Designing Smart Energy

Final Report of the Tekes Research Project 2007-2008

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Table of Contents

PREFACE **7**

EXECUTIVE SUMMARY **9**

1 INTRODUCTION **11**

1.1 Research objectives **12**

1.2 Progress of the Desme project **13**

2 OVERVIEW OF EXISTING INFORMATION **15**

2.1 Feedback **15**

2.2 Automated meter reading **16**

2.3 Demand side management, pricing, taxation, legislation **18**

2.4 Smart home and other home controlling systems **20**

2.5 Existing consumer segmentation **23**

2.6 Knowledge and attitudes towards energy saving **29**

3 NARRATIVE STUDY **30**

3.1 Sub segments in the narrative study for concept ideation **31**

3.1.1 Modern materialist 32

3.1.2 Traditional materialist 34

3.1.3 Modern idealist 34

3.1.4 Traditional idealist 35

3.2 The role of electricity in everyday life **36**

4 QUANTITATIVE STUDY **38**

4.1 Current energy usage and follow-up **38**

4.2 Attitudes towards energy saving **39**

4.3 Information needs **40**

4.4 Means for improved energy efficiency in society **40**

4.5 Consumer segments found in the Desme survey 41

4.6 Summary 43

5 CONCEPT DESIGN PHASE 45

5.1 Problem analysis 45

5.1.1 Everyday life aspect 46

5.1.1.1 Tested idea concepts 47

5.1.1.2 Other findings 51

5.1.2 Design and lifestyles 52

5.2 From ideas into concepts 56

5.3 Selection of the final concepts 58

5.3.1 Home display 65

5.3.2 Shower duck 66

5.3.3 Key hanger 67

5.3.4 Energy plant 68

6 CONCEPT TESTING PHASE 69

6.1 Expert interviews 69

6.1.1 Home display 69

6.1.2 Shower duck 71

6.1.3 Key hanger 72

6.1.4 Energy plant 72

6.2 Consumer testing 73

6.2.1 Methods and samples 74

6.2.2 Home display 75

6.2.3 Shower duck 77

6.2.4 Key hanger 79

6.2.5 Energy plant 81

6.2.6 Summary 82

7 FOCUSING COMMUNICATION 83

7.1 Communication and consumer segments 87

7.1.1 Communicative instruments for Passionate ecologists 91

7.1.2 Communicative instruments for Active energy savers 92

7.1.3 Communicative instruments for Insensitive energy users 95
7.1.4 Communicative instruments for Reluctant energy savers..... 96
7.1.5 Communicative instruments for Unaware energy consumers..... 98

7.2 Evaluating the product concepts 100
7.2.1 Passionate ecologists and Energy plant.....100
7.2.2 Active energy savers and Home display 102
7.2.3 Insensitive energy users and Key hanger.....103
7.2.4 Reluctant energy savers and Shower duck 105
7.2.5 Unaware energy consumers and Home display 106

8 CONCLUSIONS..... 107

REFERENCES..... 111

LIST OF FIGURES

Figure 1. The Sociocultural Value Map of the Norwegian Monitor 25
Figure 2. Picture collage presenting the Modern materialist segment..... 26
Figure 3. Picture collage presenting the Traditional materialist segment 26
Figure 4. Picture collage presenting the Modern idealist segment..... 27
Figure 5. Picture collage presenting the Traditional idealist segment 28
Figure 6. Summary of Attitudes, Behaviour and Activities (ieaDSM 2003: 45) 28
Figure 7. Sub segments found in the narrative study 32
Figure 8. Scenario describing the different kinds of energy meters in everyday life 48
Figure 9. Scenario describing communication as a channel to affect people..... 49
Figure 10. Scenario describing different tools to reward people 50
Figure 11. Scenario describing intelligent systems at home 51
Figure 12. Lifestyle content and arenas (Courtesy: Rewir AB, Stockholm)..... 54
Figure 13. Example of scales..... 55
Figure 14. Collage presenting some product ideas..... 57
Figure 15. Home display..... 65
Figure 16. Shower duck..... 66
Figure 17. Key hanger..... 67
Figure 18. Energy plant..... 68
Figure 19. Five energy consumer segments placed in the socio-cultural value map 86

LIST OF TABLES

Table 1. Lifestyle, driving force and aesthetic properties 54
Table 2. Example of situations and touch points..... 55
Table 3. Brief description of all 14 visualised concepts 58
Table 4. Summary of energy consumer segments 88
Table 5. Problem area and created solution 108

PREFACE

The Designing Smart Energy project (DESME) was a major, innovative research project conducted in 2007-2008. The challenging central task in this project was to figure out how to make households use less energy. The aim was to search for new solutions to help households save energy in easy, effortless, and even fun, ways through combined marketing and design expertise.

The coordinator of the project was the Western Finland Design Centre MUOVA (University of Art and Design Helsinki & University of Vaasa). Other partners in the project were VaasaEMG (University of Vaasa) and Interactive Institute Power (Sweden). DESME was funded by TEKES (Finnish Funding Agency for Technology and Innovation) and seven companies: Bord Gáis (www.bge.ie), CapGemini (www.capgemini.com), Helsingin Energia (www.helsinginenergia.fi), Semio (www.semio.fi), Tampereen Sähkölaitos (www.tampere.fi/sahkolaitos), TeliaSonera (www.teliasonera.fi) and Vaasan Sähkö (www.vaasansahko.fi).

From the researchers' and designers' point of view, the project was a really challenging, fun and creative task with satisfactory end results. Very intensive cooperation between marketing people and designers provided everyone with new views and ideas. Several extensive pieces of research were conducted simultaneously with developing new product concepts. The idea was that, through very thorough research, deep and versatile information about the consumers' needs, attitudes and behaviour regarding their energy usage would be obtained. This information was then utilised by combining it with the design and marketing expertise when creating the solutions.

One essential point of this project was to take into account that consumers are by no means a heterogeneous group of people but that they are divided into several consumer types according to their demographics, psychographics and lifestyles. The target was to provide the most suitable solutions for one or more of these different groups.

This report summarises the information collected in 2007-2008 within the DESME project. The project included several stages; starting with a desk research together

with expert interviews; going through quantitative as well as qualitative pieces of research with consumers, versatile concept testing regarding the product concepts and finally focusing on communication with different kinds of consumers. In general terms, the report follows the chronological order of the research and design stages that were carried out within the project, but it must be noted that the stages overlapped to some extent throughout the whole project.

We would like to express our gratitude to all the people and organizations who participated in the project. We are very grateful to TEKES for giving us the opportunity to carry out this project, and to all the seven companies that sponsored our research project as well as were actively part of it, giving their practical know-how as a valuable input along the way. We would also like to thank all the experts who shared their expertise with us, and all those people who shared their opinions and time in different stages of our research.

EXECUTIVE SUMMARY

The Desme project aimed at analysing the possibilities of changing consumer behaviour in terms of energy efficiency by using industrial design as a tool. Concept and interaction design was used in order to study how consumers react to the concepts of smart energy applications that focus on showing and guiding consumer's energy usage.

Several studies of people's attitudes and knowledge related to energy already exist. However, these studies measure people's intentions rather than their actions and actual buying decisions. In order to be effective, segmentation needs to be based not only on consumer attitudes towards energy saving but also on their actual energy behaviour as multiple studies have shown that the correlation between people's attitudes and behaviour is weak. It is important to understand how people use energy in their everyday lives, what kinds of energy saving actions they currently employ and what their general view on energy saving amounts to. Understanding consumers' energy behaviour is important in order to be able to create more specific energy saving solutions for different contexts of everyday life.

Several product and service concepts were created during the design phase of the Desme project. When creating the concept ideas, the designers focused on two different but supporting aspects: the everyday life context and consumer lifestyles. The existing knowledge of energy consumer segments was also employed as a framework for the concept ideas. The main purpose was to design products that would relate to some major problem areas concerning energy saving in the home environment and still fit in with the user's lifestyle.

The concept ideas were evaluated by companies, designers and a research group. Four concepts were selected for further development and consumer testing: Home display, Shower duck, Key hanger and Energy plant. The concept testing revealed that these four design concepts approached the energy saving issue from a very fresh angle. This new approach was seen as very welcome by both experts and consumers.

One of the most valuable findings was the five energy consumer segments that were identified: Passionate ecologists, Active energy savers, Insensitive energy users, Reluctant energy savers and Unaware energy consumers. These five energy consumer segments clearly differ from each other by their actions, awareness, attitudes and intentions regarding energy saving.

In conclusion, several lessons were learned during the Desme project. First of all, it is important to realize that in order to be able to influence in the consumers' energy usage behaviour, it is extremely important to deeply understand their awareness, attitudes and current behaviour. Second, it must be understood that consumers are not a heterogeneous group of people and therefore they need to be approached by different ways and to be offered different solutions.

Finally, not only communication, education and more energy efficient technology are needed in order to enhance the consumers to behave in a more energy efficient manner; also innovative and desirable products and services are needed. Industrial design can be a very effective tool for encouraging consumers to think about their energy usage more and use energy less.

1 INTRODUCTION

Climate change is one of the most discussed issues in modern society. However, few of us understand the link between climate change and energy consumption at home. Studies show that the energy efficiency of household appliances has improved by approximately 2 % per year since 1970, but, at the same time, we have almost doubled the energy consumption in 30 years. So there is a strong need to reduce the energy consumption in the domestic sector. (see, e.g., http://www.est.org.uk/uploads/ documents/aboutest/ Riseofthemachines.pdf)

How can the energy consumption information be presented in innovative ways so that customers become more aware of their energy usage behaviour? Energy consumption visibility has been found to be a key way in which consumers' energy consumption efficiency can be self-moderated and improved (University of Oxford, Environment Change Institute). According to Dr Sarah Darby (2006), "Technical solutions alone are not going to reduce demand for electricity to target levels….better feedback (is also needed) – part of building a more energy-literate, low-carbon society".

There seems to be a strong societal and environmental need, as well as a new business opportunity, to develop smart energy applications. However, we do not yet have evidence of how consumers would react to such applications. This is the focus of our study: how consumers react to the concepts of smart energy applications that focus on showing and guiding consumers' energy usage.

Our research hypothesis is that by integrating consumer behaviour research with concept design, interaction and service design, we are able to have an influence on the adoption of consumer feedback applications of energy consumption. Specifically, our research aims to integrate industrial and product design principles; the knowledge of how consumers interact with energy efficiency applications, and the broader knowledge of what drives energy customer behaviour (the areas of expertise of the researchers) in order to develop innovative concepts and services.

1.1 Research objectives

The following three research objectives were stated in the original Desme project proposal. First, new concepts of customer feedback devices and services related to them are to be developed during the project. These can be further developed after the project, which can offer new business opportunities for energy companies.

Second, the use of industrial design is at a minimal level in the energy industry, which also means that companies do not know how to use industrial design in innovative ways. This project will offer added value for future product development, increase design understanding and develop new competence in the energy industry.

Third, the research institutes involved in this project are to be able to develop their core competencies to an internationally remarkable level. The research network will involve both design research and energy research competence, which, together, can offer added value to the sustainable development research area.

More specific research questions were also defined. These specific research questions were used as guiding questions when making decisions concerning the content of each research phase. However, we did not try to find a specific answer to each of these research questions.

1. Understanding consumer behaviour:
    - *a. What kind of information (and how much) do consumers want to have and are able to understand?*
    - *b. When is the right time and place to "read" the information?*
    - *c. What is the best way of catching their attention?*
    - *d. What kinds of benefits do consumers want to have?*
    - *e. How much customers are willing to pay?*
2. Applying industrial design:
    - *a. How to present the information (and make it usable and understandable)?*
    - *b. What kind of solutions could we provide for different contexts of use (right time and place)?*
    - *c. What type of design is the most appealing?*
    - *d. What kinds of services should be offered in order to provide the desired benefits?*

Chapters 2, 3, 4 and 5 will describe how the understanding of energy consumers was generated and Chapter 7 (Focusing communication) will summarise the understanding of energy consumers in more detail.

The research questions under the title 'Applying industrial design' are covered in Chapters 5 (Concept design phase) and 6 (Concept testing phase) in this research report. These questions were covered in the concept and concept testing phases of the Desme project. Chapter 7 will also give some answers to these questions.

At the beginning of the Desme project, the aim, and also the focus, was on more advanced displays and automated meter reading. It seemed that a separate display could be a solution to make people more aware of their energy usage. The aim was to develop the kind of display that people would definitely want in their homes. The design of the displays was then seen to be the thing that would make the products desirable from the user's point of view. However, as the researchers and designers began to concentrate on the subject more deeply, they found that the display may be one solution to the research problem but there may be other solutions too. So, the aim was modified into "designing concepts of consumer feedback devices that focus on showing and guiding consumers' energy usage".

1.2 Progress of the Desme project

During the first research phase (1.1.-31.8.2007) we investigated consumer adoption of new, innovative products, both theoretically and empirically. We gathered theoretical evidence of how consumers adopt new things from the international scientific literature on marketing, consumer behaviour and product development. Also, some experts were interviewed. After the theoretical analysis we gathered empirical information about consumers as energy users by conducting a survey study. We also gathered narratives from consumers.

Consumer information was also gathered by developing scenarios of consumers using different kinds of energy saving products and services. These scenarios were tested by consumers in order to get a more accurate understanding of how people would react to these new energy saving ideas. The scenarios, presented in Chapter 5.1.1.1, were tested by interviewing people.

In the second research phase (1.9.-31.12.2007) the information was used to develop the ideas into concepts. The concepts aimed to be aesthetically appealing, intuitive, ergonomic and user friendly whilst providing the sort of information necessary to affect efficient consumer energy usage. Dozens of ideas were visualised by sketching and drawing. As many as 14 concepts ideas were presented to different companies at a workshop in October 2007. Four concepts were chosen for further development.

The third research phase (1.1.-30.4.2008) focused on testing how consumers perceived and evaluated the concepts created earlier. Four concepts were tested hypothetically using a web survey and focus group interviews as research techniques. Prototypes were produced from two product concepts (Home display and Key hanger).

The fourth research phase (1.5.-31.12.2008) aimed at interpreting and reporting the results in terms of how the consumer information can be used in order to influence the energy consumption behaviour.

2 OVERVIEW OF EXISTING INFORMATION

This chapter concentrates on the results of the desk research and the preliminary expert interviews. This research stage was conducted in order to find out what has been going on in the field of households' energy efficiency. The aim was to map the relevant research that has been done as well as the relevant products and services that already exist in order to help households to save energy. The several Finnish experts that were interviewed represented experience in energy efficiency, consumer behaviour, consumer research, future research, design and energy saving issues. A couple of energy company representatives were also interviewed.

It seems that the topic of energy efficiency has been of interest to researchers for several decades. Consumer behaviour together with energy efficiency has been comprehensively studied, including consumers' attitudes and values regarding energy saving, and the impact of, e.g., automated meter reading, feedback and its influence on consumers' energy usage. A brief overview of the most relevant research is given below.

2.1 Feedback

Researcher Sarah Darby (2006) from the University of Oxford has conducted significant research, especially with regard to the feedback's influence on consumers' energy consumption, which is an extremely important topic from the DESME point of view. Improved feedback is of great importance when trying to figure out ways to make consumer's use less energy. Several other studies (see e.g. Van Houwelingen et al 1989) have also shown that feedback is one of the most important themes when consumers' behavioural change is considered (Roberts et al 2000).

It has been estimated that approximately 5–20 % of energy could be saved through improved feedback. There are several methods, tools and channels for giving feedback to consumers about their energy consumption, such as more informative billing, new technologies (e.g. a separate display) or new services to help and guide people in using energy in a more efficient way. Different approaches suit different kinds of people.

However, some of the existing channels or tools still need to be developed further from both the technical and communication point of view. Different kinds of solutions should be easy to understand and use. Obviously they also need to be easily available (including a reasonable price) as well as interesting enough to make the consumer's make the purchasing or adopting decision.

The need for improved feedback was also mentioned by the experts that were interviewed for this research stage. Almost every one of them mentioned the consumers' need for improved feedback regarding their energy consumption. They mentioned the fact that the invisibility of the energy is a major problem and improving the quantity and quality of feedback is extremely important. Consumers often do not know or understand the amount of energy they use, and it is very difficult to control the energy usage and be motivated to save energy. The experts insisted that the feedback should be very clear and should also take account of the differences between consumers. For example, some consumers may want to get the feedback instantly when using energy whereas some may prefer feedback that summarises the energy usage patterns in the longer term. For most, a mixture of both approaches might be preferred.

Related to the feedback, the existing literature as well as the expert interviews emphasised the importance of different kinds of comparisons. Being able to compare their energy consumption with their previous consumption or with other similar types of households' consumption would significantly help the consumers to understand their own energy usage.

2.2 Automated meter reading

Traditional electricity meters are old-fashioned devices that need to be read manually by the electricity company representative. The meter itself does not provide the consumer with very useful information as the meter only shows the kWhs consumed, and these numbers mean nothing to the consumer unless he regularly keeps his own statistics on the consumption amounts. Additionally, there is no easy access to the meter because it is often located in a garage, storage area or cellar of the house. Manual reading of the meters is very slow and expensive for the electricity company as well, so it is normally done just once per year. Thus it is very difficult for the electricity company to provide the consumer with information

on his electricity consumption in any great detail. The only information the consumer gets is how much electricity he has used in the past year. The consumer doesn't know anything specific about how and when he used that energy. When considering the importance of feedback from the energy efficiency perspective, this is an extremely big problem.

Modern electricity meters can be read automatically. Automated meter reading (AMR), especially when equipped with two-way data transmission and a separate display panel located in a preferred place, can provide much more accurate information about the electricity consumption. AMR has been seen as an important way to improve feedback on the energy usage by both the previous research (Energy Watch 2006, Owen et al. 2006) and the expert interviews. AMR is becoming more and more common all over Europe, especially in Sweden where the law requires all the meters to be read on a monthly basis by 2009. However, in Finland there is no legislation or regulation to push electricity companies into changing the old-fashioned electricity meters for the modern ones. On the other hand, many companies have voluntarily replaced a large proportion of their meters. Overall, it is estimated that approximately 400,000 Finns will be within distant meter reading this year, a number which is growing all the time. Additionally, the branch organization Energiateollisuus has given recommendations to its members for progressing with AMR.

Some of the experts that were interviewed for this research stage were sceptical about whether the consumers would be interested in having a more advanced meter at home and would actually use it. If there were an extra device (display panel) for easier follow-up of the consumption, it would make the feedback much more usable. On the other hand, some of the previous research (Roberts et al 2000) indicates that the extra devices do not necessarily improve the quality of the feedback (for example, improved on-time billing could provide the same information more cheaply). It is also good to bear in mind that, from the electricity companies' point of view, AMR's main benefit is to get more accurate information about when and how much the households use energy (together with cheaper meter reading costs and more accurate billing). It is not the main interest of the electricity companies to help the households use less energy (except, perhaps, in the peak times where there is a shortage of capacity).

Although there is a need for metering improvements it is also very important to concentrate on improving the information given about the energy usage with the existing technology. It is important to consider how people can be made more aware of their energy usage because it is a pre-requisite for them to be able to try to save energy. They must learn how different actions, devices and appliances use energy. The expert interviews also revealed that consumers often do not understand the concept of energy, such as kilowatt hours. The experts also mentioned that the national "energy saving goal" is too large for the consumers to understand and it might be difficult for them to understand how individual efforts to save energy appear in the larger objective; one individual's actions might seem pointless.

Whereas improved feedback could be one solution for DESME's research problem, it can be seen that automated meter reading could significantly influence the quality of the feedback. However, the meter itself does not make electricity more visible – what is needed is an easy-to-check display, as well as lot of information and guidance for the consumers.

2.3 Demand side management, pricing, taxation, legislation

Demand side management (DSM) is very interesting issue from the electricity company's point of view. In the current situation, where companies cannot price electricity based on the exact times it is used (because the times are unknown when using the old-fashioned meters), they basically have no tools with which to get the consumers to reduce the consumption of electricity at the peak times (for example, cold winter days). Therefore, they need to have enough excess capacity to be able to produce enough electricity at all times, which is very expensive. DSM means that the company tries to control the demand for energy at different times by getting the consumers to save energy when there is a shortage of it and directing the consumers to use energy when the peak time is over. This could be done by pricing the electricity according to the situation – if only the meters can offer this information and the consumers are aware of the pricing at different times. DSM benefits both the company (less need for expensive excess energy investments and more balanced energy sales) and the consumer (cheaper total bill).

There have been many experiments all over the world on how the consumers change their energy usage patterns according to the price signals they receive. Normally, consumers change their energy consumption a lot during these experiments and the overall energy efficiency improves significantly, which is encouraging. However, some of the experts that were interviewed for this research mentioned that it might not be a purely positive thing to direct the consumers' energy consumption in this way. Some consumers can find it a negative pressure.

However, there are several other ways to make people use less energy. For instance, Australia decided to use legislation to prohibit the use of normal light bulbs and force consumers and companies to use energy-saving light bulbs instead. The energy saving influence is significant. On the other hand, even if new legislation is one way to make people change their behaviour, the experts also mentioned that forcing consumers to act some way by law is not desirable. One of the experts felt that the legislation and new laws should be concentrated on bigger issues, such as construction materials and systems, rather than individuals' actions.

