Service and product opportunities for a sustainable energy company to motivate younger household starters contribute to make their household sustainable

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Executive summary

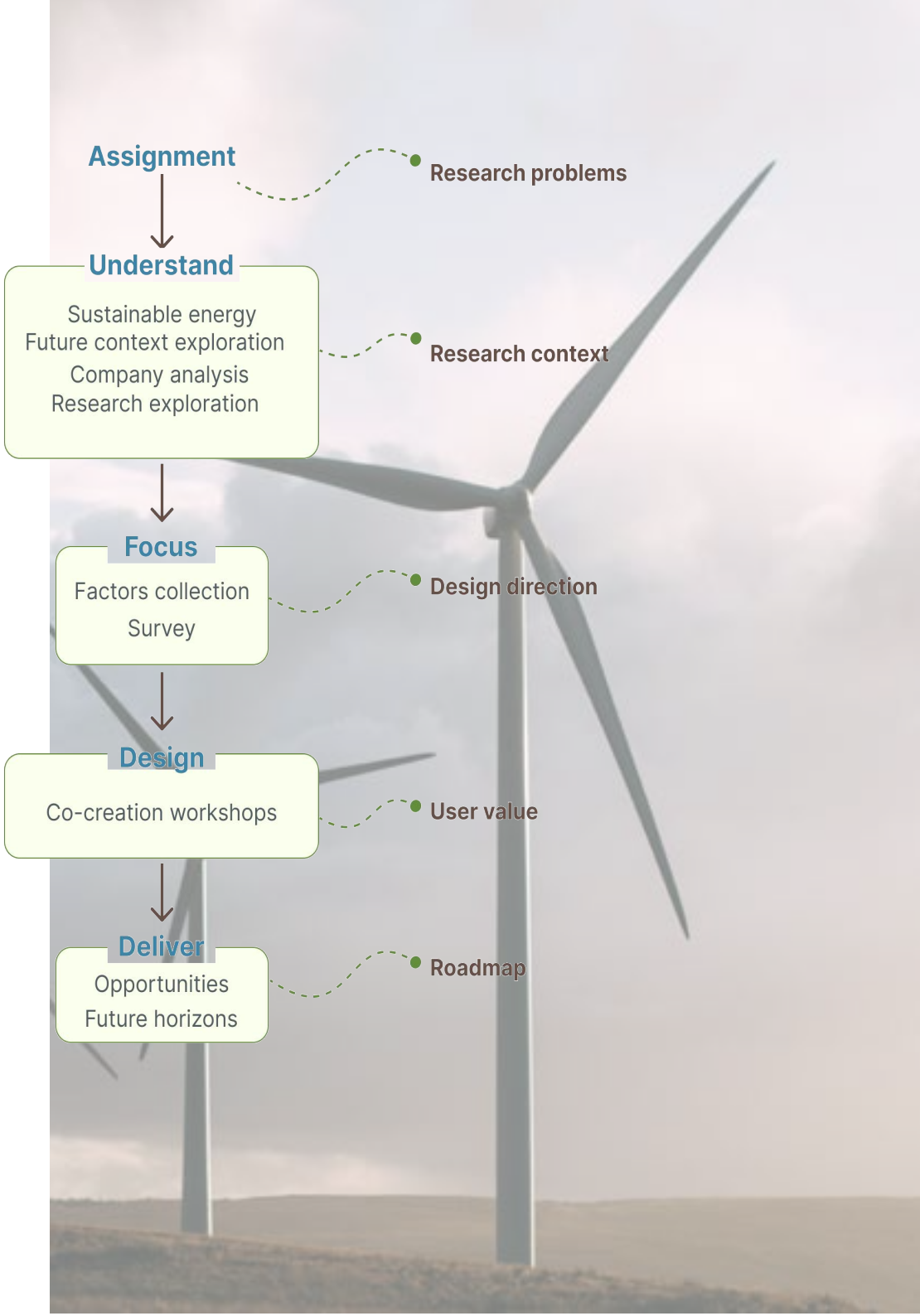
While technological development, people began to pay extensive attention to climate issues and reduce the impact of human life on the planet through actions. Household energy as one of the main energy consumption is considered as an important direction to improve energy problems. Greenchoice as a green energy provider is willing to contribute to sustainable development through its efforts to help all people make their green choices. Involve the younger household starters from 20-30 as a new target group and expanding their market is their next step of development. This research project aims to find factors that can influence the decision-making related to household energy of the target group and translated these factors into opportunities for Greenchoice to attract these people.

Desk research is done to explore the trends in the development of household energy. Besides, how do other researchers analyse the attractive factors for people to choose household energy-related products or services is explored to support this research project in building the structures.

The target group research is built based on the personas of current customers and a previous project on understanding the meaning of sustainable household energy for the target group and their lifestyle. To further measure the priority of the factors mentioned in these two data, quantitative research is built. More potential factors are selected and the lifestyle of the target group is mapped by 3 personas.

To apply these factors to suitable products or services to attract the target group, a workshop based on a decision-making process is designed to discover the need of the target group and their desired solutions. For each group of participants their needs, possible solving process and reasons related to their lifestyles are collected.

Finally, data from workshops is summarized as design opportunities for Greenchocie to attract younger household starters by providing products and services to satisfy their needs. These opportunities and the strategy for Greenchoice to achieve its vision through products and services are visualized by a roadmap with three steps (horizons). In the end, the limitation of this research and related recommendations are presented to support with future development of the result.



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Chapter 1
Assignment introduction

This chapter explains the goal of this graduation project. It introduces the context of the project, relevant research questions and the methods used to answer the research questions.

Besides, this chapter describes how the structure and approach of this graduation project were built on the basis of the double-diamond design model to guide the reading.

1.1 Assignment description

This graduation project focuses on understanding a new target group and exploring opportunities for Greenchoice, the largest green energy and gas supplier in the Netherlands, to attract them.

Currently, Greenchoice's customer base consists mainly of well-educated older customers, to realize its mission of making sustainable living possible for everyone, Greenchoice aims to expand its target market by including those younger household starters aged 20 to 30 who are about to buy or rent their first house or who have just obtained their first home as part of their customers.

This project is built based on my previous research project collaborated with Greenchoice understanding the meaning of sustainable living to younger household starters in the Dutch housing market. In the project a qualitative research was applied to explore their lifestyle related to household energy to check whether the younger household starters are suitable for Greenchoice, and collect factors related to their sustainable decision-makings that can be used as an inspiration for Greenchoice to provide suitable products or surveys.

However, to help Greenchoice came up with relevant design for the target group, further exploration about needs of the target group and priority of factors that able to attract them are needed to build a feasible development strategy. Therefore, the goal of this graduation project is to continue on understanding younger household starters' needs and desire related to household energy and develop a strategic plan for Greenchoice to attract and retain this age group by providing suitable products or services.

1.2 Research objectives

This project aims to develop a deeper understanding of the energy product and service needs of younger household starters. By identifying the key differences between the younger target group and the current customer base, the project will enable Greenchoice to develop and offer products and services that are more relevant to the needs of this group, and thereby attract and retain them as loyal customers. This will contribute to Greenchoice's mission of making sustainable living possible for everyone.

Thus, the research problem can be defined as:

"What are the marketing opportunities for Greenchoice to innovate more appropriate products and services for younger householders aged 20-30, to attract them and foster their loyalty as customers?"

The research problem can be answered by identifying the following questions:

Q1: What are the factors (product related/marketing/consumer-related factors) influencing people's decision-making related to house energy?

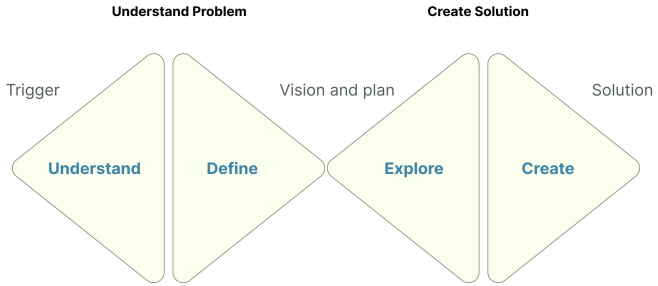
Q2: What are the most important factor of the target group and how much do they satisfy with the current market?

Q3: What are the primary energy needs and challenges faced by younger householders aged 20-30, and how can Greenchoice address these needs through its products and services?

Q4: What are the specific gaps or unmet needs in the current energy market for younger householders aged 20-30, and how can Greenchoice fill these gaps with innovative and effective solutions?

1.3 Project structure and design approach

The project structure is built based on the double-diamond design model (The British Design Council,2004). The double-diamond design model covers four phases, discover, define, develop and deliver . As the field of view changes from wide to narrow, the model is divided into two diamonds which are understanding problems and creating solutions. The understand problem diamond covers understand and define section which ends with coming up with a vision and plan, and the second diamond covers explore and create section which will deliver design solutions (Picture 1.1).



Picture 1.1 Doublediamond design model

In order to come up with a suitable strategic plan with product or service opportunities for Greenchoice, the double-diamond model is used to guide the process from research to design. Based on the double-diamond design model the approach of this project is divided into two parts which go through the process of exploring the context of the project, zooming into the design direction, coming up with opportunities and building the roadmap. Each step links to a chapter of this graduation project which are understanding, focus, design and deliver (Picture 1.2).

Understand and focus

The first part of this project is desk research and a focus on the design direction. The goal of this part is to map out the context of the research question and zoom into a design direction which able to be used as a base for the design phase.

- Understand (Chapter 2)

This chapter covers understanding the context related to household energy in the Netherlands and basic information about Greenchoice and the target group.

- Focus (Chapter 3)

This chapter reported the process of building the survey to measure the priority of factors that influence the decision-making of the target group and the result got from the survey. The goal of this chapter is to narrow down the design direction by understanding the influence of relevant factors on the decision-making of the target group.

Design and deliver

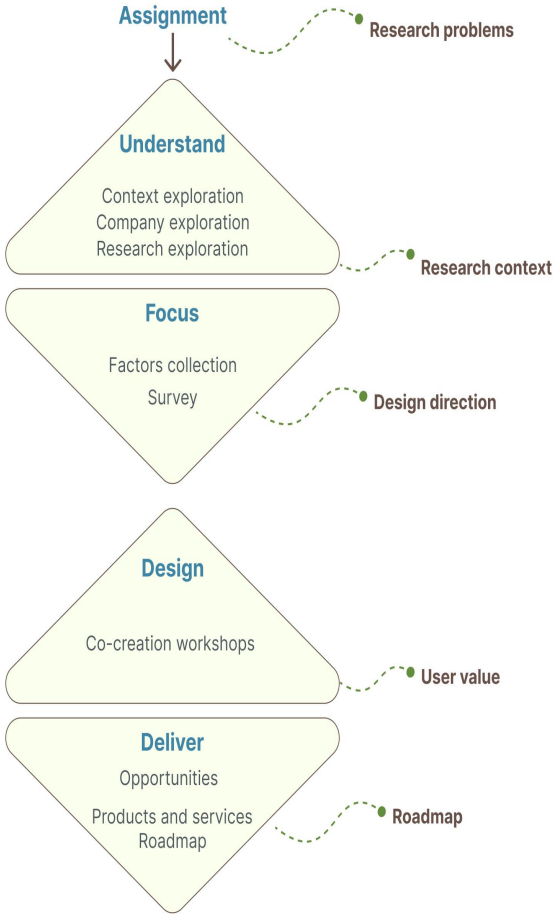
The second part of this project is to come up with opportunities for Greenchoice and present them on a roadmap as the final deliverable.

- Design (Chapter 4)

This chapter zooms into the needs of the target group and related solutions through 3 co-creation workshops with selected groups of people. The results will be used to build concepts of opportunities for Greenchoice.

- Deliver (Chapter 5)

This chapter summarizes viable opportunities for Greenchice to attract the target group based on the findings from the design section. And comes up with a deliverable by mapping out the strategic plan as a roadmap.



Picture 1.2 Design approach

1.4 Design methods

This project is designed as a mixed-method research design. It covers two research processes, a quantitative research and a generative research.

1.4.1 Data collection

The data of this research was collected within three different sections of the project. The project started with desk research that covered information related to sustainable household energy, Greenchoice, and the target group. The desk research was done by searching the website of Greenchoice and other household energy companies and published articles and reports.

The next section used an exploratory sequential design method to follow up with qualitative research I did before this graduation project. The method was used to measure the importance of factors that collected by the qualitative research and 5 personas provided by Greenchocie. The data were collected by quantitative research that measures these factors' ability of influence the decision-making related to household energy. The quantitative research was done through an online survey of 40 participants in the age group of 20 to 30 and the responses were used to select more important factors and potential target groups.

Finally, a generative research was used to dive into the understanding of the needs and problems of the target group selected by the result of the survey. This generative research was done by workshops that cover a co-creation section built on the customer decision-making process to understand the needs of the target group and how they are willing to solve these problems.

1.4.1 Data analysis

The data from the desk research were summarized into insights to build the background of this project. Besides, how to analyse the target group and design opportunities to attract them will be learned from the literature.

The quantitative research was analyzed based on the impact of each factor towards the decision-making of the target group. Factors that have more obvious effects will be selected to make simple solutions that are able to use as guidance for the next section. Additionally, the data were used to analyse the lifestyle of the target group and match the target group to current customers. By using the same model of persona, the target group were matched with 3 out of 5 personas of current customers. These three personas were used as a criterion to find participants for the workshops.

Finally, quotes collected from the generative research were translated into needs or problems related to household energy and their solutions. The needs were used as the user value that should be achieved and the solutions were used as guidance to design products and services for Greenchoice to attract the target group. The final ,results were filled into a roadmap as the deliverable.

Chapter 2
Understand

This chapter covers the background of this subject. It starts with a literature review of the context of sustainable household energy in the Netherlands. Followed by the company mission, current products and services of Greenchocie. Besides, the trends of technology for the household energy market will be introduced. At the end of this chapter, how other researchers handle design for the household energy customer will be discussed. This information will come together to build an understanding of the background of this project and provide guidance for the subsequent design process.

2.1 Household energy systems

Household energy covers energy consumption caused by households except for the dwellings themselves. The consumption usually covers energy for space and water heating, lighting and electrical appliances, cooking, space cooling, and other end-uses (Picture 2.1).

Natural gas is the most important energy source in the Netherlands. In 2018, 90% of the heating is provided by natural gas (IEA,2020). Actually, household energy is treated as one of the largest sources of greenhouse gas emissions (Özçatalbas & Imran, 2016). Therefore, improving the sustainability of household energy has a big benefit towards improve the environment and climate.

Picture 2.1 Household energy system

2.2 Sustainable household energy and renewable electricity

While discussing green and positive household energy, sustainable household energy and renewable electricity are often mentioned simultaneously. Although these two are often used interchangeably, there are some differences between them.

Crawford (2018) mentioned that renewable electricity is naturally created energy and is constantly replaced by nature, such as solar energy, wind energy and bio-energy. According to the report of Statistics Netherlands (CBS), renewable electricity generation in 2022 enhanced by 20% year-on-year. The main renewable sources in the Netherlands are wind power, solar energy, the biomass. In 2022 solar and wind power have an objective growth while biomass decreased due to the improvement of capacity and advantageous weather.

Sustainable household energy is defined as energy that reliably supports the needs of society both in the present and the future, which does not have to be made by nature but is based on environment-friendly materials (Crawford,2018). Thus, renewable energy will not be sustainable if the rate of using it is higher than the replenishing rate (Smoot, 2023) In the Netherlands the most common sustainable household energy is wind and solar energy, and biomass energy is not part of the sustainable household energy.

Biomass energy

Biomass energy is made from combusting or co-firing organic materials, such as clippings of forestry and organic household waste livestock manure and fats or oils from the food industry (Government of the Netherlands, nd). Besides the benefits of renewable energy, biomass energy is able to reduce the pressure of landfills and provides revenue for manufacturers (Mcfarland, 2017).

Wind energy

Wind energy comes from the motion of windmills caused by wind, there are no fossil fuels needed therefore wind energy is 100% green energy. In the Netherlands, wind energy is an inexhaustible source of energy. Besides, it is fast to set up wind farms. Thus, the wind energy is efficient.

Solar energy

Solar panels can also use as an energy source, similar to wind energy, solar energy is also fully sustainable. The energy generated by the solar panel can be used as household energy the extra energy can be supplied back to the energy grid and make a profit for the owner. Besides, the solar panel is able to store energy in its battery.

2.3 Trends of household energy

2.3.1 Natural gas-free homes

As climate issues are gradually paid attention to, sustainable energy has become a development trend. The government of the Netherlands propose to achieve natural gas-free and 100% sustainable energy by 2050 (Government of the Netherlands,2019). Towards 2030, the global renewable energy proportion will increase to 40% (IRENA,2022). Instead of natural gas, low-carbon energy sources such as solar energy, wind energy, biomass energy, geothermal heat and hydro-power are suggested to be used by the government (Government of the Netherlands, 2023). At the same time, the citizens become key participants in this goal, Beauchampet and Walsh (2021) mentioned that the citizens will be encouraged to take action to reduce their energy consumption due to their feeling of social responsibility.

2.3.3 AI-based Home energy management system

Monitoring

AI-driven monitoring is often expected as a better-developed information collection system that is able to collect more comprehensive reasons for energy consumption than a traditional one, such as monitoring individual appliances and other relevant causes like the weather (Himeur, Ghanem, Alsalemi, Bensaali,& Amira, 2021). For household energy, AI technology is the core of smart meters, which can not only provide detailed and accurate information and visualize energy consumption but also provide users with improved conditions through data analysis (Nutakki & Mandava, 2023). It is a fact that smart meters have begun to be used by people and will be promoted in the future. However, smart meters still face the challenge of users' concerns about privacy issues and trust issues. Since many Netherlands users reject the use of wireless transmission for their meter data collection, and the current technology does not provide accurate and real-time information, the advantages of smart meters cannot be exploited (Ten Sythoff, 2021).

Control

Besides data collection and analysis, AI technology also has great opportunities in controlling energy consumption. Nokia (2022) sees the advantages of AI in reducing energy consumption, such as turning off temporary power sources, and has already started incorporating AI technology into its products to analyze feasible energy-saving suggestions and find out energy efficiency solutions. They mentioned that by involving AI technology in trlco networks, 50% of energy could be saved when AI controls the engine based on an accurate prediction. Similar to this, AI-driven controller for household energy also becomes a trend of future development. Based on the monitoring, AI technology is able to provide products and services to improve user experience. Shareef, Ahmed, Mohamed, and Al Hassan (2018) mentioned that AI-based home energy management systems can minimize energy consumption without sacrificing comfort by calculating the most appropriate running time to achieve energy savings.

2.4 Greenchoice

2.4.1 Who is Greenchoice

As the largest green energy and gas supplier in the Netherlands, Greenchoice provide 100% green energy since 2016. It is the energy brand with the highest sustainability score in the energy sector indicated by consumers in 2023 (sustainable brand index, 2023). It provides green electricity based on wind and solar energy and forest-compensated gas.

Forest-compensated gas

Besides the 100% green wind and solar energy, Greenchoice also offers natural gas which is still the most common household energy source in the Netherlands. To limit the impact of using natural gas and make the energy more sustainable, Greenchoice combined the supply of natural gas with restoring nature and protecting the forests. This means the more gas supplied the more forest and nature project will be invested by Grennchoice. By having this project the CO2 footprint of natural gas will be reduced

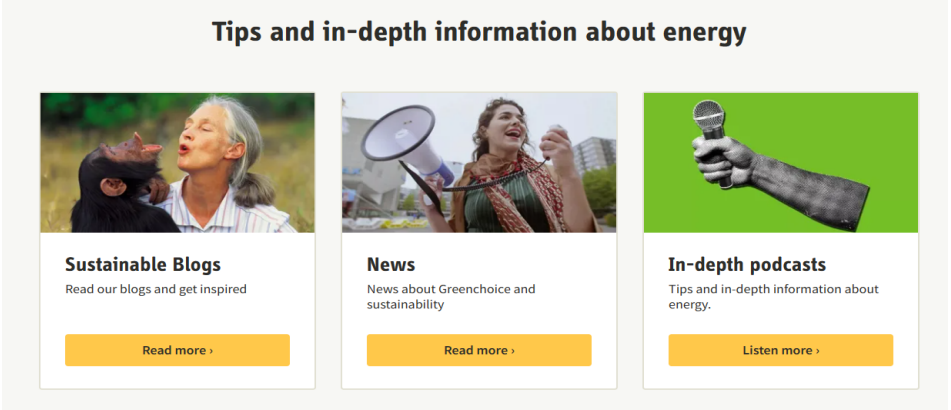
"Those who choose us have taken the first step towards sustainability."

2.4.2Greenchoice as a platform for green choice

Instead of being a dealer in energy, Greenchoice is willing to reduce the overall climate impact. In addition to providing green energy, they are committed to reducing carbon emissions and engaging all people in sustainable energy. Just like their forest-compensated gas, Greenchoice is showing their effort to bring creativity to traditional energy products and limit their impact on the environment by their actions. Instead of focusing on providing energy only, Greenchoice is moving towards a broader market which is help people make sustainable decisions. Two other services they are working on besides providing energy are giving information related to users and enabling people to install solar panels when they don't have a proper roof.

Tips and information

On the website of Greenchoice, tips and information related to energy are provided. The information is separated by blogs, news and podcasts. People can find simple tips for reducing energy consumption and topics related to household energy such as "what is heat-pumps" and "how to save energy while working at home". The information is available for everyone even not the customers of Greenchoice.



Picture 2.2 Screenshot of the Tips webpage

Energy cooperatives

If people are not able to or don't like to install the solar panel on their roofs but are still willing to contribute in make the environment more sustainable, they could become a member of an energy cooperative. And there will be their own solar panels on empty roofs in the Netherlands.

2.4.3 Greenchoice's mission

"Make sustainable living possible for everyone." is the sustainable mission of Greenchocie. The Besides of have energy cooperatives to let more people able to join the action of living sustainable, they are also willing to expand their customer group to a bigger age group to encourage more people into sustainable actions. That is why the younger household starter is set as the target group in this project. By involving younger people in action, Greenchoice going to have one more step further to its mission of making sustainable living possible for everyone.

2.5 Younger households

2.5.1 Why this group of people

To expand the target market, the younger household starters aged 20-30 were set by Greenchoice at the start of this project. The younger household starters are facing the situation of choosing the household energy supplier by themself for the first time. Since 2022, the house price is getting lower and there is a substantial increase in wages, even the price will fall with a lag, and younger people will find it more affordable to purchase a home in the next 5 years (The Netherlandsche Bank, 2023). Besides, according to both the NLTimes (2019) and European Investment Bank (2023), the younger people in the Netherlands show their concerns about the climate emergency of the world and believe that they are able to bring positive impact through their own behaviour. Such a situation will increase the amount of younger household starters and their importance in the household energy field.

2.4.2 Analysis the target group based on behaviour factors

Since there is a lack of information related to the lifestyle and needs of people from 20-30 towards household energy in the Netherlands, a relevant analysis should be done to create an understanding. Therefore, desk research about how other researchers did analyses related to the influencing factors of household energy-related behaviour is needed. To collect broader information, similar topics such as the influencing factors related to energy consumption and saving energy behaviour of people besides the target group are also used as data for the research.

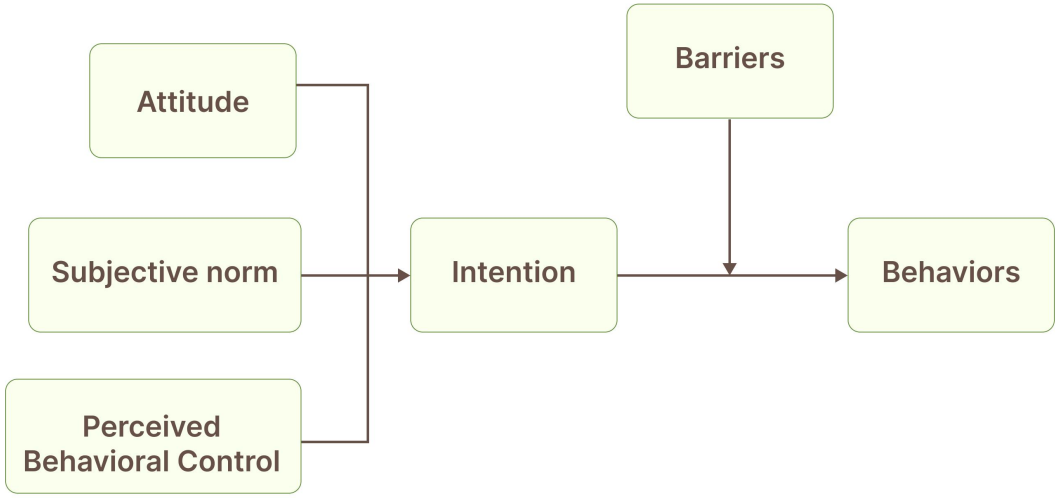
While discussing the factors that can influence the behaviour related to energy, many methods and models can be used, such as interviews, case studies, observation and surveys based on different behaviour models. For quantitative research, the most commonly used models are related to behaviour and decision-making and the Theory of planned behaviour and The consumer decision-making process models are well-used in the literature.

The Theory of the planned behaviour model

The theory of planned behaviour model describes how dose behaviour control by individuals (Blythe,2013) which also describes what are the factors that will influence peoples' decision of having a behaviour. According to the theory of planned behaviour model (Ajzen, 1988) there are three types of factors from both internal and external factors that will influence the intention of a behaviour, the attitude, subjective norm and perceived behaviour control. These factors are related to how the person believes. The attitudes related to how people consider the value and outcome of the behaviour which usually related to their beliefs. The subjective norm indicates how the person thinks others are likely to react to the behaviour. Finally, perceived behaviour control represents whether the person believes they can achieve the behaviour. These three types of factors are only able to build the intention of the behaviour which does not mean the person will take action. The theory of the planned behaviour model shows that barriers from reality such as external limitations might stop the behaviour at the end.

For this project, the factors that influence the behaviour of choosing sustainable household energy matters. In the theory of planned behaviour model, the more positive factors people believe the more intention of behaviour they will have and there will be more possibility of take action. Besides, reducing the barriers is also able to encourage the person to achieve the behaviour (Ajzen, 1988). Thus, to analyse what factors are able to encourage the target group to choose sustainable household energy, whether the factors are able to create intention and if there are any barriers blocking their choice need to be explored.

Since the theory of planned behaviour model is closely related to factors that influence the decision-making related to household energy, how to analyse these factors and limitations in the model through survey questions is used as a reference for building a questionnaire.



Picture 2.3 The theory of the planned behaviour model

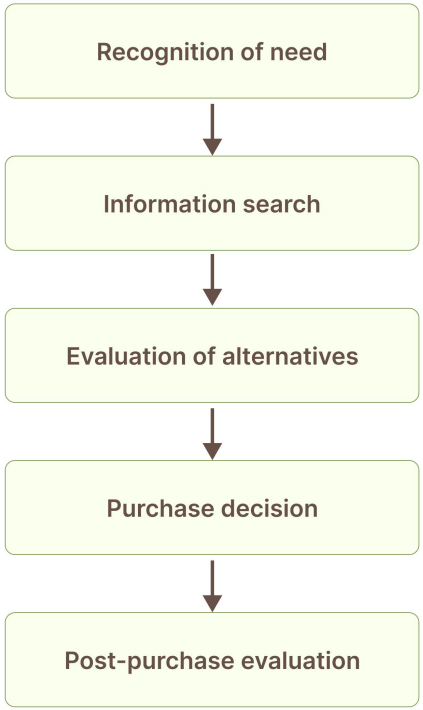
The consumer decision-making process

How target groups make their decisions related to sustainable household energy plays an important role in this project. Besides of analyse the factors that are able to influence the target group's behaviour, the process of their decision-making could help with gathering these factors and information in a more logical structure. Furthermore, the consumer decision-making process model is able to make the analysis of the project keep close to the customer perspective.

Consumers' decision-making is a complex process. Most of the time, consumers need to make choices between a bunch of alternatives, and much information needs to be gathered to help them make decisions (Payne, Bettman & Johnson, 1991). The consumer decision-making process model describes this complicated process in 5 steps, " Problem recognition, information search, evaluation of alternatives, product choice and evaluation" (John Dewey's, 1910).

The decision-making process starts with problem recognition. This shows the reason for making choices. This happens when people notice the gap between their current state and an ideal situation and their desire for an improvement. After noticing the problem, people move to the next step of searching for information. In this step, people start to collect relevant data to help find suitable solutions. It covers both "internal search" (finding information from their memories) and "external search" (getting information from others or other platforms such as advertisements, news, etc.) (Solomon,2013). The next step is to use the information gathered to compare alternative products and make a decision. After purchase, people will evaluate the outcomes such as the user experience of the product and these outcomes might influence their next decision-making process.

In this project, the consumer decision-making process model will be applied in both the focus and design sections. It will be used to guide the process of both the survey and the co-creation workshop. In the survey, the decision-making process will be used as the order of going through the clusters which makes the participants able to follow the questionnaire easier. As for the co-creation workshop, in order to find relevant problems and suitable solutions regarding household energy, the decision-making process model is used as the structure of the workshop to simulate a real decision-making process.



Picture 2.4 The consumer decision-making process model

Chapter 3
Focus

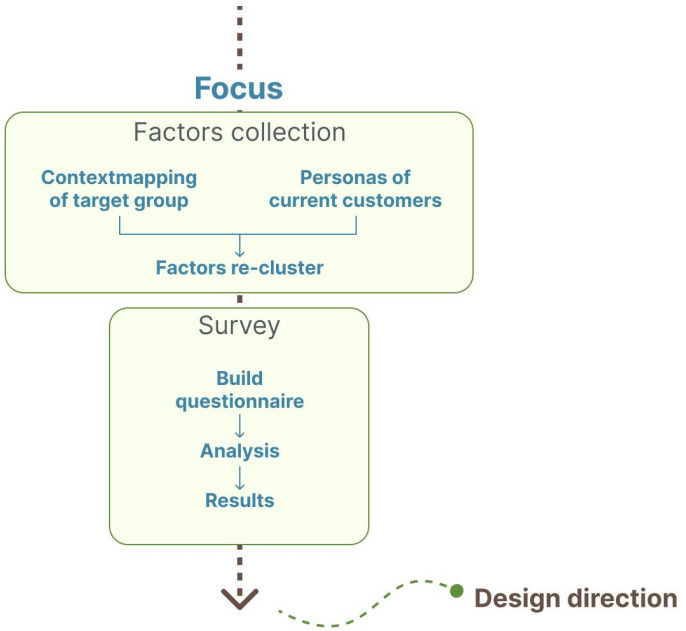
In this section, the project will zoom in to understanding the new target group, younger household starters. To gain a deeper understanding of their priority related to household energy decisions and compare the target group with current customers, a survey questionnaire was given to them. This part of the report will explain the research method, the process of building the questionnaire and the insights from the survey.

3.1 Conceptual framework of the target group analysis

To find opportunities for Greenchoice to attract the younger household starters, and understand the needs? /focuses related to the household energy of the target group and finding out the difference between them and previous users are the keys of this project. Thus, the target group analysis will be used to select the factors that are able to influence the decision-making of the target group and distinguish between their lifestyle and current customers' lifestyle by matching the similarities and highlighting the difference. The results will be used to evaluate whether current products and services are suitable for the target group based on their similarities to current customers and narrow down the focus of this project to guide the design direction for future development. In order to zoom into a design direction, it is necessary to find out which factors have more impact on the target group's decision-making related to household energy. Therefore, the goal of this research is to measure the priority of these factors for younger household starters and find out how they reflect on these factors. The target group analysis will be done by quantitative research and the approach is shown in the picture 3.1.

The research is started by collecting factors. In order to find relevant factors to define the needs of the target group, two sources can be used for this project, personas of current customers provided by Greenchoice and the context mapping result of the new target group from a previous project with Greenchoice. Both of the data include factors that are able to influence the household energy-related decisions of users. However, since these two sources have different structures and factors have overlapped, these factors need to be re-clustered for further process of this graduation project.

The second step of this section is to design a survey based on re-clustered factors to measure the priorities of these factors and check whether Greenchoice could attract the target group by improving these factors. The results of the survey will be used to make new personas for the target group and show the similarities or difference between them and current customers. Additionally, they will be used to narrow down the design directions and prepare the co-creation workshop in the design section.



Picture 3.1 Framework of the target group analysis

3.2 Factor collection

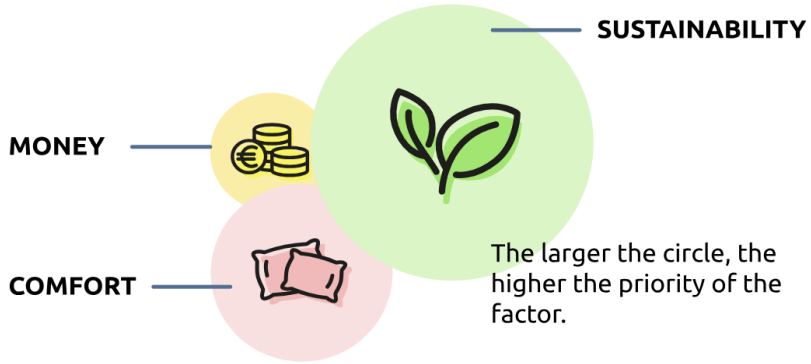
3.2.1 Context mapping of the target group

During a previous Elective course “Design for Context mapping”, I participated in the research project group on the topic “What sustainable living means for younger household starters in the Dutch housing market” and collaborated with Greenchoice. The goal of this context mapping project is to understand the target customers’ views on sustainable living household energy, and their related lifestyles through qualitative research. The insights were collected from 8 interviews that focused on their relevant attitudes and behaviour.

