GREENCHOICE MOBILITY IN THE YEAR 2030

A GRADUTION REPORT BY MAX LABEE

CHAIR: DR. IR. E.A. VAN DEN HENDE

MENTOR: IR. T.J. HEBBINK

COMPANY MENTOR: E. HOENKAMP

GREEN CHOICE

PREFACE

Since my second year of studying, I have been working at Greenchoice. After 3 years of doing customer service, an interesting oppurtinuty came along: the innovation business unit, focussing on launching Electric Vehicle (EV) products, needed a customer service employee. Each day at the innovation unit started with helping customers navigating through new products and explaining new concepts and techniques. After helping customers, I was allowed to tag along on innovation projects, gaining a lot of knowledge of the EV markets. Eventually I was promoted to product developer for the strategic product division of Greenchoice. With three other product developers, we are responsible for developing new products and creating a competitive edge compared to other companies in the market.

My graduation project fits perfectly within the team and aims to develop a vision on mobility for the year 2030. With this project, I want to create a product vision for mobility products for Greenchoice, in order to guide product development.

Within the project, I saw Greenchoice from another perspective. It was quite the challenge to balance being an employee and being a student with a research goal. The project was great to use as a reason to try new methods and sit together and discuss markets and products.

I want to thank all the people I was able to interview. From them, I got amazed during each interview with new insights and interesting perspectives.

I want to thank all the colleagues from Greenchoice who gave me the space to execute this project, but also contributed with their knowledge and interest to this project.

I want to write special thanks to Els, the company mentor, who guided me through this long project and kept me focussed on the goal. Without her I wouldn't have been able to finish this project.

I also want to thank Ellis, my university chair and Tobias, my daily mentor for all their feedback and interesting perspectives into the project. Without their guidance, the project wouldn't have the academic approach it was able to achieve.

My personal main learning point from this project is the academic approach. By setting a goal, creating an approach and working out a schedule, the last thing to do is: Just start!

EXECUTIVE SUMMARY

The goal of this project is to develop the vision on mobility for Greenchoice in the year 2030. To achieve this goal, the double diamond model is used, filled with the Vision in product design method.

The project is hosted at the energy supplier Greenchoice, which is currently in a strategic shift from energy supplier to a platform for climate positivity, where they want to offer the next step in sustainability to every customer.

Past years, Greenchoice has aquired seperate mobility services, to offer charging services, charging stations and business charging. These services are completely seperated and do not work together to create a unique value proposition in the mobility market. By developing the vision on mobility, an integrated proposition should be developed.

Interviews with EV drivers and desk research were executed, to create context factors, which in turn were used in a workshop to develop a future context. From this future context, an attitude grid was created to decide on a position for Greenchoice in the future context. A design direction is created, to serve this position: *In 2030, we envision providing our customers with their own sustainable energy always and everywhere in an intuitive way, by being able to use their sustainable energy outside of their homes with their Electric Vehicles.*

To come from the future vision statement to a concept, an analogy was brainstormed. The chosen analogy was based on the concept of a creditcard. The characteristics from the interaction with a creditcard were derived, to guide the conceptualization phase. With the characteristics of a creditcard, the project team came up with two concepts:

Happy charging & Community charging.

Through multiple iterations and with the help of user feedback through narrative storytelling and app screen prototyping, both concepts iterated into the final concept.

Happy charging lets users save up their solar energy which they don't use at home, to charge their car with on the road. The app will function as a digital battery notifying EV drivers when and where they can charge with their own solar energy.

Community charging lets homeowners register their home charging and make their charger available to the Greenchoice EV driver community. The EV drivers are able to charge at somebodies home charger between selected times, so the homeowner has a way to optimize the use of their solar generation through the home charger and the Greenchoice EV driver benefits from a more extensive charging network.

Eventually both concepts are joined into one concept, **Chargeshare**, so customers are connected to eachother, to charge their own sustainable energy at home and on the road in a seamless way. The concept is delivered with a description and roadmap for development.

CONTENT

GLOSSARY & ABBREVIATIONS

The market of Electric vehicles is still upcoming, but a lot of companies and stakeholders are involved to make electric vehicles work. This section explains the jargon of the market.

Electric Vehicle (EV):

A car that drives on electricity

Electric Mobility Service Provider (EMSP):

Companies who provide access to EV drivers, to be able to charge publicly by giving out charging passes

Charge Point Operator (CPO):

Companies who host charging stations. They are responsible for monitoring and invoicing charging sessions

Open Charge Point Protocol (OCPP):

Standard protocol in the EV market, to communicate between charging stations and the CPO

Electric Vehicle Service Equipment (EVSE):

Every piece of hardware used for charging EVs

Energy Management System (EMS):

System that controls energy assets

Internal Combustion Engine (ICE):

A fossil fueled engine, used in non EV cars

Open Charge Point Interface (OCPI):

Market standard protocol to communicate between EMSPs and CPOs

Figure 1: Imagery from brand commercial of Greenchoice

1. INTRODUCTION

The goal of this project is to *"develop the vision on mobility for Greenchoice in the year 2030"*.

This chapter introduces Greenchoice and the scope of the project. The problem definition is elaborated, and it will explain which approach is used. Finally, the project context is presented.

Imagery from brand commercial of Greenchoice

1.1 COMPANY INTRODUCTION

Before the year 2001 the energy market in the Netherlands was state controlled, where the grid operators were also the consumer energy supply company. The country was divided in regions, which was controlled by one of the three state companies: Nuon, Eneco and Essent. In 2001, the electricity market was liberalized to create a free market. In this way, companies would compete over costumers and eventually develop lower prices for consumers (ThemeGrill, 2019).

The company that hosts this assignment is the green energy supplier Greenchoice, which was started directly after the liberalization by the 3 founders in the heart of Rotterdam, see Figure 2. Greenchoice immediately focused on supplying green energy to consumers, being unique in the market at the time.

Between the years of 2001 and 2004, only the electricity market was liberalized. From 2004 onwards, the gas market was liberalized as well and Greenchoice entered this market. Even though gas is a fossil fuel, Greenchoice produced forest compensated gas. For each cubic meter of gas consumed, Greenchoice compensates with forest projects, with which they protected, conserved and planted forests all around the world.

Throughout the years, Greenchoice always supplied green electricity and forest compensated gas, combining this with a focus on customer service. This made Greenchoice rapidly grow to be the largest sustainable energy supplier. Currently with over more than 600.000 consumer customers and 80.000 business customers, Greenchoice is the 4th biggest energy supplier in the Netherlands, right after the suppliers which were already in the market before the liberalization. The scope of Greenchoice is serving the Dutch market.

Figure 2: The Greenchoice office in Rotterdam

1.2 PROJECT SCOPE

After more than 20 years as an energy supplier focused on sustainability, relying on the sales of gas and electricity, Greenchoice has started a strategic recalibration. The energy market has shown a declining trend on the sales of gas, due to sustainability guidelines by the Dutch and European Union (EU) governmental bodies. Moreover, sustainability is becoming more mainstream and less of a unique selling point.

New strategy of Greenchoice
In order to stay relevant and viable in the market, Greenchoice has created a new strategy to diversify in revenue streams. The new strategy focusses on shifting from a regular energy supplier to a platform for climate positivity, in which customers find their next steps in sustainability. By combining data and customer input, Greenchoice wants to offer the next best steps for more sustainable living suitable for each individual customer, to make sustainability accessible for everyone, and providing integrated energy solutions, all to diversify the product portfolio.

Figure 3: Visual representation of the strategic shift. Instead of just an energy contract, providing energy solutions to customers.

New products
Greenchoice is shifting in business model and diverging their product portfolio. One of the new product categories is Electric Mobility, besides Heating, Generation and EMS systems, as seen in Figure 3. The goal of these product categories is to create integrated propositions, which connect the product in a smart way with the household energy consumption. Mobility is an important pilar for this strategy, since an EV has a big impact on the electricity bill, but a lot of electricity for EVs is used outside the door.