Pricing and taxation systems can also have a significant impact on the consumers' energy usage. However, the energy taxes are already high in Finland, and the prices have been increasing without having much impact on the consumers' behaviour in the long term (the idea is very different from just directing the energy usage to different times by pricing).

Pricing, legislation, taxation and other authority-driven methods were also discussed with the experts, with conflicting results. Most of the experts agreed that forcing people to act some way is not the best solution. On the other hand, "soft" expedients (such as different kinds of "energy signs", etc.) were seen as a somewhat good way to increase awareness amongst the consumers as well as to make them to act more smartly in their daily energy usage. Overall, what was strongly emphasised was a need for better communication to make the consumers more aware of the energy usage issues. On the other hand, communication is not enough if the consumers are not willing to change their behaviour. Therefore, motivating the consumers is another key issue.

Finally, some of the experts felt that the technical development of the products is the only efficient solution to reduce the households' energy demand. They based this opinion on the feeling that the consumers would not be willing to compromise on the amenities they have already attained.

2.4 Smart home and other home controlling systems

One solution for more efficient energy usage could be the use of different kinds of smart home and home controlling systems that can, for example, adjust the lights, heating and electronic equipment according to the residents' presence at home. The basic idea is that the house is "smart" and makes the energy saving efforts on behalf of the consumer, which makes energy saving much easier and more efficient. In addition to the energy efficiency, these solutions obviously increase safety and convenience at home.

Smart home solutions are diverse and vary from simple basic solutions to extremely automatic comprehensive solutions. One standard example is that the resident programmes the smart home device when leaving home and the house then automatically "closes down", locks the doors, switches off the lights and unnecessary electronic equipment, brings down the inside temperature, switches on the burglar alarm, etc. Thus the house is safe while the residents are away and no energy is wasted when nobody really needs it. The house can be programmed to be "switched on" just before the residents come back home, automatically increasing the room temperature again. In this way, the consumer does not have to compromise on any amenities; he can come back to a warm cosy home. Without automatic systems, it would take a lot of time and effort for the residents to go through everything before leaving and again when they come back.

Some of the researchers on the DESME project visited three companies that develop these kinds of solutions in order to get familiar with the products and ideas that already exist and interview the managers in these companies. It was found that these kinds of smart home solutions already function very well and even the expense of them is reasonable from the ordinary consumers' point of view. However, the marketing of these systems is not very active, mainly because there are not enough electrical wiring design and electrical installation experts that are capable of installing smart home solutions.

As already mentioned, there are several possible smart home solutions available. People tend to have different kinds of wants and needs, and, based on those, the smart home solutions can be divided into different categories, depending on the main purpose of them. Put simply, this means that the smart home system can have several different purposes, and a consumer may purchase the system based on one or several of these purposes. The categories are:

- Security and safety
- Energy management
- Comfort control
- Communication services
- Audiovisual entertainment

However, even if the smart home systems are potentially very good solutions for improving the energy efficiency of homes, some studies have shown that people might have mixed feelings towards them (Eggen et al 2001: 48). It seems that people are interested in solutions and technologies that make life easier; they are interested in the benefits of the technology but not the technology itself. Some obstacles to smart home systems are that people might be a bit afraid that the technology will somehow diminish the cosiness of their home and make it somewhat cold or emotionless. Homeowners generally believe that technology makes life more complex and frustrating rather than easier and more relaxing (Intille 2002: 76). One main fear is the loss of control; people want to control when and how things are done at home (Eggen et al. 2001: 48).

Studies have also shown that people are rather conservative when considering their home environment and technology at home (Mäyrä et al 2006: 181). People are afraid that smart home technology is too visible or that it will gain too dominant a role. According to the study by Mäyrä et al (2006: 183), people are most willing to accept technology for so-called ambient elements at home, such as air conditioning, heating, security and lighting.

Jokinen et al (2004: 56-57) also found similar preferences. According to their study, people are willing to accept solutions that improve the feeling of security at home. People are also interested in entertainment and information centres. For example, information on the energy consumption and the control of heating and temperature are appropriate things for smart home systems. From this perspective,

it seems that smart home services could both control the energy usage and also function as a channel for improved feedback.

The studies concerning smart home systems also revealed that one of the most important goals for their development is to make people's everyday lives easier and more convenient in a way that would leave them more time to spend with their family, hobbies and friends (Jokinen et al. 2004: 21). In order to make this possible there is a need for thoroughly understanding peoples' routines, traditions and customs.

The experts that were interviewed for this research stage also emphasised the importance of understanding people's everyday lives, their routines and ways of doing things at home. This is especially important because the products and solutions need to find their place in everyday life and the solutions must meet the user's needs in terms of usability, usefulness and acceptability. The experts also revealed that new products and services should fit people's current way of doing things at home or they should somehow change the current way into something else. However, according to the interviewees, desirability may be an even more important aspect of the new products or solutions than their usability. Even if the usability is a pre-requisite for adopting any new products or ideas, they also need to be desirable in order to arouse interest and be adopted by people.

The experts considered that, from the DESME perspective, user-orientation is extremely important. User-oriented design places the person (as opposed to the 'thing' or technology) at the centre of design and development work. It is a process that focuses on peoples' interaction with and experience of things and seeks to answer questions about the users and their tasks and goals, and then use those findings as the drivers for the design. By understanding the customer needs and desires, it is possible to focus on product features that will deliver the most value to the end users.

All products and services are designed for people. However, they will fail in cases where they won't solve peoples' problems, or won't solve them at a competitive cost (e.g. time, money, effort). The product is not an end in itself; it is a means towards the end of providing a good experience for the user. This is important to

understand from DESME's point of view as the result(s) of the project should be something that would help people to use energy in a smarter way.

From the end-user point of view, the following aspects need to be considered and understood in the development process:

- Why is the product used? Is there a need for this product or solution?
- Who would use this product or solution?
- When is the product or solution used? What kinds of requirements will the situation of use set for the product or solution?
- Where is the product or solution used? What kinds of requirements will the place of use set for the product or solution? (Leppänen 2004)

As a summary of the previous studies and expert interviews, it can be argued that the aspects people value in technical devices are:

- Usability (ease of use, effectiveness, efficiency, satisfaction)
- Usefulness
- Acceptability
- Role in everyday life
- Fits into current routines at home and makes life easier
- Feeling of control
- Only requires a small amount of activity
- Safety and credibility

2.5 Existing consumer segmentation

In consumer research it is normal to classify consumers into different segments based on their values, attitudes and interests. The purpose of the classification is to help companies to understand their target groups and audiences. Through segmentation it is possible to understand why consumers choose certain products and not the alternatives. (Taloustutkimus 2005) The experts that were interviewed for this research also emphasised that the new solutions should be targeted at different kinds of people.

Jokinen et al (2004: 65) classified people into two segments according to their attitude towards smart home solutions. The people in these segments are interested in different arguments and expect different functions from their smart home solutions. The first identified segment emphasises entertainment, experience and pleasure. The other segment is more interested in information, rational reasons

and security. Both of these segments need communication, devices and arguments of their own.

When the segmentation methods were investigated more thoroughly it was noticed that different kinds of consumer segmentations already exist. General consumer segmentations are common, but from the Desme point of view they were not very useful. In the field of domestic energy consumption, there is not enough understanding of different consumer segments, even if some research has been done. In 2003, ieaDSM, the international collaboration on market transformation, conducted a multinational study of knowledge and attitudes towards efficient use of energy in private households in six European countries. The following section covering socio-cultural segments in energy use is mainly based on this ieaDSM report. (http://dsm.iea.org)

In the ieaDSM (2003) research it was found that socio-cultural analyses have been successfully used to explain motives and behaviour towards efficient use of energy and energy saving. The analyses have explained and described how different value preferences initiate different attitudes and behaviour. Through this knowledge, the products, solutions, marketing strategies, etc., can be developed for different value segments.

This study maps the value preferences of the population. The study was conducted in Norway, Finland, Denmark, The Netherlands, Sweden, and the UK. This study maps peoples' desires in terms of basic goals and means to achieve on the personal, interpersonal and societal levels.

Figure 1 describes the consumer segmentation based on the research by the ieaDSM group. (ieaDSM 2003: 29) The consumers are classified based on their preferences for new technology, risk taking, spontaneity and urban life against those who believe in established traditions, religion, authority, conformity and respect for law and order. The terms modern/change-oriented versus traditional/stability-oriented values have been used to characterise the first value dimension. The second dimension, on the other hand, is called materialistic versus idealistic value orientation. On the left, at the horizontal axis, values such as economic growth, material possessions, consumption and selfishness are strong. As

an opposite, spirituality, inner life, creativity, close interpersonal relations, health and concern for the environment are strong values on the right at the horizontal axis.

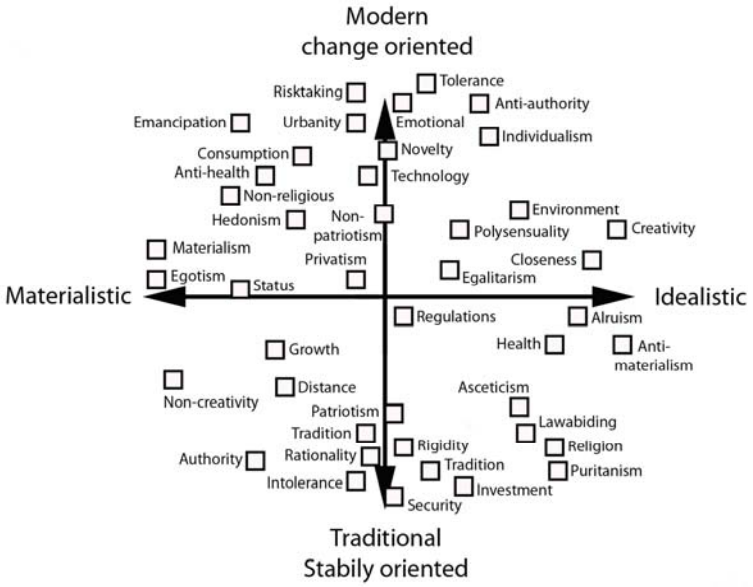


Figure 1. The Sociocultural Value Map of the Norwegian Monitor

These four segments are named Modern materialist, Modern idealist, Traditional idealist and Traditional materialist. Each of these consumer segments are briefly described below. The descriptions are based on the ieaDSM study (2003: 29-30, 44). We also present our visualisations from each of these ieaDSM segments. These picture collages were used in the first Desme workshop as inspiration material. We created picture collages in order to sum up and visualise the main features of each segment (see Figures 2-5).

Modern materialist

Modern materialists don't care how much energy they use, how they use energy and the consequences of energy waste. Modern materialists place a high priority on personal needs, and they do not care about consideration for others. They are concerned with possessing things and seek status and acceptance from others by showing their possessions. In order to make them adjust their behaviour in the right direction, one has to appeal to their need for status and materialism, and support their need for shopping and consuming.

Figure 2. Picture collage presenting the Modern materialist segment

Traditional materialist

Traditional materialists were described as having a low understanding of the problems with energy waste and energy efficiency. When the authorities tell them to be energy efficient, they react negatively because of their inability to understand the consequences of waste and why they have to save energy. Arguments related to saving money without losing comfort have an opportunity to be understood and accepted. It also has to be made clear that energy saving is a challenge for us all, that we are all in the same boat. Traditional materialists are also very concerned about economic growth, and it would be good if energy efficiency can be related to economic growth.

Figure 3. Picture collage presenting the Traditional materialist segment

Modern idealist

Modern idealists know a great deal about energy matters and energy efficiency, and they have high scores on environmental consciousness and are socially reflected. Their behaviour in the energy field does not always reflect their competence and their level of engagement. They are hard to influence through advertising campaigns, but they are more likely to react positively to public information campaigns, even if it seems that their self esteem sometimes makes them sceptical of the public authorities. Arguments should relate to their care for the community and society, that energy saving is a kind of empathy, that energy saving is ethical and that energy saving gives better comfort in the home.

Figure 4. Picture collage presenting the Modern idealist segment

Traditional idealist

Traditional idealists are concerned about all the problems they are made aware of by public information. They obey every directive from the public authorities and they have already bought low energy light bulbs, water saving shower heads and new tight windows. There will be no difficulties in communicating energy efficiency to this target group in the future, but the gains will be small due to their previous energy saving actions.

Figure 5. Picture collage presenting the Traditional idealist segment

Figure 6 summarises the attitudes, behaviour and activities towards energy saving and energy efficiency of these four energy consumer segments.

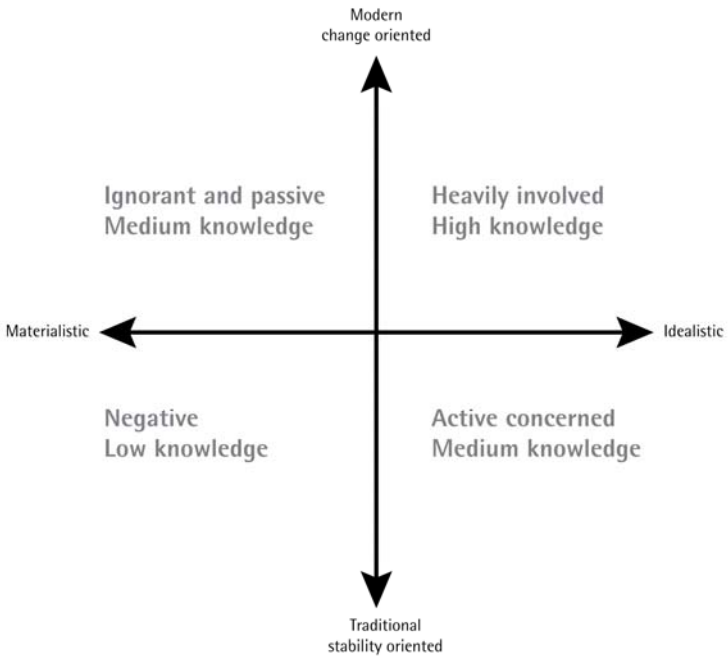


Figure 6. Summary of Attitudes, Behaviour and Activities (ieaDSM 2003: 45)

2.6 Knowledge and attitudes towards energy saving

Several studies on people's attitudes and knowledge related to energy already exist. However, these studies measure people's intentions rather than action and actual buying decisions. It is important to look for different kinds of incentives for different people in order to boost energy saving behaviour. Many consumers appreciate monetary savings but it is not the only motive for energy saving. Other kinds of incentives need to be found as well. If consumers are just forced to act in a more energy efficient way, there will probably be a great deal of resistance to change.

The expert interviews revealed that people do have quite a lot of general information on energy efficiency, but what is needed is more practical and detailed advice on how to save energy in everyday routines. The experts also characterised the tone of current and past education campaigns as often being uninteresting and old-fashioned. They said that there is a great need for new and fresh communication of environmental messages. The current way of communicating energy saving issues focuses on benefits such as saving money and the environment, being sensible and doing things in the right way. Even if the message itself is correct, it seems that these kinds of encouraging messages do not pander to all people.

The experts also revealed that the social aspect of energy saving is completely missing at the moment. There are only a few situations where people can communicate or need to confront energy issues and the subject of energy saving. However, the experts felt that other people are an important source of information. They also emphasised that people need to be encouraged and supported to adopt more energy efficient behaviour.

3 NARRATIVE STUDY

We wanted to follow the user-centred design principles from the very start of the Desme project. This means that both researchers and designers needed not only a full and rich understanding of energy users' attitudes and energy saving actions but also how people see the role of energy and energy saving in their everyday lives.

In order to better understand energy consumption at home, we asked consumers to tell us how they use energy in their everyday lives. A request was published in the Helsingin Sanomat and Pohjalainen newspapers and also in the energy companies' own customer magazines Nette (Vaasan Sähkö), Naps (Tampereen Sähkölaitos) and Helen (Helsingin Energia). A request was also published on the Internet (forum for web competitions). A request was also available when testing the concept ideas in the Rewell shopping centre in Vaasa and in Vaasa City Library. People were asked to send their narratives during the summer of 2007.

As many as 54 replies were received. The narratives were used in several phases of the Desme study. At first, these stories were analysed in order to deepen our understanding of the original segments found in the ieaDSM study. The narratives were used in order to bring these four segments (Modern materialist, Modern idealist, Traditional materialist, Traditional idealist) alive and give suggestions to the designers about the kind of solutions would best fit their purposes. This deeper understanding of energy consumers was needed when the concept ideas were created.

The narrative analyses were used as background material when trying to understand the energy consumption at home. There were also used not only as a source of ideas when creating concept ideas but also as a reference point when selecting and reasoning the concept ideas. The narratives were an important way to bring the energy consumers' voice into the Desme concepts and into our research.

Later, when the results from Desme survey were finished, the narratives were analysed again in order to deepen our understanding concerning these five new Desme segments (Passionate ecologists, Active energy savers, Unaware energy consumers, Insensitive energy users and Reluctant energy savers). The narratives

were also analysed in order to find feeling-based expressions concerning energy use.

3.1 Sub segments in the narrative study for concept ideation

When making the first narrative analyses, we mainly used the idea of attitudes, behaviour and activities towards energy saving and energy efficiency presented in the ieaDSM study (2003). Age, gender, incomes, etc., where not taken into account. Demographics were not taken into account because we found that it is not possible to mix these quantitative variables with qualitative narratives, and the number of narratives received was so small that it was not possible to make any conclusions based on demographics. Instead of following the original segmentation formally, we wanted to study the true diversity of the qualitative material.

We started by placing each narrative in one of the original segments. When analysing the narratives in this way we found some sub segments in all of the original segments. The sub segments shared the same attitude, knowledge and behaviour towards energy issues as the main segment, and were identified based on their special characteristics. Each of these sub segments found in the narrative analyses are presented in Figure 7. There, the sub segments are placed under their 'parent' segment.

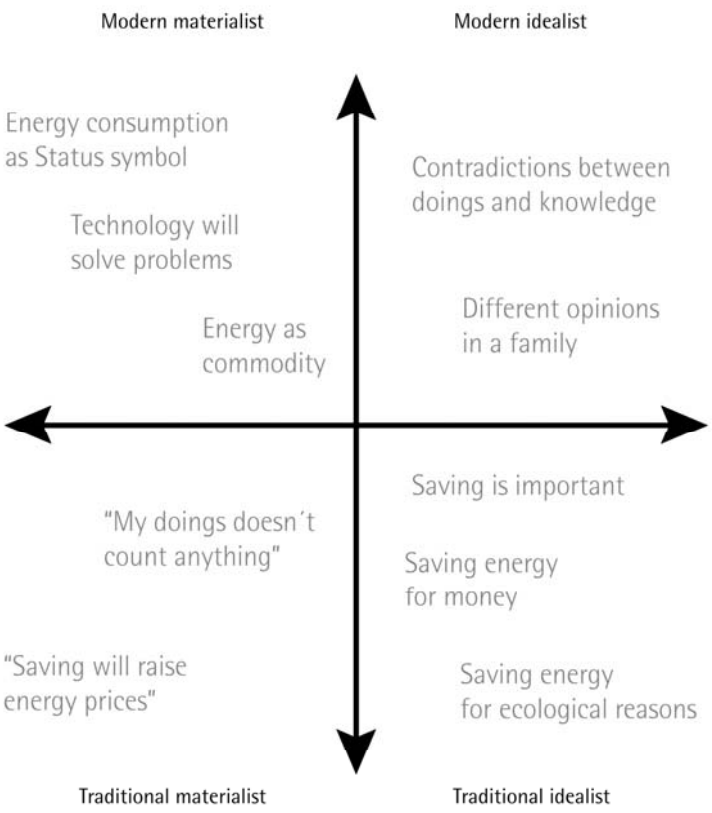


Figure 7. Sub segments found in the narrative study

These sub segments were used in order to make concept idea generation easier. We found that the understanding received from the ieaDSM study (2003) was not enough when trying to create many innovative product and service ideas. More qualitative information was needed. The sub segments were only used as material for creating concept ideas; we do not suggest that the sub segments should be used in any other way. We also give some suggestions concerning possible product solutions for each segment.

3.1.1 Modern materialist

Three sub segments were found in the Modern materialist segment. These segments are called Energy consumption as s status symbol, Technology will solve the problems, and Energy as a commodity.

Energy consumption as a status symbol

In this sub segment, large energy consumption is seen as a status symbol. “I can use electricity a lot because I can afford it!” The people want to stand out from other people (many of their friends are saving energy). These people value electrical devices a lot. They do not see why other people do not understand or value convenience as much as they do. Convenience, innovations, the best devices and material things are important for them.

Technology will solve the problems

People in this sub segment find that energy is important because it facilitates easy-going everyday life. Energy is a necessity and people cannot survive without it. They find that there is no need to save energy because new energy sources will be found in the future. They also believe that technology will eventually solve all energy problems.