As a result, the project delivered a poster （Appendix） that shows representative samples of the target group. These samples were defined based on the mindset and motivation related to sustainability and household energy use, which mindset revealed the priorities between sustainability, money, and comfort, and the motivations related to knowledge, trust, effort and pride. The details of mindsets and motivations are introduced below.

Mindsets

During the context mapping project, we found that how the target group measures the importance of sustainability, money and comfort will influence every step of their decision process related to household energy use by guiding their focus of information. Therefore the different combinations of priorities are used to represent the mindsets of people from the target group. In the poster, the larger circle represent the higher priority of the factor.



Picture 3.2 Mindsets of Context mapping

Sustainability:
In this project, it means environmentally friendly results related to household energy use.

Money:
The financial cost is related to household energy, such as the cost for purchase energy, products and services.

Comfort:
The state of physical or psychological ease that is influenced by household energy-related products and services.

Motivations

According to the poster, mindsets will influence the information that people search for, and motivations will influence whether people will take action and how much effort they will take. The motivations are summarized into knowledge, trust, effort and pride. The level of knowledge on sustainability and the trust in the sources will influence the amount of effort that people are willing to take into action. In the end, the effort that is needed to achieve the goal will decide whether people will take action. In addition to that, external recognition of the efforts of the target group will provide a sense of accomplishment and makes them well to put more effort on improve the sustainable level of their household energy.

Picture 3.3 Motivations of Context mapping

Knowledge:

The amount of information and accuracy level that people know about household energy, sustainability, and related products or services.

Trust:

The degree to which people trust the information received or channels they used for household energy-related purposes.

Effort:

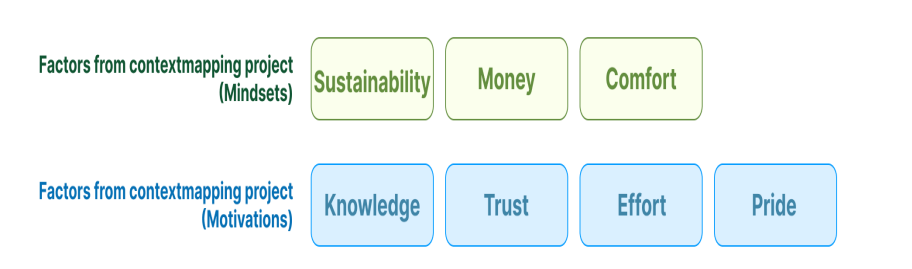
The amount of energy that people need or the difficulties that people face with household energy related actions.

Pride:

The sense of achievement or proud.

Factors from the context mapping project

For this graduation project, the context mapping results will be used as one of the collections of factors that are able to influence the decision-making related to household energy of the target group. As shown in the poster, the mindsets and motivations cover 7 factors (Picture 3.4) in total and have been used to identify the target group, therefore, these factors are selected for this project.

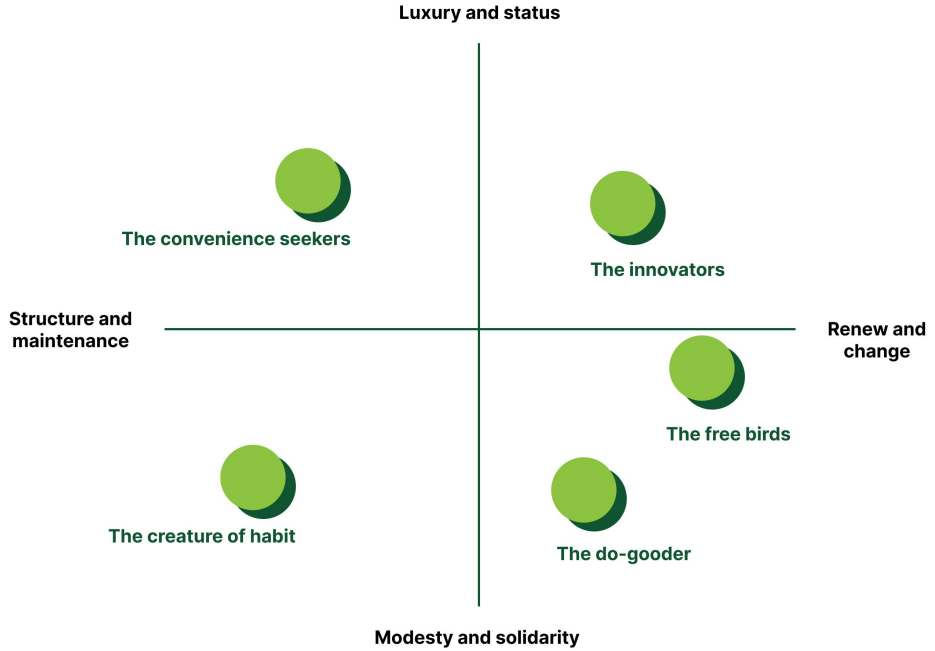


Picture 3.4 Summary of factors from context mapping project

3.2.2Personas of current customers

The second data can be used is the personas of current customers provide by Greenchoice. There are 5 personas called the convenience seekers, the innovators, the creature of habit, the do-gooder, the free birds, which identified by a four-quadrant diagram (Pitcure 3.5). Besides, each persona covers topics about lifestyle of these consumers, what can Greenchoice do for them and how to build communication with them.

These personas made by Essense, a company focus on consultant with consumer experience and understanding the needs of consumers. The translation of these personas are attached in the appendix.



Picture 3.5 Four-quadrant diagram persona

The four-quadrant diagram

In the personas, the customers are clustered based on a four-quadrant diagram in which the y-coordinate is Luxury and status (Luxe en status) vs modesty and solidarity (Bescheidenheid en solidariteit), and the x-coordinate is structure and maintenance (structuur en behoud) vs renew and change (vernieuwing en verandering) (Picture 3.5).

Y-axis

In the four-quadrant, the Y- axis represents customers' attitudes towards the value of household energy-related products. It is used to show that consumers are more interested in the practical benefits brought by the product, such as performance, quality,etc. Or more interested in the social value brought by the product, such as sustainability.

On the positive side, customers prefer to enjoy a high quality of life and expect products to provide better practical benefits and show their lifestyles. They value their personal life experience more, thus, they focus on the comfort of life and tend to enjoy higher-quality products. On the contrary, it means that customers are inclined to a more low-key lifestyle and enjoy connections with others. As a result, they are more willing to contribute to others and the world. When it comes to household energy, they will pay more attention to sustainability.

X-axis

The x-axis shows the attitude towards the lifetime of household energy products. The closer to the positive direction, the more customers prefer innovative and iterative products and have shorter expectations of product lifespan. Conversely, customers prefer to use the product for a longer time and have less interest in the innovation.

Although the current customers are different from the target group, the factors mentioned in the personas can represent a universal measure. By checking whether these factors have the same influence on the target group, the difference between current customers and the new target group can be clearly shown.

Five personas

The convenience seekers

Convenience seekers are people who prefer a carefree life. They are willing to enjoy their life, without much effort. Thus, they like to follow others instead of actively searching for information by themself. They lack knowledge about sustainability and are less motivated since they can not see the value of personal sustainable behaviour.

The innovators

The innovators treat social status and achievement as an important element of their life. They believe technology is beneficial to sustainability, and are willing to make sustainable choices if there is a financial opportunity without expensing their status and comfort.

The creature of habit

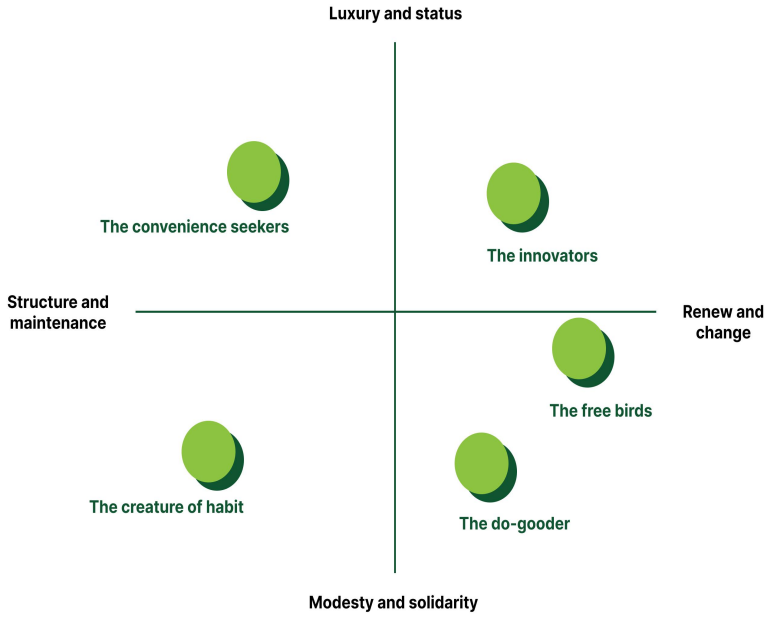
The creature of habits follows a sustainable lifestyle that is inherited from their family. Thus, they are more modest and do not tend to use the word ‘sustainable’ immediately. Besides, they have good social involvement but lack knowledge related to sustainability.

The do-gooder

The do-gooders have a spirit of solidarity and are willing to contribute to the environment to make their lives more meaningful. They actively put effort into making their life and society more sustainable.

The free birds

The free birds enjoy challenging themselves with new experiences. They believe innovation and creativity have a strong contribution to sustainability and noticed the importance of sustainability. However, they might not take much sustainable action when there is an influence on their freedom and own enjoyment.



Picture 3.5 Four-quadrant diagram persona

Factors from the personas

Similar to the contextmapping results, the factors related to decision-making and behaviours about household energy were selected. Besides the four factors (Luxury and status, modesty and solidarity, structure and maintenance, renew and change) in the four-quadrant diagram, the persona also shows other factors that are able to influence the decision-making related to household energy while explaining the lifestyle and interests of current customers in the text part.

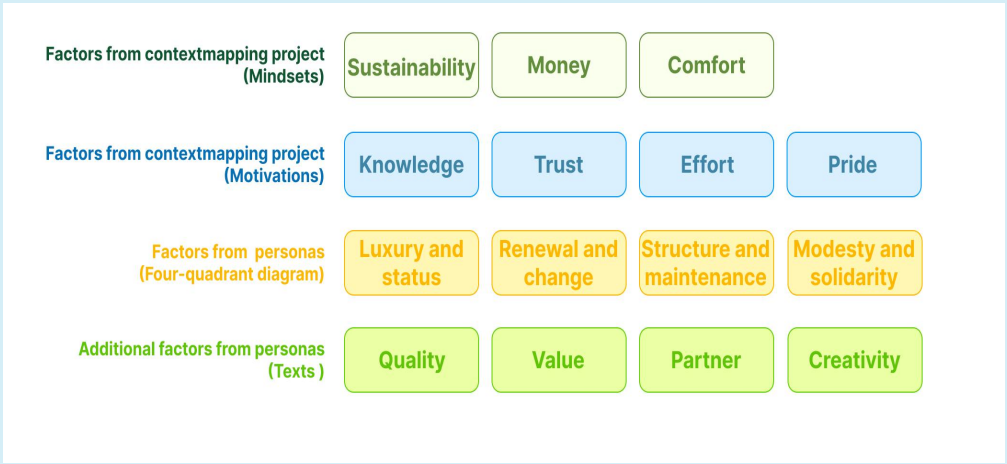
To collect these factors, the text part was translated from the Netherlands into English, and sentences showing there are elements that influence customers' behaviour related to household energy are quoted. This relevant text was extracted from the transition and summarized into 15 topics. To simplify the research process of making the survey questions, these topics were concluded into 9 factors. Besides the knowledge, trust, cost, comfort and pride which are covered in the factors from the context mapping project, there are 4 new factors collected from the personas, which are values, partner, creativity and quality. The form below shows the selected texts as well as topics and factors summarized by them.

Form 3.1 Factor selection process of personas

Factors	Topics	Text quotes
1. **Values**	1. Values of sustainability	...Appreciate sustainable behavior...
	2. Values of personal sustainable actions	... they are not the see the value of personal sustainable behavior through which they feel less responsible to contribute to a sustainable society...
	3. Personal advantages	... convenience, price and fun first... ...try (to attract) the convenience finder by focusing on other personal advantages. ...willing to make sustainable choices provided they see (financial) opportunities and it is not at the expense of luxury, status and comfort...
	4. Traditional values	They cling to traditional values ... ...they do live sustainably. Important drivers for their sustainable lifestyle are sobriety and a modesty that they often inherited from home...
	5. Future values	...convince the innovator that now Greenchoices will yield benefits in the future...
2. **Partner**	6. Together	...improving the world together... ... (Greenchoice can) challenge them to make a green choice together with their social environment..
	7. Social norms	...Address social responsibility, locally and international...
3. **Creativity**	8. Creativity	...believe that creativity can make an important contribution to the sustainability issue...
	9. Innovation	...Trigger them through innovation and surprise... ...looking for new experiences and like to challenge themselves...
	10. Technology	...highlight technical and innovative products... ...believe that technology and good entrepreneurship solutions...
	11. Surprise	...Stimulate them with surprising content...
4. **Quality**	12. Appreciate, and enjoyment	... not at the expense of luxury... ... it should not stand in the way of their personal freedom and their own enjoyment...
5. Knowledge	13. Lack of knowledge	... the lack of knowledge about sustainable solutions and their resistance is against it.
		... often do not know which products are sustainable...
6. Trust	14. Transparent	Be transparent and tell the whole story...
7. Cost	15. Financial value	...willing to make sustainable choices provided they see (financial) opportunities... ...price first...
8. Comfort		... not at the expense of comfort...
9. Pride		... not at the expense of status ...

As a summery, there are 15 factors collected from the context mapping and personas, which shows as the picture below.

Additionally, the structure of the personas will be kept and used to build new personas for the target group. This will make it more understandable for employees in Greenchoice and able to present the difference and similarities between the target group and current customers in a clearer way.



Picture 3.6 Summary of factor collection

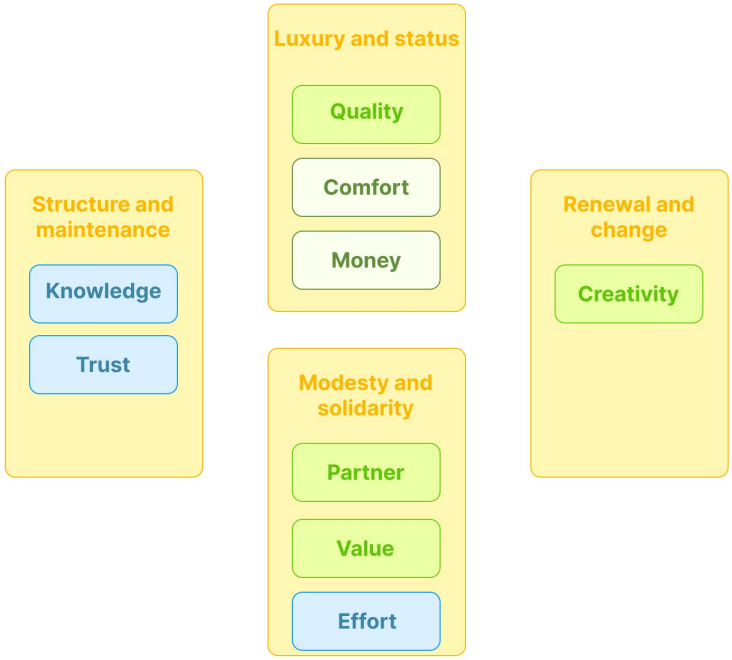
3.3 Factor re-cluster

Based on the factor collection from the context mapping project and the personas of current customers, two problems need to be solved before building a questionnaire for the survey. Firstly, the 4 factors that came from the four-quadrant diagram of the persona should be divided into smaller factors since these factors are too broad and hard to understand for participants. Secondly, all factors should be checked whether there is an overlap and group the factors that have a close relationship together to smooth the flow of the survey.

Thus, the next step of collecting factors that influence the household energy-related decisions of the target group is to compare factors collected from the context mapping project and the personas and cluster them into suitable groups for analysis.

Explain the four-quadrant diagram by other factors

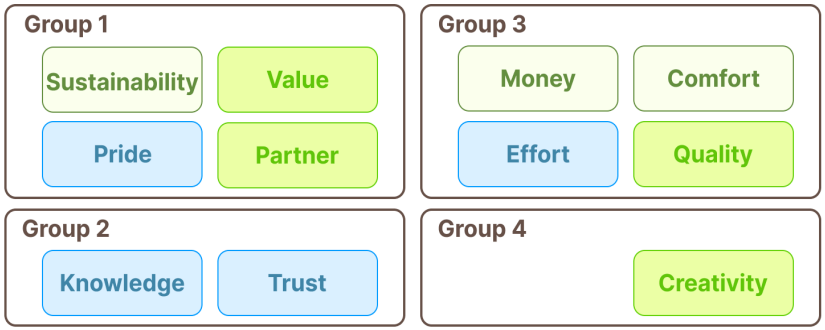
As a solution to the first problem, factors from the four-quadrant diagram were explained by factors collected from the text of personas. Since the quadrant diagram is used for designing different personas, the text part can well cover and explain the meaning of each quadrant with detailed elements and examples.
Based on the meaning explained in chapter 3.2.2 , these factors were defined as one or more factors as shown in the picture 3.7.



Picture 3.7 Explain the four-quadrant diagram persona by other factors

Group the factors

After dividing the four factors above, there are 11 factors left (Picture 3.8). To make the survey well structured, these factors were re-clustered into 4 groups based on whether there is a clear relationship and whether the factors have an overlap that is hard to be separated. The order of these 4 groups was set based on the consumer decision-making process model to make the process of filling out the survey smoother.



Picture 3.8 Four groups of factors

Group 1 Pride, partner, sustainability and value

The first group included factors related to general sustainability and lifestyle habits. These factors are broader, more basic, and more applicable at the beginning of a survey. Furthermore, people's attitudes toward these factors can reflect whether they view household energy sustainability as an individual responsibility or as a group achievement. These factors will be combined with demographic questions related to limitations related to household energy to explore the first step of the decision-making process, the needs and attitudes.

Group 2 Trust and knowledge

There is no question at knowledge and trust are closely linked together. The second group of factors aims to analyse the information-searching step of the decision-making process which focuses on how people get information related to household energy and how much they trust the information they got.

Group 3 Cost, comfort, effort and quality

The third group covers factors that show the difference between products and services, these factors are closely related to a product's performance, such as cost, functions and appearance and are able to help the target group to make decisions in the evaluation of alternatives step of the decision-making process.

Group 4 Creativity

The last group only focus on creativity. In the household energy field, creativity is mostly related to smart technology and digital products. It is separated from other factors since they are not relevant for all household-related products or services, therefore extra explanation is needed for this factor before showing the questions in the survey.

3.4 Build the survey

As the re-cluster result, the questionnaire contained 5 question sections, each section covering one of the four groups of factors. Besides, these 4 sections, there will be a demographic section to identify the participants and more importantly to check if there is any limitation for them to choose an energy provider and install energy-saving measures.

As explained in Chapter 3.3 the structure of this questionnaire was built basically on the consumer decision-making process to help the participants follow the questions. The survey questions related to factors aim to measure the influence of these factors on the decision-making related to household energy of the target group. This will be checked from two directions. On the one hand, the survey will check whether the target group considered these factors when they choose a household energy provider/product/service or make household-related actions. On the other hand, the survey will check whether the target group will be encouraged to choose a provider/product/service by improving one of these factors.

Some literature related to the influence of factors on household energy consumer behaviour and their decision-making is used as inspiration to build the questions. Questions about factors that did not mention in the literature are made based on the purpose of the question and used a similar structure to other questions. At the end of the survey, there is one extra question to ask the participant to measure the priority of these factors. Most of the questions in the questionnaire used a five-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree), and a small number of questions used multiple choice or ranking questions to make the questions more clear, and short, and to obtain better data analysis.
The list of questions and the aim of each question are shown in the appendix (question collection).
The details of the scales of each question can be found in the questionnaire in the appendix.

For the data collection, 40 participants were aimed to be found. Due to the target group being matched with university students, part of the participants are reached by students at TU Delft, other participants are chosen from people on the street of Rotterdam. Before they start the questionnaire, they will be checked whether they fit the age group of the target group, a consent form is used to inform them the goal of of this project and what kind of questions will be asked people who did not agree with the consent form will not able to fill in the questionnaire. Additionally, data from a participant that did not finish the entire questionnaire will not be used for the analysis since the data might influence the final result.

3.5 Analysis

The online questionnaire was sent to 43 participants and got valid 40 responses. Three responses were deleted since one of the response is not fit the age group of the target group, and the other two responses did not complete the questionnaire. The purpose of this survey is to measure whether people treat the selected factors as an important factor that is able to influence their decision-making related to household energy, and the priority between all these factors. The data analysis will be done by multiple steps to zoom in on the design directions and support with the next design section.

Firstly, the data of each question will be analyzed and valuable insights related to each factor will be discussed. The analysis is done by measuring the percentage of participants that are influenced by the factors and checking if the factor has a strong influence or weak influence on the participants. Later the priority of the factors is measured based on the last question that raking these factors. The insights of the result are still shown based on the clustered group. The tables of each question analysis results are in the appendix.

The next step is to narrow down the design directions based on the insights from the factors. It will start with a factor selection. The factors have less influence on the participants and the factors that are hard to improve by product or service in a short period of time will be set as a less important factor for this project. Besides, small changes to these factors will be made to support the next section.

In addition to the factor selection, the design direction will be further narrowed down by zooming into the majority of the target group. To better explain the target group to Greenchoice, the personas of the target group will be shown by the same four-quadrant diagram as the personas for current customers. Based on the data analysis, personas that fit the majority of the target group will be selected for the next design section.

Finally, some questions will be collected for the co-creation section to further dive into the insight related to the valuable factors and help with create opportunities for Greenchoice.

3.5.1 Demographic section

The ownership

The first result that will be discussed is about house ownership. Due to their young age, most target groups are still renting (88.1%) rather than buying houses (11.9%). This also means that they might have less control over their household energy products, the survey shows that there are only 28.57% of participants are free to choose their energy provider and 35.71% of participants have limitations and one-third of people can not choose the energy provider by themselves. Compare with the energy provider, the target group has more freedom to install energy-saving measures (only 7.14 % of people can not install any) and the most common energy-saving measures are the LED bulbs (31.94%)and window film (18.06%), followed by the water-saving shower head (13.89%). This shows that although most of the target group does not own a house, there is still a big opportunity to provide green energy and energy-saving products to these people.

3.5.2 Group 1 Pride, partner, sustainability and value

Sustainability and value

The servery shows that 69.05% of people will choose an energy provider with sustainable energy. Besides, 76.19% of people believe they could contribute to solving energy problems and 95.24% of people think reducing energy consumption is a personal choice.

Such a result shows that the target group sees the value of environmentally friendly energy and see their propensity to put it into action.

Pride

Pride can be shown by whether people are willing to show their actions or considerations to others. This survey covers both sharing it online and with people. 95.23% of the target group will discuss sustainable household energy with others, but only 16.67% of the target group willing to share it online. This shows that most people prefer to treat this as a personal action instead of something to show off. Which makes the pride factor less important.

Besides, such big number of people willing to discuss sustainable household energy also represents the importance of sustainability to them.

Partner

The final finding from this section is that social norms play an important role in motivating the target group to take sustainable actions. Most of people tend to reduce their energy consumption by the influence of others. The result shows that 80.97% of people agree or strongly agree that they will be encouraged by friends and family to reduce energy consumption, while 59.52% of people will be encouraged by comparing their consumption with others and 57.14% of people will be encouraged by saving energy as a group. Such result shows that people will be influenced by others, and they got more influence from the people with closer relationship such as their friends or family instead of random people.

3.5.3 Group 2 Trust and knowledge

Lack of knowledge

Question 1,2,3 in this section asked about the target group's willingness of searching and get more information related to household energy. 51.22% of the target group will search for information and 36.59% people will not. However, 95.12% of people are able to reduce their energy consumption if they got more practical information. This shows that people notice the lack of knowledge of practical solutions for reducing energy consumption.

Sources of information

The result shows that friends (31.4%) and news (27.91%) are the most frequent platform that the target group use to collect information related to energy consumption and sustainability. And people will get more information from blogs (37.5%) and videos (18.06%).

Trust

The result of question 7 and 8 in this section shows that people trust their energy providers even more than the information they find or got from other platforms. All participants are trust or neutral about the information, while there are still some people who don't trust the information they found (4.88%).

3.5.4 Group 3 Cost, comfort, effort and quality

Cost

The first question in this question compared the importance between cost and sustainability. The result shows that both price and sustainability are valuable for the target group but the cost is more important 51.22% of participants choose an energy provider/service/product based on the cost and 82.93% people will choose the cheaper provider. The other half participants will consider both of these factors, but still, 7.32% of people make their decisions based on sustainability.

Comfort

When choosing between comfort and energy consumption, 95% of people agree that they tend to put more effort to reduce their energy consumption even sacrificing some comfort. While 75.61% of participants agree to achieve it by adjusting the light, and 51.22% of people agree to use a lower temperature while showering or have a shorter shower.

Quality

Based on the result, 78.05% of participants agree that the quality of the product/service has an influence on their decision-making. With different factors to assess the quality, the user experience is the most important factor, followed by the appearance, and service life, and customer service is less important.

Effort

People do think investing in green energy products/services require more effort (78.05%). besides, 60.98% of people agree to take more effort for housework to reduce energy consumption, but 21.96 % of participants disagree or strongly disagree with this. Compare with people who disagree with sacrificing comfort (12.2% related to showering, and 0% related to the light) the target group are less tolerant of effort.

3.5.5 Group 4 Creativity

More than half of the target group will search for the current product (56.1%). however, only 17.08% of participants were willing to install a product that they did not use before and 19.51% of people were willing to switch their household energy-related products. This shows that people tend to follow familiar energy providers and products

Regarding the AI technology applies in the household energy field, 87.8% of participants are interested in using AI to monitor and analyze the data on energy consumption, and 75.61% of participants are interested in using it to control the appliances. Such a result shows that the target group is open to AI technology related to household energy.

Although AI is welcome by most people there is a small group of people have strongly disagreed with using AI products to monitor their energy consumption (2.44%) and 12.2% of people dislike is for controlling their appliances.

3.5.6 The priority of factors

The priority order of these factors shown by the result of the survey is cost, comfort, quality of the product, convenience, level of knowledge of the product, creativity, and sustainability.

The conclusion shows that the importance of cost far outweighs other factors. The rank of comfort, convenience and quality of the product are really close to each other, and the creativity, level of knowledge and sustainability are close to each other.

Picture 3.9 Priority of factors

3.6 Factor selection

To narrow down the design direction, some factors will be treated as less important than others and some changes were made for the next section. According to the analysis, some factors might be harder to provide extra value to attract the younger household starter. The factor is selected based on whether they have enough influence on the decision-making of the target group and whether Greenchoice could attract the target group by improving and providing the factors based on their product or services.

Less important factors

The factor pride and value were chosen to use as less important factors for further section. The survey shows that only a small amount of the target group is willing to show their sustainable-related actions to others, which means the target group did not treat pride as an important factor for most people. Therefore the factor pride is set as less important than other factors in the design section. As for the factor value, since the target group has a good attitude and understanding of values, there is no need to further focus on showing the value of sustainable household energy to the target group. Besides, the value is hard to be changed by a product or service which makes the factor value less important than other factors in this project.

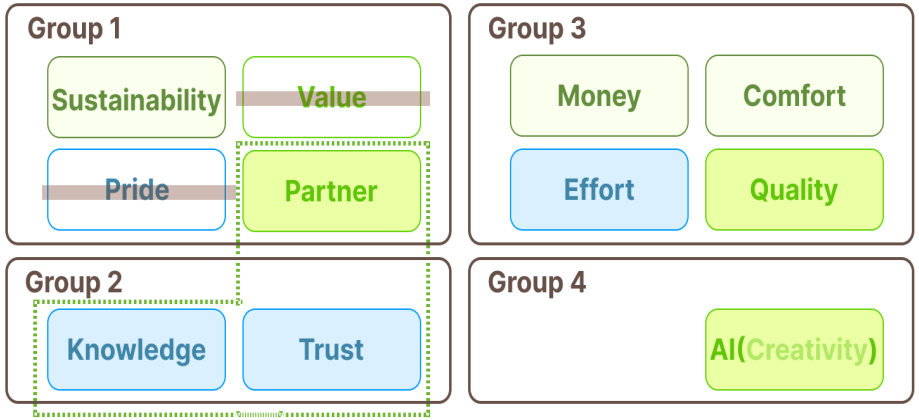
As less important factors, these two factors will not be actively mentioned during further analysis, however, they will not be completely deleted from this topic since this might cause a risk of biases. These factors will still be used and discussed during further sections if the participants mentioned them during the workshop.

Relations between partner, knowledge and trust.

Since the survey shows that people with closer relationships are the most common sources for the target group to get information, the partner factor is linked to knowledge and trust in the later design process. The relations between these three factors will be further discussed in the co-creation section and might be used in the design phase.

Change creativity to AI

According to the survey result, the rank the creativity in the priority of factors is quite low which makes it seems less important. However, the majority of the target group is open to AI technology even if they did not show interest in replacing their old products. Therefore, instead of focusing on the creativity of a product or service, the further design section will focus on AI technology to explore opportunities for Greenchoice



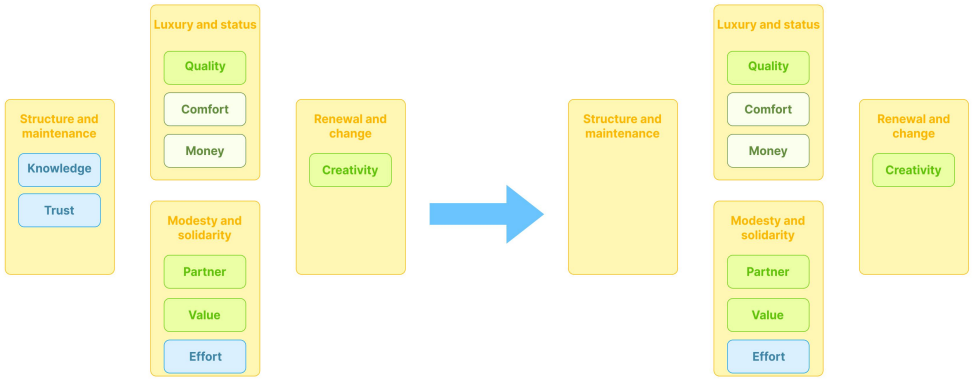
Picture 3.10 Factor selection

3.7 Persona matches

To further narrow down the design direction, the target group will be selected based on the number of their diffident lifestyle. In order to help Greenchocie to understand the target group and see the difference between the target group and their current customers, the target group will be present with the same persona structure. Therefore, the four-quadrant diagram and five personas are used for persona matches again. As a result 3 out of 5 personas are selected for the later design phase.

To put the responses from the target group into the same four-quadrant diagram Therefore the questions related to the diagram were collected based on the factors.

According to chapter 3.3, the factors on the four dimensions of the four-quadrant diagram can be explained by other factors used in the survey. However, the question related to knowledge and trust did not represent the direction of the X-axis thus, only the creativity factor will be used to map the coordinates (Picture 3.11). Questions related to each dimension of the four-quadrant diagram were selected from the questionnaire. The answers to these questions were noted by numbers from -2 to 2 (the details of these questions and notes are in the appendix) to map the participants into the four-quadrant diagram the note on X-axis and Y-axis are added separately. And the mean is calculated to draw all 40 responses on one four-quadrant diagram (Picture 3.12).



Picture 3.11 Factors used for matching the target group with personas

Picture 3.12 40 Participants on the four-quadrant diagram

While all responses are shown in the picture, the yellow line shows that the majority of participants are located at the bottom of this four-quadrant diagram which matches with the persona “the creature of habit”, “the do-gooders” and “the free birds”. This means the majority of the target group fits these three personas and might have similar lifestyles to them. Therefore, the next step of this project is to check and zoom into the difference between the target group and the current customers’ lifestyles.

3.8 Questions collected from the survey result

Before moving on to the next section, some questions collected from the survey results are summarized. Bu answering these questions, the co-creation section is able to dive into the reason and values related to the target group.

Information

- How do they get information from people they know
- What information do they interested in
- What kind of information do they willing to know

Quality

- What is a good appearance for the target group

AI

- What functions do people expect from AI?

Priority

- why this order?
- How do they rank the order?

Personas

- Are people from the target group similar to the current customers sssswith the same persona?
- If they are different, what are the differences?

Chapter 4
Design

This chapter explained the process of deeper dive into the understanding of the target group and come up with opportunities for Greenchoice. For this section, a co-creation workshop was designed.
The workshop has three main proposes. Firstly, it will be used to compare the lifestyle that did not cover in the survey to complete the new personas for the target group. Secondly, it will answer the questions that occur from the survey, to further understand their attitudes towards the factors. Finally, it will map out the top concerns related to household energy of the target group and transfer these problems into possible design solutions.
At the end of this section, the lifestyle part of the personas of the selected target group will be completed, besides recommendations of what can Greenchoice do and how to communicate will be provided.

4.1 Co-creation

Based on the result of the survey, most of the target groups are located at the bottom of the four-quadrant diagram, which matches with the creature of habit, the do-gooders and the free birds. To further zoom into the design directions, people from these three personas are chosen to join a co-creation workshop to dive into their needs related to household energy. The workshop is aimed to find out their problems in current situations and come up with suitable products or services as a solution for them. To support the participants describe their problems and desired solutions, the workshop was built based on the consumer decision-making process model to simulate the usual problem-solving steps.