Current Mobility products
Currently Greenchoice Electric Mobility serves customers with basic solutions for electric mobility, such as charging passes for public charging, home charging stations and backoffice software for business compensation of electricity use at home. With these separate products, Greenchoice has laid the foundation to be able to create integrated mobility energy solutions.

Scope
By combining the EV products, together with the supply of energy, interesting propositions could be made, and a competitive advantage should be gained over the competition.

Greenchoice is looking for a long-term direction for energy integrated mobility products, to expand the platform and make sustainability accessible to provide the next step in sustainability for everyone.

The goal of this project is: *"to develop the vision on mobility for Greenchoice in the year 2030".*

1.3 PROBLEM DEFINITION

On a daily basis, customers are confronted with a high intransparency in prices while charging, making charging publicly a gamble. Also legislation is constantly changing, creating uncertainty in costs, making it hard for customers to go over the threshold of buying an EV. The EV drivers right now mostly are business drivers, with a home charging station, which is connected to their household, creating a big impact on their electricity bill. To make EV driving more accessible, Greenchoice is focussing on the consumer EV driver. Their needs are underserved in the market.

For Greenchoice to provide the right solutions to these customers, Greenchoice needs an energy integrated solution combining public charging, home charging and the electricity bill.

The goal of this project is to *"develop the vision on mobility for Greenchoice in the year 2030"*. The aim of this project is to provide a product vision and to guide the development towards energy integrated products.

Within Greenchoice, customers are provided with the basics, but the EV products are separated. Combining these products in a new proposition would create a competitive advantage for Greenchoice. By testing the new ideas in an early stage along consumer needs, the risk in long term development would be mitigated.

Challenges
A challenge within developing for the mobility market is combining techniques. Currently the standards for charging an EV are executed by tying up multiple systems together, to facilitate one simple charging session (What Is Electric Vehicle Supply Equipment (EVSE)? | Driivz, 2024).

The complexity in the current system creates an interesting challenge to be able to eventually create a feasible new concept.

Besides technical challenges, the EV landscape is in constant change. The European Union is catching up and creating guidelines for the different stakeholders. The Alternative Fuels Infrastructure Regulation (AFIR; Van Hulst, z.d.), has been created to provide better infrastructure to EV drivers. This makes the charging pass redundant as payments are mandating directly on the charging points. This challenges the role of the EMSP.

The electrification of the cars on the road creates a challenge for the energy grid. Currently there is a lot of grid congestion, which is solved by imbalance markets (Balanceringsenergie: FCR, AFRR en Noodvermogen, z.d.). To trade on these markets is expensive and these costs are charged on to consumers. Having manageable energy assets, such as EVs, provides an interesting solution for energy suppliers. In this way, energy portfolio purchase costs can be saved, which makes electricity cheaper for consumers again.

Internally, Greenchoice currently does not work with a structure of creating a product vision and formulating a roadmap. In their strategic shift from a regular energy supplier to a platform for sustainable products, their product development methods should evolve as well. There is a huge opportunity to implement a more academic and structured way of working for product development, to shift from incidental innovation towards structured innovation.
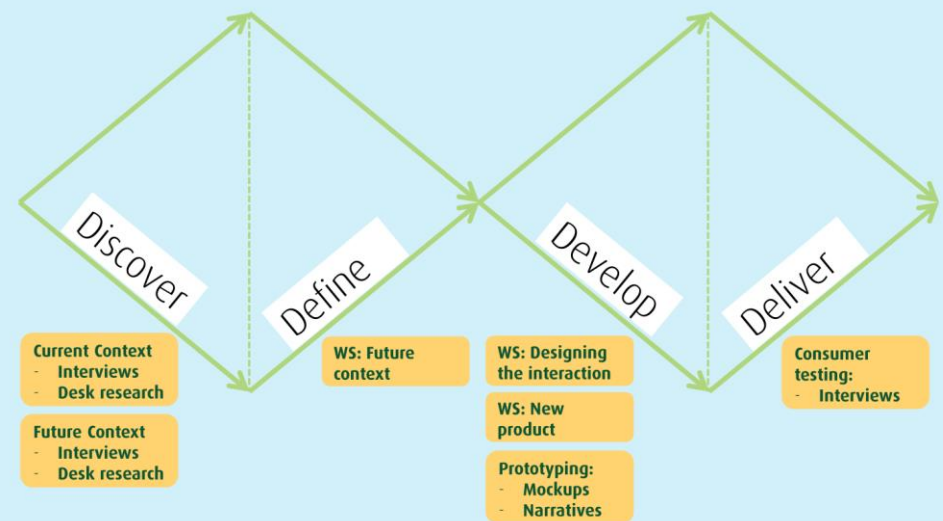
1.4 DESIGN PROCESS

The guideline for the total design process in this project is the famous Double Diamond method by Design Council, z.d. The Double Diamond method divides the project in four parts: Discover, Define, Develop and Deliver, as seen in Figure 4. This method is chosen to make sure that the project keeps structure, within the complex context of the mobility and energy market and to focus on the end user. To fill in the Double Diamond and guide through the steps, the Vision in Product Design method, by Hekkert & Van Dijk (2011), is used as well, to produce radical innovations.

The Vision in Product Design methods supports in creating a future vision for the chosen domain and developing an interaction and consequently fitting product for radical innovation.

Certain steps from the Vision in Product Design method are chosen, to execute with a delegation from Greenchoice in the form of a workshop.

These workshops are a way to go through the steps of the VIP method and create concepts with internal support.

In the end, Greenchoice is looking for a radical innovation which is suitable for the future context and focuses on the concerns of the users. By developing a radical innovation, Greenchoice is looking to disturb the current mobility market that is focused on the business driver and make it more accessible for consumer drivers.

Current Context
- Interviews
- Desk research

Future Context
- Interviews
- Desk research

Discover

Define

WS: Future context

Develop

Deliver

WS: Designing the interaction

WS: New product

Prototyping:
- Mockups
- Narratives

Consumer testing:
- Interviews

Figure 4: Double diamond project approach for the project

1.5 PROJECT CONTEXT

This project is executed within the Product and Pricing team of the Consumer branch of Greenchoice, see Figure 5. This is the team driving product development, responsible for bringing specific market and tech knowledge of the new products. The team is new within the company and responsible for introducing new products, by creating strategic partnerships in the market and combining the services into a Greenchoice product.

Situated in Rotterdam, this team consists of six members, four product developers, a pricing analyst and pricing manager. Within the Consumer branch, this team is responsible for the technical development. The team is crucial to execute the new strategy of Greenchoice by combining company knowledge with product specific technical knowledge and market knowledge.

Each product developer has their own specialism, being divided over the strategic pillars of Greenchoice: Mobility, Heating, Generation and EMS.

Although the team has a great combination of research and development skills and market & product knowledge to develop new products, the methodology and standardization is missing in their work structure. This results in an openness to experience a a more academic and scientific approach to product development. By doing this project closely with a few members of this team, we can co-create a future vision, a new product interaction and finally a new product to test, while the other team members are closely watching the progress. Hopefully, the team members will get inspired and implement the techniques and methodologies in their daily work.

Figure 5: The product & pricing team of the Consumer domain within Greenchoice during a team activity

2. DISCOVER

2.1 METHOD
2.2 CURRENT CONTEXT
2.3 CONCLUSION

The goal of this project is to *"develop the vision on mobility for Greenchoice in the year 2030"*.

To develop this vision, it is important to identify the starting point to see where the trends and developments in the sector go towards. Research was completed to investigate the current state of mobility sector in the Netherlands and the role of Greenchoice within this sector. The current state of the market and the role of Greenchoice are crucial for developing fitting solutions in the future context. To create insights in these situations, interviews were held with consumers to find the current state of mobility overall. Interviews with employees were held, to develop insights in the situation of Greenchoice in the market. To guide these employee interviews, the 4C method was used.