Energy as a commodity

These people do not evaluate their energy consumption critically; they consider their energy consumption to be “normal” and use as much energy as they need in their everyday lives. They do not care how or where they use energy. Energy consumption does not prey on their conscience. They do not try to save energy, but they may try to avoid needless energy consumption. They may have energy saving habits, which they have learned in their childhood. They value new devices, new and better features, brand and new design. Energy is seen as a necessity and a self-evident matter. Energy does not give rise to any feelings.

Solutions for Modern materialists

Modern materialists appreciate solutions that are simple and easy-to-use. They especially appreciate technical solutions. They are not interested in energy and they firmly believe that energy saving should not complicate daily routines. Any solutions should also have an option for some social aspect. Consumers in this segment do not want to discuss their own energy consumption with their friends, but they are interested in new devices they might like to show to their friends. Good design and features are very important for them.

3.1.2 Traditional materialist

The narrative study found two sub segments of the Traditional materialist segment: 'My doings don't count for anything' and 'Saving will raise energy prices'.

"My doings don't count for anything"

These people are not interested in energy. They are aware that they have some problem areas in their energy consumption, but they do not find it necessary to change their behaviour because they find that their doings don't count for anything. Why bother when everyone else is wasting energy?

"Saving will raise energy prices"

These people do not want to save energy because they fear that electricity companies will raise energy prices when consumption is lower. Some of them are even willing to schedule their lives based on night and day tariffs. They are ready to do this because they want to save money, not electricity.

Solutions for Traditional materialists

Traditional materialists would appreciate solutions that are clearly connected to their familiar routines and ways of doing things at home. Constancy of familiar habits and things is very important for them. They need easy-to-use and simple solutions because they may have doubts concerning new technology and new devices. They may have problems in trusting new technology or trusting themselves as users of new technology. People in this segment need solutions that explain the amount of energy consumption in a concrete and accurate way, and also the benefits and results of energy saving actions. This could gradually teach them that they really can make a difference by their own actions.

3.1.3 Modern idealist

Two sub segments were found in the Modern idealist segment. These sub segments are called Contradictions between actions and knowledge, and Different opinions in a family.

Contradictions between actions and knowledge

These people have quite good knowledge of energy issues and they try to act in a way that saves nature and energy. However, there are conflicts in their energy

behaviour compared with their energy knowledge. Although environmental issues are important for them, convenience and pleasure may bypass energy saving in everyday life. They are interested in energy saving for ecological reasons. They feel bad about not acting as ecologically as they feel they should. They would like to do more but they do not have the time or place for saving energy.

Different opinions in a family

These people have quite high knowledge of energy issues. They recognise problems they have in their own energy behaviour. They would like to save energy but they run into different opinions within the family concerning energy saving: “The wife would like to save energy but the husband appreciates convenience”. They may find that they are the only person in the family who wants to save energy and is committed to energy saving.

Solutions for Modern idealists

Modern idealists would appreciate solutions that make electricity consumption more visible and consumption information available all the time, that make it easier to remember energy saving actions in everyday life and help them to show the electricity consumption to other members of the family in order to justify energy saving actions.

3.1.4 Traditional idealist

We found three sub segments iIn the Traditional idealists segment: Saving is important, Saving energy for money and Saving energy for ecological reasons.

Saving is important

People in this sub segment have quite good knowledge of energy issues. They have several energy saving habits. They are interested in energy issues and, e.g., read energy articles in newspapers. They have also adopted new energy saving habits. They feel that energy saving is important, without any particular reason. They do not emphasise money or ecological reasons as a motive for saving. They are economical consumers in other fields of life as well, not only in energy issues.

Saving energy for money

People in this sub segment have very high knowledge of their own energy consumption. They have several energy saving habits, which were learned in childhood. Their attitude towards energy saving is positive. They have invested in energy saving - e.g. they already have tight windows, a fireplace in the house - or they use alternative energy sources. They are very aware of how much money they have saved with their investments and habits. The ultimate or only motive for energy saving is money. Money which is saved on energy can be used for a family holiday abroad, for example.

Saving energy for ecological reasons

These people are devout eco-persons or conservationists. They have several energy saving habits and find that environmentally sustainable behaviour needs to be learned at a young age. They find it important to highlight that people do not need all the modern conveniences.

Solutions for Traditional idealists

Traditional idealists would appreciate solutions that support the social aspect of energy saving. They are proud of their saving actions and their energy saving skills. They are eager to put their point of view to other people. They need solutions that give more specific information concerning their household's energy consumption because they are interested in following the results of energy saving actions.

3.2 The role of electricity in everyday life

Another example of how narratives were analysed during the Desme project is the categorisation of the people's own description of the role of electricity in their everyday life. We separated four different categories describing the role of energy. In their stories, the people were talking especially about electricity. This is understandable because the stories were gathered in Finland. From these categories we can see some of the main problems confronted when trying to motivate people to save electricity.

In their narratives, the people were talking about electricity as an essential part of everyday life. Electricity was stated to make everyday activities easier and more convenient. People saw that electricity has great importance when thinking about

how women's daily activities have become easier over the years. Electricity provides ease of everyday activities and home comfort. When electricity is mainly attached to easiness, comfort and pleasure, it is no surprise that people are not willing to cut down on their electricity consumption. For them, saving means less convenience or more time spent on everyday activities.

Some people had realised how much they depend on electricity. Perhaps they had confronted a power failure recently. Any problems with electricity were seen as a disturbance that damages the smooth running of everyday activities. In the case of power failures, parents were especially concerned about their children, who are not used to any problems with electricity.

Electricity was also seen as a certainty. A continuous flow of electricity was seen as obvious. Many of these people also found that the energy shortage will never come. They found it incomprehensible that people should save electricity. There has always been enough electricity so why should that situation change in the future?

Also vVery responsible energy consumers were also found in the narratives. They felt that people should not use energy more than necessary. They felt that there are several ways in which electricity can be saved without lowering the convenience. They found energy saving an important issue, either for monetary reasons or environmental reasons.

4 QUANTITATIVE STUDY

After the researchers had done some desk research as well as some expert interviews, it was decided that a quantitative study needed to take place. Through the preliminary research stage, the researchers gained a lot of knowledge and understanding of the households' energy efficiency issue as a whole. The researchers were now familiar with the main issues that needed to be concentrated on and the main challenges that needed to be solved in order to make the energy saving easier and perhaps more interesting for the consumers. However, more specific information was still needed. The aim of the quantitative study was to find out how consumers differ from each other in the way they think and act towards using and saving energy, including their current behaviour, attitudes and motives as well as what they see as the most efficient ways to get people to save energy. Consumers' information needs were another key issue. A brief summary of this quantitative report is presented in this chapter. (Pakkanen & Peltola 2007)

It was decided that a questionnaire study that would enable a large enough sample size with reasonable costs and time would be the most appropriate method for achieving the necessary information. The sample size had to be reasonable in order to be able to constitute different kinds of consumer segments.

The responses were collected by sending 3,000 questionnaires to Finnish households chosen at random. The questionnaire was quite extensive, including five full pages of questions. It seems, however, that the respondents considered the topic interesting because the response rate was as high as 44 %, despite the time and effort involved in completing the questionnaire.

The results of this questionnaire study broadly represent Finnish households. The sample included a good mixture of young and old, female and male, consumers in cities and the countryside.

4.1 Current energy usage and follow-up

Consumers already seem to do quite a lot in order to save energy. However, it seems that they do not have very much knowledge of the best ways to save

energy; often they seem to do the easiest and most concrete things, which are not always the most efficient ones. The most common actions are switching lights off in empty rooms and only washing full loads of laundry or dishes (which is logical anyway). However, compared to their effectiveness, lowering room temperatures and reducing the consumption of warm water is quite rarely done in a goal-oriented way. This probably has a lot to do with the convenience; people don't want to rough it.

Almost half of the respondents follow their energy consumption from a meter 1-4 times a year and almost one-fifth follow the consumption very intensively, at least monthly. The main reason for following the consumption is for expenses/housekeeping. Approximately one-third (perhaps a surprisingly small number) of the respondents do not follow their energy consumption from a meter. The main reasons for not following energy consumption are that the respondents think it is difficult (or they do not have access to the meter) or that they are just not interested in the topic.

4.2 Attitudes towards energy saving

Even if there are a lot of people that really are not at all interested in energy usage and saving issues, approximately one-third of the respondents are at least relatively interested in the topic, and as large a share as two-thirds of them feel that they also try to save energy in their daily routines – at least to some extent.

One person or one household cannot significantly influence the society's energy consumption, but most of the consumers do not seem to accept this as an excuse for not caring about how much energy they use. Approximately two-thirds of the respondents feel that they, as well as other households, should aim at efficient use of energy, and that there is no guarantee that there will always be enough energy available.

Even if consumers seem to consider efficient energy usage important, most of them are not willing to put significant effort into it. Two-thirds of the respondents feel that energy saving should not complicate their daily routines. A similar share of the respondents believe that households' energy consumption won't diminish, because people don't want to compromise on their amenities. These findings clearly indicate

that it is extremely important to make energy saving as effortless as possible. Only a few consumers are genuinely prepared and willing to lower their standard of living and to make efforts in order to help society to control the energy demand.

As one could expect, financial saving is the main motive for people to try to save energy. However, still more than one-third of the respondents see environmental protection as more important to them.

4.3 Information needs

It is evident that consumers need much more information about their energy usage and the best ways to save energy. However, the information must be easily available and in a form that is easy to understand, without putting too much effort into it.

Almost half of the respondents feel that following energy consumption is too complicated, but they would like to do it in real time and get more precise information about their usage. On the other hand, one-fourth of the respondents feel that the current type of energy bill gives them all the information they need with regard to their consumption.

4.4 Means for improved energy efficiency in society

The majority of the respondents believe that coercive means would not be efficient when the aim is to reduce the households' energy consumption. Energy price increases, as well as changes in legislation, are believed to be an inefficient way to influence energy consumption habits. On the other hand, these findings probably partially reflect people's attitudes; they do not wish to be forced into saving energy, they want to do it on their own terms (if at all).

In the respondents' opinion, in a society with an objective of getting the households to save energy, the most efficient methods would be developing energy saving technology, remoulding people's attitudes and increasing their awareness.

Consumers seem to think that a more informative meter device and/or more informative electricity bill would be very useful in order to help them to follow their energy consumption. Illustrative information, graphs and comparisons would also

be useful. The Internet, e.g. customer-specific premium pages on an electricity supplier's web site, was seen as a good idea by many. More personal channels, such as a personal service via the telephone or the possibility to ask for information by a text message, were much less popular among the respondents. However, different methods and channels for distributing energy usage and saving information suits different kinds of people. It is important that the different types of consumers are targeted with a method that fits each of them best.

4.5 Consumer segments found in the Desme survey

One main starting point for this research was to try to find consumer groups that differ from each other in the way they think and act regarding energy usage. Five energy consumer groups were identified through the questionnaire survey. These groups are similar by size. The main characteristics of each group are summarised below. A more detailed picture from these five segments is presented in Chapter 7.1.

Passionate ecologists

A Passionate ecologist is a consumer who is really committed to saving energy and tries to save it wherever he can, even if it requires a lot of effort or lowers his standard of living. He considers energy saving to be of great importance. His main motive for saving energy is environmental considerations. He even believes in the efficiency of coercive means (price and tax increases and legislation changes) as a way to get people to save more energy. The Passionate ecologist has done the most to save energy during the past year, but he does not follow energy consumption from a meter more often than most of the other groups. He is more motivated by environmental considerations than the other consumers. A relatively large number of the Passionate ecologists live in apartment houses in big cities and do not have electric heating. As consumers generally, they tend to consider their purchases carefully and try to avoid unnecessary or non-sustainable consumption.

Active energy savers

The Active energy saver knows a lot about energy efficiency and knows how much energy he uses at home. He thinks that following energy consumption from a meter is interesting and not too complicated. He follows his energy consumption from a meter much more actively than other consumers, and has also done a lot to save

energy during the past year. Overall, the Active energy saver is very similar to the Passionate ecologist when it comes to using energy as efficiently as possible. The difference, however, is that the Active energy saver is not as devoted to energy saving as the Passionate ecologist; he is not really keen on lowering his standard of living in order to save energy, and he does not think society should force people to save energy by changing the legislation or taxation. Active energy saver is a group that has a relatively large number of males when compared to the other groups. This group has the least number of single households. Active energy savers often live in houses in small towns. The share of single households is low and the households' income level is higher than in the other groups. As consumers generally, they consider themselves to be quite aware and quite economical and to do a lot of long-term planning.

Insensitive energy users

The Insensitive energy user believes there will always be enough energy available, therefore he is not afraid of energy shortages. He does not see any reason why he should save energy. He thinks that it is not worth him saving energy if the others won't do the same. Most energy is wasted by industry anyway. The Insensitive energy user is not interested in energy saving and feels that he does not have time for that. The group of Insensitive Energy Users has more males than females and is clearly the oldest of the five groups that were identified. This group has the most single households (and, at least partly, related to that, also the lowest income level). Insensitive energy users are also clearly the least educated group. As consumers generally, this group does not seem to consider their purchases on a long-term basis; rather, they don't think about things so much and just buy by the cheapest price.

Reluctant energy saver

The Reluctant energy saver is the most negative towards energy saving. He doesn't think saving energy or following the energy consumption from a meter is interesting. He does not really want to save energy and doesn't want to get more information about ways to do it. He does not have time; he has more important things to think about. He thinks that society definitely should not force people to save energy (by, e.g., changing legislation or taxation) because how much energy he uses is a person's own business. The Reluctant energy saver is clearly the most

passive type of consumer when it comes to following energy consumption from a meter. He has also done the least to reduce his energy consumption during the past year. Maybe surprisingly, the group of Reluctant energy savers is clearly the youngest group of all those identified. Relatively many of them live in apartment houses in big cities. As consumers generally, they buy a lot on impulse and do not want to put a lot of effort into their purchasing decisions. This group also cares clearly less about the environment than any of the other groups.

Unaware energy consumers

The Unaware energy consumer thinks energy saving is a good thing and he is interested in it, but he just does not have enough information about the best ways he could save energy at home. He also thinks that following his energy consumption at home is quite difficult. He needs much more information in order to be able to save energy. On the other hand, he does not think people should be forced to save energy by increasing the energy price or by changing the legislation, and he tends to feel that energy saving should not complicate his daily routines. The share of females is a bit higher in the group of Unaware energy consumers than in the other groups. As consumers generally, this group was difficult identify because they seem to be a quite heterogeneous group in the way they do shopping. Also, the demographics of this group did not really provide more information about who these people are; it seems that Unaware energy consumers are relatively common in all consumer groups and cannot be identified based on special characteristics.

4.6 Summary

Based on this study, it seems obvious that a large proportion of consumers genuinely consider energy saving to be a good thing and are interested in learning what they can do in order to reduce their own household's energy consumption. The motive behind this is often the possibility for financial savings, but also environmental considerations are extremely important for some consumers. It seems that majority of consumers already think about their energy usage and try to save energy wherever they can. However, it must be noted that this is not a totally realistic picture of the consumers. Questionnaire respondents always tend to describe themselves as "good guys", emphasising their positive attitudes and good intentions rather than their real actions and choices in everyday life. In addition, it

is very likely that those who received the questionnaire but did *not* answer it are less interested in energy saving issues than those who did. However, it is encouraging to notice that at least the attitudes are extremely positive for most consumers. Also, the results clearly show a great need to improve consumers' awareness regarding their own energy usage as well as to spread information on the best ways to save energy.

The most valuable finding, from the point of view of DESME's next stage, was the different kinds of consumer groups that were identified. These five groups clearly differ from each other by their actions, awareness, attitudes and intentions regarding energy saving. When trying to influence consumers and get them to use energy in a more efficient manner, it is extremely important that different types of consumers are approached in a way that speaks to them. The most relevant issues to be taken into account are the awareness level, the basic attitude and the willingness to save energy. These needs should be answered in a way that is most appropriate for each group. Various types of products and services are needed. It is also of great importance that the communication is adjusted according to the target audience. This is not only true for the general communication regarding efficient energy use but also when new products or services are launched. The marketing methods (including the distribution channels, pricing and selling arguments) need to be right in order to make people adopt the new products or services. Therefore, when the project continued with concept development, these segment findings were a strong background influence.

5 CONCEPT DESIGN PHASE

Concept design aims to produce design principles for a new product (Baxter 1995). Concept is a rough description of a new product and the benefit transferred to its users. Its purpose is to serve as a basis for the subsequent physical product, its financing, production and marketing. Concept planning can be seen as a process in which you identify the product need, explore the needs in multiple ways, define the goals for planning, and create possible solutions. After you have your possible solutions, you have to select the best one/s, and concretise and evaluate them.

As Baxter (1995: 201) comments: "There are two simple secrets to successful concept design. Firstly, generate lots and lots of concepts and secondly select the best." Next, we will describe the progress of producing the Desme concepts.

5.1 Problem analysis

The reason why the creation of new product concepts is essential as it gives the frames for the ideas. At the beginning of the DESME project the aim, and also focus, was on more advanced displays and automated meter reading. It seemed that a separate display could be a solution to make people more aware of their energy usage. The aim was to develop the kind of display people would definitely want in their homes. The design of the displays was then seen to be the thing which would make the products desirable from the user's point of view. However, as the researchers and designers began to concentrate on the subject more deeply, they found that the display may be one solution to the research problem but there may be other solutions too. So the aim was modified into "designing concepts of consumer feedback devices that focus on showing and guiding the consumer's energy usage".

The goal of concept design in general is to describe the main functional and styling principles that will deliver the core benefits for the users. So, in order to do this, the designers had to analyse who the main target groups are, what kind of solutions would fit into different consumer segments, what the main benefits would be for the consumers, what kind of contexts of use there may be, what type of design would be the most appealing, what kind of services could be offered and,

last but not least, how to make the energy consumption information usable and understandable.

One of the main issues to be considered in the concept design process is the user's point of view; the real benefit offered to the user. For example, the user does not buy a phone because of the object itself; he buys a solution to fill a specific need. In this case, the need is communication, possibility to communicate. The telephone is just a device to get what is needed.

In our concept planning, the designers familiarised themselves with the research material produced by the consumer researchers and discussed the results with the researchers and other designers, as well as with other experts.

Based on the discussions, we concluded that either the products should need to find their place in peoples' everyday lives or they should be otherwise desirable, for instance, by being related to the consumers' values and lifestyles. So we decided that the design group at Muova would focus on the everyday life aspect and the designers in Stockholm would focus on consumer lifestyles. In both cases, the purpose was to understand the target group: what are they like, what do they look like, what do they do, what are their needs, what is their lifestyle?

5.1.1 Everyday life aspect

At Muova, the designers started to study the possible target groups with a concept idea testing. For this testing, the designers made four user scenarios, which are described more in detail in the following chapter.

A user scenario is a story about how the user uses and communicates with the product in everyday life. Generally, user scenarios are represented in images, they are visualised and text is used, which, in fact, is an affordable way to represent a product before it exists. A scenario is first of all a means of communication. It eases communication with users, customers or the product development group. The stories in user scenarios are catchy and easy to return to later. User scenarios support design and crystallise the needs for the product development. Scenarios also function as common tools for designers, because of describing all possible ways of using the product, and they are concrete material with which to

communicate. By using scenarios, new ideas and functions are better planted into the environments. Without a deeper analysis of the field, the designers can miss essential information on the users and the product can become a failure. The scenarios ensure that the essential things are taken into consideration in the design process.

In the Desme project, the scenarios for concept idea testing were built on the grounds of the material from the consumer studies made earlier. In these scenarios, the products to be designed were left secondary, although they could have been presented in more detail. This was because we wanted the consumers to pay attention to the user, the context of use and the product concepts, not the concept details, such as the colour or size of a concept.

The purpose of this testing was to collect feedback from consumers concerning several energy saving ideas. The interviewed consumers were asked to evaluate each of these ideas. We wanted to know how consumers find these ideas in general and how they evaluate the capacity of each idea to contribute to energy saving and making the household's energy consumption more visible and understandable. User testing was organised in order to get authentic feedback on the concept ideas from users. We wanted to make sure that the ideas chosen for further development were the right ones from the consumer point of view and also that these ideas were being developed in the right direction.

The results of the scenario testing guided the designers forward: they got valuable information about the different target groups and the kind of solutions that could be further developed.

5.1.1.1 Tested idea concepts

Different concept ideas were tested in the Rewel shopping centre in Vaasa and Vaasa City Library. Fifty people were interviewed during the two-day testing period. For the testing purposes, four scenario boards were prepared (each board presenting one scenario). Each of these scenarios presented different kinds of means and devices for energy saving purposes. The consumers were asked to state how they found these different solutions.

The main themes presented in the scenarios were:

- Different kinds of energy meters in everyday life (Figure 8)
- Communication as a channel to affect people (Figure 9)
- Rewarding people in order to encourage them to save energy (Figure 10)
- Intelligent systems, e.g. Smart home (Figure 11)

These four tested scenarios are presented next. A short summary of the consumers' comments is also presented after each scenario.

Maria is on her way home when she gets an SMS message on her mobile phone. "Energy consumption of your apartment has been 10 € this week." This information makes Maria happy: "This service offered by my energy company is absolutely great. I can definitely say that the instructions given by the energy expert have been very useful."