In this section, three workshops were held. In each workshop, two participants from similar personalities will work on the templates together for discussion. The workshop started with a short introduction, followed by 3 templates about household energy and related problems solving processes, the workshop ended with a discussion that allows participants to explain their situations and ideas further. Besides, questions related to their lifestyles and further discuss the reasons behind the survey result. In the end, recommendations of communication and what can greenchoice do will be made based on their needs and lifestyle.

These workshops aimed to answer the following questions.
- What are the main problems related to household energy do they facing?
- How will they collect information and solve their problem?
- How do they think about AI?
- Do they have a similar lifestyle to the original personas.?

Picture 4.1 Process of workshop based on decision-making process

4.2 Process of the co-creation workshop

Select the participants

Before the co-creation workshop, suitable participants are selected. Since the survey shows that most target groups fit the persona of the creature of habit, the do-gooders and the free birds (Chapter 3.7 persona match), the co-creation workshop will focus on younger household starters from these three personas to zoom into the needs of most people from the target group.

The selection is done by asking people to answer the questions related to the four-quadrant diagram which is listed in Chapter 3.7. By mapping the responses into the four-quadrant diagram, people from the selected personas are shown.

For the co-creation workshop, 2 people from each selected persona (the creature of habit, the do-gooders and the free birds) were found. Therefore, 6 participants in total joined the workshop.

Step 1: Map you and your home

Action: In the first step of the co-creation section, the participants were asked to fill in the appliances they owned and draw the most important household energy appliances they have at home on the first template(Picture 4.2).

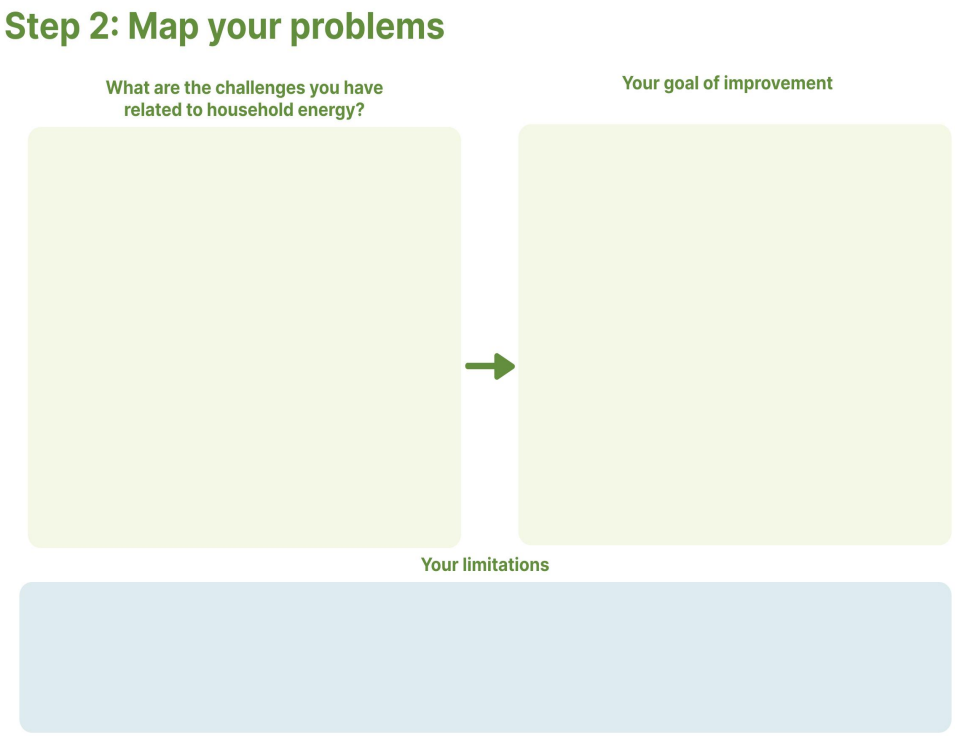
It is used as a warm-up section to help participants recall their experiences with household appliances by thinking of what appliances they currently owned. Thus, they can recognize the problems they are facing and the expectations of household energy-related products.

Picture 4.2 Workshop step 1

Step 2: Map your problems

Action: Participants will be asked to fill out the top concerns or challenges they have related to household energy and their ideal results of the solution. They will also list the limitations that have prevented them from addressing these issues so far. After finished, I will let them explain their answers.

The second section matches the first step of the decision-making process which is the reorganization of needs. Since the survey shows that most of the target group have restrictions on their household energy decision-making, the limitations might have an influence on their situation. By asking participants to write down their limitations, templates can lead participants to think about the causes of their problems. And, breaking these limitations may be the key to the next step of the co-creation workshop which is creating design solutions to solve their problems.



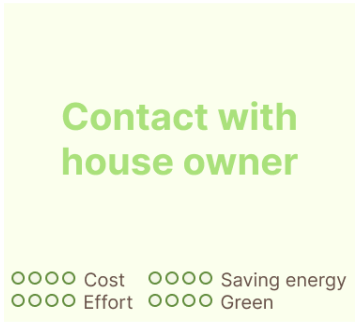
Picture 4.3 Workshop step 2

Step 3: Map your solutions

Action: In this section, participants were asked to create possible solutions for the problems they mentioned in step 2 and map the process on the template. To help the participants to create their solutions, some basic ideas which can be used as starting points are provided to them (Picture 4.4). After that, I guided participants through the explanation process, they answered how they willing to collect information, what could be solutions they considered and what actions they will decide to take.

This section shows the action part of the decision-making process. Which is combined with the information search, evaluation of alternatives and purchase decision. By asking participants to map out their process of solving their problem, the priorities and whether they will solve the problem in a short or long-term process can be shown.

The solution cards were made based on the factors left and changed after the survey analysis. For each factor, there are some cards with simple ideas that can be used to solve problems related to this factor or that can be used to solve household energy problems of the target group through the factor. The list of all cards is shown in the appendix. Each card contains a place for participants to explain how much money and effort they willing to spend for the solutions, and what is the expect sustainable level achieved by the solution. Besides, participants can make new cards with empty cards (Picture 4.5) or block a card if they don't like this kind of solution.



Picture 4.4 Example of solution card

Picture 4.5 Example of empty card

Picture 4.6 Workshop step 3

Step 4: Discussion

Action: In this section, I led the discussion section. We evaluated the solutions and more questions related to their personas. The possible questions are shown in the appendix.

The final step of the workshop is a discussion section which covers the post-purchase evaluation step of the decision-making process, and questions occur after the survey analysis. Firstly, the details of the solutions they created will be discussed to make the design clearer and more complete. Secondly, whether the participants think the solutions could achieve their ideal results mentioned in step two will be discussed. Finally, questions related to their lifestyle will be asked to refine the differences between target customers and current customers. (List of possible questions are shown in appendix)

4.3 Analysis

The insights from each workshop are collected through quotes. The data covers problems related to household energy that participants face and link to relevant solutions. Besides, the difference in lifestyle between the target group and previous personas were collected.

Insights from the workshop with the creature of habit (rented, shared house)

Problems

The first problems mentioned by the participants are the difficulties of communication. While they have to share appliances with others, although they are dissatisfied with others' behaviour, they are afraid to speak out in order to keep a good relationship.

> A: "It is not convenient to share appliances with others. You don't want to break the relationship, but sometimes you really feel not that comfortable with their behaviour. But it is hard to tell them directly."
>
> B: "Yes, and even if you want to say it, it is hard to find the right timing."

Besides, household energy is not a common topic to discuss with roommates. People found they prefer to talk with their friends about it even if it may not be able to solve the problem.

> A: "Most of the time, you just complain about it instead of asking for solutions."

The second problem is related to the satisfaction of the appliances. The participants mentioned that the products do not meet their demand, especially the bigger appliances such as washing machines, and personal appliances such as fans and radiators. These products they owned are not fully functional, but they do not tend to spend more money on buying a new one.

> A: "The radiator can not warm up the room, you still need to wear a sweater at home. The bed was freezing in winter. "
>
> B: "But you will not buy a new one, they are expensive, and you don't want to spend money on a house you don't own. I don't know how to deal with the old one either."

Solutions

Regarding the solutions, participants mentioned that they enjoy a face to face contact or online chat with people with similar problems. Discussion of their solutions will be more helpful than an advertisement. When they can not find suitable solutions they will also try to contact the house owner for asking suggestions.

A: “I usually start with finding people. ”

B: “Yes, sometimes I tried to contact people who lived there before. You trust this information because these are real people and real solutions. Or the house owner, they know the situation quite well. ”

If they can not get solutions from people, they will try to ignore these problems or buy cheap products to improve their situations. The price can help them to make quick decisions and sustainability is a good addition if you do not need to pay for that.

A: “It is not that bad. Also usually you can’t solve this problem with a cheap solution. Actually, I can put up with this inconvenience”

B: “I will try to buy some cheap products, no more than 30 euro, like a small fan (for summer) to make it a bit cooler. Just choose the cheapest one in the shop.”

Q: Will you consider sustainability?
B: “ If you don’t need to pay more for that, of course. ”

Attitudes towards AI

Finally related to AI, participants are not really willing to use it for a rented house since they will not buy a house within a short period. Besides, they are not sure what can AI do and did not see the value of using it.

A: “Currently, I don’t this AI is necessary for my home at least. It is good but not needed for me.”
B: “I am not sure what can AI do. But I think I can live without it.”

Lifestyle

The lifestyle of the creature of habit form the target group is very similar to the current customers. They enjoy their relationship with others and carefully take care of their social relationships. Both participants agreed that frugality and sustainability are lifestyles that developed from an early age. Also, they lack knowledge since they will not actively search for information unless they are facing problems and most of their information are come from friends

The suggestion of what can Green choice do:
Provide a knowledgeable but simple explanation
Focus on solving their problems

Suggestions for communication:
A cheaper solution might help them to make decisions
Make things easier

Insights from the workshop with the do-gooders

Problems

The main problems for the do-gooders are the unbalance desire between being more sustainable and their actual ability to achieve it. This can be shown by barriers.

The first barrier mentioned by the participants is their financial pressure.
They have to secure their lives before they have the energy to focus on sustainability.

A: “I think the first limitation I can think of is related to money. Sustainable (energy) products are usually more expensive.”
B: “I cannot only pay for sustainability, there are too many things I need to spend money on, like food, my car...”

A: “At this stage, you need to make sure you have everything you need for life, and you don’t concerned about quality that much. ”

The second barrier due to the limitation of the house type.

A: “I was willing to install the solar panel before, but I can’t install it in my current house. That’s why I choose to have green-energy providers. But I still think that will be nice to have a solar panel.”

“Solar panels make your achievement more visible, they make you notice the effort you put into sustainability. ”

Besides, the participants mentioned their expectation of more precise control over energy consumption.

A: “Actually, you don’t know where all the electricity goes. I can only notice it when I open my radiators in the winter. ”

“Sometimes I worry about my lights at home, I need a light that is bright enough for work, but not all the time, You feel wasted when you don’t need such bright lights.”

B: “Similar to the radiator, you have to switch it several times a day to make the temperature suitable .”

Finally, participants mentioned that they don’t know what they can do to reduce energy consumption anymore, since they’ve done a lot within their ability.

A: “I used to search for tips to reduce my consumption, but I haven’t had any new ideas recently. I think I’ve done the best I can, and if I want to continue to improve the situation, I need to invest more money. ”

B: “I think some practical factors are my biggest obstacle, I have done what I can do, but now I really don’t know any other action I can do. Maybe I need to collect information differently, but I don’t know how”

Solutions

Will discuss the solutions, participants mentioned that they need a better way to get information, they want to know more about new products and tips from experts. The information needs to be integrated and can be constantly updated.

A: “I search for information online, this is the easiest way for me. You can get almost everything you need. But sometimes you may feel that these methods are not practical enough or are not suitable for your situation. ”

B: “I also check YouTube videos, I followed some YouTubers and I used to check their videos. You can find the most recent tips from there. Tips from real life as well.”

“Or some experts, if you know someone who works in energy, they could be really helpful. ”

“I like to get everything from one platform, it saves a lot of time.”

Besides, they think sharing could be a nice solution to reduce the cost pressure. A shared or second-hand product will not influence their satisfaction, as long as it is safe and clean.

A: “I am slowly replacing the products I am using with more sustainable and smarter products. I just replaced my original lights with LED lights that are able to change the brightness and colour. I brought a second-hand one, but I like it. It’s the same as new but much cheaper.”

B: “I don’t mind second-hand products, or sharing products. I used to have these when I was in university, they are really cheap. But they should be clean.”

A: “Safety is also very important. You need to find a trusted seller and check the product before using it.”
“ If you can talk to the seller in detail, you can easily buy a satisfied product. ”

Finally, they are willing to have more control over their energy consumption, such as getting the data on the energy consumption of every single product, a more frequent data analysis and setting the time of use.

A: “I do willing to have a meter to check the energy consumption of each of my appliances. But I think I only needed it once, or a really short time.”

B: “Or it could be real-time consumption monitoring. You can still get the data, and you can know how long you’ve used the product, then you might know how to improve the situation. ”
“I do think that knowing how much energy I have used is more clear than just knowing the price.”

“Also it will be great if you could adjust the appliances you have. I like the new LED lights. Also, there are some radiators that can shut down automatically by setting a timer or temperature. ”

A: “Yes, maybe AI can help with that. Like both for monitoring and control?”

Attitudes towards AI

Participants from the do-gooders already think of using AI to solve their problems such as for monitoring and controlling the appliances. But they are worried about the price and did not get ready to change their house appliances. When the technology is well developed and they could get more feedback from others, such technology might be used by do-gooders who just brought a house.

A: “They must be expensive though. And I don’t know if I will switch everything to a smart product.”
B: “It will be really difficult, especially since everything in my house is still quite new.”

“Maybe when the technology is very mature and people around me start to use it, I will consider such products.”
A:“Or when I buy another house, haha”

Lifestyle

Compare with the current customers from the do-gooders persona, the target group has more limitations such as financial pressure and the limitation of their house ownership. Such limitations make the target group from the do-gooder less ability to realize their ideal of contributing to sustainable life. It makes them more eager to find more tips and solutions and have a desire to control their energy consumption.

The suggestion of what can Green choice do:
Provide detailed information to help them make decisions

Suggestions for communication:
Check their goal and limitations firsts
Trigger them with long-term benefits

Insights from the workshop with the free birds

Problems

The first problem mentioned by the participants is related to information and communication. On the one hand, they are eager to have a better platform to search for the most recent and trusted information. On the other hand, they are willing to find more people with similar interests.

A: “New technologies are attractive, and I enjoy spending time searching for relevant information, watching videos, blogs ..., I also joined a chat group about new technologies, and sometimes there is information related to household energy as well.”

B: “I also read blogs and news. But I have doubts about this information. The same topics will be repeated over and over again .”

“I like to discuss it with my friends, but they are not always interested in the topic. And they don’t know much about innovations.”

Besides, they also need to balance their financial ability and their interests. A creative and innovative product seems risky since they are expensive and lack of feedback. They buy the product for fun or to improve their life, but not for the technologies. For young people, innovative products are more attractive, but their financial ability is not enough, especially for those who just bought a house.

A: “New products are always way more expensive, and you can’t guarantee they are practical. I always bought products with creative functions but they are not helpful.”

“Since the product was not working well, I have to buy a replacement and put away the old one. ”

“You think that it is a waste of money, but you don’t know what to do with the product. I thought about reselling them, but it was hard to find anyone interested in them.”

B: “I do need to save money for the product I like. Actually, I know these are not something I can afford, since I just brought my house, and have to use the money wisely. ”

“I don’t want to pay that much for a product that is without feedback, even if it seems great. I actually trust comments more than the introduction of the product.”

Thirdly, they have more expectations of a convenient and joyful life. Reflecting on the product, they hope that the control is simpler, the product is more environmentally friendly and has more functions in one. They should support their life as well, such as building an atmosphere at parties. As long as the product is good to use they don’t mind borrowing one. But not always have a chance to do so.

A: “Convenience is very important, I like products with multiple functions. But simple interface. If you want your home to be a place to relax, then you need appliances to support you, but not waste the energy.”

B: “Yes, everything in one will be great, but these kinds of products are complex to use. I do like to have one remote or button than multiple. Even for my energy consumption, I only check the app, and never check the emails. ”

“Good user experience always comes first for me. Sustainability is also important, but only as an addition, I have to spend my money on those more important factors first. ”

A: “I like to invest people in my home for parties, so they (appliances) should support different situations. Sometimes I will borrow from my friends, but they are not always available.”

Solutions

To solve the problems, the idea of making an online group came up during the workshop.

Firstly, there should be a place to collect all information related to household energy. Besides, the platform should be able to gather people with similar interests. It could be added to an application with data of energy consumption so you don't need an extra app.

A: "I would contact people in the same interest group. And find more people who are interested. If I could know more people, maybe it will be easier to resell my products. Or we could share our products together, and also try out the product before buying it. "

B: "I do like to have an online group with people interested in new products and sustainable products. And we could share and discuss the most current information with each other. "

"Discuss the products they have used before, and give suggestions to each other. "

"It could be a good place to get second-hand products as well, but I am not sure if this will be trustful."

Attitudes towards AI

People from the free birds are very open to new technology and new products. But they have more concerns about it as well. They evaluate the product based on its functionality and how will it help with their life. They do trust that AI could make their life easier through automatic control, and systematic control. They also think that will also make their life more sustainable.

A: "Like control all appliances on your phone? Sometimes I'm too lazy to go up or down stairs to turn off the appliances..."

B: "Yes, I usefully forgot the light downstairs. If I could control it with my phone. Also, control the temperature. It will be the easiest way for me to become more sustainable."

"Maybe it can set your using time based on the goal of saving energy. Like make a plan for energy consumption, and give some suggestions. You can reduce the temperature while showering to save more energy, for example."

Lifestyle

The free birds enjoy challenging themselves with new experiences. They believe innovation and creativity have a strong contribution to sustainability and noticed the importance of sustainability. However, they might not take much sustainable action when there is an influence on their freedom and own enjoyment.

Similar to the current customers from the free bird persona, the target group also shows strong interest in having new experiences. And indeed, possession is not that important to them. They are willing to spend more money on improving their life than on sustainability or even creativity, making it more comfortable and convenient. Enjoyment is important, and they believe technologies can help them to make their life better. They are interested in creativity and technology but have doubts about these since they have experienced not being satisfied with the product. At this stage, they will consciously balance their interests and needs for the product.

The suggestion of what can Green choice do:
Provide a knowledgeable but simple explanation
Focus on solving their problems

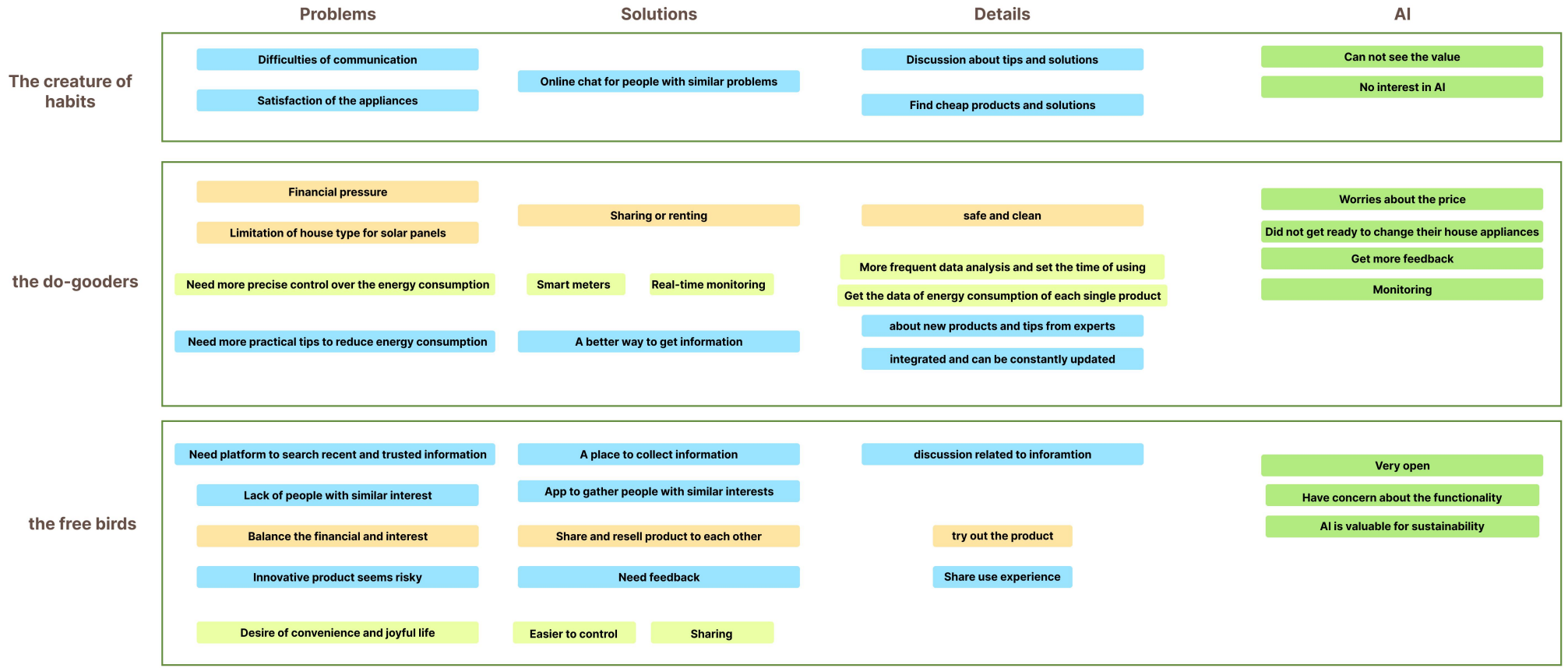
Suggestions for communication:
Trigger the free birds through a good user experience
Be humorous

Chapter 5
Delivery

This chapter summarized the problems and solutions collected from the co-creation section as opportunities for Greenchoice. The final deliverable is shown by a road-map that presents these opportunities and the strategy plan based on three horizons. How is roadmap built and a detailed explanation of actions in each horizon will be introduced in this chapter.

5.1 Opportunities

Based on result form the co-creation workshop, the insights from each group of target group are summarized into 4 topics, the problems, solutions details and AI. These problem and solutions are grouped into 4 opportunities for Greenchoice, which are built communication and information platform (blue), sharing or leasing (orange), smart technology to control energy consumption (light green), attitudes towards AI (dark green).



Picture 5.1 Insight summary from workshops

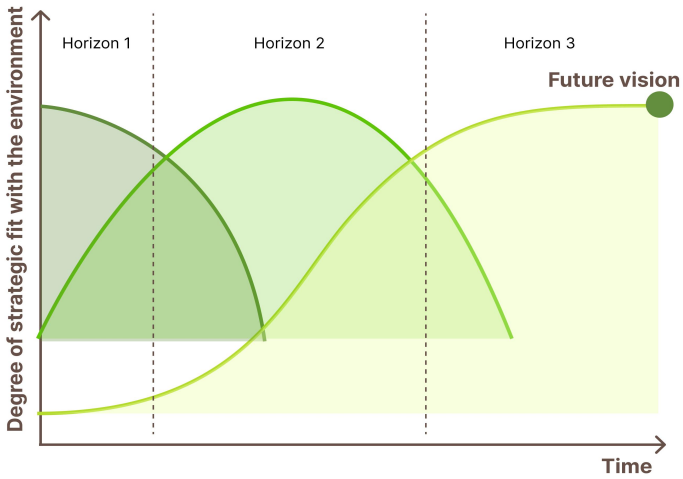
5.2 Roadmapping

As a result of this project, a roadmap will be delivered as the final result. A roadmap is a visual depiction of design innovation elements on a timeline (Simonse, 2017). In this project, the roadmap will be used to show the product and service opportunities for Greenchoice from 2023 to 2030. Generally, A roadmap need to have a future timeline and covers layers of user value, product/service, market and technology to explain the innovation step to explain the innovations(Simonse, 2017, p.12-14).

The timeline

The timeline is the most important element of a roadmap. The timeline will start with the current business situation of the company and end up with the future vision of the company. While creating the roadmap the timeline will be cut into three parts which are called three horizons (Picture 5.2). Each horizon represents a strategic life cycle in the innovation process. The innovation starts slowly at first, therefore, horizon 1 is made based on the current products and services of the company and makes smaller changes to the business model. Horizon 3 shows innovative design in the long run to achieve the future vision of the company. New product and services will be achieved and the business model might be grows or switches in this stage. Horizon 2 is used to connect the business process of horizon 1 and 3. New insights related to the need and values will be reached in this stage. The new technologies will be added to the market to prepare for actions on the horizon 3.

In this project, the time line is set based on the difficulty of achieving the design opportunities for Greenchoice, and a logical process from reaching the target group to design for the target group. Thus, the process will start by building a communication and information platform (blue) based on the website and app that Greenchoice currently have to reach the target group since Greenchoice has an application and website available to use as a starting point. Followed by sharing or leasing (orange) since this is a new service, and needs more time to get ready. The roadmap end with the opportunities of smart technology to control energy consumption (light green) and attitudes towards AI (dark green) since the relevant technology still needs to be developed.



Picture 5.2 Strategic Life Cycles model of Three horizond

User value, product/service, market and technology

These four layers are used to describe the actions that will be taken in each horizon and the purpose of these actions. Besides, showing the possible product and services that are able to attack the target group, the layers will represent the value driver of these solutions, the technology needs to achieve theses products and services and how will the market model changes through the process.

For this project, the layers are collected from the insight of co-creation workshops. The problems will be used to define the user values. The solutions with details will be used as the product/service layer, and relevant market and technology will be built based on the product and service.

5.3 Horizon 1

The topic of Horizon 1 is to bring Greenchoice to the target group. This first step for Greenchoice is to introduce themself to the target group. Since the result shows that most of the target group gets information from people who have relationships with them and are willing to find people with similar problems and interests, a platform for gathering people is used in this first horizon. The current customers, YouTube videos and blogs can be used as a channel to target customers.

The main user value for this horizon is to solve the problems related to collect of information and finding people with similar problems and interests related to household energy. For this reason, the application and website of Greenchoice will be developed.

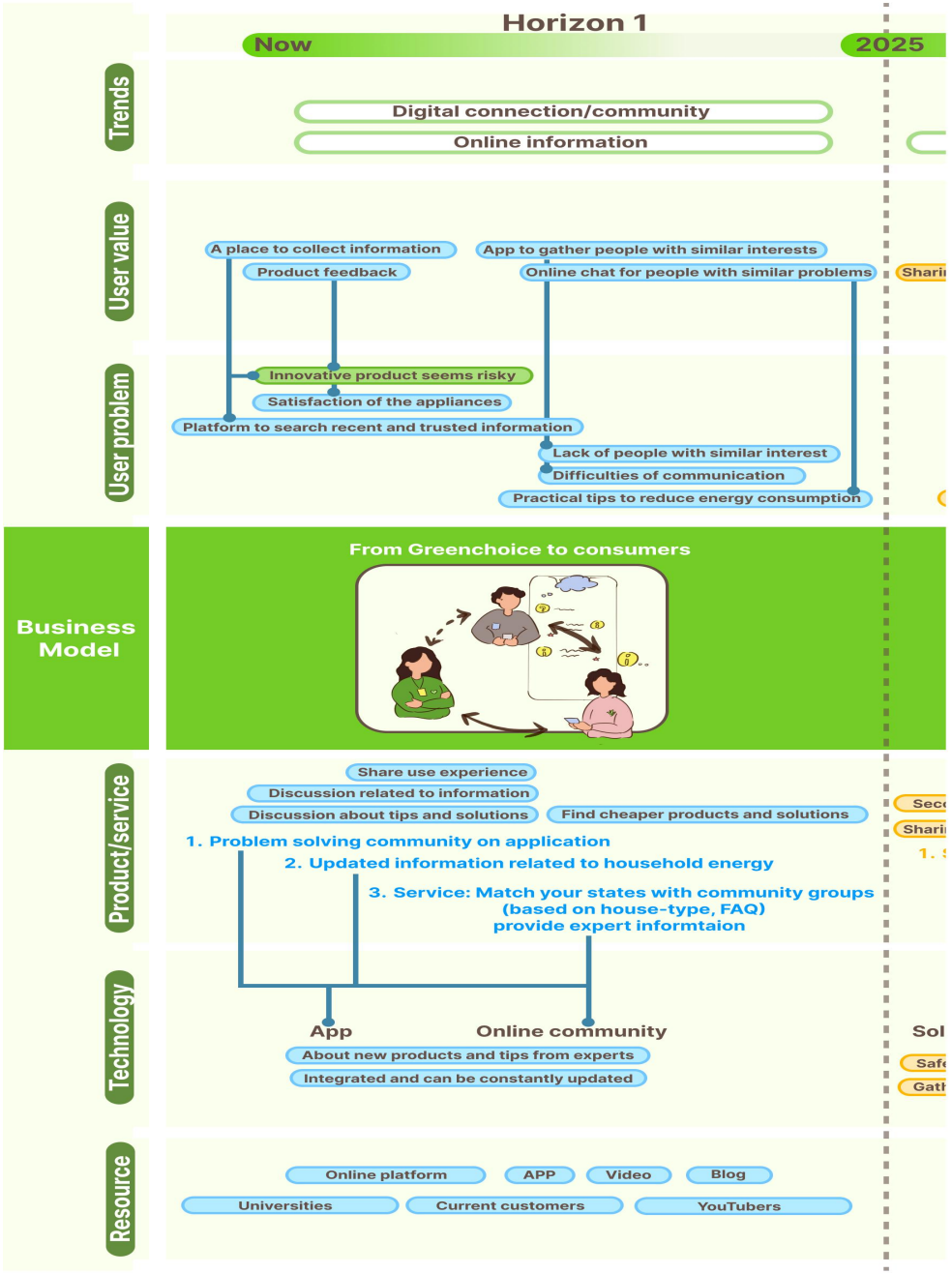
The platform for communication

Online Community

The online community will enable users to find relevant discussion groups based on their situation, such as house type, main problems and interested information. Within the group, topics related to practical tips and solutions to improve their energy consumption can be discussed. Besides, people can share their experience of using the tips, energy-saving products, how did they install solar panels and also their worries. This function can build a good environment of communication and make this platform becomes a good place to get practical information to attract the target group, at the same time introduce Greenchoice to them.

Information provider

In addition to the experience and tips people can get from the discussion and sharing in the online community, Greenchoice can also present as an expert and provide the most current information related to household energy. There could be some reading or video suggestions shared on this website based on the hot topics discussed in the community. This is really similar to what Greenchice is doing on their website, just the users should be joined the discussion as well. Through this function, this platform can keep professionalism and practicality and also shows the brand identity to people.



Picture 5.3 Roadmap H1

Business model

On this horizon, there are no big changes in the household energy product or services for Greenchoice. Therefore, the business model for household energy stays in a B to C model. There are two ways of reaching the new target group. On the one hand, the target group can be reached by current customers of green choice. Since they could be the family or friends of the target group and the survey shows that they are more tend to use the product they used before or influenced by others.

On the other hand, Greenchoice can introduce itself to the target group through this online platform. Besides, advertisement through YouTube, blogs and their university could be helpful to get the attention of the target group.

5.4 Horizon 2

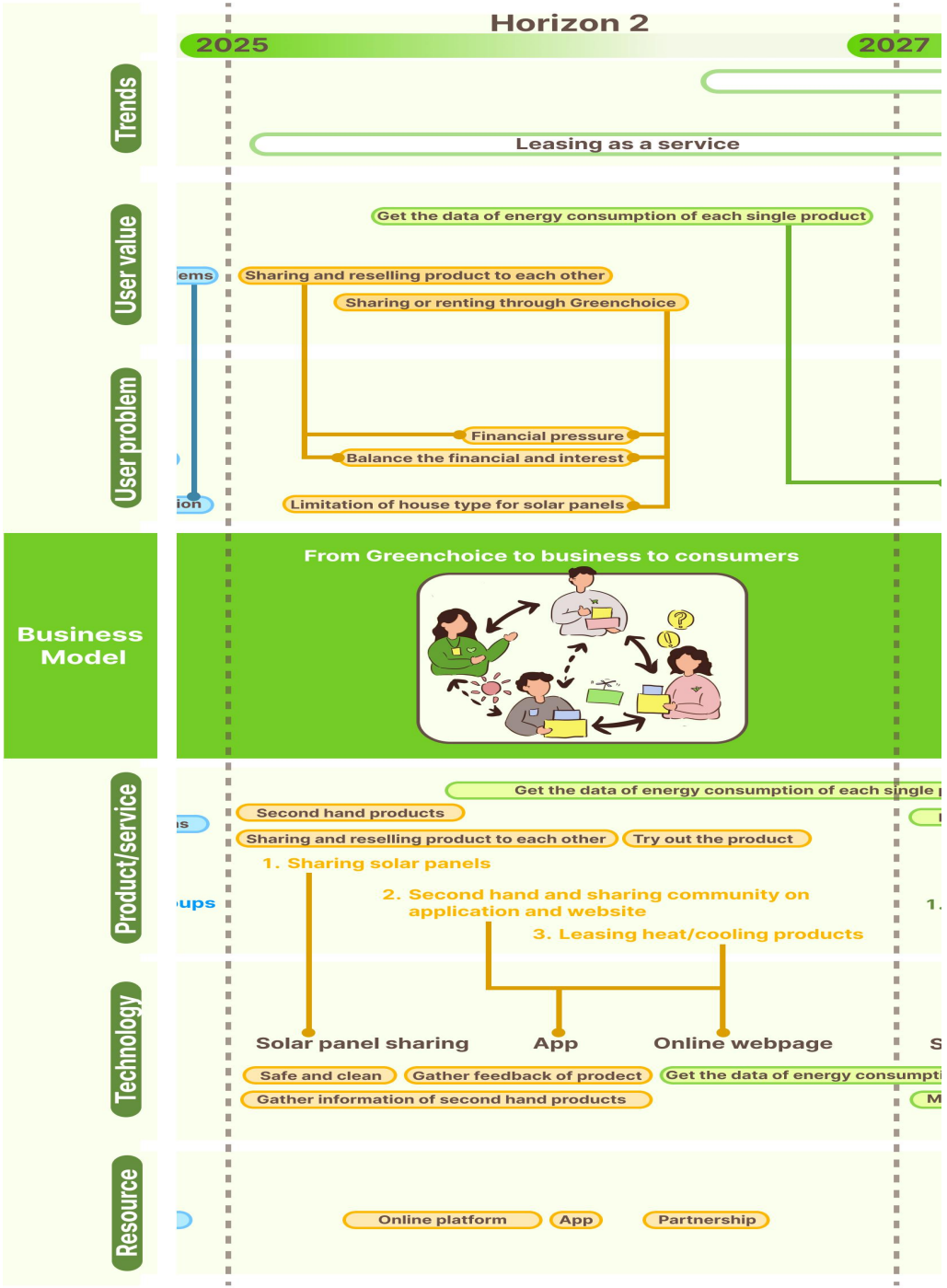
The second horizon focused on reducing the financial pressure on the target group the make them more involved in sustainable household energy. Since the target group believes in the value of sustainability, especially the target group do-gooders, reducing their barriers of financial difficulties and limitations related to house ownership can enable them to contribute to sustainable energy.
Of cause, reducing the price of the product will not be a solution. Since the younger household starters might experience renting or second-hand products during university, they are more open to having a second-hand product or leasing a product to reduce the cost. During the second horizon, leasing as a service is used. Besides, the digital monitoring product also started in this period to prepare the next horizon of innovative products.