Imagery from brand commercial of Greenchoice

2.1 METHOD

In this section, the methods and approaches for creating the current context and future context are explained. Interviews with mobility users and Greenchoice employees were held in combination with desk research, all within the current context . For the future context, interviews and desk research were executed as well.

The exact approach will be explained in this chapter.

Approach current context

Research question

The overall question to answer for the current context is: *"What is the current state of the mobility market and what part does Greenchoice play in this? "*

To create insight in this question, qualitative interviews were held with different stakeholders in combination with desk research.

Electric vehicle driver interviews

Interviews with users of EVs were conducted to gain insight into the current state of the electric mobility market.

Sourcing
EV drivers were approached on the street around the office in Rotterdam and were interviewed using a set questions. The respondents included people driving EVs for work and private users of EVs This group was then divided into people having a home charging station and drivers who don't have a home charger. Although the project is scoped towards consumers, business drivers were interviewed to have a comparison between the experience of business and of consumer EV drivers.

Setup
Eight drivers were divided into four equal groups by these criteria, of each group two drivers were interviewed along the Blue Ocean method by Van Liemt en Van Liemt (2011). The Blue Ocean Method lets participants think about what needs to be eliminated, removed, improved and created within the market. This is an alteration on the Value Proposition Canvas' pains, pain relievers, gains and gain creators, but without the specific products & Services and jobs to be done. The interviews are logged in a form in which the questionnaire was put, see Appendix 8.1.

Employee interviews

Greenchoice employees were interviewed to gather an understanding of the role of Greenchoice in the mobility market. Three employees were approached who had worked on mobility within Greenchoice. To guide the interviews, the 4C method was used, to gather an understanding in Consumer, Context, Company and Competition. To analyze the company regarding the mobility market, a Resource based view and Sustainable competitive advantage analysis was done, (Clulow et al., 2003). This analysis looks at the company from five different perspectives: Imitability, Durability, Appropriability, Substitutability and Competitive Superiority.

Desk research

To supplement and confirm the insights from the interviews, desk research was conducted. Sources from other companies' research were included, such as Shell and Vereniging Elektrische Rijders. Besides that, search terms such as "EV charging", "public charging" and "trends in EV charging" were used to find interesting sources. Sources looking into the Dutch EV market were given preference, since electric mobility is different in the Netherlands compared to the other countries such as the United States or Scandinavia.

2.2 CURRENT CONTEXT

The overall question to answer for the current context is: *"What is the current state of the mobility market and what part does Greenchoice play in this?"*

This chapter discusses the insights created by the methods provided in the chapter 2.1. The data created by the interviews and desk research was structured in the 4C method, which zooms in on: Consumer, Context, Company and Competition. This structure is used to share insights in the different perspectives on the current market situation and the role of Greenchoice in the current market.

2.2.1 Context

2.2.2 Company

2.2.3 Competition

2.2.4 Consumer

2.2.1 CONTEXT

Start of electric driving

The EV market started around the 2000's as a reaction on the global warming crisis, where automotive developers started using electric motors to support gas powered cars for lower fuel mileage. In 2010, Nissan produced the first publicly available battery electric vehicle (BEV), with the Nissan Leaf (Nissan Motor Corporation Global Website, z.d.). This car needed to be charged with electricity, but for this there needed to be infrastructure. Working together with governments and power companies, Nissan developed the CHAdeMO1 chargers. With the combination of a CHAdeMO1 charger and a Nissan leaf, bi-directional charging was already possible, where the car would be able to supply the residence. Shortly after the Nissan Leaf, Tesla launched their EV in the United States in 2011, where Tesla built the infrastructure of fast chargers themselves.

It was not sustainable for car manufacturers to develop cars and charging infrastructure, so separate companies started to develop their own charging infrastructure. To be able to use each other's infrastructure, meaning that every car could charge everywhere, standard protocols needed to be written. In this way, the car could communicate with the charger to ensure safe charging.

Electric vehicles in the Netherlands

In the Netherlands, the government supported electric driving, by giving tax benefits for leasing EV. EV driving in the Netherlands started with businesspeople leasing EVs, because of this the infrastructure developed around businesspeople. Similar to internal combustion engine cars, where drivers get a company tank pass, the company needed to pay for the charged electricity as well. This was the start of the infrastructure, which is still used today. For an electric car to charge using public infrastructure, the infrastructure consists of the following parties:

- Charge point energy supplier; responsible for the electricity supply to the charge point.

- Charge point operator (CPO); responsible for the functioning of the charge point and creation of the charging session. CPO communicates the charging session through the Open Charge Point Protocol (OCPP) towards the electric mobility service provider (EMSP).

- EMSP; responsible for receiving the charging session and billing the end user.

- EV; which is connected to the charge point through a physical cable, to start a charging session.

All public charging infrastructure is provided by a CPO party and accessible through an EMSP party. For home charging, the owner can choose to connect the charge point to a CPO, so the charge session can be billed to, for example, a company.

2.2.2 COMPANY

When Greenchoice started with building their entrance into the EV market, they were advised by a consultancy firm to focus on the consumer market for EV products. The conclusion was to implement EV products, due to their potential impact on the grid.

Strategy

To be able to offer a climate positivity platform to all customers, Greenchoice is executing a partner strategy behind the screens. The Partner Strategy involves partnering up with expert companies in the sector to offer their services whitelabel by Greenchoice. In this way, Greenchoice owns the data and can connect the whitelabel data to the energy platform, being able to create integrated solutions to its customers.

Imitability

At present, Greenchoice is easy to imitate. Other energy suppliers can partner up with the whitelabel partners Greenchoice already has selected. The business setup of Greenchoice is, at this very moment, still centralized around energy contracts. Other products are not connected or integrated with the energy administration. These connections between other energy related products and energy supply administration would be hard to imitate.

Durability

The durability of the mobility unit within Greenchoice is ensured by the partner strategy, where Greenchoice works with whitelabel partners to offer solutions to its customers. In this way, Greenchoice ensures flexibility and continuity in their product offering towards customers.

Appropriability

Regarding the appropriability of mobility within Greenchoice, it is shown from experience that the business model shift from an energy supplier towards product platform is hard to implement within the different facets of the company. Greenchoice is more focused on being an energy supplier, than trying to implement the new products. For the integrated products to work, Greenchoice needs to focus on building a strong IT department to be able to build the connections necessary for the integrated products.

Substitutability

The current product offering of mobility from Greenchoice is still based on whitelabel platforms, which are not connected nor integrated into a broader solution. One of the consequences of these platforms, is that the current product range is easily copied by competitors. Moreover, these platforms are too similar to other platforms for customers. This makes market entrances and substitutability a big risk for Greenchoice's position in the EV market. On top of that, having a product of Greenchoice doesn't ensure advantage for customers to acquire more products and services of Greenchoice.

Competitive superiority

Greenchoice is an energy supplier in the Netherlands but fails to connect this to the other products in the company. For years, the unique selling point of Greenchoice was its excellent customer service, but this has been lacking the previous years. In new markets, such as mobility, customers are looking for advice and customer service, but Greenchoice currently fails to provide this. To create competitive superiority, Greenchoice needs to have more in-house development to connect the different sub platforms.

2.2.3 COMPETITION

The competition for Greenchoice regarding the mobility market is divided into multiple sections. Figure 6 shows the competitive landscape for Greenchoice in the mobility market. The landscape is constructed into circles, where two circles are identified.

Outside the circle: Companies who offer separated products, such as a charging station or charging pass.

Inside the circle: Companies who offer integrated services, such as smart charging, which combines energy contracts with EV hardware.

In the circles axis are made, to divide the companies into sectors where they are active. On the horizontal axis is the target market the company focusses, either the market for energy at home, or the market for energy on the road.

The vertical axis regards the focus group of the company, either consumer- or business drivers.