At home, Maria starts to prepare the dinner with her new energy efficient electric cooker. The energy meter hanging on the kitchen wall shows the energy consumption in kilowatts and euros in real time.

Maria decided to take some exercise with her stationary bike. This special bike generates kinetic energy that can be used for watching TV, for example. Maria decides to exercise a bit longer so that the energy lasts for the whole movie night tomorrow.

Maria turns on the sauna stove and nods off to sleep on the couch. She is awoken by the alarm, which informs that the sauna is ready. In her bathroom, Maria has a motion-sensor shower, which helps her to keep the water consumption low. Before Maria goes to bed, she checks with the digital display that all the electrical devices in her apartment are turned off.

Figure 8. Scenario describing the different kinds of energy meters in everyday life

The most interesting idea from the interviewees' point of view was the energy meter that visualises the energy consumption better and in a more concrete way than current energy meters. Many of the interviewees found that monitoring the household's energy consumption is too complicated at present and the current type of energy meter does not encourage people to follow energy consumption at home.

Other interesting ideas in this scenario were the energy expert who could advise and give concrete and personalised instructions on energy saving matters at home. Intelligent devices that express the amount of consumed energy or automatically switch off unnecessary devices were also found interesting. This kind of automatic system was found to be good and convenient, especially when leaving home.

The Laakso family are on their summer holiday trip when they hear the 'Everyday life and energy' programme. In this radio programme, people share their own energy saving tips with others. Seven-year-old Lasse remembers that they have also talked about energy saving at school. In fact, al thel kids in the school got the interesting 'Energy invaders' game Lasse is playing with her sister at that very moment.

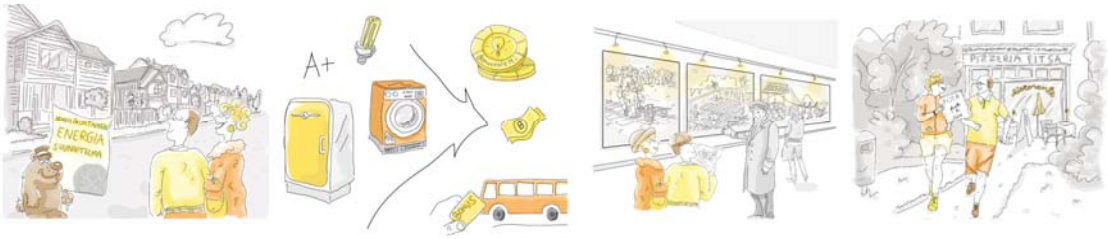
The family arrives at the petrol station and order a family pizza. On the receipt they can see how much energy was used in order to prepare their food. The father buys a newspaper, which has a headline pointing to the energy consumption in Finland versus developing countries. 'Hmm, do we really use that much energy?' he wonders.

The family heads towards the hotel. On their way they pay attention to the big billboards on the side of the road. On these posters there are pictures from different kinds of environmental disasters and how they can be seen in Finland.

The Laakso family booked their low-energy hotel on the internet. There is also a possibility to make an 'ecologic footstep' test in the hotel. After the test, the father decides that they really do have to change their old household devices for more energy efficient ones.

Figure 9. Scenario describing communication as a channel to affect people

The interviewees were unanimous concerning the need to teach reasonable energy behaviour at school. Children and young people were found to be a favourable target group for communication and teaching because they are still receptive to new information. Also, information internalised at young age is remembered in adulthood. The interviewees were especially inspired by the interesting and exhilarating energy game for children.



Mr and Mrs. Rajala have adopted an energy efficient way to live. For example, they have made a personal contract with their local tax authorities. According to the contract, they are committed to using no more than a fixed amount of electricity. If they manage to save electricity from this quota, they will get benefits in their taxation.

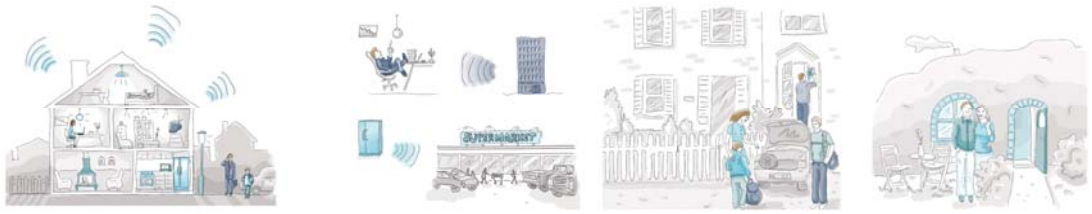
The Rajalas also receive a bonus (card, coupon, tokens, etc.) if, for example, they choose ecologically safe devices instead of others. They can freely choose how they want to use their bonus, such as in the local supermarket or the use of public transportation.

The Rajalas are participating in a public energy campaign that takes place once a month. This time, the Ralajas are visiting an exhibition about how people used their own muscles to produce energy in earlier times. They can see, for example, pictures about inspection trolleys speeding up the railways or people pulling up water from the well.

'Energy saving day' is not only a theme day for energy saving, it is also a statutory holiday that is held once a year during the summertime. This theme day is a good time to use different kinds of energy efficient services. The Rajalas decide to go in for sports. On their way back home they drop into a local pizzeria, which is also known for their energy friendly ways of making food.

Figure 10. Scenario describing different tools to reward people

Rewards and bonuses received from successful energy saving actions were seen as an encouraging way to promote energy saving behaviour. However, people emphasised that there should be many flexible alternatives for using the accrued bonuses.



The parents of the Niemi family are very busy and do not want to use their time following their energy consumption. However, they find energy saving a very important issue and, because of that, they

decided to install a comprehensive smart home system. This system monitors the energy consumption and assists them in energy saving. The system can be either automatic or manual.

The family have been very satisfied with their smart home because it saves time in normal everyday activities and they can then be with each other more. Their smart home includes, for example, a refrigerator that is connected directly to the local supermarket, which makes shopping easier for the family. The father also appreciates his home office. All of these services are provided through a wireless system, so there has been no need to buy several extra devices.

The family is leaving for a visit. The father puts the system into a 'stand by' mode. This means that the system can then turn off all the unnecessary devices. The danger of fire, for example, is then minimal. If there any problem appears while family is away, the system automatically informs the family as well as the service company.

The Niemi family arrive at their friends' new house. What is special about this house is that it is build under the ground, which makes it very energy efficient.

Figure 11. Scenario describing intelligent systems at home

People found interesting devices in the smart home solutions, which makes it possible to turn the whole home into shut down mode from one switch. The smart home would then switch off all unnecessary electrical devices. This kind of device was found especially useful when leaving home. In order to prevent damage, the system needs to be absolutely safe and reliable.

5.1.1.2 Other findings

The interviewed consumers were quite interested in energy saving issues. Their attitude towards concept ideas was positive and open-minded. Many of the ideas were found good and worth further development. They especially appreciated practical, realistic and easy-to-use solutions that fit well with their everyday lives and routines. People seem to prefer easy solutions for energy saving purposes and do not want energy saving to change their everyday routines or somehow disturb their lives. For example, constant reminding of energy consumption is not wanted.

High purchase price and the small energy saving capacity are the facts that were seen to hinder the use and installation of energy saving devices at home. People were also reluctant to purchase some new electric device for energy saving purposes or in order to follow household energy consumption.

The interviewees were also asked to talk about their experiences concerning energy saving light bulbs. Most of the interviewees were familiar with energy saving light bulbs. The majority had purchased at least one energy saving light bulb and their experiences from using them were positive. It was noted that energy saving lights bulbs lasted longer than ordinary light bulbs, and the light was softer. The main rationale for buying energy saving light bulbs was their ability to save energy. Energy saving is seen important as it saves both money and the environment.

High purchase price was mentioned as a drawback to energy saving light bulbs. However, people mentioned that buying energy saving light bulbs is quite a small purchase, so price is not a definitive issue.

The interviewees were asked if they knew what is the biggest object of energy consumption at home. Lighting was mentioned only in one interview. Based on this, we might conclude that consumers are perhaps not aware how much lighting contributes to the electricity consumption at home. In order to make people more aware there should be more information available. However, the communication should be more diverse and funnier than it is at the moment.

5.1.2 Design and lifestyles

In collaboration with the team at Muova, the research team from the Interactive institute in Sweden was conducting parallel studies. The intention was to broaden the study and to approach the fundamental research question from another point of view based on knowledge, experiences and interests. In Stockholm, the research group chose to frame the possibilities within Design and Lifestyles.

The personal engagement in saving electricity and making efforts in the domestic area varies a lot. Large groups declare they do want to improve the efficiency and make savings, but many express that it is hard to know how. Along with the fact that many experience energy and electricity as very abstract and dull, environmentally friendly living and energy saving is quite often associated with negative values such as a trade-off in general quality of life. It is quite a challenge to find a trigger that fits in with the daily life of the modern individual where many other things often have higher priority, such as work, family and friends.

In order to be able to interest and engage people in these actions we need to understand the importance of identification and self-image - the way one sees oneself and believes one is seen by others. Lifestyle is a manifest choice of living that helps us cope with our environments on a day-to-day basis in what we do, our interests and attitudes, values and allocation of income.

Since we are studying possibilities in the domestic area, we are specifically interested in leisure behaviour. What keeps us employed outside our work? What do we do in our spare time? Some spend many hours in front of the computer, maybe gaming; some are into gardening, fishing, golf, fitness, travel, etc. Which attractive forces make us spend a lot of time and money on activities? What are the needs, motives and wants? How is it expressed? Why do golfers spend fortunes on clubs, clothing, fees, magazines, travel, courses? Why do golfers spend so much time on a golf course? These questions enrol all sorts of wellbeing-occupations in paying interest to plants, memories, the body, the car, etc. Maybe we can combine an activity with an energy activity? If we can come closer to an understanding of certain activities, we might find important keys that can be adopted for energy savings.

The group in Stockholm was processing ideas in a series of themes: Lifestyles/Interests - Situations/Touch points - Energy data/Mobility. Figures 12-13 and Tables 1-2 serve as examples of the tools, frames and criteria that were partly used in the ideation phase.

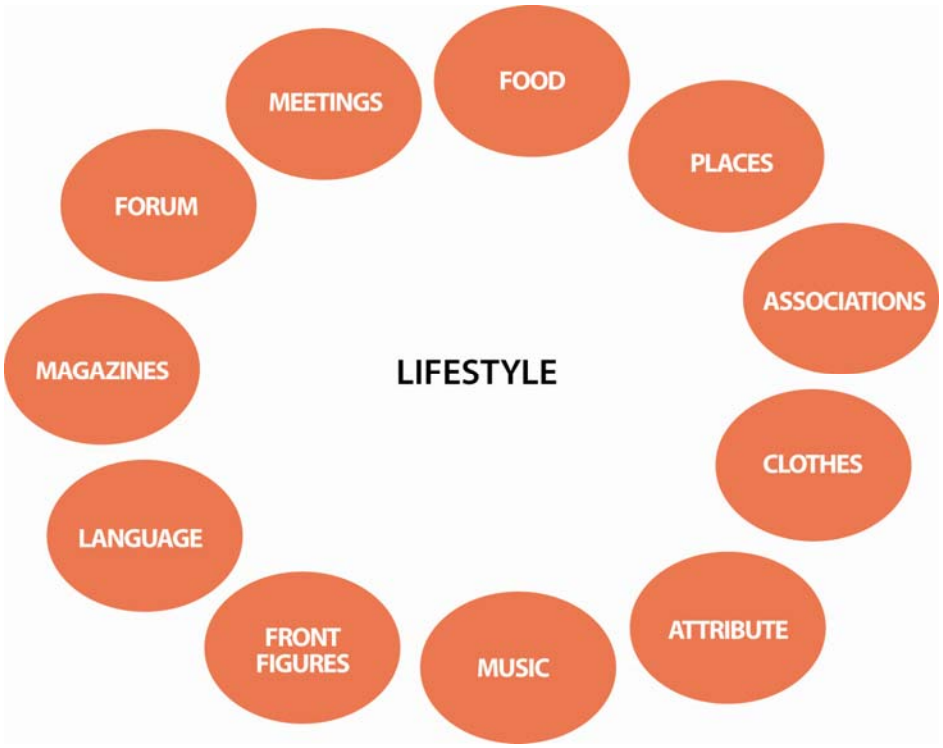


Figure 12. Lifestyle content and arenas (Courtesy: Rewir AB, Stockholm)

Table 1. Lifestyle, driving force and aesthetic properties

Lifestyle:	Driving force:	Aesthetic properties:
'Fitness' (modern idealist)	Control, performing well, centre of attention	Clear colours, speed stripes, reflector stripes, function visible, rubber, hi-tech materials, microfiber, steel, organic forms
'Scrapbooking' (traditional materialist)	Creativity, collect/sort, memories, visualizing	Lots of colours/patterns, pastels, eclecticism, baby, panduro, paper, plastic, thread, 2D, book, analogue
'Gamers' (modern materialist)	Competition, social meetings, confirmation	Black/neon, stereotype, sharp, hard, masculine, war, weapons, plastic, metal, cables, dust

'Brats' (traditional materialist)	Affiliation, signals, attention	Bling-bling, leather, gold, diamonds, sunglasses, back slick, sober colours, homogenous, limited edition, brands, tight
'Gardeners' (traditional idealist)	Relaxation, control, nature experience	Natural materials, rubber, colour of nature, traditional, wood, porcelain, country
'Adventurer/explorer' (modern materialist)	Experience, control, excitement	High tech, the latest stuff, military green/ camouflage, carbon fibre, comfort

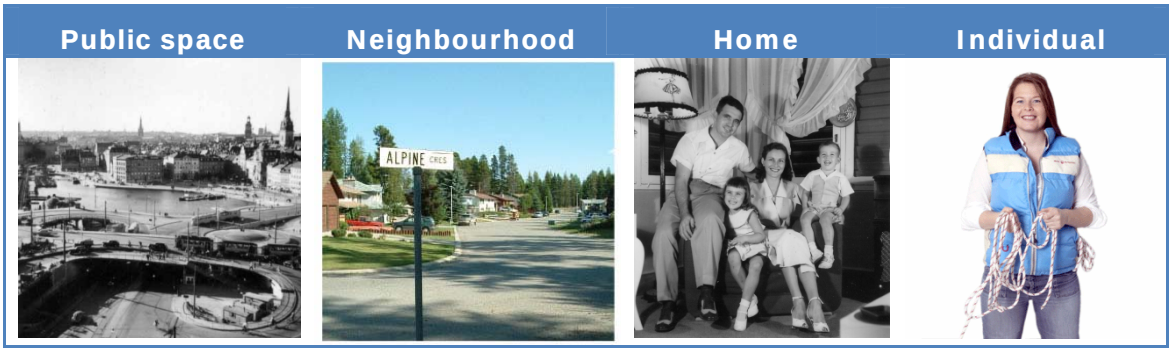


Figure 13. Example of scales

Table 2. Example of situations and touch points

Place:	touch points:	Aesthetic properties:
Fitness centres, gym halls	Reception, Computers, calendar, bill boards, shoe stands, lockers, locks, benches, water fountains, gym equipment, sauna, showers, log book	
Nature and Garden		analogue
At home		metal, cables, dust
'Brats'	Affiliation, signals, attention	edition, brands, tight

(traditional materialist)		
'Gardeners' (traditional idealist)	Relaxation, control, nature experience	porcelain, country
'Adventurer/explorer' (modern materialist)	Experience, control, excitement	comfort

5.2 From ideas into concepts

Concept design is perhaps the most creative part of the design or product development process. There are several idea generation techniques that can be used in this phase, both analytic, such as morphological matrix or function analysis, and intuitive methods, such as brainstorming or synectics. Different kinds of material can be used in the idea generation phase: designers can, e.g., construct mood and image boards of people's lifestyles and values. In finding ideas, it is important that designers do not stick with the most obvious solution. Instead, they can, for instance, unify old and new, benchmark and borrow ideas. In the idea generation phase, quantity really compensates for quality; the best concepts can come out of weird ideas, since there are no bad ideas, nor space for criticism. Criticism though, is a useful tool in the selection phase.

The designers worked individually and as a group in and between Vaasa and Stockholm. They produced (by sketching and drawing) dozens of ideas (see Figure 14), discussed the ideas and finally selected 14 ideas that were visualised as concepts in October.

Figure 14. Collage presenting some product ideas

Through a series of workshops, discussions, studies and interviews the aim was to generate strong ideas that where anchored in the Finnish survey and the findings in the Lifestyle research. We had staff exchanges in both Finland and in Stockholm, which was an important part of building mutual understanding and high-level design discussions. The process was very democratic with participants from

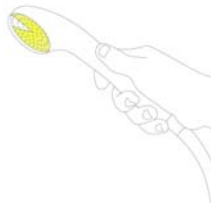
interaction design, industrial design, architecture, cognition science, computer science, energy engineering and consumer behaviour.

5.3 Selection of the final concepts

In our workshop in October 2007 we presented the visualised 14 concepts. Muova had designed Home display, Shower wall, Key hanger, Toy for children and Web-service. The Interactive Institute had designed Power shower, Shower duck, Energy tags, Garden gnome, Solar lamp, Public display, Energy plant, Balanced life and Charge your home. The concepts were based on the different needs of the consumer segments.

All of these 14 concepts are presented in Table 3. Each are briefly described (reasoning and background to each concept) and presented with a picture.

Table 3. Brief description of all 14 visualised concepts

	INSTANT FEEDBACK Personal hygiene is a necessity and today almost all people shower on a daily basis. Some even shower several times a day, depending on their activities. Using less hot water has great potential for saving energy. If a family uses the shower for 20 min a day, the amount of energy used in heating the water is about 4,000 kWh per year. The potential saving by halving this time is 2,000 kWh plus the water! However, today, it is not easy to estimate either the time taken to shower or the amount of water used.
	Power Shower This shower handle is just like an ordinary shower handle when it comes to the actual showering. Additional important features indicate water pressure, temperature and showering time, which is integrated into the shower head. The time, shown in five-minute intervals, uses a cake analogy with strong colour feedback for every interval. Temperature is indicated by thermo-chromatic colours that react to heat by changing colour. The small amount of electricity needed could be generated by using a small turbine inside the handle. Values: Easy access/ direct feedback/ redesign/ easy to install/ easy to understand Consumer types likely to use the Power Shower: In the moment consumer - Let go consumer - Ecological consumer - Occasional considerate consumer - Long term planner consumer
	Shower Duck The duck is a universal symbol for bathing and is connected to a playful positive experience. The Shower duck is a smart duck that will recognise and react to the sound of running water. Placed near the shower or the bathtub, the duck registers when the water starts to pour and sets a time limit. When the time is up, the duck becomes angry and quacks loudly, if the shower is not turned off, the sound will become more annoying. Values: Trend/ design gadget for families/ young households/ easy to understand/ humorous Consumer types likely to use the Shower Duck: In the moment consumer - Let go consumer - Ecological consumer

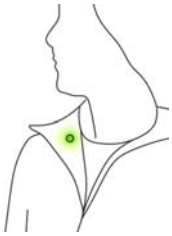
Wall

The shower wall visualises how much warm water is used. The water level inside the shower wall changes according to the water consumption. The shower wall provides valuable information concerning water consumption in real time. It can also be seen as an easy and enjoyable tool when parents are teaching reasonable water usage to their children. It could also activate passive energy consumers because it offers concrete and instant information about water consumption.

The shower wall would offer a totally new way of not only seeing but also measuring the water consumption instantly.

SYMBOLS AND FASHION CRAZE

Certain trends and movements have a very strong impact on individuals, as well as larger groups in society. Wearable decorations such as badges and pins are common communicators for showing a personal standpoint or support of a 'good' cause such as, Live Strong - a rubber armband that states that you support a biker and his fight against cancer by wearing it. By buying it you are contributing to cancer research. Another example is "The Pink Ribbon", a symbol for supporting breast cancer research, which has also gained tremendous attention.



Energy Tags

The basic idea is to encourage young people to get involved in energy/environmental matters. By wearing the Energy tag, purchased in certain shops or outlets, you are supporting the future by energy savings. You activate the tag by logging in on a web page.

A smart radio feature makes the pin react when you are passing a central public place with a billboard / info zone that can be seen by passing people. For instance, your nickname will be shown on the screen along with a counter that indicates an increasing number of people who have taken the standpoint.

Values: Cool factor/ young influencing elderly/ discussions and opinions/ sharing knowledge/ feel good aspect/ branding opportunity/ personal engagement

Consumer types likely to use the Energy Tag: In the moment consumer - Let go consumer - Ecological consumer

Garden Gnome

Most people living in their own house take a special interest in their garden and front yard. Various decorations, arrangements and installations along with shrubs are quite common.

The mythical gnome is having a revival in terms of garden decoration. The story indicates that the gnome is influential, you have to be nice to him and he is also concerned about the environment. This Garden Gnome serves as a symbol for a concerned owner. It is powered by the wind, which can light the gnome. The garden gnome comes with a story that stands for environmental consciousness, the wind power station for energy efficiency. This topic can be further discussed with curious neighbours and visitors, for with an owner that is smart and trendy.