Leasing and sharing as a service

This horizon covers multiple ways of leasing and sharing household energy products. Firstly, after using the online committees for a while, people are able to build trust in the platform and this makes it possible to buy second-hand products from this platform. Since the platform covers using the experience of the product, sending or reselling the product you others who needed it might be a good solution of deal with expensive household energy-related products. The platform is able to help them to gather people. Secondly, Greenchoice could collaborate with other appliances company to provide sustainable energy-saving products.

Besides household appliances, Greenchoice can also provide the possibility of sharing with or renting public solar panels. This allows people to get involved and experience the financial benefit with less effort. This can also be achieved by asking people to join the energy cooperative.

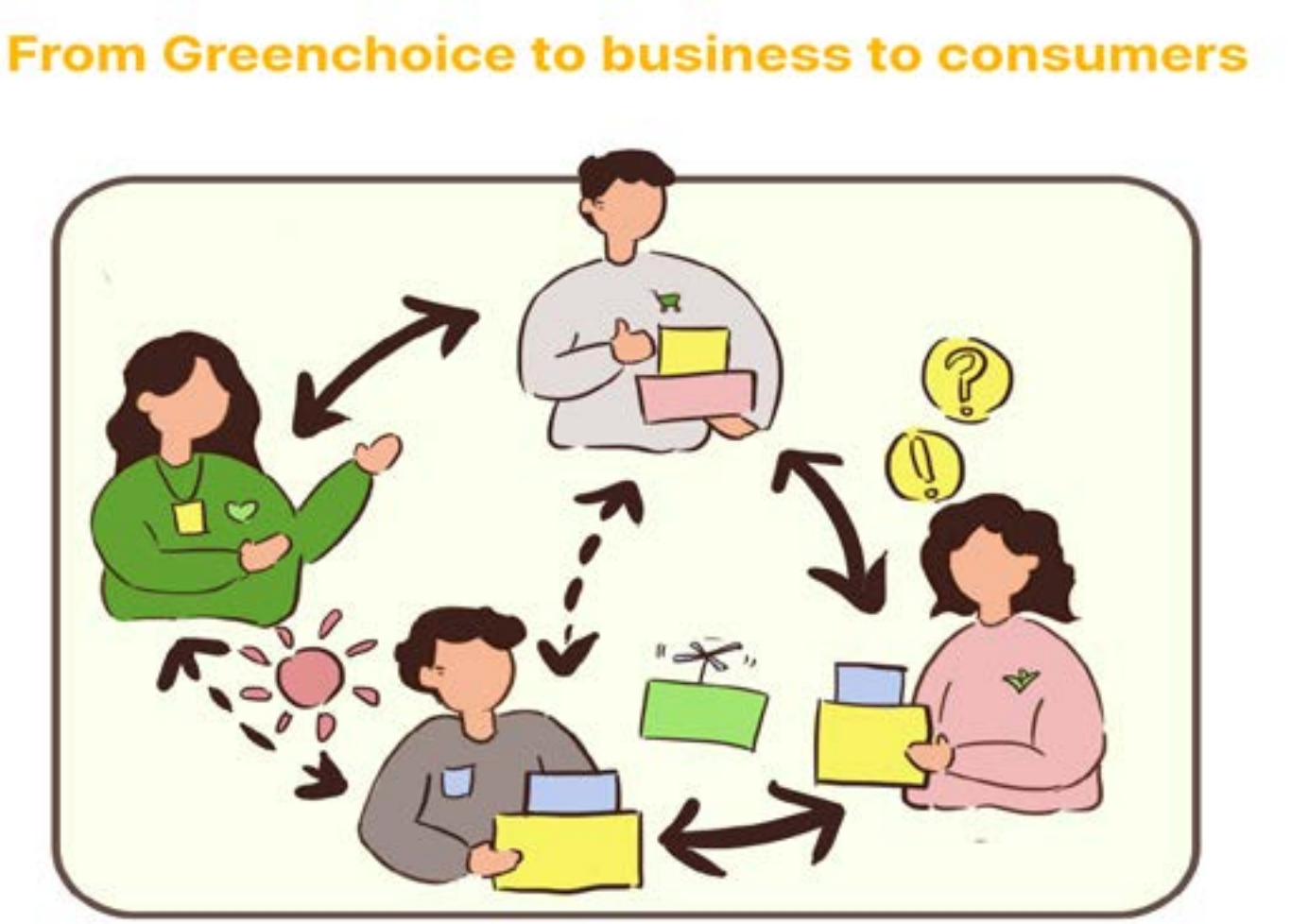
Finally, the smart meters. During the co-creation workshops, participants mentioned their desire of having more control over their energy consumption. However, since they also show their worries about the quality of new technology, a smart meter that is able to check the energy consumption of a single appliance can be used as a starting point. Since thinking kind of product might only need for once or in a short period. Both leasing and buying possibilities could be provided to users.



Picture 5.3 Roadmap H1

Business model

In the second horizon, the business model involved other companies providing products and Greenchoice will provide the service. By using this model, Greenchoice is not necessary to make big changes within their business and not necessary to consider storage problems. Besides, this will enable Greenchoice to further expand its visibility.



5.5 Horizon 3

The last horizon shows a future in that AI monitoring a contrary actively used. For house starters making all appliances as one system is the most convenient solution. For Greenchoice better consumption monitoring could help the user fully control their energy consumption. By using digital monitoring to check real-time energy consumption, and use AI to analyse the energy usage state, a feasible energy-saving plan can be proposed quickly. Under the control of AI assistants, energy consumption can be minimised without losing convenience and comfort.

Smart technology to control energy consumption with AI assistant

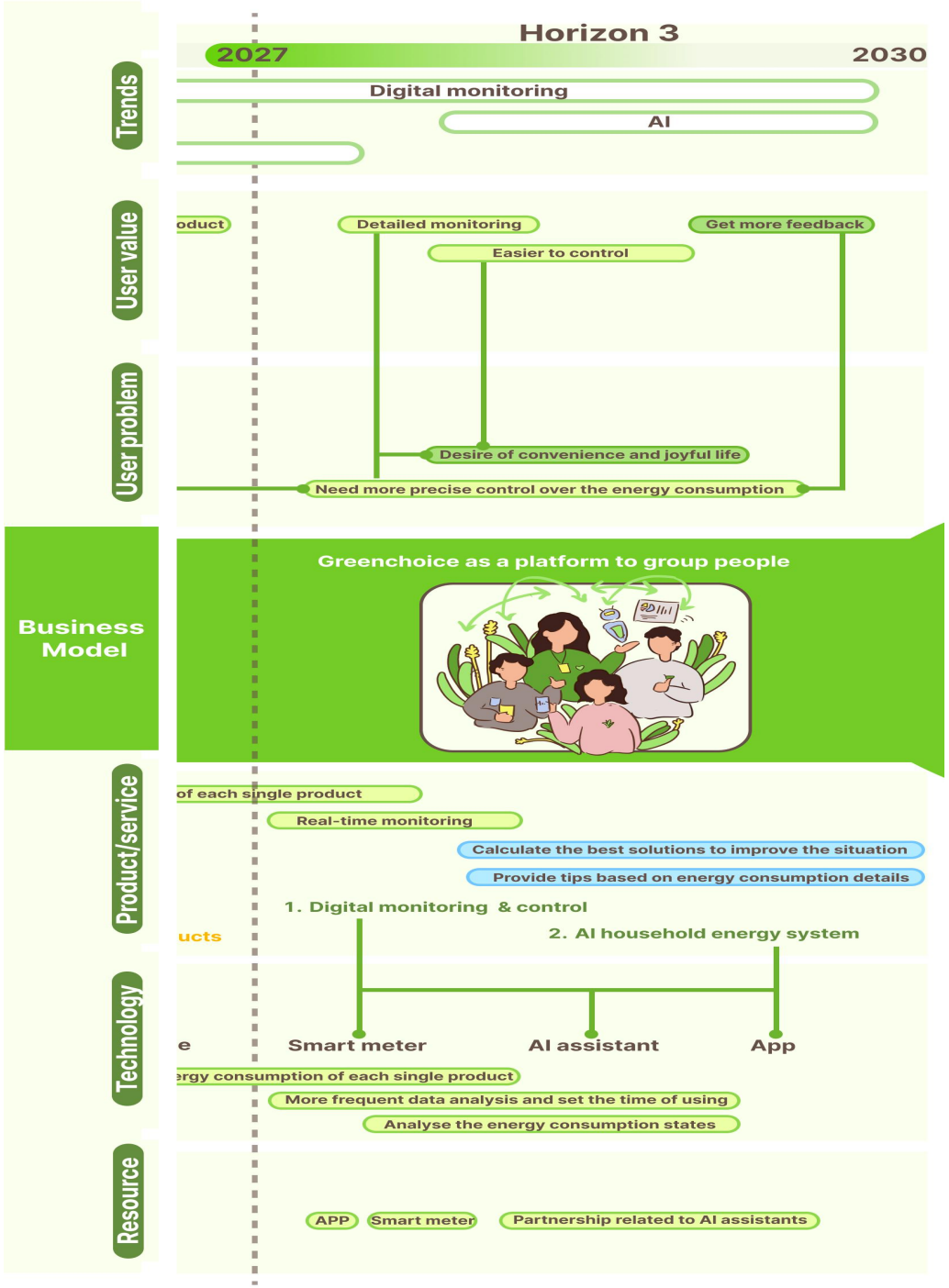
The final horizon aims to meet the needs of the target group for accurate mastery of household energy consumption. This will be achieved by a combination of smart meter and AI assistant.

Smart meter

The smart meter will be used to take real-time monitoring of the energy consumption of the selected appliances. It will show how long the appliance is being used, and how much energy consumption it took.

AI assistant

The AI assistant can be used together with the smart meter. It will analyse the energy consumption state, such as comparing the energy consumption during a similar period of time with similar products and analysis if there is any possibility of reducing the energy consumption.
The AI assistant could be combined with the online platform as well. It can represent an expert to provide professional tips and solutions. Users can still share their experience with others and the AI assistant could collect useful solutions from other users as well.



Picture 5.3 Roadmap H1

Business model

Till this horizon, the users, Greenchoice and other partners should have a better connection with each other. Besides the partnership with smart meter providers, household appliance providers and maybe the AI developer company for the service shown in this horizon, by this close connection, people are able to solve most of the problems related to household energy.

For example, consumers could find a suitable product based on the advice of an AI assistant and be able to find feedback from other users and buy the product afterwards. Therefore, people can be gathered and Greenchocie could archive the goal of becoming a platform for green choices.

5.6 Suggestion for Greenchoice

At the end of this project, the limitations of this graduation project will be analyzed. These limitations were due to the length of the project and the scope of this graduation project. To let Greenchoice further improve the results of the project, some recommendations are then presented to the company for subsequent analysis.

Limitations regarding the quantitative research

There was a limited number of participants who joined quantitative research. Due to the time limitation, I only reached participants to get 40 usable responses. However, as quantitative research for a company study, more participants might make the result more accurate.

Besides, due to the small number of participants, fewer target groups that owned a house are reached. Although they are not the majority of the target group, their responses might be different since they have fewer limitations renegading to choose energy providers and install energy-saving products.

Recommendation

More participants could be found for another quantitative research. It is advised to use the same questionnaire or improve it by adding questions instead of changing it. Thus the result could be checked.

Limitations regarding the co-creation workshop

Due to time constraints, the workshop only did one section per selected persona. Also, house ownership was not considered as a role for participant selection. The result shows that ownership does have a big influence on their lifestyle and decision-making related to household energy, thus people owned a house and rent a house should be separated.

Recommendation

Workshops with the target group who owned a house only are recommended, especially for the people from the creature of habits, since they mentioned a lot of insights related to limitations caused by renting. By doing this different insights would be collected to make the result more complete.

Limitations regarding the opportunities

Again due to time constraints, this project did not cover the design of detailed solutions and make prototypes. Although the opportunities came from the co-creation with the target group, the result did not evaluate by them. Therefore, an evaluation with the target group and Greenchoice will help to improve these opportunities.

Recommendation

Make simple prototypes and discuss them with designers in Greenchoice and ask for feedback from target group for further development.

6. Reference

1.Beauchampet, I., & Walsh, B. (2021). Energy citizenship in the Netherlands: The complexities of public engagement in a large-scale energy transition. Energy Research & Social Science, 76, 102056.

2.Council, B. D. (2005). The Design Process: The 'double diamond'design process model. http://www. designcouncil. org. uk/about-design/how-designers-work/the-design-process/. Acesso em, 11(12), 2013.

3.Crawford, M. (2018). Renewable Energy or Sustainable Energy? ADEC ESG. https://www.adecesg.com/resources/blog/renewable-energy-or-sustainable-energy/#:~:text=Simply%20put%2C%20renewable%20energy%20is,term%20needs%20of%20a%20society.&text=Sustainable%20energy%20maintains%20the%20natural,out%20of%20environment%2Dfriendly%20materials

4.De Netherlandsche Bank. (2023.May.03). Will Dutch first-time buyers be able to afford a home again? De Netherlandsche Bank. https://www.dnb.nl/en/general-news/dnbulletin-2023/will-dutch-first-time-buyers-be-able-to-afford-a-home-again/

5.Government of the Netherlands (n.d.) Central government encourages sustainable energy. Government of the Netherlands. https://www.government.nl/topics/renewable-energy/central-government-encourages-sustainable-energy

6.Government of the Netherlands (n.d.) Government stimulates biomass energy. Government of the Netherlands. https://www.government.nl/topics/renewable-energy/government-stimulates-biomass-energy#:~:text=Besides%20being%20a%20useful%20source,generate%20plastics%2C%20energy%20and%20fuel.

7.Groh, E. D., & Ziegler, A. (2022). On the relevance of values, norms, and economic preferences for electricity consumption. Ecological Economics, 192, 107264.

8.Himeur, Y., Ghanem, K., Alsalemi, A., Bensaali, F., & Amira, A. (2021). Artificial intelligence based anomaly detection of energy consumption in buildings: A review, current trends and new perspectives. Applied Energy, 287, 116601.

9.IEA (2020), The Netherlands 2020, IEA, Paris https://www.iea.org/reports/the-netherlands-2020, License: CC BY 4.0

10.International Renewable Energy Agency. (2022). World Energy Transitions Outlook 2022.IRENA. https://www.irena.org/Digital-Report/World-Energy-Transitions-Outlook-2022#page-2

11.Kwon, K., Lee, S., & Kim, S. (2021). AI-based home energy management system considering energy efficiency and resident satisfaction. IEEE Internet of Things Journal, 9(2), 1608-1621.

12.Mcfarland, K, (2017). Biomass Advantages and Disadvantages. SynTech. https://www.syntechbioenergy.com/blog/biomass-advantages-disadvantages

13.Niamir, L., Ivanova, O., Filatova, T., Voinov, A., & Bressers, H. (2020). Demand-side solutions for climate mitigation: Bottom-up drivers of household energy behavior change in the Netherlands and Spain. Energy Research & Social Science, 62, 101356.

14.NLTimes (2019. November. 29) Young adults positive about Netherlands' future; worried about climate change. NL Times. https://nltimes.nl/2019/11/29/young-adults-positive-netherlands-future-worried-climate-change

15.Nokia (n.d.) Nokia. https://www.nokia.com/networks/bss-oss/ava/energy-efficiency/?did=D000000007BR&gad=1&gclid=Cj0KCQjw0IGnBhDUARIsAMwFDLIwIshWppC9URwBXxbV2JWnuHsRGTYkso8PIpeAPKI0okxcBY39CulaApanEALw_wcB

16.Nutakki, M., & Mandava, S. (2023). Review on optimization techniques and role of Artificial Intelligence in home energy management systems. Engineering Applications of Artificial Intelligence, 119, 105721.

17.Özçatalbas, M. I. O., & Imran, M. (2016). The Importance of Clean and Efficient Household Energy. In 2nd Annual International Conference on Social Sciences (AICSS).[online]. Available: https//: www. researchgate. net/ publication/307628906.

18.Payne, J., Bettman, J. R., & Johnson, E. J. (1991). Consumer decision making. Handbook of consumer behaviour, 50-84.

19.Productfolio. (n.d.). Double Diamond Product Planning. Productfolio. https:// productfolio.com/double-diamond/.

20. Simonse, L(2017). Design Road mapping. BIS PUBLISHERS.

21.Shareef, H., Ahmed, M. S., Mohamed, A., & Al Hassan, E. (2018). Review on home energy management system considering demand responses, smart technologies, and intelligent controllers. Ieee Access, 6, 24498-24509.

22.Smoot, G. (2020). Is All Renewable Energy Sustainable? Nearly.... Impactful Ninja. https://impactful.ninja/is-all-renewable-energy-sustainable/#:~:text=Most%20 renewable%20energy%20is%20sustainable,however%2C%20is%20generally%20 not%20sustainable.).

23.Ten Sythoff, F (2021. August 12). Why smart meter programs run into roadblocks without real-time data. Greenbird. https://www.greenbird.com/ resources/why-smart-meter-programs-run-into-roadblocks-without-real-time-data#:~:text=Smart%20Meter%20Challenges%3A%20The%20Story%20from%20 the%20Netherlands&text=The%20poor%20flow%20of%20data,It%20is%20also%20 frustrating%20consumers.

24.The European investment back (2023.March.21) Over two-thirds of young Dutch people say the climate impact of prospective employers is an important factor when job hunting. EIB. https://www.eib.org/en/press/all/2023-132-over-two-thirds-of-young-dutch-people-say-the-climate-impact-of-prospective-employers-is-an-important-factor-when-job-hunting

25.Van der Werff, E., & Steg, L. (2015). One model to predict them all: Predicting energy behaviours with the norm activation model. Energy Research & Social Science, 6, 8-14.

Appendix 1 Project brief

DESIGN FOR our future

TU Delft

6481

IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT
Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy".
Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !

family name: Yang
initials: _____ given name: Mo
student number: 5629004
street & no.: _____
zipcode & city: _____
country: The Netherlands
phone: _____
email: _____

Your master programme (only select the options that apply to you):

IDE master(s): ( ) IPD ( ) DfI (★) SPD
2nd non-IDE master: _____
individual programme: 17 - 04 - 2023 (give date of approval)
honours programme: ( ) Honours Programme Master
specialisation / annotation: ( ) Medisign
( ) Tech. in Sustainable Design
( ) Entrepeneurship

SUPERVISORY TEAM **

Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair: Carissa Champlin — dept. / section: HCD
** mentor: Mahshid Hasankhani — dept. / section: SDE
2nd mentor: Merel Baazil
organisation: Greenchoice
city: Rotterdam — country: The Netherlands

comments (optional)

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

Second mentor only applies in case the assignment is hosted by an external organisation.

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair Carissa Champlin date 25 - 04 - 2023 signature Carissa Champlin Digitally signed by Carissa Champlin Date: 2023.04.25 16:00:58 +02'00'

CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: 27 EC

Of which, taking the conditional requirements into account, can be part of the exam programme 27 EC

List of electives obtained before the third semester without approval of the BoE

(x) YES all 1st year master courses passed

( ) NO missing 1st year master courses are:

name K. Veldman date 2 - 5 - 2023 signature

FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: (V) APPROVED ( ) NOT APPROVED

Procedure: (V) APPROVED ( ) NOT APPROVED

comments

name Monique von Morgen date - KE 16/5/2023 signature MvM

Initials & Name Yang Student number 5629004

Title of Project Opportunities for a sustainable energy company to reach younger target

Opportunities for a sustainable energy company to reach younger target — project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 17 - 04 - 2023 — 28 - 08 - 2023 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

This project involves collaboration with Greenchoice, the largest green energy and gas supplier in the Netherlands, which supports customers in making sustainable choices. Since energy is used in every aspect of people's lives, transitioning to renewable energy is considered to be an indispensable part of sustainability. While people are becoming more familiar with sustainable energy, energy crises are also bringing pressure to people and increasing their attention to energy use, especially house energy. Meanwhile, most younger people who are buying or renting their first house are facing the situation of choosing their energy supplier for the first time. Currently, Greenchoice's customer base consists mainly of well-educated older customers. To realize its mission of making sustainable living possible for everyone, Greenchoice aims to expand its target market to include younger household starters aged 20 to 30.

My previous research project with Greenchoice on "What sustainable living means for younger household starters in the Dutch housing market" was conducted through qualitative research based on 8 interviews. This research identified 6 profiles of the target group based on their mindset and motivations. These mindsets revealed their priorities between sustainability, money, and comfort, as well as their motivations related to knowledge, trust, and effort (Picture 1). All these factors were collected through the interviews. The results show that the target group may become a future customer group. However, these profiles were easily confused with the personas of Greenchoice's current customers. Thus, a quantitative customer research is needed to analyze the difference between the new target group and current customers and help Greenchoice find design opportunities and strategies.

The goal of this project is to conduct research on the younger household starter demographic and develop a strategy for Greenchoice to attract and retain this age group by providing suitable products or services. Younger household starters are defined as individuals in the age demographic of 20 to 30 years who are about to buy or rent their first house or have recently moved into their first home.

This graduation project will start with desk research related to household energy and collect factors that can influence consumers' decisions. The priority of these factors will be analyzed by a quantitative research. Finally, important factors will be selected, and viable opportunities for Greenchoice will be identified to cover the factors that have not been reached by current products.

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introduction (continued): space for images

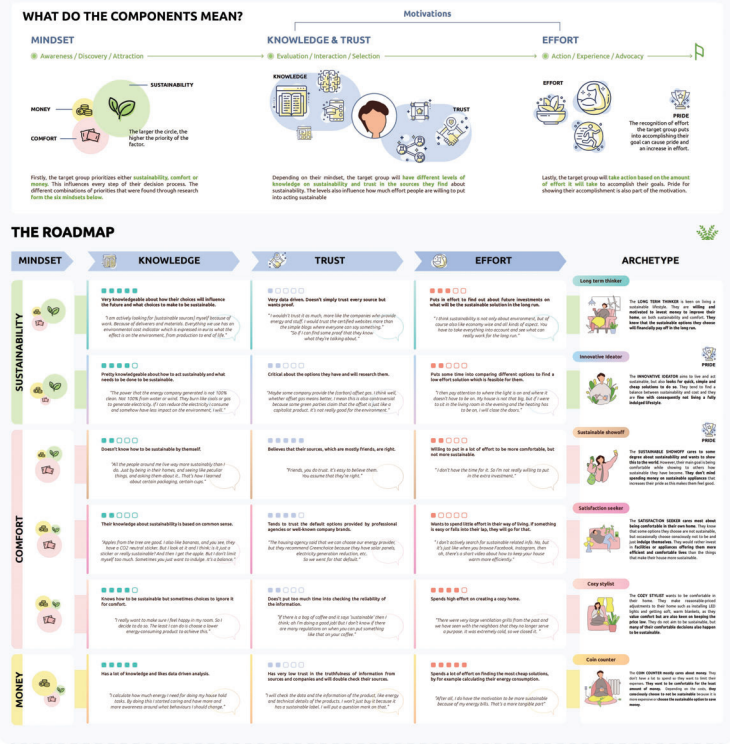

image / figure 1: Result of Contextmaping project

TO PLACE YOUR IMAGE IN THIS AREA:

- **SAVE THIS DOCUMENT TO YOUR COMPUTER AND OPEN IT IN ADOBE READER**
- **CLICK AREA TO PLACE IMAGE / FIGURE**

PLEASE NOTE:

- **IMAGE WILL SCALE TO FIT AUTOMATICALLY**
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- **IF YOU EXPERIENCE PROBLEMS IN UPLOADING, COVERT IMAGE TO PDF AND TRY AGAIN**

image / figure 2:

Initials & Name Yang Student number 5629004

Title of Project Opportunities for a sustainable energy company to reach younger target

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

Although Greenchoice has excellent products and services available to help users improve their energy use and lead more sustainable lives, the current customer base for these products is mainly aged 40 and above. To achieve sustainable living for all in the future, Greenchoice thinks it is crucial to include younger household members aged 20-30 as customers, especially since this group is moving into new homes and may be more open to selecting or changing their home energy systems and products. However, it is unclear whether the current products for well-educated older customers are suitable for younger household starters and what are the specific factors that younger people are concerned about. Therefore, a customer research project is necessary to identify these factors so that Greenchoice can develop and offer more relevant products and services for this age group, and thereby attract and retain them as loyal customers. This will contribute to Greenchoice's mission of making sustainable living possible for everyone.
The research question can be defined as: What are the marketing opportunities for Greenchoice to innovate more appropriate products and services for younger householders aged 20-30, to attract them and foster their loyalty as customers?
The main research question can be answered by identifying the following questions:
- What are the factors (product-related/marketing/consumer-related factors) that influence people's decision-making related to house energy?
- What is the priority of these factors for the target group, and what are the factors that the current products/services do not focus on?
- What are the key energy needs and challenges faced by younger householders aged 20-30, and how can Greenchoice address these needs through its products and services?
- What are the specific gaps or unmet needs in the current energy market for younger householders aged 20-30, and how can Greenchoice fill these gaps with innovative and effective solutions?

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

Find factors that are able to influence decisions related to housing energy by doing desk research and interviews. Design a quantitative research to analyse the priority of these factors for younger household starters and find gaps between the top factors and the focus of current products/service. Identify opportunities to attract the target group and visualise them with a road-map or other format that is able to show those opportunities with a time-line and process.

Firstly, a desk research of current market, user and product/service context will be done to collect the factors related to housing energy market or able to influence decisions related to housing energy. The factors from the 6 profiles of Contextmapping project result and the personas of current customers will be used as parts of the sources as well. Besides, relevant methods of analysis factors related to consumer needs will be find by literature research. Secondly, a quantitative research will be used to collect data from the target group. Around 30-40 participants will be reached through an online or offline questionnaire, which can be accessed through a web-link or Qr-code. Participants can be recruited from people at school, train station or other public space. The Qr-code/web-link will be provide after the participant signed for the consent from. The questions will focus on ranking the priority of different factors and other considerations related to energy using if there is a research method is found during the desk research. There might be questions related to challenges they are facing, their consideration of current product or service in the market and their expectations. The results will be compared with the products and services that Greenchoice currently offers to identify the gaps in current market. This analysis will inform the development of product or service opportunities that can attract and retain the younger household starter target group as customers. Thirdly, the identified opportunities will be further developed and refined through a product design process that incorporates market trends, current technology, the value proposition of Greenchoice. This may include concept of new product or service designs, as well as strategies for Greenchoice to market and deliver these offerings to the target group. Finally, the project will deliver a roadmap that visualizes the opportunities and development process steps for new or improved products and services.

Initials & Name Yang Student number 5629004

Title of Project Opportunities for a sustainable energy company to reach younger target

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 17 - 4 - 2023 28 - 8 - 2023 end date

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
Month	4				5				6					7				8		
CalendAr week	17-21	24-28	01-05	08-12	15-19	22-26	29-02	05-09	12-16	19-23	26-30	03-07	10-14	17-21	24-28	31-04	07-11	14-18	21-25	28-01
Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Kick-off meeting time																				
Kick-off meeting room																				
Brief																				
RRPC																				
Contract																				
Background analysis																				
Relavant methods of analysing facotrs																				
Current personas																				
Contextmapping result																				
Desk review of energy saket trends and technology																				
Collect factors																				
Relations and influence between product, marketing and consumer factors																				
Find people for the interviews (current customers 3-5)																				
Questions for interviews (current customers)																				
Research																				
Create questionnaire (digital and physical)																				
Collect data (about 40 samples)																				
Data analysis																				
Notes the data																				
Analysis the prority of these factors																				
Sellect the top factors																				
Difference between current product/service and new target group (detailed)																				
Gap of market and needs																				
Come up with opportunities																				
Trends and relavent technology or strategy																				
Opportunities																				
Sellect 1 main opportunity and add details																				
Visualisation of the design																				
Roadmapping/visualization of the results																				
last improvement of the deliverables																				
Report and prezentation																				
Mid-term, green light and final Presentation								05 10: 30						17 10: 30						28 2: 00

Initials & Name Yang Student number 5629004

Title of Project Opportunities for a sustainable energy company to reach younger target

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

I developed my passion for sustainable-related design during my entire study process of learning industrial design engineering, and I believe a sustainable approach is an important trend in the current and future context. However, energy direction is a topic that I did not dive into before. During my elective course Contextmapping Skill I learned about housing energy system for the first time but not able to dive into solutions. Therefore I came up with this graduation project to keep working on the topic and I am excited to keep undertaking this project in collaboration with Greenchoice.

In this project I will prove my abilities of user research, context analysing and brand strategy. Especially, analysis the context with systematic methods that I learned from Design for complexity and identify strategic solutions based on Road-mapping course. By using such skills I could help the company with provide creative and viable opportunities. Through this project, I aim to deepen my understanding of sustainable house energy and the needs of younger household starters, while further developing my skills in data analysis and communication.

One of my personal ambitions for this project is to build my expertise in quantitative data analysis. While I have worked with data before, I have not yet had the opportunity to conduct a full-scale customer research project using a quantitative approach by myself. I am eager to gain experience in this, and to learn how to draw meaningful insights from data to inform strategic decision-making by using new tools and methods.

Another personal ambition of mine is to strengthen my communication skills. In order to deliver effective results for Greenchoice, I will need to communicate my findings clearly and concisely to people involved in the project. This includes presenting data and insights in a compelling way, as well as engaging with customers and other members of the Greenchoice team to gather information and feedback.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

Initials & Name Yang Student number 5629004

Title of Project Opportunities for a sustainable energy company to reach younger target

Appendix 2 Translations of personas

Convenience seekers

Lifestyle

A carefree life

Convenience seekers are characterized by their carelessness.

They want to be able to enjoy life without themselves too busy.

They are looking for regularity and like to follow others.

When it comes to sustainability, convenience seekers are the gate closers.

They often do not know which products are sustainable and are less motivated to do so make sustainable choices.

This is because they are not the see the value of personal sustainable behavior through which they feel less responsible to contribute to a sustainable society

Help with green choices

Focus on other benefits. A convenience seeker is not easy to motivate to it making sustainable choices.

For them is convenience, price and fun first. If something is sustainable, that is nice bonus.

So try the convenience finder by focusing on other personal advantages.

10% of the convenience seekers are also with rising energy prices to pay more for sustainably generated energy

Communication

Make it easy, we arrange it.

Use simple language rather than jargon.

Focus on personal benefits.

Give the feeling that everyone is already doing it and that they are not left behind can stay.

Amuse through humor and commitment of well-known Dutch people.

Innovators

Lifestyle

An optimistic view of the future

Innovators have an optimistic view of the future and pursue their own goals.

It's important to them to gain social status and show what they are have reached.

Innovators strongly believe that technology and good entrepreneurship solutions and progress will achievement in terms of sustainability.

This group is willing to make sustainable choices provided they see (financial) opportunities and it is not at the expense of luxury, status and comfort.

Help with green choices

A smart investment

Innovators are becoming increasingly aware of sustainability issues.

They are also increasingly willing to make sustainable choices, but it has to yield something.

Convince the innovator that now green choices will yield benefits in the future.

21% of the innovators is also with the rising energy prices to pay more for sustainably generated energy

Communication

Motivate the innovator with the latest of the latest Focus on personal benefits.

Highlight technical and innovative products.

Be informative and not pedantic.

Sketch a win-win situation; better for yourself and the world

The creature of habit

Lifestyle

A modest doing and leaving Creatures of habit are characterized by their social involvement and good citizenship. They cling to traditional values and are very concerned about poverty and inequality in the Netherlands. A creature of habit will not use the word 'sustainable' quickly.

However, they do live sustainably. Important drivers for their sustainable lifestyle are sobriety and a modesty that they often inherited from home. However, the lack of knowledge about sustainable solutions and their resistance is against it

Help with green choices

Take them by the hand. Creatures of habit are from a societal point of view willing to contribute to a sustainable society.