From the figure, we can see that there is a clear distinction between companies who focus on home energy or on the road energy. Bridging the two markets is the focus of Greenchoice, because of the potential electricity flexibility and usage EVs bring. Frank energy is the first energy supplier who offers smart integrated products for EV drivers, but only focuses on home. Greenchoice wants to offer smart integrated products, for consumers to use at home and on the road.

The difference between brands on the ends of the axis, seems to be between the old and new energy suppliers. Old energy suppliers most often have self-built systems, which are hard to adapt for integrated products. The new energy suppliers are building more flexible systems but lack the experience and portfolio in the energy markets.
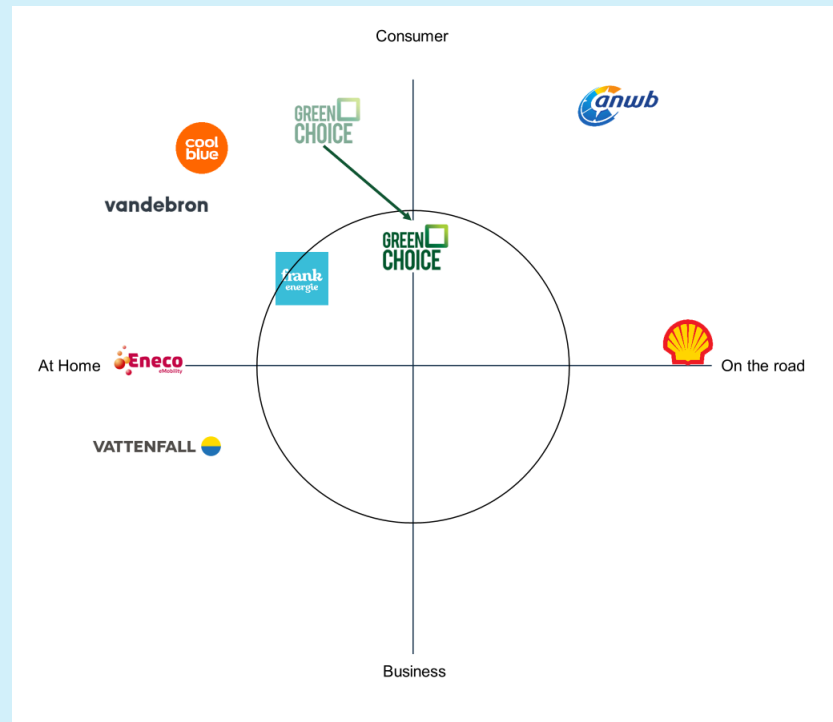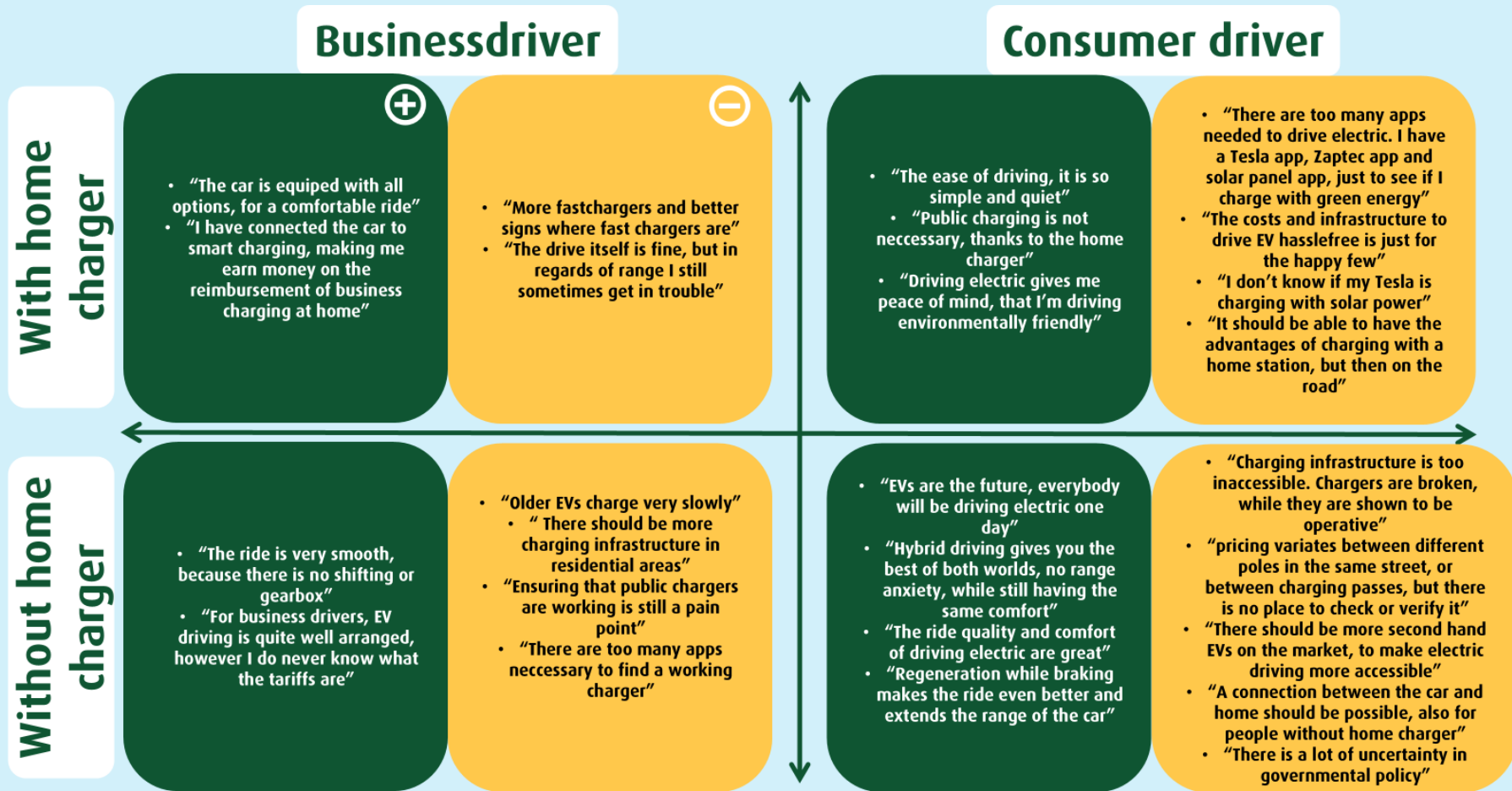

Figure 6: Competition grid for the mobility market in the Netherlands

2.2.4 CONSUMER

The current users of EV in the market are perceived as early adopters, since it is becoming more standard to drive EV for consumers. To get a feeling of what the current sentiment regarding driving electrically is, EV drivers were interviewed and asked about their opinion of EVs. Eight users were interviewed (Appendix 8.1); four business drivers of which half had a home charger and half not and four consumer drivers of which half had a home charger. The quotes displayed in the figure below are the most notable quotes from the interviews and show the amount of positive or negative points for the specific target group.