Values: Trend/ design/ status/ humorous/ social interaction/ branding

Consumer types likely to use the Garden Gnome: In the moment consumer - Let go consumer - Ecological consumer

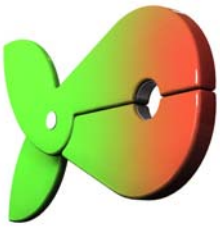
Solar Cell Lamp – Self-sustained

Saving energy can be given new, more positive values, revealed through statements embodied in the design of an artefact. A product that creates a strong desire to be owned and also redefines energy saving as something positive does not need to end with the actual product itself but can change behavioural patterns in a broader context.

The Solar Lamp is an eye-catching symbol for environmentally friendly living, fusing modern technology with a traditional small decorative lamp that is usually placed in the window – something well known and familiar. The shade of the lamp is made of a thin solar film that harnesses the energy of the sun during the day and releases it through ultra-bright, energy efficient LEDs when switched on. There is no need for power cords since the lamp is completely self-sustainable. The lamp is therefore easy to move around. The light can be adjusted and the remaining battery time could be displayed in relation to this.

Values: Trend / design / lifestyle / statement / feel good aspect / discussion and opinion / redesign / easy to install

Consumer types likely to use the Solar Cell Lamp: In the moment consumer - Let go consumer - Ecological consumer - Occasional considerate consumer - Long term planner consumer



Toy

An energy toy is a playful energy meter that visualises energy consumption in an illustrative and funny way. The toy measures energy consumption by 'biting' the wire. The colour of the toy indicates the amount of electricity the device consumes. The wireless device in the toy enables connection with a computer, for example, to have more information and compare the energy consumption of different equipment or households.

In the narrative study, people did not mention having so many habits they had learnt in adulthood. However, people had several energy saving habits they had learned in childhood. Even people with negative thoughts towards energy saving still had the energy saving habits they had learned as a child. Also, the interviewees in the pre-concept testing phase emphasised the importance of teaching children reasonable energy saving behaviour. At the moment, there are not so many interesting games for energy teaching purposes.

Playing, games and toys could awaken children's interest in effective energy use in a nice, playful and fun way. At the same time, toys and games can also be pedagogic; you learn while you play. Children are quite open to new ideas. If you can build a positive attitude towards energy saving among children, it is likely that they will not only act but also feel positively about energy saving as adults. Another thing not followed or done in order to save energy was replacing old machines with new ones. Perhaps the toy could also be a good way to show (not only children but also their parents) how much electricity is consumed by the household machines (and to compare the results with other families).

Children at elementary school would be a fruitful target group for this toy/game. When they measure energy usage at home, they can show the results to other children and their teacher. The results can also be examined on the web page, where the whole class can discuss them together. When children measure energy usage at home, their parents can be involved, which makes them interested too.

Key hanger

The key hanger is placed in the hallway near the door. When people come home, they put their keys in the hanger. When none of the keys are hanging there, the device will automatically switch off the lights and unnecessary electric devices.

People are not making so many energy saving actions in their everyday lives and it seems that they do not want to learn any new habits either. Consumers who are not interested in energy and energy saving actions need easy solutions for energy saving (one-button systems, no need to remember new things, automatic solutions, etc.).

The key hanger would be an easy solution that could have several functions at the same time (lights, electrical devices, etc., connected to the key hanger). A semi-automatic system that does not make a person need to think or remember anything extra would work, especially for those segments who are not interested in energy issues. These people are interested in making routines at home easier. People also have existing routines with their home keys. Consumers who are interested in saving money would be interested in this solution, which is a concrete and easy way to avoid unnecessary energy usage. This solution would not only be an energy issue but also a safety issue. This could help to prevent fires and other problems occurring when electric devices are left either switched on or in standby mode.

PUBLIC DISPLAY

Energy-related strategies throughout an entire apartment block have high potential for improving energy efficiency. The individuals, the building and the infrastructure are factors which, in combination, can lead to a decrease in energy loss and better performance. The individual in society often has difficulty connecting to the bigger picture. Revealing energy usage in comparison with others, along with more relevant and up to date channel information, opens up greater possibilities for engagement.

Public Display

The front door is a place people living in the house always engage with. Having a display in the door handle is an ideal place to catch attention. Before entering the building you have to identify yourself. The handle will instantly react and show your position on the score list. Apartment owners can compete for a higher position by being more energy efficient. Their monthly or weekly performance is tracked by individual meters; the figures are calculated and compared with the size of apartment, the number of people living in the household and individual lifestyle factors. With feedback in the smart handle, it is likely that people will reflect, react and discuss.

Values: feedback in relation to others/ increasing awareness/ simplicity/ social pressure/ social interaction/ status/ design/ based on existing technology

Consumer types likely to use the Public Handle: In the moment consumer - Let go consumer - Ecological consumer - Occasional considerate consumer - Long term planner consumer

AUTOMATIC METER READING

Feedback on one's actions is an important factor for increasing understanding and changing behaviour. With the traditional energy bill, feedback is so delayed that one could say it is almost non-existent. There is no way to tell what actions resulted in the presented sum of kilowatt hours. One way to solve this problem is to use AMR (Automatic Meter Reading) creatively to provide instant feedback in the course of the daily life of the customer.

Energy Plant

Looking at different lifestyles and hobbies is a way to find the relevance of energy usage, Building on the idea that many people like to nourish their plants and see the result grow into something beautiful, we suggest an electricity display that does the same.

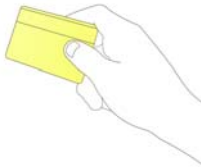
The Energy Plant is a decorative transparent display placed on the windowsill or attached directly to the window. It visualises electricity consumption by digital plants referencing traditional pot plants normally seen placed on the windowsill. Every month, when a new seed is planted, it begins to grow in response to the electricity use.

Using a lot of energy makes the plant wither, whilst more modest use rewards you with a plant that thrives and grows faster. Every month could mean a new type of seed and a new, different looking plant, depending on how well you treat the plants. The Energy Plant could even be a service connected to a website where one can get new types of seeds, compare plants with friends and administer other kinds of features.

The LCD display has low energy consumption and is powered by the sun, making it a zero home electricity consumer. It utilises AMR to pull information for giving instant feedback on your actions. As an example, the plant could shiver when electricity consumption rises rapidly.

Values: Trend/ design/ lifestyle/ statement/ feel good aspect/ discussion and opinion/ redesign/ easy to install/ something to take care of

Consumer types likely to use the Energy Plant: In the moment consumer - Let go consumer - Ecological consumer - Occasional considerate consumer



Balanced Life

Being healthy and fit is a strong trend in the Western world. People put a lot of money, effort and time into training, equipment and knowledge. Looks and improvements are strong factors that are often calculated and documented. Tables of energy in food as well as energy consumed in various exercise programs are quite familiar to these people. Could this interest be matched with energy saving in a home?

The basic idea is to balance your life and to maintain 0-level consumption. The AMR System figures are transferred into a smart card (or a watch) to enable users to monitor their energy usage. The user has to log in to activate the service, which starts an account where monthly goals are set. This balance account will keep track of the household improvements made in energy savings compared to personal training improvements. If the goal is reached, a reward scheme is available, such as guidance with a personal trainer or time with an energy consultant, discounts, etc. Each time the account is checked, the user will be provided with tips on training, food and sustainability.
Competitions among club members or colleagues are other potential ways to engage more people.

Values: Encouraging and rewarding/ wellbeing/ health and strength/ gaining knowledge on energy efficiency /training

Consumer types likely to use the Balanced Life: In the moment consumer - Let go consumer - Ecological consumer - Occasional considerate consumer - Long term planner

Charge Your Home

Finland has a strong and mature mobile market. The overall penetration rates in 2005 were above the EU average, and annualised growth has continued at nearly 7%. The development of the mobile phone and services you can use it for is rapidly expanding. However, the consumers might be tech-savvy but they only adopt the services that have real benefits. We believe there are opportunities for new service development in connecting mobile services with AMR data.

Every mobile phone has to be charged. While the battery is charging, information on your energy status is transferred into your mobile. Charge your home offers the mobile phone as a medium for consumers to interact with energy-related information and transactions that will be carried out contactless by any mobile and the device holder.

The customer starts the service by paying for the estimated electricity needed for the coming month. This will not require a credit card. This is similar to filling the 'house tank', which is visualised as a shelf on the wall. Every time the mobile is charged, data will be transferred for comparison and deeper study. Prepayment will make a better relationship between usage and costs - it makes it possible to set goals and get higher interest in following the data. A reward scheme could serve as a carrot.

The idea of a house with a tank will give intuitive feedback on the amount of electricity left to run the house. The device holder, the shelf, is placed so that it is easy to plug in and convenient to grab the mobile in a hurry.

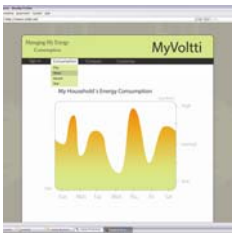
Values: Adopted mobile/ easy handling / design / high-tech/ low threshold / convenient/ needs not much effort / time shortage / prepayment

Consumer types likely to use the Balanced Life: In the moment consumer - Let go consumer - Ecological consumer - Occasional considerate consumer - Long term planner

Home display

Home display is a display that enables following and managing the household's energy consumption. Extra features are a clock, a calendar and a recipe bank. With Home display, it is possible to make a shopping list and send it by SMS to a cell phone.

The interviewed experts emphasised that products and solutions need to find their place in people's everyday lives. They have found that new products and services should fit people's current way of doing things at home. Any new display for the home should be connected to the central routines at home. The context for using Home display could be the fridge door in the kitchen. Routines for using Home display already exist: food and activities related to the kitchen, especially food and the fridge are very central at home. This device would bundle several home activities into the same place (digital calendar, clock, note book for shopping list or food recipes, energy information, etc.). Easy-to-access energy information could make it following the household's energy consumption an everyday thing. Energy information could become as much an everyday thing as looking at the calendar or clock, making food or writing a shopping list.



Web service

The web site includes information about energy consumption at home. You can find statistics, the energy bill, energy saving tips and a discussion forum. The easy-to-use web page can be personalised according the user's needs and wishes.

People have learned to use Internet services for many purposes. Energy companies have some web services where consumers can read their energy meter and report it to their energy company. In addition, there are some official web sites that give information on energy usage. However, many of these web services are quite complicated to use and the tone of communication is very edifying. Even though there is a lot of energy information available, some consumers mentioned that they do not have enough information about energy saving actions. Lack of knowledge may be one reason for their passive energy saving behaviour.

A possibility to modify the type and complexity of the information given in the web service could provide more information for those people who are interested in energy issues and energy saving issues. Consumers who have a negative or more passive attitude towards energy would object to too-specified information. A collection of different styles of visualization of energy consumption would be appreciated. Some like bar charts while others prefer pie charts or something else. People could then modify the information to match their needs and preferences.

After presenting each concept, we asked the company representatives individually to evaluate which of these would be the best ones. The evaluation was based on criteria freely chosen by each person. At this point we could not use a detailed evaluation matrix because the concepts were based on the needs of the different target groups and contexts of use, and because concrete features of concepts were not yet specified. The companies had to choose one Stockholm concept and one Vaasa concept because the aim was to have both the everyday life and lifestyle aspects in the further development. Also, those companies that were not able to attend the workshop selected the best ones via e-mail.

After the companies had made their selection, the researchers and designers in Vaasa and Stockholm selected their favourite concepts. In all, the companies selected the Home display and Shower duck, and the design and research teams selected Key hanger and Energy plant. These four concepts were further developed into more detailed visualisations (see the next chapters), which we then used in the concept testing phase.

5.3.1 Home display

Figure 15. Home display

A Home display (see Figure 15) makes following and managing the households´ energy consumption easier. Home display gives a possibility to follow the energy consumption in real time, whenever you want to. The energy information, presented with figures, charts and graphs, will also help with the understanding of energy information. Green and red lights in the Home display will instantly indicate major changes in the electricity consumption level.

The Home should be connected to the central routines at home. A context for using the Home display could be the fridge door in the kitchen. Routines for using Home display already exist; food and activities related to the kitchen, especially food and the fridge, are very central for persons at home. This device would bundle several existing home activities into same place (digital calendar, clock, note book for shopping list or food recipes, energy information, etc.).

Easy-to-access energy information could make following the household's energy consumption an everyday thing. Energy information could become as much an everyday thing as looking the calendar or clock, making food or writing a shopping list.

5.3.2 Shower duck

Figure 16. Shower duck

The duck is a universal symbol for bathing and is connected to a playful positive experience. The Shower Duck (see Figure 16) is a smart duck that will recognise and react to the sound of running water. Placed near the shower or the bathtub, the duck registers when the water starts to pour and sets a time limit. When the time is up, the duck becomes angry and quacks loudly. If the shower is not turned off, the sound will become more annoying. Except for quacking, the duck may turn transparent, revealing its beating heart. The duck's heart beat indicates how long the shower has already taken.

By designing new features for the common duck, it is likely to be adopted by many people, especially families. The duck responds to the need for instant and simple feedback in a situation where it actually can influence the behaviour. However, the design is not explicitly targeted towards children; rather, it is an educational artefact for a broader group. It is designed for basically everyone, but families are the likely consumers. The simplicity and ease of use targets those people who are not interested in energy. Consumers also want to learn about energy and the duck can be seen as a behaviour-learning artefact for showering in the "right" way.

5.3.3 Key hanger

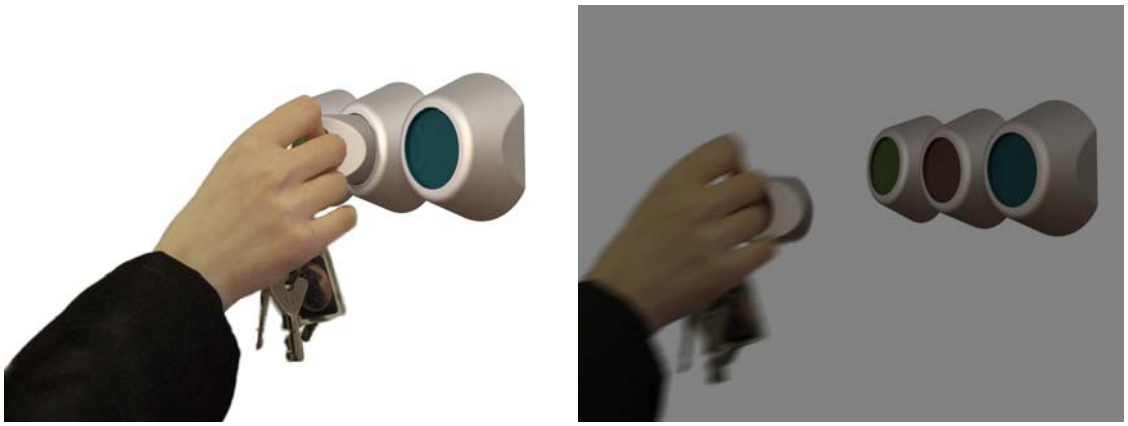


Figure 17. Key hanger

The Key hanger (see Figure 17) is placed in the hallway near the door. When people come home, they put their keys in the hanger. When none of the keys are hanging there, the device will automatically switch off the lights and unnecessary electric devices. This solution would be a safety issue as well as an energy issue. It could help to prevent fires and other problems occurring when electric devices are left either switched on or in standby mode.

The Key hanger is a modular solution that is easy to install and use. It may have several functions at the same time. Because the Key hanger is a semi-automatic system, the users do not need to think about it or remember anything extra. This would work for those people who are not interested in energy issues. However, everyone is interested in making routines at home easier. People also have existing routines with their home keys.

People are not making so many energy saving actions in their everyday lives and it seems they do not want to learn any new habits either. People who are not at all interested in energy and energy saving actions need easy solutions for energy saving (one-button systems, no need to remember new things, automatic solutions, etc.). The Key hanger might be an interesting product for them.

5.3.4 Energy plant

Figure 18. Energy plant

The Energy plant (see Figure 18) is a decorative transparent display placed on the windowsill or attached directly to the window. It visualises electricity consumption by the digital plant's referencing the traditional pot plants normally seen on the windowsill. Every month, when a new seed is planted, it begins to grow in response to the electricity use. Using a lot of energy makes the plant wither, whilst more modest use rewards you with a plant that thrives and grows faster. Every month could mean a new type of seed and a new, different looking plant.

The core idea with the Energy plant is the nourishing aspect, through which one wants to make the plant thrive and grow. To take care of something is a strong human need. The idea is to persuade the flower users to be curious and start to have an interest in energy saving. The reward is seeing the plant react and grow through our efforts, and by being actively engaged in the creative process, which makes us feel engaged.

The plant is targeted at a broad consumer group. However, people that are interested in their homes (design and coyness of it) and want to make a visible statement (idealist) are particularly targeted - that is, a design-oriented modern-urban person. This is related to the form and representation of the flower that might appeal to different user groups (i.e., tulip vs. modern fractal representations).

6 CONCEPT TESTING PHASE

6.1 Expert interviews

Expert interviews were conducted in December 2007 in order to reach quick glance at the innovativeness and potential of these four product concepts. Four experts were selected for a telephone interview. Three of them were also interviewed at the beginning of Desme project. The interviewees were from consumer behaviour (2 experts), industrial design and one energy efficiency expert from Motiva (the Finnish office that promotes the market for renewable energy sources and efficient energy use).

The experts were very interested in the concepts and were very willing to participate in the interviews. They felt that all of the concepts were innovative and the energy issue was being examined from a fresh point of view.

6.1.1 Home display

The experts described Home display as a traditional and informative smart metering application. They found that these kinds of easy-to-use displays, which indicate energy consumption information in an understandable way, are very much needed. They liked the idea that Home display is placed in the kitchen (in the same place as everyday routines). However, some experts found that kitchen might not be the best place for Home display in every household. There are families where, e.g., the living room is more central than the kitchen. They also suggested that there could be several displays at home, such as one display in each room. The displays could then show the energy consumption separately in each room. One expert wondered if the Home display placed in the kitchen would give the signal that energy consumption at home is mainly caused by the activities in the kitchen. She pointed out that this is not the case in most households.

The idea that energy information is attached to some other information was also appreciated. In particular, the clock was very much appreciated by one expert. When energy information is given together with some other information, people would perhaps follow the energy information as well, even though they were not so interested in energy. People could also find some other interesting elements and

uses for Home display. However, consumers would get energy information as an extra feature. Home display was also trying to normalise the energy information following an everyday routine. This effort was very much appreciated by the experts.

The information given by the Home display should be informative, neutral, simple enough and perhaps somehow guiding. Feelings of guilt should be avoided by any means. Home display provides people with new information concerning their energy consumption and they may change their behaviour because of it.

The experts found that information presented on a day-of-the-week basis was a good solution. Some experts found that energy consumption presented in real time would also be a nice extra feature in Home display. They saw that the information presented in Home display has to be very easy to understand, and must be understandable at a one glance. One expert argued that people will not adopt Home display as a separate device. Instead, he felt that all the features of Home display should be integrated into some other existing device at home, such as a television or home computer.

The main benefits of Home display that were mentioned were the money and environmental savings. One argument for Home display was that it could provide consumers with information that has not been available before.

People who live in houses with electric heating were seen as the main users of Home display. Their electricity bill is so big that they are motivated to follow their energy consumption. Urban people who have a high environmental awareness might also be interested in this solution. People need to have enough possibilities to adjust their energy consumption in order to find Home display an interesting solution. For example, if a person lives alone in an apartment house and does not have a sauna, there is perhaps not so many things that can be done in order to make significant cuts in electricity consumption.

One expert mentioned that the target for Home display marketing should be construction firms. Big companies in the construction business would be interested

in showing their corporate social responsibility by using Home displays in their buildings.

6.1.2 Shower duck

Shower duck was the concept that divided the experts most clearly into two groups; some found Shower duck a fresh idea and very sympathetic while others found Shower duck an irritating and guilt-provoking product. The experts were unanimous that it is very important to find some means to pay attention to hot water usage at home. People do not really understand how much energy is wasted in a long shower. Shower duck could also be used in the kitchen (many people rinse dishes under running water).

Young people were mentioned as the most promising target group. Young people would buy the Shower duck as a gift to their friends or a parent would buy a duck for their teenager. The Shower duck would mainly be bought as a funny gift, not so much for someone's own use.

The most important benefits were not only saving the environment but also money. Money can only be saved if the water charge is based on actual consumption. Shower duck was seen as a product that really can teach people a more rational way to take a shower. Instant response is the main benefit in this concept.

Shower duck was considered a fresh and funny product. One expert argued that if these four products (four concepts) were sold on the Internet, Shower duck would definitely get the most attention. Shower duck is easy to use, it is obvious how it works and it combines humour with energy saving. Some risks were also identified: Shower duck might have a narrow user segment and it might be annoying (if too annoying, it would not be used or it would be destroyed).

One expert had the idea that Shower duck could also have a social aspect. You could use Shower duck, learn how to take shorter showers, and share this experience with your friends by giving your duck to them. In this way, water saving could be a shared experience.