Help from a reliable sender is here of great importance.

They listen carefully to authorities such as the government and large energy suppliers.

Take it creature of habit so at hand and help them step by step.

15% of the innovators of habit is also met

rising energy prices to pay more for

sustainably generated energy

Communication

Keep it simple and polite

Be knowledgeable and reliable.

Try to explain things step by step; roadmaps help with this.

Give them the confidence that they are not tied to anything.

Give a clear sender, they are sensitive to authority.

The do-gooders

Lifestyle

Living from an ideal

Do-gooders show solidarity and stand up for others and the environment.

They are politically involved and want to lead a meaningful life.

Do-gooders like to contribute to a more sustainable society.

This group approaches sustainability from their ideal.

They therefore strive for a conscious and sustainable lifestyle.

Help with green choices

The greenest choice

Do-gooders don't need to be convinced to make sustainable choices.

They feel responsible enough for this as an individual.

So show a world improver that you are the greenest choice of all and that you want to make the world a better place together with them.

36%of the do-gooders is also with rising energy prices

willing to pay more for it sustainably generated energy

Communication

Trigger the intrinsic motivation

Be transparent and tell the whole story.

Address social responsibility, locally and international.

Appreciate sustainable behavior.

Focus on improving the world together.

The free birds

Lifestyle

Looking for new experiences

Free birds are always looking for new experiences and like to challenge themselves. Possession is not that important to them.

They are tolerant and believe in equal opportunities for all.

Free birds believe that creativity can make an important contribution to the sustainability issue.

Most free birds see the importance of a more sustainable world, but do not always behave in a consistent way in daily life.

Above all, it should not stand in the way of their personal freedom and their own enjoyment.

Help with green choices

Challenge to change

Free birds do not always behave sustainably, but they are open to change.

Therefore, challenge the free bird to make a green choice together with their social environment.

Show that there are plenty of fun green initiatives that they can be part of.

30% of the free birds is also with the rising energy prices to pay more for sustainably generated energy

Communication

Stimulate the free bird with surprising content.

Trigger the free bird through innovation and surprise.

Trigger self-development and pleasure.

Focus on here and now and doing interesting and innovative things together.

Appendix 3 Survey questions

Sections	Related factor	Questions	Aim of the question	Literature
1. Demog raphic	Age	What is your age?	To make sure the participant is part of the target group	Based on the target group
	House-type	Please specify your house type: - Selected Choice	Collect data related to the background	Niamir, Ivanova, Filatova, Voinov & Bressers, 2020
	Number of people	Please specify how many people live in your house	Collect data related to the background	Groh & Ziegler, 2022
	Ownership	Please specify your house ownership:	Check the ownership of the house	Groh & Ziegler, 2022
	Limitation	Please specify if you have the freedom of choose the energy provider	Check their limitation related to energy provider	Based on the goal
	Limitation	Please specify if you have the freedom of install energy-saving measures	Check their limitation related to energy saving	Based on the goal
2. Pride, partner, sustainabil ity and value	Value	I believe that I can contribute to solving environmental, climate, and energy problems.	Do people think sustainability is valuable	Van der Werff & Steg, 2015
	Value	I believe that reducing my energy	Do people believes that	Van der Werff & Steg, 2015

		consumption is a personal choice and requires self-motivation.	their actions are valuable for sustainability	
	Sustainability	I would choose an energy provider based on its offer of renewable/green energy and service.	Do people treat sustainable as an important topic	Niamir, Ivanova, Filatova, Voinov & Bressers, 2020
	Pride	I would like to discuss sustainable household energy or reducing household energy consumption with others, such as friends, family, and co-workers.	Do people treat pride as an important topic	Van der Werff & Steg, 2015
	Pride	I would like to share my sustainable actions online.	Do people willing to share their actions to others? (online or off-line)	Van der Werff & Steg, 2015
	Partner	I will reduce my energy consumption if encouraged or influenced by friends and family.	Do people feels their parents/friends/colleagues able to influence their decisions?	Van der Werff & Steg, 2015
	Partner	I will reduce my energy consumption if I see the average energy consumption of others is lower than mine.	Do people feels motivated by doing sustainable actions with others	Van der Werff & Steg, 2015
	Partner	I prefer to save energy consumption when I have someone to do it with, such as saving energy as a group.	Do people feels motivated by doing sustainable actions with others	Van der Werff & Steg, 2015

3. Trust and knowledge	Knowledge	I actively search for information related to sustainability and household energy.	Do people willing to have more information	Niamir, Ivanova, Filatova, Voinov & Bressers, 2020
	Knowledge	I will reduce my energy consumption if more practical information on how to reduce energy consumption at home is available.	Do people know how to be more sustainable	Niamir, Ivanova, Filatova, Voinov & Bressers, 2020
	Knowledge	I would use green energy if more practical information on how I can invest in green energies (e.g., installing solar panels) were available.	Do people know how to invest in green energies	Niamir, Ivanova, Filatova, Voinov & Bressers, 2020
	Knowledge	I am willing to learn more about existing products/services to reduce my energy consumption.	Do people know what product existing?	Niamir, Ivanova, Filatova, Voinov & Bressers, 2020
	Trust	I trust the information related to sustainability and energy consumption I got from the sourse I choose above.	Do people trust the information they got form (internet, ad, books, friends, family, colleagues (people they know))?	Groh & Ziegler, 2022
	Trust	I trust the energy consumption data I receive from my energy provider.	Do people trust the information they got form energy provider (like	Groh & Ziegler, 2022

			greenchoice)	
4. Cost, comfort, effort and quality	Cost and sustainability	If I choose an energy provider/service/product to reduce my household energy consumption, I mainly do it for: - cost , sustainability both	Why people reduce their energy consumption What is more important,cost or sustainability	Niamir, Ivanova, Filatova, Voinov & Bressers, 2020
	Cost	I would choose a provider if a cheaper offer was available.	Do people treat cost as an important factor	Niamir, Ivanova, Filatova, Voinov & Bressers, 2020
	Comfort	I will try to minimize energy consumption when I adjust the room's temperature, such as wearing warm clothes indoors and turning the heating down when the room is unoccupied.	Do people treat comfort as an important factor	Groh & Ziegler, 2022
	Comfort	I will try to minimize energy consumption when I adjust the brightness of the room, such as turning the lights off when leaving.	Do people treat comfort as an important factor	Niamir, Ivanova, Filatova, Voinov & Bressers, 2020
	Comfort	I will try to minimize my energy expenditure when I shower, such as using a lower temperature or having a shorter shower.	Do people treat comfort as an important factor	Groh & Ziegler, 2022
	Effort	I try to minimize my energy consumption when doing housework, even if it requires more effort, such as sweeping the floor	Do people treat effort as an important factor	Van der Werff & Steg, 2015

		with a broom instead of using a vacuum cleaner.		
	Effort	I believe that investing in green energy products/services (e.g., installing solar panels or funding a wind turbine) requires more effort.	Do people treat effort as an important factor	Groh & Ziegler, 2022
	Quality	The quality of the product/service influence will influence my decision when choosing an energy provider.	Do people treat quality as an important factor	Niamir, Ivanova, Filatova, Voinov & Bressers, 2020
	Quality	Please rank the importance of factors to assess the quality of a household energy product. For 1 is most important and 4 is least important. - The product's service life, appearance,good user experience,good consumer service	How do people evaluated on quality	Niamir, Ivanova, Filatova, Voinov & Bressers, 2020
5. Creativity	Creativity	I actively search for the most current products/services in the energy field.	Do people interested in creativity	Based on the goal
	Creativity	I tend to install household energy providers/products/technologies that I used to have instead of trying more current ones.	Will people use creative product/service	Based on the goal
	Creativity	I am willing to switch my household energy provider/product/technologies when there	Do people willing to change their product/service	Based on the goal

		is a new one on the market.		
	Creativity	I would like to use Artificial Intelligence products to monitor and analyze the data of my energy consumption in the future, such as smart meters that can show accurate energy consumption data and analyze the data based on time, weather, etc.	Do people interested in AI monitoring and analyzing data	Based on the goal
	Creativity	I would like to use Artificial Intelligence products to control my household equipment and save energy, such as automatically shutting down the power of unused products in the future.	Do people interested in AI control	Based on the goal
	Rank the factors	Please rank the importance of the following factors. For 1 is most important and 7 is least important. -sustainability, cost, comfort, convenience, quality of the product, Creativity of the product, The level of knowledge of the product	That are the priority of these factors	Based on the goal

Appendix 4 Questionnaire

Click Next button to confirm that you are agree to participant.

Page Break

Thank for your participation! In the first section we would like to know about you, your house and your household energy situation.

*Your answers to these questions will remain anonymous.

1/9 What is your age?

- ○ Below 20 (1)
- ○ 20-25 (2)
- ○ 26-30 (3)
- ○ 31-35 (4)
- ○ Over35 (5)

2/9 What is the highest degree or level of education you have completed?

- ○ Primary education (1)
- ○ Secondary education (2)
- ○ Master's degree (3)
- ○ Above (4)
- ○ Other (please specify) (5) _____

3/9 Please specify your house type:

- ○ Detached house (1)
- ○ Semi-detached (two under one roof) (2)
- ○ Terraced house at corner (3)
- ○ Terraced house in the middle of another two (4)
- ○ Other (please specify) (5) _____

4/9 Please specify how many people live in your house

- ○ 1 person (1)
- ○ 2 persons (2)
- ○ 3 persons (3)
- ○ 4 persons (4)
- ○ 5 persons or more (5)

5/9 Please specify your house ownership:

- ○ Owned (1)
- ○ Rented (2)
- ○ Other (please specify) (3) _____

6/9 Please specify the type of your house heating system: (you can choose multiple ones if needed)

- [ ] Central heating or HR boiler (1)
- [ ] District heating (2)
- [ ] (Hybrid) Heat pump (3)
- [ ] Solar water heater (4)
- [ ] Hot air heating (5)
- [ ] Air conditioning (6)
- [ ] I do not know (7)

7/9 Please specify if you have the freedom of choose the energy provider

- ○ I am free to choose the energy provider that I like (1)
- ○ I have limitation to choose the energy provider that I like (2)
- ○ I can not choose the energy provider that I like (3)

8/9 Please specify if you have have installed any energy-saving measures

- [ ] Solar panels (1)
- [ ] LED bulbs (2)
- [ ] Tour strips (3)
- [ ] Radiator foil (4)
- [ ] Radiator fans (5)
- [ ] Water-saving shower head (6)
- [ ] Infrared panels (7)
- [ ] Window film (8)
- [ ] No (9)

9/9 Please specify if you have the freedom of install energy-saving measures

- I am free to install energy-saving measures (1)
- I have limitation to install energy-saving measures (2)
- I can not install energy-saving measures (3)

End of Block: Question Block 1

Start of Block: Block 1

Q11 Cool! Now we would like to know more about your thoughts of sustainability and whether you are motivated to be more sustainable by others. Let's start it!

1/8 I believe that I can contribute to solving environmental, climate, and energy problems.

- Strongly disagree (1)
- Disagree (2)
- Neutral (3)
- Agree (4)
- Strongly agree (5)

2/8 I believe that reducing my energy consumption is a personal choice and requires self-motivation.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

3/8 I would choose an energy provider based on its offer of renewable/green energy and service.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

4/8 I would like to discuss sustainable household energy or reducing household energy consumption with others, such as friends, family, and co-workers.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

5/8 I would like to share my sustainable actions online.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

6/8 I will reduce my energy consumption if encouraged or influenced by friends and family.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

7/8 I will reduce my energy consumption if I see the average energy consumption of others is lower than mine.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

8/8 I prefer to save energy consumption when I have someone to do it with, such as saving energy as a group.

- Strongly disagree (1)
- Disagree (2)
- Neutral (3)
- Agree (4)
- Strongly agree (5)

End of Block: Block 1

Start of Block: Block 2

Q27 How did you learn about sustainability and household energy? Do you trust the information you got? In this section, please let us know your about your source of sustainable information.

1/8 I actively search for information related to sustainability and household energy.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

2/8 I will reduce my energy consumption if more practical information on how to reduce energy consumption at home is available.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

3/8 I would use green energy if more practical information on how I can invest in green energies (e.g., installing solar panels) were available.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

4/8 I usually get information related to sustainability and energy consumption from: (you can choose multiple ones if needed)

- [ ] Books (1)
- [ ] Friends (2)
- [ ] News (3)
- [ ] Email (4)
- [ ] Ads (5)
- [ ] Blog (6)
- [ ] Radio (7)
- [ ] Website (8)
- [ ] Video (9)
- [ ] Other (Please specify) (10) _____

5/8 I am willing to get more information related to sustainability and energy consumption from: (you can choose multiple ones if needed)

- [ ] Books (1)
- [ ] Friends (2)
- [ ] News (3)
- [ ] Email (4)
- [ ] Ads (5)
- [ ] Blog (6)
- [ ] Radio (7)
- [ ] Website (8)
- [ ] Video (9)
- [ ] Other (Please specify) (10) _____

6/8 I am willing to learn more about existing products/services to reduce my energy consumption.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

7/8 I trust the information related to sustainability and energy consumption I got from the sourse I choose above.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

8/8 I trust the energy consumption data I receive from my energy provider.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

End of Block: Block 2

Start of Block: Block 3

Q21 Have you thought of reduce your household energy consumption before? In this section, we would like to know your thoughts of some actions of minimize the energy consumption at home.

1/5 If I choose an energy provider/service/product to reduce my household energy consumption, I mainly do it for:

- ○ Save money (1)
- ○ Sustainability (2)
- ○ Both (3)
- ○ Other reasons (4) _____
- ○ I will not choose an energy provider/service/product for reducing energy consumption (5)

2/5 I would choose a provider if a cheaper offer was available.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

3/5 I will try to minimize energy consumption when I adjust the room's temperature, such as wearing warm clothes indoors and turning the heating down when the room is unoccupied.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

4/5 I will try to minimize energy consumption when I adjust the brightness of the room, such as turning the lights off when leaving.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

5/5 I will try to minimize my energy expenditure when I shower, such as using a lower temperature or having a shorter shower.

- Strongly disagree (1)
- Disagree (2)
- Neutral (3)
- Agree (4)
- Strongly agree (5)

End of Block: Block 3

Start of Block: Block 4

Q37 Great! You already finished more than a half this survey. Let's move on!

Q1 I try to minimize my energy consumption when doing housework, even if it requires more effort, such as sweeping the floor with a broom instead of using a vacuum cleaner.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

Q2 I believe that investing in green energy products/services (e.g., installing solar panels or funding a wind turbine) requires more effort.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

Q3 The quality of the product/service influence will influence my decision when choosing an energy provider.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

Q4 Please rank the importance of factors to assess the quality of a household energy product. For 1 is most important and 4 is least important.

_____ The product's service life (1)
_____ Appearance (2)
_____ Good user experience (3)
_____ Good customer service (4)

End of Block: Block 4

Start of Block: Block 5

Q42 Are you interested in new products about green energy? Have you thought about using AI in energy products? Please let us know!

1/5 I actively search for the most current products/services in the energy field.

- Strongly disagree (1)
- Disagree (2)
- Neutral (3)
- Agree (4)
- Strongly agree (5)

2/5 I tend to install household energy providers/products/technologies that I used to have instead of trying more current ones.

- Strongly disagree (1)
- Disagree (2)
- Neutral (3)
- Agree (4)
- Strongly agree (5)

3/5 I am willing to switch my household energy provider/product/technologies when there is a new one on the market.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

4/5 I would like to use Artificial Intelligence products to monitor and analyze the data of my energy consumption in the future, such as smart meters that can show accurate energy consumption data and analyze the data based on time, weather, etc.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Somewhat agree (4)
- ○ Strongly agree (5)

5/5 I would like to use Artificial Intelligence products to control my household equipment and save energy, such as automatically shutting down the power of unused products in the future.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

End of Block: Block 5

Start of Block: Block 6

Q48 This is the last question of this survey! You may find that there are many factors that influence your choice of household energy producer/products/service. Please rank the importance of the following factors. For 1 is most important and 7 is least important.

_____ Sustainability (1)

_____ Cost (2)

_____ Comfort (3)

_____ Convenience (4)

_____ Quality of the product (5)

_____ Creativity of the product (6)

_____ The level of knowledge of the product (7)

End of Block: Block 6

Appendix 5 Note for persona analysis

		Survey question	Note
X-axis	Creativity	I actively search for the most current products/services in the energy field.	Strong agree=2, agree=1, neutral= 0, disagree=-1, strongly disagree = -2
		I am willing to switch my household energy provider/product/technologies when there is a new one on the market.	Strong agree=2, agree=1, neutral= 0, disagree=-1, strongly disagree = -2
		I tend to install household energy providers/products/technologies that I used to have instead of trying more current ones.	**Strong agree=-2, agree=-1, neutral= 0, disagree=1, strongly disagree = 2**
Y-axis	value	I believe that I can contribute to solving environmental, climate, and energy problems.	**Strong agree=-2, agree=-1, neutral= 0, disagree=1, strongly disagree = 2**
	value	I believe that reducing my energy consumption is a personal choice and requires self-motivation.	**Strong agree=-2, agree=-1, neutral= 0, disagree=1, strongly disagree = 2**
	partner	I prefer to save energy consumption when I have someone to do it with, such as saving energy as a group.	**Strong agree=-2, agree=-1, neutral= 0, disagree=1, strongly disagree = 2**
	Cost and Sustainability	If I choose an energy provider/service/product to reduce my household energy consumption, I mainly do	Save money= 2, Sustainability= -2, Both=0

		it for: - Selected Choice	
	Cost	I would choose a provider if a cheaper offer was available.	Strong agree=2, agree=1, neutral= 0, disagree=-1, strongly disagree = -2
	Comfort	I will try to minimize energy consumption when I adjust the room's temperature, such as wearing warm clothes indoors and turning the heating down when the room is unoccupied.	**Strong agree=-2, agree=-1, neutral= 0, disagree=1, strongly disagree = 2**
	Comfort	I will try to minimize energy consumption when I adjust the brightness of the room, such as turning the lights off when leaving.	**Strong agree=-2, agree=-1, neutral= 0, disagree=1, strongly disagree = 2**
	Comfort	I will try to minimize my energy expenditure when I shower, such as using a lower temperature or having a shorter shower.	**Strong agree=-2, agree=-1, neutral= 0, disagree=1, strongly disagree = 2**
	Effort	I try to minimize my energy consumption when doing housework, even if it requires more effort, such as sweeping the floor with a broom instead of using a vacuum cleaner.	**Strong agree=-2, agree=-1, neutral= 0, disagree=1, strongly disagree = 2**
	Quality	The quality of the product/service influence will influence my decision when choosing an energy provider.	Strong agree=2, agree=1, neutral= 0, disagree=-1, strongly disagree = -2

Appendix 6 Process Guide of Co-creation workshop

Before the workshop

Actions:

Send the questionnaire to find participants

Sign the consent from

During the workshop

Step 1:

- We will start with a simple warm up
- Here is the fist template, please check the boxes to show what household appliances do you have.
- You could write the name if the appliances is not on the list
- Please draw the most important appliances in your home

Step 2:

- New we will talk about your problems and limitations
- Please write or draw the problems you have related to household energy
- and you could write or draw the goal of improvement in the right box
- Please write or draw your limitations, talk about what caused the problems ans stopped you solve the problems

Q:

Could you talk a bit more about....

Could you explain this?

Why do you find this difficult?

What do you think that is due to?

Step 3

- Now let us try to solve these problems. Please explain how will you collect information, how will you make decisions and what is your decisions.
- Here are some cards with simple ideas that you could use as a inspiration. You could combine these cards, built based on these cards or block the card you don't like.

Step 4

- Now lets start the discussion! Could you please introduce you result of the step ?

Q:

Related to collect information:

Why did you choose this platform?

Do you trust the data from here?

Do you think you will get enough information from here?

How do you get information from people you know, what information do you interested?

What kind of information do you willing to know?

Related to decision making and decisions

Could you explain this idea?

Why do you think this is useful?

What do you think if there is a product ...?

Why do you think this is important?

How will you evaluate on the quality this produce/service?

What is a good quality/ user experience/ service/ appearance?

Related to AI

Do you have any opinions of use AI in household energy field?

What functions people expect from AI ?

Will you install AI in your home for household energy purpose?

Related to the order of factors

How will you order the importance these factor?

Why do you this this factor is more important than this one?

How will consider about sustainability? And why?

Questions related to their personas

For creature of habits

Do you think you have good social involvement?

Do you think you have enough knowledge about sustainable solutions?

Do you think you live in a sustainable way? What actions did you do?

For do-gooders

Do you willing to stand up for environment or constitute to sustainable society?

Do you think you live in a sustainable way? What actions did you do?

For free birds

Will you enjoy new experience?

Do you think creativity is more important?

Do you think freedom and enjoyment is important?

How do you think of sustainability? Do you think it is valuable/important?

Appendix 7 workshop Cards

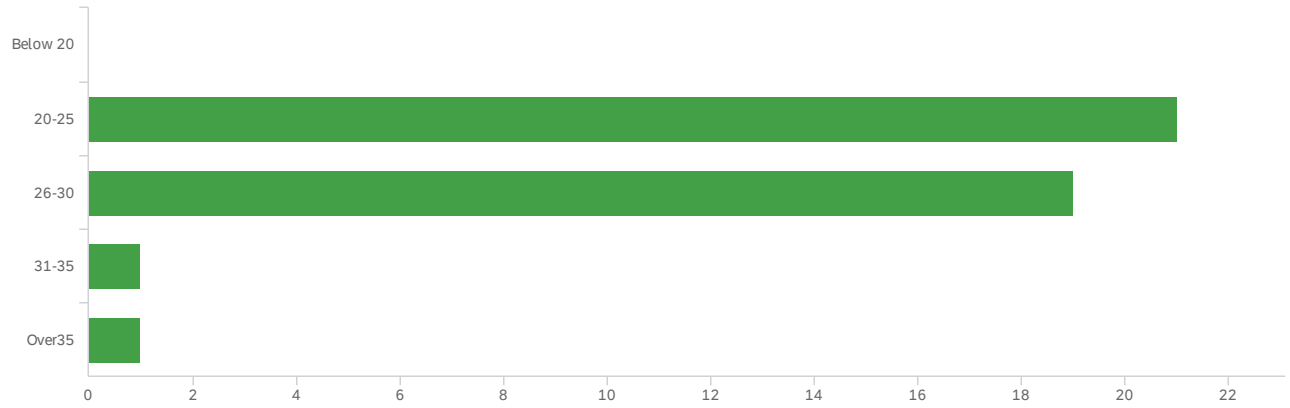
Appendix 8 Survey result

Default Report

Graduation project

August 21, 2023 7:36 AM CEST

1/9 - What is your age?

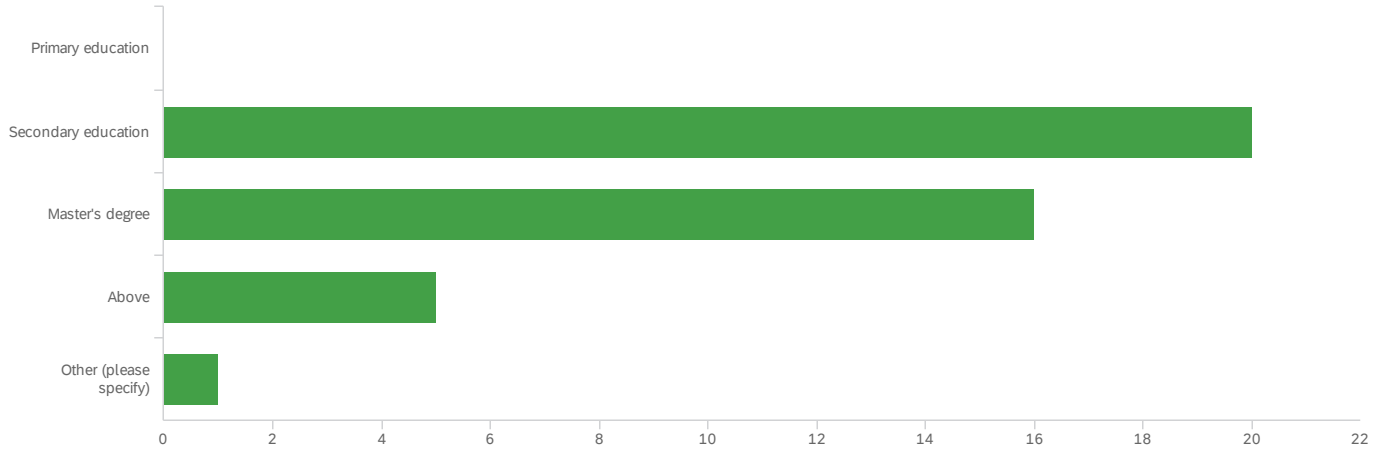


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	What is your age?	2.00	5.00	2.57	0.66	0.44	42

#	Field		Choice Count
1	Below 20	0.00%	0
2	20-25	50.00%	21
3	26-30	45.24%	19
4	31-35	2.38%	1
5	Over35	2.38%	1
			42

Showing rows 1 - 6 of 6

2/9 - What is the highest degree or level of education you have completed?



#	Field		Choice Count
1	Primary education	0.00%	0
2	Secondary education	47.62%	20
3	Master's degree	38.10%	16
4	Above	11.90%	5
5	Other (please specify)	2.38%	1
			42

Showing rows 1 - 6 of 6

#	Field		Choice Count
1	Primary education	0.00%	0
2	Secondary education	47.62%	20
3	Master's degree	38.10%	16
4	Above	11.90%	5
5	Other (please specify)	2.38%	1
			42

Showing rows 1 - 6 of 6

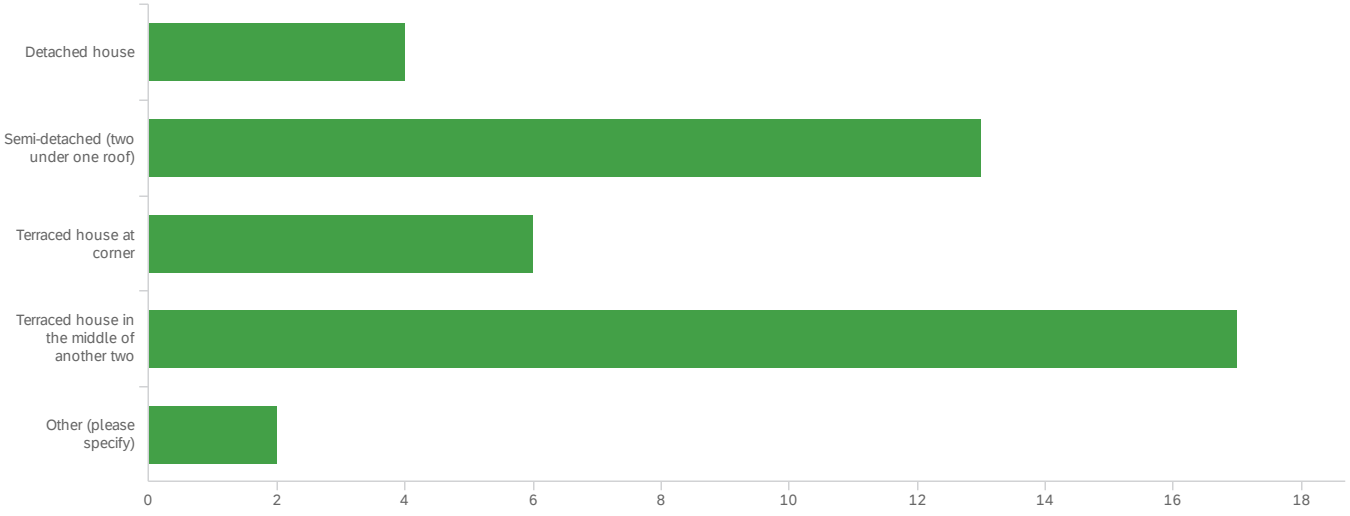
2/9_5_TEXT - Other (please specify)

Other (please specify)

Other (please specify)

Bachelor

3/9 - Please specify your house type:



#	Field		Choice Count
1	Detached house	9.52%	4
2	Semi-detached (two under one roof)	30.95%	13
3	Terraced house at corner	14.29%	6
4	Terraced house in the middle of another two	40.48%	17
5	Other (please specify)	4.76%	2
			42

Showing rows 1 - 6 of 6

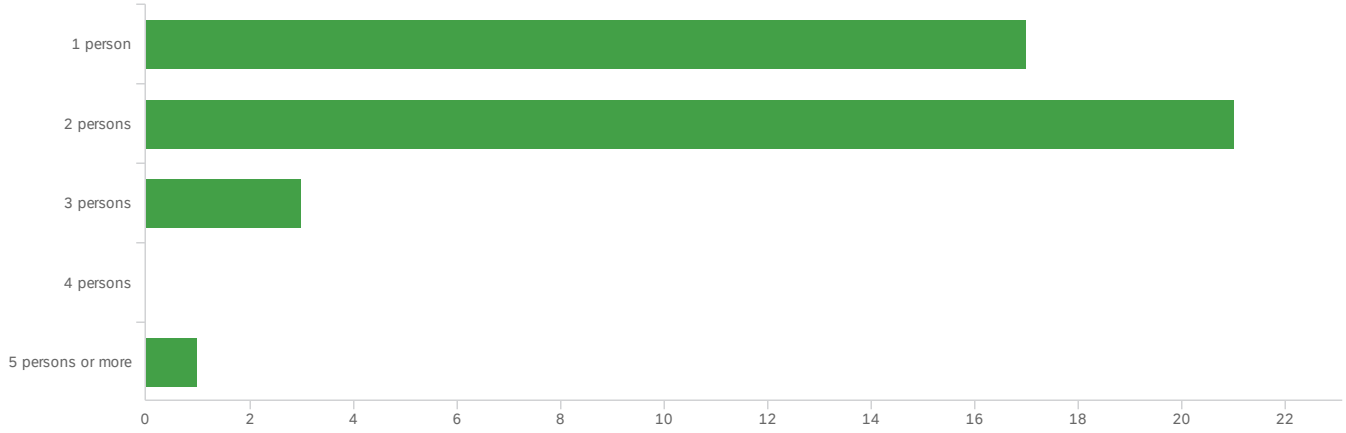
#	Field		Choice Count
1	Detached house	9.52%	4
2	Semi-detached (two under one roof)	30.95%	13
3	Terraced house at corner	14.29%	6
4	Terraced house in the middle of another two	40.48%	17
5	Other (please specify)	4.76%	2
			42

Showing rows 1 - 6 of 6

3/9_5_TEXT - Other (please specify)

Other (please specify)
appartment
Studio

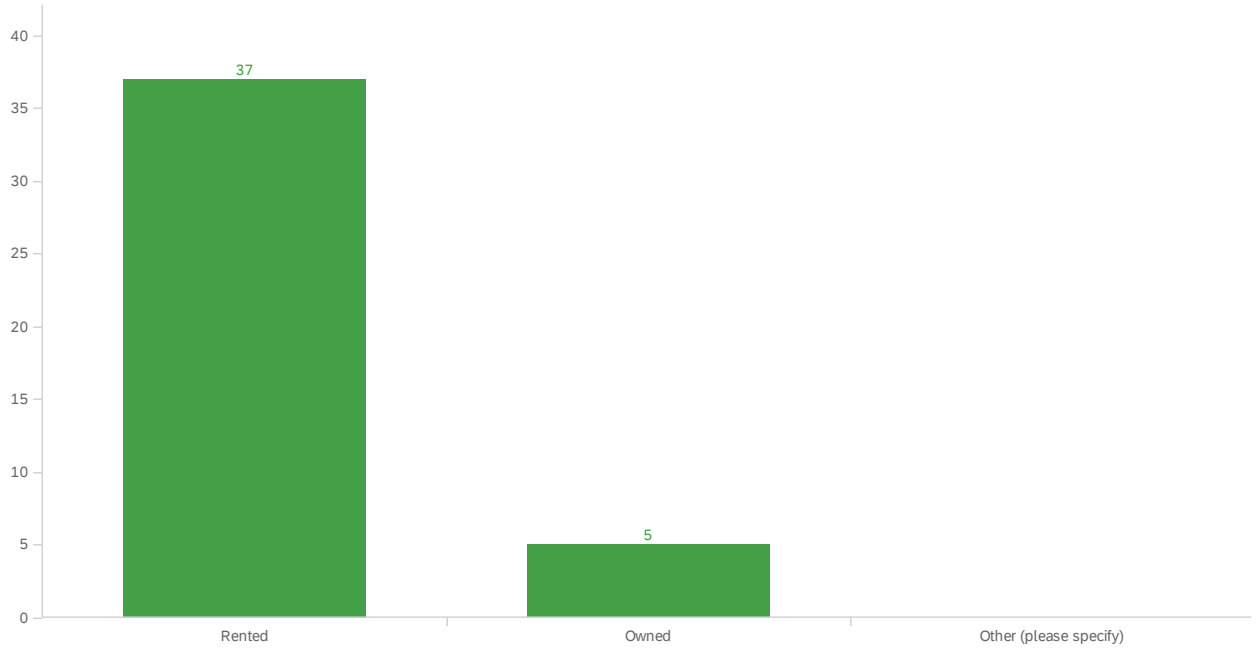
4/9 - Please specify how many people live in your house



#	Field		Choice Count
1	1 person	40.48%	17
2	2 persons	50.00%	21
3	3 persons	7.14%	3
4	4 persons	0.00%	0
5	5 persons or more	2.38%	1
			42

Showing rows 1 - 6 of 6

5/9 - Please specify your house ownership:



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Please specify your house ownership: - Selected Choice	1.00	2.00	1.88	0.32	0.10	42

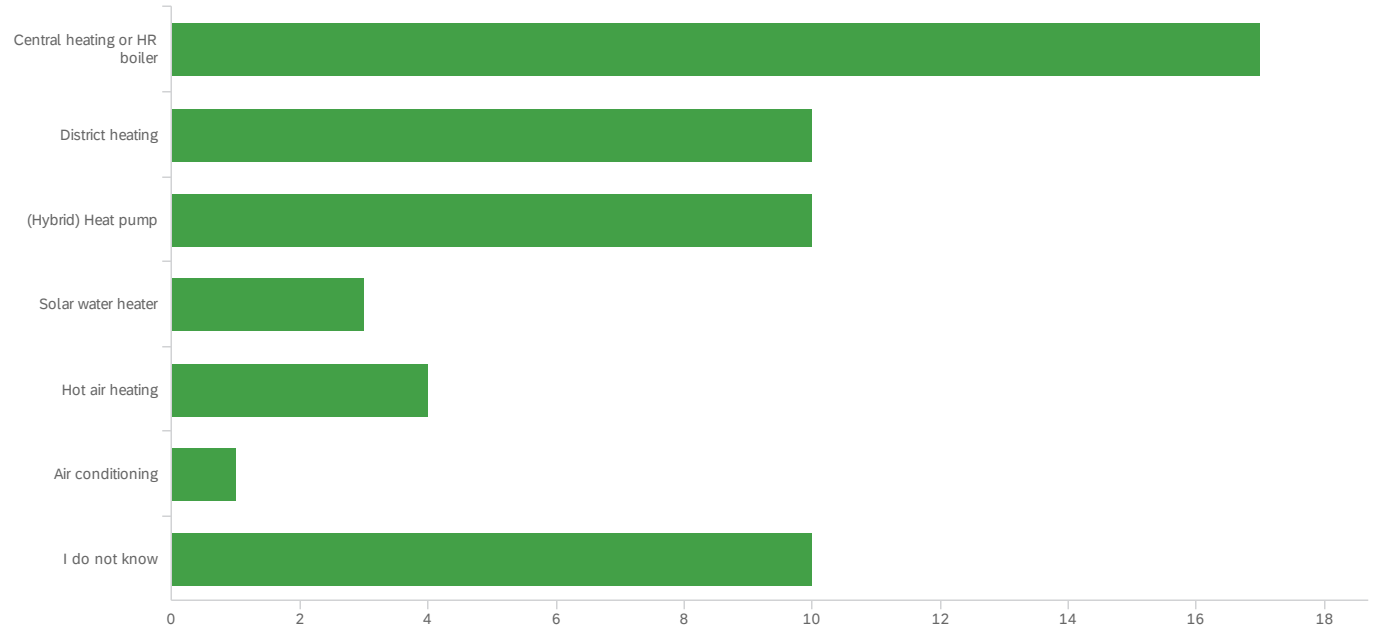
#	Field		Choice Count
1	Owned	11.90%	5
2	Rented	88.10%	37
3	Other (please specify)	0.00%	0
			42

Showing rows 1 - 4 of 4

5/9_3_TEXT - Other (please specify)

Other (please specify)

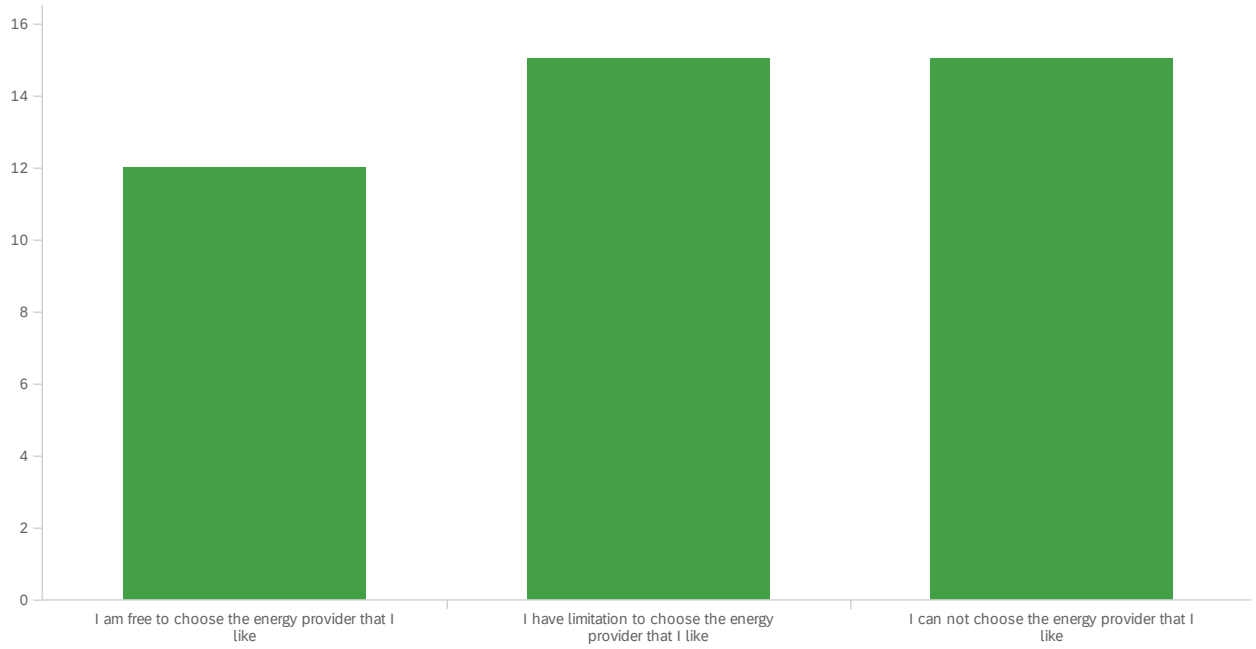
6/9 - Please specify the type of your house heating system: (you can choose multiple ones if needed)



#	Field	Choice Count	
1	Central heating or HR boiler	30.91%	17
2	District heating	18.18%	10
3	(Hybrid) Heat pump	18.18%	10
4	Solar water heater	5.45%	3
5	Hot air heating	7.27%	4
6	Air conditioning	1.82%	1
7	I do not know	18.18%	10
			55

Showing rows 1 - 8 of 8

7/9 - Please specify if you have the freedom of choose the energy provider

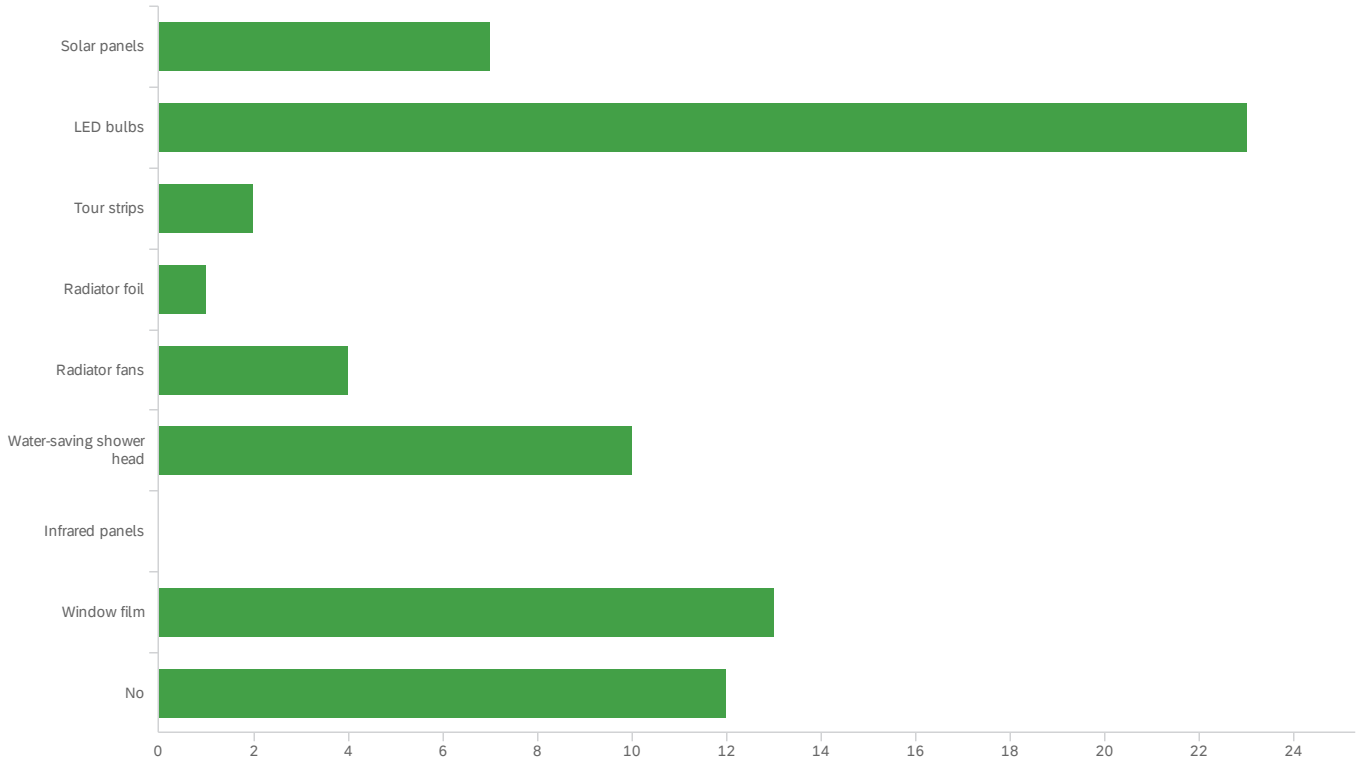


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Please specify if you have the freedom of choose the energy provider	1.00	3.00	2.07	0.80	0.64	42

#	Field		Choice Count
1	I am free to choose the energy provider that I like	28.57%	12
2	I have limitation to choose the energy provider that I like	35.71%	15
3	I can not choose the energy provider that I like	35.71%	15
			42

Showing rows 1 - 4 of 4

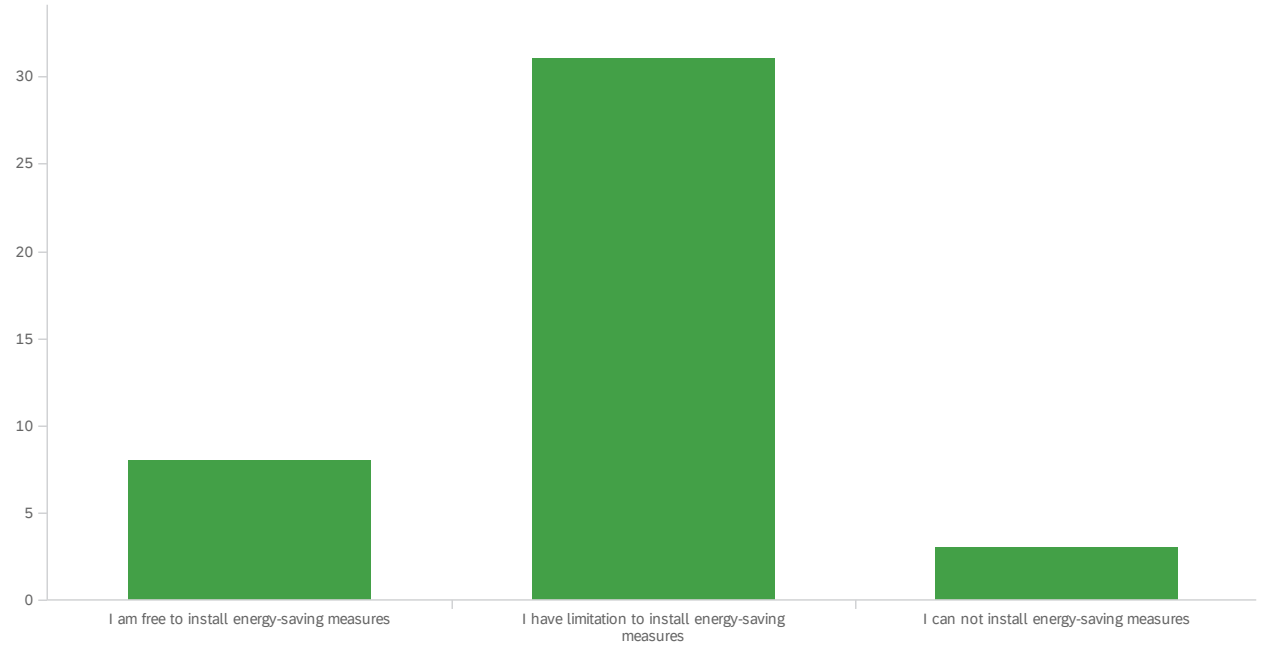
8/9 - Please specify if you have have installed any energy-saving measures



#	Field		Choice Count
1	Solar panels	9.72%	7
2	LED bulbs	31.94%	23
3	Tour strips	2.78%	2
4	Radiator foil	1.39%	1
5	Radiator fans	5.56%	4
6	Water-saving shower head	13.89%	10
7	Infrared panels	0.00%	0
8	Window film	18.06%	13
9	No	16.67%	12
			72

Showing rows 1 - 10 of 10

9/9 - Please specify if you have the freedom of install energy-saving measures

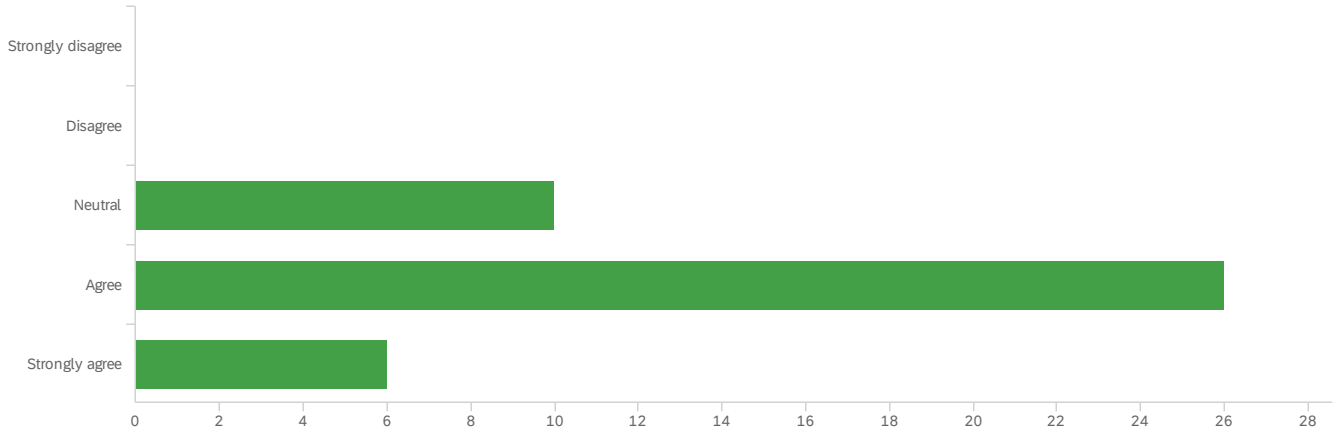


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Please specify if you have the freedom of install energy-saving measures	1.00	3.00	1.88	0.50	0.25	42

#	Field		Choice Count
1	I am free to install energy-saving measures	19.05%	8
2	I have limitation to install energy-saving measures	73.81%	31
3	I can not install energy-saving measures	7.14%	3
			42

Showing rows 1 - 4 of 4

1/8 - I believe that I can contribute to solving environmental, climate, and energy problems.

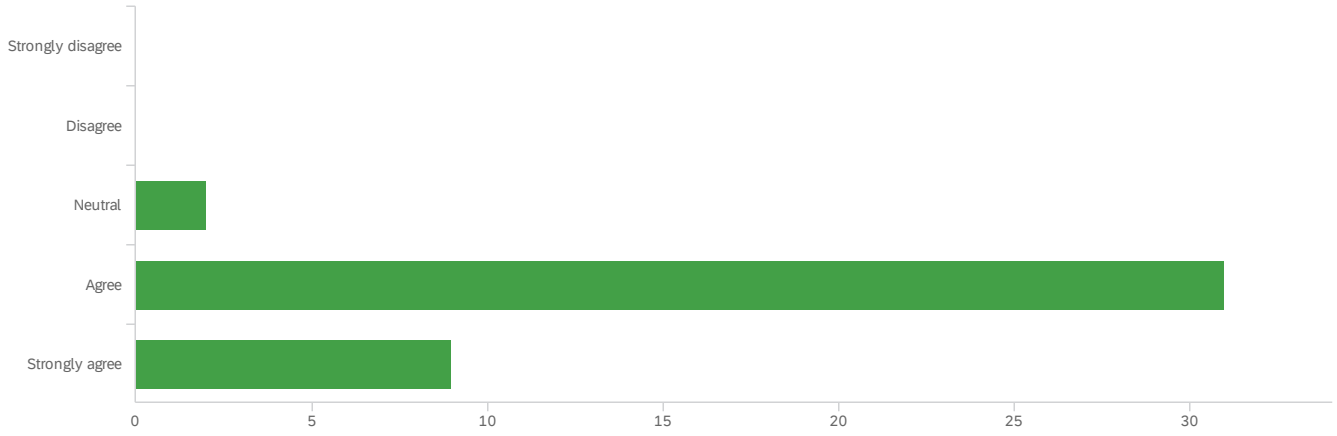


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	I believe that I can contribute to solving environmental, climate, and energy problems.	3.00	5.00	3.90	0.61	0.37	42

#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	0.00%	0
3	Neutral	23.81%	10
4	Agree	61.90%	26
5	Strongly agree	14.29%	6
			42

Showing rows 1 - 6 of 6

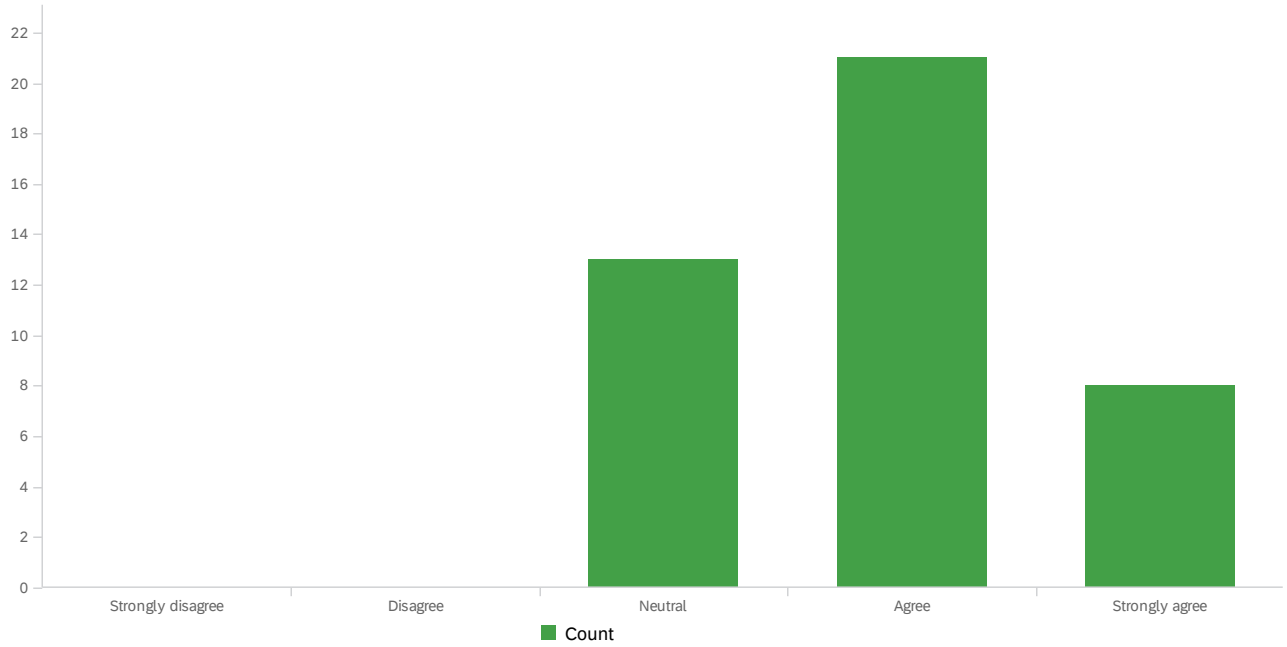
2/8 - I believe that reducing my energy consumption is a personal choice and requires self-motivation.



#	Field	Choice Count	
1	Strongly disagree	0.00%	0
2	Disagree	0.00%	0
3	Neutral	4.76%	2
4	Agree	73.81%	31
5	Strongly agree	21.43%	9
			42

Showing rows 1 - 6 of 6

3/8 - I would choose an energy provider based on its offer of renewable/green energy and service.



#	Field	Choice Count	
1	Strongly disagree	0.00%	0
2	Disagree	0.00%	0
3	Neutral	30.95%	13
4	Agree	50.00%	21
5	Strongly agree	19.05%	8
			42

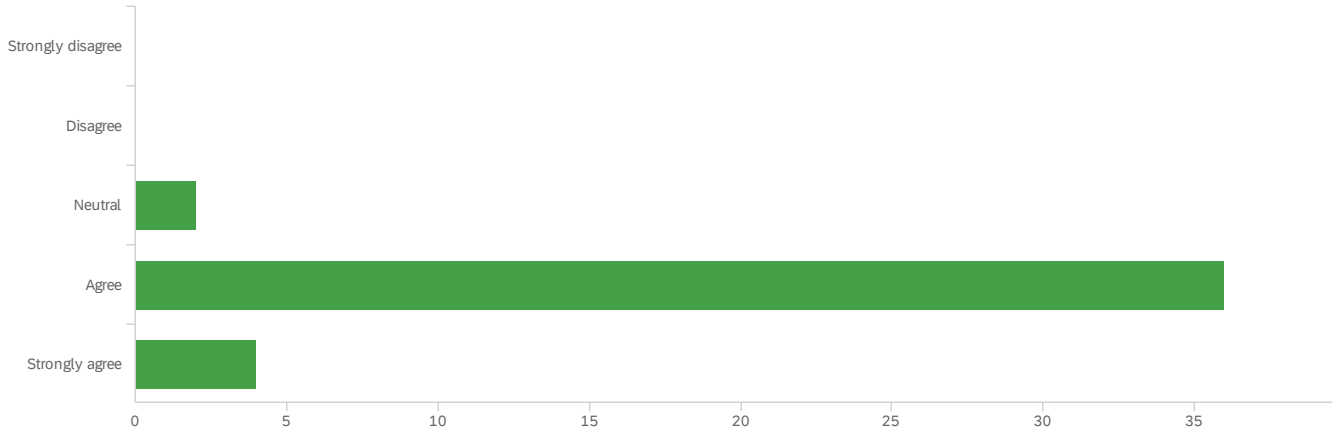
Showing rows 1 - 6 of 6

#	Field	Choice Count	
1	Strongly disagree	0.00%	0
2	Disagree	0.00%	0
3	Neutral	30.95%	13
4	Agree	50.00%	21
5	Strongly agree	19.05%	8

#	Field	Choice Count
		42

Showing rows 1 - 6 of 6

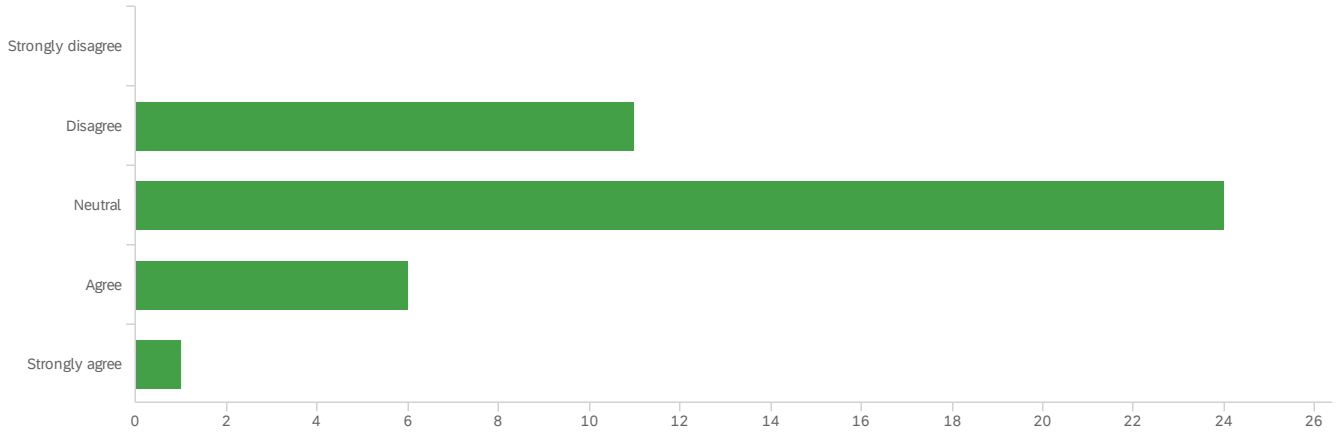
4/8 - I would like to discuss sustainable household energy or reducing household energy consumption with others, such as friends, family, and co-workers.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	0.00%	0
3	Neutral	4.76%	2
4	Agree	85.71%	36
5	Strongly agree	9.52%	4
			42

Showing rows 1 - 6 of 6

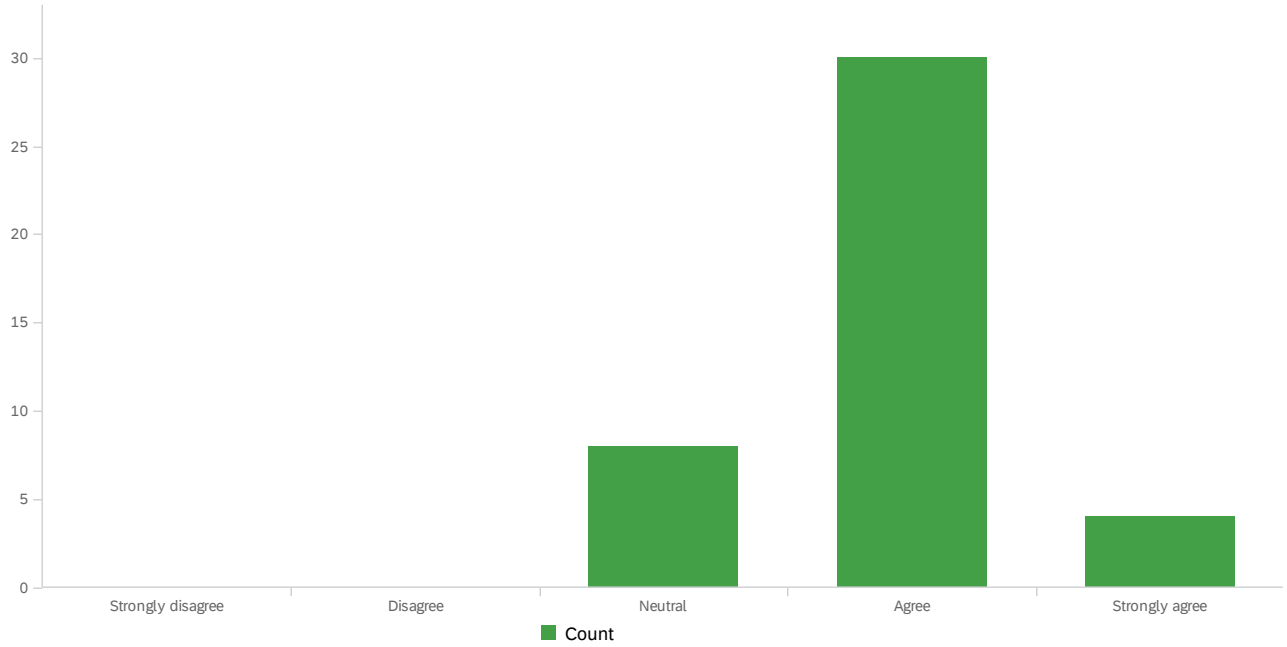
5/8 - I would like to share my sustainable actions online.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	26.19%	11
3	Neutral	57.14%	24
4	Agree	14.29%	6
5	Strongly agree	2.38%	1
			42

Showing rows 1 - 6 of 6

6/8 - I will reduce my energy consumption if encouraged or influenced by friends and family.

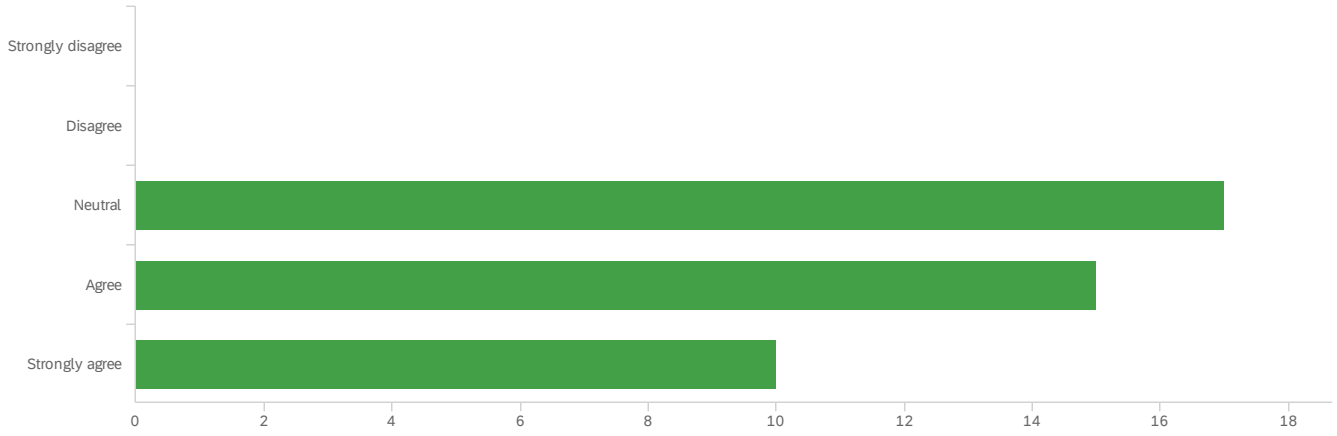


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	I will reduce my energy consumption if encouraged or influenced by friends and family.	3.00	5.00	3.90	0.53	0.28	42

#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	0.00%	0
3	Neutral	19.05%	8
4	Agree	71.43%	30
5	Strongly agree	9.52%	4
			42

Showing rows 1 - 6 of 6

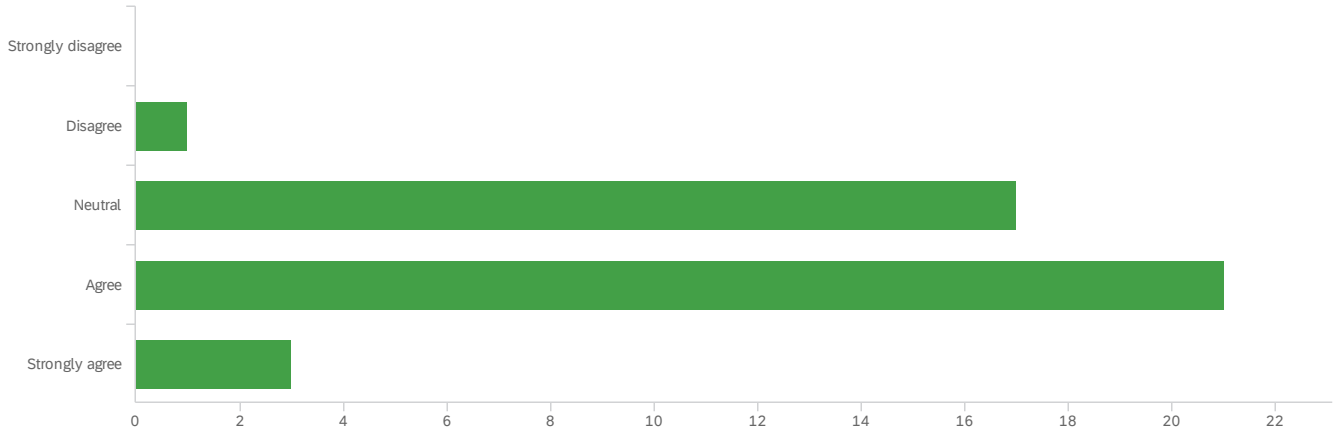
7/8 - I will reduce my energy consumption if I see the average energy consumption of others is lower than mine.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	0.00%	0
3	Neutral	40.48%	17
4	Agree	35.71%	15
5	Strongly agree	23.81%	10
			42

Showing rows 1 - 6 of 6

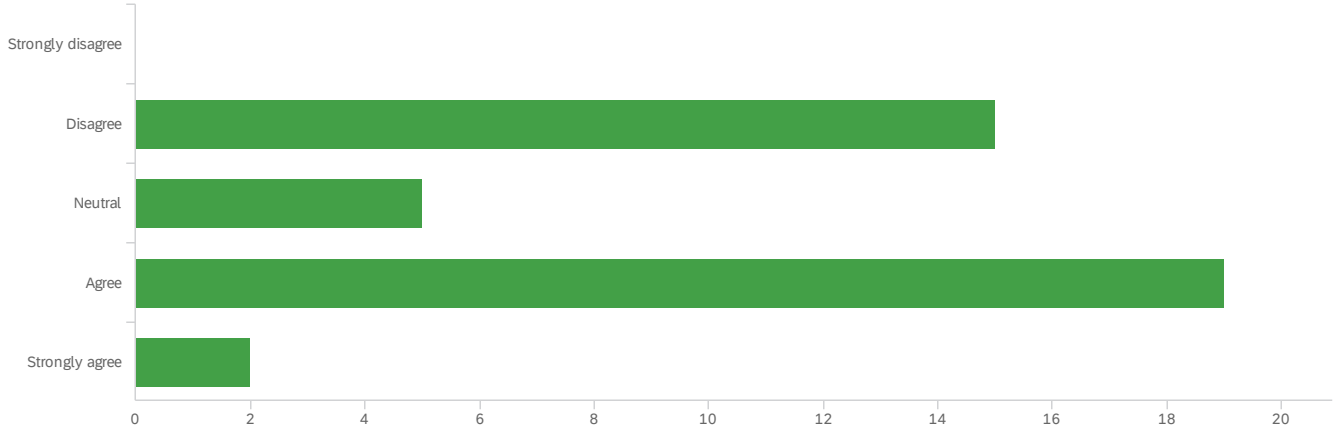
8/8 - I prefer to save energy consumption when I have someone to do it with, such as saving energy as a group.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	2.38%	1
3	Neutral	40.48%	17
4	Agree	50.00%	21
5	Strongly agree	7.14%	3
			42

Showing rows 1 - 6 of 6

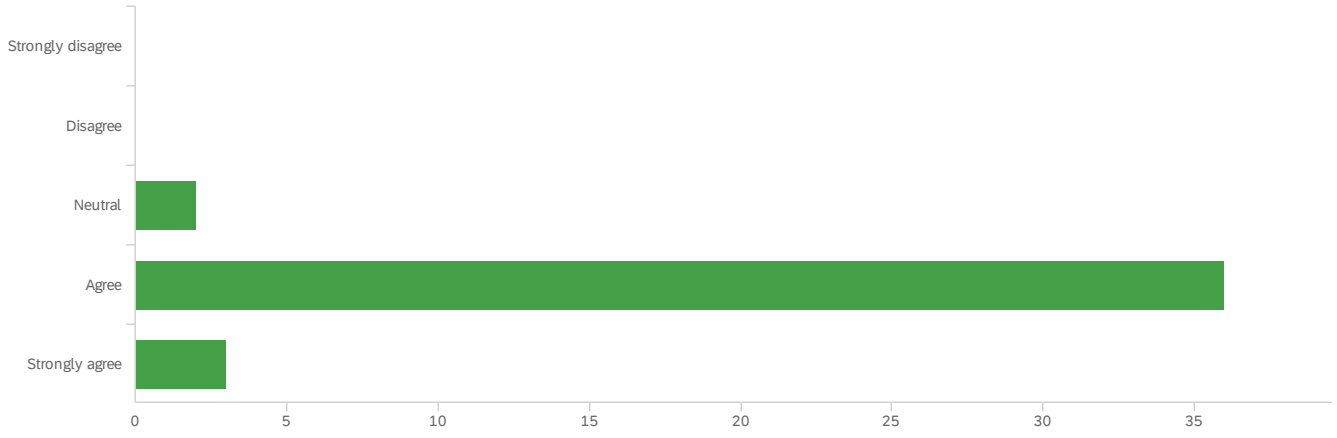
1/8 - I actively search for information related to sustainability and household energy.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	36.59%	15
3	Neutral	12.20%	5
4	Agree	46.34%	19
5	Strongly agree	4.88%	2
			41

Showing rows 1 - 6 of 6

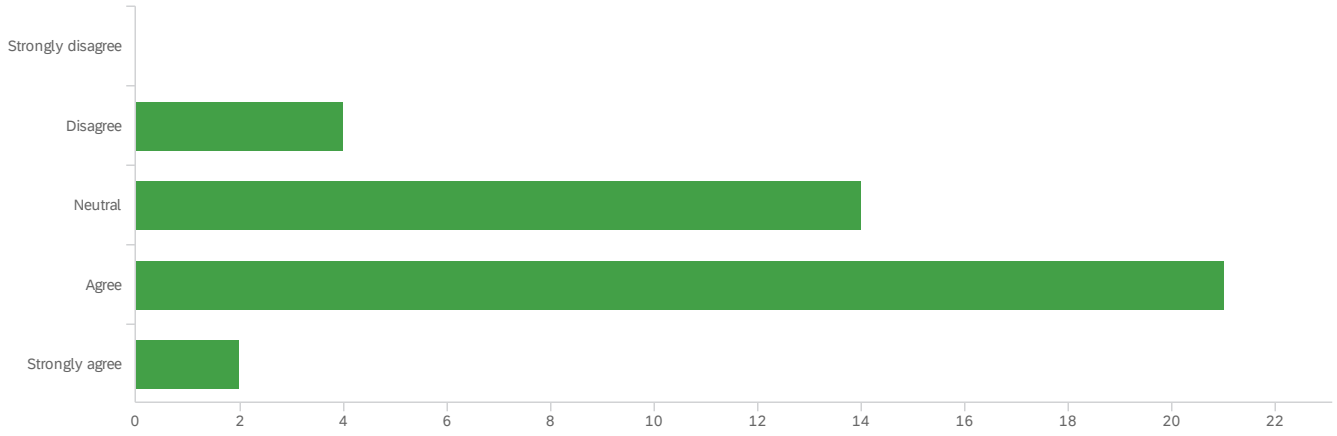
2/8 - I will reduce my energy consumption if more practical information on how to reduce energy consumption at home is available.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	0.00%	0
3	Neutral	4.88%	2
4	Agree	87.80%	36
5	Strongly agree	7.32%	3
			41

Showing rows 1 - 6 of 6

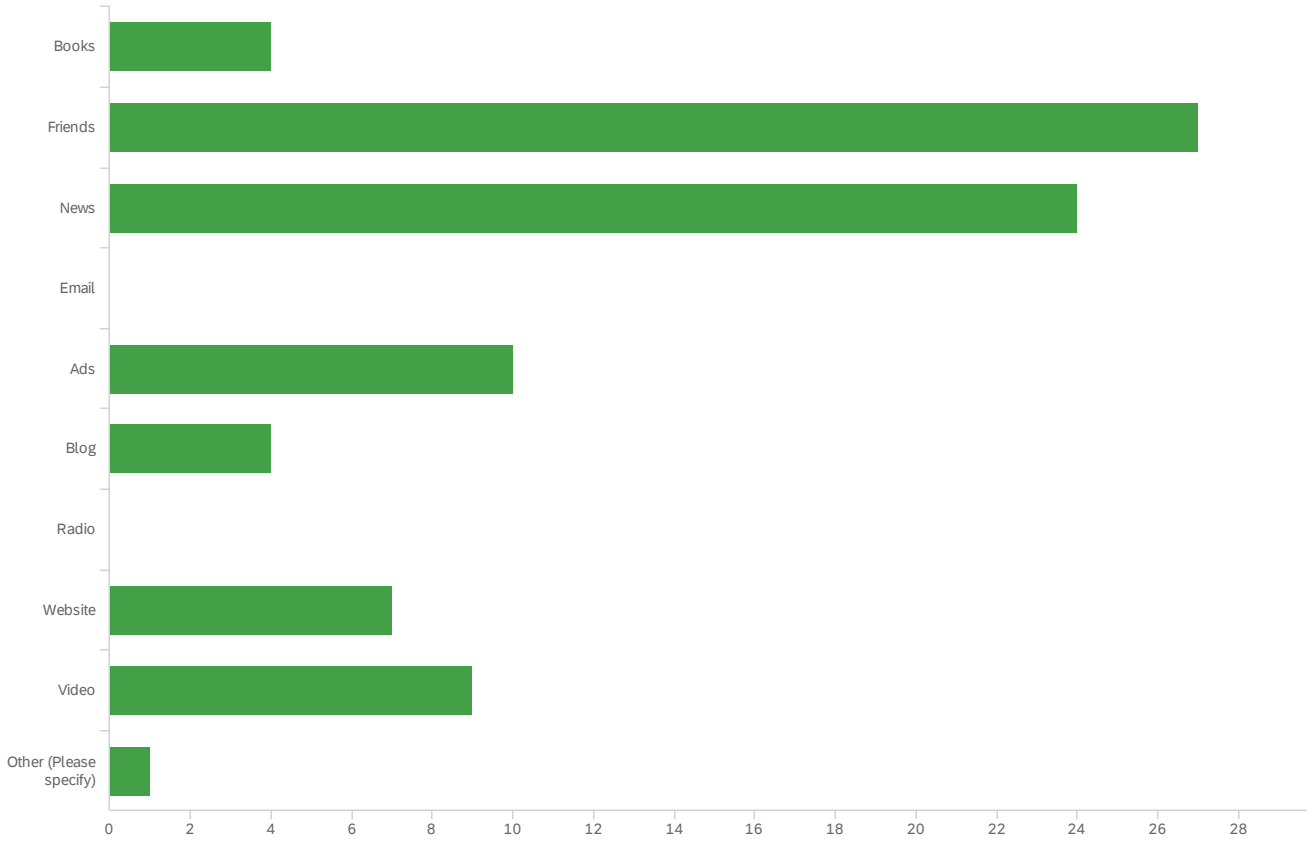
3/8 - I would use green energy if more practical information on how I can invest in green energies (e.g., installing solar panels) were available.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	9.76%	4
3	Neutral	34.15%	14
4	Agree	51.22%	21
5	Strongly agree	4.88%	2
			41

Showing rows 1 - 6 of 6

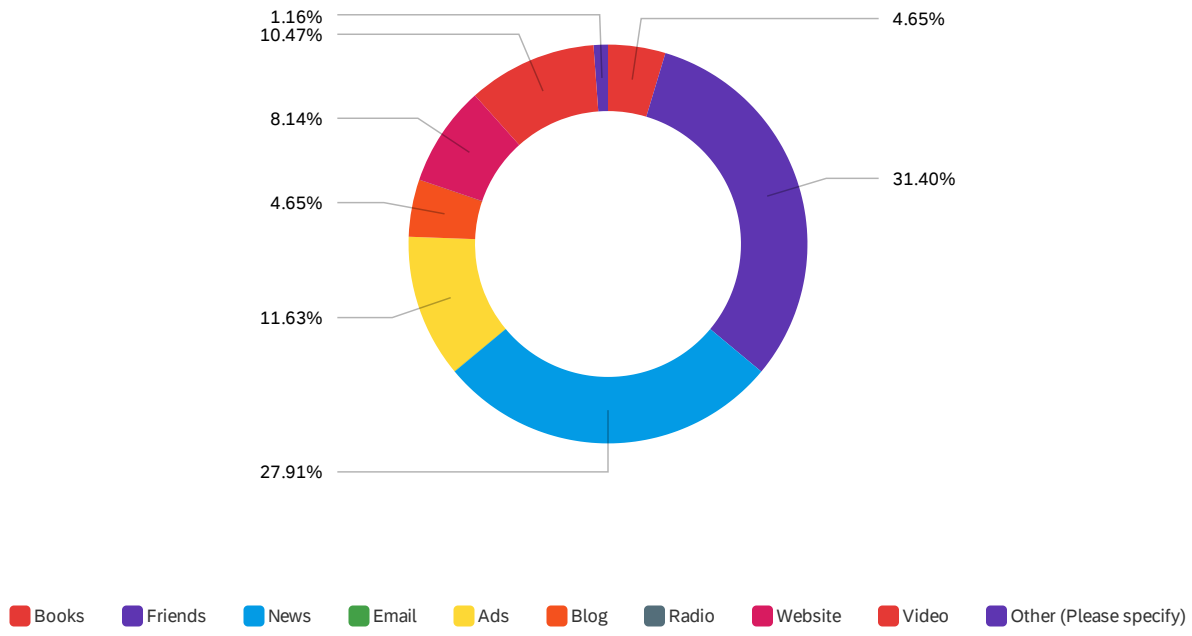
4/8 - I usually get information related to sustainability and energy consumption from: (you can choose multiple ones if needed)



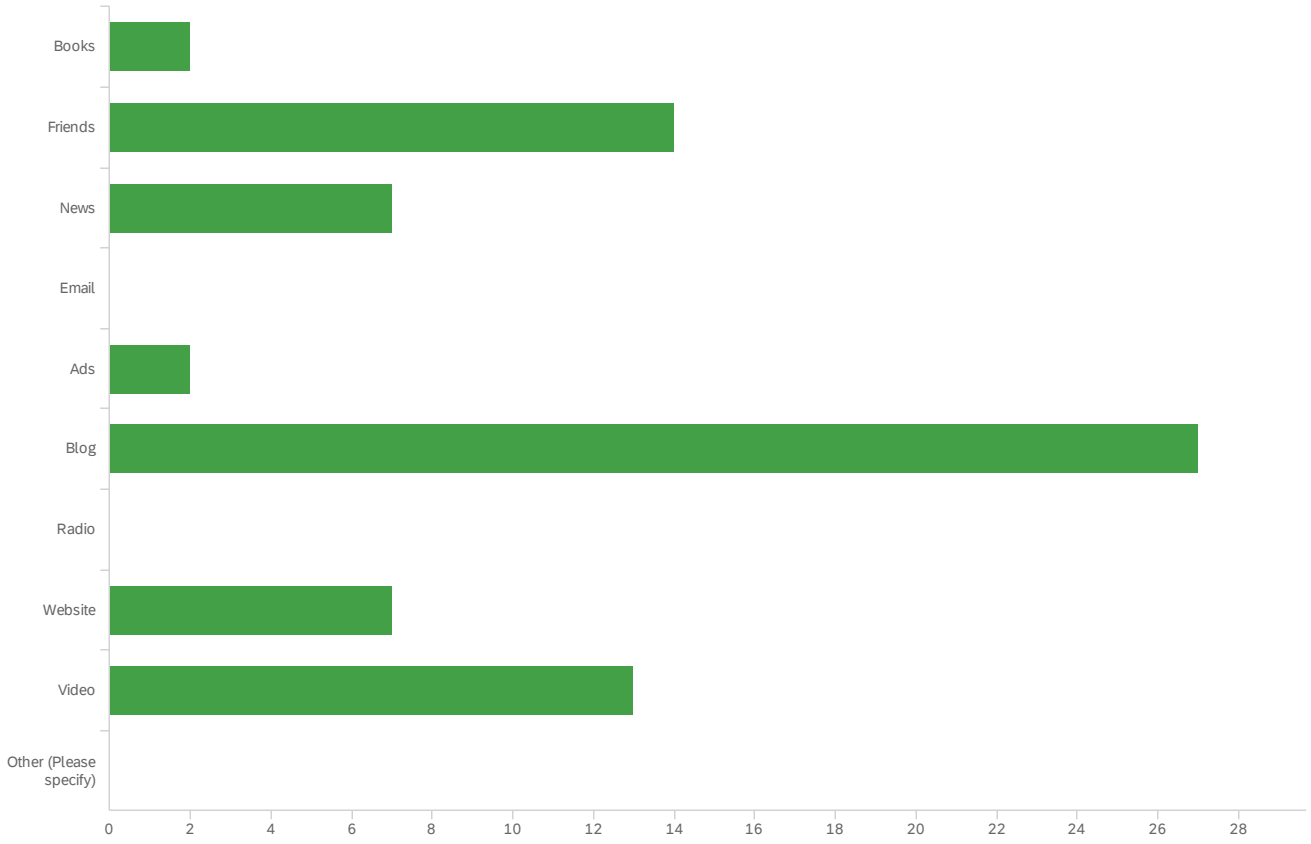
#	Field	Choice Count	
1	Books	4.65%	4
2	Friends	31.40%	27
3	News	27.91%	24
4	Email	0.00%	0
5	Ads	11.63%	10
6	Blog	4.65%	4
7	Radio	0.00%	0
8	Website	8.14%	7
9	Video	10.47%	9
10	Other (Please specify)	1.16%	1

#	Field	Choice Count
		86

Showing rows 1 - 11 of 11



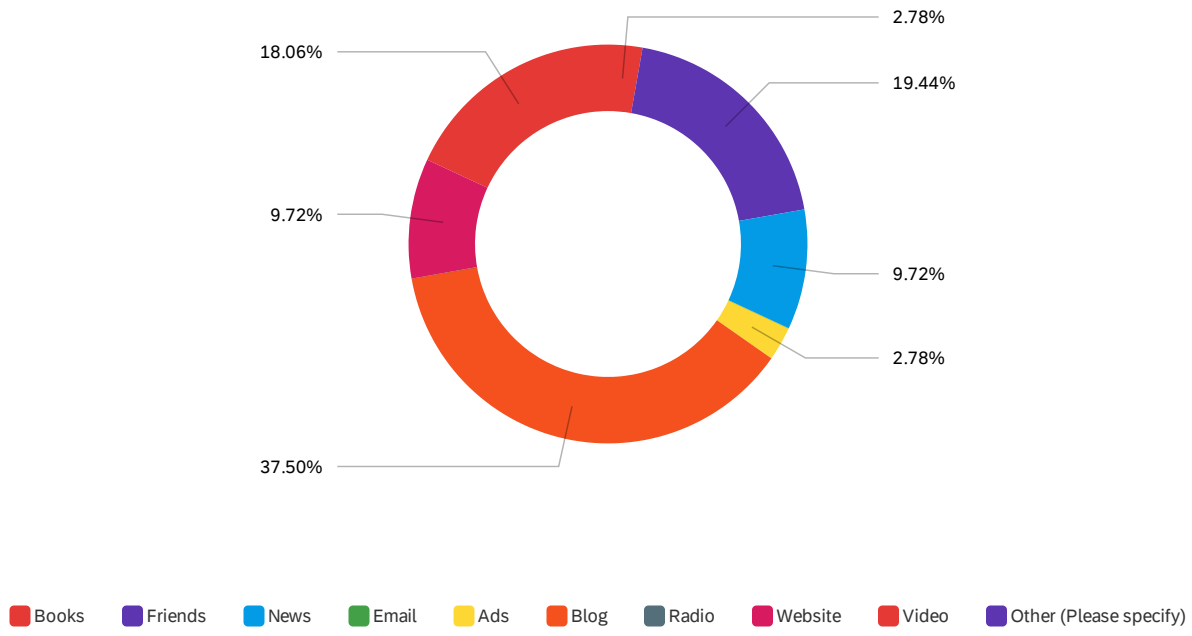
5/8 - I am willing to get more information related to sustainability and energy consumption from: (you can choose multiple ones if needed)



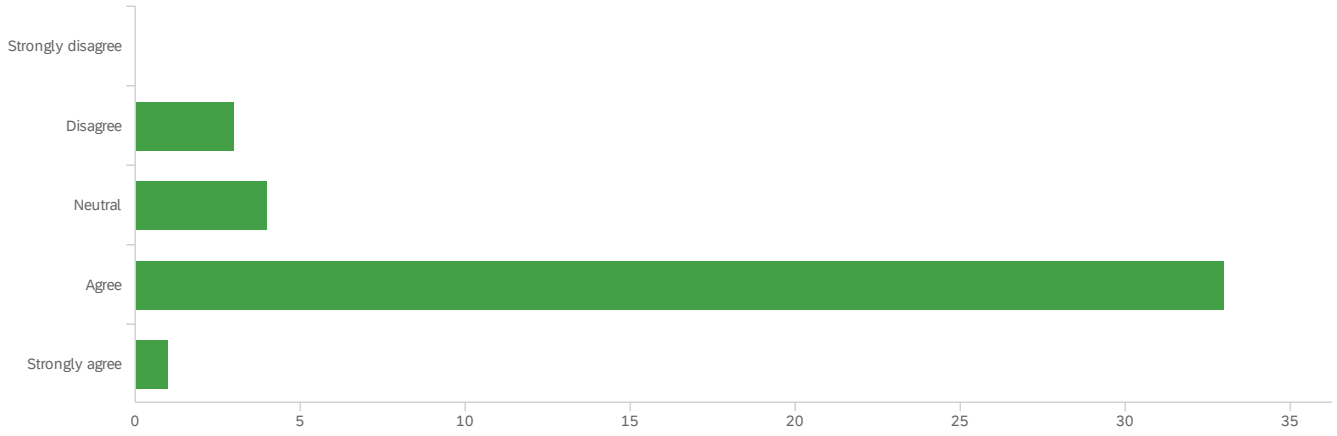
#	Field		Choice Count
8	Website	9.72%	7
9	Video	18.06%	13
7	Radio	0.00%	0
10	Other (Please specify)	0.00%	0
3	News	9.72%	7
2	Friends	19.44%	14
4	Email	0.00%	0
1	Books	2.78%	2
6	Blog	37.50%	27
5	Ads	2.78%	2

#	Field	Choice Count
		72

Showing rows 1 - 11 of 11



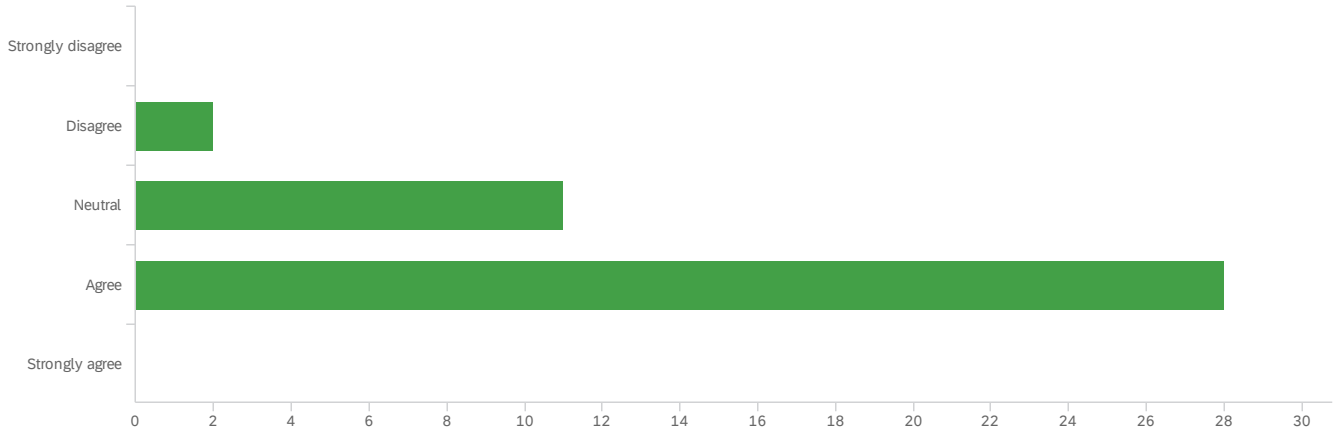
6/8 - I am willing to learn more about existing products/services to reduce my energy consumption.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	7.32%	3
3	Neutral	9.76%	4
4	Agree	80.49%	33
5	Strongly agree	2.44%	1
			41

Showing rows 1 - 6 of 6

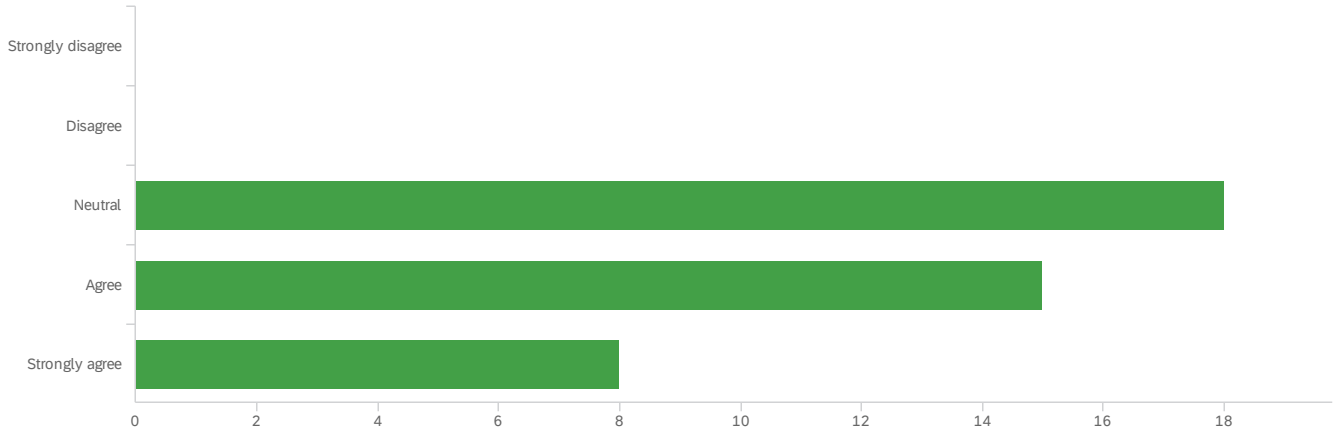
7/8 - I trust the information related to sustainability and energy consumption I got from the sourse I choose above.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	4.88%	2
3	Neutral	26.83%	11
4	Agree	68.29%	28
5	Strongly agree	0.00%	0
			41

Showing rows 1 - 6 of 6

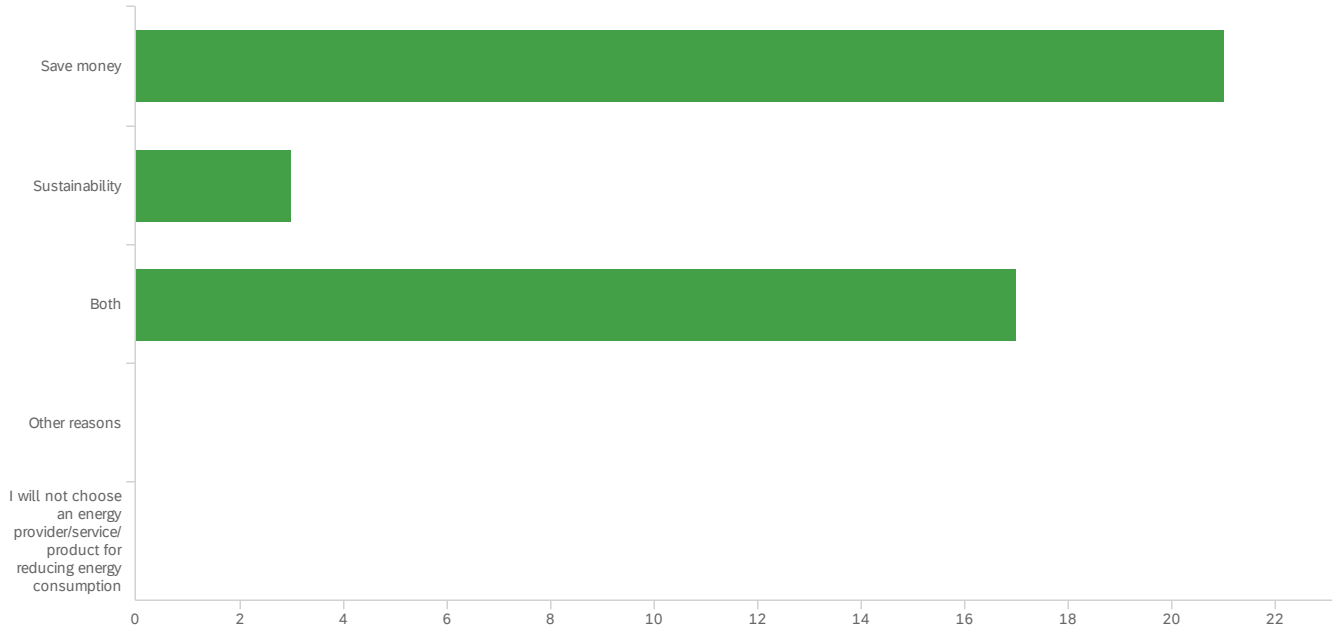
8/8 - I trust the energy consumption data I receive from my energy provider.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	0.00%	0
3	Neutral	43.90%	18
4	Agree	36.59%	15
5	Strongly agree	19.51%	8
			41

Showing rows 1 - 6 of 6

1/5 - If I choose an energy provider/service/product to reduce my household energy consumption, I mainly do it for:



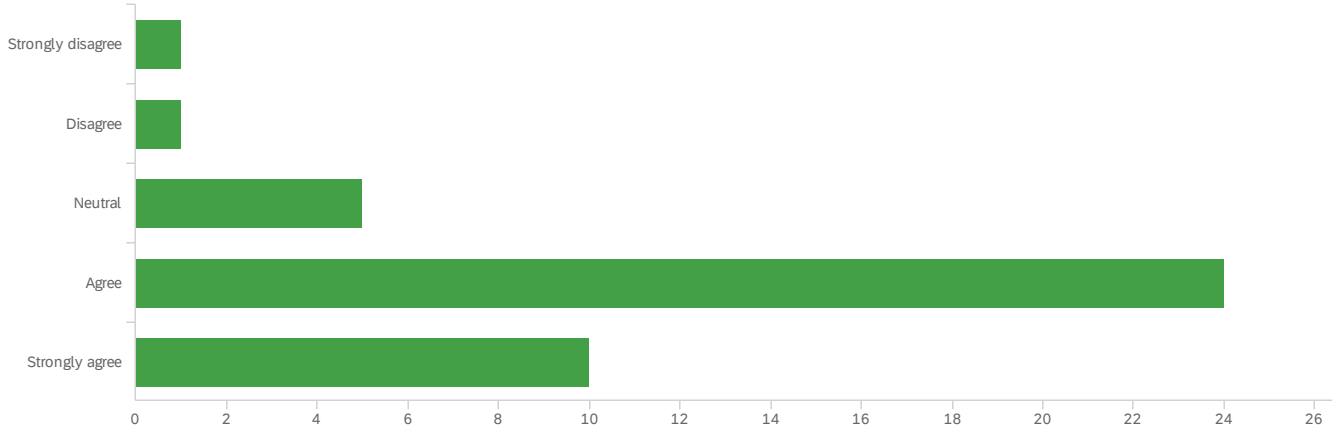
#	Field	Choice Count	
1	Save money	51.22%	21
2	Sustainability	7.32%	3
3	Both	41.46%	17
4	Other reasons	0.00%	0
5	I will not choose an energy provider/service/product for reducing energy consumption	0.00%	0
			41

Showing rows 1 - 6 of 6

1/5_4_TEXT - Other reasons

Other reasons

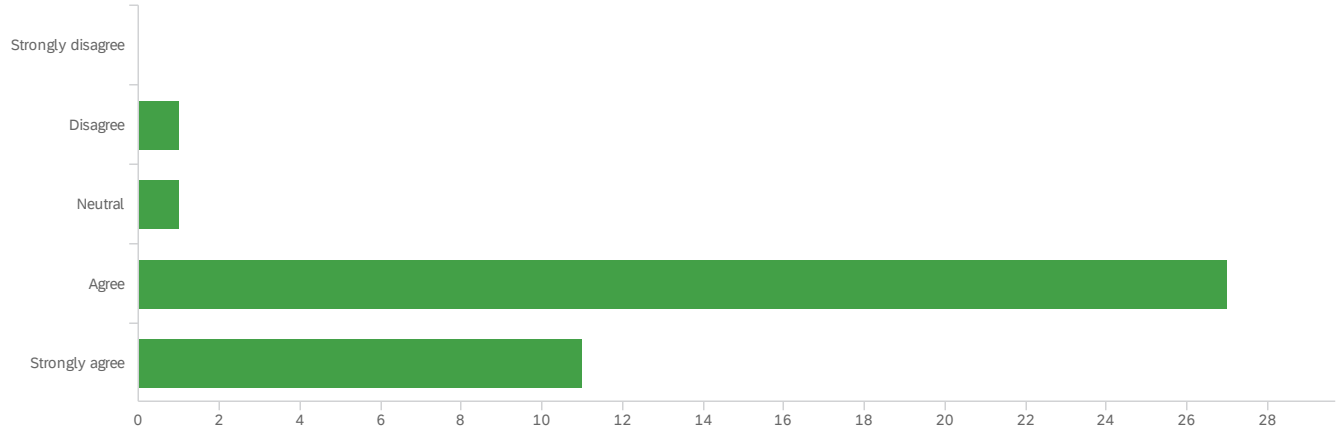
2/5 - I would choose a provider if a cheaper offer was available.



#	Field		Choice Count
1	Strongly disagree	2.44%	1
2	Disagree	2.44%	1
3	Neutral	12.20%	5
4	Agree	58.54%	24
5	Strongly agree	24.39%	10
			41

Showing rows 1 - 6 of 6

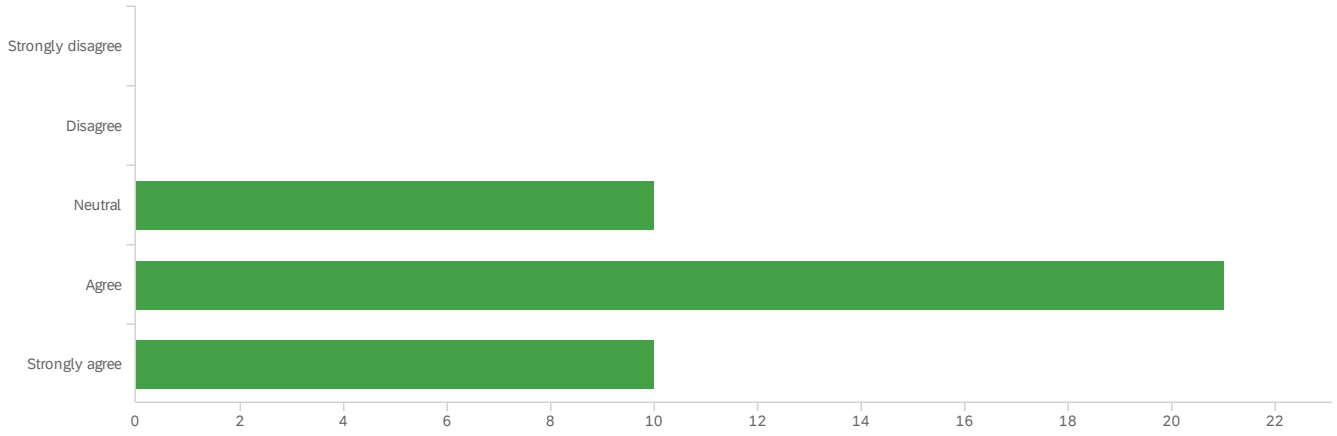
3/5 - I will try to minimize energy consumption when I adjust the room's temperature, such as wearing warm clothes indoors and turning the heating down when the room is unoccupied.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	2.50%	1
3	Neutral	2.50%	1
4	Agree	67.50%	27
5	Strongly agree	27.50%	11
			40

Showing rows 1 - 6 of 6

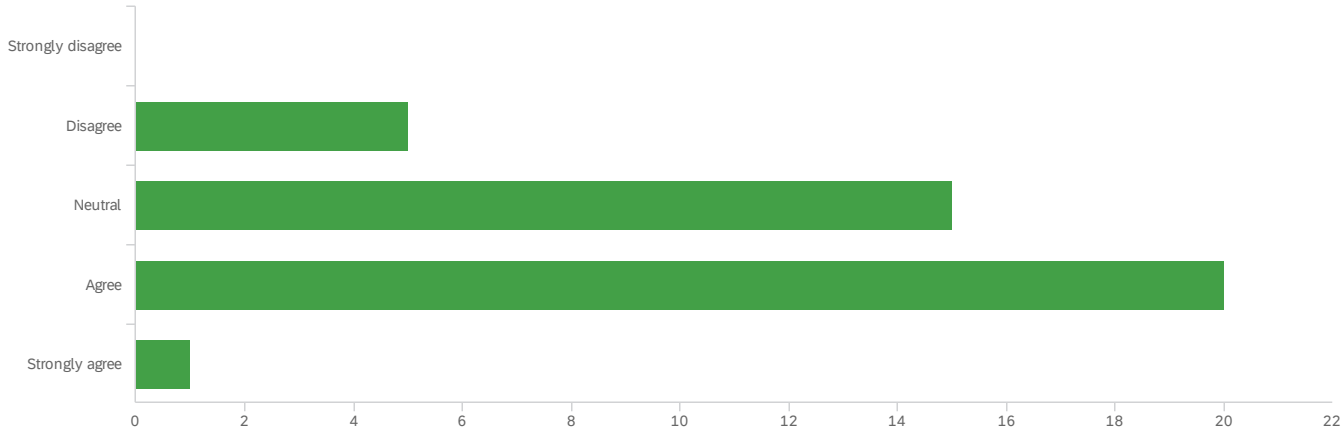
4/5 - I will try to minimize energy consumption when I adjust the brightness of the room, such as turning the lights off when leaving.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	0.00%	0
3	Neutral	24.39%	10
4	Agree	51.22%	21
5	Strongly agree	24.39%	10
			41

Showing rows 1 - 6 of 6

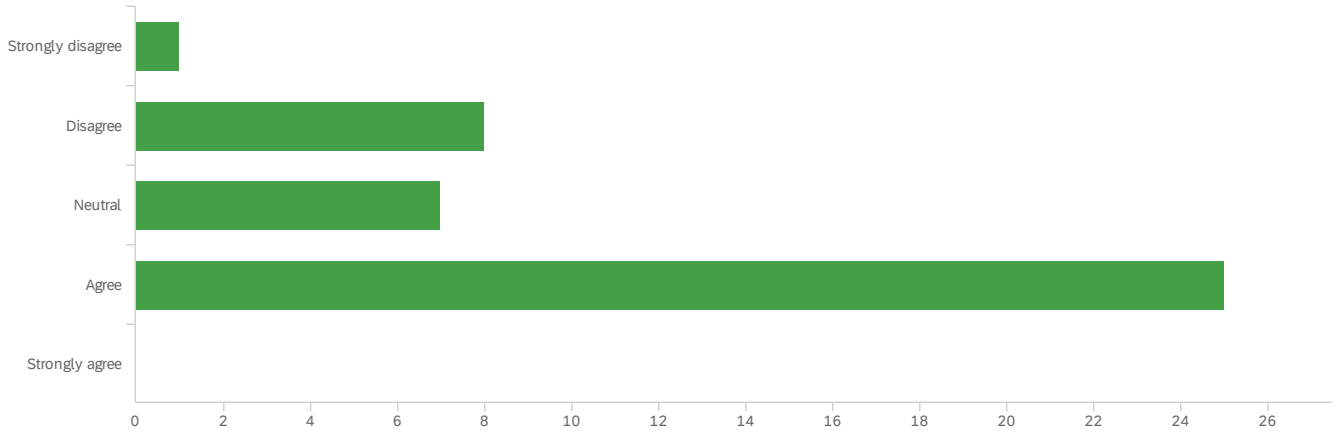
5/5 - I will try to minimize my energy expenditure when I shower, such as using a lower temperature or having a shorter shower.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	12.20%	5
3	Neutral	36.59%	15
4	Agree	48.78%	20
5	Strongly agree	2.44%	1
			41

Showing rows 1 - 6 of 6

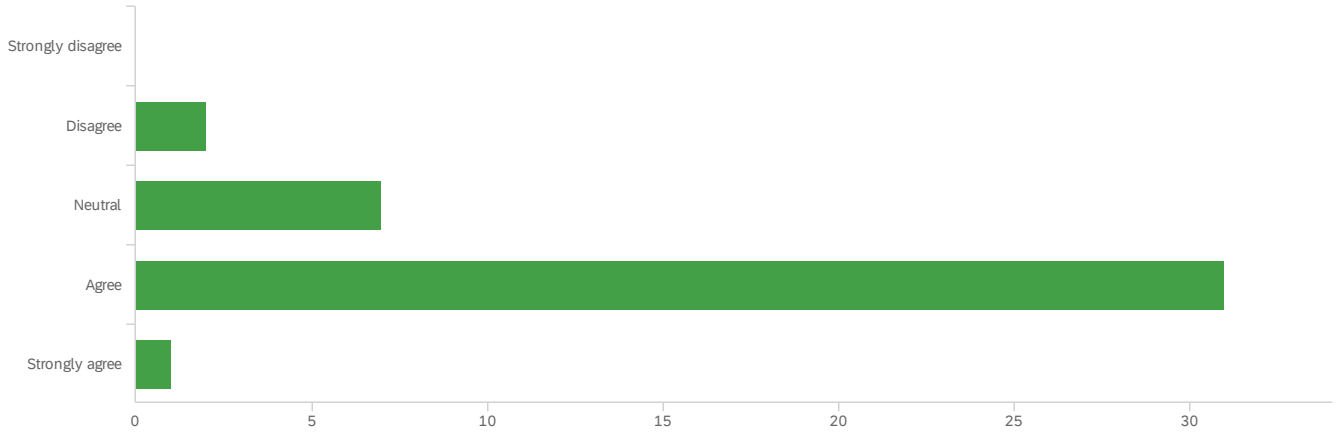
Q1 - I try to minimize my energy consumption when doing housework, even if it requires more effort, such as sweeping the floor with a broom instead of using a vacuum cleaner.



#	Field		Choice Count
1	Strongly disagree	2.44%	1
2	Disagree	19.51%	8
3	Neutral	17.07%	7
4	Agree	60.98%	25
5	Strongly agree	0.00%	0
			41

Showing rows 1 - 6 of 6

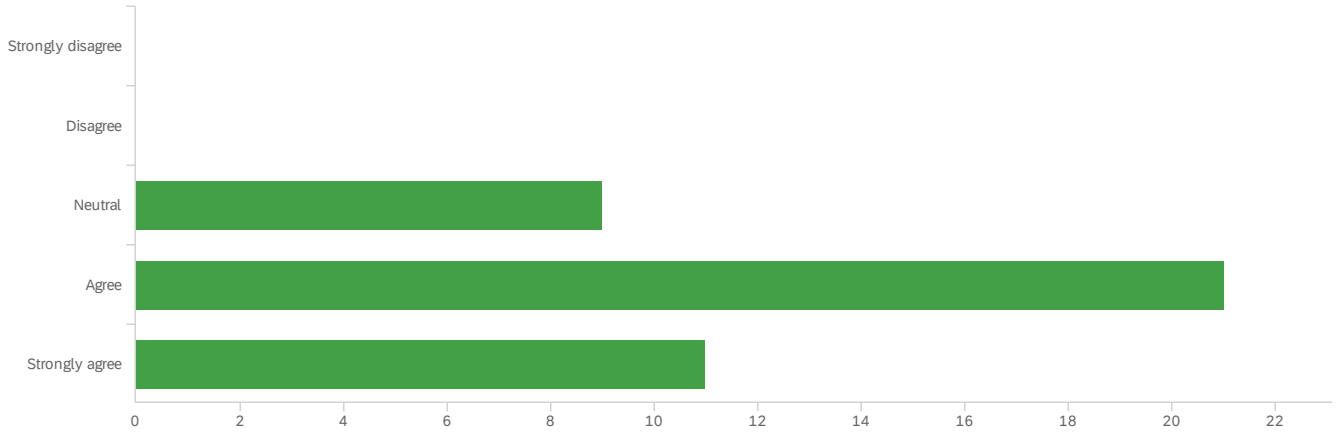
Q2 - I believe that investing in green energy products/services (e.g., installing solar panels or funding a wind turbine) requires more effort.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	4.88%	2
3	Neutral	17.07%	7
4	Agree	75.61%	31
5	Strongly agree	2.44%	1
			41

Showing rows 1 - 6 of 6

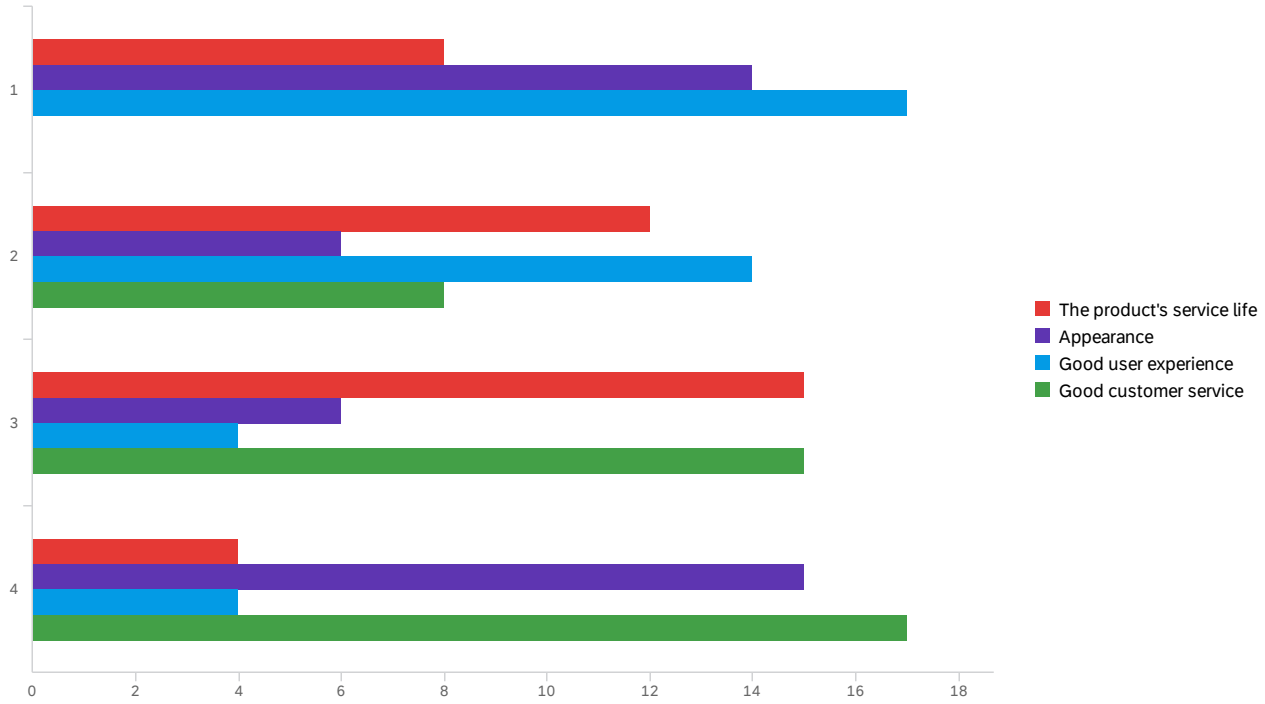
Q3 - The quality of the product/service influence will influence my decision when choosing an energy provider.



#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	0.00%	0
3	Neutral	21.95%	9
4	Agree	51.22%	21
5	Strongly agree	26.83%	11
			41

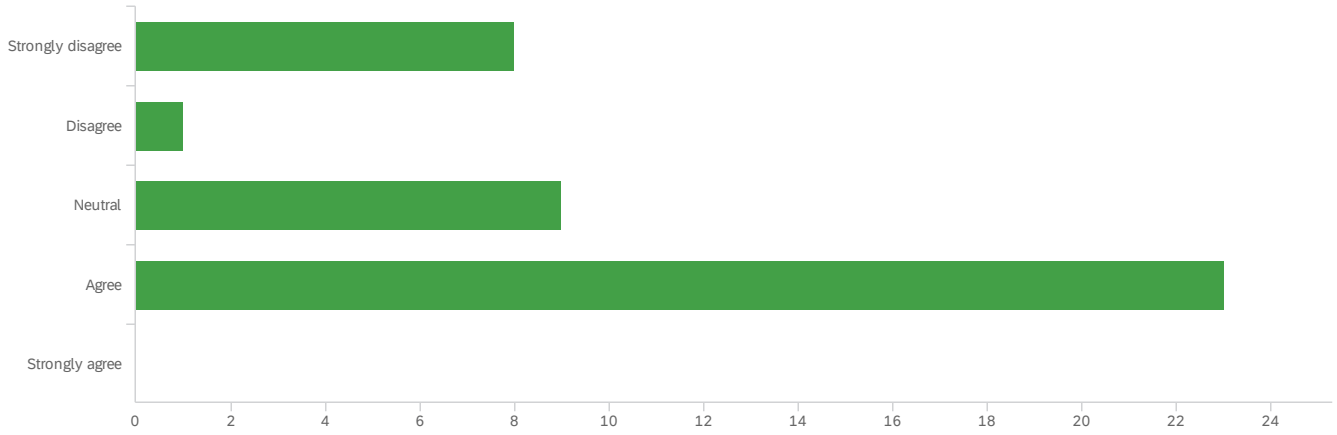
Showing rows 1 - 6 of 6

Q4 - Please rank the importance of factors to assess the quality of a household energy product. For 1 is most important and 4 is least important.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	The product's service life	1.00	4.00	2.38	0.92	0.85	39
2	Appearance	1.00	4.00	2.54	1.29	1.66	41
3	Good user experience	1.00	4.00	1.87	0.97	0.93	39
4	Good customer service	2.00	4.00	3.23	0.76	0.57	40

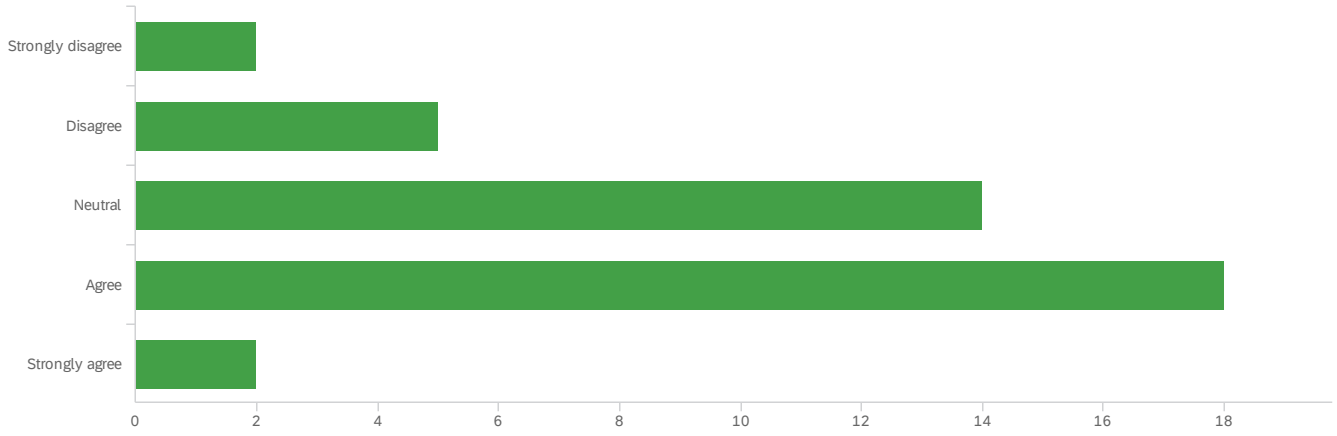
1/5 - I actively search for the most current products/services in the energy field.



#	Field	Choice Count	
1	Strongly disagree	19.51%	8
2	Disagree	2.44%	1
3	Neutral	21.95%	9
4	Agree	56.10%	23
5	Strongly agree	0.00%	0
			41

Showing rows 1 - 6 of 6

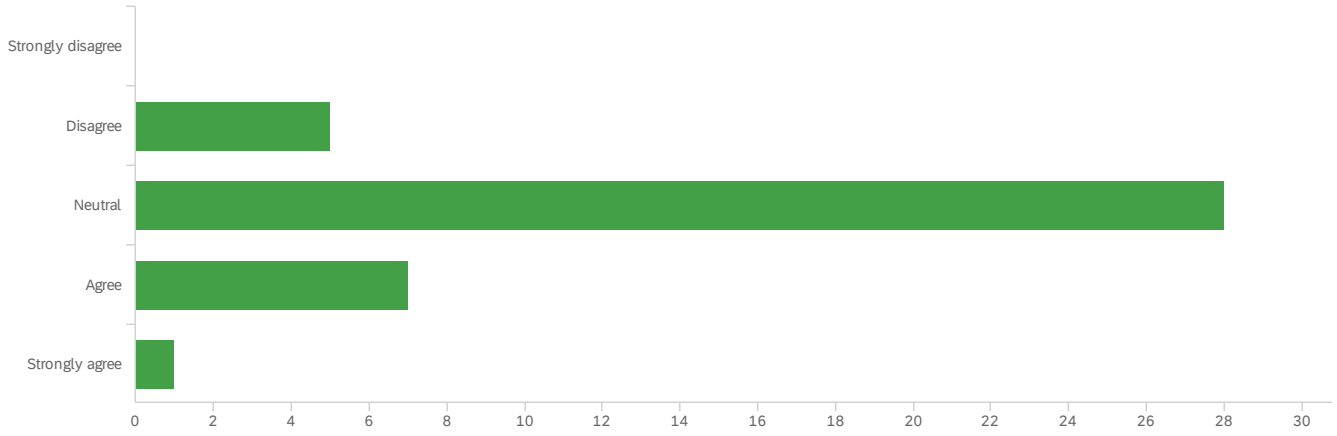
2/5 - I tend to install household energy providers/products/technologies that I used to have instead of trying more current ones.



#	Field		Choice Count
1	Strongly disagree	4.88%	2
2	Disagree	12.20%	5
3	Neutral	34.15%	14
4	Agree	43.90%	18
5	Strongly agree	4.88%	2
			41

Showing rows 1 - 6 of 6

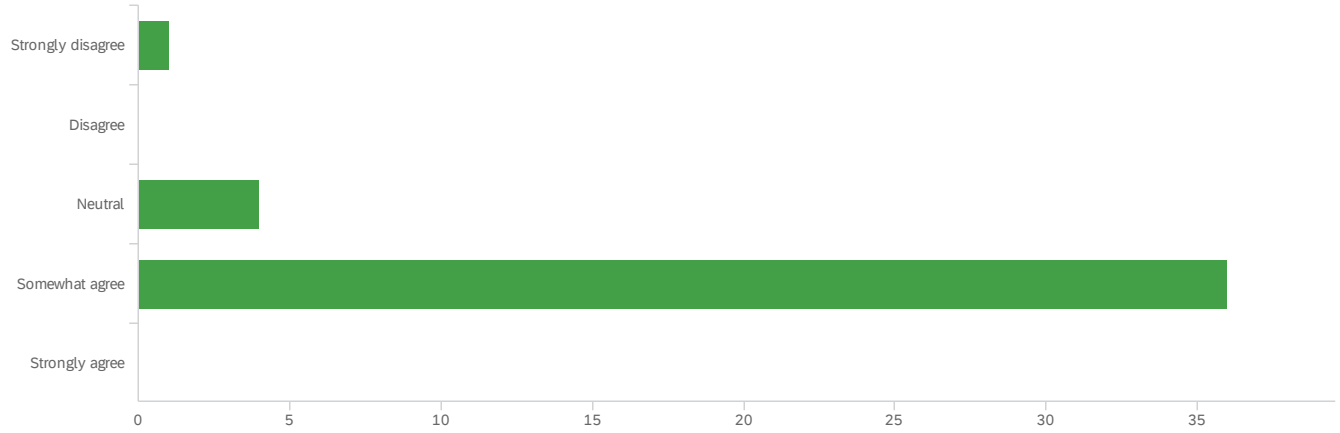
3/5 - I am willing to switch my household energy provider/product/technologies when there is a new one on the market.



#	Field	Choice Count	
1	Strongly disagree	0.00%	0
2	Disagree	12.20%	5
3	Neutral	68.29%	28
4	Agree	17.07%	7
5	Strongly agree	2.44%	1
			41

Showing rows 1 - 6 of 6

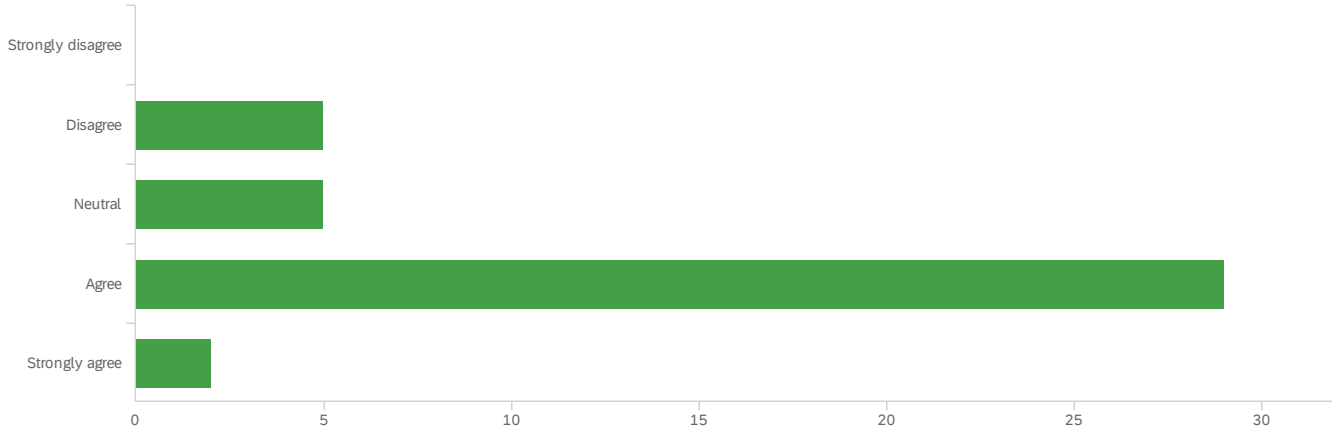
4/5 - I would like to use Artificial Intelligence products to monitor and analyze the data of my energy consumption in the future, such as smart meters that can show accurate energy consumption data and analyze the data based on time, weather, etc.



#	Field		Choice Count
1	Strongly disagree	2.44%	1
2	Disagree	0.00%	0
3	Neutral	9.76%	4
4	Somewhat agree	87.80%	36
5	Strongly agree	0.00%	0
			41

Showing rows 1 - 6 of 6

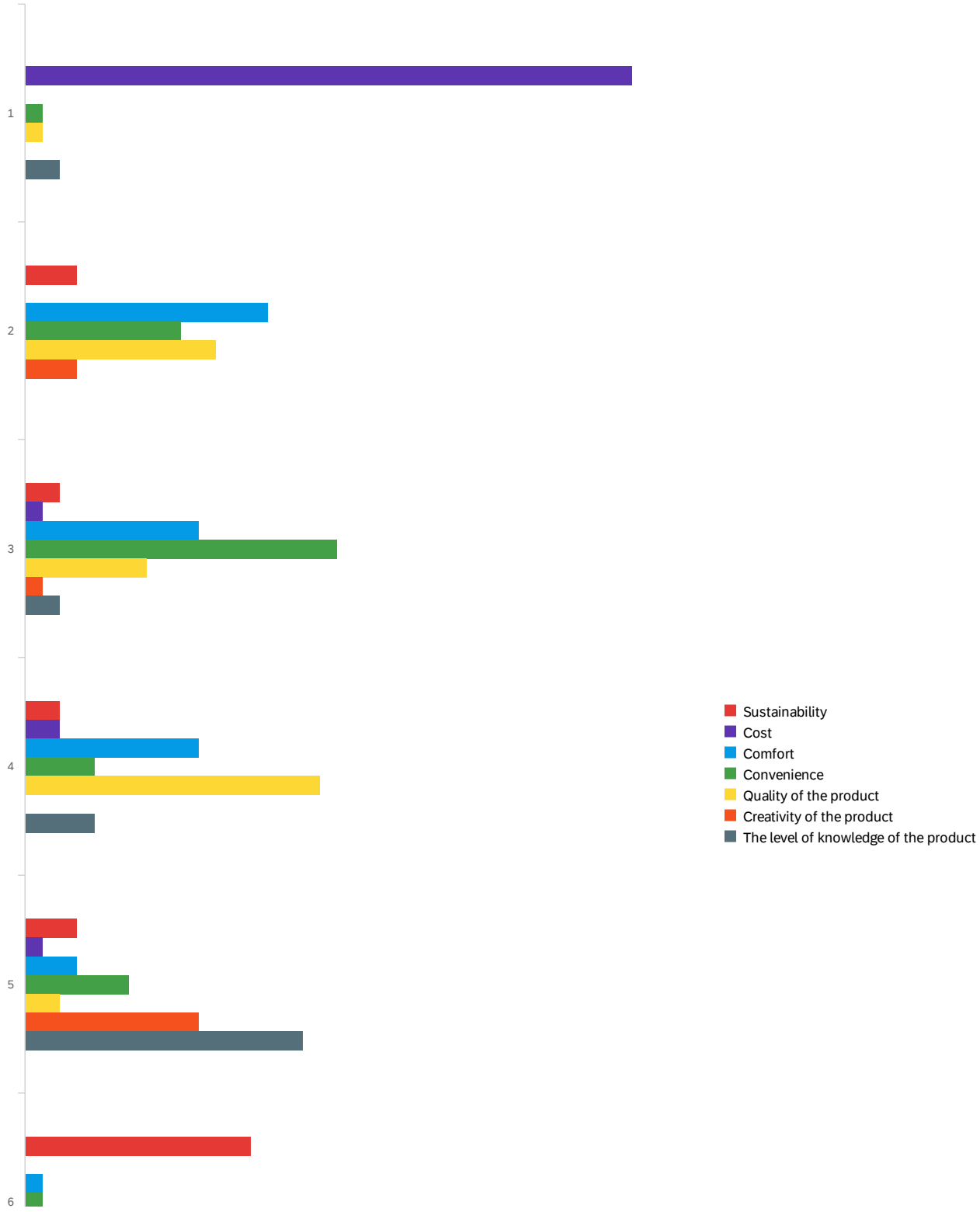
5/5 - I would like to use Artificial Intelligence products to control my household equipment and save energy, such as automatically shutting down the power of unused products in the future.

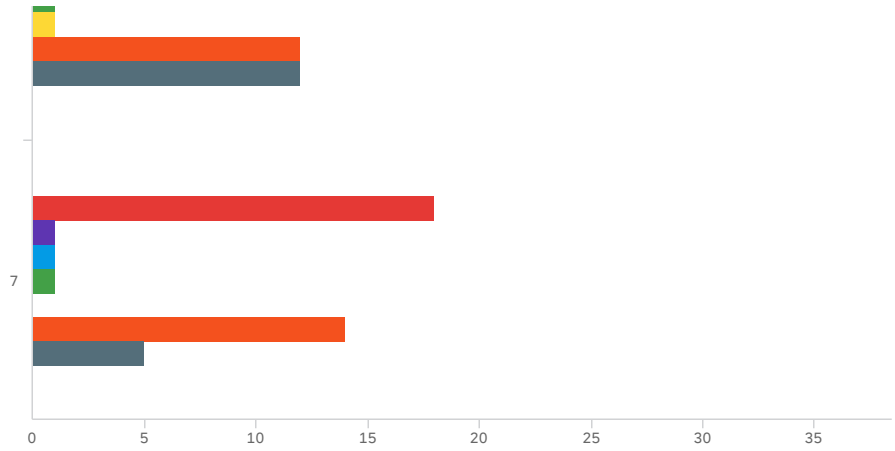


#	Field		Choice Count
1	Strongly disagree	0.00%	0
2	Disagree	12.20%	5
3	Neutral	12.20%	5
4	Agree	70.73%	29
5	Strongly agree	4.88%	2
			41

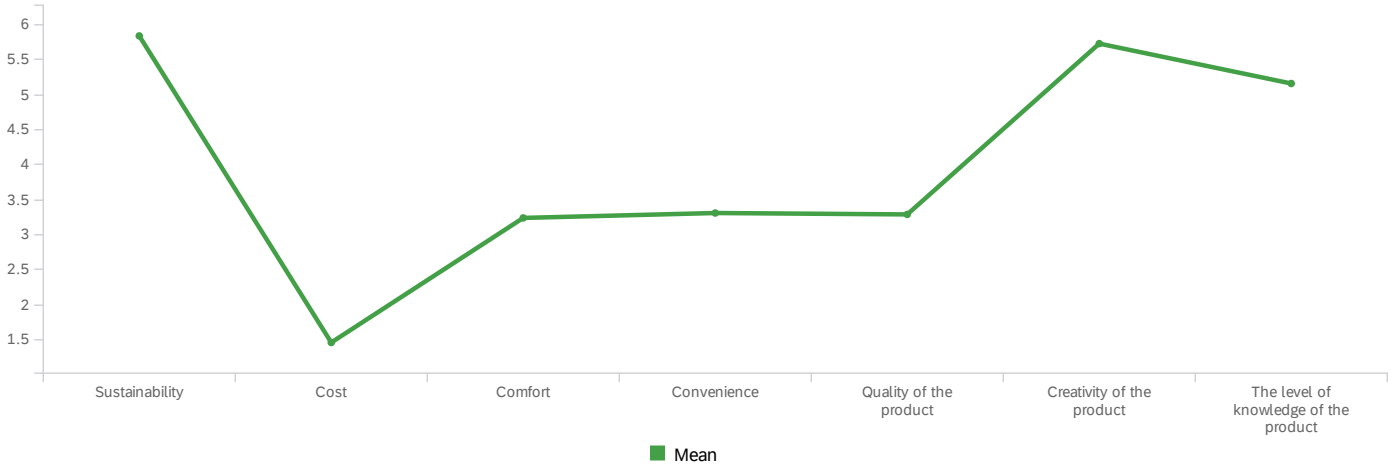
Showing rows 1 - 6 of 6

Q48 - This is the last question of this survey! You may find that there are many factors that influence your choice of household energy producer/products/service. Please rank the importance of the following factors. For 1 is most important and 7 is least important.





#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Sustainability	2.00	7.00	5.83	1.51	2.29	41
2	Cost	1.00	7.00	1.45	1.28	1.65	40
3	Comfort	2.00	7.00	3.23	1.23	1.51	39
4	Convenience	1.00	7.00	3.30	1.25	1.56	40
5	Quality of the product	1.00	6.00	3.28	1.08	1.18	39
6	Creativity of the product	2.00	7.00	5.72	1.40	1.95	40
7	The level of knowledge of the product	1.00	7.00	5.15	1.35	1.83	41



End of Report

Appendix 9 Roadmap

GREEN CHOICE

Future vision

Bringing people together

Greenchoice becomes a platform for green choices

Step by step towards climate positivity

	Horizon 1 (Now)	Horizon 2 (2025)	Horizon 3 (2027–2030)
Trends	Digital connection/community Online information	Leasing as a service	Digital monitoring AI
User value	A place to collect information App to gather people with similar interests Product feedback Online chat for people with similar problems	Get the data of energy consumption of each single product Sharing and reselling product to each other Sharing or renting through Greenchoice	Detailed monitoring Get more feedback Easier to control
User problem	Innovative product seems risky Satisfaction of the appliances Platform to search recent and trusted information Lack of people with similar interest Difficulties of communication Practical tips to reduce energy consumption	Financial pressure Balance the financial and interest Limitation of house type for solar panels	Desire of convenience and joyful life Need more precise control over the energy consumption
Business Model	From Greenchoice to consumers	From Greenchoice to business to consumers	Greenchoice as a platform to group people
Product/service	Share use experience Discussion related to information Discussion about tips and solutions Find cheaper products and solutions 1. Problem solving community on application 2. Updated information related to household energy 3. Service: Match your states with community groups (based on house-type, FAQ) provide expert informtaion	Get the data of energy consumption of each single product Second hand products Sharing and reselling product to each other Try out the product 1. Sharing solar panels 2. Second hand and sharing community on application and website 3. Leasing heat/cooling products	Real-time monitoring Calculate the best solutions to improve the situation Provide tips based on energy consumption details 1. Digital monitoring & control 2. AI household energy system
Technology	App Online community About new products and tips from experts Integrated and can be constantly updated	Solar panel sharing App Online webpage Safe and clean Gather feedback of prodect Get the data of energy consumption of each single product Gather information of second hand products	Smart meter AI assistant App More frequent data analysis and set the time of using Analyse the energy consumption states
Resource	Online platform APP Video Blog Universities Current customers YouTubers	Online platform App Partnership	APP Smart meter Partnership related to AI assistants