Businessdriver

With home charger

+
- "The car is equiped with all options, for a comfortable ride"
- "I have connected the car to smart charging, making me earn money on the reimbursement of business charging at home"

−
- "More fastchargers and better signs where fast chargers are"
- "The drive itself is fine, but in regards of range I still sometimes get in trouble"

Without home charger

- "The ride is very smooth, because there is no shifting or gearbox"
- "For business drivers, EV driving is quite well arranged, however I do never know what the tariffs are"

- "Older EVs charge very slowly"
- " There should be more charging infrastructure in residential areas"
- "Ensuring that public chargers are working is still a pain point"
- "There are too many apps neccessary to find a working charger"

Consumer driver

With home charger

- "The ease of driving, it is so simple and quiet"
- "Public charging is not neccessary, thanks to the home charger"
- "Driving electric gives me peace of mind, that I'm driving environmentally friendly"

- "There are too many apps needed to drive electric. I have a Tesla app, Zaptec app and solar panel app, just to see if I charge with green energy"
- "The costs and infrastructure to drive EV hasslefree is just for the happy few"
- "I don't know if my Tesla is charging with solar power"
- "It should be able to have the advantages of charging with a home station, but then on the road"

Without home charger

- "EVs are the future, everybody will be driving electric one day"
- "Hybrid driving gives you the best of both worlds, no range anxiety, while still having the same comfort"
- "The ride quality and comfort of driving electric are great"
- "Regeneration while braking makes the ride even better and extends the range of the car"

- "Charging infrastructure is too inaccessible. Chargers are broken, while they are shown to be operative"
- "pricing variates between different poles in the same street, or between charging passes, but there is no place to check or verify it"
- "There should be more second hand EVs on the market, to make electric driving more accessible"
- "A connection between the car and home should be possible, also for people without home charger"
- "There is a lot of uncertainty in governmental policy"

2.3 CONCLUSION

To sum up the insights from the current context research, we look back at the initial question:

"What is the current state of the mobility market and what part does Greenchoice play in this?"

Using the 4C method, looking into the Context, Company, Competition and Consumer, a broad view into the current context is generated.

Current state of mobility

From the context, the main learning point is the remaining complexity and division of systems within the EV charging chain. This also gives insight in the complaint from the consumer interviews, where consumers signaled the impenetrableness in tariffs for charging publicly.

We also gain the insight from the context that the EV driving solutions started as solutions aimed towards business drivers, the consequences of this are noticeable in all facets of the EV charging market.

Overall, we can conclude that the mobility market still is too much focused on creating solutions for business drivers, since they generate the most profit currently. Consumers are not well supported and their needs for price transparency and ease of use are not met.

Greenchoice's role in the market

By looking into the company and interviewing employees, we can see that Greenchoice has collected partners to have a stake in the EV charging chain, but still has not managed to connect the services.

Within the mobility market, all competitors struggle. Either with their own IT legacy when trying to add services while being an energy supplier, or being a smaller tech focused company without enough leverage on the energy markets.

For Greenchoice, the focus on consumer EV drivers is logical in regards of the company strategy and underserved needs in the market. Greenchoice wants to supply customers an integrated mobility proposition, to serve the needs of consumers. In the current state, however, Greenchoice is not able to supply customers with this proposition, due to legacy in self-built IT systems.

The current role of Greenchoice in the mobility market is providing basic propositions to its energy supply customers with whitelabel partners. Behind the screens Greenchoice is building towards a platform for integrated mobility solutions.

3. DEFINE

3.1 METHOD

3.2 FUTURE CONTEXT

3.3 ATTITUDES IN THE FUTURE

3.4 DESIGN DIRECTION

3.5 CONCLUSION

From the Discover phase, the project goes on to the Define phase in which a design direction through all of the found information is created. The starting point for the Define phase are all the different context factors created from the different interviews and desk research in the Discover phase. The endpoint for the Define phase is a design direction, which will be in the form of a future vision statement. This future vision statement will function as the start of the Develop phase.

To get from the different context factors to the future vision statement, steps three and four of The Vision in Product Design method by Hekkert & van Dijk (2011) are followed.

Image from Greenchoice brandkit

3.1 METHOD

This chapter describes the set up and execution of the workshop. In total, three workshops were held in a group of five participants and a facilitator (Figure 7). The participants were a broad selection of Greenchoice employees, affiliated with mobility. The group consisted of two product developers, a proposition manager, customer service representative and a fulfilment expert. These participants were selected due to their different perspectives on EV drivers and different levels and angles towards the mobility market The product developers have a more technical view at the market, while the proposition manager is focused on marketing the right fit of a product to customers. The customer service representative and fulfilment expert have customer contact on a daily base and hear the concerns and opinions from customers the most. The workshops were held live in the office with printed paper material.

The goal for the Future Context workshop is to introduce the participants to the VIP method and get them familiar with the used factors for the workshops. A result of the workshop is having the factors clustered and divided into axis on a grid with different concerns of the created future. Next, a concern grid will be chosen based on the strategic fit of Greenchoice. For this quadrant, a future vision statement will be created, how Greenchoice wants to service the needs of this quadrant.

Research question

The research question for the first workshop focuses on the Future context and was formulated as followed: *"What does the Mobility sector look like in the year 2030?"*

Workshop

At the start of the workshop, the participants were shown the factors as provided in Appendix 8.2. The participants received the assignment to read through the factors and cluster them based on a higher meaning, either as a common-quality cluster or emergent-quality cluster (Hekkert & van Dijk, 2011). These clusters were used as input for the next step: creating a concern grid. This grid is based on creating axes, by creating opposites in meaning of the clusters. The axes are given a scale and meaning, creating quadrants which divide the concerns in the chosen sector. One of the quadrants, *perspective,* is chosen to focus on to add value to a group of users. To finalize the future vision workshop, the participants have brainstormed to come to a concluding design direction in the form of a future vision statement.

Figure 7: Future vision workshop

2.1.2 Approach future context

Research question

To execute the project goal of: *"Developing the vision on mobility for Greenchoice in the year 2030"* , it is necessary to form the future context in which this vision will take place. The Discover phase is concluded with all the different factors, in order to start the future context workshop.

EV driver interviews

The people interviewed for the current context, were also asked to look ahead and try and think of trends they see in the market. The Blue Ocean method used for the current context, also functions for the future context.

DEPEST

To get a sense of the different trends influencing the market, to see how mobility will evolve, DEPEST is used. DEPEST stands for Demographic, Economic, Political, Ecological, Social and Technological. By using DEPEST, a broad view into the trends is created.

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Vision in Product Design method

The Vision in Product Design method, by Hekkert & van Dijk (2011), is used to guide the process of creating concepts for the vision on mobility for Greenchoice. This method uses factors to deconstruct ,and eventually construct, the future context in which the product finds its place with users. These factors are either trends, developments, states and or principles. The factors collected for this project were found based on the previous interviews, desk research and the DEPEST method, to create a broad set of factors. These factors are used for workshop 1, Future Context.

3.2 FUTURE CONTEXT

To determine the future context, a workshop was executed to give form and meaning. As a start for the future vision workshop, a DEPEST trend analysis and interviews were done to create context factors for the VIP method workshops. Each factor consists of a title, an explanatory text, figure to support the text, reference and theme. See the following example (Figure 8). The factors were chosen together with a product developer as a starting point for the workshops. Prior to the workshops, the factors were sent to the participants of the workshop for preparation. All context factors are provided in Appendix 8.2.
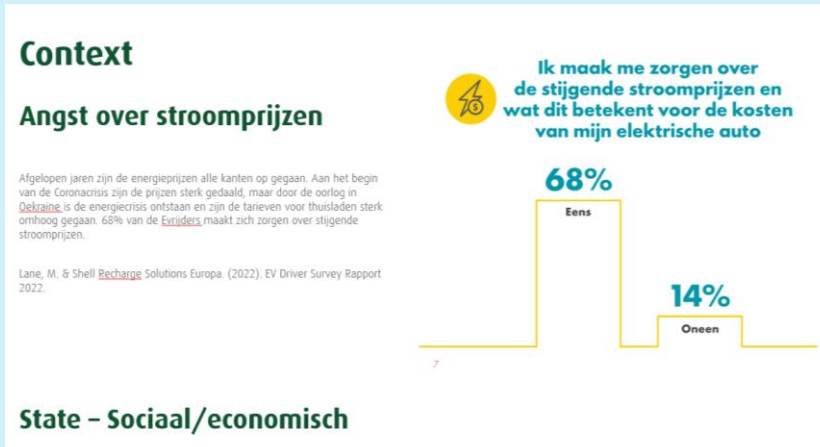
Figure 8: Example of a context factor

At the start of the workshop, the group was provided with all the context factors and were asked to sort them into clusters based on underlying meaning, either being a common-quality cluster or emergent-quality cluster.

