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Activating the Smart Future:

Customer Incentives in the Transforming Energy Market

— Master-Thesis —

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Preface

This thesis has been written as a part of the degree project course in the Masters program "Sustainable Business Leadership" at the School of Economics and Management, Lund University. The course was based on the methodology of action learning and self managed learning. The students were all assigned to an in-company project as consultants. As a part of course the students were responsible for organizing several learning events addressing relevant issues related to the in-company projects. The students continuously documented their learning in learning journals and participated in tutorials on these journals. The assessments of the students are done partly on the written thesis, partly on the consultancy process, partly on performance in learning events and other parts of the course and partly on the ability to document and reflect on the student's individual learning and development.

We would like to express thanks to all of those persons that made this project possible: the numerous respondents to our questionnaire; Simon Brown of ISS Facility Services AB, Emma Kindesjö of Sony Mobile Communications AB, Rikard Sjöqvist and Karin Skiöld of Midroc Property Development AB for their time and input into our interviews; Li Lövehed, our project sponsor, Petra Janfelt and Ulf Gustafsson of E.ON Sweden and Stein Kleppestø our project supervisor who has provided us with direction and support.

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Abstract

Title: Activating the Smart Future: Customer Incentives in the Transforming Energy Market

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Background: Pressure from volatile fossil fuel prices, an increased awareness of climate change and technological advances has resulted in a changing relationship between utility companies and their customers and has created a demand for more efficient and controllable electricity products and services. Smart services are seen as a tool to meet the demands of the market and to encourage consumers to take more control of their energy usage. However, smart services are still in their infancy and knowledge of how to encourage their adoption in Sweden and therefore stimulate Swedish consumers to take a more active role in electricity consumption is insufficient.

Purpose: This is a mixed method study of residential and commercial electricity consumers in Sweden. The purpose is to assist E.ON in meeting the demands of the transforming energy market by collecting and analyzing data concerning the awareness, drivers and willingness of consumers to adopt smart services, and to suggest incentives that could encourage consumer engagement with electricity use, including market segmentation of residential consumers.

Method: This study uses a mixed method analysis. Primary data for residential Swedish electricity consumers was collected through 528 completed questionnaires whereas interviews were conducted with representatives from ISS Facility Services, Sony Mobile Communications and Midroc Property Development in order to obtain a commercial perspective on smart services.

Conclusions: This study suggests that there is currently a very low level of awareness of smart services both in the residential and commercial sectors but that despite this a high proportion of respondents are willing to adopt smart services at some level with the ability to monitor energy use in real time being the most popular. Cost was identified as the most important consumer driver to adopt smart services and ultimately change energy consuming behavior but the ability to control ones energy use and environmental considerations were also significant drivers. Trust in the utility company was recognized as the most significant barrier to smart service adoption. However, the level of knowledge about smart services showed a positive correlation with consumers' willingness to adopt smart services suggesting that barriers can be broken down by information. A residential consumer market segmentation matrix was constructed from which tailored incentives were derived to cater to the increasingly heterogeneous market.

Commercial consumers were more receptive than residential consumers and put more significance of the environmental benefits of smart services however, cost still remained a decisive issue. Incentives must be specific to the size and type of commercial consumer with simplicity and customer support being desired.

Key words: Awareness, Customer Incentives, Drivers, Electricity, E.ON, Energy, Hyllie, Market Segmentation, Smart Grid, Smart Services, Sustainable Development, Swedish Consumers, Willingness to Adopt.

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Chapter 1 Background

Energy and public utility systems such as electricity grids are generally accepted to be natural monopolies; the high costs of building the transmission infrastructure create huge barriers for new entrants to join the market. However, the continued increase in the demand for energy means there is a growing need for a better level of cooperation within the energy market in order to improve transmission and distribution efficiency. The increase in the demand for energy, coupled with a precarious oil supply, has resulted in volatile energy prices. Consequently there has been increasing pressure for individuals, organizations and governments to become less dependent on oil by using energy more efficiently and by developing renewable energy sources.

The electricity industry is currently faced with many challenges: an ageing infrastructure; continually growing demand; the integration of a variety of renewable energy sources; the increasing numbers of electric vehicles; the need to improve the electricity supply security; and the need to lower carbon emissions (IEA, 2011). Moreover, since it is expensive to store electricity, the electricity supply and demand must be constantly balanced in order to be economical. Most electricity systems are therefore vertically integrated, which has lead to integrated transmission grids (Van Vactor, 2004), and also increased the efficiency of operation. However, it is far from sufficient to only have vertical integration; horizontal cooperation is also required to meet the growing demand in a sustainable and efficient way.

These factors have provoked an electricity market transformation, which is two-fold. Firstly renewable sources are taking a larger proportion of all energy consumed; secondly the need for cooperation and integration between electricity generation and consumption requires better demand side management in order to maximize the efficiency of energy utilization (Van Vactor, 2004).

IBM's 2007 paper *Plugging in the consumer: Innovating utility business models for the future* describes that, in concordance with the market transformation, there is also a radically changing relationship between utility companies and their customers. Previously, utility companies enjoyed seemingly ubiquitous control and customers were happy to be, what the paper later

describes as, ‘Passive Participators’ (“An energy consumer who is relatively uninvolved with decisions related to energy usage and uninterested in taking or unable to take added responsibility for these decisions” (IBM, 2007)). However, increased awareness of climate change together with the development of technology has created a demand from customers to be able to manage and control their own energy usage.

E.ON have proposed the implementation of smart services to address the challenges of the transforming energy market by providing a more efficient, sustainable and affordable electricity supply and to meet the new demands of consumers. Smart services can be categorized into three components: smart grid, smart meter and smart appliances.

Smart grids are owned by utility companies, they intelligently balance electricity production with electricity demand therefore reducing the need to store energy and increasing energy efficiency. An example of its application would be to automatically switch off air conditioners or freezers during short-term periods of high demand when electricity price is higher. Smart meters measure the consumption of energy in real time; they relay this information back to the utility companies who can then use the information for remote data gathering or billing purposes. A smart meter can also serve a purpose for the consumer; it monitors energy use so that user can be more aware of their energy consumption levels and can then act in an informed manner to reduce them. The smart meters serve to meet the demand for consumers to have more control over their energy use. The tertiary level of smart integration is having smart appliances. Smart appliances are electronic devices, such as dishwashers and washing machines, which can operate intelligently with the smart grid to function at times of low electricity demand and therefore reduce the cost and environmental impact of the energy use (Ernst & Young, 2010).

The implementation of the potentially omnipresent smart services brings with it significant challenges. E.ON are still in the early stages of the implementation and the Swedish residential and commercial market’s receptibility to smart services is relatively unknown. In order to optimize the adoption of smart services, an understanding of consumer awareness levels, behavioral drivers and level of willingness to adopt is essential. Having gained this information, E.ON must then be able to create tailored incentives that target the different segments of their consumer market.

Purpose Statement:

This is a mixed method study of residential and commercial electricity consumers in Sweden. The purpose is to assist E.ON in meeting the demands of the transforming energy market by collecting and analyzing data concerning the awareness, drivers and willingness of consumers to adopt smart services, and to suggest incentives that could encourage consumer engagement with electricity use, including market segmentation of residential consumers.

Chapter 2 Previous Reports

IBM and Accenture have both published reports in which electricity consumers' awareness, drivers and willingness to adopt electricity management services were determined. The Accenture report also includes the format from which our market segmentation analysis was adapted. This chapter discusses the importance of these reports in the construction of our questionnaire, the formation of our segmentation matrix, and introduces the data to which some of our results are compared.

IBM Global Business Services published a series of reports between 2007 and 2011 that revealed an evolving relationship between utility companies and their customers within the transforming energy market. The scale and scope of the reports is far beyond that of which could have been achieved by this project given the time constraints; IBM surveyed over 5000 energy consumers and 100 business executives throughout 12 countries with developed energy markets. These questionnaires and subsequent reports offered significant aid to this project: data is presented that suggests consumers' levels of awareness to energy management programs, key drivers of consumers' energy consuming behavior and their willingness to adopt smart services.

In 2010 Accenture published the report '*Understanding energy consumer preferences in energy efficiency: Accenture end-consumer observatory on electricity management'* that examined consumer opinions and preferences of electricity management programs. The report is based on a global consumer survey of over 9000 individuals across 17 countries including Sweden. It aims to understand the awareness levels and identify the key drivers of consumers with regards to electricity management programs, and bares significant congruence to the objectives of this project. Further to this, the report also makes recommendations to utility companies on how best to target consumers through market segmentation and identification of specific information channels. The report supports the suggestion made by the 2007 and 2008 IBM reports that climate change and volatile energy costs are driving a changing relationship between utility companies and their customers, which have lead to large-scale investments in more efficient, renewable and controllable energy solutions. The report also recognizes that smart services are

tools that can address the demands of the consumers but that the challenge lies with engaging the consumers to adopt the smart services and ultimately to play a more active role in energy usage.

In order to understand the respondents' awareness about energy management programs, Accenture posed the question: "Have you heard of programs that help you to optimize your electricity consumption (i.e., electricity management programs)? The average number of respondents that had heard about such programs was only 28% and perhaps surprisingly in Sweden this figure was only 14%. Although smart services have been presented as a possible tool to forge the new active symbiotic relationship between utility companies and their customers since IBM's report in 2007, the Accenture report suggests that awareness levels amongst the end-consumers are low. The 2007 IBM report suggests that willingness to adopt is positively correlated to awareness, therefore understanding whether Swedish consumers' awareness level of smart services is as low as 14% is crucially important for E.ON when they devise their implementation strategy. The 2011 IBM paper supported Accenture's findings of low awareness levels of energy management services and stated that there remained a lack of awareness on the part of consumers about what they could do to take a more active role in energy consumption and what services were available to better manage and control their energy usage.

Despite the low levels of awareness, the Accenture report presented some encouraging results; the majority of respondents indicated that their utility company would be their first choice of contact for information, advice, purchasing and customer service with regards to electricity management programs. This suggests the need to do little work to convince consumers that they are the right people to be implementing smart services. However, although this is the case the Accenture report suggests that a remarkably low percentage of respondents would trust the information and advice given to them by utility companies. On average only 29% of respondents trusted utility companies to inform them of actions that could be taken to optimize energy usage, and this figure fell to 16% in Sweden. The evidence suggests that if E.ON are to implement products and services to increase the efficiency of energy use, there will be trust barriers that must be overcome first.

IBM's 2008 report identifies that the three main drivers that would act to alter the respondents' behavior with regards to energy usage are cost, control and environmental impact. Understanding

consumers' drivers for behavioral change is integral to the output of this project. Cost is reported to be the most significant factor to motivate behavioral change with regard to electricity use. This was compounded by the onset of the economic downturn. When asked by IBM, 80% of respondents reported that they would change the time that they did their energy intensive housework (washing clothes etc.) if there was a saving of 50% on the cost of electricity used. This project has posed a similar question to end consumers so that the Swedish energy consumers' behavioral incentives can be compared.

IBM's reports of 2007 and 2008 indicate that there is increasing demand from customers to be able to control their energy usage, both in terms of cost reduction and environmental impact. Almost 100% of consumers were once deemed to be in the 'Passive Persistence' segment of the market (i.e. they are happy with a constant flat rate price and very little interaction with the energy company). However, the 2008 study indicates that they now make up only 31% meaning that nearly 70% of consumers are looking to take a more active role in their relationship with their energy company. It was through such an understanding that we could present control as a key driving option in our questionnaire.

The environmental factors remain at the forefront of most of the respondents' minds; for 11 out of the 12 countries between 64 and 75% of respondents saw environmental impacts as an important factor when purchasing non-energy related products.

The Accenture report supports the findings of the 2007, 2008 and 2011 IBM reports by suggesting that cost is the key driver for adopting electricity management programs with 88% of respondents placing it in their top three determining factors. Increased control and environmental concerns are again the second and third most important factors, but with environmental concerns this time placing higher; at 51 and 66% respectively. However, when the respondents were asked to place relative importance on each component in the decision to adopt electricity management programs (cost, control, environmental concerns and time taken to manage electricity use) the Swedish respondents answered: cost 37%, control 33%, and environmental concerns 17%, therefore supporting IBM's suggestion of control being a more important factor. This evidence reinforced the decision to target these drivers in the questionnaire.

The 2008 IBM survey also asked its subjects to rank a list of risks related to smart services and then collated the respondents' top 3 responses in order to provide evidence of barriers to the adoption of smart services. The risk posing the greatest concern was that the smart meter will be inaccurate and that the user will be over charged for the electricity. The questionnaire distributed as part of this project asked the same question in order to identify whether the barriers that were seen to be the most important amongst the respondents of the IBM survey posed the same deterrent in Sweden.

Although the report highlights the concerns that consumers have about smart services, it does provide encouraging evidence that draws a strong positive correlation between consumer knowledge about smart services and their willingness to adopt them. 43% of respondents with little knowledge of common industry terms such as the abbreviation 'kwh' have positive opinions about smart meters; this figure rises to 50% with a moderate level of knowledge and 61% with a high level of knowledge.

IBM's 2008 report showed that 90% of respondents indicated that they wanted a smart meter or other tools to manage their usage with 55-60% willing to pay an up-front fee or a monthly fee for the service. Swedish end-consumers have been asked in our questionnaire whether they wanted a smart meter and whether they would be willing to pay an up-front fee for it so that the Swedish population can be positioned on a global scale.

The Accenture report identifies that the customers' readiness to adopt energy management programs is dependent on numerous drivers that extend beyond ordinary purchasing decisions. In response to this, they have defined six market segments based on the different levels of importance customers put on: cost, control, environmental concerns, and time. Figure 2-1 below is taken from the Accenture report (2010) and describes the market segments in terms of adoption attributes and demographics. The numbers in brackets indicate the average customer distribution for the respondents throughout the 17 countries.