6.1.3 Key hanger

The experts found that the target group for Key hanger is very wide; almost everyone could be interested in this product. Low price, easy to use (and install) and the functional characteristics of the product were mentioned as reasons why people would be interested in Key hanger, and people who are building a new house or renovating their current house would be the most promising target group. The core idea of Key hanger was not seen as innovative as other concepts because the basic idea behind the Key hanger concept was recognised from some hotels. Key hanger was mainly seen as an easy-to-use product.

The experts had diverging views on how much energy saving potential Key hanger would have. Some experts thought Key hanger would save a great deal of unnecessary energy (turning off lights and standbys when leaving home) while other experts thought it have value mainly as a convenient way to store their keys (without any connection to energy). They thought Key hanger would be very helpful when switching off lights (when leaving home), but switching off standbys is more problematic - there might be several devices consumers want to keep turned on, even when they are not home, and there should be a possibility to choose which devices are controlled by Key hanger. There should be default settings consumers could use if they are not so interested in programming Key hanger to supervise their whole house, and the settings should be very easy to change.

The benefits in using Key hanger were thought to be saving money and the environment. Safety issues were also mentioned in this context. Key hanger could prevent fires because electric devices (e.g. stove, iron or coffee maker) would never be left on when nobody is at home. As a drawback, the experts mentioned that Key hanger does not teach people rational energy behaviour.

6.1.4 Energy plant

Experts found Energy plant a very innovative concept. Energy plant was seen as good and easy-to-sell giftware. All the experts mentioned that Energy plant is like Tamagotchi for adults, and they liked this idea. A growing plant was seen as a good metaphor.

Experts had contradicting ideas concerning the benefits of Energy plant. Some experts found that Energy plant is more informative than Shower duck (flourishing/withering plant adds the information level), while others had problems seeing the connection between a flourishing Energy plant and changes in energy behaviour - they argued that the use of exact numbers, bars and graphs would be more informative than (coming and going) leaves, and wondered how well this information could encourage people to act in a more energy efficient way.

According the experts, main target group for Energy plant could be people who are keen on living in an environmentally friendly way. Perhaps these people belong to some environmental group that shares common goals and ideology (like weight watchers but in the energy field). People engaged in this kind of environmental group would probably find Energy plant very motivating. Another target group might be older women who like flowers and gardening.

The experts were not convinced by the idea that people (other than those engaged in environmental groups) would like to show their success in energy consumption to other people. One expert had the idea that Energy plant could be somewhere other than in a window, e.g. it could be placed on the kitchen table - Energy plant would then raise conversation within a family concerning their energy consumption.

6.2 Consumer testing

The Desme concepts were comprehensively tested amongst the consumers. Three separate items of research were conducted, all of which supported the others.

The first item was a quantitative study that was conducted via the Internet. The aim was to get some basic information on how different kinds of consumers find the product ideas. A quantitative study was needed in order to get a large enough amount of information that could be generalised. The web survey was the chosen method due to the fact that it was not possible to quickly show the necessary material of the concepts to a significant number of respondents in any other way. The web survey included “films” on the use of each of the product concepts to help the respondents evaluate them.

Based on the preliminary understanding that was gained through this web survey, it was decided that more detailed information and deeper understanding of the consumers' thoughts were needed through a qualitative study. Focus group was the research method that was chosen because it was the most appropriate and could be carried out within the time limits. Focus group enables genuine interaction between interviewers and interviewees, and especially between the interviewees who were ordinary consumers. Following the consumers' discussion gave the researchers a lot of understanding of the various ways of looking at the concepts and evaluating them.

However, what was still missing after these two extensive research items was information on who are the main target groups for each product concept. There were hints reached through the web survey, but, due to the biased sample, that quality of information can be considered indicative more than statistically proven fact. Therefore, some confirmation was needed. Vaasa Housing Fair offered a possibility to present the concepts to the consumers and ask for their comments via a short questionnaire. Unfortunately, the sample size was relatively small and this research offered some additional information but did not quite reach its ultimate goal.

A brief summary of the results of these three items of research are presented in this chapter. (Pakkanen & Peltola 2008a, Pakkanen & Peltola 2008b, Peltonen & Peltola 2008)

6.2.1 Methods and samples

The concept testing among the consumers started with a quantitative survey that was conducted as a web survey in March 2008. A total of 1,334 responses were received in 20 days when the survey was open and advertised. 70 % of the respondents were females and 30 % males. The average age of the respondents was 35 years and the age distribution overall was emphasised in the "35 years or less" age group.

After the web survey there was a focus group study conducted in April – May 2008. In total, 32 consumers were interviewed in 6 groups in 3 towns in Finland. 59 % of these consumers were males and 41 % females. The age distribution was not

documented but it was quite representative; there was a fairly even spread of all age groups participating in the focus groups.

Finally, the last item of research was conducted as a questionnaire study. The product concepts were presented at the Vaasa Housing Fair between 11.7. and 10.8. and the fair attendees were asked to fill in a short questionnaire regarding their opinions of the products. A total of 287 questionnaires were received. 69 % of these consumers were females and 31 % males. The average age of the respondents was 38 years, varying between 8 and 76 years.

6.2.2 Home display

The web survey respondents found Home display the most interesting concept by far; As many as 50 % of the respondents liked Home display the most. They also thought it would encourage them to save energy (62 %). The majority of the respondents considered Home display an exciting product that is quite easy to use, fits quite well with everyday life and aids energy saving. However, almost all the respondents thought this product would be quite expensive to purchase. Despite this, as many as 36 % of the respondents felt they would be likely to purchase Home display in the near future.

The focus group participants also found Home display an interesting product. The informative and personal consumption information was seen as the most interesting point in this product. People found that concrete and real-time energy consumption information would make energy saving easier, more interesting and motivating. They felt that Home display would motivate them towards energy saving mainly because the consequences of their actions can be seen immediately. This teaches you what kind of effect different actions have. Exact energy consumption information would also make people talk more about energy consumption with their family and friends. The informative Home display would also help people to better understand their own energy behaviour. More detailed energy consumption information was seen as edifying for everyone.

The focus groups shared the thought that Home display can be too expensive (device + installation). Another drawback that was mentioned was that people may lose interest in Home display quite quickly. This leads us to the interesting question

of how to keep people interested in Home display. One thread of the focus group discussion was that extra features in Home display would have a more central role later, when energy consumption is already familiar. After all, Home display was seen to have an important role as a reminder about energy consumption.

Home display was a product that many web survey respondents liked a lot. However, when looking at who liked it most or least, some differences were found. Logically, the Active Energy Savers seem to like Home display most, whereas the Insensitive Energy Users were less positive about the product than the other groups. On the other hand, Active Energy Savers are not necessarily the group that is most likely to purchase this product because they already follow their energy consumption quite closely and therefore do not really need help with that. Based on the web survey results, the Passionate Ecologists group are the most likely group to purchase this product.

The people in the focus groups thought Home display would be most suitable for those who really have a possibility to cut down on their energy consumption. People living alone or in a small or rented apartment may have a high threshold for buying this product.

Many focus group participants found that it a good and important idea to have a separate device for following your energy consumption. However, some people felt there is no need for a new separate energy information device; they thought that the same information is already available from other sources or in some other form.

Some people criticised Home display because they felt the product does not do enough to encourage people to save energy. Contradictory ideas were also stated; many people felt that understandable, easy-to-access energy information could arouse interest toward energy saving. Detailed energy consumption information was appreciated. The more detailed the information, the better; room-specific, fuse-specific and even device-specific consumption information was mentioned. Detailed consumption information was considered important because people want to understand how their energy consumption is made up. Energy information in both kilowatts and euros is needed. People also wanted to have the freedom to choose how the information is shown. Graphical form, tables, charts, numbers and

statistics were mentioned as possible formats. A very important issue was that the device is easy to use and personal settings have to be easy to modify.

The Housing Fair survey respondents also found Home display a very interesting product. When compared to the web survey however, the results were much more evenly spread between the different product concepts. Home display was not a huge favourite but it was liked a lot, slightly more than the others; 29 % of the respondents thought it was the most interesting product. As a product most likely to motivate the respondents to save energy, Home display was seen as significantly better when compared to the other products, chosen by 45 % of the respondents. In total, as many as 49 % of the respondents thought they would be likely to purchase Home display in the near future. Males especially seemed to appreciate this product.

6.2.3 Shower duck

Shower duck is a product that does not suit as many people as some of the other concepts, but those who like it seem to like it a lot. However, only 13 % of the respondents found Shower duck the most interesting product and 9 % thought it would do most to encourage them to save energy.

Most of the web survey respondents thought Shower duck is a product that is very easy to use. It fits quite well with everyday life and aids energy saving, and the majority of the respondents thought the product would be quite inexpensive to purchase. Half of the respondents also considered Shower duck an exciting product. In total, 23 % of the respondents felt they would be likely to purchase Shower duck in the near future.

Overall, Shower duck got quite a mixed response through the web survey. Some respondents liked it a lot and some did not like it at all. Some quite clear differences were found from the demographics; the women liked Shower duck more than the men and the young people liked it much more than the older people. It seems that the group most likely to buy this product is women that are 36-55 years old. When looking at the consumer types, it was found that Unaware Consumers and Insensitive Energy Users like Shower duck more than the other groups

generally. However, Passionate Ecologists and Unaware consumers seem to be a bit more likely to purchase this product.

According our qualitative testing material, Shower duck was seen to guide people to more reasonable water usage in a positive way. The product was seen to be especially suitable for families with children as it was assumed that Shower duck would reduce the need for constant nagging about the water usage in families. Parents could use Shower duck as an educational tool when teaching their children how to use water economically.

Shower duck was also considered to be good giftware. The duck could motivate family members to compete with each other in water saving. However, Shower duck also evoked some more negative feelings. People want to relax in the shower and the respondents regarded hot showers as an everyday luxury and did not want any interruptions or have a bad conscience because of their everyday shower.

People did not believe the duck would really shorten the shower time. The reasons for this were that water is already used very economically or the attitude that a shower takes as much water as it takes. Many people also thought the duck would not have a lasting effect because you would get used to it too soon.

There was also discussion in the focus groups concerning the need for this product. Some people found there is no need for a new device because you can use an egg timer or a clock. Bathrooms are also often cramped rooms and there is no place for the duck (all the shelves are already crowded). Children may also misuse the duck by playing with it.

The duck was considered too simple a product because it does not give so much information about water consumption. More illustrative and well-defined information was needed (time and amount of consumed water). However, the humorous and funny approach was appreciated.

The Housing Fair survey respondents had a mixed attitude towards Shower duck. On the one hand, it was considered to be the least interesting as well as the least motivating to save energy. On the other hand, there were still a number of people

that really liked the idea (more often females than males). 22 % of the respondents found Shower duck the most interesting product, and 16 % the most motivating to save energy. In total, 44 % of the respondents considered themselves likely to purchase the product in the near future.

6.2.4 Key hanger

Key hanger was a concept appreciated by many. In total, 25 % of the web survey respondents considered it to be the most interesting concept. However, only 15 % considered Key hanger would encourage them to save energy. This might have to do with the fact that many respondents liked Key hanger for reasons other than its ability to help in energy saving.

More than two-thirds of the web survey respondents considered Key hanger an exciting and easy-to-use product. On the other hand, almost all of them thought it would be an expensive product to purchase. However, the product was seen to fit well with everyday life and aid energy saving. In total, 24 % of the respondents thought they would be likely to purchase Key hanger in the near future.

The qualitative study also confirmed that people liked Key hanger because it makes everyday life easier. A key hanger that automatically switches off electrical devices would be a great relief for many people. Those people who were used to double checking all electrical devices when they were leaving home were especially enthusiastic about Key hanger, and people who have lost their keys several times were particularly interested in the product.

In our focus group discussions, safety issues were emphasised over the energy saving. However, energy saving was considered to be an important issue as well. Many electrical devices have a stand-by mode but people do not normally bother to switch them off when leaving home. Although Key hanger would do this automatically, Key hanger would not create a bad conscience because it does such things automatically.

Key hanger was a product that seemed to be accepted by most web survey respondents, but it was most loved and most likely to be purchased by the older people and Insensitive Energy Users. These potential target groups might be

explained by the fact that Key hanger was often not only seen as an energy saving product but as being very good for safety and convenience as well.

In the focus group discussions, Key hanger was seen as especially suitable for families with children, absent-minded people, large apartments and senior citizens. The working principle is already familiar from hotels.

Our qualitative testing also revealed that people expected Key hanger to be too expensive (especially installation). The use of the product and installation were seen as problematic (how to define the appliances, restrictions, possible problem situations, etc.). People also found that Key hanger does not motivate people to be more careful with their electrical devices or teach them how to save energy. However, Key hanger was liked because it saves energy automatically.

The automatic nature of Key hanger was also criticised, especially in the open-ended answers in the web survey. People found that Key hanger does not save energy; quite the contrary, it might even increase the energy consumption at home. If people rely on the system too much, they might stop switching off electrical devices by themselves. People also found that Key hanger may cause some safety problems because it is not safe to keep all home keys near the outside door. Keys are just too visible there.

In the focus groups, people also expressed their fear of losing the feeling of control over their home, and felt that the systems at home should not be too automated. In order to fit into people's lives, Key hanger must be easily adjustable to the changing needs of the family. Every day can be different, so Key hanger must be very flexible and easy to use. Also, the design of Key hanger has to fit into different kinds of home decorations. Another problem with Key hanger might be caused by the fact that people are not using home keys only as home keys, they also have many other incidental functions too (bottle-opener, car keys are attached, etc.). The respondents wondered whether it is a good idea to combine home keys and an electricity switch. The credibility and safety of the device were thought to be the most important characteristics of the product.

Key hanger was not one of the most loved products by the Housing Fair survey respondents. 22 % of the respondents found it most interesting but only 12 % considered it would motivate them to save energy. However, this might have to do with the fact that Key hanger was generally seen as more efficient for safety than for energy saving. In total, the purchasing likelihood was lower (38 %, which is still excellent) for Key hanger than for any other product idea. Key hanger was equally liked by males and females.

6.2.5 Energy plant

Energy plant was considered the most interesting concept by 12 % of the web survey respondents, and the most encouraging for saving energy by 14 %.

Approximately half of the web survey respondents thought Energy plant is an interesting product and that it fits well with everyday life and aids energy saving. The majority thought it would be an easy product to use. However, most of the respondents supposed that it would be an expensive product to purchase. 15 % of the respondents felt they would be likely to purchase Energy plant in the near future.

Based on the web survey results, Energy plant is a product that is more loved by women than by men, and slightly more liked by young people than the other age groups. Energy plant seems to be most appreciated by the Passionate Ecologists and the Insensitive Energy Users.

Based on the focus group discussions, Energy plant was seen as a particularly suitable product for children, young adults and the whole family, while Home display is mainly directed at the father. It was perceived as a good and interesting education tool for children, but the design element is very important in this product. However, the design of the product may also be a great challenge because it needs to fit into different decoration styles.

Energy plant was regarded as good giftware. The product also emphasises that energy saving can be fun and trendy. The idea of Energy plant was appreciated because it indicates the energy saving in a positive and pleasant way. Some people

found it a less stressful alternative for following electricity consumption than, e.g., Home display.

The Housing Fair survey respondents found Energy plant a very interesting product. 26 % of the respondents thought it was the most interesting concept. As a product to motivate the respondents to save energy, Energy plant was chosen by 26 % of the respondents. In total, 41 % of the respondents thought they would be likely to purchase Energy plant in the near future. When it comes to different respondent groups, it seems that females like this product more than males.

6.2.6 Summary

Based on the consumer testing results, the four product concepts were evaluated as having some special characteristics. When comparing the concepts with each other, Home display Key hanger were the most exciting products with the most potential for energy saving. Shower duck, on the other hand, was seen to be most easy to use and most inexpensive to purchase. Energy plant was seen to fit with everyday life and aid energy saving a bit less than the other products.

When looking at the purchasing likelihood, it seems that Home display has the most commercial potential by far; Shower duck and Key hanger coming next and Energy plant as the least loved product but still with satisfactory results. However, all these concepts seem to interest a lot of people. The products were designed for different consumer groups and they are, therefore, very different by nature, so it can be expected that they interest different kinds of people. The concept design, therefore, seems to have achieved the goal that was set for it: not designing “something for everyone” and trying to please everybody with one solution, but taking different consumer types into account and designing the product concepts accordingly.

7 FOCUSING COMMUNICATION

Over the last few years, environmental concern has increased remarkably all over the globe. Evidence that global warming is happening continues to accumulate and almost everybody agrees that something has to be done before it is too late. Although energy efficiency is recognised as being the fastest and most cost-effective response in the battle against climate change, energy consumption in the household sector has not shown any signs of decreasing in the 21st century (BEHAVE 2007b: 82). It seems that attitudes towards energy saving and a greener lifestyle are positive; however, people have not made any real changes in their consumption habits yet.

Communication guidelines always highlight the importance of timing. The follow-up study on Finnish attitudes towards energy issues shows that positive attitudes towards energy conservation increase an economic recession. This happened in the early 1990s and now the belief in the opportunities of energy conservation has started to increase again. More than six out of ten are basically ready to compromise over personal standards of living in order to reduce the environmental impacts caused by energy production, (Energiateollisuus Ry 2008) and three out of four are at least quite ready to start taking energy saving actions (Valtioneuvoston kanslia 2008: 22). Therefore, we can strongly claim that the time is right for communication about energy saving issues as well as for suitable energy saving solutions.

Many studies have recently concentrated on searching ways to turn these positive attitudes into actions (see, e.g., BEHAVE 2007; Valtioneuvoston kanslia 2008). One of the most commonly used tools that aim to change the behaviour of the public is communication, even though it doesn't always appear to be the most effective one. Many energy efficiency campaigns have tried to offer "everything to everybody" and this has led to a situation where behavioural change programmes do not usually have the significant impact they could potentially have because overall communication doesn't reach anybody in the end (BEHAVE 2007b: 3–4).

The thought that careful target group segmentation is an important success factor for a campaign is not a new one because, nowadays, people are suffering from an

information overload and it's even more important to tailor every message and focus the communication correctly. The key to effective communication is to use different methods for different types of people. Also, the products, which, in this Desme, case are the concepts, are more likely to be bought if the products are planned to fulfil the needs and desires of the specific target group. In order to do so, one has to know the selected target groups very well.

A tool for understanding the five segments

In our Desme survey we found five energy consumer segments. Because each segment needs communication and arguments of their own, we wanted to understand the nature of these segments more deeply. Although we worked on the basis of an earlier quantitative study, we also needed some rich qualitative material. Therefore, we decided to use the results from the narrative analysis as well. Moreover, we created a tool based on useful theories to review our five segments completely.

While doing the background research we found an interesting project supported by the European Commission called BEHAVE, which aims to improve the impact of energy-related behavioural change programmes in the household sector (see BEHAVE 2007a, BEHAVE 2007b). According to BEHAVE (2007a: 12–14), behaviour is a complex of different factors that need unravelling before choosing the right mix of instruments (which can be judicial, economical, communicative or structural instruments) that effectively alter the consumers' energy-related behaviour. Because we are only focusing on communication in Desme project, we used the tool created in BEHAVE for inspirational purposes. In order to find out what really differentiates our five segments from each other, we created our own framework, which also uses elements from another stimulating theory, the goal framing theory.

The goal framing theory (Lindenberg & Steg 2007) is a new approach to environmental behaviour. It posits that multiple goals are active at any given time. Three main goals are distinguished: the hedonic goal "to feel better right now" (by avoiding effort, negative thoughts and events, by seeking direct pleasure, excitement or improvement in self-esteem), the gain goal "to guard and improve one's resources" (like money, status or time) and the normative goal "to act appropriately". It is very likely that one goal is dominant and influences information

processing the most (it is a goal frame), while other goals are in the background and increase or decrease the strength of the focal goal.

In the environmental domain, goal conflicts are very common, which is why the goal framing theory seems highly relevant. (see Lindenberg & Steg 2007: 118–119, 121, 127) Our main interest in using the goal framing theory in our Desme study was to deepen our understanding of energy consumer segments in order to develop communication suggestions for each of these segments. With the help of the right arguments, one can affirm those goals that reinforce the energy conservation and weaken those that work against it.

In Chapter 2.5 we described the socio-cultural value map that was used in the ieaDSM (2003) study. After we had worked through all the five segments we started to find many similarities between the five segments that were found in our Desme survey and the four segments found in the ieaDSM study (see Pitkäjärvi & Peltonen 2008). Because of these similarities, we decided to combine these two different segmentation frameworks so that we used not only the information received from Desme survey but also knowledge which can be traced back to the ieaDSM (2003) study. Figure 19 shows how the five Desme survey-based energy consumer segments are placed in the socio-cultural value map used in the ieaDSM (2003) study.