In total, the participants created the following 7 clusters. Together, these clusters form the future context for the mobility market.

1. **Future problems of infrastructure**

2. **Aiming for a better future**

3. **Dissatisfiers during usage**

4. **Barriers before acquiring**

5. **Majority of electric charging**

6. **Advantages for innovators**

7. **Future enablers**

Each of these clusters has a cluster meaning, based on the collection of factors it consists of.

On the next pages, each cluster of the future context is elaborated.

① FUTURE PROBLEMS OF INFRASTRUCTURE

In the future, more and more people drive electric, have solar panels and are connected to the grid. In this way, the capacity of the grid will be too narrow to service all electric needs (Ministerie van Algemene Zaken, 2024). Grid congestion will be a growing problem, when more and more people are charging electric cars. In order to combat grid congestion through charging, delayed charging to direct power usage after peak hours will be standard for EV charging, (Lane, M. & Shell Recharge Solutions Europa, 2022). EVs will be more accessible, also for people without a home charger. To be able for the whole Dutch fleet to charge, more and more charging solutions will be available where smart technology will push people to maximize the use of the grid.

Technology will connect different devices and assets of the regular consumer to direct usage into the appropriate hours, so the grid is not congested constantly. Consumers will notice little to nothing of the technological interference, because the focus will be on the bigger power usages in the residences, such as solar panels, home batteries, heating pumps and EV chargers.

Figure 9: Image generated by Chatgpt, to illustrate the core meaning of the cluster

② AIMING FOR A BETTER FUTURE

In the future, the EU needs to be climate neutral. The fleet of cars plays a big part in becoming climate neutral. The final years of buying an ICE car are arriving, where in 2035 consumers will not be able anymore to buy an ICE car (EU-verbod op de Verkoop van Nieuwe Benzine- en Dieselauto's Vanaf 2030 Uitgelegd | Onderwerpen | Europees Parlement, z.d.). This political mandate will make the aquisition of EVs more regular. In 2030, the majority of sold cars will be an EV. The standard knowledge of driving electric has evolved throughout the regular consumer and buying an EV is becoming more common (Terwindt, M. et al., 2023).

Politically, there is a lot of pressure to make the shift towards climate neutrality work. Municipalities of big cities are preparing to prevent cars into city centers and are currently restricting ICE car access to city centers, (Ministerie van Infrastructuur en Waterstaat, 2023). This will push consumers into taking EVs for granted in the selection of a new car.

These EVs all need batteries, of which most used materials need to be mined. This mining will be more on the forefront in the production of new EVs, to create a more sustainable end-to-end product (Milieu & Milieu, 2023).

Figure 10: Image generated by Chatgpt, to illustrate the core meaning of the cluster

③ THE PAST OF DISSATISFIERS

When owning an EV in the future, public charging is made more transparent and people will know exactly what tariffs and charging times are used (Donat, 2022). All public charging apps will be standardized in the amount of information the different parties have to provide in the app, so users will not have to download multiple apps to find a suitable charging station (Lane, M. & Shell Recharge Solutions Europa, 2022).

For home charging, EVs will be responsible for more usage on the electricity bill, on average 1500kWh will be added. This is similar to an average 2-person household without an EV. People will have certainty in adding this extra usage to their electricity bill, by accepting flexible charging. In this way, their energy supplier can direct the usage towards hours everybody is available to profit from it, in order to prevent grid congestion and maximize usage of green energy.

Figure 11: Image generated by Chatgpt, to illustrate the core meaning of the cluster

④ BARRIERS BEFORE BUYING

Towards 2030, a lot of consumers will make the switch from driving an ICE car towards an EV. The car itself will still have four wheels and a steering wheel, however driving and maintaining an EV is different than an ICE car. More and more dealerships will transition into EV ambassadors for regular consumers. The current complexity in driving an EV will disappear through the better advice of salespeople (Vereniging Elektrische Rijders, 2022), and more accessible apps.

The expectancy of driving an EV needs to be made clearer, to inform people what they can expect from their EV range, charging speeds and availabilities, to be able to prevent bad public stigma.

Figure 12: Image generated by Chatgpt, to illustrate the core meaning of the cluster

⑤ MAJORITY OF ELECTRIC DRIVING

As of 2024, the average EV driver is a male business driver, with the age of 52, (Wolterman, B. et al. 2023). Towards 2030, EV driving has developed further into the innovation acceptance curve and will have shifted from early adaptors, (Lane, M. & Shell Recharge Solutions Europa, 2022), towards early majority, which will create a broader audience for EV driving.

New cars are often introduced through leasing contracts for business drivers. Because the EV adoption is further in business leasing already, a lot of used EVs will come available as affordable options on the second-hand consumer market, making EVs more accessible for the regular consumer, (Terwindt, M. et al., 2023).

Applications and services need to adapt to these new EV drivers, which will be younger of age and have more consumer needs, such as transparency in pricing and availabilities.

Figure 13: Image generated by Chatgpt, to illustrate the core meaning of the cluster

⑥ ADVANTAGES FOR EV DRIVERS

When buying an ICE car, people are used to looking into the mileage and fuel consumption of the car to determine how much it will cost to run the car. When buying an EV, this calculation will change. People will look more into the functions and features of the car, such as the possibility of bi-directional charging. Bi-directional charging will create the possibility for people to use their EV as a home battery, to optimize their home energy system, (Team & Team, 2021).

In the current situation, smart connections to optimize the use of your EV with your energy household, is just for the innovators, however towards 2030, smart connections will become more mainstream and around 2030 even standard, (Wolterman, et al. 2023). This will create the possibility for people to earn money with their EV if they use it in the right way, to support the electricity grid, making money though different electricity markets, such as EPEX and imbalance, (Laadkompas, z.d.).

Figure 14: Image generated by Chatgpt, to illustrate the core meaning of the cluster

⑦ DIGITAL DRIVERS

The development in EV driving is not only focused on the cars, but the whole infrastructure is constantly developing. With the Alternative Fuel Infrastructure Regulation (AFIR) by the EU, EMSPs and CPOs are obligated to create more price transparency and CPOs need to allow direct payment at their charging points, making EMSPs redundant in the current situation. EMSPs will develop into creating a position for themselves, to offer consumers more than just charging at the charging stations. Fundamental for this is technological development in charging protocols between the different facets in infrastructure, such as the new OCPP 2.0.1 protocol, which will be widely available in 2030, (Open Charge Alliance, 2023). New protocols will unlock digital features for consumers to create a better user experience for EV driving, such as plug & charge, where the car will identify itself towards the charging station, to start charging, (Van de Wetering, z.d.).

Figure 15: Image generated by Chatgpt, to illustrate the core meaning of the cluster

3.3 ATTITUDES IN THE FUTURE

The clusters gathered in the workshops describe different facets of the future context, together they form the context in which consumers will move. The clusters have underlying opposing meanings, creating axis, which define the possible concerns of different consumers groups in the future context. The clusters are divided over axis in a grid, which are identified by the numbers within the grid, see Figure 16. The opposition in clusters give meaning to the axis, which is the following:

Intended use: This axis describes the intended use of the EV driver for the car. On the one hand we have the people who use the car exclusively for the function of driving, like a regular ICE car. On the other hand, we have the people who use the EV as an extension of their energy household and connect it to their house to be more sustainable.

Practicality: This axis describes going from looking for an intuitive user experience, towards focusing on the technical side of the products that is going on. People on the end of intuitive, expect a better experience and need assurance that the products or services they acquire are up to standard. People on the end of technical are constantly looking for new products and try to create new tech combinations.

