fourth, I have constructed this analysis based on a highly possible future scenario about market conditions of N. Cyprus. However, these assumed conditions are real for the Republic of Cyprus PV market. Moreover, diffusion rate of the residential PV applications has not reach to a mature level in energy market. Therefore, constructs of this research can be used to design a similar segmentation study for the Republic of Cyprus energy market. Then, companies could use findings of this research and develop new strategies according to the expectations of customers.

7.7. Limitations and Future Research Directions

One of the biggest limitations in this study is current situation of the Cyprus. The island is separated into two parts and Northern part is not developed as Southern part. Therefore, I constructed the mainframe of the study according to the existent conditions in Southern part. It is still possible that two parts will be united again and same conditions will be available for whole country. Despite shortcomings concerning governmental institutions, government in the Northern part has developed future plans for RES with the support of European Union. Therefore, results of this study lighten up the possible scenario of the immediate future. I can propose a similar customer segmentation study for Republic of Cyprus RES market. Since residential PV system use is supporting by institutional laws, customers’ behavior and attitude towards this residential PV system can be measured and evaluated in more healthy conditions.

Second, I carried out this analysis based on the future intentions of the customers. Since this product has not been launched to the market, are not able to have actual customer adoption data. During the questionnaire preparation, I tried to give optimum amount of information about attributes and costs of PV systems. I did not want to affect the customer attitudes by providing conflicting or exaggerated information about product.

Third limitation was the questionnaire distribution. Since I conduct this research in Netherlands, I devoted 10 days for distributing and collecting the print out version of the questionnaires. Although
online version is aired more than 20 days, most of the house owner participants are not highly involved with the internet usage. In addition, response bias is expecting in questionnaire answers especially this research has a moral aspect in the environmental basis. Thus, results could positively deviate from real opinion of participants. Further research should consider a longer period for distribution and collection of the questionnaires in order to gain broader sample structure and size.

Fourth, this research focused on the pre-launch approaches thus I made comments and discussions for pre-launch activities. Therefore, I strongly recommend that new studies will be needed after PV systems will be launched and available in N. Cyprus market. These new dynamic segmentation studies should be conducted based on the actual customer adoption and usage data for PV systems. Further diffusion of these systems can be observed by conducting dynamic segmentation analysis based on the actual purchasing data from customers.

Finally, I would like to mention about the general opinion of the people towards PV systems in N. Cyprus. I gained these insights from informal conversations while I was distributing questionnaires. A group of the people, who was aware of these technologies, was very keen on to adopt these technologies. Moreover, they have already made some individual pre-research for installation of these technologies into their houses. However, high installation costs and absence of the feed-in-tariff policy is two most important obstacles they have faced. Another common feature of these enthusiastic people was their professions, notable amount of them have gained Engineering degrees thus they already have notion on how PV systems work technically.
References


### Appendix 1

Table 10 Evaluation of Different Support Mechanisms for PV

<table>
<thead>
<tr>
<th></th>
<th>Investor security</th>
<th>Simplicity</th>
<th>Proven Success</th>
<th>Cost Effectiveness</th>
<th>Guarantying a mix of different technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Feed-in Tariff</strong></td>
<td>😊😊😊</td>
<td>😊😊😊</td>
<td>😊😊😊</td>
<td>😊😊😊</td>
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<tr>
<td><strong>Quota systems</strong></td>
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<td>😊😊😊</td>
<td>😊😊😊</td>
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<td>😊😊😊</td>
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<tr>
<td><strong>Investment subsides</strong></td>
<td>😊😊😊</td>
<td>😊😊😊</td>
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<td>😊😊😊</td>
<td>😊😊😊</td>
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<tr>
<td><strong>Voluntary demand</strong></td>
<td>😊😊😊</td>
<td>😊😊😊</td>
<td>😊😊😊</td>
<td>😊😊😊</td>
<td>😊😊😊</td>
</tr>
</tbody>
</table>
Appendix 2

Photovoltaic power capacity installed in the European Union at the end of 2009.*

- TOTAL EU: 15,861.2 MWp
- 5,485.1 MWp

Legend/Key:
- Cumulated installed capacity in the European Union countries at the end of 2009 (in MWp)
- Installed capacity in the European Union countries during 2009 (in MWp)

### Appendix 3

**Table 11 Regulatory framework for PV in EU-25 and Switzerland (2004)**

<table>
<thead>
<tr>
<th>Country</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>Feed-in tariff paid for 20 years with cap of 15 MW, but only for systems installed in 2003 and 2004 (cap was already reached after four weeks): 0.6 €/kWh &lt; 20 kW, 0.47 €/kWh &gt; 20 kW</td>
</tr>
<tr>
<td>Belgium</td>
<td>Feed-in tariff: 0.15 €/kWh</td>
</tr>
<tr>
<td>Cyprus</td>
<td>Feed-in tariff: 0.12 – 0.26 €/kWh and investment subsidies up to 55% for private investors and up to 40% for companies.</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Feed-in tariff: 0.2 €/kWh for one year; reduced VAT and subsidies of 30% (private: &lt; 2 kW; legal entity investors: &lt; 20 kW); planned Renewable Portfolio Standard (RPS).</td>
</tr>
<tr>
<td>Denmark</td>
<td>No specific PV programme, but settlement price for green electricity.</td>
</tr>
<tr>
<td>Estonia</td>
<td>Feed-in tariff: 0.07 €/kWh; RPS for electricity (11% by 2005, including large hydro); green certificates</td>
</tr>
<tr>
<td>Finland</td>
<td>Investment subsidy up to 40%.</td>
</tr>
<tr>
<td>France</td>
<td>Feed-in tariff: 0.15 €/kWh for systems &lt; 1 MW for 20 years in continental France, 0.30 €/kWh in Overseas Department and Corsica; 5.5% VAT on investments on existing buildings, 15% tax credit for individual tax payers (40% in 2005).</td>
</tr>
<tr>
<td>Germany</td>
<td>Feed-in tariff for 20 years with built-in annual decrease of 5% from 2005 onward. For plants (not buildings and sound barriers), the decrease will be 6.5% from 2006 onward. The second REE injection law has been approved by the German Federal Chamber, the Bundesrat: 0.46 €/kWh minimum; on buildings and sound barriers 0.57 €/kWh (&lt; 30 kW), 0.55 €/kWh (&gt; 30 kW) and 0.54 €/kWh (&gt; 100 kW), for façade integration there is an additional bonus of 0.05 €/kWh.</td>
</tr>
<tr>
<td>Greece</td>
<td>Feed-in tariff: 0.08 €/kWh on islands and 0.07 €/kWh on the mainland. Grants for 40-80% of total cost. Holds only for commercial applications &gt; 5 kW, no grants for domestic applications.</td>
</tr>
<tr>
<td>Hungary</td>
<td>Feed-in tariff: 0.073 €/kWh until 2010; soft loans; tax reduction, investment and R&amp;D subsidies for RES (private: max 1 k€; companies: max 140 k€; annual funding: 1.2 M€).</td>
</tr>
<tr>
<td>Ireland</td>
<td>Alternative Energy Requirement tender scheme (no targets for PV).</td>
</tr>
<tr>
<td>Italy</td>
<td>Investment subsidy, feed-in law was passed in February 2004 but regulations and tariffs are not defined yet (expected for 2005).</td>
</tr>
<tr>
<td>Latvia</td>
<td>Feed-in tariff: double the average sales price (&lt; 0.15 €/kWh), for 8 years, then reduction to normal sales price; RPS for electricity (6% by 2010); national Investment programme for RES since 2002; “soft” loans granted by the Latvian Environmental Investment Fund.</td>
</tr>
<tr>
<td>Lithuania</td>
<td>Feed-in tariff: 0.056€/kWh</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>Feed-in with quota (1% of total energy consumption). For systems &lt; 50 kW: municipalities 0.25 €/kWh and private investors: 0.45 €/kWh (after the revision of the law in January 2004); in addition investment subsidies up to 40% possible (this was also reduced for systems &gt; 10 kW).</td>
</tr>
<tr>
<td>Malta</td>
<td>No specific PV programme yet, but reduced VAT 5% instead of 15%.</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>Feed-in tariff: 0.068 €/kWh</td>
</tr>
<tr>
<td>Poland</td>
<td>Tax incentives: no customs duty on PV and reduced VAT (7%) for complete PV systems; soft loans (3%) for up to 650.000, max. 5 years and subsidies up to 50% of total costs. April 2004 law; tariffs for all RES-e have to be approved by the regulator; RPS for electricity (2.85% in 2004 and 7.5% in 2010)</td>
</tr>
<tr>
<td>Portugal</td>
<td>Feed-in tariff: 0.41 €/kWh (systems &lt; 5 kW) and 0.224 €/kWh (&gt; 5 kW). Investment subsidies and tax deductions.</td>
</tr>
<tr>
<td>Slovakia</td>
<td>No specific PV programme. Tax deduction on income earned. RE exempt from income tax for 5 years; “soft” loans (granted on case-by-case basis)</td>
</tr>
<tr>
<td>Slovenia</td>
<td>Feed-in tariff: 0.37 €/kWh (systems &lt; 36 kW) and 0.065 €/kWh (&gt; 36 kW) for 10 years; soft loans; subsidies: up to 40% of costs for grid PV, plus 10% for SMES, plus 10% if PV sole electricity source</td>
</tr>
<tr>
<td>Spain</td>
<td>New feed-in law passed in March 2004, which went into effect immediately, 0.396 €/kWh &lt; 100 kW (previously limited to 5 kW systems); &gt; 100 kW 0.216 €/kWh. Duration of payment 25 years, with payment on 80% of rated power output beyond that. The decree has also lifted the 50 MW cap, being now 150 MW</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Net metering with feed-in tariff of min. 0.15 CHF/kWh (0.10 €/kWh); Investment subsidies in some cantons; promotion of voluntary measures (solar stock exchanges, green power marketing).</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>Investment subsidies in the framework of a PV demonstration programme. Reduced VAT.</td>
</tr>
</tbody>
</table>
Appendix 4

The Questionnaire

This questionnaire will be used in a master’s graduation project which aims to investigate the customer behaviors and attitudes towards residential use of Solar Energy Technologies. Current technologies in the market and electricity substructure of North Cyprus are ignored. This project based on assumptions that renewable energy laws will be enacted and EU legislations will be followed in North Cyprus and also smart meter technology will be integrated to the houses. I would be pleased if you keep these conditions in your mind while filling this form.

Thanks for your contribution.

Ulaş Akal

Master’s Student

Eindhoven University of Technology

Industrial Engineering and Innovation Sciences Department
A. Residential Part

A1. Do you own the house that you are living at the moment? Yes | No | I am not the owner but not paying any rent.

A2. Do you have a house in construction process? Yes | No

A3. Do you play a significant role in the economical decisions of your family? Yes | No

A4. Which option in below is describing your house type mostly?

1. Detached House  
2. Semi-Detached House  
3. Flat

A5. Do you have a solar heating system in your house? Yes | No

A6. How much is your house’s monthly electricity bill on average? (Turkish Lira, TL)

1. 0-50 TL  
2. 50-100 TL  
3. 100-200 TL  
4. 200-250TL  
5. More than 250 TL

B. Product Part

B1. Are you interested in long term solutions that would lower down the amount of your monthly electricity bill? Yes | No

If your answer is YES then continue to question B2; otherwise skip to the question C1

B2. Please circle the number that represents how you feel.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neither Agree nor Disagree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

a. My average monthly electricity expense has a significant share within my general expenses. 1 2 3 4 5

b. My average monthly electricity expense is pushing boundaries of my budget. 1 2 3 4 5

c. I am not able to cover other needs because of my average monthly electricity expense. 1 2 3 4 5

d. My average monthly electricity expense has a negative effect on my life quality. 1 2 3 4 5

B3. Have you ever heard anything about Renewable Energy Technologies such as solar panels, wind turbines etc.? Yes | No

If your answer is YES then continue to question B4; otherwise skip to the question B5
**B4.** Please circle the number that represents how you feel.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
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<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neither Agree nor Disagree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

- a. I have a broad knowledge about renewable energy technologies.  
  1  2  3  4  5
- b. Renewable energy technologies are able to solve the energy problem that the world is facing now.  
  1  2  3  4  5
- c. Renewable energy technologies have reached the level to produce economically feasible energy.  
  1  2  3  4  5
- d. Renewable energy technologies are playing a crucial role in order to prevent environmental pollution.  
  1  2  3  4  5

**B5.** Have you ever heard anything about Solar (Photovoltaic, PV) Panels which are one of the renewable energy technologies?

| Yes | No |

If your answer is **YES** then continue to question **B6**; otherwise skip to the question **B7**

**B6.** Please circle the number that represents how you feel.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neither Agree nor Disagree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

- a. I have a broad knowledge about solar panels.  
  1  2  3  4  5
- b. Solar panels are capable to produce economically feasible energy production.  
  1  2  3  4  5
- c. Solar panels are capable to increase the national electricity production capacity.  
  1  2  3  4  5
- d. I wish for an increase in the diffusion of solar panel use in both residual and industrial levels.  
  1  2  3  4  5
- e. Solar panels are economically feasible in residential use.  
  1  2  3  4  5
B7. Consider the assumptions given in the beginning of the questionnaire for this question. Average installation cost for a residential use solar panel technology is 8000 Euro and this technology pays-off after 6 years on average. There will be no more electricity bills after installing this system. Even more you will be paid according to the values on the smart meter that measures the amount of the excess electricity your system provides to the main grid. Considering this information above; how likely you install this technology into your house?


If your answer is c/d/e then continue to question B8 and leave B9 & B10 empty; otherwise skip to the question B9

B8. Please circle the number that represents how you feel.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
</table>

Using solar panels in my house will provide me an economic relief.

Using solar panels in my house will lower down the environmental damage that I cause.

I will be a good example to the society by installing solar panels in my house.

Opinions of the first users about solar panels are important to while installing this technology into my house.

B9. Most of the European Union countries have been following a national program regarding the renewable energy technologies and providing subsidies to the Solar energy applications. Let’s assume that a similar program will be applied in North Cyprus. Then the government would subsidy the 50% of investment cost according to this program. In this case, how likely you install this technology into your house.

C. Psychographic Part

### B10. Please circle the number that represents how you feel.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neither Agree nor Disagree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

- Installation cost of the solar panels is quite high for me. 1 2 3 4 5
- Installing solar panels will cause me an economical burden. 1 2 3 4 5
- I won’t install solar panels in my house until this technology became popular within people around me. 1 2 3 4 5
- I won’t install solar panels in my house until this technology became a necessity. 1 2 3 4 5

### C1. Please circle the number that represents how you feel.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neither Agree nor Disagree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

- a. When I see a product somewhat different from the usual, I check it out. 1 2 3 4 5
- b. I am often among the first people to try a new product. 1 2 3 4 5
- c. I like to try new and different things. 1 2 3 4 5
- d. I regularly purchase different variants of a product just for a change 1 2 3 4 5
- e. I find it boring to use the same product (or brand) repetitively 1 2 3 4 5
- f. I always have the newest gadgets. 1 2 3 4 5
- g. People think of me as a good source of shopping information. 1 2 3 4 5

### C2. Please circle the number that represents how you feel.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neither Agree nor Disagree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

- a. It is important to me to fit in. 1 2 3 4 5
- b. It bothers me if other people disapprove of my choices. 1 2 3 4 5
- c. I like to have some problems which I can solve without much thinking. 1 2 3 4 5
- d. My behavior often depends on how I feel others wish me to behave. 1 2 3 4 5
### C3. Please circle the number that represents how you feel.

<table>
<thead>
<tr>
<th></th>
<th>1: Strongly Disagree</th>
<th>2: Disagree</th>
<th>3: Neither Agree nor Disagree</th>
<th>4: Agree</th>
<th>5: Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. I compare prices of at least a few brands before I choose one.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b. I find myself checking the prices even for small items.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>c. It is important to me to get the best price for the products I buy.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

### C4. Please circle the number that represents how you feel.

<table>
<thead>
<tr>
<th></th>
<th>1: Strongly Disagree</th>
<th>2: Disagree</th>
<th>3: Neither Agree nor Disagree</th>
<th>4: Agree</th>
<th>5: Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. My household budget is always tight.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b. My household often has problems making ends meet.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

### D. Environmentally Consciousness Part

### D1. Please circle the number that represents how you feel.

<table>
<thead>
<tr>
<th></th>
<th>1: Strongly Disagree</th>
<th>2: Disagree</th>
<th>3: Neither Agree nor Disagree</th>
<th>4: Agree</th>
<th>5: Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. We need to worry much about the environment because future generations will not be better able to deal with these problems than we are.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b. The effects of pollution on public health are worse than we realize.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>c. I know that I buy products and packages that are environmentally safe.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>d. I know more about recycling than the average person.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>e. I am very knowledgeable about environmental issues.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
**D2.** Please circle the number that represents how you feel.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Strongly Disagree</strong></td>
<td><strong>Disagree</strong></td>
<td><strong>Neither Agree nor Disagree</strong></td>
<td><strong>Agree</strong></td>
<td><strong>Strongly Agree</strong></td>
</tr>
<tr>
<td>a. We are approaching the limit of the number of people the earth can support.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b. The balance of nature is very delicate and easily upset.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**D3.** Please circle the number that represents how you feel.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td></td>
<td><strong>Strongly Disagree</strong></td>
<td><strong>Disagree</strong></td>
<td><strong>Neither Agree nor Disagree</strong></td>
<td><strong>Agree</strong></td>
<td><strong>Strongly Agree</strong></td>
</tr>
<tr>
<td>a. I do not believe most environmental claims made on package labels or in advertising.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b. I believe that environmental claims are exaggerated</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**E. Demographic Part**

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</thead>
<tbody>
<tr>
<td>E1. Sex</td>
<td>1. Female</td>
<td>2. Male</td>
<td></td>
<td></td>
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</tbody>
</table>

<p>| | | | | | |</p>
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</tr>
</thead>
<tbody>
<tr>
<td>E2. Age</td>
<td>1. 18-25</td>
<td>2. 26-35</td>
<td>3. 36-45</td>
<td>4. 46-55</td>
<td>5. more than 56</td>
</tr>
</tbody>
</table>

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</thead>
<tbody>
<tr>
<td>E5. Monthly Household Income (TL) (Salary + Interests + Rental income)</td>
<td>1. less than 1500</td>
<td>2. 1500-3000</td>
<td>3. 3000-4500</td>
<td>4. 4500-6000</td>
<td>5. 6000-7500</td>
</tr>
</tbody>
</table>

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</table>
## Appendix 5

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>House Ownership</td>
<td>Nominal</td>
</tr>
<tr>
<td>A2</td>
<td>House in Construction</td>
<td>Nominal</td>
</tr>
<tr>
<td>A3</td>
<td>House Economical Decision</td>
<td>Nominal</td>
</tr>
<tr>
<td>A4</td>
<td>House Type</td>
<td>Nominal</td>
</tr>
<tr>
<td>A5</td>
<td>House Electricity</td>
<td>Ordinal</td>
</tr>
<tr>
<td>B1</td>
<td>Electricity Solution</td>
<td>Nominal</td>
</tr>
<tr>
<td>B2A</td>
<td>Electricity Cost 1</td>
<td>Scale</td>
</tr>
<tr>
<td>B2B</td>
<td>Electricity Cost 2</td>
<td>Scale</td>
</tr>
<tr>
<td>B2C</td>
<td>Electricity Cost 3</td>
<td>Scale</td>
</tr>
<tr>
<td>B2D</td>
<td>Electricity Cost 4</td>
<td>Scale</td>
</tr>
<tr>
<td>B3</td>
<td>RSE Awareness Level</td>
<td>Nominal</td>
</tr>
<tr>
<td>B4A</td>
<td>RSE Awareness 1</td>
<td>Scale</td>
</tr>
<tr>
<td>B4B</td>
<td>RSE Awareness 2</td>
<td>Scale</td>
</tr>
<tr>
<td>B4C</td>
<td>RSE Awareness 3</td>
<td>Scale</td>
</tr>
<tr>
<td>B4D</td>
<td>RSE Awareness 4</td>
<td>Scale</td>
</tr>
<tr>
<td>B5</td>
<td>PV Awareness Level</td>
<td>Nominal</td>
</tr>
<tr>
<td>B6A</td>
<td>PV Awareness 1</td>
<td>Scale</td>
</tr>
<tr>
<td>B6B</td>
<td>PV Awareness 2</td>
<td>Scale</td>
</tr>
<tr>
<td>B6C</td>
<td>PV Awareness 3</td>
<td>Scale</td>
</tr>
<tr>
<td>B6D</td>
<td>PV Awareness 4</td>
<td>Scale</td>
</tr>
<tr>
<td>B6E</td>
<td>PV Awareness 5</td>
<td>Scale</td>
</tr>
<tr>
<td>B7</td>
<td>Intention to buy PV</td>
<td>Scale</td>
</tr>
<tr>
<td>B8A</td>
<td>Attitude to PV1</td>
<td>Scale</td>
</tr>
<tr>
<td>B8B</td>
<td>Attitude to PV2</td>
<td>Scale</td>
</tr>
<tr>
<td>B8C</td>
<td>Attitude to PV3</td>
<td>Scale</td>
</tr>
<tr>
<td>B8D</td>
<td>Attitude to PV4</td>
<td>Scale</td>
</tr>
<tr>
<td>B9</td>
<td>Subsidy</td>
<td>Scale</td>
</tr>
<tr>
<td>B10A</td>
<td>Cost Concern 1</td>
<td>Scale</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>Type</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>B10B</td>
<td>Cost Concern 2</td>
<td>Scale</td>
</tr>
<tr>
<td>B10C</td>
<td>Cost Concern 3</td>
<td>Scale</td>
</tr>
<tr>
<td>B10D</td>
<td>Cost Concern 4</td>
<td>Scale</td>
</tr>
<tr>
<td>C1A</td>
<td>Innovativeness 1</td>
<td>Scale</td>
</tr>
<tr>
<td>C1B</td>
<td>Innovativeness 2</td>
<td>Scale</td>
</tr>
<tr>
<td>C1C</td>
<td>Innovativeness 3</td>
<td>Scale</td>
</tr>
<tr>
<td>C1D</td>
<td>Innovativeness 4</td>
<td>Scale</td>
</tr>
<tr>
<td>C1E</td>
<td>Innovativeness 5</td>
<td>Scale</td>
</tr>
<tr>
<td>C1F</td>
<td>Innovativeness 6</td>
<td>Scale</td>
</tr>
<tr>
<td>C1G</td>
<td>Innovativeness 7</td>
<td>Scale</td>
</tr>
<tr>
<td>C2A</td>
<td>Motivation to conform 1</td>
<td>Scale</td>
</tr>
<tr>
<td>C2B</td>
<td>Motivation to conform 2</td>
<td>Scale</td>
</tr>
<tr>
<td>C2C</td>
<td>Motivation to conform 3</td>
<td>Scale</td>
</tr>
<tr>
<td>C2D</td>
<td>Motivation to conform 4</td>
<td>Scale</td>
</tr>
<tr>
<td>C3A</td>
<td>Price consciousness 1</td>
<td>Scale</td>
</tr>
<tr>
<td>C3B</td>
<td>Price consciousness 2</td>
<td>Scale</td>
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Appendix 6a

1st Factor Analysis Results for psychographic and environmentally consciousness variables

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Extraction Method: Principal Component Analysis.

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Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 22 iterations.
### Appendix 6b

#### 2nd Factor Analysis Results for psychographic and environmentally consciousness variables

#### KMO and Bartlett's Test

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | .768 |
| Bartlett's Test of Sphericity | Approx. Chi-Square: 1504.049, df: 171, Sig.: .000 |

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Extraction Method: Principal Component Analysis.

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Extraction Method: Principal Component Analysis.
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Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 8 iterations.
Appendix 7
PCA (Principal Component Analysis) Results for Indicator Variables

**KMO and Bartlett's Test**

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | .769 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 1191.244 |
| df | 78 |
| Sig. | .000 |

**Total Variance Explained**

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Extraction Method: Principal Component Analysis.
Total Variance Explained

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Extraction Method: Principal Component Analysis.

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Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.
### Appendix 8

#### Segment Profiles

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