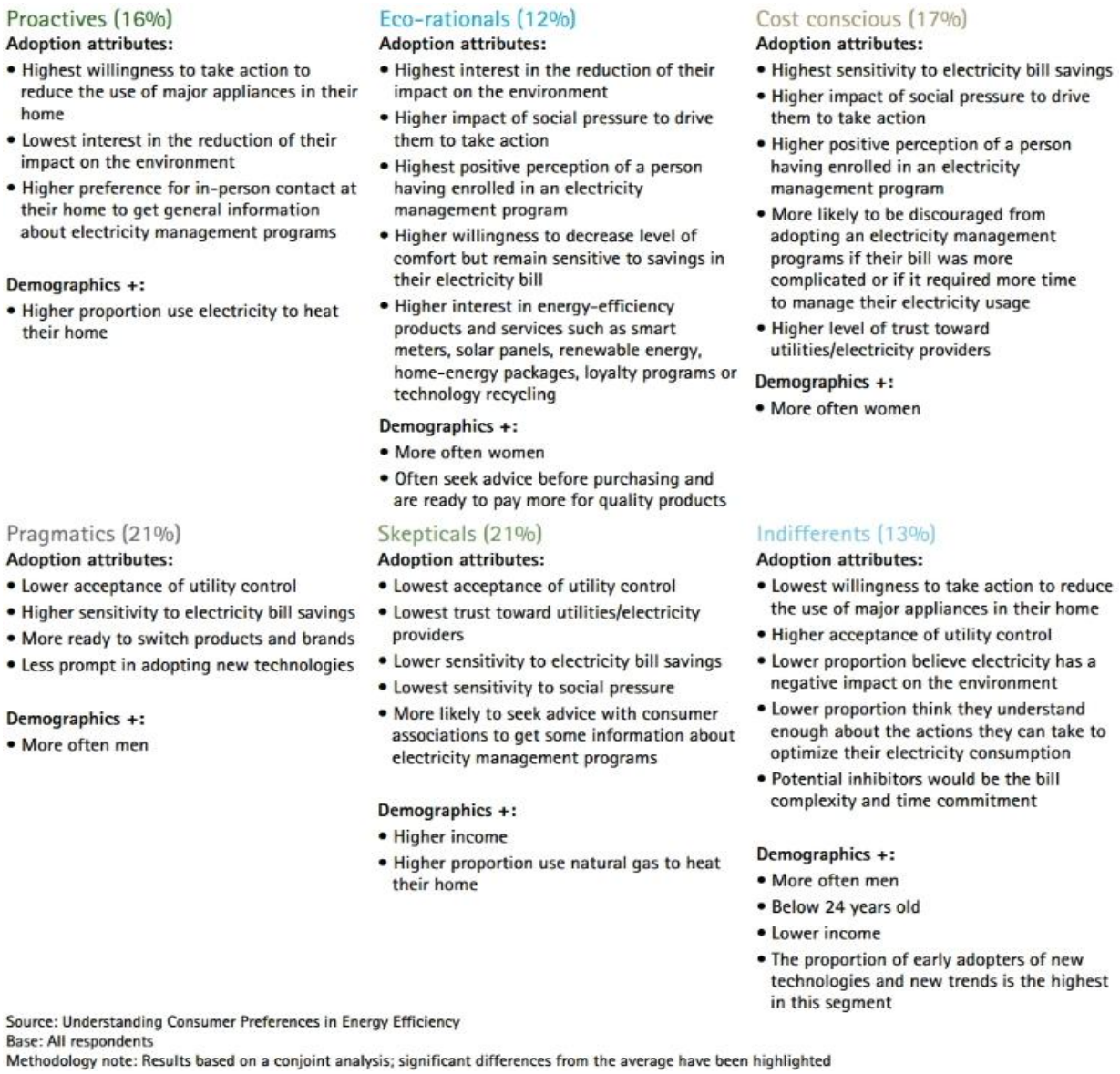


Figure 2-1 Customer Segmentation Model (Accenture, 2010)

This model has been used as a basis to segment the Swedish electricity end-consumers in this report albeit with modifications. The time taken to manage energy use during the energy management program was a criterion used to generate these market segments however, it was not a criterion used in the IBM report when determining the drivers of smart service adoption. It was also not deemed a justifiable criterion in the questionnaire produced by this report as only 38% of respondents marked it as one of their top three factors that would encourage the adoption of

energy management services compared to 88%, 66% and 51% for cost, environmental concerns and control. Similarly, it was recognized that the Proactives group did not fully represent those that were most willing to adopt smart services from the results of this survey. The current level of knowledge was a far more closely linked factor to likeliness to adopt and therefore a new category was created to account for this population (Technical Pioneers).

IBM and Accenture are internationally credited consultancy firms; their reports on consumers' attitudes and knowledge about energy management programs are easily accessible to all audiences. The reports offer a vast quantity of data (5000 and over 9000 respondents for IBM and Accenture respectively); this far exceeds the volume of data that was realistically obtainable in this survey given its 9-week duration. However, the use of these reports does have limitations; most substantially the questions asked by Accenture to gather the information used to generate the market segmentation analysis are not reported. It has been possible to create our own market segmentation based on the traits described by Accenture but because of the lack of protocol the two populations are not comparable. Another limitation is that the data collected for the first IBM report is now 5 years old since which there has been an economic downturn, the 2008 and 2011 reports address the changing global financial state but the time between reports must be taken into account when comparisons between our results and IMB's and Accenture's are made. Despite these limitations, the reports provided tested questions that we adopted into our questionnaire, provided background information about existing drivers of behavior, and suggested possible barriers to smart services. The reports also serve as a global data set against which our findings are compared, allowing unique features of the Swedish market to be identified.

Chapter 3 Methodology

The purpose of this section is to discuss the data required and the methods of the research process, and the range of implications of these methods upon our results. This research project involves qualitative as well as quantitative methods, as both are relevant in researching consumers' awareness, drivers and willingness to adopt.

3.1 Data required

We sought data from residential and commercial energy consumers that would allow us to assess their awareness levels, drivers and willingness to adopt in relation to smart services. For residential consumers, we required mainly quantitative data that would allow us to create market segments based upon their knowledge of, and motivations towards smart services, for the purpose of effectively targeting incentives. For commercial consumers, we sought more in-depth qualitative data, due to the relative complexity of an organization adopting smart services compared to a single household. We aimed to gain an understanding of the organizations' attitudes towards energy and sustainability in order to assess their drivers and willingness to adopt, and to create suggestions for incentivizing smart service adoption.

3.2 Mixed methods

There are three distinct methods on which research can be based – quantitative, qualitative, and mixed methods. The mixed method approach, used for this research, includes both quantitative and qualitative data and analysis, but is considered a separate method that develops its own strategies.

Creswell (2003) explains quantitative research within a survey; it "provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population. From sample results, the researcher generalizes or makes claims about the population" (Creswell, 2003, p.153). Creswell (2003) provides detailed plans for how research should be designed and implemented for a particular project. In the case of quantitative method research,

he emphasizes the importance of identifying the purpose of the survey; justifying the reason for using a certain type of data collection; indicating the time frame of data collection; and introducing the form of the method used to gather information.

Qualitative research can be described as "social or behavioral science research that explores the processes that underline human behavior using such exploratory techniques as interviews, questionnaires, case studies, and other relatively personal techniques" (Salkind, 2012, p.213). According to Creswell (2003), there are several approaches to ethnographic data collection by qualitative means – taking observational notes; audio taping and transcribing interviews; leading a journal during the process of gathering information; staying updated with different forms of public and personal documents; and collecting electronic messages. In addition, he states that it is characteristic of the qualitative method to be represented in a narrative text, which again is a consequence of it being descriptive and interpretive.

The third approach, mixed methods research, is a combination of both quantitative and qualitative methods within one study. In terms of implementing mixed methods research, Creswell (2003) focuses on some core steps, namely clarifying what the method means; how it is perceived by the reader; if the criteria are clear; if there is a visual model properly presented; if the procedures are identified; and if the narrative structure of the analysis is made clear.

According to the implementation sequence, the prevailing method in the study, the manner of data integration, and the theoretical outlook, Creswell (2003) distinguishes several types of strategies. Using both quantitative and qualitative research methods simultaneously, our strategy could be classified as being the 'concurrent triangulation strategy', with both methods being key parts of the research on customer incentives. The two methods complement each other and provide us with considerations of incentives for the Swedish market as a whole.

Mixed methods research is more comprehensive than individual quantitative and qualitative methods as it includes characteristics of both, and therefore offers the opportunity for a more detailed analysis, as well as for the researcher to embrace a wider range of questions (BMC, 2007). Gray et al. (2007) simply define quantitative research as using "numbers to describe what exists", and qualitative research as using "words […] that convey what exists" (Gray et al., 2007,

p.42). Therefore, by adopting a mixed methods approach, we ground our analysis upon numerical as well as textual data, providing a suitable level of detail and relevance to meet our research objectives.

3.3 Methods of obtaining data

3.3.1 Questionnaire

It was decided that questionnaires provide the best solution for obtaining the residential consumer data. Having considered several channels for questionnaire distribution, an online tool, Netigate, emerged as the most suitable for this research project in terms of timescale and the output of data it could provide, and E.ON provided the funding for using this service that provided guaranteed responses. It was economical in terms of time, and allowed us to gain a reasonably large sample of data. It also broadened the geographical span of the research beyond the Lund/Malmö area, which could have been an issue for face-to-face questionnaires.

The questionnaire carried the E.ON and Lund University logos, and was quality verified by E.ON so that they were happy for the questionnaire to be endorsed with their branding. We considered that the combination of the E.ON and Lund University logos and an introduction at the beginning of the questionnaire would create a level of professionalism, which would establish enough trust for respondents to give useful information. The questionnaire was trialed on a small population in order to verify the comprehension of the questions and to fine tune particular aspects. Having first designed the questionnaire in English, it was later translated into Swedish in order to increase the response rate and also the understanding for the respondents. A detailed and specific design plan for the questionnaire is included in Appendix 1.

In order to make sure that the data collected precisely reflected the Swedish population, we calculated the required sample size based on the population of Sweden. Sweden's population of 7.4 million over 18 years old (Sweden's Official Website, 2012), combined with a confidence interval of 4, and a confidence level of 95% gave the result of 600 questionnaire responses. These figures mean that the results could be applied to the general Swedish population, with an error level up to a 4%, with a 95% certainty that the error does not exceed this. Research has shown that it is possible to achieve response rates anywhere from 20% to over 70% with online

surveying (Sheehan, 2001) so online surveying showed potential to achieve our target of 600 responses fairly efficiently. Shannon and Bradshaw's (2002) research showed an average response time of around 10 days (from sending the questionnaire to receiving responses back). However, other research has shown quicker responses than this; around 5 days (Sheehan and McMillan, 1999), which seemed reasonable to fit in the timescale of this project. The guaranteed responses via the Netigate service overcame these problems, as responses were guaranteed within 2-3 days.

Questionnaire Analysis: To allow us to analyze the data, numerical information was extracted from the Netigate online tool into an MS Excel database. Some of the tools available on the Netigate service were used to create charts to display the data, but the limited options meant that some graphs were constructed in MS Excel. Statistical analysis was performed, mainly in the identification of market segments and the size of each segment. Segmentation is loosely based upon theories of behavioral market segmentation, (discussed in Chapter 4 on theory), and Accenture's market segmentation model. See Appendix 3 for information on the statistical calculations behind our segmentation.

Challenges for online questionnaires: If using the Netigate tool was not an option, obtaining a wide set of email addresses could have been somewhat problematic as there are limited sampling frames within the wide online population (Bryman, 2008), and there is "a growing antipathy towards unsolicited emails" (p.484). It may have been necessary to use email lists from within an organization or to publish the questionnaire online on a forum or blog where it would see enough internet traffic to gain an adequate number of responses. For example, targeting faculty/students at a range of Swedish universities was considered. Although this would have limited the range of respondents, we considered that this option could still provide responses from which meaningful conclusions could be drawn, and that subjects may be more receptive to students performing a survey compared to those outside an academic setting. Of course, generalizations from the data cannot be applied outside the group of respondents themselves and cannot be considered representative of a wider context. For instance, students could not be considered representative of the wider Swedish population. With a self-selection sampling method, it is important to remember that those who are most likely to respond are those who feel strongly or are most vociferous on the issue of energy use, and this is true for both face-to-face street questionnaires

and online questionnaires. Respondents who are uninterested may rush the questionnaire and leave responses without much thought, especially on more complex questions, and it is typical for respondents to lie about such things as their income (Deaton, 1997), which creates a limitation to the accuracy and reliability of the data. It can be hard to determine people's real willingness to pay because respondents may say that are willing to pay a premium for environmentally-friendly products, but in reality they may still buy the cheaper, non-eco alternatives. To minimize this limitation, in-depth interviews with some questionnaire respondents could have provided more insight about their willingness to pay. Understanding of the questions is a concern common to all questionnaires, and therefore much effort was spent attempting to make the questions as simple and clear as possible.

3.3.2 Interviews

Face-to-face, semi-structured interviews were used to obtain the commercial energy consumer data. We conducted a combined interview with Simon Brown, who has the role of Global Project Leader for ISS Facility Services (ISS), and Emma Kindesjö, the Carbon Footprint Specialist at Sony Mobile Communications (Sony Mobile). We also interviewed Rikard Sjöqvist, the technician from Midroc Property Development (Midroc). Questions were prepared to provide some direction to the interview, whilst maintaining a level of freedom for the respondents to respond in a broad manner and express their feelings on an issue that they feel is particularly pertinent. The interviewees represented three different users of commercial buildings: Midroc construct and own commercial buildings, ISS manage buildings and Sony Mobile is a tenant. This gave us different perspectives from within the commercial sector. See Appendix 2 for a more detailed explanation of the interview design.

Interview Analysis: Qualitative information was transcribed and underwent a thematic analysis. In order to do this, the transcripts were thoroughly read and re-read, as suggested by Bryman (2008) and coded into themes. We followed Ryan and Bernard's (2003) recommendations to search the data for: repetition of topics; metaphors and analogies; similarities/differences between interviewees; linguistic connectors; and missing/avoided questions. The information was then synthesized within a discussion of each of the identified themes. Interview transcripts are available on request.

Challenges for interviews: The issues of ethics and positionality were relevant within this study, as is the case in any research project, and whilst interviewees are representatives of an organization, they are still individuals expressing their own personal views. In the analysis of interviews, it is important to remember that beyond the verbal responses of interviewees, the way in which people respond and react to questions can provide insight into their true feelings. Interviews can quite often be "considered more carefully to be a narrative of activities which they themselves require analysis" (Silverman, 2010 p.48). Thematic analysis of interviews "lacks a clearly specified series of procedures" (Bryman, 2008, p.555), and its broadness can make it difficult in identifying relevant themes. Effort was therefore made in keeping the analysis relevant to our larger research themes of awareness, drivers and willingness to adopt.

3.4 Assessment of data and results

The 2-month time scale of this project meant that choice of methods that can yield enough data within that time was vital, and we must acknowledge the limitations of such methods and the implications this may have in our data and results.

3.4.1 Limitations of online questionnaire

One of the major limitations is that all the respondents were Internet users and this inevitably excluded those ones who are not. We found no evidence showing whether there are big differences between frequent and non-frequent computer/Internet users in terms of energy consumption, but there may be some differences in income or education level, which could in turn affect their energy consumption behaviors. With more time and resources, conducting part of the questionnaires through postal mails could minimize this limitation. Another limitation of using the Netigate service is that we do not know how they approach the respondents and what the incentives are to answer the questionnaires, which could risk the reliability of the data.

Our concern with the branding of the questionnaire was that respondents might be conservative in giving opinions to an E.ON survey, due to general low levels of trust in energy suppliers. This could affect the reliability of the data.

Financial constraints meant that only 300 responses could be guaranteed. After collecting the first 300 completed answers, we examined the questionnaire response distribution on the bias of gender, region and age group. Those 300 responses were collected evenly according to gender and region, but did not show an accurate representation of the Swedish age distribution, compared to census figures. Almost 50% of the responses came from the age group above 65 years old. This issue was discussed with Netigate, who agreed to collect more responses from the other age groups to give a more representative age distribution from the respondents. In total, there were 528 completed responses, fairly close to our original target of 600.

3.4.2 Lack of expert opinion

Expert opinions could provide insight and increase the reliability of the data and results. Researchers looking into relevant topics and sales representatives in energy companies would have been potential targets for this. However, accessibility and timing meant that our research lacks direct information from such sources, although it did involve considerable research of existing reports.

3.4.3 Access to interviewees

Gaining access to representatives from businesses presented some challenge, as expected, and therefore our selection method was based somewhat on the access and availability of individuals. The three companies that we interviewed are all located in Southern Sweden (Lund/Malmö), where the climate is moderate and the culture and lifestyle is different from Northern parts of Sweden. The interview data is not representative of the whole country.

Moreover, this research is only conducted in Sweden so generalizations from the data cannot be applied outside Sweden nor considered representative of a wider context. Considering that the common Nordic end-customer market will be introduced 2015, we feel that more comprehensive similar research across other Nordic regions in the future could provide useful information.

Chapter 4 Theories

In this chapter, we will discuss the ties between market segmentation and customer incentives. The analysis is concerned with three perspectives: customer awareness, drivers and willingness to adopt. The purpose of this chapter is to provide theoretical support for analyzing the questionnaire and interview data.

4.1 Market segmentation

There are many definitions of market segmentation, but the one which stands out the most is by the pioneer of the concept, Smith (1956, p.5), according to whom "segmentation is based upon developments on the demand side of the market and represents a rational and more precise adjustment of product and marketing effort to consumer and user requirements. In the language of the economist, segmentation is disaggregative in its effects and tends to bring about recognition of several demand schedules where only one was recognized before". Despite the fact that the above definition is the one most cited, in the case of our research, in which we focus on customers' incentives for a new product adoption, we need to use Smith's own elaboration on the term, and further explain the concept by noting that "market segmentation […] consists of viewing a heterogeneous market […] as a number of small homogeneous markets in response to differing product preferences among important market segments. It is attributable to the desires of consumers or users for more precise satisfaction of their varying wants" (Smith, 1956, p.6).

Kotler and Keller's (2012) detailed models of market segmentation present various ways to distinguish different groups that can be targeted, but one of the most important conditions is that the division is upon clear principles. Segments must be measurable, substantial, accessible, differentiable, and actionable, in order for the segmentation to be an effective strategy for the company. Within our research, obtaining demographic characteristics of questionnaire respondents allows us to relate customers' responses to their needs and desires stemming from factors such as age, family size, gender and income, and as Kotler and Keller (2012) state, collecting demographic data is a simple way to measure the size of the market. However, our focus is on is behavioral segmentation, which is based on "knowledge of, attitude toward, use of,

or response to a product" (Kotler and Keller, 2012, p.249). The behavioral segmentation breakdown below shows the different bases theorized by Kotler and Keller (2012), which reflects the behavior of customers according to their awareness and experience of a product.

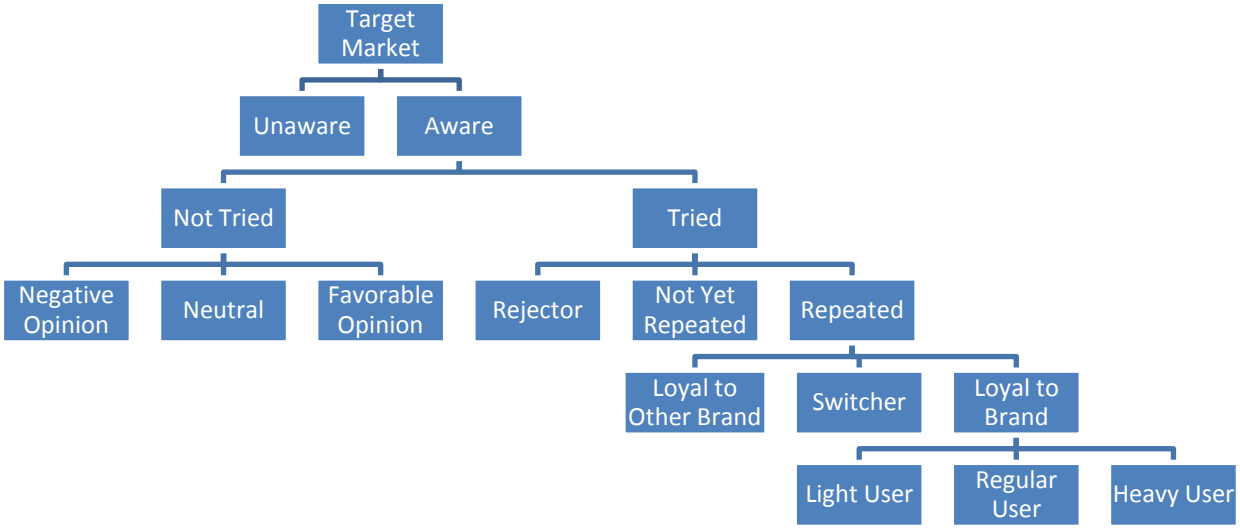


Figure 4-1 Behavioral Segmentation Breakdown (Kotler and Keller, 2012, p.251)

4.2 The ties between market segmentation and customer incentives

The term *customer incentives* refer to a set of factors that attract and satisfy customers, boost sales, expand the customer base and build customer loyalty. Moreover, customer incentives, if properly delivered, can also enable companies to track and even change consumer behavior. Market segmentation and customer incentives could be seen as interactive. Each segment of the market contains customers that have similar responses to incentives. At the same time, a good understanding of customer incentives helps companies to better segment the market based on different incentive factors.

Based on Kotler and Keller's (2012) definition of behavioral segmentation, as mentioned above, there are three levels of customer incentives embedded in the behavioral segmentation approach: customer awareness, drivers and willingness to adopt.

4.2.1 Customer awareness

Customer awareness refers to the potential customers' knowledge of a product or service and is the first consideration for a marketing program. Awareness therefore forms a basis for further marketing. Although Figure 4-1 categorizes customers as either aware or unaware, we consider that different levels of knowledge could actually have implications in segmenting customers and designing incentives.

4.2.2 Drivers

After becoming aware of a product or service, customers could have a different attitude towards it (Kotler and Keller, 2012). Customer values describe the customer's expected experience when they buy and use a product or service, and three major sources of customer value are financial value, functional value and psychological value (Dowling and Uncles, 1997). Accordingly, customer drivers can be categorized under those three dimensions.

Affected by the financial value proposition, customers will be driven by pricing. According to the neoclassical theory of consumer choice, the maximization the satisfaction customers feel is in the basis of their decisions, but at the same time they are challenged by the limitations of their income and the prices on the market. Therefore, customers' level of willingness to pay varies according to their financial situation (Jonsson, 2005). Ekström (2010) also argues that there are always budget constraints when customers face a buying decision, because "in the long run the value of the goods and services that a household or individual consumes cannot exceed the income" (Ekström, 2010, p.118).

The functional value proposition drives the customers to pursue sound functionality when making buying decisions. Consistent with Kotler and Keller's (2012) findings, Ekström (2010) also states that many customers want to see and try the products before buying to be confident of the reliability and quality of their purchase.

In relation to the psychological aspect, one popular theory that explains drivers is 'Maslow's Hierarchy of Needs'. Maslow (1954) describes human needs in the form of a pyramid, with the most basic needs on the bottom and the self-actualization needs at the top, where the lower needs

must be satisfied before pursuing a higher need. The implication of Maslow's hierarchy of needs to customer drivers is that only unsatisfied needs can be used as incentives, and once that need is satisfied it stops being an incentive and a higher level need becomes the motivator.

The drivers coming from Maslow (1954), Jonsson (2005) and Ekström (2010) normally do not act separately. Instead, they interact with one another and form an integrated driver that affects customers buying decisions. One such model is the MAO Model, which describes how internal Motivations (norms and values), Ability (customer knowledge) and Opportunity (external conditions like cost or time consumed) interact in determining environmentally responsible behaviors (Ekström, 2010).

4.2.3 Willingness to adopt

Different awareness levels and drivers result in different levels of willingness to adopt. Frank, Massy and Wind (1972) clarify the concept of adoption and customers' participation in the adoption and diffusion process by dividing them into groups that accept and develop information of new products differently. According to information-processing behavior, there can be distinguished transmitters, seekers, and avoiders of information; in terms of influence patterns, customers can be opinion leaders or not; and in terms of innovativeness, customers can range from early adopters to laggards in adopting a new product.

4.3 Customer behaviors in the energy market

4.3.1 Service and consumption

The Information and Communication Technology (ICT) revolution has dramatically changed the way customers behave in terms of their selection and use of products. Ekström (2010) argues that historically, services have developed with the organization at the center, and rather what is needed is a customer focus where the wants and needs of the customer are central. This type of focus is emerging, and it has been argued that the service economy in which we currently live means that we no longer buy products, rather offerings which help us to create value in various parts of our lives (Grönroos, 2007 cited in Ekström, 2010 p.495). In terms of marketing there should therefore be a focus on the value of the use of the product from the perspective of the

consumer. Edvardsson et al. (2005, cited in Ekström, 2010 p.496) contend that for a service "the focus is on value through the lens of the customer; and co-creation of value with customers is key and the interactive, procedural, experiential, and relational nature form the basis for characterizing service".

The trend has been towards services that are more personalized, and the increased controllability via smart energy services is certainly an example of this. Beyond merely providing energy, the service that smart services offers could be seen to be one enabling the customers to meet their own challenges of contributing to something which is environmentally positive, as well as possibly cost reducing. Marketing in general has seen a movement towards a more service-dominant (SD) logic, and perhaps the energy sector has been a laggard in this area with energy suppliers simply considered as utilities rather than a supplier of a service with which the user interacts to create value. The service offered, therefore, must be more than just electricity. It is in the user's interaction with energy to move towards environmental and cost-reducing goals that the value of this service lies, and smart meters, smart mobile-apps, and smart appliances are a means for customers to be able to create this value. By considering the value creating processes and daily activities of consumers, there is a stronger focus on providing a solution that enables customers to create value through their own behavior i.e. their interaction with smart services. The results of the questionnaire, discussed later, provide some evidence of which factors are most important for consumers and thus as what type of service smart services should be marketed.

Ekström (2010) also notes that becoming a service rather than a product creates greater leverage for improvements in customer satisfaction and loyalty – customers feel more strongly bonded to something that they themselves interact with and have played a part in creating the value of. Branded phone and computer smart apps could remind customers that this is a joint process of value creation with the energy provider and themselves, and firmly puts the energy company in the category of being a service rather than just a utility. The feeling of working collaboratively with other consumers and the energy supplier to reach environmental goals could be a powerful motivation, but of course trust in the energy company is needed and is something that should be nurtured, with communication being important in this issue.

One major aspect of the ICT revolution is the liberation of constraints of where, when and with whom things need to be done, and the nature of spot pricing could be seen as constraining rather than liberating when considered in relation to current patterns of daily energy use. One emphasis of smart services therefore needs to be that it is something that makes the process of value creation easier for consumers, i.e. whilst achieving environmental, controllability and cost-saving benefits requires some effort on the part of the consumer, smart services minimize the effort and maximize the benefit; if the consumer can become slightly more flexible then smart services can work with them to save them money and protect the environment.

4.3.2 Incentives for smart services

Before creating segmented incentives, it is important to more broadly classify the service. Smart services, which can be used only after the installation of the smart grid, could be classified as 'durable goods'. Durable goods "have a significant life span, often three years or more" (Encyclopedia Britannica, 2012), and therefore require an appropriate marketing approach, based on their characteristics. The smart grid, allowing the use of the smart services, can be seen as a long term investment, since they last for a significant time in the consumer's home.

Deaton and Muellbauer (1980) explain different neoclassical models, part of which is the demand for durable goods. They list 14 points, which cover the major problems in the analysis of durable purchases, the following show relevance to smart services and have been considered when making recommendations for commercial market strategy (Deaton and Muellbauer, 1980, pp.345-346):

- The presence of stocks that last through more than one time period means that past decisions affect present behavior just as present decisions set constraints on future action.
- The purchasing decision can be advanced or postponed in the light of new information.
- Consumer confidence and income and price expectations are important determinants of purchases.
- Purchases of durable goods are particularly volatile.

- Many durable goods are either new to the market or are subject to a high level of technical change. Hence, information about them may take time to diffuse through the population.
- Stocks of durables and 'stocks' of habits play a similar role in linking past, present, and future decisions and ought to be analyzed using the same tools.

Considering the special nature of smart services described above, energy suppliers need to adjust their strategies in order to attract new customers and increase consumer involvement. The research of Smart Grid Consumer Collaborative (SGCC, 2011) revealed an important shift in the focus of energy suppliers launching smart services in the US, from being a supplier of electricity to being a service provider involved in customer engagement.

Consumers will be most receptive to becoming engaged with energy suppliers when there is a high level of trust and goodwill in the relationship. In the SGCC (2011) study, the companies that experienced the least resistance from customers were those that had put focus in to building goodwill, and the customers then trusted the intentions of their energy supplier. The issue of communication is clearly vital for customer engagement and building trust. The more trust that consumers have that the intentions of the energy supplier in rolling out smart services involve distinct benefits to the consumer rather than merely profit maximization for the supplier, the more receptive and interested those consumers will be in the adoption of such technologies.

A portfolio of smart services should be structured simply and communicated to the customer in a simple and logical manner. Clear, concise descriptions of the various smart services resulted in higher levels of adoption in the SGCC study (2011). They point out that energy is a low interest area for consumers, so simply structured smart service offerings, messages and sign-up procedures gave an advantage. For example, having a two option pricing system rather than a four-option system reduced levels of confusion amongst consumers, and only a small minority (19%) of consumers was aware of all four options of San Diego Gas & Electricity's smart service program.

The SGCC (2011) also found that messages about potential cost savings were relevant across all market segments, but whilst offering financial incentives boosted levels of interest and adoption,

the size of the incentive was less important than simply its existence. Small incentives can be enough to increase interest in the smart services. Many of the energy companies in the SGCC study agreed that, in general, customers responded best to messages about saving money, rather than more environmentally focused messages. This is not to say, however, that a particular customer segment may not respond well to an environmental message being the primary focus, or that environmental considerations should be excluded from particular segments - a secondary focus on environmental factors could work well to boost interest.

It is not necessary, therefore, for incentives to be solely financial. The EPA (2010) launched a customer incentives program for energy efficiency, and this program is both horizontally and vertically integrated. On the horizontal dimension, there are mixed incentives including financial incentives like rebates, discounts and financing; and non-financial incentives like support services, technical assistance, education and training, and information sharing. Vertically, the incentives are offered at various levels for different energy markets. What is worth mentioning here is that the term customer does not only mean end consumers; it also indicates internal customers on the whole energy supply chain. Therefore, different players and stakeholders from the upstream, to the midstream and downstream on the energy supply chain should be identified and taken into account when designing incentive programs so that all their specific interests are satisfied.

Chapter 5 Questionnaire Results and Analysis

The data from 528 completed questionnaires was received; by analyzing this data we were able to identify the Swedish residential consumers' awareness level, behavioral drivers and willingness to adopt smart services. In addition to this we identified that the level of knowledge, gender and income of the respondents played a significant role in their attitudes towards smart services.

5.1 Awareness

In general, the level of awareness that residential consumers have about smart services is low, as the responses showed in Figure 5-1. Only 4% of respondents considered themselves to have strong knowledge about smart services, whilst 77% of the respondents reported they had no knowledge or limited knowledge. Moreover 65% of respondents answered that they did not know whether their electricity provider offered any kind of smart services. However, encouragingly, the proportion of respondents who would like to know more about smart services is 72%, indicating that there is already a very receptive audience to educate about smart services.

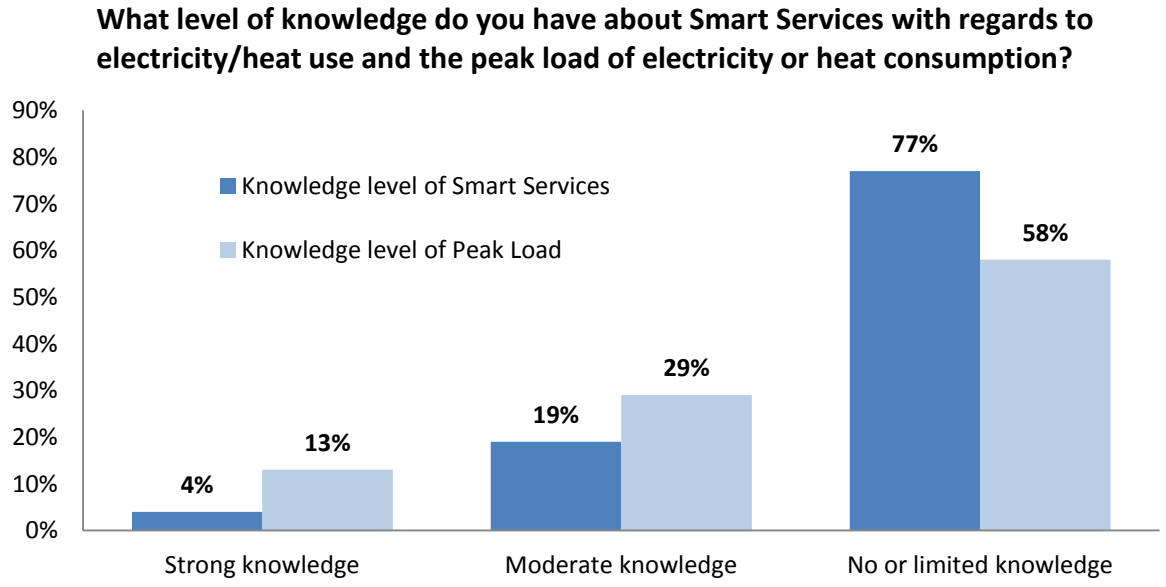


Figure 5-1 Consumers' level of knowledge about smart services

5.2 Drivers

Figure 5-2 shows that when choosing electrical products, although 57% of respondents reported that the environment is an important factor in choosing electrical products, cost and reliability are still more important considerations for Swedish consumers at 73% and 84% respectively. A similar question was asked on a global scale by IBM in 2007 in which 88% of respondents deemed cost and quality (synonymous with reliability) to be important whereas only 70% of the respondets marked environmental impact as important (IBM 2007 p.13).

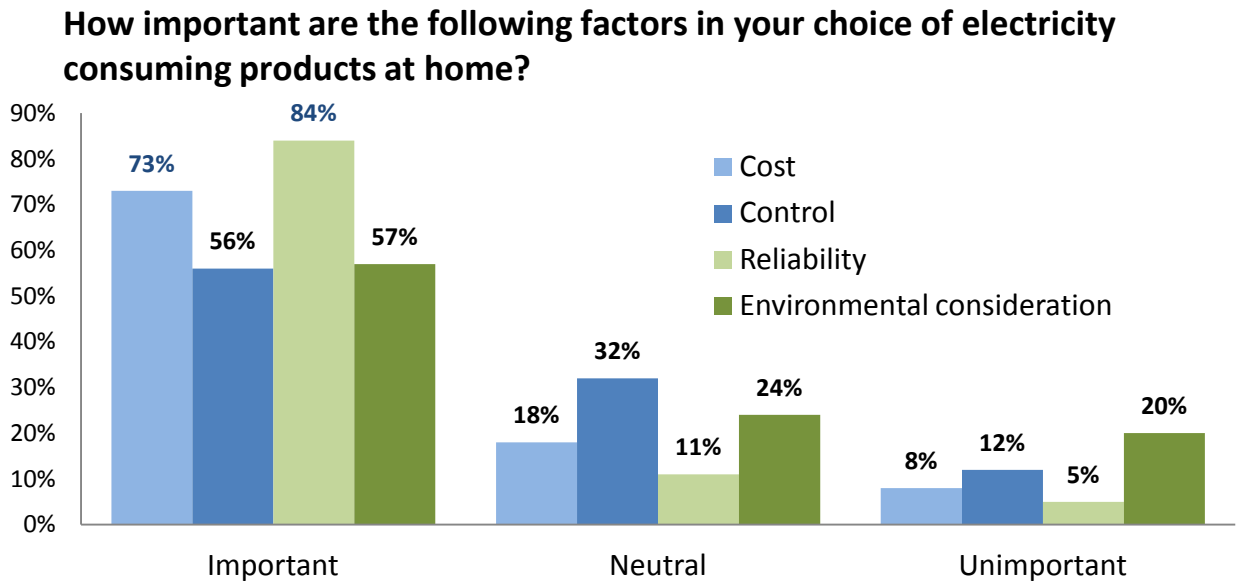


Figure 5-2 The importance of different factors in the choice of electricity consuming products for Swedish consumers.

When asked 'what are the most important factors in encouraging you to adopt smart services', cost was the most important determining factor with 83% of respondents indicating that a reduction in their electricity bill is an important factor in their potential adoption. 69% of respondents indicated that more control over energy use was important whilst only 57% identified environmental concerns as an important factor.

Figure 5-3 shows that the most significant barrier to the adoption of smart services is "That my provider could charge rates in a way unfavorable to me based on my energy usage data". 65% of respondents put it in their top three barriers against smart services. This question was taken from

IBM's 2011 report but the results indicated that for a global population this factor was not even in the top three concerns (IBM 2011 p.4). Swedish customers are more concerned that the energy provider will charge them in a unfavorable way, which suggests that their trust in their energy provider is weaker than the average global consumer. Increased trust in the electricty provider was also seen as an important driver to encourage consumers to adopt to smart services, with 50% indicating that it was an important factor in their decision to adopt.

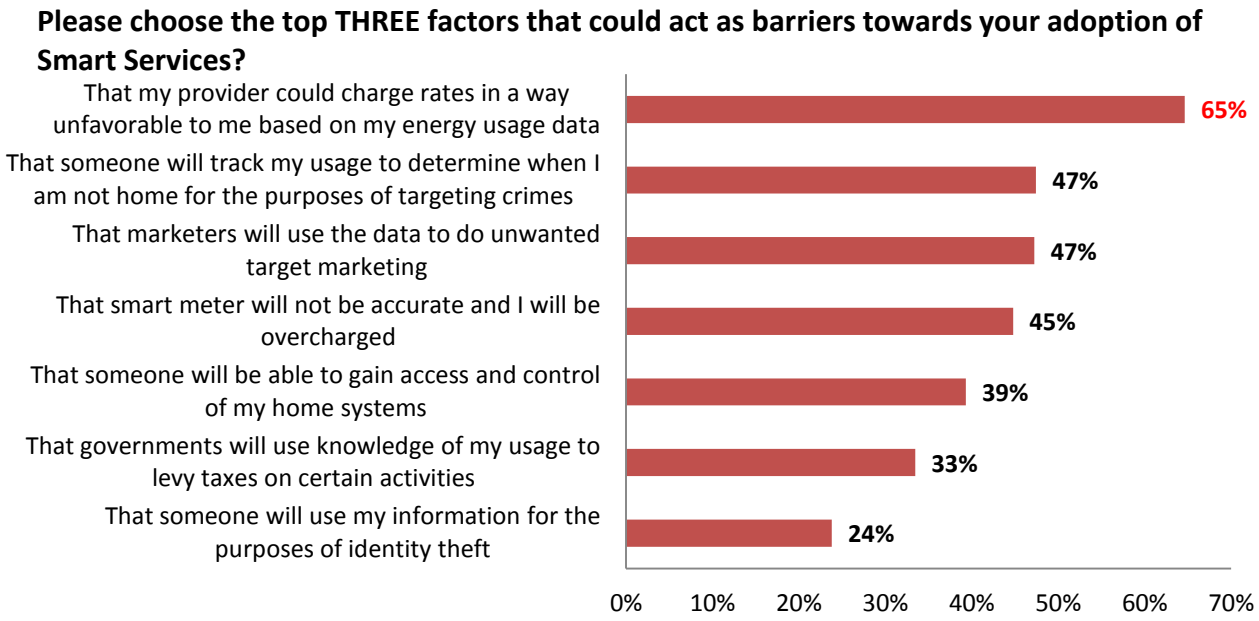


Figure 5-3 A ranking of the barriers towards to Swedish consumers' adoption of smart services

5.3 Willingness to adopt

The proportion of customers who answered that they are willing to pay more for energy produced by a renewable source is higher than those that are not willing, but with diminishing popularity as the price increases (Figure 5-4). Similarly 67% of respondents indicated that they would also pay a premium for smart appliances that had environmental benefits.

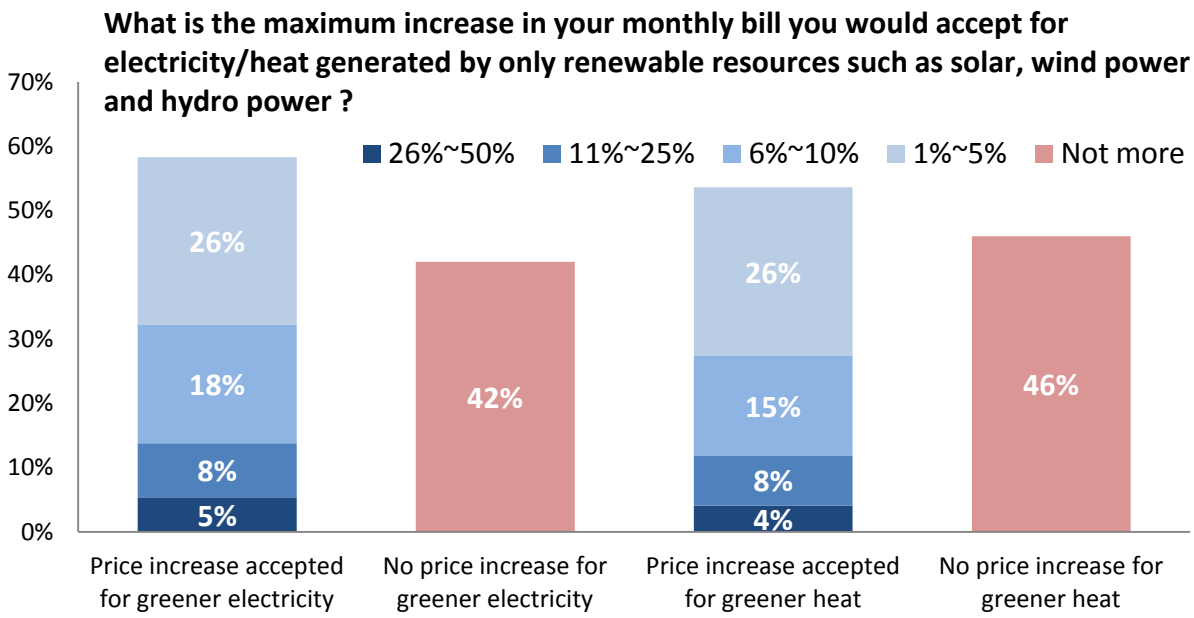


Figure 5-4 The willingness of Swedish consumers to pay more for energy generated by renewable sources.

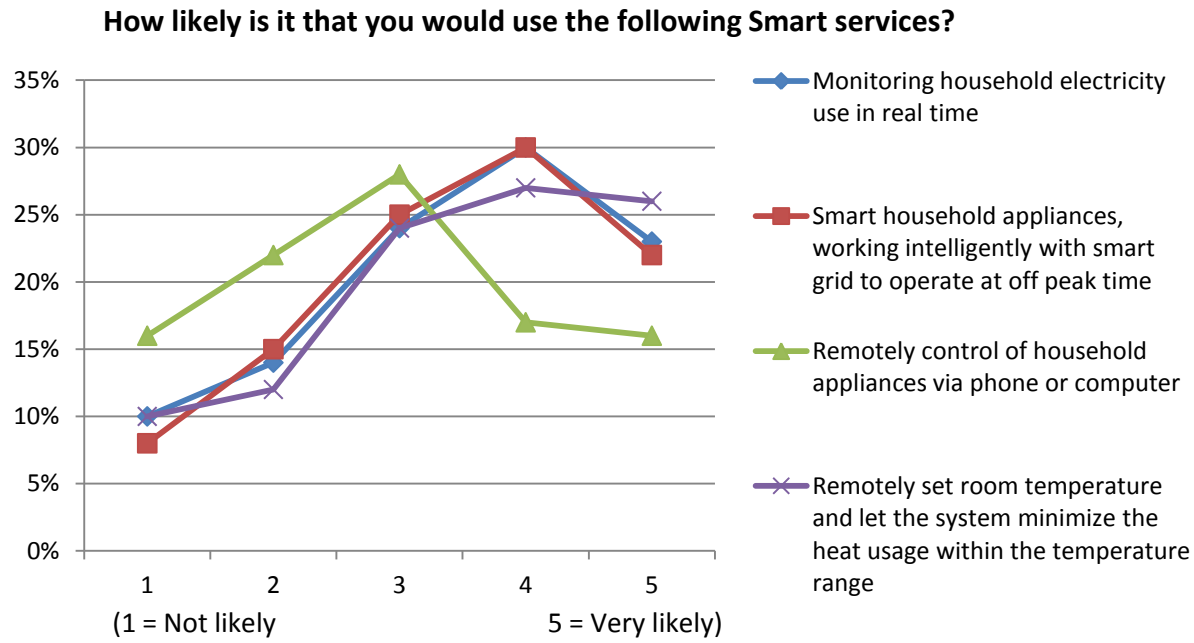


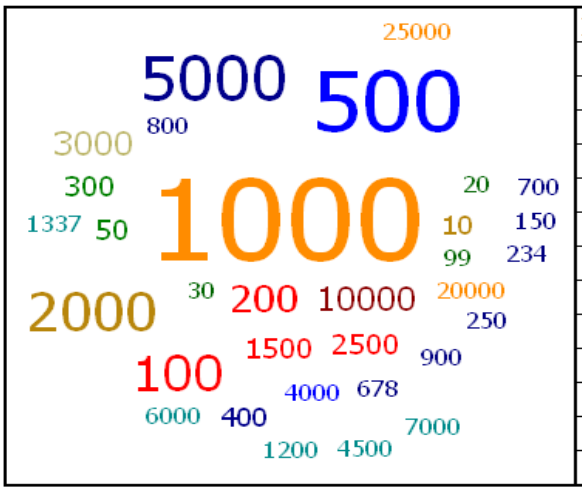
Figure 5-5 The willingness of Swedish consumers to adopt different smart services

Figure 5-5 shows that more than half of respondents reported that they would like to use smart services to monitor their electricity use in real time, to use smart appliances and to remotely set room temperature. But the interest showed in remotely controlling household appliances via

phone or computer was lower with the 38% of respondents suggesting that they would be unlikely to use the service.

A direct question was asked to the respondents in the questionnaire: “How much would you be willing to pay up front for installing smart services given their environmental benefits and controllability?” 57% of them gave a price higher than 99 SEK, and the average price calculated on the total number of 525 valid responses is about 1128 SEK (figure 5-6).

How much would you be willing to pay up front for installing Smart Services given their environmental benefits and controllability?



Price (SEK)	Occurrences	Percentage
1000	81	15%
500	54	10%
5000	36	7%
2000	29	6%
100	25	5%
200	14	3%
10000	11	2%
3000	10	2%
...		
0-99	228	43%
Total Respondents:		525
Average Price (SEK):		1128

Figure 5-6 The amount that respondents reported that they were willing to pay for installing smart services

5.4 Other key findings

5.4.1 Level of knowledge

The consumer’s knowledge level of smart services has positive impact to the consumer’s attitude towards the adoption of smart services (Figure 5-6). The more knowledge the consumer has about the smart services, the more likely they are to consider reliability and the possible reduction in energy consumed important adoption determining factors. Those respondents with a high level of knowledge are also the most willing to adopt a range of smart services including remotely controlled household appliances, the ability to monitor household electricity consumption and smart appliances.

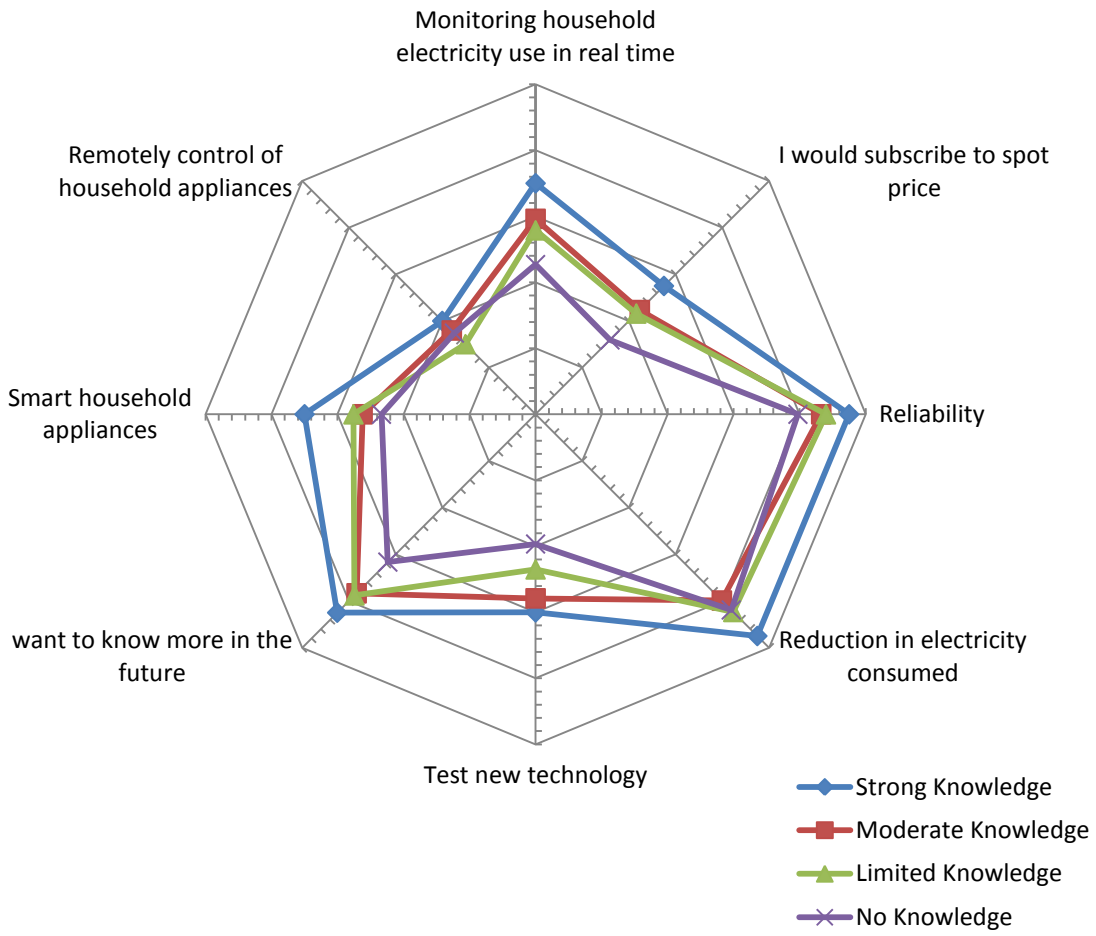


Figure 5-7 Respondents' attitudes towards different factors based on their knowledge level of smart services. Values increase with distance from the middle i.e. the strong knowledge respondents have a greater desire to test new a technology than those of less knowledge.

A strong level of knowledge about smart services is not positively correlated to all factors related to the adoption of smart services (Figure 5-7). The data suggests that the respondents who already have strong knowledge of smart services are less likely to have a strong concern about the environmental benefits of smart services; they are less likely to be willing to pay a higher rate for electricity generated from renewable sources; the cost of an electrical product is less likely to be considered to be an important factor in their purchase decision, but the average price they answered for installing the smart services does not raise along with the knowledge level they have. More trust in the electricity provider is less likely to help encourage them to adopt smart services.

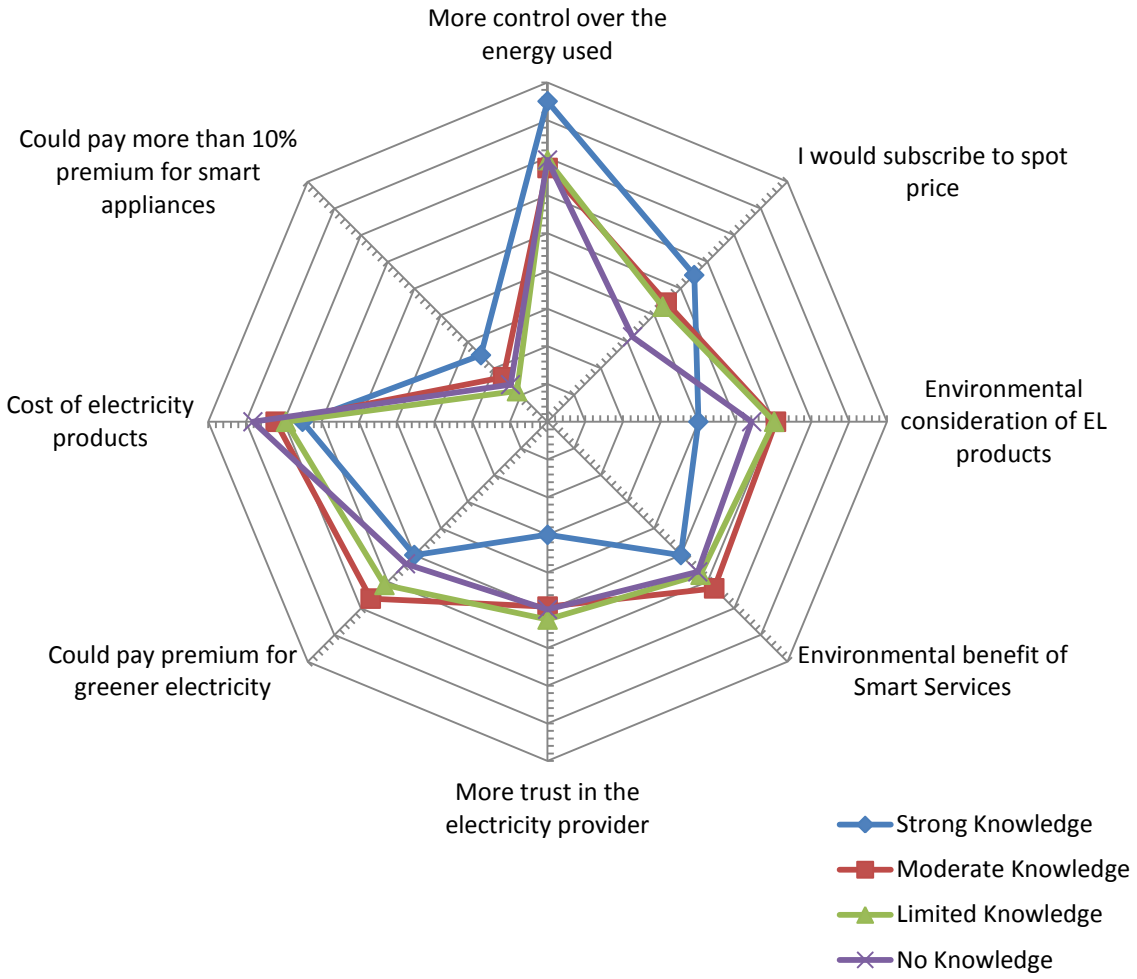


Figure 5-7 Respondents' attitudes towards different factors based on knowledge level of smart services (Continued. Again values increase with distance from the middle.)

5.4.2 Level of income

The data from questionnaire responses shows a clear trend that the high-income families have a higher potential to accept spot pricing. The proportion of the respondents that wanted to subscribe to spot price increase from 27% of household monthly income less than 20 000 SEK to 55% of household monthly income more than 90 000 SEK.

Those respondents of a higher income were more driven by the possibility to use smart appliances. 73% of the respondents with highest income (household monthly income more than 90 000 SEK) ranked the possibility to program smart appliances to automatically operate at off peak time as an important driver to their adoption of smart services, but only 36% from the

lowest income respondents (household monthly income less than 20 000 SEK) reported the same. Higher income households are also willing to pay higher prices up front to install smart services. The average price they answered increased from 570 SEK of lowest income respondents to 2663 SEK of highest income respondents.

5.4.3 Gender difference

The results of the questionnaire suggest another interesting phenomenon; in Sweden females are more environmentally conscious than males. Environmental impact is a more important factor for females when making a purchase or adoption decision. 41% of female respondents considered environmental benefit to be a very important factor when asked what would encourage them to adopt smart services while only 19% from the male respondents have the same view. However, the average amount that females claim they would be willing to pay up front for smart services is 1046 SEK whereas males are willing to pay 1216 SEK.

Chapter 6 Interview Analysis

This chapter analyses the interviews that were conducted with Simon Brown, who has the role of Global Project Leader for ISS, Emma Kindesjö, the Carbon Footprint Specialist at Sony Mobile, and Rikard Sjöqvist, the technician from Midroc. It provides information regarding commercial electricity consumers' attitudes and awareness about smart services.

6.1 Background

Interviewing ISS, Sony Mobile and Midroc gave us opinions from various commercial perspectives, all very relevant to incentivizing the adoption of smart services, and in this section we analyze the interviews. As a property development firm, Midroc are strongly involved with energy related technologies and services and so have prior knowledge about the various systems available and have a keen interest in the future of such systems. They work with E.ON in the sustainable city development in Hyllie, amongst several other players in the development with whom they have close links. ISS are a facilities management firm and offer a wide portfolio of services. Of course, in the management of a facility, its energy consumption will need to be considered. Energy is just one part of ISS's services so they have a less direct focus on energy use than Midroc and have less specific knowledge of smart services. They are, however, involved with reviewing and implementing energy related equipment and policies and therefore come from a different direction to that of Midroc. Sony Mobile provides another perspective – that of a commercial client within a rented building. They pay directly for the electricity that they use within the building and have a range of factors they need to consider when making energy related decisions. Sony Mobile's situation provides an example of a more complicated relationship where the end-user neither owns nor directly manages the facilities that they operate from, meaning that cooperation is required for the implementation of new systems.

We now analyze the key themes that emerged from the interviews.

6.2 Responsibilities

The nature of the Sony Mobile-ISS relationship is that Sony Mobile operates out of a building owned by a private landlord and ISS take the role of facility management. This creates some complex issues when it comes to the adoption of smart services, in terms of ownership, installation costs and maintenance and management of the systems. Simon Brown of ISS highlighted that this is already an issue in certain areas. For example, the lighting system is split up so that some are owned by Sony Mobile, and others by the landlord. A solution for smart services would therefore entail discussion between the several parties involved and would of course be more complex than residential adoption, at least in terms of who would meet the costs and manage the services. Another possible issue that was brought up was the frequency with which Sony Mobile move into new buildings, not specifically in the case of the Lund offices, but on a more international basis. In this case, there would be further debate about costs, which were building specific, and items that could not be transferred. There is clearly some concern about how such things as cost sharing would work, and these issues need to be addressed for the successful engagement of commercial consumers with smart services. Midroc has implemented a scheme called the 'Green Agreement' which aims to deal with the cost sharing aspects of new green technologies. It works both in the commercial and residential sectors. If the owner of the property wants to invest in making it more energy efficient, then a midpoint of the new lower energy costs and the original energy costs is determined. This way the tenant pays a lower price (through consuming less energy thanks to a more efficient building) but the owner gets a payout by collecting the difference between the actual price of energy and the price charged to the tenant.

Midroc also highlighted their flexibility in choosing solutions for their building developments. Each project's electricity and heating supply is judged on its merits of the triple bottom line of sustainability; there is no default position that Midroc take *"We always have to think about what is best for the project*." - Rikard Sjöqvist, Midroc. Heating could be district heating, heat pump, ground pump etc. Usually, within cities, district heating is chosen but this is after careful consideration of other viable means and it is not always the case. However, for electricity Midroc sees very little difference between the suppliers and so making the decision is much less of an issue. The responsibility for the electricity supply varies from case to case. In the World Trade Centre (WTC) building in Malmo, Midroc buy the energy from E.ON. There is a similar set up

in many of Midroc's other buildings, where Midroc have initiated the electricity supply. In general, Midroc's larger commercial clients have the resources to investigate the feasibility and to set-up building facilities themselves whereas small companies would rely on other actors. Using the WTC as an example, the larger companies prefer to supply everything themselves but the smaller companies want everything provided from the desks to the cleaning services. Discussions of installing new smart services would therefore include both Midroc and the client in the building, as well as any external building facilities management company that is involved. Conversely, for a residential building there is less involvement with Midroc - usually the tenant sets up the electricity supply.

6.3 Green philosophy and previous energy strategies

For Midroc's property developments, sustainability is clearly an important factor. Firstly the owner and the board have installed the triple bottom line of sustainability in to the mantra of the company; it is set as a goal in all activities and operations. To back that up the operational managers push the same objectives and this creates an environment in which all employees think in that way. Smart meters are installed as standard in every Midroc project, including in the WTC. For apartment blocks there is a smart meter for the entire building primarily to monitor heat consumption rather than electricity.

A fundamental philosophy of Midroc is that it is better to not use energy than to create complex technological methods to save it. They consider that it is most important to first ensure that a building is energy efficient rather than to impose technology to curb the peripheral energy usages. Midroc are therefore strong proponents of simple and cheap technologies that can change behavior and reduce energy. An example of this that they have implemented is a lighting system with a sensor that will detect if there is no one in the room and will switch off, whilst requiring use of a manual switch to turn it on in the first place.

Switching lighting on and off has also been a concern at Sony Mobile. The point was raised that if one person is working at a weekend, as they walk to their desk the overhead sensors would turn on the lights wherever they walk, and therefore the lights across a whole wing could potentially turn on before they get to their desk. Some extra kind of control would be beneficial

to this situation, whether that be simply by a different type of sensor, or an integrated solution with smart technology, for example where it could be programmed to only use safety lighting in the corridors at certain times or when there are very few people present.

Sustainability is very important for Sony Mobile, as a core company value, and it is recognized that there is certainly scope and desire to improve. Previous initiatives include 'Green Friday', where the staff is encouraged to be more environmentally friendly by taking alternative transport to work, for example. Smart services could certainly help to move in their desired direction in reducing energy use.

6.4 Drivers

Sony Mobile's interest in sustainability has been there from the start and has been compounded by demands from customers for information about how they operate as a company, as well as a general increased consumer interest in issues of sustainability. The idea of some kind of technology that could improve their energy use would therefore be welcomed from the point of view of environmental benefit, cost savings and improving their reputation as a sustainable company. Sony Mobile showed recognition that transparency is good for a company. They showed interest in the idea of smart services, and the potential to use less energy via this service but of course cost would be a vital consideration. Whilst additional costs could be acceptable if it meant an improvement in environmental performance, the level of costs and the related payoff time are important factors that would need to be analyzed.

For a company like Sony Mobile to adopt smart services in their offices, information would be required about exactly what savings could be made and what costs would be incurred. Possible lack of flexibility in the times that things need to be done could mean that spot pricing may not be ideal, and Sony Mobile would be keen to ensure that such a pricing system would not result in increased energy costs. "*It's easy to kind of sell-in the concept if we can back it up with data of how much or what changes we can make*" – Simon Brown, ISS.

Midroc showed a strong desire to be a part of the smart service implementation program in Hyllie. They consider it to be a new and exciting concept that is occurring within an area in which they have significant involvement *"If at anytime you should try it [implementing smart*

services], you should try it in the area where you build" - Rikard Sjöqvist, Midroc. The possibility to try out new technology and to have input on its development is valuable for their business to consider ways that the technology can be implemented in their future property development projects. They consider themselves to be a leader in the field of development of more sustainable and energy efficient properties, and achieve a competitive advantage through this. Midroc are able to charge more to commercial tenants to rent properties that are more energy efficient. The WTC, for example, has the most expensive office space in Malmö and there is a waiting list of companies that want to move in. Within the Hyllie region there should be no need to incentivize Midroc's customers to adopting smart services. Hyllie's reputation for being a sustainable lighthouse project means that any stakeholders in Hyllie will be likeminded and should be open to new energy saving technological ideas.

6.5 Interest

In terms of interest, Sony Mobile recognizes that there is scope for some kind of smart service, and that technologies that could improve energy use would certainly be welcomed. There is recognition, however, that there is still plenty of room for improvement in energy efficiency, for example with lights being left on and laptop chargers being left plugged in overnight. This has been the focus of several reviews at Sony Mobile, since lighting uses a substantial amount of the electricity usage in some of their buildings. Energy efficient lighting and sensors therefore have great potential for Sony Mobile to reduce costs. This is along similar lines to Midroc's view that they may be able to make significant steps in energy efficiency via improving existing systems such as lighting, or new construction techniques, and that an investment in a seemingly complicated technology such as smart services would therefore be better spent on simple solutions. Ensuring that buildings are energy efficient is a core focus of Midroc, and they show a preference for simple technologies that can change behavior. For both Sony Mobile and for Midroc, ensuring the simplicity of smart services is vital in engaging staff and improving energy use, and there is a desire for continued efforts to invest in equipment that is more energy efficient. In addition to the basic functionalities of smart services, there is great scope to provide an integrated solution for commercial customers that involves installing new sensors, energy efficient equipment such as new lighting, and implementing policies for staff to change their behavior, so that a smart system would work to its fullest potential. A detailed proposal of what

smart services can do for a specific organization, and how it would link to existing systems would be vital for the prospective company in their consideration of smart services.

There has been some discussion between ISS and a consulting firm, who did a lighting review at Sony Mobile in Lund, about technologies that put more responsibility on the individual. For example, there was some thought about software installed on every employee's laptop that showed how much energy they were using, and how good or bad this was. Beyond just showing information, technologies that allow control of heating, ventilation and lighting could also be useful. However, creating an integrated system at the Sony Mobile offices, where users could control a range of energy related functions, would take much discussion and co-operation with the landlord that owns and control certain energy consuming appliances within the offices. For ISS, the Sony Mobile offices at Lund are seen as the pilot for any new initiatives, which can then be branched out from there, to a national or international scale.

Midroc are keen to be pioneers in a smart service technological breakthrough, and recognize the need to work closely with other players including energy companies, in relation to both the developments in Hyllie as well as their property developments more generally. Within the Hyllie development, Midroc is embracing the smart services that are being championed there. However, they state that it is always important for them to be case specific, and to consider the bigger picture when making their choices of which smart services to adopt and where to implement them. Midroc showed some frustration at the current building regulations arguing that the energy efficiency levels are not strict enough, *"There is a difference between being 'green' and being 'green'* - Rikard Sjöqvist, Midroc. Midroc produces properties that have energy efficiencies that are well below the regulation levels. This costs them more than property developers that do not produce such efficient housing but still meet the legal criteria and they both sell for the same price. Incentives for end-customers to become more energy efficient could create more demand for the most energy efficient housing, a positive market impact for Midroc.

They recognize that despite the short fallings of the residential sector with regards to energy efficient properties, the commercial sector do frequently pay premiums for energy efficiency. Midroc's commercial clients want high quality, sustainable buildings to operate in and there is a huge demand for sustainability within the commercial sector in Sweden. A key part of Midroc's

business is based on meeting this demand by developing highly energy efficient commercial premises, and they believe that any company not thinking about sustainability will not be around in the future. What is currently important to Midroc, therefore, is maintaining their status as a market leader in efficiency.

6.6 Behavioral changes of end-users

An issue recognized by both Midroc and Sony Mobile is the need to educate and engage the end users of smart services. For Sony Mobile, there was recognition that different groups of employees may respond differently to the changes that smart services would entail. For instance, the employees with a technical background would be attracted by the technical and controllability aspect of smart services; "*This is a company with engineers, and if they can see this gets a little more technical then they want to do it a bit more*" – Emma Kindesjö, Sony Mobile. For others, the aspect of increased individual responsibility could bring about an element of competition. The phrase 'what gets measured gets done' seems particularly pertinent here, as these people may respond positively simply by giving them an indication of how much energy they are using individually and how this can be improved. "*It would be easier to monitor them and from there the scope is pretty big. "You could have interdepartmental league table challenges, and then reward people for being more conscious*" – Simon Brown, ISS.

There are, of course, those who would oppose the introduction of such technology, especially if it meant increased control and engagement was required, rather than being able to run things from the background and forget about them. Sony Mobile recognized that there are many individuals that have heavy workloads and busy schedules and therefore engagement with energy use would be a low priority for them, and it could be a struggle to get them onboard on such an initiative. A smart services system would therefore need to take into account varying levels of flexibility from individual to individual. Some of those who would normally be interested in engaging with the technology, whilst at home for example, may simply not have the time to monitor and change their behavior during their work life, and this needs to be taken into account. At least, an effective communication strategy would be vital if Sony Mobile were to adopt smart services. Letting people know about how to use the new systems and the benefits of doing so would be a base, and a more incremental implementation could be more effective. "*By just*

implementing and not saying anything about it, people would feel left out. For something like this to work it's important to engage our employees and make them feel like they are a part of the change" – Emma Kindesjö, Sony Mobile.

Educating clients and end-users is something that Midroc has been closely engaged with. They create instruction manuals for the houses and apartments that they build so that the tenants and owners can use the property to its full functionality. There is a chapter on 'green living' that aims to educate the owner/tenant on how to utilize the features of the property to ensure the optimum level of energy efficiency. A similar outreach program could take place further up the value chain, by energy companies themselves in order to build customer relations, raise awareness about the advantages of smart Services and educate their customers on how to use the products and services effectively. Midroc constantly educates its clients about sustainability and energy efficiency through consulting with developers and customers, and this has been effective in changing behaviors patterns of certain end-users. For example, since the WTC office has been open the car park that was outside has made way for a recreational park and occupants of the WTC have started commuting to work through other means such as public transport and car-pooling. This clearly shows the desire for some groups of individuals to engage in more energy efficient behavior, and a scheme designed to educate such end-users could be particularly effective in gaining their adoption of smart services.

6.7 Barriers

Whilst Sony Mobile showed much interest in the idea of smart services and acknowledged that there might be scope for such a system at their Lund offices, there were also some key barriers and concerns. Of course, the concept of spot pricing – to encourage a market driven shift towards lower peaks of energy use – may clash with many aspects of Sony Mobile's business which are inflexible. Obviously, working hours cannot be dramatically shifted, and some processes that can be done overnight at off-peak times are already done in this manner, such as computer software that has to run through a time consuming task is left to complete at night. If the total cost for energy were higher because of a lack of flexibility then obviously spot pricing would not be an attractive option. Adoption of spot pricing and smart services would therefore require a detailed assessment about what degree of flexibility there is for energy consuming devices to run at

different times, and the potential of the system to result in higher or lower total energy costs. Interestingly, the aspect of trust in the energy company was not considered a significant barrier like it was for residential customers, as discussed in the previous chapter.

From Midroc's perspective, they have some concerns over the complexity of smart services, and believe that residential customers are not ready to pay for such services – there is little market demand. *"[With regards to residential consumers], today they are not willing to pay more for more efficient housing but tomorrow…maybe."* – Rikard Sjöqvist, Midroc. A multi-price spot pricing system could be too complicated, and therefore Midroc considers that a dual price system could be more suitable. Related to this was the concern that smart services over-complicate a fairly straightforward idea – they offer the advantage of automatically operating appliances at low peak times but a simple clock system on the appliance would be sufficient to do the same thing, since off-peak times are generally at the same time every day. For example, many washing machines and dishwashers come with functions to postpone the start of the cycle by a programmable amount of time. Rikard from Midroc mentioned, for example, that for a modern passive house it is more important to be able control the blinds and the windows to maintain temperature, but this can be done automatically without the need of smart technologies. Emphasizing the simplicity of smart services is therefore crucial for their adoption, along with the compatibility to integrate with other energy saving features of a building.

Chapter 7 Conclusion

7.1 Consumer understanding

After conducting the questionnaire of residential consumers and interviewing various commercial consumers, it is reasonable to draw conclusions based on the major findings provided in the previous data analysis.

7.1.1 Awareness levels

Both residential and commercial electricity consumers have a low level of knowledge about emerging smart services. More than 65% of the residential consumers do not even know whether their electricity supplier provides such kind of services. The situation is very similar for commercial consumers, including those that have been working on sustainable development for years. They may have some knowledge of new energy related technologies or services, but this is still far from enough for them to consider the specific behavior changes in energy use. However, over 70% percent of the residential consumers expressed their willingness to learn more about smart services in the future, and the commercial consumers also clearly showed a desire for more knowledge of smart services.

7.1.2 Drivers

Similar to the attitude of global electricity consumers, Swedish residents ranked reliability and cost as the most important concerns when choosing electricity management products or services. For smart services, cost is in relation to the cost of electricity consumed as well as any up-front or installation costs. Two thirds of the residential consumers expressed that the controllability aspect of smart services was important in encouraging them to adopt smart services.

Despite environmental factors being less of a driver than cost, it is still of significant importance for the majority of consumers, slightly more-so females than males in Sweden. Increasing consumer awareness of environmental issues means that it is becoming more of a driver, and smart services could be promoted with messages of their potential environmental benefits. Both

residential and commercial consumers stated that they could be prepared to pay a small premium for the environmental benefit.

Having trust in electricity suppliers seems to be an essential factor for Swedish residential consumers. There is concern that electricity providers could use data from smart meters to charge rates in an unfavorable ways. Half of the questionnaire respondents considered that more trust in the electricity provider is important to encourage them to adopt smart services, and therefore energy providers could take the opportunity of using smart services to promote engagement and to establish better trust between themselves and customers.

7.1.3 Willingness to adopt

Despite a lack of knowledge about smart services, there is evidence of a generally positive attitude towards them. More than half of the questionnaire respondents answered that they would like to use features of smart services like monitoring electricity use in real time and using smart household appliances. Surprisingly, the service of remotely controlling household appliances via phone or computer saw a lower level of interest. Consumers tended to show a fairly neutral attitude towards electricity spot pricing, although there is a clear trend that the higher income families are more likely would accept spot price.

The availability of programmable smart appliances that interact with the smart meter could mean consumers are more enthusiastic towards a spot pricing system. This, along with financial incentives, were ranked as the most important factors that would encourage consumers to shift their energy intensive housework to off-peak times, above spot pricing's claimed environmental benefits.

Commercial consumers have a conservative attitude when it comes to spot pricing since there is limited flexibility to change the timing of their energy use. Clearly, it is very difficult to change the working hours for an entire organization, and further specific investigation is needed into what aspects of their energy use could be changed and improved before a decision is made to subscribe to spot pricing.

Knowledge plays a very important role in the willingness of consumers to adopt smart services. More knowledge shows a very obvious link to consumers' willingness to adopt smart services, and their desire to learn more in the future. However, this does not necessarily mean that simply by educating consumers they will be more willing to adopt. Those who already have knowledge of smart services could be those who are most interested by the idea and have therefore proactively sought information.

7.2 Suggestions of residential market segmentation

Creating market segments involved considerations of Kotler and Keller's (2012) theorization of behavioral segmentation, based upon consumers' knowledge, attitudes, and response to products.

Segment	TechPioneers	Eco-rationals	Cost Conscious	Pragmatics	Skepticals	Indifferents
Environmental Concern	No	Yes				No
Yes / No						
57% / 43%						
Control Matters	Yes		No	Yes	Yes	No
Yes / No						
69% / 31%						
Knowledge	Strong					Weak
Strong / Weak						
4% / 77%						
Cost Sensitive		No	Yes	Yes	No	
Yes / No						
73% / 27%						
Proportion in Population	1%	15%	23%	50%	19%	10%

*Figure 7-1 Swedish residential electricity market segmentation (*Explanation of percentages available in Appendix 3*)*

The structure showed in Figure 7-1 was loosely based upon a previous Accenture energy market segmentation model that stemmed from research on consumer opinions of electricity management programs (Accenture, 2010). In analyzing our data, we formed market segments to which incentives could be targeted, based upon environmental concern, importance of controllability, level of knowledge, and sensitivity to cost. The results from the questionnaire

showed that the level of knowledge of smart services was a clear adoption determinant and those with the highest level of knowledge were most willing to adopt smart services and therefore warranted a discrete category. Five of the six segments are named as they are in the Accenture report (2010), with the exception of the category Technical Pioneers.

Technical pioneers, 1%: This customer segment represents a small percentage of the total respondents, but is an important group as it represents the possible early adopters of smart technologies. They typically rate their desire for control as being a higher priority than environmental concern. They have a high level of knowledge about smart services, and their interest in technology could mean that they would be open to using a wide range of the features available with smart services. There may be disproportionate amounts of this type of person in certain organizations, for example Sony Mobile pointed to the fact that the high number of engineers at the Lund offices could mean that many are interested in the technical and controllability aspects of smart services – people that would likely fit into this category of Technical Pioneers.

As the potential first customers of smart services, a priority should be targeting this group (Energy Business Reports, 2010). They are a particularly important group as they set the tone for further development and roll out of the services, and they may also provide reviews of a range of features. The quality and reliability of the new technology is therefore important in securing positive feedback. Energy Business Reports (2010) suggests targeting such groups with special attractive promotions to get the ball rolling, but it may be necessary to change the approach for subsequent adopters who are not so interested in the range of features that these technical pioneers use, seeking instead a simpler solution.

Eco-rational, 15%: This next segment shows the highest environmental concern, and low sensitivity to price. This is a small and specific group of respondent are highly motivated by their norms and values concerning environmentally friendly products (the M of the MAO model; see Chapter 4 - Theories). In communicating with such consumers, environmental considerations could be the key focus of messages about the benefits of smart services and spot pricing systems.

Cost conscious, 23%: Whilst considerations of cost were generally fairly important across most respondents, some were particularly sensitive to changes in prices, and showed little interest in other aspects of smart services such as increased controllability. So, messages emphasizing possible cost savings would resonate especially well for this segment, whilst at the same time being a relevant message for most other customers.

SGCC research (2011) showed that creating a sense of urgency could be effective in boosting an adoption campaign. Thus, a limited time only financial incentive may work well for this group, who are most strongly influenced by cost savings. Communication with customers could raise levels of knowledge and awareness so that they are fairly interested in the technology, and then some kind of monetary discount or energy bill reduction could be the defining factor for their decision to adopt. As discussed in the theory section, previous research showed that the size of the financial incentive is not actually particularly important; a large financial incentive does not boost adoption levels much more than a relatively small financial incentive.

Pragmatics, 50%: This group is similar to the cost conscious customers, but the element of control that smart services can provide is more important. Information is key for these customers, allowing them to weigh up the options and understand what the adoption of smart services will entail in terms of changes in their behavior and the cost implications. Opportunities to test the technology may be appreciated by such customers, so presence at public community events and shows could be a means to give information, show what smart services can do, and convince them they are investing in a reliable and worthwhile product. These may be the group of customers that are most interested in seeing and trying things before they buy.

Re-inventing the utility company as a service rather than just a provider of electricity could also be relevant for these consumers (as discussed in Chapter 4 - Theories). It is a service with which the users' interaction is vital in creating its value – that of moving towards environmental and cost reducing goals. The benefits of Smart services should be emphasized and communicated clearly and logically to these customers. Smart services should be presented as a positive investment at many levels – they provide a means for the consumer to achieve environmental, controllability and cost-saving benefits as long as the user becomes engaged with the technology,

yet relatively little engagement is required to see some benefits due to the automation of smart services.

Skepticals, 19%: The issue of control is important for these more skeptical customers, not necessarily in that they want more control, but that their distrust of the utility company means that they fear that smart services could give the utility company more control of the end-user's energy use. Cost is less important for this group. There were many comments from respondents that fit in to this group about a lack of trust in the energy supplier. Creating a simple, clearly structured portfolio of the smart service options available is relevant here. Clear and informative descriptions of the services could increase levels of trust.

Again, re-inventing the utility company as a service-provider could encourage a shift in consumers' attitudes. Building trust via communication and engagement is vital. The SGCC research (2011) suggests that regular presence at local events and sponsorship of local organizations can create and maintain goodwill. Customer pushback has been minimized in previous smart service rollouts by fostering goodwill so that customers have trust in the intention of the energy company. Ekström (2010) mentions how being a service, rather than simply a product, creates greater customer satisfaction and loyalty, as customers feel a greater sense of attachment to something that they interact with and are part of creating the value of that service.

Indifferents, 10%: These people have no interest or awareness in environmental concerns. They have a low level of knowledge about smart services, and are not interested in increased control of their energy system. Communication to raise awareness and to engage these customers is a first step. Our questionnaire showed that those respondents with the least knowledge of smart services were also those who were least keen on knowing more in the future. Some may never be willing to change their lifestyles to use the full range of smart service features, and their willingness to adopt may increase gradually over a long period of time, so a careful long-term market approach is crucial.

A simply structured portfolio of services may also be relevant here. As energy is generally a low interest area (SGCC, 2011), clearly and concisely presented features, benefits and costs of smart services, and straightforward sign-up procedures could help to boost adoption from Indifferents.

Appropriately timed messaging is important to a marketing campaign for smart services, since the promotion of future services can lead to a perceived failure of the energy company to deliver, as customers are most interested and focused on the immediate implications of a new energy program or service (SGCC, 2011).

General incentives: Whilst this segmentation provides some direction for targeting incentives, many customers could fit into several categories. In reality, the boundaries of these groups are very blurred and several incentives could be effective across most, if not all, of the groups. Our questionnaire data showed that the bottom line driver that most respondents shared was, of course, cost. Thus, incentives that give some kind of monetary discount, and communication that emphasizes the possibility to save money on the energy bill could be used fairly confidently for all potential smart services.

7.3 Recommendations of market approach for commercial consumers

Some information from our interviews shows that commercial consumers are more receptive to smart services than residential consumers. However, there are some obstacles revealed and based on the collected data we offer following suggestions on how to encourage commercial consumers to adopt smart services.

7.3.1 Commercial consumers are currently more willing to adopt smart services than residential consumers.

Residential consumers currently have a very low level of awareness about smart services and although the desire for knowledge is high there is currently a relatively low level of willingness to adopt smart services compared to the commercial sector. Rikard from Midroc also commented that his residential customers are not yet willing to pay for ‘greener’ energy services. However, in the commercial sector, energy efficiency and sustainability are factors that are currently far more significant. Being ‘green’ is becoming more and more a part of a company’s license to operate, as a positive corporate image is increasingly important. A company that actively embraces technologies or services that improve energy efficiency will improve its corporate image and reputation among their customers. This has lead to a growing number of companies that develop energy efficiency as their competitive advantages. Despite improvements in energy

efficiency smart services offer companies a tool to develop their energy efficiency standards further.

7.3.2 Special business models should be designed for commercial consumers of different sizes and types.

Unlike the residential consumers, whose consumption decisions are mostly made by only one or a few people, commercial consumers have to take into account many other stakeholders when making decisions like whether or not they should invest in smart services or which energy suppliers should they choose. The more stakeholders that become involved, the more complicated the process will become.

The business models for commercial consumers must be specially designed according to their specific situation (business type, company size, corporate philosophy and involved stakeholders etc.). There seem to be few barriers for energy suppliers to approach the commercial consumers in order to develop the business models; we found that there are barely any trust problems between energy suppliers and commercial consumers.

7.3.3 Cost matters

Despite commercial consumers reporting that they care about sustainability and would like to pay a premium for improved energy efficiency, cost still matters. E.ON must create a clear price model for the implementation of smart services that suggests future costs, savings and payoff times for the targeted company.

7.3.4 Simplicity is key

The introduction of smart services within a commercial arena will involve behavioral changes from staff. In order to encourage these energy saving behavioral changes the engagement of the workers is essential. In order to promote engagement and therefore adoption of smart services it has been expressed that the products and services should be made to be as simple as possible. As mentioned in the data analysis, in addition to the basic functionalities of smart services, there is

great scope to provide an integrated solution for commercial customers that involves installing new sensors, energy efficient equipment such as new lighting, and implementing policies.

7.3.5 Energy consultancy - professional technology support and education program is needed

Whilst the commercial consumers show great interest in smart services, knowledge of the services is low; they require technological support from specialists for reassurance that they are operating the systems correctly and that they have a clear vision for the future. A sound communication and education plan is therefore needed from the supplier and also within organizations so that the knowledge can permeate throughout the company. We suggest that at this early stage of promoting smart services, energy suppliers need to assign an energy consultant to each of the important commercial customers to help make an evaluation of their current energy consumption to determine how much they could benefit from spot pricing and smart services.

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Appendix 1 - Questionnaire Design

The purpose of the questionnaire is to gather a large volume of primary data from Swedish electricity end-consumers to address the projects objectives of providing data and analysis their awareness, drivers and willingness to adopt smart services and generating market segmentation information.

The questionnaire was the most important component of this project. Whilst we gained background information about electricity consumers from existing reports, understood theories about customer incentives and segmentation from books and collected primary data from interviews with industry professionals these factors merely acted to support the findings obtained from the questionnaire. Although the interviews provided industrial insights into consumers' awareness, drivers and willingness to adopt smart services, a wide reaching survey of residential electricity end-consumers was needed to better understand the Swedish energy consumers.

In order to ensure that the questionnaire was accessible to the majority of the respondents it was translated into Swedish and verified by native Swedes. It was intended that the questionnaire would be distributed to 600 Swedes aged 18 or over, in order to survey a significantly large sample size whose results could therefore be representative of the Swedish population. Due to budgeting constraints the sample size was limited to 300 respondents however, whilst 300 respondents were paid for, the survey received 561 responses.

<u>Questions 1- 5, personal information.</u>

"Q1a. Region"

"Q1b. Sex"

"Q1c. Age"

"Q1d. Type of accommodation"

"Q1e. Number of people living in your household"

“Q2. Monthly household income before tax”

“Q3. Average monthly household electricity and heating bill”

“Q4. Do you share your heating costs with your neighbors?”

“Q5. What type of heating do you have in your home?”

Q1a. The respondents were required to provide a number of personal details so that consumer profiles could be generated. Sweden is a very climatically diverse country; Skåne in the south enjoys much milder winters and warmer summers than Norrbotten in the north. With such different climates energy consumption levels were expected to be very different. It was therefore deemed necessary to understand the location of the respondents to determine whether the awareness, drivers and willingness to adopt smart services differed between the provinces of Sweden.

Q1b+c. Understanding the respondents age and sex was done to realize whether these factors played a significant role in the answers given. The age categories used were taken from the 2007 IBM Global Residential and Small Businesses Survey so that comparisons could be made between the findings.

Q1d. The type of accommodation the respondent resided in was asked to determine whether behaviors and attitudes would vary between them. Information obtained from the interview with the representative from Midroc indicated that smart services would have a very different impact on owners of single villas to those residing in an apartment primarily due to the cost of heating and cooling. It would be therefore interesting to determine whether these attitudes exist in our survey sample.

Q1e. How many people are in your household? This was a question again asked by the 2007 IBM survey. It is a relevant question for this study because it could provide evidence as to whether number of people in the dwelling is an important factor in their potential adoption of smart services i.e. should E.ON target single occupancy households first who can then remotely

control their energy usage not needing to consider anybody else or should they target families who perhaps desire an energy monitoring system.

Q2. The IBM reports 2007-2011 provided strong evidence to suggest that one of the most important factors that affected consumers' behavior was their level of disposable income. Quantifying the level of disposable income is an ever changing and very subjective process therefore this questionnaire asked the respondents to give their monthly household income. It was then possible to plot drivers and likelihood of adopting smart services against income with the results providing E.ON with greater knowledge of consumer groups.

Q3, 4 & 5. These questions were asked on behalf of Group 1 (Business model smart grids and district heating). Group 1 also required primary data from a large quantity of end-consumers and therefore this questionnaire was used as an economic means for collecting this data.

"Q6. How important are the following factors in your choice of electricity consuming products at home?"

- Cost
- Energy efficiency
- Control
- Reliability
- Environmental considerations.

This question was set in order to provide evidence to E.ON as to the key drivers and motivations of Swedish energy consumers. The IBM reports 2007-2011 suggested that cost and quality were the most important factors with regards to energy consuming products and non-energy consuming products with control and environmental impact having less significance. The question remained very similar to that of the IBM reports so that the results obtained from this survey could be compared to those of the IBM reports and the Swedish consumers can be categorized on a global scale.

"Q7. What is the biggest increase in your monthly bill you would accept for electricity/heat generated by only renewable resources such as solar, wind or hydro power?"

- 26-50%
- 11-25%
- 6-10%
- 1-5%
- No increase

One of the objectives of the smart services initiative is to be able to meet the needs of the consumers with reused and renewable energy sources. Therefore it was important to gauge how much the consumers valued energy that came from renewable energy sources so that E.ON could then identify whether promoting smart services through highlighting its environmental benefits was a worthwhile venture. IBM asked the same question in their 2007 report but used different boundaries of increase: 0%, 5%, 20% 35% 50%. 78% of respondents in the IBM survey answered with 0 or 5% generating a very skewed graph. The question on this questionnaire attempted to address this issue by having more categories at the smaller level of increase.

"Q8. Please read the information on "smart services" and then answer the questions.

Smart services refers to the integrated grid, meters, appliances and even software on your computer or phone, that can interact intelligently to provide improvements in energy efficiency, environmental impact and cost control.

It will be possible to:

• Monitor your household's electricity consumption

• Check your household use

• Monitor and control your heat usage

• Set the desired temperature

…when you want, wherever you are.

Q: What knowledge did you have on smart services for electricity and heating before you read

this information?"

- Strong
- Moderate
- Limited
- None

This question marked the start of the questions that were are directly related to smart services. The brief introduction to smart services was given to enable the respondents to answer the subsequent questions about their willingness to adopt and whether they would like to find out more about them. It also served to act as a control so that respondents would not report a strong level of knowledge believing that they are something different to what we describe. This question directly addresses the objecting of gaining data to further understating the level of awareness of Swedish residential consumers with regards to smart services.

"Q9. Does your electricity / heat provider offer any smart services?"

- Yes
- No
- Don't know

This question was asked to again understand the level of awareness that Swedish consumers have about smart services. It will be possible of E.ON to use the results as a starting point to monitor progress on raising awareness about smart services nationally.

"Q10. Have you ever used any kind of smart services in your household?"

- Yes
- No
- Don't Know

Question 10 identifies the current level of adoption of smart services and again can be used as a tool to monitor progress for E.ON about levels of adoption of smart services.

"Q11. Specify the type of smart services you have used in your household."

The results from this question support question 10 in that the results can be checked to verify that the smart services used by consumers are indeed smart services. This question also serves to identify the most popular smart service for early adopters and therefore can act as a guide for E.ON on which services to promote first.

"Q12. Which of these factors would encourage you to use smart services in your home?"

- Reduction of electricity consumption
- More control over energy used
- Environmental benefit
- More confidence in the energy supplier
- Test a new technology.

This question addresses the drivers for consumers to adopt smart services. It is similar to question 6 but focuses directly on smart services rather than energy use per se. Cost, energy efficiency and environmental considerations are again represented as possible drivers with influence taken from the IBM reports. However, in the interview with Midroc the representative remarked that Midroc needed no further incentive than to be a part of a new technology movement within their field of operations. This combined with the segmentation analysis done by IBM in their 2008 report that identified that some "Energy Stalwarts" have the desire to be the first to adopt new technologies meant that the "Test a new technology" criterion was added. Similarly the 2011 report by IBM suggested that trust in the energy supplier was acting as a barrier against the development of the relationship between utility company and its customers. By asking how important confidence in the supplier was it was possible to determine whether trust was an important issue with regards to smart service adoption in comparison to other factors.

"Q13. Want to know more about smart services in the future?"

- Yes
- No

The IBM reports (2007-2011) suggested that energy consumers had very little knowledge about energy management programs. It was therefore anticipated that this questionnaire would be the first time that many of the respondents were given any information about smart services. It was therefore necessary to ask whether they were now interested in finding out more about smart services. This data could then be used by E.ON as evidence of a demand for information about smart services.

"Q 14. Please first read the information on "peak load" and then answer the question.

Peak load refers to the highest demand for electricity and heat supply system for a period of time. Energy companies generally prefer to use renewable energy sources such as solar, wind and hydroelectric power to generate energy. However, when consumption is higher than the available capacity for these, especially at high load, the energy company may need to use oil or coal to generate energy, which is more environmentally damaging.

Q: What knowledge did you have on the peak load of heat or electricity consumption before the above information?"

- Strong
- Moderate
- Limited
- None

As in question 8, background information is provided about 'peak load' energy usage. Reducing the 'peak load' of energy consumption is the main objective of the implementation of smart services. This question serves to understand the consumers' level of awareness about 'peak load' the data from which E.ON can use when promoting smart services. For example if there is a high level of knowledge about 'peak load' E.ON can explain how the smart services can reduce smooth the 'peak' whereas is there is limited knowledge about 'peak load' E.ON must educate its consumers as to the environmental and financial benefits that are available from using energy

off-peak with smart services.

"Q15. First read the information and the answer the following question.

Spot pricing of electricity is that sold to the customer at a floating price, depending on the grid load. For example, electricity at peak load to be more expensive than otherwise. Spot pricing encourages consumers to spend their energy consumption to periods of lower load on the energy system and thus get cheaper prices, as energy companies which can meet the demand without oil and coal and thus reduce their environmental impact.

Q. How likely is it that you would choose variable electricity price (spot price) rather than a fixed price contract? Supposing that spot price is available for all customers."

- 1- least probable, 5- most probable.

In addition to the intended widespread integration of smart services another pull factor to reducing the peak load is by offering 'spot pricing' for energy. It is intended that the adoption of spot pricing would encourage the use of smart services so that consumers are in more control of their energy usage and are able to make savings by using energy off-peak. Whilst smart services have the potential to save consumers money by reducing their electricity bill through reduced energy use, the largest benefits can be seen is the adopt spot pricing payments and smart services so that their energy is consumed at off-peak cheap-rate times. Therefore by gauging the interest in spot pricing data can be provided to E.ON as to the scale for the effects of the adoption of smart services and what groups need more persuasion to adopt spot pricing.

"Q16. How likely is it that you would use the following smart services?"

- Monitoring household electricity use in real time
- Smart household appliances working intelligently with the smart grid to operate at off-peak times
- Remote control of household appliances via smart phone or computer
- Remotely set room temperature and the system will minimize heat usage within a range.

This question addresses the consumers' willingness to adopt different levels of smart services. It provides evidence to suggest which are the most desirable products and services, which E.ON could use to promote the more wanted products first or to provide the consumer with more information about the less desired products.

"Q17. How likely is it that your use of smart services will lead to a change in your behavior regarding energy use?"

- Monitoring household electricity use in real time
- Smart household appliances working intelligently with the smart grid to operate at off-peak times
- Remote control of household appliances via smart phone or computer
- Remotely set room temperature and the system will minimize heat usage within a range.

IBM's reports 2007-2011 identify a changing relationship between utility companies and consumers away from 'Passive Participatory". In order to meet the changing demands of 21st century energy consumers' utility companies must provide services that encourage a change in behavior towards energy consumption. Question 17 is therefore asked to determine whether smart services will lead to a change in consumer behavior.

"Q18. Select the THREE most important factors that could act as a barrier to your adoption of smart services."

- That someone will track my usage to see when I'm not at home for the purpose of targeting me for crime
- That knowledge about my energy consumption could be used by my provider to charge rates that are unfavorable to me
- That someone will use the information for the purposes of identity theft
- That someone with malicious intent will be able to gain access to and control of home systems
- That governments will use knowledge of my usage to levy taxes on certain activities
- That marketers will use the data to do unwanted target marketing.

This question is taken from the IBM 2008 report; it is used to identify potential barriers against the adoption of smart services. It is relevant for this project as it identifies factors that are negative drivers toward smart services. The data can be used by E.ON to address the concerns that consumers have and thus make the adoption of smart services more appealing.

During the testing phase of the questionnaire this question posed many problems; in its original format there were nine possible barriers and each were long sentences. It was observed that the respondents tended to skim read the question and answer hastily, often the answers closer to the top that they had read. To avoid this problem for the issued questionnaire, four of the least popular responses from the IBM survey were removed to make the question shorter and the order at which the answers appeared was randomized for each respondent.

"Q19. If you are currently carrying out energy-intensive housework (e.g. washing clothes, washing dishes) during peak times (peak load), what factors would encourage you to do household chores during off-peak times (off-peak)?"

- 11-25% reduction in off-peak rates
- 5-10% reduction in off-peak rates
- Positive environmental impacts
- The ability to program smart devices to operate at off-peak times.

This question again addresses the drivers of energy consuming behavior using control, cost and environmental factors as the criteria. However the answers offer evidence to E.ON as to how responsive consumers would be to possible incentives to changing their behavior to reducing peak load.

"Q20. How much more would you be willing to pay for smart appliances?

Smart appliances (dishwashers, washing machines, etc.) can work intelligently with smart services, so that they operate at off-peak times if desired."

- 1-5% more
- 6-10% more

- 11-20% more
- >20%
- No more.

"Q21. How much would you be willing to pay in advance to install smart services in view of their environmental benefits and controllability?"

(Answer typed in a box with no choices available)

The final two questions address the objective: how much are consumers willing to pay for smart services as both an installation fee and a supplement to household appliances. It was originally intended that the question would ask the respondent to give a figure of how much they would pay for smart services given predefined changes to their monthly electricity bill. For example if your monthly electricity bill would be reduced by 10% how much would you pay up front for smart services? However, test respondents met this question with almost unanimous confusion and therefore it was altered into the existing format.

Appendix 2 - Interview Design

The interviews were semi-structured. Questions and topics were prepared that largely directed the interviews, at the same time as leaving some room for the interviewees to express their feelings on other issues that they felt were relevant and important. With relatively little knowledge of the specific approaches taken to energy use within the organizations, it was difficult to foresee exactly what would be important to them so scope for less structured and more open conversation was maintained.

For Sony Mobile and ISS, we asked questions to assess their current level of knowledge about smart services, and the current set up they have in terms of energy use and how they manage the relationship between themselves and their landlord. This discussion on the responsibilities between each party led us into questions about cost sharing and how it is decided who would bear the costs. We asked questions about Sony Mobile's company values regarding sustainability and the customer interest in their behavior, to gain insight as to how much environmental issues are a driver for change. Discussion about what implications use of smart services could have for Sony Mobile allowed us to assess the level of interest and the willingness to adopt. We also posed questions about staff engagement, and the level of flexibility to shift work to benefit from spot pricing, as possible subsequent cost savings could be a driver for adoption.

For Midroc, our aim was to gain an understanding of the firm with regards to energy company relations and the scale of their activities. We asked questions about their awareness level of smart services and what factors would encourage or discourage adoption. We also probed their knowledge about the demands of the property market in relation to smart services, and what their motivations therefore were within the commercial and residential property markets. This gave us information to assess their drivers for adoption and led to discussion of what incentives could be used to motivate change for Midroc and Midroc's clients.

Interview transcripts are available on request.

Appendix 3 - Segmentation Calculations

The percentages for each of the characteristics come from the questionnaire data. For example, 57% of respondents ranked the importance of environmental factors as a 4 or 5 in encouraging them to adopt smart services (range from 1: Not important to 5: Very important) and 69% ranked the importance of control as a 4 or 5. For knowledge levels of smart services, the data shows that 4% of respondents consider they already have strong knowledge. However, 77% of all respondents have limited or no knowledge about smart services. The proportion of different attitudes toward to cost sensitivity is obtained from the questionnaire data as well, 73% of respondents ranked the importance of cost as a 4 or 5.

The size of each segment is calculated by multiplying the ratio for all the relevant factors for that segment. For example, the proportion of Technical Pioneers is calculated by multiplying the percentage of those who consider environmental factors to be of little importance (43%), with the percentage that felt that control was an important factor (69%), and those with strong knowledge (4%). In the same way the proportion of Pragmatics is calculated by multiplying the percentages of for importance of control (69%) and sensitive to cost (73%).