These axis together divide the future into four main attitudes on the grid, The DIYer, The exotic driver, The Carefree driver and the Seamless integrator. Each attitude will be elaborated on.
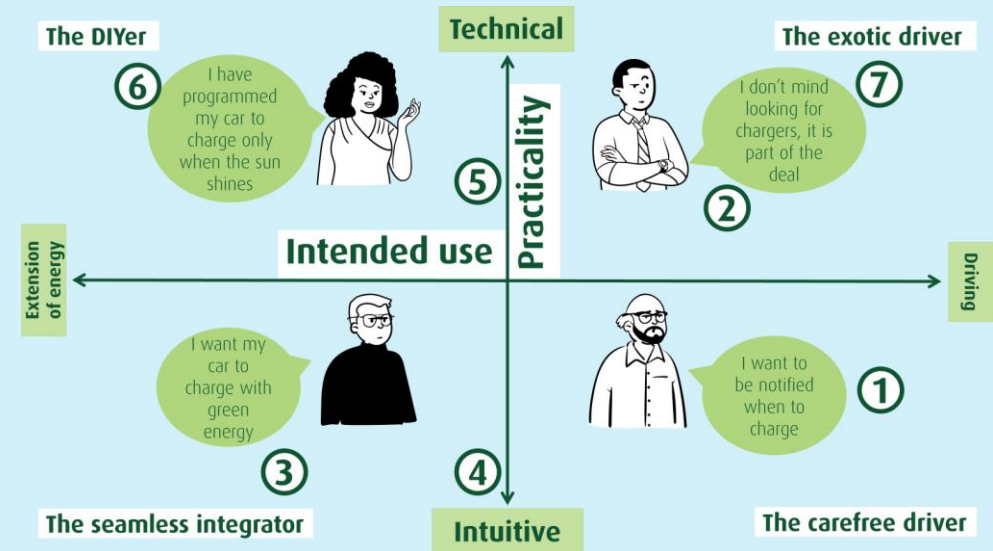
Figure 16: Attitude grid based on the opposing meaning in clusters

1. FUTURE PROBLEMS OF INFRASTRUCTURE	5. MAJORITY OF ELECTRIC DRIVING
2. AIMING FOR A BETTER FUTURE	6. ADVANTAGES FOR EV DRIVERS
3. THE PAST OF DISSATISFIERS	7. DIGITAL DRIVERS
4. BARRIERS BEFORE BUYING	

THE DIYER

THE EXOTIC DRIVER

People described in the first quadrant are taking matters into their own hands and create connections, so their EV is an extension of their energy household. These are the people who are more technically focused, instead of car focused. They are not choosing the EV based on the range or smoothness of the drive, but on the technical features, such as the used inverter, bi directional charging capabilities and integrations with home energy management systems. Their main concern is keeping their self built systems working and finding out how to make something work.

People described in the second quadrant are buying Evs because of the speed and the smoothness. These are the drivers that are constantly accelerating full throttle at every traffic light. Their main concern is being the quickest and having the newest and most expensive car. They are less interested in the technological features of the car, but more the feeling of driving it.

Figure 17: Image generated by Chatgpt, to illustrate a potential consumer within the quadrant

Figure 18: Image generated by Chatgpt, to illustrate a potential consumer within the quadrant

THE CAREFREE DRIVER

People described in the third quadrant don't want to be hassled with finding chargers or watching the range of their car. They want to step into their car and drive from A to B, they see their car purely as means of transport. When selecting a car, their main concerns are basic functionalities and they make the choice based on reliability and price. When using an EV, they like that the car thinks along with them and the smoothness of operating, but they don't want to experience any hassle in regards of charging.

Figure 19: Image generated by Chatgpt, to illustrate a potential consumer within the quadrant

THE SEAMLESS INTEGRATOR

People described in the second quadrant want to be relieved of all the hassle, but are looking for new technologies. These are the people who are completely into the Apple ecosystems, but for energy. They have bought the all-in-one pack: solar panels, home charger and battery package with complementary home energy management system. They have everything sorted out and working intuitively. When something bugs or is broken, they need someone to fix it for them. Their main concern is finding someone who can help them set everything up and ensures it will work.

Figure 20: Image generated by Chatgpt, to illustrate a potential consumer within the quadrant

ATTITUDE CHOICE

"Designing always involves taking a position"(Hekkert & van Dijk (2011), in order to create a successful product, we need to choose who to design for. The people in the different quadrants will need completely different products to satisfy their concerns. For instance people identifying with the careless driver, just want a simple car to bring them from A to B, whereas the DIYer likes to have a special charger installed, just to be able to bi directionally charge and let the car battery charge the house.

To make a choice in which quadrant to design for, the strategy and values of Greenchoice are used, to check for alignment in the quadrants. The strategy of Greenchoice is to become a platform for climate positivity, to offer customers their personal next best action towards more sustainable living, based on their data. For this Greenchoice has the "for everyone and by everyone" approach, where they want to include everyone who wants to set the next step.

In the road towards a platform for climate positivity, Greenchoice has the most alignment with the Seamless integrator, since these people are wanting to connect their vehicle to their energy household but are looking for services and companies who are able to support their total requests, instead of just supplying a part of the solution, this is what the future of the platform is aimed towards. The seamless integrator has invested into living more sustainable, with solar panels, home battery and an EV, but wants to profit as much as possible from this, without having to program difficult apps.

THE SEAMLESS INTEGRATOR

3.4 DESIGN DIRECTION

The goal of this project is *to develop the vision on mobility for Greenchoice in the year 2030.*

In this project the scope is to integrate the different separate products of Greenchoice into an integrated product. To do this for the seamless integrator who expects a completely integrated energy solution, to connect their car to, we need to take into account that the customer expects a seamless experience between their energy household and charging experience on the road, not only for homeowners with a driveway and home charger.

The problem statement is formulated as:

"For consumer EV drivers, there needs to be a solution to connect their EV to their energy household to prevent infrastructure problems and fulfil their need of connecting their sustainable assets in an intuitive way".

In order to solve the problem statement and acknowledge the concerns of the Greenchoice mobility consumer, a design direction is formulated, to guide the design process. The design direction is the following:

"In 2030, we envision providing our customers with their own sustainable energy always and everywhere in an intuitive way, by being able to use their sustainable energy outside of their homes with their Electric Vehicles."

The highlighted parts in the design direction, give insights in the focus points for further design processes. The highlighted parts mean the following:

Own sustainable energy
Consumers with a green energy contract, or even their own solar generation, want to use this as much as possible, to have certainty in origin and financials. This is linked towards the Past of dissatisfiers cluster.

Always and everywhere
In line with Greenchoice strategy, we want to supply our customers with sustainable solutions always and everywhere.

Intuitive
Customers driving an EV are looking for an intuitive experience not only in driving, but also optimizing charging and connection towards their home, this is linked towards the Barriers before buying cluster.

3.5 CONCLUSION

The goal for the Define part of the project is to make a choice in the gathered context information how the future for the mobility market will look like. Through seven clusters the future context is described and these clusters were used to create an attitude grid, which describe the different mindsets of people in the future context.

The clusters were divided over the grid and created two axis, one describing the intended use of the EV driver for the EV and the other axis described the practicality of the user.

From the attitude grid, the Seamless integrator is selected as focus, because of the alignment with the Greenchoice strategy.

To create a fitting product in the future for the selected attitude, a problem statement and design direction is created:

In 2030, we envision providing our customers with their own sustainable energy always and everywhere in an intuitive way, by being able to use their sustainable energy outside of their homes with their Electric Vehicles."

This design direction will be starting point for the Develop stage of the project.

Imagery from brand commercial of Greenchoice

4. DEVELOP

4.1 METHOD

4.2 DESIGNING THE INTERACTION

4.3 NEW PRODUCT CONCEPTS

4.4 CONCLUSION

The Defining phase is concluded with the future vision statement:

"In 2030, we envision providing our customers with their own sustainable energy always and everywhere in an intuitive way, by being able to use their sustainable energy outside of their homes with their Electric Vehicles."

This statement is used as starting point for the Develop phase. In this phase new concepts are developed, by firstly brainstorming an analogy, which fits the statement and company strategy. This analogy is deconstructed into product characteristics, which will be used as inspiration to brainstorm new concepts. To accomplish this, two workshops were held with the group. The first workshop focusses on brainstorming the analogy and dissecting it into characteristics. The second workshop focusses on brainstorming new concepts with the characteristics as input.

Finally, the concepts are formed by using narrative storytelling and creating visuals of the possible app screens it could have.

Image from Greenchoice brand kit

4.1 METHOD

The Develop phase focusses on creating concepts to solve the problem statement. The problem statement sounds as:

"For consumer EV drivers, there needs to be a solution to connect their EV to their energy household to prevent infrastructure problems and fulfil their need of connecting their sustainable assets in an intuitive way".

To create concepts for this problems statement, the VIP method steps five, six and seven are executed through the means of workshops. The process is divided over two workshops in three sessions:

- Workshop 1: Designing the interaction

- Workshop 2: New product concepts

Each workshop is elaborated on later in the project.

Research question

The research question for the development phase sounds as:

"For consumer EV drivers, there needs to be a solution to connect their EV to their energy household to prevent infrastructure problems and fulfil their need of connecting their sustainable assets in an intuitive way".

Workshop

The workshop started and the participants were shown the factors as provided in Appendix 8.2. The participants received the assignment to read through the factors and cluster them based on a higher meaning, either as a common-quality cluster, or emergent-quality cluster (Hekkert & van Dijk, 2011). These clusters are input for the next step: creating a concern grid. This grid is based on creating axis, by creating opposites in meaning of the clusters. The axis are given a scale and meaning, creating quadrants which divide the concerns in the chosen sector. One of the quadrants is chosen to focus on, regarding perspective, to add value to a group of users. To finalize the future vision workshop, the participants have brainstormed to come to a concluding design direction in the form of a future vision statement.

Interviews

The method used for consumer testing is Narrative Storytelling, where potential customers are provided with a product narrative, to receive their input in the early stages of development, Van Den Hende & Schoormans (2012).

The interviews were held with people who drive EV themselves, so they have experience with the current context of driving electric. The interviews were executed in a face-to-face setting, where the interviewee was asked to read through the first narrative and look at the app screens. After that the associated questions were asked. The interview started with the generic question what their experience was with driving electric.

The interviews were held anonymously, and the elaborate results are in Appendix 8.4

4.2 DESIGNING THE INTERACTION

The goal for Designing the interaction, is to come up with an analogy which explains the future vision statement in the form of a relatable product-user interaction. From this analogy, product characteristics can be distilled, which will be input for the last workshop.

Research question

The research question for the second workshop focuses on designing the product-user interaction: *"What product interaction characteristics should be used as design criteria for concept development??"*

Figure 21: Product interaction workshop in progress

Workshop

The workshop started with a recap of the previous workshop, walking through the concern grid buildup and going through the different costumer perspectives (Figure 21). The rationale of the consumer perspective is repeated, and the participants are reminded of the future vision statement. The materials of the previous workshop are used as visual material during the explanation.

The steps from the VIP method, used to guide this workshop, are steps five and six. In the VIP method to come to a set of product characteristics, is to think of an analogy with an interaction which fulfills the preferred interaction in a different context. To get to this analogy, a physical brainstorm is organized with sticky notes, so participants can write down their thoughts of wanted interactions.

To choose the definitive analogy, the participants were asked which analogy fits the created vision statement the best, based on Greenchoice's strategy.

ANALOGY

The workshop started with the brainstorm (Figure 22) for the different analogies, to think of interactions, which fit the vision statement of:

In 2030, we envision providing our customers with their own sustainable energy always and everywhere in an intuitive way, by being able to use their sustainable energy outside of their homes with their Electric Vehicles."

The analogy that was finally chosen was the credit card analogy. This analogy was chosen because of the alignment with the key interaction characteristics from the vision statement.

"Own sustainable energy" translates into "own funds" of a credit card, where people feel it is their money they are using

"Always and everywhere" is directly applicable to a credit card, where people take their credit card along on holiday to provide certainty.

"Intuitive way" is directly applicable as well, because the services around a credit card are intuitive, to make people use the credit cards more.

Figure 22: Product-interaction analogies for the future vision statement

Google, where you have all the knowledge available

A jerrycan, which you fill up with gas as backup

A creditcard, which you take along on holidays

An insurance, so you know you are covered

A cloud, where you can find your files

CHARACTERISTICS

After the analogy is chosen, product characteristics are distilled from it, to define characteristics for the new concepts. Figure 23 shows the results of the of the brainstorm for product characteristics of a credit card.

To be able to go from the brainstorm of the product-interaction characteristics to new product concepts, a choice needs to be made on which characteristics to focus.

A credit card is not necessary to have, since in Europe most of the transactions are done with a debit card. However, most people still have a credit card, for the international accessibility and security it provides. Credit cards also most often provide additional services, to make people use them more.

The final choice in characteristics is made, based on the chosen key points from the vision statement: *"Own sustainable energy"*, *"Always & everywhere"* and *"Intuitive way"*. The chosen characteristic which is used, is **Ensuring, Accessibility and Features.** These are chosen as characteristics for the new concepts, since this suits the mobility market and sustainable energy market the best, where having access is still a main point in everyday use.

Instant insight

Loyalty points per transaction

Possibility to cancel from a distance

Insurance on products

Certainty

Ease of use

Ensured accessibility

Possible extra services

Necessary evil for shop owners

Borrowing credits

Standard provider

Status

All in one solution

Avoiding direct cost
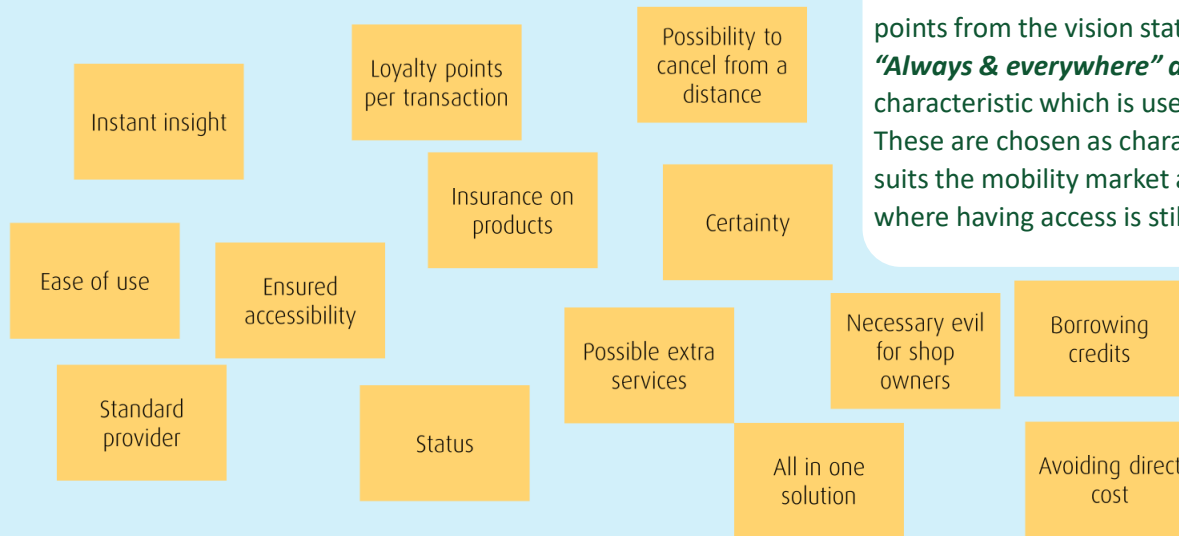
Figure 23: Results of the creditcard product-interaction characteristics

DESIGN CRITERIA

The characteristics that are chosen create criteria for the product concepts to fulfil. The chosen characteristics are: Ensuring, