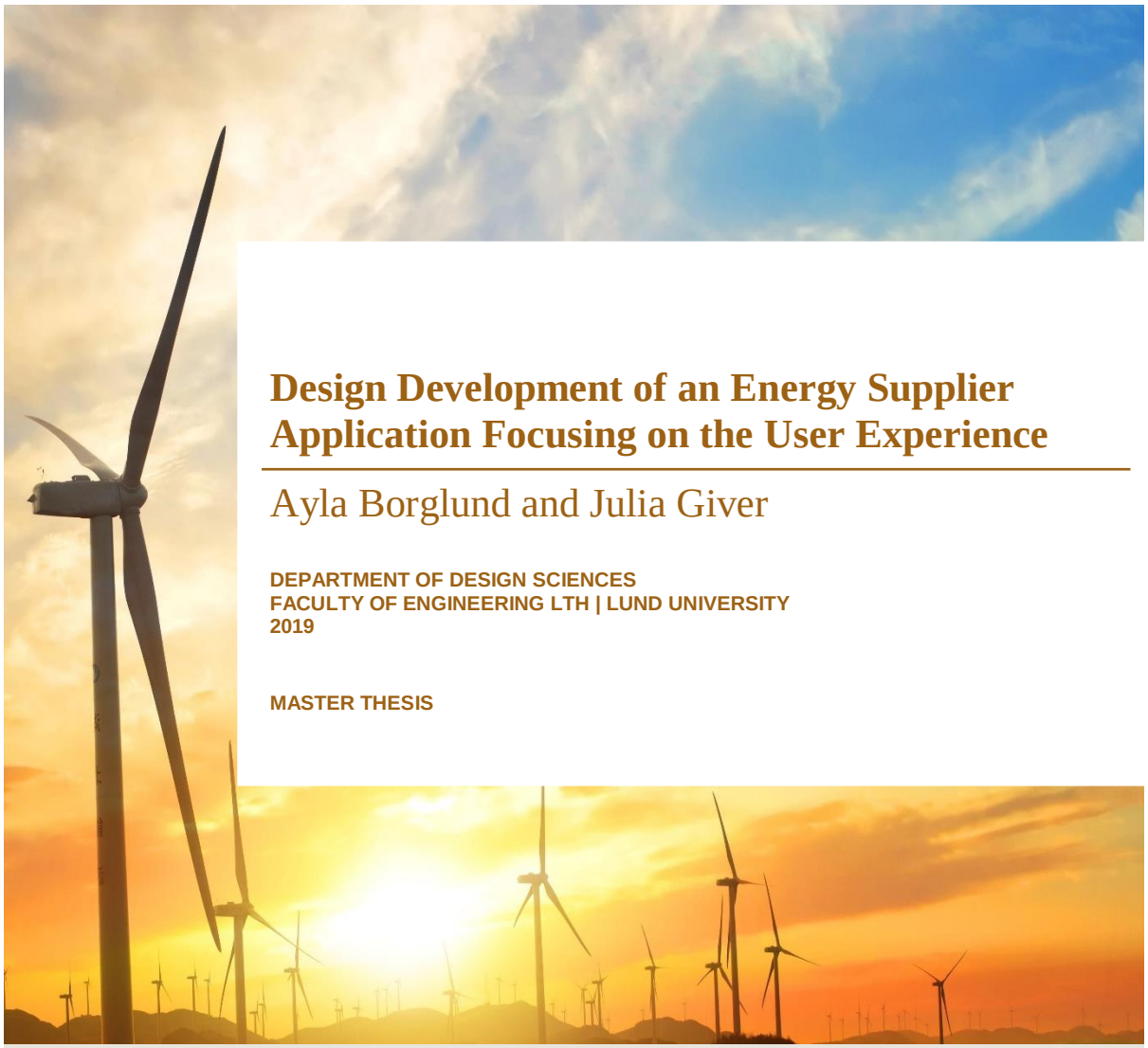

Design Development of an Energy Supplier Application Focusing on the User Experience

Ayla Borglund and Julia Giver

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Abstract

What do customers want from an energy supplier application? To meet the increasing digitalization of the society, the energy supplier Kraftringen strives to create a new application that will match the customer's needs and Kraftringen's vision. This thesis was performed in order to present a user interface proposal of Kraftringen's new application, to improve the user experience. The goals included an exploration of what users want and expect from an energy supplier, and how users are best motivated to increase their environmental awareness. Throughout the interaction design process, the focus on and involvement of users have been central, to ensure a final user interface proposal that from the user's perspective is intuitive and pleasing to use.

Needs and desires of both Kraftringen, Kraftringen's customers and energy supplier customers in general were established by evaluating the company and their current application, combined with a data collection consisting of earlier performed investigations, tools for statistics and a customer survey through a focus group and a questionnaire. Together with theoretical design and usability principles, possible solutions were iteratively created as low and high fidelity prototypes and successively evaluated through user tests. A final prototype was developed and evaluated in an assessment test containing 20 users together with a heuristic evaluation to determine the user experience.

Both the theoretical heuristic evaluation and the empirical assessment test of the final user interface proposal indicates a good user experience. A System Usability Scale score above average was obtained of the final proposal. The proposal provides a user interface that the majority of involved users consider as well structured with relevant functions and a pleasing design and layout. The evaluation of the user interface also indicates that users think that they would use the application and that the application motivates users to become more environmentally aware.

Keywords: UX, UI, Interaction design, User test, Prototyping, Environmental awareness

Sammanfattning

Vad vill kunder ha av deras energibolags applikation? För att möta samhällets ökande digitalisering strävar energibolaget Kraftringen efter att skapa en ny applikation som matchar både kundens behov och företagets vision. Arbetet utfördes för att presentera ett förslag på användargränssnitt för Kraftringens nya applikation, för att erhålla en förbättrad användarupplevelse för kunderna. Målet med arbetet inkluderade en undersökning av vad användarna vill ha och förväntar sig av ett energibolag samt hur användarna bäst motiveras att öka sin miljömedvetenhet. Under hela interaktionsdesignprocessen har användarnas involvering varit central för att säkerställa ett slutgiltigt användargränssnitt som utifrån användarens perspektiv är tilltalande och intuitivt att använda.

Behov och önskemål från både Kraftringen, Kraftringens kunder samt energibolagskunder generellt, formulerades genom att utvärdera företaget och deras nuvarande applikation i kombination med en datainsamling bestående av tidigare utförda undersökningar, program för statistisk data, en fokusgrupp samt en enkät. Tillsammans med teoretiska design- och användbarhetsprinciper skapades iterativt olika lösningsförslag i form av low fidelity- och high fidelity-prototyper, vilka successivt utvärderades genom användartester. En slutgiltig prototyp utvecklades och utvärderades i ett användartest som innefattade 20 användare, tillsammans med en heuristisk utvärdering för att bestämma själva användarupplevelsen.

Både den teoretiska utvärderingen och det empiriska användartestet för det slutgiltiga användargränssnittet tyder på en bra användarupplevelse. Ett kvantitativt värde över medel på en systemanvänsbarhetsskala erhölls. Förslaget ger ett användargränssnitt som majoriteten av de involverade användarna anser vara välstrukturerat, med relevanta funktioner och en tilltalande design och layout. Utvärderingen av användargränssnittet indikerar också att användarna tror att de skulle använda applikationen och att applikationen motiverar användarna till att uppnå en ökad miljömedvetenhet.

Nyckelord: UX, UI, Interaktionsdesign, Användartest, Prototyp, Miljömedvetenhet

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Lund, May 2019

Ayla Borglund and Julia Giver

List of acronyms and abbreviations

- App = Application
- NPS = Net Promoter Score
- FAQ = frequently asked questions
- Hi-Fi = High Fidelity
- kWh = Kilo watt hours
- Lo-Fi = Low Fidelity
- SUS = System Usability Scale
- UX = User Experience
- UI = User Interface

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Chapter 1

Introduction

Digitalization is an ever growing force in our society and it manifests itself in all kinds of businesses. The demands from customers regarding digital solutions are high and one industry that is working on meeting these demands today is the energy business. The energy industry today is regarded as a *low interest industry* [1]. This entails that people in general are not very interested in knowing very much about their energy usage. The industry is also considered to be an industry which people have low faith in [2]. At the same time, the planet's environment, which the energy industry is closely linked to, is in general opinion of very high interest today [3]. Many people today want to be aware of, and want to reduce their environmental footprint as much as possible. People are prepared to dedicate both time, money and effort in order to do this, but they first need to be informed of how to do it [4].

1.1 Purpose and Goal

The purpose of this thesis was to present a user interface (UI) proposal for the energy supplier Kraftringen's new application (app), to improve the user experience (UX) for their customers. Today, Kraftringen offers an app for their customers, but very few customers use it. In order to match the increasing digitalization of the society, the company strives for creating a new app that will be of value to their customers and that corresponds to Kraftringen's vision. The main goal of this thesis was to:

- Create and evaluate an interactive UI for Kraftringen's app, focusing on the UX

To achieve this goal, the three following subgoals were defined:

1. Explore what users expect and want from an energy supplier.
2. Evaluate why customers contact Kraftringen's customer service today and how the workload on customer service could be reduced.
3. Examine user's desire for environmental awareness and how users are best motivated to reduce their environmental footprint.

1.2 Kraftringen as a Company

Kraftringen is an energy supplier that is owned by the four municipalities Lund, Eslöv, Hörby and Lomma [5]. The company supplies energy in the form of electricity, heating, cooling, gas and other energy solutions, as well as fiber. Kraftringen has a history going back to 1863, and today the company strives for being a front figure in the development of future energy solutions. Kraftringen has more than 500 employees and has a turn over of roughly 2900 million Swedish kronor. Approximately 260 000 customers, where about 90 400 are private customers, has Kraftringen as their energy supplier.

1.3 Method

Throughout the entire process, design methods have been used iteratively and in parallel. This thesis is based on literature studies, evaluation of the current solution and establishment of the needs for Kraftringen and their potential customers. Users' needs were evaluated using exploratory methods such as a customer survey through a focus group and a questionnaire, combined with earlier performed investigations and tools for statistical data. Based on theory and established needs, four paper based low fidelity (Lo-Fi) prototypes of an app were generated and evaluated through a user test. A digital high fidelity (Hi-Fi) prototype was developed in three iterations with corresponding user tests. Finally, the final UI proposal was evaluated by 20 participants in an assessment test together with an heuristic evaluation to examine the UX. An overview of the different phases and their relation, in the design development, can be seen in Figure 1.1.

1.4 Limitations

In order to fit the time limitation of the thesis project, it was decided to focus the process on creating a UI specifically for an app that private customers could use. With more time, a version that also could have been used by companies and housing cooperatives, as well as a web based UI in line with the app, could have been created. It was decided to create the UI for as many customers as possible, therefore the UI was created for the layman, instead of including specific target groups such as people with a more profound interest in energy usage. Since the project was time limited, the number of users that could participate in the iterative design process was limited and also the numbers of iterations were limited. Had more iterations been performed, the final prototype could have been better adapted to fit more types of user groups and also the user's UX of the final prototype could have been more statistically ensured.

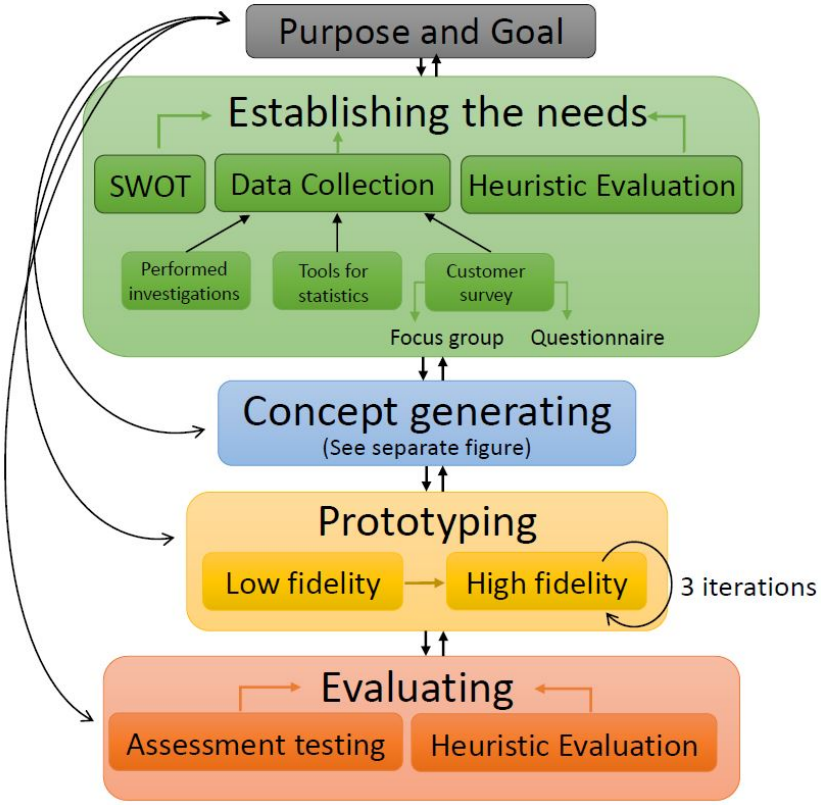


Figure 1.1: Overview of the design development.

1.5 Work Distribution

The work load has been distributed equally between the two authors during all parts of the project. The two authors have studied essentially the same courses and have similar previous experiences, which entailed that both authors could contribute evenly throughout the thesis.

Chapter 2

Theoretical Background

The theoretical background will describe what interaction design is, with focus on the UX, UI, conceptual and mental model, gamification, different design aspects, triangulation, pilot studies and SUS. Secondly, the design tool Figma is presented which can be used for Hi-Fi prototypes.

2.1 Interaction Design

Interaction design is a practice of developing interactive products with the end users in mind during the design process [6]. The aim is to increase the positive aspects of the UX while reducing the negative ones as well as to create products that the users consider easy, effective, and pleasurable to use [6]. Considering the end users during the entire process of designing a product can have a major effect on the final product's usability and the UX [7]. Having the users in mind during development entails having an iterative design process where users are considered and consulted in all stages of the development process.

2.1.1 The User Experience

User experience (UX) design focuses on the interaction between a product and a user [8]. UX is about user's overall impression of how good a product is to use and user's satisfaction and feelings when using it [6]. According to Nielsen and Norman, UX is defined as "all aspects of the end-user's interaction with the company, its services, and its products" [9]. Some important aspects of the UX that can be considered and taken into account when designing are the functionality, usability, aesthetics, content and the sensual and emotional appeal [6]. Also, people's expectations can beneficially be considered when designing for a good UX [10].

There are several design methods, guidelines and relevant research findings to ensure a well achieved UX. For example, the *10 Usability Heuristics for User Interface Design*, defined by Nielsen and Molich's can be used during a development and as a heuristic

evaluation method [11]. To include the actual end user of a product, during the development, user surveys in form of questionnaires and focus groups can be performed, in combination with iterative user tests of different Lo-Fi and Hi-Fi prototypes.

2.1.2 The User Interface

User interface (UI) design focuses on how a system looks and how it will be perceived, unlike UX, which focus on how the product is used. A good UI entails catching the interest of the target group by implementing the right functionality, colors, contrast, light, graphic elements, fonts and text formatting and images etc [8]. Developers strive for designing a suitable UI, to achieve a good UX. It is important to strive for a good UI when designing with the end users in mind, because according to Norman, "beautiful things work better" [12].

2.1.3 Conceptual and Mental Models

A conceptual model entails how a product works and can often be detailed and complex. A mental model entails a persons understanding of how a product works. A mental model of a product can differ from person to person and the model is constructed by experience. Having an incorrect mental model of a product can lead to incorrect handling of the product. To ensure a good UX, it is important to consider people's mental models in the design process, and design in a way that enables people to create a correct mental model of the product [12].

2.1.4 Gamification

Gamification is a method commonly used in interactive products in order to motivate and engage people [13]. The method is acknowledged as a possible way of encouraging people to change their behaviors and it can be implemented in a great number of ways, depending on the product and goal. To achieve behavioral changes, it is important to increase the awareness and knowledge for the user, which can be acquired through gamification [14].

2.1.5 Design Aspects

Different design aspects are beneficial to consider during a design process, to create an effective UI, which leads to a great UX.

Gestalt Psychology and Visual Hierarchy

When designing graphically, it is important to understand how users perceive and process information. Gestalt psychology is one element that is essential to understand. The gestalt principles state that a user consciously and unconsciously arranges presented information to an intelligible entity, instead of seeing objects as individual components [15]. The gestalt psychology includes for instance the laws of proximity, similarity,

closure, symmetry, common fate, continuity, good gestalt and past experience. A modernized version of the gestalt psychology is called visual hierarchy. The visual hierarchy is used as a basis for designing systems, that enable a user to understand presented information and what the user should pay attention to first, i.e. thus the order in which users should process the information they see. The eight principles for visual hierarchy is size, proportion, proximity, symmetry/structure, equality, grouping, contrast and color [15]. A fundamental design principle is that everything cannot be highlighted, i.e. to emphasize elements in a design others must fade into the background [16].

The Importance of Space
Another important design aspect is the importance of space, for example white space. According to Jan Tschichold, "White space is to be regarded as an active element, not a passive background" [17]. There are at least three gestalt principles in which space plays a prominent role; figure-ground, proximity and closure. Considering space as a design element, space can establish contrast, emphasis and hierarchy, generate drama and tension in the design, and provide visual rest between groups of objects [17]. Improving the readability is one of the most important function of space, which is done by micro-space (within elements in a group) or macro-space (between major elements).

Naturally Eye Movements Patterns
Z pattern and F pattern are two common patterns for hierarchy based on the users eye movements when presented a new page, both printed and digital [18]. The Z pattern entails information that is placed in an order that in shape, looks like the letter Z. This is more common in websites with a low level of text content, which is frequent in apps. The most important information is beneficially placed along the Z pattern to focus the attention of the user. The F pattern entails information placed corresponding to the shape of the letter F, and is more common on text-heavy websites. These naturally occurring patterns is beneficially to be considered when developing a UI to guide the user through it.

7 Principles of Universal Design
The *7 Principles of Universal Design* include the following aspects: equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort and size and space for approach and use [19]. For instance, in line with the 7:th aspect about physical effort, the ability to reach different areas on a smartphone with a one- or two-handed grip are important to take into consideration when designing a UI. To obtain a good user experience, important objects should be placed within reach for a one-handed grip [20]. Moreover, simple and intuitive use as well as perceptible information, is important to consider during the entire design development of a UI.

Personalization and Customization
Adding a mascot can be a great way of making an interface feel as human-centered as possible. A mascot can be a personification of a business and enhance communication between a company and it's customers. Since humans are often very visually driven and mascots are well suited to be remembered by the human memory, a mascot can also be a great way of increasing the memorability and recognizablility of a com-

pany [21]. To increase the customization within an app, only relevant information and options should beneficially be presented to the user.

2.1.6 Triangulation

To understand the needs and desires of the end users, different data collecting techniques can be used, in complement to theoretical design principles. These techniques can consist of focus groups, questionnaires, interviews and observations. To avoid biases, which can occur using a specific technique, it is important to combine different data collection techniques and use them flexibly [6]. The use of methods from at least two perspectives is called triangulation, where the most common form is called methodological triangulation, which refer to the use of different data collection techniques [6].

2.1.7 Pilot Studies

Pilot studies can be used to test the arrangement of a proposed data gathering technique before the main study, to make sure it is viable [6]. The aim is to identify potential problems in advance in order to correct them. For example, controlling that a question is clearly stated is especially important in questionnaires, since the respondents are not able to ask about the interpretation. Pilot testing a questionnaire can, in addition to evaluating the questions, also provide a sense of the fill-in time, an identification of unneeded questions and ideas for further questions [7]. Pilot studies are also important to conduct before a user test, to make sure that tasks and time limits are reasonable and to check that all needed tools and materials are gathered and prepared. It is important to conduct pilot test of an entire user test, to avoid unexpected problems during the real tests, such as difficulties for the participants, where they ask questions or get stuck. A pilot test can be performed either internally or externally.

2.1.8 System Usability Scale

System Usability Scale (SUS) is a method frequently used to quantify the usability of a system and measure cognitive attributes. SUS involves a survey that users answer, after testing the system. The survey consists of ten standardized statements and the user answers the survey by choosing between five options per statement, from strongly disagreeing to strongly agreeing [7]. A SUS survey can be used to calculate a quantitative number to represent how the users in a usability test experience the UX of a system. A value over 68 is stated as over average, and the interpretation of the SUS can be described by different things, such as percentiles, grades, adjectives, and Net Promoter Score (NPS) categories, see Figure 2.1, [22].

Grade	SUS	Percentile range	Adjective	Acceptable	NPS
A+	84.1-100	96-100	Best Imaginable	Acceptable	Promoter
A	80.8-84.0	90-95	Excellent	Acceptable	Promoter
A-	78.9-80.9	85-89		Acceptable	Promoter
B+	77.2-78.8	80-84		Acceptable	Promoter
B	74.1 – 77.1	70 – 79		Acceptable	Passive
B-	72.6 – 74.0	65 – 69		Acceptable	Passive
C+	71.1 – 72.5	60 – 64	Good	Acceptable	Passive
C	65.0 – 71.0	41 – 59		Marginal	Passive
C-	62.7 – 64.9	35 – 40		Marginal	Passive
D	51.7 – 62.6	15 – 34	OK	Marginal	Detractor
F	25.1 – 51.6	2– 14	Poor	Not Acceptable	Detractor
F	0-25	0-1.9	Worst Imaginable	Not Acceptable	Detractor

Figure 2.1: Percentiles, grades, adjectives and NPS categories to describe raw SUS scores [22].

2.2 Design Tool

Figma is an online UI design application for creating and visualizing the navigation and design of an interface [23]. The tool can be used to make prototypes and create flows by connecting frames and adding elements like interactions, transitions, overlays, scrolling etc. Since Figma is a browser based UI tool, developers can collaborate simultaneously in real-time within the same project. Figma also provides the code for each frame, which can be used to program a system that is visually similar to the Figma prototype. When designing layouts for interactive apps in Figma, there is a possibility to present the prototype in smartphones, to better evaluate the created UI.

Chapter 3

Establishing the Needs

To gather necessary data for establishing the needs of both Kraftringen, Kraftringen's customers and energy industry customers in general, a theoretical evaluation of the company and of the current product was done. This was combined with data collecting techniques of performed investigation, tools for statistics, a focus group and a questionnaire. To summarize the identified needs, an affinity diagram was used to establish the most prominent types of needs.

3.1 SWOT

The design of a product should reflect a company's vision and values, which makes an evaluation of a company an important part of a product development [24]. In order to chose the right strategy for achieving a company's goals during a design development, a SWOT-analysis can be performed. By analyzing a company's strengths, weaknesses, opportunities and threats, a quick overview of the goals can be created [25].

3.1.1 Strengths

Kraftringen is a well established company within the energy industry, with a history going back to 1863 [5]. For customers, this can create a feeling of stability and quality, which inclines customers to choose Kraftringen as their electricity supplier. Another strength for the company is their high level of renewable energy and the great focus on sustainability, which is very much in line with the priorities of many people today and also the 17 global sustainable development goals for 2030 defined by United Nations [5, 3, 26]. Furthermore, Kraftringen has made great investments in power stations for electric cars, which results in the logo of Kraftringen to be visible in association with a good cause, in many different places [5].

3.1.2 Weaknesses

One of the greatest weaknesses for Kraftringen, as for other energy suppliers, is customer's low interest in the energy industry in general [1]. The energy industry is also considered to be an industry which people have low faith in [2]. This can create a difficulty regarding establishing good customer satisfaction and loyalty. Electricity suppliers' customers often only contact their company when a problem occurs, since electricity is something that is usually taken for granted. This entails that there is more ingratitude than gratitude from customers.

3.1.3 Opportunities

One opportunity for Kraftringen is the new trend of using gamification for creating an interest among customers. This can be used by Kraftringen to inspire more customers to use their customer gateways and see all their features. Another opportunity is regarding sustainability focus. Due to many people's great interest in reducing and being aware of their environmental footprint, many people want to be informed about their energy usage and its environmental impact [4]. For a company, well functioning communication channels can be a good tool for reaching out and maintaining a positive relationship with customers. Having well functioning communication channels is an opportunity of letting customers perform errands by themselves, which among other things can ease the pressure on a company's customer service and save money. A relationship between a company and its customers can possibly also be strengthened by letting customer perform errands independently, as it can create a feeling of a more equal relationship.

3.1.4 Threats

The greatest threat to the company is that their customers change to another energy supplier or that Kraftringen would not obtain any new customers. It is difficult for a company to be a front figure of the market regarding trends such as sustainability and entertainment. Today there are competitive energy suppliers that have a strong focus on being fun and entertaining, which can be a reason for their customers to have a stronger inclination for recommending their electricity supplier, for example the company *God El*. Another threat is the increasing digitalization within the society, which implies that even the energy industry is now facing the challenge of meeting customers' high demands of digitalization and more personalized service [27].

3.2 Heuristic Evaluation of Current Product

As a step towards verifying Kraftringen's need for a new app, as well as finding aspects or functions in the current app that work well today and could be used for inspiration when designing the new app, the current app was heuristically evaluated. A heuristic evaluation can be used to find design aspect of a product that confirm or contradict different design principles [7]. There are several guidelines for interaction design that are

commonly used, as mentioned in section 2.1 In this thesis, the *10 Usability Heuristics for User Interface Design*, by Nielsen and Molich's was used. The results from the heuristic evaluation of the current app, which can be seen in Figure 3.1, with regard to each of heuristics, follows.

(a) Start page **(b)** Logged in mode

Figure 3.1: Presentation of the current app.

Visibility of system status

To provide good visibility, a UI should allow a user to always be aware of what is going on. When using the current app and switching between functions, the user is often given a distinct evidence of the page being loaded, in the form of a loading circle, which provides valuable feedback to the user. Some buttons however give the user no feedback that they have been pressed, for example if the button leads to the same page as the user is currently using. Another lack of feedback concerns that it is possible to choose a sound signal to the app, but the user is not able to hear any of the sound signals in the settings, nor get information about when the sound signal can appear in the app.

Match between system and the real world

In a good UI it is important to provide users with appropriate names and labels for the different functions and features. In the current app, many system-oriented terms are used, which can cause confusion for the user regarding the meaning of different information.

User control and freedom
To make users feel that they are in control, it is important to easily obtain information necessary to perform tasks and to produce the desired results. In the current app however, there are functions that can be difficult for a user to understand what they do and why they exist. The app also gives no information of the task flow, which further reduces the feeling of control for the user. Also, there are functions that are not well displayed in the app, which can result in the customer missing the functions or using them by mistake. This can lead to the customer not feeling in control. Furthermore, there are some false information and bugs, differentiating between different kinds of devices that the app can be used on.

Consistency and standards
The app today lacks consistency regarding how the different functions in the app are displayed. All functions are displayed as equal, see Figure 3.1, even though some functions can only be used once, some are links to other apps and others are functions that are thought to be used frequently. The current app also has no distinct difference between the page that can be visited when logged in and when not being logged in, whereof the user is simply transferred to a new (and very similar looking) page in the app when going to logged in mode. The user then has to leave this logged in mode in order to access the functions that were available when not being logged in. This may create confusion and inconsistency with regard to the user's mental model of the app. Confusion can also be caused by the inconsistency of icons, where as an example, the hamburger menu is replaced with a house icon when logged in, and then replaced with a backward button in some functions. The fact that the feature FAQ (frequently asked questions) only can be accessed in some functions, is another reason for confusion.

The fact that customers today are able to log in using mobile BankID to *Mina Sidor* on Kraftringen's web page, but not in the app, is also creating inconsistency. Another lack of consistency appears in the function *sun map*, where the user is transferred from the app to Kraftringen's web page, where the user can log in with mobile BankID to *Mina Sidor* and see all other website functions, which are otherwise not available in the app.

Error prevention
Some functions are labeled and grouped in a way that can appear illogical to a user, and this can cause a risk of clicking on an undesirable function. There are also functions that are irrelevant for some customers, or that are irrelevant after using the app for the first time. That these types of functions are still present, and can cause the user to err. There is also no automatic log out from the app, instead the user needs to actively log out in order to hide sensitive user information.

Recognition rather than recall
Since a human has a limited capacity in short-term memory, it is important to visualize information necessary to perform a task, on the current page. In the current app, there is an indication of which function the user is currently visiting, in the top of each page, which is helpful to users. However, users can experience an insufficient feeling of flow through the app, which will burden the short-term memory.

Flexibility and efficiency of use
The app today lacks functions such as zoom, which could otherwise help people with impaired vision to use the app. Many functions in the app also lack the possibility of providing the user with helpful information regarding how the different functions work, something that could help more people of different ages and backgrounds to use the app. It is also not possible to change language in the app, which restricts non-Swedish speaking people from using it.

Aesthetic and minimalist design
Users can in the current app be overwhelmed with the great amount of visible functions, together with the prominent background. The current design can be straining for the user, since the user has to read and compare the name and icon of every function, instead of being lead to the most important functions through a minimalist design.

Help users recognize, diagnose, and recover from errors
The functions in the app which allow the user to enter new information or change information, are all instantly updating. This gives the user easy access to reversal of actions, since the user can simply update the information again. There is however no possibility of going back a page before saving an update, which would save the user from implementing an accidental update.

Help and documentation
Using the different functions in the current app, the user is often presented with a text at the top of the page, letting the user know what is possible to do in the current function.

If the user is adding or changing personal information in the current app, the user is presented with helpful text, letting the user know if the information is added in a wrongful way or if any information is forgotten to be added.

3.3 Data Collection

3.3.1 Performed Investigations

In the years of 2016 and 2018, two different investigations were performed by Kraftringen, Web Service Award (WSA) and Net Promoter Score (NPS), aiming to investigate Kraftringen's customers' views on the company and establish their customers' needs.

Web Service Award
In the year 2016 a Web Service Award (WSA) investigation was performed by Kraftringen in order to gather usability data regarding the customers' views on Kraftringen's web page. The investigation also indirectly covered the customer's view on the page *Mina Sidor*, which is the customers logged in mode, and has many functions that overlap features that could be included in an app. In the thesis project, some data regarding *Mina Sidor* was taken into consideration when analyzing the customer's current view of Kraftringen's communication channels. For example data regarding what the cus-

tomer's reasons for logging in to *Mina Sidor* were, what they liked and disliked about *Mina Sidor* and how they perceived the UX on the page. Some information was however discarded since functions and layouts of the page partly had been changed since the investigation was performed.

Net Promoter Score
To be able to obtain an estimation regarding customer's inclination to recommend a company to someone else, the Net Promoter Score (NPS) can be used. During 2018 an investigation was performed and an NPS (which can vary between -100 and +100) of -26 was obtained for Kraftringen [28]. Compared to other companies within the energy industry, this value is below the average range, which is -20. Kraftringen's aim is to increase this value to average or above average. Through the investigation, customer's requests were specified as wishes for clearer descriptions of Kraftringen's ongoing work and visions concerning environmental and sustainability aspects.

1126 customers participate in an internal NPS investigation, which Kraftringen performed in 2018. The customers were asked to describe how they experience the "personality" of Kraftringen, had the company been a person. The highest ranked personality trait from this question were that most people thought Kraftringen was organized and impersonal. The personality features, that Kraftringen would like to enhance in the future, are mainly that it should feel more personal and also more environmentally friendly (which in the investigation was not ranked as one of the highest traits). These personality traits are therefore considered in the app's design development.

3.3.2 Tools for Statistics

To statistically analyze real-time-data, Kraftringen uses data collection tools such as Evado, Google Analytics, ImBox and Pivotal. These tools were used to analyze data in order to establish the needs in regard to an app.

Evado
Evado is a data collection tool that among other applications can be used to allow investigators to see how many times an app has been downloaded over time and how many times a day an app is being used [29]. Kraftringen has used the tool since 2015. The tool is limited to presenting how many times a day the app's page is reloaded, and is not able to show how many times a day a unique customer session occurs. This entails that it was not possible to decide how many people that used the current app each day. However, the number of reloads of the app was on average 10 to 15 times a day, which entails that a maximum of 15 users a day on average used the app. Since it was possible to see that the app in total (since 2015 when the app was launched) had been downloaded 13 749 times (2019-01-18), see Figure 3.2, it could be concluded that only a small percentage (about 0.1 %) of the total number of people who had downloaded the app, used it daily.

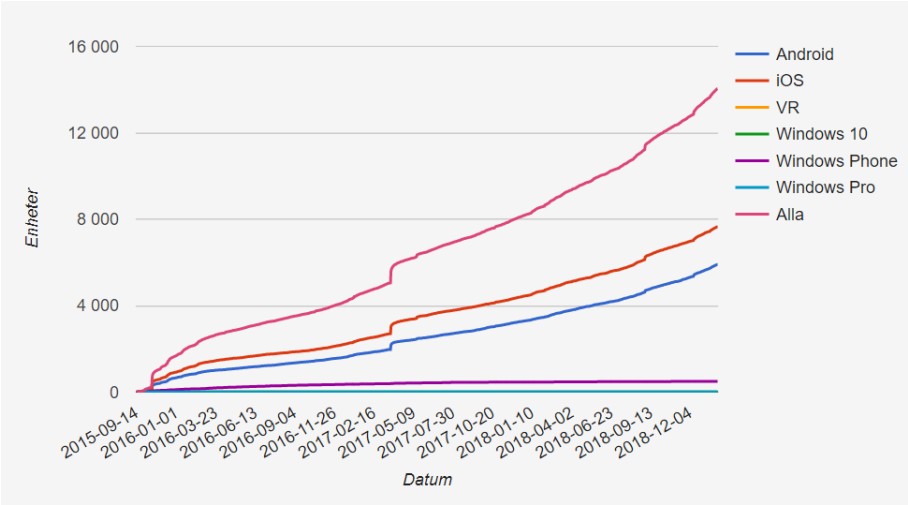


Figure 3.2: Kraftringen's current app, number of downloads since launch for different systems.

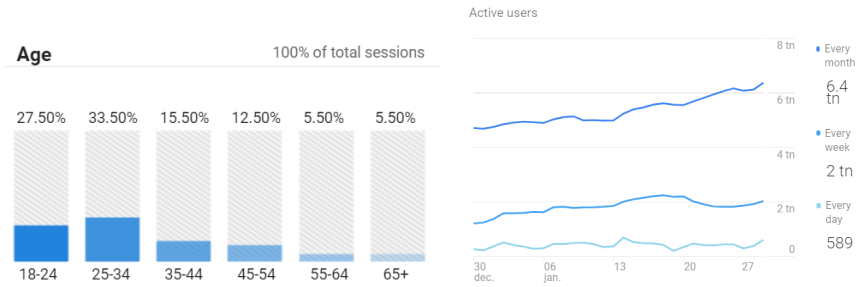
Google Analytics

Google Analytics is a tool that can be used to see customer's behavior on a specific site [30]. The tool has been used to analyze Kraftringen's customer's behaviors on the web page *Mina Sidor*, in order to acquire information regarding what information and functions that customers mainly want from Kraftringen, and could also be presented in an app. The tool has in this project also been used to gather information regarding the demographics of the users, how many active users the page has, the most common devices used to access *Mina Sidor* and which functions that are most commonly used on *Mina Sidor*.

Concerning the demographics, the different ages of the users of *Mina Sidor* can be seen in Figure 3.3a. From the tool it can be stated that the site *Mina Sidor* has approximately 6400 active users per month, and about 600 active users each day, see Figure 3.3b.

Using Google Analytics it was also possible to establish from which devices these customers were accessing *Mina Sidor*. During November and December 2018, 61 % of the customers used a computer, while 31 % used a mobile phone and 8 % used a tablet.

When looking at the most common functions used in *Mina Sidor* it can be established that customers mostly visit the front page (which contains the users detailed energy usage), their invoices, their contracts and customer service, see Table 3.1.



(a) Ages of the customers **(b)** Number of active customers

Figure 3.3: Data from Google Analytics, about customers visiting *Mina Sidor*.

Table 3.1: The most common pages visited on *Mina Sidor* during December 2018 to March 2019.

Page in *Mina Sidor*	**Number of page visits**
Front page (Energy usage)	86 152
Invoice	15 082
Contract	6 499
Customer service	3 194

ImBox

Since the end of 2017, Kraftringen is using the data collection statistic tool ImBox to compile and analyze the data from FAQ, which customers or other visitors can reach from the company's website [31]. The five most common questions searched for in FAQ, connected to the information on *Mina Sidor*, during 2018, are the following:

1. I am moving to a new house, what do I need to do?
2. Why can I not see my energy usage on the *Mina Sidor* page?
3. How often will I receive my invoices?
4. Which contracts and prices do you have?
5. What happens if I do not pay my invoice on time?

There are approximately 180 viewed questions per day in total, questions out of which the majority advantageously could have been answered by the information presented in *Mina Sidor*, there is room for great improvement, using an app.

Pivotal
Kraftringen is using the tool Pivotal as a CRM (Customer Relationship Management) where all customer communication is logged and classified, such as communication through email, telephone, chat, physical customer meetings etc [32]. In this thesis, the tool was used as a way of establishing the most common problems that Kraftringen's customers have today and their reasons for contacting the company.

Approximately 400-500 cases burdened the customer service each day, during office days in 2018. Using Pivotal it could be stated that during 2018, most cases regarding different products were concerning power grid, electricity trading, gas, district heating, and *Mina Sidor*, see Figure 3.4a. Furthermore it could be stated that most cases regarding different categories were concerning invoices, contracts, report moving to a new house, facility data, customer data and *Mina Sidor*, see Figure 3.4b. Using Pivotal it could also be statistically stated what area the cases in the different categories could be divided into, which enabled a more detailed analysis to be performed.

Radetiketter	Antal av Produkt
Elnät	56026
Elhandel	25235
Gas	3261
Fjärrvärme	2539
Mina Sidor	1106
e-faktura	781
Öppet Stadsnät	637
Fordonsgas	615
Solceller	609
Övrigt	266
SMS-avisering	156

(a) Cases sorted by products

Radetiketter	Antal av Kategori
Faktura	28416
Avtal	22240
Flytt	20520
Anläggningsuppgifter	8136
Kunduppgift	3513
Anläggningsuppgift	1472
Mina Sidor	1087
Övrigt	991
Säkringsändring	685
Kunduppgifter	541
Tankkort	473

(b) Cases sorted by categories

Figure 3.4: Pivotal representation of customer service cases during the year 2018, with corresponding amount of different cases sorted by products or categories.

3.3.3 Focus Group

To establish what customers want from an energy supplier app, customer needs can be evaluated using a focus group [6]. The method was used exploratory, to find new innovative ideas and solutions.

Focus groups are a qualitative data gathering technique. The method can be used to explore and understand how potential end users of a product think and feel in great depth [7]. Focus groups are a form of group interview that encourages discussions between participants. A focus group consists of three to ten selected participants that preferably represent the target group best as possible, and the focus group is led by a facilitator [6]. Throughout the method, participants express their personal opinions by discussing with each other, in a supportive environment.

When analyzing data gathered from focus groups or other methods, it is important to take into account that what people say that they do or want to do, and what they actually do, is not always the same [33].

Execution
A two hour long focus group was performed to explore people's general interests and awareness of energy, how people can be motivated and what people experience as good usability in other apps. The focus group consisted of six people, three women and three men, between the ages of 21 and 25. The participants had various levels of education and various levels of knowledge about energy and the electricity industry. The discussion was recorded in order to facilitate gradual analysis of the findings.

Result
The participants where asked whether they would say that they have good knowledge about their respective energy usage today or not, and if they would like to have more knowledge. The majority of participants answered that they do not consider themselves knowledgeable about their energy usages, neither in actual kWh (kilo watt hour) measurements or in comparison to others. The majority of the participants expressed that they would like to be more knowledgeable about their own usage, and also know more about how they themselves can affect their usage. Concrete examples of how to reduce their energy usage and how much of an effect this would have, was requested. As well as information regarding how much energy different products in their home consume. The participants thought information regarding different products could affect both their usage of a product and which specific products they choose to buy.

Regarding the discussion of using less energy, all participants expressed that they would like to use less energy, in order to reduce their environmental footprint. Some also expressed that they would mainly like to use less energy in order to save money. Discussing energy usage and personal knowledge about energy, a majority of the participants also expressed a desire for knowing more about where their electricity came from (hydroelectricity, wind power, nuclear power etc.), and easy access to statistics regarding this. The participants had different views regarding how often they would like to check their energy usage, ranging from every day to maybe every month.

A question was asked about what the participants were expecting and wanted from their electricity supplier. The majority of the participants were expecting cheep and green power, and quick and easily accessible information about relevant outages, as well as a well-functioning and simple customer support. The participants were also asked what motivates them to change their behavior to the better, which the participants had differentiated opinions about. Some mentioned that rewards, positive feedback and seeing an improvement would motivate a change in behavior, while others stated that negative feedback was a better approach for them. The importance of not pushing too much was also mentioned, since it could create guilt for the user, which could have an opposite effect.

The majority of the participants were skeptical regarding the thought of being in a competition concerning their energy consumption, whether it was in comparison to others or with themselves. It was mentioned that in order to enter a competition, many people wanted to know that winning is plausible, which few people have reference to regarding energy usage. Participants were also worried that a competition would cause stress in their daily life that they would not like. Several participants said that they liked the idea of gamification, but they did not know how this could be implemented in an energy supplier's app.

A question about simplicity in general was asked and discussed. The majority of participants emphasized how important it was to quickly and easily understand how to find requested information, without effort. A clean, smooth and intuitive interface with no plotter was discussed. All participants agree that it was more important with an intuitive and clean overview of an interface, compared to a very low number of "clicks", in order to navigate well in an app.

A question was asked about what the participants favourite apps in general were, and why they liked them. It was stated that the two main aspects were usability and functionality. Specific apps were mentioned both because of their graphical interface and because of their functionality which simplifies the everyday life of the participants. In general, the ease of learning how to use a new app was something that all the apps that the participants liked the most, had in common. To facilitated a good first impression of an app, only a few featured functions should be presented, and more advanced functions should be "hidden" and easily accessible in a logical way.

Regarding functionalities, the participant's different ideas for the app consisted of mainly four things:

- Easy access to my energy usage over time.
- Easy access to information about how to reduce my energy usage.
- Easy access to seeing and paying my energy invoices.
- Easy access to information regarding outages.

3.3.4 Questionnaire

To futher establish what customers want from an energy supplier app, customer needs were evaluated using a questionnaire [6], see Appendix 3.3.4. The method was used exploratory, to find new innovative ideas and solutions.

Questionnaires are a well-established data gathering technique, that can be distributed to a large amount of people in an accessible manner regarding time and location [6]. A questionnaire consisting of both closed and open questions can be used to gather both quantitative and qualitative data.

Execution

A web-based questionnaire was designed to investigate the general interest and awareness about energy, motivation for people, and the perceived usability of other apps. After pilot testing the questions, the questionnaire was distributed in two different social media groups on the platform Facebook. One group, with approximately 27 000 members, consisted of mainly women with a connection to technology in one way or another. The other group, with approximately 240 members, consisted of mainly engineering students. The groups were chosen because of the member's supposed profound interest in technology, which was thought to provide new and innovative ideas to include in the design development of the UI. Members from the two groups may overlap. In both groups, members may not have been notified of the questionnaire being posted, which decreased the chance of receiving a high response rate.

Result

253 people responded to the questionnaire. The age of the questionnaire's respondents can be seen in Figure 3.5. A question was asked about how aware the customer is of their monthly energy usage, which showed that most people estimated their awareness to low or very low, see Figure 3.6. At the same time, the majority of the respondents desired a higher level of awareness, see Figure 3.7. 36 % of the respondents expressed that they wanted to check their energy usage (given it was very easily accessible) every week, 27 % wanted to check it every month, 23 % every day and 8 % every hour. Another question was asked regarding whether the respondent would think that it would be interesting to know how much energy different kinds of products uses. In regard to this, a majority answered that they would find it interesting.

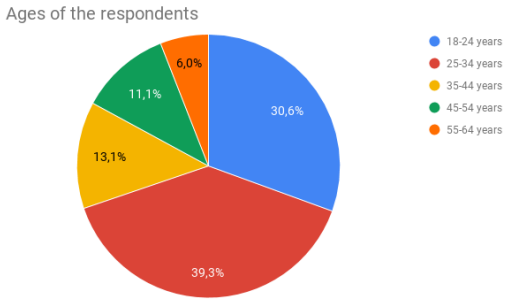


Figure 3.5: Ages of the respondents in the questionnaire.

Two questions were asked concerning how motivated the respondents would say that they are about reducing their energy usage. One question was asked in regard to reducing their usage to save money, while a second question was asked in regard to lessening their environmental footprint. The result for the first question showed no indication whether people want to use less energy to save money or not. However the second question gave rise to a distinct result, showing that a clear majority (>80%) of respondents were motivated or very motivated to use less energy in order to reduce their environmental footprint.

Two questions regarding people's motivation to compete (with themselves or with others) and/or to set up goals to fulfill, gave rise to a result that showed no majority for either motivation or no motivation to compete. However, there was a slight majority of people (54.5 %) that were positive or very positive as to set up goals regarding energy consumption for themselves.

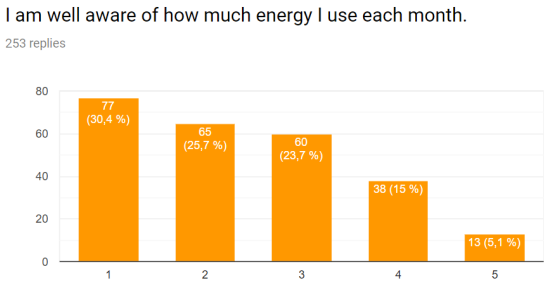


Figure 3.6: Estimated knowledge about personal energy usage, 1 corresponds to not agreeing with the statement at all and 5 corresponds to totally agreeing with the statement.

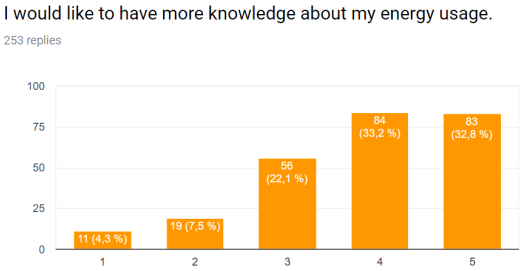


Figure 3.7: Desire to know more about personal energy usage, 1 corresponds to not agreeing with the statement at all and 5 corresponds to totally agreeing with the statement.

A question was asked about what the respondents thought were the most important functions to have within an energy supplier's app. The respondents could choose more than one function. There were six functions that a majority of the respondents thought was very important for them to have, see Figure 3.8. These were in regard to seeing one's energy usage in detail, seeing one's contracts, seeing outages, receiving notifications of unpaid invoices, paying invoices and receiving tips on how to use less energy.

An open question regarding what functions people's "fantasy electricity supplier" would offer was asked in order to obtain inspiration for creating the app. Mainly, the requested functions were concerning being able to obtain real time energy measurements, gamification of energy usage, information about where the energy comes from and its environmental footprint, ease in regard to comparing contracts, tips on how to use less energy, ability to set up individual goals and implement warnings as well as discounts

or encouragements for customers using less energy.

Finally, an open question was asked concerning which apps in general that were the respondent's favorites and why. Many specific apps were mentioned and used as inspiration in the process to achieve the best UI. Regarding attributes, the respondents mainly preferred apps with an easy overview with options for detail, apps that are inspirational and can be customized, as well as apps with good layout, logical structure and that are fast and easy to use.

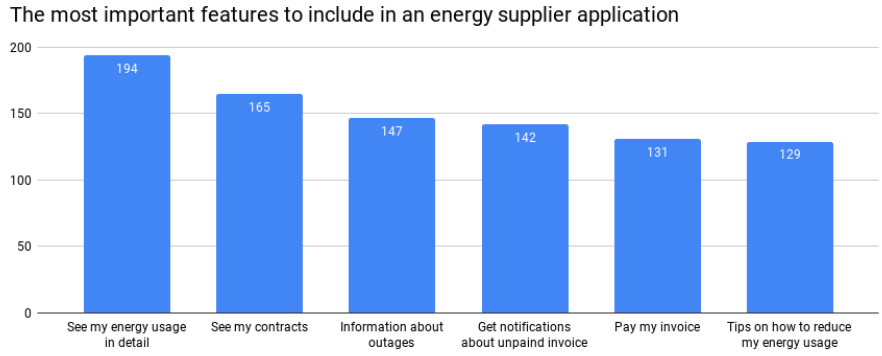


Figure 3.8: Most important features to include in an energy supplier's app, according to respondents in the questionnaire.

3.4 Summary

As a result of examining the needs regarding Kraftringen's current app, it can be established that, from the point of view of the company, there are several aspects that strongly indicates a demand for a new solution. Among other things, the customers inclination of recommending the company to someone else (NPS) is lower than average. From the data collection it can be stated that the current information and features on the customer gateways are insufficient, since it occurs approximately 180 views on FAQ and 400-500 cases for customer service per day. The low WSA indicates inadequate usability and information on *Mina sidor*. The current app is also barley used. Furthermore it could be stated that it existed a great customer interest for receiving information and performing errands, due to the high burden on customer service and the high level of active users on the website today. One of Kraftringen's ambitions were to encourage customers to gain an increased awareness about their energy usage and environmental impact. Hopefully, all established needs and desires from the customers and the company, can be applied in a new app.

3.4.1 Target Group

The target group, which the app was designed for, was established based on Kraftringen's customers who visit *Mina Sidor*. These were the customers who were thought to be the main candidates for using an app, especially since 39 % of the visitors were already accessing *Mina Sidor* through their smart phone or tablet, see section 3.3.2. Google analytics determined the ages of the customers visiting *Mina Sidor* to mainly being between 18 and 54 years, with a peak between the ages of 25 and 34 years, see Figure 3.3(a).

3.4.2 Affinity Diagram

An affinity diagram can be used to structure compiled data and gather the data in meaningful clusters [34]. These clusters can be titled to highlight the main focuses that the compiled data concerns. In this thesis, the method was used as a way of organizing and focusing the data collected in the phase of establishing the needs.

All the materials and aspects that had been gathered during the establishment of the customer needs, were written down on sticky notes in different colors depending on how the information was collected. The four methods used for gathering the information were tools for statistics and performed investigations (yellow), focus group (green), questionnaire (orange) and heuristic evaluation (pink). Heuristic evaluation was a form of theoretical method, while the other three methods were empirical.

Using the affinity diagram, a number of main points (blue) to consider when creating the app were identified, see Figure 3.9. These were regarding *Motivation*, *Usage* and *Design*. The Motivation part consisted of how to motivate customers when using the app, and of the two motivation aspects *Environment* and *Cost*. The main point *Usage* was divided into *Receiving information* and *Performing tasks*. All main points were connected to post-its with different colors, which entails that data, compiled using several different methods, supports the main points. This strengthens the reliability and importance of each main point.

Figure 3.9: Affinity Diagram.

Chapter 4

Concept Generation

During the concept generation, different types of brainstorming methods and storyboarding were performed to generate ideas for the app. Additionally, inspiration was taken from other apps and design aspects were considered to produce an effective UI. Through concept selection, different ideas were ranked. Using the established requirements, a mind map was created, containing the most vital aspects. Each phase in the concept generation is visualized in Figure 4.1.

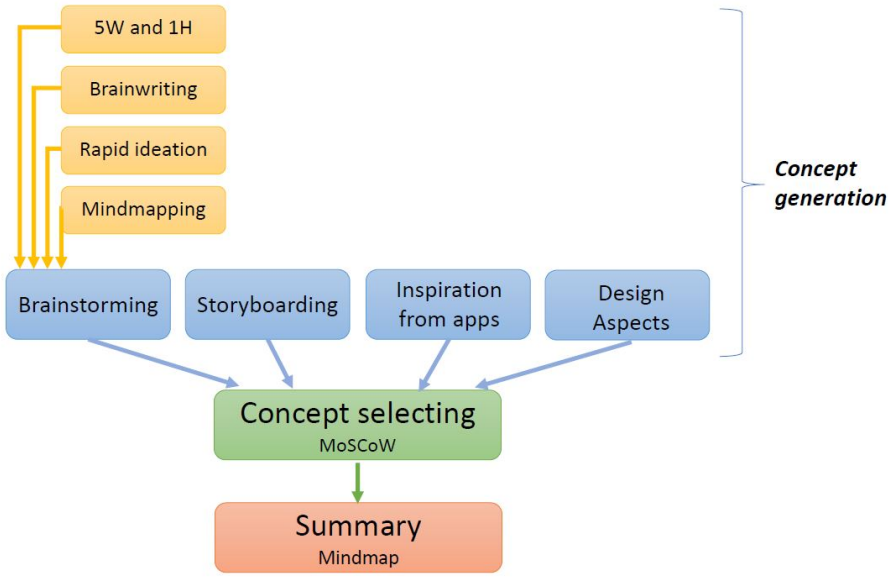


Figure 4.1: Overview of the Concept Generation.

4.1 Brainstorming

Brainstorming is a well known and established method for generating and developing new ideas [6]. In this thesis, several different brainstorming methods were used, in order to generate as many ideas as possible. During brainstorming sessions it is considered to be beneficial to focus on generating a great quantity of ideas, opposed to few ideas with great quality [35]. To achieve this, rules such as no permission of criticism of other ideas where applied during the brainstorming sessions. Four methods were used on the process; Five W and One H, Brainwriting, Rapid ideation and Mindmapping.

Five W and One H
Five W and One H is a method used to establish needs and opportunities that the current market can entail for new ideas [36]. The five W stands for *Where, When, Who, Why* and *What*, while the H stands for *How*. The idea is that by focusing on each of these areas, new aspects and ideas will be generated [37].

Through the method, several important aspects regarding the aims and purpose of the app were established. It was established that the app needed to be appropriate for use in stressful as well as relaxed situations. This entails that the app must be efficient, in order for stressed customers to reach the most important features quickly. At the same time, the app can be fun and full of features to be used by customers who use it at a more relaxed time. Also ideas regarding how the UI of the app should look depending on who was using the app was generated.

Brainwriting
The idea behind Brainwriting is that participants can contribute to, and further develop, other team member's ideas [38]. The methodology is that someone starts writing down an idea on a paper, and then passes the paper to another person, that continues to develop that same idea, and then this continues for a couple of iterations [34].

In the thesis, the method gave rise to different ideas regarding how a mascot could be used in the app. Ideas regarding implementing functions and providing information that is not directly connected to energy, was also generated.

Rapid Ideation
Rapid ideation was used as a brainstorming method, where relevant topics where picked, and then ideas associated with this topic were brainstormed for a limited time [34].

The rapid ideation resulted in a great amount of ideas, mainly regarding which functions could be included in the app. Also ideas regarding how the layout of these functions and the UI of the app in general where accumulated. What the name of the app would be was also brainstormed in the rapid ideation and resulted in the name *Kraftkollen*.

Mindmapping
A quick and simple form of brainstorming, called mindmapping, was also used. The essence of the method is to create a web of relations between different areas concerning a topic [39].

The method entailed ideas concerning how different ideas regarding both functions and layouts could be combined with each other and how they could be further developed.

4.2 Storyboarding

Storyboarding is a Lo-Fi prototyping method which involves sketching different scenes or scenarios, in which the product can be used [6]. The idea behind using storybording in the process was mainly to generate new perspectives and ideas regarding *where* and *when* an energy industry app could be used by customers. These insights would then in turn generate new ideas regarding the structure of the app and different functions which could be useful to include in the app.

The storyboarding concerned and introduced new ideas regarding how and when the app could be used. The idea that the app could be used to pass the time as well as to complete a specific task was formed, together with the idea that the app could be helpful in different scenarios in everyday life.

4.3 Existing Apps for Inspiration

As a part of the concept generation, inspiration and ideas were gathered from existing apps. The apps that were used for inspiration were mainly those mentioned in the focus group and survey, together with apps that were identified as popular in general. Existing apps can with advantage be used to find inspiration regarding layout, icons, structure etc for a new app. Having a similar basic foundation in an app, can make the user feel familiar with the app right from the start [12]. Also, the user's mental model will probably match better, if the UI is similar to commonly used apps. Another idea behind using existing apps for inspiration was that it would be beneficial to take inspiration from, and further develop, already invented and functioning solutions, instead of reinventing the wheel.

Apps within the energy industry were studied, but mainly apps within other areas were used for inspiration. This was based on the fact that it is these apps that a potential user of the app is familiar with, and will compare it to. Iteratively during the design process, inspiration has been taken from, for example, bank, traveling, training and social media apps.

The exploration of existing apps resulted in inspiration regarding how the structure and flow through an app could be created. Also inspiration regarding how different types

of swipe functions, color themes, icons, mascots, layouts and functions for graphical diagrams, were gathered.

4.4 Design Aspects

During the iterative process of designing possible variations of the app and creating different Lo-Fi and Hi-Fi prototypes, many design aspects, described in section 2.1.5, were taken into account. Among other things, the *10 Usability Heuristics for User Interface Design*, described in the section 2.1, were in great focus, in order for these aspects to be considered to the greatest extent.

One design aspect concerned what colours to focus on in the layout of the app. Kraftringen has a colour palette which they strive to use in all of their printed and digital products. Their three primary colours are found within their logo; dark blue, light blue and orange. To achieve consistency both within the app and between Kraftringen's other products, these colours together with similar colours (different tones of orange and blue) from their colour palette, were used within the app. As Kraftringen declare in their graphical profile, blue gives a sense of stability and confidence, while orange gives a sense of innovation and courage.

Like the colors, the font was considered when creating the app, to achieve consistency both within the app, and between Kraftringen's products, and to convey a suitable feeling with the app. Kraftringen is using four different typefaces; Neo Sans, Geramond, Arial and Architects Daughter. As Kraftringen declare in their graphical profile, Neo Sans is a typeface with a clear cut character and Architects Daughter looks more like a handwritten typeface, with personal feeling. It is beneficial to use only a few different fonts within a UI to achieve consistency and cleanness i.e. for instance color, size and thickness depending on whether it is to be used for a headline, body text, links, buttons etc.

4.5 Concept Selection

To establish a prioritized list of ideas and customer requirements identified in the establishment of the needs, the method MoSCoW was used. MoSCoW stands for must, should, could and won't have [40]. Ranking aspects can make the most important ones appear more clearly. The *must* requirements in the product are non-negotiable needs, the *should* requirements should be attempted to be included to the greatest extent, the *could* requirements are desirable but not necessary, and the *won't have* has the lowest priority and will not be included this time. The rated aspects and functions can be seen in Table 4.1. This prioritized list constituted the basis on which the upcoming prototypes were created.

Table 4.1: Result from the MoSCoW method.

Must have	**Should have**	**Could have**	**Won´t have**
- Contact customer service - Customer information	- Energy usage - See invoices - Pay invoice - Contracts - Outages - Log in with BankID - Customized - Environmental motivation - Notifications - Energy saving tips	- Report moving to a new house - Change contracts - Competitions - Energy converter - Charging stations for electric cars - Solar power - Offers - Estimated personal energy usage on products - Electricity's journey - kraftringen.se - Mascot	- Real-time monitoring - Electricity's journey, personalized - Samples, competitions - AR for competitions - Connection to smart home - Weather

4.6 Summary

To sum up the requirements and ideas from the concept generation, a mind map was created. With a starting point based on the main areas from the affinity diagram, and the result from the MoSCow method, the mind map was achieved, see Figure 4.2. The main aspects became keywords, design, motivation for reducing environmental footprint and costs, customization, and the most important functions within the app.

Since the environmental focus was a central part in the project, the concrete ideas regarding motivation for reducing the environmental footprint and reducing costs can be seen in Table 4.2.

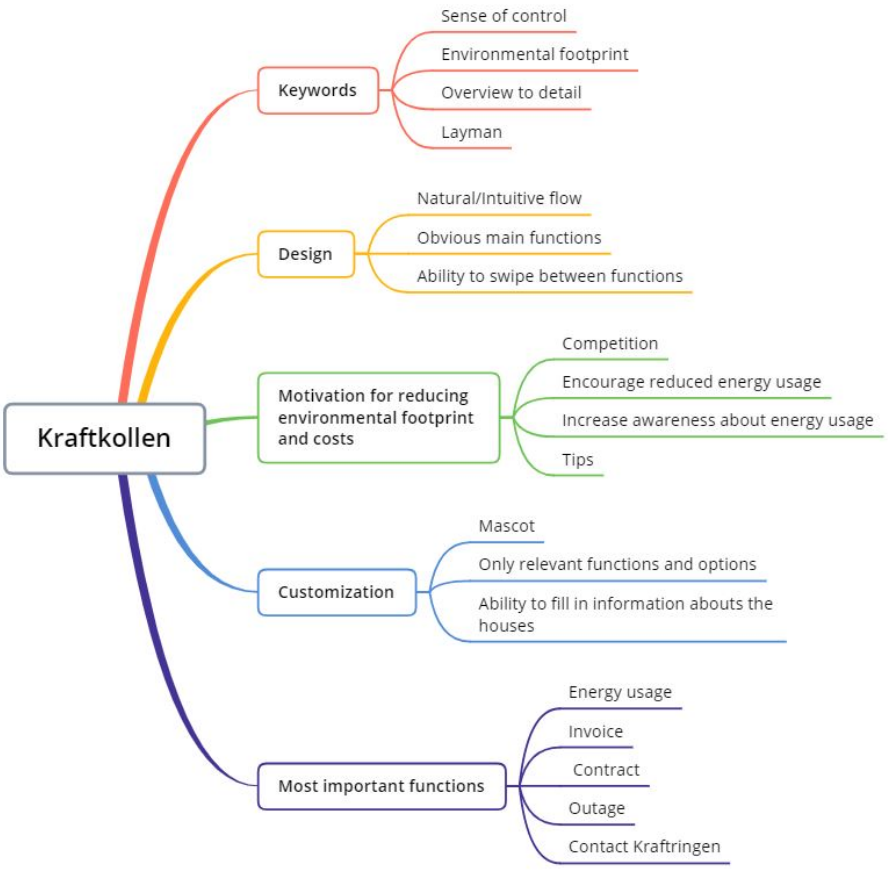


Figure 4.2: Mindmap over the most important aspects for the app *Kraftkollen*.

Table 4.2: Concrete ideas in purpose of motivation for reducing the environmental footprint and reducing costs.

Motivation through	**Specific function**
Tips	- The tips/information for the week. - Energy saving tips. - Recommended contracts.
Increased awareness and knowledge	- Information about the energy. - Connection between CO_2, Kr and kWh. - Energy converter for household products.
Encouragement to reduced energy usage	- Goals. - Comparisons. - Notifications. - "Personalized environmental tree".
Competitions	- Knowledge within a quiz. - Energy usage. - Personal goals.
Other	- Option for adding payment in purpose for the environment, when paying invoices.

Chapter 5

Prototyping

Prototyping was iteratively used during the entire design process. Particular focus was put into creating and evaluating four different Lo-Fi prototypes and one Hi-Fi prototype through user tests. The Hi-Fi prototype was further developed in three iterations, and enhancements were successively implemented.

5.1 Prototypes

In UX design, the user is successively involved in the development [7]. As a part in this involvement, it is common to use different kinds of usability tests, which are performed with prototypes in order to obtain a better understanding of how the user perceives the design and functionality. A prototype is an early version of how a future product, either an entire product or just a part of it, will become. Prototypes can either be sketched and simple paper-based prototypes with a low level of detail (Lo-Fi prototype) or it can be an interactive computer-based prototypes with a high level of detail (Hi-Fi prototype), or it can be something in between [37].

Prototypes are often designed either vertically or horizontally. In vertical prototypes, only a few functions are implemented and can be seen in detail. In horizontal prototypes, all the functions can be seen but none is implemented in detail. So called T-prototypes can be used as a combination of these categories; they have the horizontal and comprehensive overview of the interface, but also a vertical depth within a few functions. In this thesis, T-prototypes were used when creating Lo-Fi prototypes. The Hi-Fi prototype had almost all the functionality implemented that a finished product would have had. The choice of prototype depends on the purpose of the user test [37].

5.2 Low Fidelity Prototyping

The main idea behind conducting a user test with Lo-Fi prototypes was that the tests would show how well the navigation and task flow in the prototypes worked, from

overview to detail. The idea was to examine how different users experienced the different prototypes. During the test, data regarding both users' thoughts about the layouts of the different prototypes, as well as their general thoughts associated to the prototypes, were gathered using observations and discussions. One reason for using Lo-Fi prototypes, i.e. paper prototypes, was that it is quick and easy to create several different prototypes. However the main reason was that people are generally more inclined to give critique to a prototype, when they can see that the creator has not spent a lot of time and money on constructing it [6].

Based on the established needs and the concept generation, four concepts with different focuses were visualized as four paper based Lo-Fi prototypes. The prototypes were created as T-prototypes, with two functions implemented for each Lo-Fi prototype. Based on the data collection, it was established that two very important and by users desired functions were "see my energy consumption in detail" and "see my invoices". Because of this, these two functions constituted the vertical depth in all the prototypes. Pilot tests were conducted before the real user test, to ensure that the scenarios were viable, clear and unambiguous and to estimate the time duration of a test.

One user test, with 13 participants of various ages, sexes and backgrounds, to represent the target group, was performed. The participants were asked to attempt two main tasks, which entailed an examination of the two implemented functions. Each Lo-Fi prototype test session lasted for 15 to 40 minutes, and entailed that a participant tested all four Lo-Fi prototypes. In each test, the prototypes were tested in an order that varied.

The Lo-Fi prototyping technique called Wizard of Oz was applied in all user tests. The idea behind the method is to simulate to the participant that they are interacting with a real working software prototype [6, 34]. This was in the user test applied through the test leader switching papers as the participant pressed or scrolled on the prototypes, to simulate a system response. During the user test, participants where encouraged to "Think out Loud" while they were performing the scenarios. This is an established method that entails that the test person lets the test leader know their thoughts in every step of the test session, through verbally expressing their thoughts as they explore the prototype [7].

5.2.1 The Four Prototypes

Prototype A
The concept of prototype A, see figure 5.1, explored the idea of creating a fun and relaxed feeling through a mascot and with a layered navigation. The prototype entailed functions that were available when the user was not logged in, presented through a horizontal scroll function. When logged in, there was a navigation bar at the bottom of the screen and there was also a collapsed menu icon at the top left corner. All the functions had sub-functions, which were presented in a navigation bar at the top of the screen. To change between functions, the user could press the backward arrow to go back to the start page.

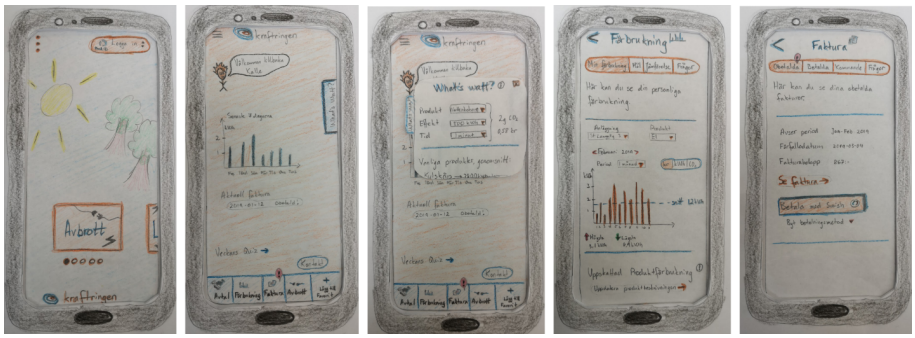


Figure 5.1: Prototype A.

Prototype B

The concept of prototype B, see figure 5.2, explored the idea of creating a more formal and structured feeling in the app, with a simple navigation. This prototype presented functions available when not logged in through a horizontal scroll function, just like prototype A. However in prototype B the functions were presented as pictures, while the background of the log in page consisted of one colour. When logged in, the prototype had no start page, instead the user was presented to the function *usage*. To change between functions, the user could either press the different functions, or scroll between them. There were no sub-functions, instead the user could scroll down to see all features within a function.

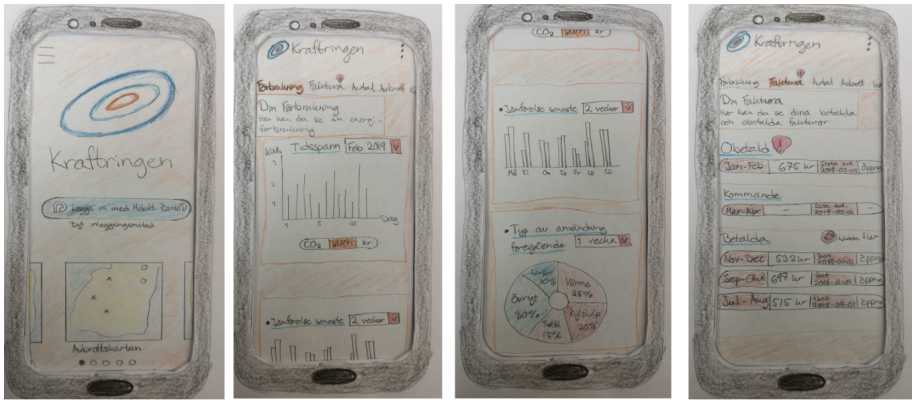


Figure 5.2: Prototype B.

Prototype C

The concept of prototype C, see figure 5.3, explored the idea of having a great focus on encouraging people to reduce their environmental footprint. The concept aimed for creating a feeling of encouragement and with a simple and discrete navigation. When not logged in, available functions were presented as words in a navigation bar at the bottom of the screen. Prototype C had a start page when logged in, and on this page the user was presented with an "environmental tree", which would change appearance

depending on how much energy the user had been using. There was no navigation bar, instead the user used the collapsed menu in the top left corner to navigate. In this menu, the user was, apart from functions, also presented with tips for reducing their environmental footprint. There were no subfunctions, just like in prototype B, the user could instead scroll down to find all features within a function.

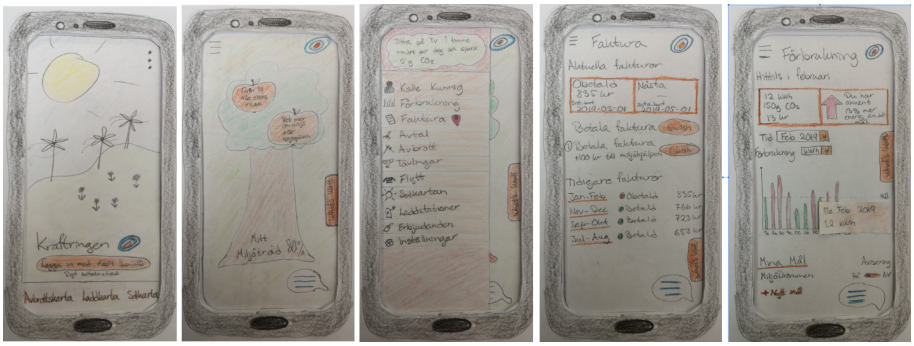


Figure 5.3: Prototype C.

Prototype D

The last prototype, prototype D, see figure 5.4, contained features combined from the three previous prototypes, to further explore the different concept ideas. The prototype presented functions when not logged in as buttons, and all four functions were visible without scrolling. When logged in, the prototype had a start page, with shortcuts to different functions. There was an ever present navigation bar at the top of the screen and subfunctions were presented below this bar as a second navigation bar. In the top left corner, there was a collapsed menu for remaining functions that were not present in the navigation bar.

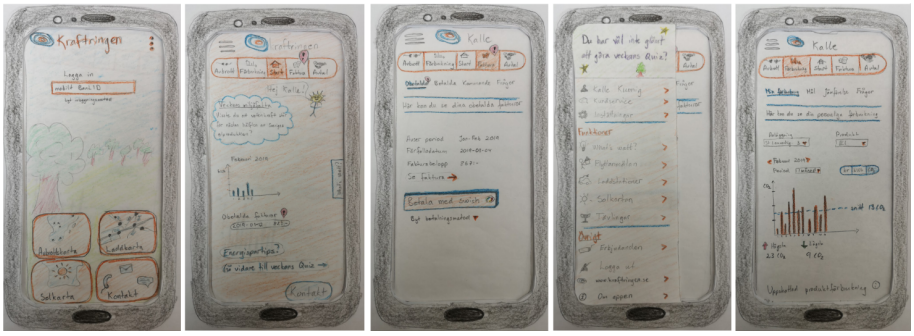


Figure 5.4: Prototype D.

5.2.2 Results

From the user study based on the 13 participants, it could be established that the users in many aspects expressed opinions that were differentiating. During the tests, data regarding age, sex, background and if the user used Android or iOS on their smartphone, was gathered. This data was used as an attempt to connect different opinions to different user groups. However, it was not possible to determine a majority of opinions that could be connected to the participant's background data concerning any aspects of the prototypes. The opinions were instead regarded as personal preferences.

A phenomena of being affected by in which order a participant was presented to the different prototypes, was evident in the Lo-Fi prototype test. 9 out of 13 participants thought that the first prototype they tried was the best, regardless of which of the four prototypes they tried first. The reason for this may be that people often prefer systems that they are used to [12]. Participants in the Lo-Fi prototype test often spent most time and mainly explored the first prototype that they tried. A result that could be connected to this, was that all four Lo-Fi prototypes contained aspects that participants appreciated. How familiar the participant was with a prototype, could be connected to their opinions regarding the prototype.

An aspect that was brought to attention during the Lo-Fi prototype user test was that many users reacted strongly to the tips and focus on environmental footprint in the prototypes. These reactions were mainly present during the tests of prototype C, which had a great environmental focus. 50 % of the users thought it was pleasant or fun to be presented with tips and reminders regarding environmental footprint, while the other 50 % thought it was very unpleasant to be presented with that kind of information, without actively looking for it. The 50 % that did not like the environmental focus expressed that it gave rise to bad conscious, and would be a reason for them not to use the app. This result was contradicting to the results from the focus group and the survey done during the establishment of the needs, see chapter 3. At that point, a majority of involved users had stated that they would like to be presented with tips and encouragements on how to live more environmentally friendly.

Remaining opinions which a majority of the participants expressed, and which after the Lo-Fi prototype user test were continued to be developed in the Hi-Fi prototype, can be seen in table 5.1.

Table 5.1: Most prominent results from the Lo-Fi prototype user test.

Aspect	Specific
Log in page	- Display offline functions in a horizontal scroll. - Log in button in the center or slightly above the center of the screen, and possibility to log in using BankID. - Include a dot menu.
Start page	- Include a start page. - Present news and promotions from Kraftringen. - Have shortcuts to important functions in the app.
Functions	- Ever present navigation bar in the bottom of the screen, containing the most common and important functions. - The current function is colour coded in the navigation bar. - Subfunctions are displayed as color coded text in the top of the page. - Possibility of swiping between subfunctions.
General	- An ever present compressed menu for functions and information that is not present in the navigation bar. - Include a mascot. - Always easy access to customer service. - Prioritize overview over quantity of functions and information.

5.3 High Fidelity Prototyping

A Hi-Fi prototype was iteratively created during the project, and its design and functions were based on results from the user test of the Lo-Fi prototypes, as well as the establishment of the needs and the concept generation. The Hi-Fi prototype was developed as a digital prototype that could be tested using a smartphone. The prototype was designed in the program Figma, see section 2.2. A benefit of using digital prototypes, compared to paper prototypes, is the ability to examine the layout and feeling of the design within a product, due to the details and real-feeling of the visual and interactive interface [37].

The Hi-Fi prototype was developed and enhanced in three iterations, where the previous version was further elaborated between each cycle. These types of prototypes are called evolutionary prototypes, which entails a slowly growing system as the prototype refines over time and functionality is added iteratively [37]. Through the process, three smaller iterations were performed, with five to seven users in each usability test. The number of participants was determined based on research that indicates that four to five users per user test will expose the majority of usability problems of a product, about 80 %, [37]. Furthermore, if the plan is to conduct multiple tests during a product development, it is even more evident that few participants in each iteration are sufficient. The selection of participants was based on the app's target group, see section

3.4.1. In the selection process, the participants background and knowledge about the energy business was also considered, in order to achieve a diverse and representative group to test.

In total, three iterations of user tests were conducted, involving 18 participants. The test sessions in each iteration varied in time depending on the availability of the participants. All test sessions were between 10 and 45 minutes each. During the user tests, participants were encouraged to explore the app and test different functions. Simultaneously as the participants explored, they were presented with different scenarios or tasks such as "how would you now contact customer service?" or "how can you see if you used less or more electricity this week compared to last?" etc. This was done in order to examine how well the structure of the app, and the visibility of different functions and features in the app, was designed according to the participants.

5.3.1 Results

During all three iterations, many aspects of both positive and negative opinions regarding the app were brought to light. The most prominent negative or constructive feedback was used as a base to make changes after each iteration. These changes can be seen in table 5.2. The positive feedback was used to establish what aspects of the app should remain the same or be enhanced. This feedback can be seen in table 5.3.

Table 5.2: Iterative changes made after the three iterations of the Hi-Fi prototype.

About	**Action**
Enhancement	- Made buttons and texts larger and distinguishable by changing colors, contrasts and shapes. - Changed the vertical order on some objects, depending on what is to be empathized. - Added headlines and clarified descriptive texts to achieve a quicker understanding of what everything means. - Increased the consistency between frames, to let the user recognize more.
Navigation	- Added links on different functions, to reach an other function in multiple ways (e.g. contact, changes payment period and sign new contract). - Clarified the subfunctions to emphasize them.
Customization	- Increased the customization in the app (e.g. added recommended contracts, possibility to see outages for your own houses and "my position", and seeing your own contracts when comparing with others).
Continued development and debugging	- Implemented more links for those that users usually press at. - Added features that arose during the iterations or earlier need findings. - Corrected bugs, specially linking the flow.

Table 5.3: Positive Feedback from the Three Iterations.

Aspect	**Specific**
Log in page	- The background picture with wind turbines on a hill. - Log in using BankID.
Start page	- Gives the app an impressive and real-feel first impression. - Contact to Kraftringen is clear and visible. - The pictures are pleasing to look at.
Functions	- The five functions that are present in the navigation bar are relevant and important. - The more unusual functions are easily accessed in the compressed menu. - Specific functions or actions that were particularly appreciated revolved around sustainability, increased knowledge about energy, contact to Kraftringen and changing ones contracts with Kraftringen.
General	- Intuitive in that way that it is easy to use, navigate and understand. - The design is beautiful and modern. - The color theme is happy, nice and pleasing to look at. - The real pictures gives a stylish feeling. - The notifications are visible and gives rise to a feeling of control. - The mascot is charming and gives a personalized feeling.

Chapter 6

Final Prototype

The final solution, created using the UI design tool Figma, was presented as a digital interactive prototype of an app. The prototype was described through specifications and features and evaluated using a heuristic evaluation.

6.1 Specifications

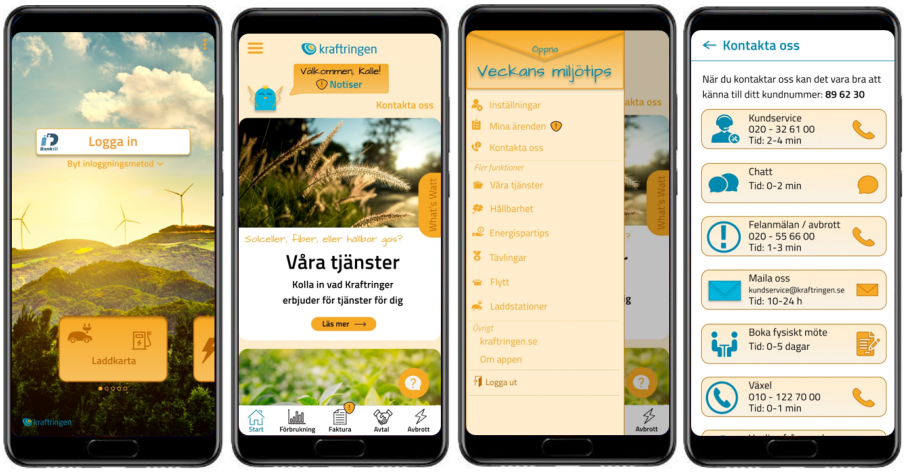
The final product consists of a prototype of an app with a log in page, a start page, four main functions (*Usage*, *Invoice*, *Contracts* and *Outages* (all with three subfunctions)), and eleven other functions. Many of the functions also contain pop-up windows or features. Some selected frames from the final product can be seen in Figure 6.1 to 6.3.

Log in page and start page
The log in page, see Figure 6.1(a), contains a button for logging in (with linked possibility to change log in method) together with functions available for logged out mode and a dot menu (in the top right corner).

The start page contains a feed of selected highlighted functions, which can vary depending on different campaigns and others that Karftringen may have. The page also contains a mascot welcoming the user and notifications that concern the user, see Figure 6.1(b).

Functions
The main functions are all accessible through the navigation bar at the bottom of the screen, see Figure 6.1(b). All four main functions have three subfunctions which can be accessed through swiping the page or through the top of the screen, see Figure 6.2.

The remaining functions are available through the compressed menu, see Figure 6.1(c), or through the shortcuts on the start page, see Figure 6.1(b), alternatively through shortcuts in the main functions. A selection of different functions can be seen in Figure 6.3.



(a) Log in page **(b)** Start page **(c)** Compressed menu **(d)** Contacts

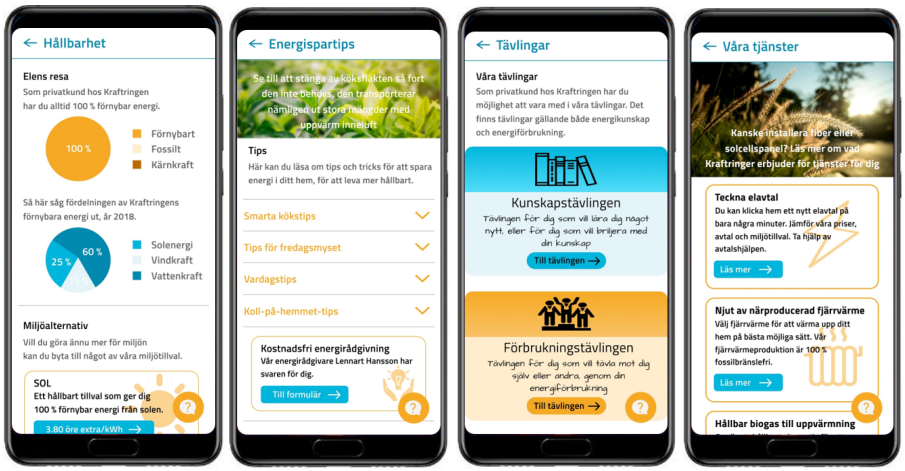
Figure 6.1: Frames from the final iteration, showing selected frames and functions.

(a) Energy Usage **(b)** Invoice **(c)** Contract **(d)** Outages

Figure 6.2: Frames from the final iteration, showing the functions in the navigation bar.

Environmental aspects

To motivate customers to reduce their energy usage, different features were implemented in the UI. One feature was called *My usage compared to others*, which specified how the customer's energy usage related to other users, with similar prerequisites. The prerequisites were based on information regarding accommodation, which the user could fill out in the app. Customers could further be motivated to reduce their energy usage through a possibility to participate in competitions, see Figure 6.3(c), and through creating personal goals regarding their usage. When using the main function



(a) Sustainability **(b)** Saving energy, tips **(c)** Competitions **(d)** Services

Figure 6.3: Frames from the final iteration, showing a selection of different functions.

Usage, see Figure 6.2(a), the customer could switch between a view of energy usage measured in cost, kWh and CO_2-equivalents. Apart from this, the customer could view and compare their usage over time. There was also a possibility of paying extra for environmental purposes when paying an invoice, as well as an option of changing their contract to a more environmentally friendly one in the app. Customers could also read tips and information regarding how to reduce energy usage, see Figure 6.3(b), where the electricity comes from and how it is produced. If the user so desired, a feature called *The environmental tips of the week*, see Figure 6.1(d) and environmentally friendly campaigns could be seen, as well as information about installing solar power customized for the user. A map showing stations for charging electric cars was also easily accessible and visible.

Design aspects

The design of the UI in the final prototype aimed to take into consideration each design aspect mentioned in section 2.1.5. The gestalt physiology and the importance of space was taken into consideration when creating, grouping and spacing between the different elements in the interface. This was very important in order to emphasize what was most important to highlight in the UI.

People's natural eye movement patterns were taken into account and resulted in a layout where the most text heavy frames followed an F shape, see for example Figure 6.1(c) and Figure 6.3(d). While the over all design mainly followed a Z shape, with subfunctions and information in the top of a frame, and also a navigation bar at the bottom of the frame.

The 7 principles of universal design were iterativly considered in the design process.

In the UI of the final prototype it manifested itself among other things as a navigation bar at the bottom of the app, see Figure 6.2, to allow ease of reach for a one-handed grip. Also how the information and elements in the UI were presented were designed in order to achieve a simple and intuitive use of the app, as well as to provide perceptible information to the user.

Layout
The general layout and structure of the app followed conventions for Android apps. The coloring of the app was done in line with Kraftringen's standardized colors, blue and orange. The main color of the layout was orange with several blue elements. The main typeface was *Neo Sans*, in line with Kraftringen's standardized typeface, due to the clear cut character, together with the less formal typeface *Architects Daughter* to convey a happier impression when it was suitable. The choice of colors and typeface in the UI was based on the design aspects described in section 2.1.5, to convey a suitable feeling and to achieve consistency. As well as to create a more personal feeling in the app. As an app for an energy supplier it was important to maintain stability and confidence for customers, but introducing innovation and happiness to the app was also highly prioritized. The icons in the UI occurred together with corresponding text, to ease the understanding of the icons.

Personalization and Customization
To customize the app's UI, only relevant options could be seen by the user. This included the ability to switch between different houses or between products such as electricity, gas and district heating. These options were hence not shown in the app, if the customer only had, for example, one apartment with electricity connected to Kraftringen, see Figure 6.2(a). Another aspect of the customization was a feature called *Recommended contracts*, which specified if the user would benefit from a change of contract, based on the customer's energy usage. Push notifications could also be activated or inactivated for different features.

As an approach to personalize the app, a mascot was implemented. The mascot was implemented in all main functions and on the start page, see Figure 6.1, as well as in pop-up windows and other features. The mascot was blue and orange and included both a sun and lightning bolts, as a reference to the energy business. As an other reference to the company, the name of the app was decided to be "Kraftkollen", as a spin-off to "Kraftringen". The name was thought to give a personal feeling to the app, and also thought to encourage people to achieve a high level of awareness.

Conceptual and Mental Models
During the design process it was sought to ensure that user's mental models of the app were consistent with the conceptual model of the app. User's mental models were considered greatly when designing the transitions and sweap between different functions and within functions. As well as how the navigation in the app was structured and how and when pop-up windows and overlays appeared.

6.2 Heuristic Evaluation of Final Prototype

Before usability tests were performed on the final prototype of the app, it was evaluated in the same way as Kraftringen's current app was evaluated, using a heuristic evaluation, see section 3.2. Again, the *10 Usability Heuristics for User Interface Design*, by Nielsen and Molich's, was used.

Visibility of system status
When logging into the app, the user is presented with notifications, both gathered under the feature *Notifications* and as a notification symbol placed on the concerned functions. This can give the user a quick overview of the status of the systems in the app, and what is currently of most importance.

How the user is provided feedback regarding when a page is loading or when a features is changed, was however not possible to implement or evaluate, because of limitations in the design tool Figma.

Match between system and the real world
In the app, the words and terms used are well suited and easily understood by a layman. However, some units, for example CO_2 equivalents of energy usage, can for some users be difficult to relate to.

User control and freedom
Which main actions and tasks that are possible to perform in the different functions in the app are easily understood by users. The ever present navigation bar provides a quick exit for users, if they accidentally choose the wrong function or simply want to switch function. Users are also constantly exposed to the title of the currently used function, even when scrolling down in a frame. This can enable users to feel in control and make sure that they will not feel lost in the app.

Consistency and standards
In the app there is a distinct difference between being logged in and not being logged in. When not being logged in, there are only a few functions available. Instead, the log in page highlights a button for logging in. Having a log in page with only a few functions, can make it obvious for a user that when logged in, the app displays personal information that concerns the user. The functions within the app are consistently presented based on their priority, with main functions in a navigation bar and remaining functions in a compressed menu. FAQ is also constantly available and positioned in the same place in all functions.

Error prevention
An error prevention in the app appears when a user presses a function that would either send the user to another app, log out the user or send the user to a web page. In these cases, a message in a pop-up window appears, letting the user know what is about to happen and allows the user to either press "okay" or exit the pop up and stay in the app. The app also only presents the user with information that is relevant to the user,

for example if the user only has one house or apartment the possibility to chose place of residence, is not available. This can prevent error and reduces confusion. The app is preset to log out the user after 15 minutes of inactivity, to prevent errors and heighten the security.

Recognition rather than recall
Using the app, the user is presented with headlines and color coding, to always be aware of which function that the user is currently using. Opposed to having to recall which steps have been taken to reach the function. However the subfunctions in the main functions can be difficult for users to see, which may cause users to have to remember that there are subfunctions, instead of seeing them straight away.

Flexibility and efficiency of use
The app provides flexibility of use through presenting the user with the most commonly wanted information first and providing the user with the possibility to change settings if other, or more detailed information, is wanted. The app also provides descriptions to how the different functions work, which enables people with different background and ages to use the app. It is also possible to change language in the app, something that enables non-Swedish speaking people to use it.

A limitation in the design program Figma entailed that it was not possible to implement a zoom function in the app, which would otherwise have enabled more people with different conditions to use it.

Aesthetic and minimalist design
Most functions in the app are by minimalist design and the app has an aesthetic design which can be pleasing for users to use. However some functions, such as *Usage*, contain a vast amount of information, which may cause confusion for the user.

Help users recognize, diagnose, and recover from errors
When editing information in the app, the user can always use the feature of going back in the app, which will end the editing of new information. Using the interface design tool Figma, it was however not possible to create error messages and evaluate these, since it was not possible to save changed settings in the app.

Help and documentation
At the top of each function, the user is presented with a text letting the user know what is possible to perform within the function. This can help the user keep track of what is happening.

Chapter 7

Assessment Testing

To evaluate how the final prototype was perceived by users, the prototype's UX was tested using a user test. The test was performed according to a test plan, and results were gathered as observations during the test sessions and questionnaires and open questions during the debriefing. Through a debriefing survey, a SUS score was obtained.

7.1 Approach

As an approach to evaluate the final product, a usability test with 20 participants was conducted. The purpose behind conducting the test was to evaluate the UX of the final product's interactive UI. The test was a so called *Assessment test*, which is performed early to midway in the development of a product [7]. The test aimed to see what potential users thought of the functionality and the layout of the app. Before the assessment test, pilot tests were conducted to ensure that the scenarios and questions were viable, clear and unambiguous, that the hardware, software, and documentation were in order and ready for testing and to estimate the duration of a test session.

Rather than evaluating a hypothesis regarding the UX of the app, the UI was evaluated using research questions. These research questions, that the usability test aimed to answer, were:

1. How do the participants experience the app's UI?
2. What is the participants' experience of navigating in the app?
3. What do the participants think of how the app is structured?
4. How do the participants experience the relevance of the different functions in the app?
5. Are there functions that the participants are missing in the app?

In order to answer these questions, different types of data needed to be collected. In usability evaluations, it is important to gather both qualitative and quantitative data, as well as both objective and subjective data [7]. All of these types of data were gathered through observations, surveys and interview questions, and complemented with a screen and sound recording during the performance of the tasks in the test.

When selecting participants for the user test, the aim was to find participants that represented the target group of the app, see section 3.4.1, as well as possible. An aim was also to, within the target group, find participants with different backgrounds, such as different education level, knowledge about energy business, sex and interests, to represent as many people in the target group as possible. The age varied between 23 and 58 years, in order to represent the ages of the customers visiting *Mina Sidor*. The 20 participants were divided into two groups with 10 participants each. This is in line with the theory that in user tests, there should be at least 10 to 12 participants per condition in order to achieve statistical certainty [37].

The test was performed in field, in a calm environment, to simulate the true environment that the app would be used in. The test started with the participant being presented with the arrangements of the test, signing an informed consent, see Appendix C, and answering a survey about the participant's background. The test, with a maximum time limit of 20 minutes, was then performed. In the debriefing after the test, the participant filled out a survey that contained a SUS, and answered interview questions. The entire test plan can be seen in Appendix B.

For each usability test, the participants were presented with a scenario that told them that their name was Kalle Karlsson and that they had different kinds of contracts with Kraftringen. They were also presented with the fact that they have two accommodations called *Apartment* and *Summerhouse*. During the test, the participants were asked to fulfill two tasks. One of them, task A, was divided into two sub tasks; "Check the electricity contract for your *Summerhouse*, and "Compare how much you paid on average per day during this and last week for electricity". The other task, task B, was to explore the app freely, and if the participants did not know what to do, the test moderator asked different questions such as "How would you contact Kraftringen", "Where would you look to obtain information about solar power?" and "Do you think you have favorable energy contracts today?" etc. Half of the participants (10 people) were asked to first perform task A and then to explore the app in task B (this was called *Structured* test), while the other half were asked to do the test the other way around (this was called *Unstructured* test).

To conduct the usability test, both a test moderator and an observer were present. The test moderator read a script, to make sure the participant felt welcome, let the participant know the arrangements of the test and presented the participant with the test's instructions. The test moderator was seated next to the participant throughout the test and provided the participant with tasks and probing when needed. If the prototype erred or stopped responding, the test moderator could also use a computer prepared with Figma, to correct the prototype. The test observer made sure that Figma was working

correctly in both computer and smartphone and that screen recording was working on the smartphone. The observer was, during the tests, responsible for keeping track of the time and keeping records.

A SUS survey was used to calculate a quantitative number to represent how the users in the usability test perceive the UX of a the app. Different SUS scores were calculated for each subgroup, based on demographics and background of the participants.

7.2 Results

From the usability test, results in the form of surveys, observations and interview questions were gathered.

7.2.1 Demographics

The demographics of the participants can be seen in Figure 7.1 and in Table 7.1.

Table 7.1: Demographics of the participants.

Nr.	Based on
12	Women
8	Men
7	Having iOS on their smartphone
13	Having Android on their smartphone
9	Works at Kraftringen
2	Working, but not at Kraftringen
9	Students

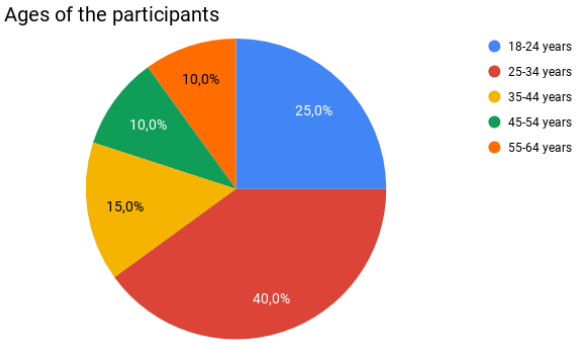


Figure 7.1: Ages of the participants in the assessment test.

7.2.2 Observations

During the test, observations regarding how the users managed the log in page, as well as the two different tasks and two sub tasks, were recorded.

Log in page
The test started with the participants being introduced to the log in page, see Figure 6.1(a), at the same time as the participants received their tasks (either *Structured* or *Unstructured*). Out of the ten participants who had an *Unstructured* test, seven logged in straight away, while three participants first tested different functions available on the log in page. The statistics regarding the *Structured* test was identical, seven participants logged in straight away while three first visited functions on the log in page. During the *Structured* tests however, two participants also had to be probed to log in.

Comparing participants in regard to their age, ten out of 13 under the age of 34 logged in straight away. Over the age of 34, four out of seven logged in straight away.

Task A, sub task 1: Finding contracts
One of the two sub tasks that the participant was presented with was: "Examine what kind of electricity contract you have for your summerhouse." The sub task was completed by all 20 participants without any probing or help from the test moderator. However one participant, with an *unstructured* test, searched in the compressed menu before choosing to look in the function *Contracts*. Also four participants, all with a *structured* test, scrolled through all contracts for *Apartment* before they detected where they could choose *Summerhouse*, see Figure 6.2(c).

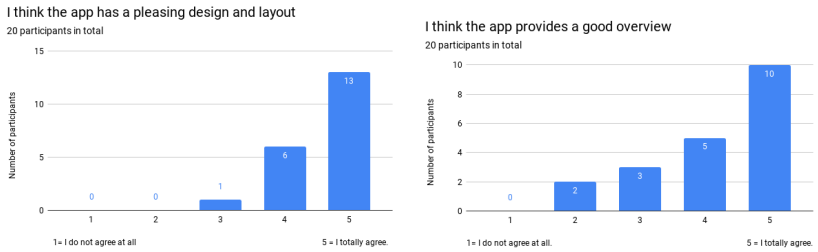
Task A, sub task 2: Comparing electricity cost over time
The second sub task was: "Compare how much you paid on average per day during this and last week for electricity". During this sub task, three participants found the subfunction *Comparison* directly and fulfilled the task with no difficulties (two with *unstructured* tests, one with a *structured* test). 16 participants (eight with a *structured* test and eight with an *unstructured* tests) wanted to compare their usage in the subfunction *Overview* by either changing week in a calendar, changing the view to month or day, or by swiping horizontally in the diagram, see Figure 6.2(a). These methods were also correct approaches to fulfilling the sub task, but not implemented or intended ones in the test. In total, nine participants needed a short time to search, and one participant needed to be probed, before they detected the box for changing from *kWh* to *Kr*, see Figure 6.2(a), which was necessary in order to complete the sub task. Four participants also examined other functions before finding the correct one, which was *Usage*.

Task B: Exploring the app
During task B, participants could explore the app freely. Observations regarding which functions were visited and what participants did when asked questions, were recorded. During task B, eleven of the participants expressed that they noticed the notification icon in the navigation bar by the *Invoice* icon and two participants expressed that they noticed the notification icon in the collapsed menu at *My errands*. When asking the

user to find where to contact Kraftringen, seven participants went to the start page and found *Contact us* there, five found *Contact us* in the collapsed menu, and five clicked on the speech bubble with a question mark. Three of the participants who clicked on the speech bubble with a question mark, clicked on it before they were asked to. All three options were correct.

7.2.3 Debriefing

The debriefing consisted of the participants filling out a survey, as well as answering seven interview questions. The survey consisted of a SUS survey, see section 7.10, together with two statements. The results from the two statements can be seen in Figure 7.2, where the number *5* represents a total agreement with the statement and number *1* represents a total disagreement with the statement.



(a) Pleasing design and layout **(b)** Provides a good overview

Figure 7.2: Two separate questions about the app in the debriefing questionnaire.

Answering the interview questions, the number of participants are accounted for as a number (Nr.) in the tables below. There was an exception regarding question 1, where many participants stated more than one aspect of the app as the best thing about it. The results from the seven interview questions can be seen in Table 7.2 to 7.8.

Table 7.2: Question 1.

What was the best thing about the app? (Possibility to state more than one aspect)

Nr.	Answer	Comment
15	The structure	- Provides good overview - Easy to navigate and use. - The clearly visible navigation bar, highlights the most important functions.
10	The many usable functions	- Energy usage. - Log in with BankID. - Invoice. - Contract.
9	The pleasing design and layout	- Nice colors. - Happy feeling. - Entertaning mascot. - Nice pictures.

Table 7.3: Question 2.

What did you dislike the most about the app?

Nr.	Answer	Comment
10	Nothing	- Nothing. - Do not know.
10	Specifics	- Difficulty of knowing whether functions are placed in the navigation bar or in the collapsed menu. - The layout on the Energy Usage page. - Too much text to read. - The start page was too unpersonal.

Table 7.4: Question 3.

What did you think about the structure of the app?
Was it easy to navigate and find what you were looking for?

Nr.	Answer	Comment
18	Yes	- Good and clear headlines everywhere. - The structure of the different functions felt logical. - Good with both text and icon in the navigation bar.
2	No/ not always	- Too much information per page. - Confusion about what was in the compressed menu and what was in the navigation bar, can be confusing for first time users. - The diagrams and settings in the "usage" function was too small and too much. - It was difficult to see the sub-functions. - Got confused by the functions visible on the log in page.

Table 7.5: Question 4.

Do you think that the functions were relevant?

Nr.	Answer	Comment
18	Yes	- Yes, definitely. - Liked all the extra features. - Everything was relevant, even though I would not have used all the features.
2	No	- It did not feel customized with the charging map, if you do not have an electric car. - The competition, but it can probably be relevant for others.

Table 7.6: Question 5.

Are there functions that you are missing in the app?

Nr.	Answer	Comment
12	No	
8	Yes	- Would like a more environmental focus. - See my energy usage on the start page, not as a function. - Implement functions for comparing different types of contracts. - See my contracts with other energy suppliers, if I have them.

Table 7.7: Question 6.

Do you feel that the app motivates you to increase your environmental awareness?

Nr.	Answer	Comment
13	Yes	Especially with the: - Energy saving tips. - Energy usage visualization. - Competitions. - "Good choice for the environment" (Contract).
3	Do not know	- I am already empowered, but the app will probably help others.
4	No/ not so much	

Table 7.8: Question 7.

Do you think that you would use this app?

Nr.	Answer	Comment
16	Yes	- To keep track of my energy usage. - To pay or check my invoices. - To check my contracts, errands, goals and to contact Kraftringen. - To enter competitions.
3	Yes/ yes sometimes	
1	No	- Not possible for me because I do not pay for any energy, but otherwise I would.

7.2.4 SUS Score

The SUS scores, based on different demographics and prerequisites, can be seen in Table 7.9. A total SUS score of 82.3 was attained, which is stated as a grade A, described as excellent, acceptable and as a promoter, see Figure 2.1. For women, both women younger than 35 and women using iOS as their operative system, the SUS score became higher then 84.1, which equals the highest SUS ranking and is stated as the best imaginable UX. The lowest SUS score became 78.1, which was for men, and equals a B+. Each of the ten statements and their individual median score can be seen in Table 7.10.

Table 7.9: SUS scores based on different things

SUS score	Based on	Nr. Participants
82.4	Total	20
84.6	Younger than 35	13
80.1	Older than 35	7
85.2	Women	12
78.1	Men	8
86.1	Having iOS on their smartphone	7
78.7	Having Android on their smartphone	13
81.3	Started with exploring the app	10
83.5	Started with fulfilling two sub tasks	10
81.7	Works at Kraftringen	9
83.1	Not working at Kraftringen	11
81.0	Customer at Kraftringen	12
83.7	Not customer at Kraftringen	8

Table 7.10: Statements in the SUS survey and their median score from the 20 participants. 1 (do not agree at all) to 5 (totally agree).

Question	Median	Max	Min
I think that I would like to use this app regularly.	4.0	5	1
I found the app unnecessarily complex.	1.5	5	1
I think the app is easy to use.	4.0	5	2
I think that I would need the support of a technical person to be able to use this app.	1.0	1	1
I found that the various functions in this app were well integrated.	4.0	5	3
I thought that there was too much inconsistency in this app.	1.0	3	1
I would imagine that most people would learn how to use this system quickly.	4.0	5	3
I found the app very cumbersome to use.	1.0	2	1
I felt very confident and secure (regarding what I did) when using the app.	4.0	5	2
I needed to learn a lot of things before I could get going with this app.	1.0	2	1

Chapter 8

Discussion

This thesis project was performed in order to present a proposal to Kraftringen regarding how the UI of their new app should be designed, including an exploration of what users want and expect from an energy supplier, and how users are best motivated to increase their environmental awareness. Based on both theoretical and empirical methods and evaluations, the proposed UI of the final prototype is believed to create a good UX and meet the goals of the project. This was ensured through establishing the needs and desires of both Kraftringen, Kraftringen's customers and energy supplier customers in general. The established needs and desires were used together with theoretical design and usability principles to generate possible solutions and concepts. These concepts were evaluated and used to create a final prototype, which was evaluated in an assessment test to determine its UX. Throughout the design process, users have been considered and involved, to ensure a final prototype that from the user's perspective is easy and pleasing to use. Based on the results from the assessment test, the final prototype provides a UI that the majority of users declare that they thought had a good structure, relevant functions, motivates them to become more environmentally aware, and which they think that they would use.

8.1 Establishing the Needs

Questionnaire
Letting mostly engineering students and women with a connection to technology answer the exploratory questionnaire, limited the input that could be generated from it. The groups were however chosen because both contained people who are likely to be interested in technology, and the main purpose of conducting the survey was to establish the thoughts and ideas for design and technical solutions to implement in the app. Therefore, even though the input may have been limited because of the slim profile of the respondents, the respondents may have been well chosen based on the purpose of the exploratory survey.

8.2 Users and user tests

Finding participants
In this thesis, it was a challenge to find representative participants to include in the design process, to represent the target group of the app. This applied to the customer surveys when establishing the needs (focus group and questionnaire), during the Lo-Fi prototype user tests and Hi-Fi prototype iterations, and for the assessment test. It was assumed that the target group for the app approximately corresponded to the customers that were visiting *Mina Sidor*. It was attempted, as well as possible, to obtain a representative distribution among participants regarding for example: sex, age, different knowledge and interest of electricity and energy, background, etc. When including the participants in the project, the selection was limited by the fact that the participants needed to want to participate as well as be able to participate during the time they were asked. New participants were also required for every new part of the development and for every iteration, in order to avoid participants who are affected by their earlier involvement in the design process. This conveyed that a large amount of participants needed to be included. The requirements for obtaining well suited participants for the project entailed that, not during all parts and iterations of the project, were the participants well representative of the app's target group. However in general, the participants represented the target group relatively well.

User tests
There are several limitations associated with using user tests. Among other things, the environment which the tests are performed in may not be entirely representative of the environment which, in this case, the app would actually be used in. There is also a great chance of the user thinking and acting differently during the test, compared to how the user would when using the app normally. This can partly be traced to the fact that participants may feel observed during a test, and because of this, they can be stressed when asked to perform tasks. The method of thinking out loud, which was applied during all user tests, also tends to affect the users and make them analyze their behavior and the design of the app more than they would usually do [7].

User Opinions
During the project, several desires and requests regarding features to include in the app have been brought to light by participants of the different user based methods. For example during the exploratory focus group, the questionnaire, and the user test for the Lo-Fi and Hi-Fi prototype iterations. All opinions have been considered, however mainly the most prominent and common opinions have been included in the continued development of the UI. Decisions regarding which opinions to mainly include in the development has been based on for example the technical difficulty of implementing a function, that the information is not available today, that people's opinions contradict each other or that none in the development team agrees with the change due to earlier knowledge accessed from users or based on theoretical knowledge.

Another reason not to include all aspects and desired features that the participants expressed, is the fact that there is a difference between what a person expresses that they

want and what the person actually wants when it is presented to them [33]. This, for example, turned out to be the case regarding the environmental motivation in the app. During the establishment of the needs, see chapter 3, participants expressed a desire for receiving a lot of tips and motivation regarding how to live sustainable. However when actually being presented to it, they thought it was unpleasant and invasive. The opposite was true regarding gamification in the app, where participants were not expressing a pronounced interest in gamification when being asked during the establishment of the needs, but expressed a greater interest when being presented to it during the assessment testing, see chapter 7.

8.3 Final prototype

Design tool
The design tool Figma entailed a number of limitations for the Hi-Fi prototype. This entailed an incorrect representation of the app, in relation to the thought solution. One main limitation was that the possibility for users to achieve changes in the prototype could essentially not be implemented, for example "pay" invoices or change view in *Usage*. This resulted in the fact that the feedback of the UI could not be evaluated.

Another limitation was that the prototype, when presented in a smartphone, was running extremely slowly. This sometimes led to impatience, frustration and multiple clicks from the participants in the assessment test. Moreover, Figma did not provide the possibility to implement zoom, illustrate animations, or horizontally switch between subfunctions. Since the prototype was not programmed, but instead a visual representation of the app, the possibility to press a smartphone's physical backward button was not available. Before the assessment test was initiated, to avoid letting the limitations of Figma subside the participants' views on the final prototype, the participants were asked to try to ignore these limitations. Some limitations were also explained during the test, through the test moderator for example saying "just like you are trying to, you would be able to zoom here, but this feature was not possible to implement in this prototype." Also, when the prototype was slow or non responding, the test moderator refreshed the prototype shown in the smartphone through using Figma on a computer. However these limitations can still have affected the overall impression of the app, which may have lead to a diminished SUS score.

Environmental focus
Concerning environmental motivation from the app, it was difficult to make all participants satisfied, due to different levels of interest for environmental questions and due to how the participants wanted to be encouraged and informed. During the development phases, the expressed interest for environmental focus was generally high. When asking participants in both the focus group and questionnaire about what features they wanted to have in an energy app, several environmental aspects were requested. However, when presenting these requested features during Lo-Fi prototype user tests, the features were generally considered too pushy or invasive. It was indeed different groups of people who expressed that they wanted a lot of focus on the environment in

the app, and who expressed that the environmental focus became too much, still, both groups represented the target group. The result may indicate that people, as mentioned, can have different opinions regarding a feature when imagining it and actually being presented to it. Alternatively, the result indicates that more people should be tested in order to make statistical conclusions about the limit of environmental motivation to include in the app. More iterations, with different levels of environmental focuses in prototypes, could show where the limit lies.

Seen in Table 7.7, 13 out of 20 participants expressed that they feel that the current app motivates them to increased environmental awareness. Four participants however expressed *no* or *not so much*, while three expressed that they are already very motivated and would not be motivated further by the app, but that they thought it could help others find motivation. These results indicate that there is an opportunity to expand features in the app in order to motivate more people to live more sustainable. Caution should however be taken when expanding environmental features, to not push people too much and give them an undesirable UX.

Personality
During this thesis, it has been sought to increase the Net Promoter Score (NPS) and change customers' views on Kraftringen's "personality", see section 3.3.1. Regarding how customers describe Kraftringen as a person, Kraftringen aimed to make its "personality" feel more personal and environmentally friendly. These personality traits have both been attempted to be enhanced through features such as mascot, competitions, customization, tips on how to save energy, overview of personal usage and correlation to CO_2 etc. As can be seen in Table 7.7, a majority of the participants in the assessment test announced that they think the app motivates them to increased environmental awareness, which can be interpreted as perceiving the app, and perhaps also Kraftringen, as environmentally friendly.

SUS score
The obtained SUS score for the final prototype, which in total reached a grade A on average, indicated a well developed prototype for the target group. The fact that the SUS scores, see Table 7.9, did not have any substantial differences between any of the sub group, can be considered an indication that the developed UI was designed relatively well for everyone within the target group. When looking into each statement from the SUS survey, see Table 7.10, the positive statement that stood out the most (because it had a max of 5 and min of 1) with a median score of 4 out of 5, was "I think I would like to use this app regularly." This result may indicate that the app could be developed further to be more useful to customers. However this score does not have to imply that the design had deficiencies, but may be due to the fact that the energy industry in general is a low interest industry, as described in chapter 2. The word *regularly* is also highly subjective and compared to other apps that the participants may use in general, an energy supplier app probably would not be used as often. It can also be seen in Table 7.8, that 19 out of the 20 participants, stated that they think that they would use this app, when asked an interview question in the debriefing of the assessment test.

When looking at each SUS statement, see Table 7.10, a negative statement that stood out (because it had a max of 5 and min of 1), with a median of 1.5 when 1 was an ideal score, was "I found the app unnecessarily complex." For designers, it is a challenge to present both a good overview and all desired details of a feature, simultaneously. The score on the statement however implies that the number of functions, or features within the functions, may have been too much and created confusion for the users. The complexity of the app should therefore be considered to be reduced, in order to emphasize the most important functions and features, alternatively less frequently used functions could be "hidden" in a better way. However looking at the results from the first interview question, see Table 7.2, which asked the participants what they thought the best thing about the app was, 15 out of 20 mentioned positive aspects regarding the structure of the app's UI, and 10 mentioned the amount of usable functions in the app. Also, as can be seen in Table 7.5, an interview question about whether the participants thought the functions in the app were relevant, only two expressed that they experienced that there were functions that was not relevant for them. Furthermore, from Figure 7.2(a), a predominantly positive result was obtained regarding that the majority of participants thought the app had a pleasing design and layout. Even though, as can be seen in Figure 7.2(b), there was less positive result on a statement regarding the overview of the UI, the result still shows that the majority of participants considered the UI to provide a good overview. Also, as can be seen in Table 7.4, the structure of the app and how easy it was to navigate in, yielded positive responses and only two participants expressed that it could be improved.

Improvements

Many results from the assessment testing have been positive, but the prototype still has potential for improvement. When asking what the users disliked the most about the app, half of the participants (10) expressed that they did not dislike anything while the other half (10) specified specific improvement aspects, which can be seen Table 7.3. The most common aspects were regarding difficulties of knowing whether functions were placed in the navigation bar or in the collapsed menu, that the layout of the function *Usage* could be improved, that there were too much text to read, and that the start page was perceived as impersonal. As can be seen in Table 7.6, the question about whether there are functions missing in the app, a number of potential functions or features were proposed, from eight of the participants.

8.4 General

Design team and UX
When designing a UI, or when designing anything at all, it is important to be aware of the fact that it can be easy to design a product for yourself [6]. Beneficially, a design team should consist of people with diverse backgrounds to avoid this phenomenon. In the project, the two developers were both young women using Android as their operative system, and both had similar educational background. This limitation of having a design team with members who are very similar, was attempted to be overcome by iteratively including many users during the design process. Still, the phenomenon may have contributed to the small difference in the SUS scores obtained in the assessment test, regarding the scores for different ages and sexes. Results regarding women and people younger than 35, were higher than for men and people older than 35. Further involvement of users or a more divers design team, could have minimized these differences.

The UX and the SUS scores for those who are used to the operative system iOS however, had the highest SUS score. This result may be an indication that Android apps are easier to use compared to iOS apps, for first time users. Therefore the participants who are used to an iOS interface may have experienced the app's UI, made for Android, more favorable. The high SUS score for iOS may however be incidental.

8.5 The Main Goal and Subgoals

Create and evaluate an interactive UI for Kraftringen, focusing on the UX
The purpose and goals of this thesis were considered in every phase of the design process. Based on the theoretical and empirical methods used to create and evaluate the proposed UI of the app, it can be established that the proposed UI creates a good UX for an app for Kraftringen. The app's UI can therefor be recommended to be used by Kraftringen in the future. There is still room for improvement of the UI and further testing should be performed in order to authenticate the UX of the app.

1. Explore what users expect and want from an energy supplier
The goal to explore what users expect and want from an energy supplier was attempted to be answered mainly during the establishment of the needs, but many different demands and expectations regarding desired functions and information were brought to light during the entire timeline of the thesis. All desires were taken into account when establishing what was most common and of greatest importance. Customers mainly expect to be provided with essential information regarding outages, unpaid bills, usage over time etc. Customers also want to be provided with the possibility, on their own terms, to know how they can live more sustainable, how they can understand and pay their bills in an easy way, be motivated to change their behavior to the better and understand their energy usage and contracts better. These expectations and desires were taken into consideration when creating the app's UI.

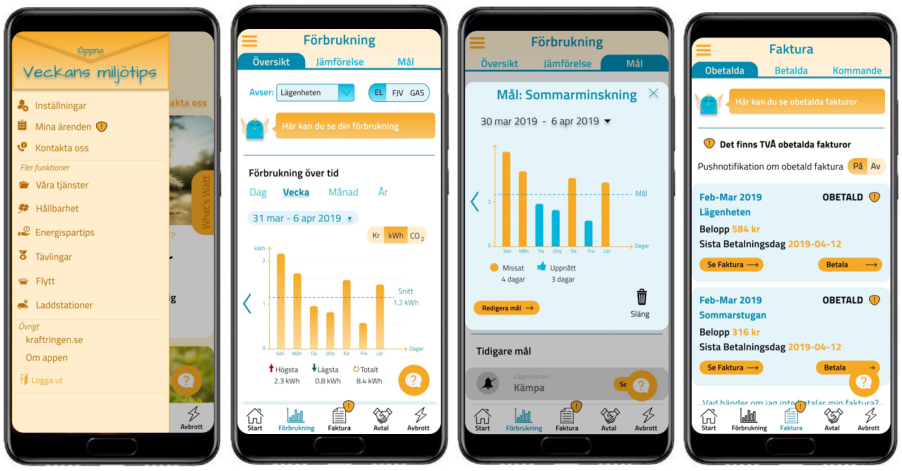
2. Evaluate why customers contact Kraftringen's customer service today and how the workload on customer service could be reduced
It could be established that the most common reason for customers to contact Kraftringen and other energy suppliers was regarding questions concerning invoices. Based on this, the UI was created to supply customers with functions and features needed to obtain and perform all desired information and errands to achieve customer satisfaction and ease the workload on customer service. The same was done regarding contracts, report moving to a new house, environmental information, outages and usage, which were also common reasons for contacting Kraftringen.

3. Examine user's desire for environmental awareness and how users are best motivated to reduce their environmental footprint
It could be concluded that the majority of users involved in the design process expressed a great desire for being aware of their energy usage and environmental footprint. However when exposed to features and functions in a UI, focusing on how to live more sustainable, the UX was diminished for many users. However when not being presented to much environmental focus in a UI, but instead having to find the information oneself, some users did not feel motivated to reduce their environmental footprint. More research needs to be done in order to establish how prominent an environmental focus can be in a UI, in order to still maintain a good UX. However it could be concluded that the majority of involved users wanted to have easy access to environmental information and functions, but that it should not be highlighted excessively, since this can create unwanted guilt and a bad UX of the app.

8.6 Next Step

The prototype has been further developed, based on the results from the assessment test, as a fourth Hi-Fi prototype iteration. The next step would be to evaluate these changes in a user test. The changes are mainly regarding improvements for the contrast, the layout of the feature *energy usage goals* and the main function *Usage*, the visibility of the subfunctions accessible in each of the four main functions, as well as changes of size and position of important buttons, see Figure 8.1. In a future user test, more focus could beneficially be concerning the impression of the environmental motivation in the app. An option would be to investigate how much the environmental focus could be, without it being perceived annoying. In order to be able to draw better statistical conclusions, the next step would also be to perform user tests on larger groups, to achieve a more accurate evaluation of the UX of the app's UI.

Finally, after ensuring good results from forthcoming user tests of the prototype, the next step would be to program the app. In the end of the implementation phase, and before releasing the app, the programmed prototype would also be evaluated through a verification user test. This would ensure a good UX of the product and check that it meets the requirements, before it would be placed on the market.



(a) Collapsed menu **(b)** Energy usage **(c)** Personal goals **(d)** Invoice

Figure 8.1: Changes for the next step.

Chapter 9

Conclusion

To achieve a good UX of a UI for an energy supplier's app, most people want an app that will make them feel in control. They also want an app that is fun and has a pleasing design and layout. What users mainly want to feel in control regarding is their usage, invoices, contracts and possible outages. They also want to be informed and encouraged to reduce their environmental footprint, but not excessively, since this will create guilt and result in the application not being used. Considering the largely positive results generated from the empirical assessment test and the theoretical heuristic evaluation, the final proposal can beneficially be recommended to Kraftringen as a good UI for their new app.

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Appendices

Appendix A

Questionnaire

Energiintressekollen

Vi är två civilingenjörsstudenter på Lunds Tekniska Högskola som gör vårt examensarbete och håller nu på att utveckla en app på ett energibolag för att förbättra användarupplevelsen för kunder. Enkäten handlar om allmänt intresse för appar och privat energianvändning. De anonyma resultaten kommer att användas för att stödja våra beslut i arbetet.

Enkäten tar cirka tre minuter att genomföra.

Tack för att du tar dig tid att svara!

*Obligatorisk

1. **Jag är mellan...?** *
   Markera endast en oval.
   - ◯ Yngre än 18 år
   - ◯ 18-24 år
   - ◯ 25-34 år
   - ◯ 35-44 år
   - ◯ 45-54 år
   - ◯ 55-64 år
   - ◯ 65 år eller äldre
   - ◯ Vill inte uppge

2. **Jag har bra koll på hur mycket energi jag använder varje månad.** *
   Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer helt

3. **Jag hade velat ha bättre koll på min energianvändning.** *
   Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer helt

4. **Jag tycker att det hade varit intressant att veta mer om hur mycket energi olika produkter drar, t.ex. en vattenkokare.** *
   Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer helt

5. **Det är viktigt för mig att använda mindre energi, för att spara pengar.** *
Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer helt

6. **Det är viktigt för mig att använda mindre energi, för att minska min miljöpåverkan.** *
Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer helt

7. **Tävlingar (med mig själv och mot andra) motiverar mig att förändra mitt beteende till det bättre.** *
Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer helt

8. **Jag skulle vilja kunna sätta upp mål för min energianvändning, och se hur väl jag uppfyller dem.** *
Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer helt

9. **Jag vill kolla min energianvändning (förutsatt att det är mycket lättillgängligt)** *
Markera endast en oval.

- ◯ Varje timme
- ◯ Varje dag
- ◯ Varje vecka
- ◯ Varje månad
- ◯ Mer sällan
- ◯ Aldrig
- ◯ Vet ej

10. **Via mitt energibolags app är det viktigaste för mig att kunna utföra/se följande:** *
Markera alla som gäller.

- [ ] Få notiser om obetald faktura
- [ ] Kunna chatta med kundservice
- [ ] Se avbrott
- [ ] Tips på att minska min energianvändning
- [ ] Ändra mina avtal
- [ ] Se min energianvändning i detalj
- [ ] Se information om solcellslösningar
- [ ] Göra en flyttanmälan
- [ ] Se laddstationer för elbilar
- [ ] Få notiser om att jag måste förnya avtal
- [ ] Betala min faktura
- [ ] Få mer information om min faktura
- [ ] Se mina avtal
- [ ] Övrigt: _____

11. **Vad hade ditt dröm-energibolag erbjudit för tjänster? Tänk gärna fritt och begränsa dig inte till vad ett energibolag erbjuder för tjänster idag.**

_____

_____

_____

_____

_____

12. **Vilken är din/dina favoritapp/favoritappar? Förklara gärna varför.**

_____

_____

_____

_____

_____

Appendix B

Test Plan

Testplan

Assesment testing

Syfte

Testets syfte är att utvärdera om det interaktiva användargränssnitt som i examensarbetet har föreslagits upplevs som användarvänligt och funktionsenligt för potentiella användare av prototypen av appen. Testet syftar till att undersöka hur olika funktioner upplevs av användare och i vilken utsträckning de inbjuder till att användas.

Frågeställningar

1. Vad är testpersonernas upplevelse av appens användargränssnitt?
2. Vad är testpersonerna upplevelse av att navigera i appen?
3. Hur upplever testpersonerna uppbyggnaden av de olika funktionerna i appen?
4. Hur upplever testpersonerna relevansen av olika funktioner i appen?
5. Finns det funktioner som testpersonerna saknar i appen?

Typ av datainsamling

Frågeställning	**Objektiv/kvantitativ**	**Subjektivt/kvantitativ**	**Objektiv/kvalitativ**	**Subjektiv/kvalitativ**
1		SUS-enkät		Öppen fråga.
2	Antal felsteg		Typ av felsteg	Öppen fråga
3	Antal felhanteringar	SUS-enkät	Typ av felhantering	Öppen fråga.
4				Observationer av besökta funktioner Öppen fråga
5				Observationer av önskade funktioner Öppen fråga

Testuppgifter STRUKTUR

Uppgift	**Korrekt slutförd när...**	**Maxtid**
0. Logga in	Sidan Start visas.	2 min
1. Kolla vilket elhandelsavtal som är aktuellt för “sommarstugan”	Sidan med Avtal/Aktuella visas, “sommarstugan” markeras, och FP säger vilket elhandelsavtal som visas.	3 min
2. Jämför hur mycket el som användes denna jämfört med förra veckan, i “Lägenheten” och vad denna skillnad motsvarar i kronor	Sidan med Förbrukning/Jämförelser visas och FP klickar fram kr och säger vad skillnaden är från förra veckan.	3 min
3. Undersök appen i stort	När maxtid uppnåtts eller FP känner sig nöjd.	7 min

Testuppgifter LEK

Uppgift	**Korrekt slutförd när...**	**Maxtid**
1. Undersök appen i stort	När maxtid uppnåtts eller FP känner sig nöjd.	9 min
2. Kolla vilket elhandelsavtal som är aktuellt för “sommarstugan”	Sidan med Avtal/Aktuella visas, “sommarstugan” markeras, och FP säger vilket elhandelsavtal som visas.	3 min
3. Jämför hur mycket el som användes denna jämfört med förra veckan, i “Lägenheten” och vad denna skillnad motsvarar i kronor	Sidan med Förbrukning/Jämförelser visas och FP klickar fram kr och säger vad skillnaden är från förra veckan.	3 min

Procedur

Moment	**Delmoment**	**Material**	**(Max)tid**
Före testuppgifter	FP skriver under NDA, svarar på enkät ang. bakgrund	Dator, Google forms till enkät, NDA, bläckpenna, utskrivet TL-script	5 min
Testuppgifter	Utför momenten enligt *Testuppgifter*	Utskrivna scenarion, dator med observationsprotokoll, dator med Figma i webbläsaren, mobil med figma-app och inspelning	15 min
Debriefing	FP svarar på ytterligare frågor i intervju och post-enkät, angående upplevelser.	Dator med observationsprotokoll, dator med Google forms till enkät, utskrivna intervjufrågor	10 min

Urval

- I detta test planeras det att medverka 20 testpersoner, varav hälften (10 st) ska utföra två scenarion först och avsluta med att utforska appen fritt (STRUKTUR), medan hälften ska utforska först och därefter utföra de två scenarierna (LEK).
- Testpersonerna ska representera användarmålgruppen av appen. De ska vara spridda av olika åldrar mellan 18 år och uppåt, med olika bakgrunder. Detta innebär till exempel att testpersonerna har olika utbildningsnivåer, kunskaper om energibranschen, kön, intressen osv.

Testmiljö/Utrustning

Testmiljö:

- Testerna ska utföras i fält. De ska ske i en lugn omgivning, utan speciell lokalisation.

Utrustning:

- En dator med enkäter för innan och efter testet. Figma öppet i webbläsaren med samma internetanslutning som mobilen.

- En dator med observationsprotokoll för under test och under debriefing. Datorn startar ljudupptagning under debriefing.
- En mobil med figma-app och AZ screen recorder.
- Utskrivna papper
    - Informerat samtycke
    - Scenarion till FP
    - Script till TL
    - Öppna frågor till debriefing

Roller

Testledare.

- Testledaren kommer att vara närvarande under hela testet. Testledaren kommer att välkomna försökspersonen, gå igenom instruktionerna med denne och sitta bredvid försökspersonen under testet och ge ledtrådar om personen inte kommer framåt. Testledaren avslutar också testet och tackar försökspersonen för deltagande.
- Vid eventuella buggar i prototypen eller vid kraftig fördröjning, kan testledaren ingripa och skicka FP till rätt sida i appen via Figma i webbläsaren.

Protokollförare och inspelningsansvarig.

- Innan testet påbörjas kommer personen säkerställa att figma-appen är igång med prototypen samt att skärminspelningen är startad. Den inspelningsansvariga kommer ingripa om inspelningen skulle sluta fungera.
- Personen kommer även att agera protokollförare. Denne kommer att hålla sig i bakgrunden under testet och anteckna stämningen, generella problem och så vidare under testet. Protokollföraren kommer också att ansvara för tidtagningen under testets olika moment och meddela om maxtid nås.

Rapportering av resultaten

Resultatet av testet kommer att användas i examensarbetet för att utveckla en interaktiv prototyp av en app. Resultaten av testerna kommer att vara anonyma och presenteras i examensarbetets rapport. Materialet kommer att lagras på Google Drive fram till avslut. Testgruppen lagrar inga känsliga personuppgifter av försökspersonerna (så som namn eller personnummer). Testgruppen refererar istället till försökspersonerna som “Deltagare” med ett tilldelat unikt identifikationsnummer.

Appendix C

Informed Consent

Informerat samtycke

- Jag samtycker till att frivilligt medverka i en användarstudie, som syftar till att utvärdera en prototyp av en app, i samarbete med Kraftringen.
- Jag tillåter att sessionen ljud- och skärminspelas samt att inspelat material endast kommer att användas internt inom forskningsgruppen.
- Jag är informerad om att mina personuppgifter och mina resultat behandlas konfidentiellt, och presenteras anonymiserat.
- Jag är medveten om att jag när som helst kan avbryta sessionen utan anledning.

Lund den _____

Namnteckning

_____

Namnförtydligande

_____