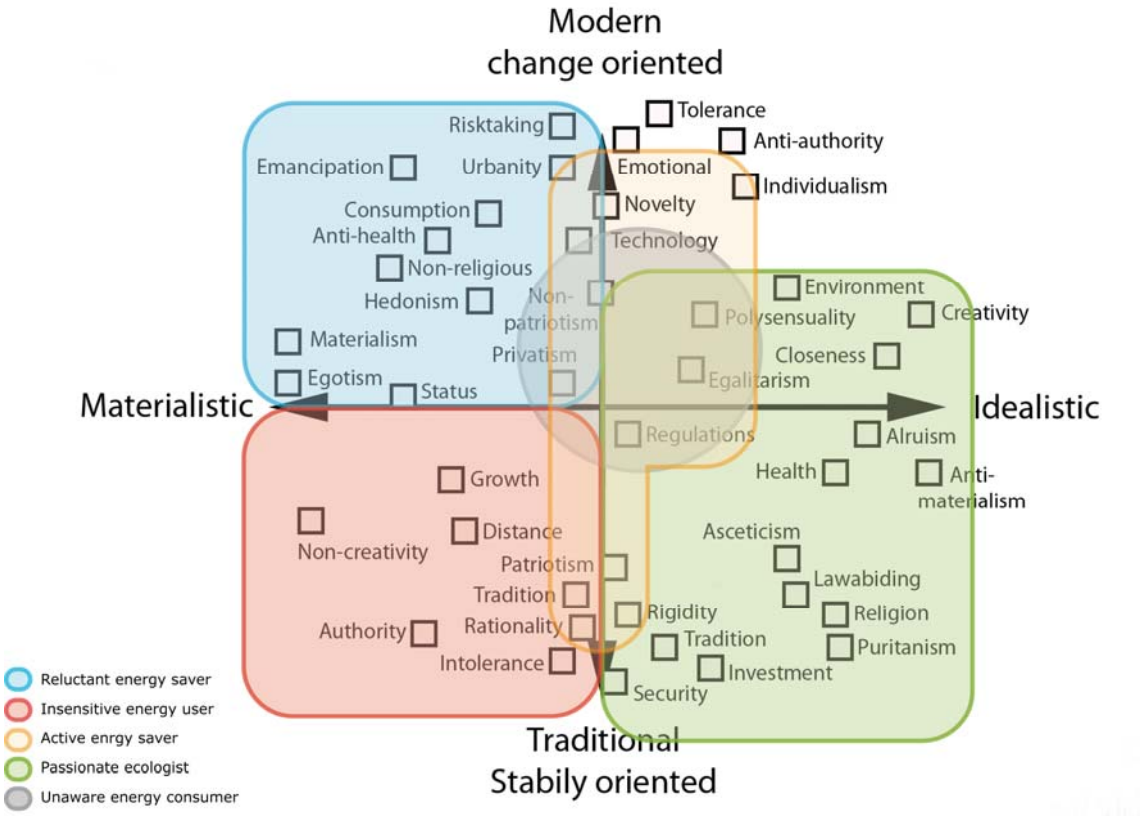


Figure 19. Five energy consumer segments placed in the socio-cultural value map

Although we can find some major differences between the five energy consumer groups, one should not confuse the segments with real people. Segmentation always constructs an image of a group with average or extremist people (Eräranta & Moisander 2007: 23). Actually, most of the people are in the centre of the socio-cultural value map, as the ieaDSM study (2003: 35) noted. This means that the major part of the population are quite average in that their behaviour varies a lot, depending on the situation, because they are not strictly engaged with the values they have (see also Taloustutkimus 2003).

The next chapter will summarise in more detail what we found out about the segments when we combined all the information mentioned above and worked through the five segments one by one.

7.1 Communication and consumer segments

A single ad or a campaign message rarely makes an attitudinal or behavioural change. The correlation between knowledge, attitudes and behaviour is positive but weak. With communicative instruments, it's easiest to influence knowledge, but hard to have an effect on attitudes or behaviour. (Valtioneuvoston kanslia 2008: 38) Only a few messages take the person all the way from awareness to action (Behave 2007b: 45). What makes energy conservation communication extremely challenging is that 95 % of household energy behaviour is a form of habitual behaviour, which is much more difficult to change with communication than planned behaviour (BEHAVE 2007a: 6 ref. Wagenaar 1992).

Although communication has a possibility to influence behaviour in limited ways, 30 % of the people think that communication and informing are the best communal ways to make people act against climate change along with technology development (Valtioneuvoston kanslia 2008: 20). Perhaps that is why a myriad of studies have listed the success factors of environmental communication. You will find our communication suggestions after Table 4, which summarises what we found out from the five consumer segments.

Table 4. Summary of energy consumer segments

	PASSIONATE	ACTIVE	INSENSITIVE	RELUCTANT	UNAWARE
Main points	- Passionate ecologists can be placed in a continuum from traditional idealist to more urban and modern ecologist - responsibility and high care for the environment - a strong need to behave in the right way, even if it requires time and effort - responsible behaviour is clearly a part of their identity	- Active energy savers are almost as active in their energy saving actions as Passionate ecologists, but they save energy because they think it has positive consequences for themselves - some Active energy savers are more traditional and they hold on to their old routines so that everything follows the familiar procedure - other Active energy savers are more modern oriented. They also want to maintain their habits but only because of the willingness to maintain running routines in everyday life	- Insensitive energy users are as into personal wellbeing as Active energy savers - Insensitive energy users have a negative attitude towards energy conservation and they don't save energy because they feel there's no point in saving actions for several reasons (can't save so much electricity that it would have a significant effect on the electricity bill, why should I save if others won't do the same, energy saving doesn't even have much importance because most of the energy is spent elsewhere)	- Reluctant energy savers don't have any interest in energy, which is reflected in their attitudes and their actions as well - they have the most negative attitudes and are the least active in energy saving - whereas Insensitive energy users don't save because they cannot see any point in it, Reluctant energy savers avoid the effort and negative thoughts just by ignoring the whole issue	- Unaware energy consumers have positive attitudes towards energy saving and they are quite active in their energy saving actions - however, they think following their energy consumption is complicated at the moment and they want to learn more about energy saving - because Unaware energy consumers don't have many recognisable characteristics (like value priorities) we may assume that they are quite average and not extremely committed to the values they have
Current behaviour	- always tries to save energy in daily routines - is willing to lower the standard of living in order to save energy - saves energy even if it makes everyday life more complicated	- saves energy actively for money, but feels that energy saving should not complicate daily life - tendency to compromise	- does not save energy because he can't find any motivating reasons why he should - however he can be very active in some energy saving actions (following energy consumption from a meter and switching off the machines) but he may pursue something other than saving energy while doing so	- least active energy saver - is not interested in the whole subject and uses energy without worries - has no willingness to lower his own convenience in order to reduce energy consumption	- quite active in energy saving actions - would like to do even more but do not know enough about the best ways to save

	PASSIONATE	ACTIVE	INSENSITIVE	RELUCTANT	UNAWARE
Buying behaviour	- sticks to decisions and value quality, reuse, recycling and eco-friendly products	- rational consumer who likes to think money and numbers	- favours cheaper products and buying those more often - favours shopping by brand - does not compare domestic appliances according their energy consumption	- impulsive consumer who has very short-term views on money issues and has driving need to consume	- when buying domestic appliances, makes a comparison between their energy consumption
Goal frame guiding behaviour	- strong normative goal frame (need to act appropriately) but also hedonistic goal (feeling good when acting correctly) and gain goal (appreciation received from others) increases the energy saving behaviour	- usually strong gain goal frame (improving one's recourses) increases the motivation to save energy, but if energy saving requires a lot time (or effort), gain (and hedonistic) goal will then decrease the willingness to save	- can't find any reason to save energy so gain goal frame decreases the motivation to save - may even have a need to act correctly, but the self-serving denial weakens the strength of normative goals	- strong hedonistic goal frame (to feel good right now) decreases the energy saving behaviour and makes him avoid negative thoughts, responsive to things that improve the way one feels in a particular situation and makes them choose the easiest option	- main motivating reason in energy saving is saving money, so gain goal frame is dominant and increases the motivation to save energy - thinks it is important that everybody tries to save energy, so some normative goals are in the background
Knowledge level	- high knowledge and awareness - wants to keep the gap between knowledge and action small	- knows a lot about energy efficiency and follows the energy consumption but behaviour does not always reflect the high competence and engagement level (width of the gap between knowledge and action is fluctuating)	- low knowledge and awareness level - gap between knowledge and energy saving actions is quite small	- although he knows something about energy efficiency and the connection between energy consumption and environmental problems, he uses energy without worries and do not really think of how his own energy consumption affects the environment	- interested in energy saving and would like to know more
Openness and faith in technology	- does not believe that technology will solve all the problems but is quite open-minded toward new information and viewpoints where pro-environmental lifestyle and behaviour is concerned	- not ready to revaluate current behaviour because it is easier and faster to act in the same way as always - modern active energy savers have higher faith in technology than more traditional ones	- not open to new information or technology because values constancy of familiar habits and traditions	- not open-minded when it comes to energy issues - generally modern and change-oriented people, who don't find familiar habits that important - interested in technology and new innovations	- open-minded toward new information, but not willing to change behaviour if energy saving complicates daily life

	PASSIONATE	ACTIVE	INSENSITIVE	RELUCTANT	UNAWARE
Norms	- thinks that society should make people save energy - wants to make energy conservation the norm rather than the exception	- values the opinion of others but makes his own decisions in the end	- does not want to deviate from the masses and behaves according to the standard he expects others to behave by	- possibility to stand out is very important for this segment	- wants everybody to try to save energy
Attitude towards energy saving	- very positive	- positive attitude if energy saving brings monetary benefits	- insensitive and sceptical attitude - feel that no one should interfere with others' energy consumption	- most negative attitude - has more important things than energy saving to think about	- positive attitude but feels that following energy consumption is too complicated and does not know enough about the best ways to save
Self efficacy	- feels that every action counts and that one can make a difference	- believes that energy saving leads to smaller energy bills and doesn't doubt his own energy saving capability	- feels that energy saving actions have no contribution	- does not really think about whether his energy consumption habits have meaning or not	- believes that his energy consumption has an effect - has doubts about his own saving skills
Socio-demographic factors	- lives in big cities and in apartment houses	- live in a small town and has a house - only a few have district heating - highest income and education level	- oldest segment - most single households and most households with no children - lowest income and education level - lives in the countryside - only a few have electric heating	- lives in apartment houses and in big cities - youngest segment	- no specific information available
Values	- environmental protection, religion and spiritual life, avoiding extremes in feelings and actions, equality between people and getting to know new cultures, avoiding getting too materialistic - money and fortune least important values	- religion and spiritual life are less important	- money and fortune, retaining good public image, religion and spiritual life, avoiding risks, constancy of familiar things and habits as well as respecting traditions and manners	- constancy of familiar habits and things, respecting traditions and manners, avoiding risks and extremes in feelings and actions, responsibility to cure inequity, avoiding getting too materialistic, taking care of weaker ones and equality between people are less important	- no specific information available

7.1.1 Communicative instruments for Passionate ecologists

There is no need to increase the Passionate ecologists' knowledge because they already know a lot. They also have very positive attitudes towards energy saving issues and their concern has gendered a lot of passionate and powerful feelings. These facts suggest the communication should mainly concentrate on reinforcing and modifying their current behaviour.

Many other things support this suggestion. Because of their willingness to lower their own convenience in order to act pro-environmentally, we may argue that Passionate ecologists are quite open-minded towards adjusting their current behaviour. They are used to evaluating the positive and negative consequences of their behaviour from an environmental standpoint, so, when receiving new information, they might be ready to revaluate their old habits, if they can find some ecological reasoning for it. Because personal benefits are not value priorities for Passionate ecologists, the arguments should relate to their care for environment.

Although the basis for communication is ideal, there are also some challenges ahead. Based on Desme survey, we may point out that even though Passionate ecologists are very active energy savers, there is still some room for improvement. The challenge is to make the Passionate ecologists see that there is always something more they can do in order to save energy. For example, some new possibilities for energy saving could be found by screening everyday life. It is also important to affirm their current behaviour and strengthen the normative goal frame. When the normative goals are strong, the behaviour is stable and doesn't vary according to the situation. Highlighting the importance of their current behaviour can be done in several ways.

Although Finnish people think the best way to resolve the environmental problem is to use economic incentives to encourage those who act correctly (Eurobarometer 2008), this may not be the case with Passionate ecologists. The Passionate ecologists' gain goals are weak and they do not value money and fortune all that highly, whereas recognition received from other people may be a good motivator for them. We may even assume that Passionate ecologists crave feedback because they know it is going to be positive. The arguments for this segment should

emphasise that they show example to others by acting correctly. Knowing their energy saving actions might change the behaviour of those who do not save at the moment might bring them great joy.

Although Passionate ecologists know a lot, they may have a use for some well tailored information. Knowing their care for society, they might be interested to know how much their specific energy saving actions matter in the big picture. In any case, the communication that appeals to soft values may best influence the behaviour. However, even subtle communication plan won't work if Passionate ecologists question the sincerity of the message sender. Top-down communication doesn't work in most cases, but with this segment you have to be extremely careful to avoid it.

Because Passionate ecologists are already very active in their energy saving, there is probably not a great amount of extra energy that could be saved. However, it is important that Passionate ecologists continue with their ecological activities because they may have a great impact on other people's attitudes towards the Passionate ecologist lifestyle. People's beliefs about normality control their consumption (Ahonen 2006: 79) and most of the people act according to what they think is normal (Valtioneuvoston kanslia 2008: 41). At the moment, a green consumer is an almighty superhero (Eräranta & Moisander 2006: 30) so it's not hard to understand why most people do not relate to it (Moisander 2001: 77–79). Therefore, one has to make sure that the arguments to promote pro-environmental behaviour do not put green consumers on a pedestal because people should understand that energy conservation is not about giving up all conveniences and living modestly. More likely, it is noble but normal, not an exception.

7.1.2 Communicative instruments for Active energy savers

There is no need to increase Active energy savers' knowledge because they already know a lot about energy saving and energy efficiency. And their attitude towards energy saving is very positive. What Active energy savers need is encouragement to think about energy saving in a wider context, not just focusing on their own personal gains. If the normative goal is strengthened, the vulnerability to compromises will be smaller. A stronger normative goal frame would make the gap between knowledge and actions smaller than it is at the moment. At present, Active

energy savers don't seem to mind that their knowledge and actions do not always correlate.

People with low environmental concern tend to shift the responsibility for environmental problems onto others (BEHAVE 2007b: 86). Therefore, it is important to promote positive feelings associated with pro-environmental behaviour among Active energy savers. The communication should point out that their personal wellbeing does not have to be in contradiction with nature. Messages should enhance the idea that besides saving money, energy saving can make everyday life easier, and foremost, it is the right thing to do. The rationality of the energy saving should also be further emphasised.

It is important that busy and modern Active energy savers feel that new ways of doing things would fit into their everyday lives without lowering convenience and comfort or slowing their routines. However, it should be borne in mind that they will not change their behaviour just because someone tells them to do so; knowledge and education makes Active energy savers very critical.

A family with children may be more ready to absorb information about how to reduce energy bills than a retired couple that uses less energy (BEHAVE 2007b: 43). More traditional Active energy savers are also not as willing to change their behaviour as their modern counterparts. They are keen on their old habits and like to do things as they always have. That is why new behaviour should somehow be connected to the old routines they already have.

Active energy savers are probably heavy users of electricity. They already take quite a lot of energy saving actions but there is still potential for saving more energy. Because Active energy savers live in houses, they have a possibility to make big changes to their electricity use. New energy saving potential can be found in those areas that some Active energy savers count as everyday luxury. If they become aware of how much this luxury costs, they might be ready to abstain from doing it.

There are many families among Active energy savers. Because children adopt energy-related habits and attitudes from their parents, it is important to pay

attention to how energy issues are discussed at home. Active energy savers might be sensitive to the argument that energy saving is important in order to make a better and safer future for their children.

Because Active energy savers are very aware of the threats and problems relating to energy, they must feel at least some concern for society and the community. If the problems are brought closer to their personal level, this might have an effect. Because Active energy savers are so used to thinking about money and numbers, the communication that relates consumption to something more effective might appeal to them. Empathy is a powerful motivator for change if it is used properly (see Futerra 2006). Although this segment is most likely to feel the green ideology distant, it might flatter them if the communication makes them feel that they are seen as rational and knowledgeable consumers because of energy saving actions they take.

It is also important to reinforce the current behaviour of Active energy savers. Feedback appears to be successful in promoting energy saving and rewards seem to have a positive effect. (see Abrahamse et al 2005) When gain goals dominate, people are extremely responsive to information about incentives (Lindenberg & Steg 2007: 124). That is why all financial bonuses and rewards may reinforce the behaviour of Active energy savers quite well. Because Active energy savers like to discuss energy saving issues, peer support might also make them more keen on the energy issues. An open event or a forum, where they can have some personal advice and share their experiences, might suit them.

Active energy savers are interested in information, rational reasons and security. Factual and benefit-based information or the idea that their current behaviour does not give the best benefits might encourage them to change. However, it is extremely important to avoid the rebound effect. If the information makes Active energy savers see that they do not benefit that much (for example, save money) from some energy saving action, they might even stop doing it and increase their electricity consumption.

7.1.3 Communicative instruments for Insensitive energy users

Communication targeted at Insensitive energy users should focus on changing their attitudes to a more positive direction when it comes to energy saving and energy efficiency. At the moment, their attitudes are quite negative and they think energy saving is pointless. Because Insensitive energy users like to stick with their familiar habits, it is very unlikely that they will start to modify their behaviour before the insensitive attitude is changed. If the disbelief in self efficacy is removed, it might increase their activity level. All sorts of indisputable and concrete benefits received from energy saving should be promoted, and not only personal benefits but also benefits received on a larger scale as well. This will increase Insensitive energy users' knowledge and understanding concerning energy issues, which might make them see their energy saving actions in a more meaningful light.

A new kind of approach is needed in order to awaken Insensitive energy users' motivation for energy saving. Because money, fortune and a feeling of low cost of living are important to them, all arguments relating to these issues might catch their attention. The need for rationality and security may be a good motivator as well. The misconception that energy saving always makes your everyday life more difficult needs to be changed too. If simple and effective energy saving tips are promoted, they must fit into their current habits and respect their traditions so that Insensitive energy users feel they are still controlling their everyday lives.

As suggested in the ieaDSM report (2003: 44), this type of person does not want to deviate from the mass. Therefore, Insensitive energy users could be motivated to save energy if they believe that we are all in the same boat and everyone else is doing their part. According to the Finnish Prime Minister's Office (2008: 42), it is a general and widespread problem that people end up being bystanders because of doubts that other people won't take action. People are motivated into actions if they presume that others are committed as well. Therefore, the communication should relieve uncertainty about other people's acts. A 'Yes we can' attitude is needed to motivate people and help them integrate environmentally friendly habits into their everyday lives. (Valtioneuvoston kanslia 2008: 42–43)

Because Insensitive energy users feel that interfering in their energy consumption is insulting and want to deny any connection between energy consumption and

environmental problems, the communication should not invoke feelings of forcing or blaming. According to Futerra (2006), people really want to be good, important and useful, but the communication often makes them feel bad, irrelevant and useless. With Insensitive energy users, it is even more important that the communication is positive and helps them to trust that they are making a difference.

We learn more effectively from people who simply are “like us” (Jackson 2005: xi). Because the community is exceptionally important to Insensitive energy users, an energy saving campaign that is brought on the local level might encourage them to participate. For example, if some familiar intermediary in their community were to recommend some energy saving actions or devices, they might be convinced. A situation where they can even try new behaviour or devices before they make actual decision, lowers the risk of becoming even more dissatisfied. In a campaign where Insensitive energy users feel that the whole village is taking actions, they might not want to end up as bystanders.

In her dissertation study, Abrahamse (2007: 96) found that households with higher incomes, and larger in size, use more energy than smaller households with lower incomes. Older people also tend to use less energy than younger ones (BEHAVE 2007: 43). Because Insensitive energy users are the oldest segment and have the lowest income, only a few of them have electric heating and many of them live alone, we may assume that their energy consumption is not very high. But if we think about the need to replace oil heating with something more ecological, then Insensitive energy users are a very important target group.

7.1.4 Communicative instruments for Reluctant energy savers

Reluctant energy savers feel they do not need any new information concerning energy. Because their current activity level is very low, the most important thing would be to grasp their attention so that they would start paying attention to energy saving issues, at least at some level. At the moment, Reluctant energy savers are avoiding negative thoughts and effort by simply ignoring the whole issue.

Energy communication doesn't interest Reluctant energy savers at all. This might be a consequence of current energy saving information not being presented in a way that appeals to their interests. Therefore, the promotion should focus more on fun, enjoyment and excitement, so that energy saving doesn't feel like something that makes your life difficult, miserable and serious. Because Reluctant energy savers are very materialistic people, ideologically charged messages may only cause anxiety and the information should not be infiltrated with a negative bias.

It is very common that people do not see their own behaviour as problematic, and, usually, comfort and a feeling of freedom feels more rewarding than acting in the right way (Valtioneuvoston kanslia 2008: 40). Because Reluctant energy savers are not the kind of people who always weigh the pros and cons – they just do whatever lifts their mood – there's no need to emphasise the rationality of energy saving. However, Reluctant energy savers probably want to be pace-setters and be "on the ball". Thus one should make energy saving more trendy and something that raises their status. Reluctant energy savers do not feel any social pressure to save energy because it is not an important matter or "cool thing to do" among their reference group.

Reluctant energy savers especially value technology, novelty, status and hedonism. As suggested in the ieaDSM report (2003: 44), these values should be taken into account when planning effective arguments. For example, Reluctant energy savers might be interested in innovative new products that are not designed solely in order to save energy. Because Reluctant energy savers seem to be very concerned about appearance and they want to stand out from the crowd, they are sensitive to things they can "show off". According to the ieaDSM (2006: 44) study, the communication should also give support to the need for shopping and relate consuming to energy saving devices.

Although Reluctant energy savers' current actions work against energy conservation, they might be ready to adapt their behaviour if they immediately gain pleasure by acting right way. Because familiar habits and traditions are not important to them, they might just go with the flow with the right feedback. Feedback on individual performance relative to the performance of others may evoke a feeling of competition and suit them well.

Reluctant energy savers are younger people living in big cities, so their total energy consumption might not be the biggest. However, they probably have many entertainment electronic devices at home and because their share seems to be quite big (22 % of respondents), the increase in their energy saving activity would count.

It is also important to note that because Reluctant energy savers are the youngest segment, we may assume that they will probably move to other segments their life situations change. People are usually far more open to modifying their behaviour at times of big changes because their habits are in a state of flux (Futerra 2006). Therefore, it is important that they are directed to the way of Active energy savers or possibly even Passionate ecologists with normative goals in the background.

7.1.5 Communicative instruments for Unaware energy consumers

The most important thing for Unaware energy consumers is to increase their knowledge. They are already quite active in energy saving but they feel that they do not have enough knowledge about the best ways to save energy. They need more knowledge concerning energy efficiency and energy saving. The objective of the behavioural change should be to ensure that Unaware energy consumers move closer to the Passionate ecologist segment.

A variety of studies have established that enhancing knowledge and creating supportive attitudes often has little or no impact on behaviour (McKenzie-Mohr 2000: 544). However, information and education should by no means be forgotten. Gatersleben, Steg & Vlek (2002: 335) refer to several studies that show that information and education on energy saving options can result in reductions in household energy use. It is probably the form and content of the information that matters and maybe energy saving information has been a bit irrelevant and difficult to understand for Unaware energy consumers. The Finnish Prime Minister's Office (2008: 26) noted that half of the Finnish population think they do not have enough information about climate change, even though they already know a lot. This might also be the case with Unaware energy users and the energy issue.

People need more concrete information that they can directly apply to their everyday living. According to the reviews by Lindenberg and Steg (2007: 130) and

Abrahamse et al (2007: 35), tailored information appears to be more successful in promoting pro-environmental behaviour than non-tailored messages and mass media campaigns. Tailored information is extremely personalised and specific information, which can be given through a home visit by an auditor who gives households energy saving instructions based on their current situation. For instance, they may advise a household to install insulation and apply lower thermostat settings. (Abrahamse et al 2007: 33)

The advantage of tailored information is that people only get information that is relevant rather than getting an overload of general information that does not always fit their household's situation. Because Unaware energy consumers seem to be a bit uncertain of their intentions, personal and undisputable information might make them convinced that they are on the right track and increase the strength of normative goals. At present, their decisions are mostly based on money, which, according to Futerra (2006), makes them shallow, fragile and very vulnerable to changing circumstances.

The positive thing is that Unaware energy consumers are probably the most receptive energy consumer segment. Their attitudes towards energy saving are very positive, they are interested in the subject and they are willing to take more energy saving actions. Although an increase in knowledge might lead to changes in behaviour, we need to remember that Unaware energy consumers are not willing to lower their standard of living or level of comfort in order to save energy.

Because Unaware energy consumers are already quite active in energy saving, this might mean that there is no significant energy saving potential left in their everyday lives. However, if their energy behaviour could be guided more in the direction of Passionate ecologists, their susceptibility to compromises in everyday energy consumption might decrease. Unaware energy consumers might also have some unconscious habits that consume a lot of energy. In order to change them, their behaviour has to be raised to the level of practical consciousness, which is known to be easier in a supportive and social environment (Jackson 2005: xii). Thus the communication should not only be very encouraging and supportive but also rational and concrete in order to change their behaviour to more energy efficient direction.

7.2 Evaluating the product concepts

We can try to change people's behaviour with communication strategies. However, at the moment it is not easy to aspire to a low-carbon lifestyle because of the lack of tools and services (Valtioneuvoston kanslia 2008: 40). Therefore, it is important to develop concepts like those created in Desme and make them attractive to different kinds of consumer groups.

In order to do so we have to evaluate what kinds of products fit certain types of people and create variations so that the products will satisfy the needs and desires of different consumers. This is why we evaluated the positive and negative features of the four Desme concepts (Energy display, Key hanger, Shower duck and Energy plant) from the viewpoint of our five energy consumer segments (see Pitkäjärvi et al 2008: 46–55) and chose the most promising concept for each segment, which are presented in more detail in the following sections.

7.2.1 Passionate ecologists and Energy plant

Because Passionate ecologists already know a lot and are very active in their energy saving actions, they need a device that gives them support and enables them to make a statement. Therefore, the interactive Energy plant is an ideal product for them because it reinforces the normative goal by rewarding and giving pleasure from acting in the right way, and also supports the social aspect of energy saving. However, Energy plant makes the ideology visible in very subtle ways and is a reminder of a good cause. A plant in a window also exposes others to social pressure, which could motivate them to save even more. The plant is a conversation piece and gives its owners a reason to share their opinions on energy saving and show example behaviour to others.

Although Passionate ecologists have not uttered any signs of interest in following their consumption in real time, Energy plant visualises the connection between energy consumption and nature and invokes feelings and emotions by showing the consequences of energy consumption in a very concrete way, and gives feedback that Passionate ecologists are probably eager to get because they know it is going to be positive. Energy plant is easy to install and fits well with the Passionate ecologists' urban lifestyle.

Passionate ecologists want to satisfy their needs in a sustainable way. Because saving is more important to them than consuming, they need a rational reason to justify their purchases. Therefore, it is important that Energy plant is produced in an eco-friendly way so that all the materials and manufacturing methods promote a non-disposable culture. This means that Energy plant should be made out of recycled materials, be fully recyclable and be sold with recycling instructions.

Passionate ecologists expect products to be long-lasting. Thus Energy plant should look like a stylish and timeless high-quality design object. The flowerpot itself should be very neutral so that product variations can be made with different and easily transported Energy plant seeds. Because Passionate ecologists are probably very unwilling to buy new energy consuming devices, Energy plant should definitely be powered by the sun; otherwise, it might not be believable and only cause a guilty conscience.

Energy plant in a window is clearly a statement. However, to support the social aspect of saving even more, Energy plant's buyer should have access to an international website where the plant owners can interact, get new types of seeds, buy spare parts and compare and trade plants with friends. A website makes it possible to bond with other people who find energy saving an important matter.

Passionate ecologists are willing to pay for quality and if, for example, a quarter of the plant's price were to be directly donated to charity, price might not be an issue. However, if we want to promote Energy plant as a sign of commitment, it should be accessible to many. An ideal distribution channel for Energy plant would be some reliable and neutral party that could launch the product within the context of energy saving or some other pro-environment campaign. In that way, Passionate ecologists would not suspect the sincerity of the plant. The best way to promote Energy plant would be in the context of an energy saving campaign, because then Passionate ecologists would not suspect the sincerity of message sender. Energy plant could be marketed to Passionate ecologists as a way of showing their personal engagement with and participation in the fight against climate change.

7.2.2 Active energy savers and Home display

Home display is a most promising concept for Active energy savers because it enables the real-time following Active energy savers found important. Home display gathers and analyses the information about energy consumption and thereby saves Active energy savers time, effort and money, which are all important things to them. Home display also helps Active energy savers to plan their finances in the long term and perhaps motivates them to save energy in situations where they usually make compromises. Active energy savers like to think about money and numbers, and Home display offers them the exact, rational and number-based information they appreciate. It fits well with everyday routines, makes a familiar habit easier (they already read an energy meter) and makes the monetary benefits of energy saving actions more visible.

Because Active energy savers already follow their energy consumption from a meter and many of them think their energy bill provides them with all the information they need, Home display must offer exact and reliable information as well as some new features (like statistics, consumption analysis, comparisons, forecasts, etc.) in order to be more desirable. In order to stir up the normative goals of Active energy savers, Home display should make the results of energy use more visible from nature's point of view. For example, pop-up fact sheets could offer a new approach to energy saving. Home display should also give some signal when the energy consumption rises above the normal level because it might reduce the vulnerability to compromises and make the gap between knowledge and actions smaller.

One important and motivating feature would be the possibility to set a saving goal (for instance, to save 10 % energy), so that Home display can give constant feedback to Active energy savers about how they are performing. A feature that allows two-way communication so that both parties can transmit information might also interest Active energy savers. In addition to automatic meter reading, energy companies could send newsletters and other information to Active energy savers and reward them directly from their energy saving actions. Because Active energy savers might already have other smart home systems, it would be important to have a possibility to integrate Home display with them.

Active energy savers have the highest income level, so their purchasing power should be high as well. Although Active energy savers might take Home display as an investment for the future, they always like to evaluate the pros and cons of their purchases. Therefore, Home display should easily pay back the investment Active energy savers have made. Energy companies might be logical distributors of Home displays. Usually, such companies only send quite formal messages to their customers (electricity bills) and Home display might be a new and positive way to approach energy consumers.

Because Home display is a big investment, it is important to create the image that product users can turn to their energy company in case of any questions or problems. The ideal would be that the distributor could offer the whole package: installation, support and maintenance. However, Active energy savers might demand some face-to-face services, which might be challenging for energy companies to arrange equally to all customers no matter where they live.

The selling argument to Active energy savers should enhance the idea that besides saving money, Home display makes everyday life easier. Some statistics about how much energy people have saved with the help of devices that give constant feedback might convince them. Because Active energy savers can be very critical, it might be hard to influence them through advertising campaigns. Thus, comments and stories collected from experts and real users might encourage them best. It is important that any arguments focus on gains and rational reasons that are based on solid facts.

7.2.3 Insensitive energy users and Key hanger

Insensitive energy users do not save energy because they can't find any motivating reason why they should. Therefore, a device that is easy to use and offers other benefits is best suited to this segment. Insensitive energy users are probably also interested in the safety of their home and belongings because they always try to switch off their machines and avoid leaving them on stand-by. Thus, Key hanger might interest them because it lowers the risks and increases security; in particular, those elderly Insensitive energy users who have started to have doubts about their memory might be keen on the product, and adult children might be ready to buy this device as a gift for their elderly parents.

Another good feature is that Key hanger is not trying to change Insensitive energy users' behaviour and force them to save energy; it just makes a familiar habit easier so that they do not have to compromise on their standard of living in order to save energy. Key hanger proves that energy saving actions do not have to complicate everyday life.

Insensitive energy users are slightly older people so they might like a more traditional looking Key hanger - now, the appearance is probably too modern for their taste - and Key hanger's material could be warmer and something that feels more pleasant to handle (like wood for example). Because many Insensitive energy users live alone, the device should look good with only one key in it. A more manual Key hanger could also feel more reliable to Insensitive energy users, who might find it hard to trust new devices. Just a simple click sound might convince them that Key hanger is working properly. An integrated burglar and fire alarm might bring added value and make Active energy savers feel even more safe when leaving home.

It is important that Key hanger is extremely reliable. In case of a fault situation, the support has to be available around the clock because Active energy savers are probably not used to technology and do not want to feel left alone in a problematic situation.

Because Insensitive energy users have the lowest income of all the segments, a low-end product would be ideal for them. However, we should not underestimate their willingness to buy products that increase their feeling of safety. There is a strong possibility that Insensitive energy users do not buy anything without seeing it first. Therefore, for Insensitive energy users, a distributor that can offer a face-to-face service and some personal guidance is probably the only option. Because Insensitive energy users do not believe in energy saving, the arguments should mainly focus on safety and comfort issues. The communication should highlight that Key hanger increases economic wellbeing as well as comfort, security and quality of life. Key hanger should have the image of a sympathetic janitor who takes care of your property.

7.2.4 Reluctant energy savers and Shower duck

Because Reluctant energy savers have a very strong hedonistic goal frame, it is important to give them instant feedback in situations where energy is used. Thus Shower duck is an ideal product for them. As only 11 % of Reluctant energy savers have tried to reduce their consumption of warm water, the saving potential is enormous. Shower duck is the only product concept that has a clearly funny and light approach to the energy issue. It is cheap enough for impulsive Reluctant energy savers to buy it just because it is a funny product. Shower duck also has the novelty value and potential to become a trendy item among young people. It leaves the decisions to the user, so it doesn't control you. The down side is that Shower duck makes you feel guilty, and Reluctant energy savers are prone to avoiding negative thoughts.

Reluctant energy savers do not care whether the product is ecologically produced or not, they just want it to be good looking. Therefore, Shower duck has to be either more stylish or sympathetic and funny in order to be more appealing and become a show-off product. Because Reluctant energy savers are probably more interested in time than water loss, it is important that Shower duck clearly shows the time consumed in the shower. The installation should be easy enough so that Shower duck suits those Reluctant energy savers who live in rented apartments.

In order to appeal to status seeking Reluctant energy savers, Shower duck has to offer them a way to stand out. Because Reluctant energy savers are impulsive buyers and like to consume, price might not even matter if they like the idea of the product. When considering a distributor, Shower duck might lose its novelty value quite quickly if it is possible to buy it from any supermarket nearby. Because Reluctant energy savers do not take all their purchases seriously, Shower duck might work well as a joke. Therefore the communication should be light and humorous as well, and rational arguments should focus more on time than energy saving.

Careful branding is needed in order to make Shower duck a must-have product. Reluctant energy savers probably do not want to be labelled as a pro-environmentalist, so Shower duck should not be sold as an eco-product. If the selling arguments speak too loudly about Shower duck being an energy saving

device, they most likely will not buy it because Reluctant energy savers are so used to ignoring the whole issue.

7.2.5 Unaware energy consumers and Home display

Unaware energy consumers are a challenging segment because we do not know much about them. However, we do know that they want to have more information about their energy consumption and energy efficiency in general, so Home display is a product that can satisfy their thirst for knowledge. Home display also makes following their energy consumption easier, which Unaware energy consumers find too complicated at present. In addition, Home display is the only concept that can offer the tailored and personalised information Unaware energy consumers need.

However, Unaware energy consumers might like Home display to be a more guiding device than it is at the moment. Therefore, Home display should give as much instant and specific feedback on their actions as possible. Energy saving tips and fact sheets are also extremely important in order to increase Unaware energy consumers' knowledge and awareness. Home display should offer information that strengthens not only the gain but also the normative goals.

Compared with Active energy savers, Unaware energy consumers might be willing to pay more for the information Home display offers because they do not find the current information providers satisfactory enough. Home display should not only be promoted as a solution for uncertainty in energy issues but also as a tool to save money. Because Unaware energy consumers want to know more about energy issues, they might read all the bulletins and news sheets their energy company delivers, so all channels that discuss energy issues might attract Unaware energy consumers' attention.

8 CONCLUSIONS

> *"I'm some kind of eco-person and economical consumer. That explains why I think about my energy consumption almost all the time."*
>
> *"A fight is guaranteed if I dare to say aloud that devices also use energy when they are in standby mode. The wife would like to save energy but the husband values comfort more. I guess that's the way it is in many families."*
>
> *"Concerning energy issues, you may call me a careless prodigal. Availability of energy has always been an obvious thing for me. The idea that energy does not last forever is unimaginable. My generation has never had to restrict their energy use. That's why energy savings have not broken through yet."*

These quotes from the Desme narratives give an idea of how different people's attitudes toward energy saving are. This huge variation in attitudes, motives and actions pose a great challenge when trying to encourage people to save energy in their everyday lives. Many different means of motivating consumers towards energy saving have already been tested. For some reason, this message has not reached all consumers. Based on our experiences in this research project, we provide a set of statements that direct future research and design on households' energy saving.

Statement 1: A deep understanding of energy consumers is a necessity when trying to influence consumers' energy-related behaviour.

In the field of marketing, consumer segmentation is a very widely used tool when designing new products, creating marketing actions, etc. However, in the energy field, segmentation seems to be a rarely unused tool, both in industry and in academia. For example, we noticed early on in this research project that no attempts have been made to segment energy consumers appropriately.

In order to be effective, segmentation needs to be based not only on consumer attitudes towards energy saving but also on their actual energy behaviour, because multiple studies have shown that the correlation between people's attitudes and behaviour is weak. Hence it is important to understand how people use energy in

their everyday lives, what kind of energy saving actions they currently make and what their general view of energy saving is. Understanding consumers' energy behaviour is important in order to be able to create more specific energy saving solutions for different contexts in everyday life. Although it is obvious that the same product, service or communication doesn't suit everyone, energy saving campaigns have usually lacked market segmentation or the target group selections have been heavily based on demographic factors (see, for example, BEHAVE 2007b). Nevertheless, this report provides a comprehensive analysis and segmentation strategy that will be valuable for researchers in energy conservation and design in the future.

Statement 2: New kinds of innovative and desirable products and services are needed in order to enhance the energy saving actions in households.

In the Desme project we wanted to create innovative energy saving products and services and we found that it is imperative to embed these in peoples' everyday lives. Hence, two supplementary aspects were used when we developed these concepts: the everyday life aspect and the lifestyle aspect. The existing knowledge of energy consumer segments was also employed as a framework for our concept ideas. The main purpose was to design products that would relate to some major problem areas concerning the energy saving in the home environment and still fit into the user's lifestyle. Table 5 summarises the concepts that were created to approach each problem.

Table 5. Problem area and created solution

Problem area	Solution
Many people find that following their energy consumption is too complicated and time consuming, or that the consumption information is hard to understand	The energy display should give the energy information in a pedagogical, understandable and visual form
People tend to forget that warming water consumes a great deal of energy	By giving instant response to person in the shower, Shower duck will gradually teach people to take shorter showers
A great deal of unnecessary energy is consumed when electrical devices are in the stand-by mode	Key hanger will automatically cut down on unnecessary consumption by switching off unnecessary electrical devices when no one is at home

Some people find energy saving too technical with boring devices	Energy plant is a beautiful design object that gives qualitative and more appealing energy consumption information than ordinary energy meters

When testing these four Desme concepts with consumers and experts, everyone unanimously expressed the opinion that the concepts approached the energy saving issue from a very fresh angle, and this new approach was seen as very welcome.

Moreover, from a behaviour science and design perspective, we have learned that there are two principal types of feedback schemes that are needed to influence energy consumers: informative and cueing feedback (Riding, Rayner 2000). Belonging to the informative class of feedback are, for example, energy displays and websites that have the ability to provide detailed information on personal energy consumption with graphics such as histograms, analysis tools and billing information, etc. Belonging to the second class of feedback are non-intrusive devices that provide “information at a glance”. These tools can be embedded in the home and provide information on specific energy consuming behaviours (e.g., Shower duck) and also indicate when the household is consuming a lot of electricity. These devices provide direct feedback on the energy consumption behaviour in order to support learning and behaviour change. How these devices should to be designed as services is still a research question, but the designs presented in this project are a fresh starting point for further research.

Statement 3: New kinds of means are needed in order to encourage energy saving among different kinds of energy users.

Five different consumer segments were found in the Desme survey. A deeper and more vivid picture of these five energy consumer segments was obtained by combining both quantitative and qualitative research. In order to understand the behaviour of these five consumer segments we combined the results received from the Desme survey and narratives with the existing knowledge of consumer segmentation in the energy field. By doing this, we managed to create extensive understanding concerning several areas of their behaviour, including their energy behaviour.

Because of the significant differences in their attitude and behaviour towards energy saving, each of the energy consumer segments need to be approached with specific reasoning in order to encourage them to save energy in their everyday lives. The reasons and motives for saving or not saving energy can differ a great deal between these segments. Where one person finds saving the environment a very motivating factor in energy saving, some other person may find this same argument a provocative attempt to interfere with his daily life. Therefore, the different energy consumer segments need their own communication of. For example, with some segments the focus needs to be on increasing knowledge, while with others the communication should primarily concentrate on changing attitudes or modifying current behaviour. And not only the communication but also the energy saving solutions need to be modified so that they meet the needs and desires of each segment.

Statement 4: Design can be an effective tool in encouraging consumers to save energy.

Design can be a powerful tool in changing behaviours and attitudes (Fogg 2003). Future research in the area of energy needs to apply segmentation and persuasive design to encourage consumers to conserve more. Taking this challenge seriously, these designs need to be *sustainable* and not consume additional energy in counterproductive amounts. Moreover, it is clear from the research conducted in the Desme project that the solutions must be close to the user and his/her everyday activities in order to be effective. An approach here is to embed the feedback in the existing household devices or devices we already use (McCalley et al., 2006). For example, a relatively unexplored area is the mobile phone as an energy feedback device that could provide feedback on our behaviour and give added value services to the energy saving consumer. Exactly what persuasive design strategies and incentives are applicable in the area of personal energy are questions for the future. Nevertheless, future research will benefit from the results of Desme – namely, that it is important to design for the different energy user groups we have identified and appropriately embed these designs in the everyday life of the prospective energy consumer.

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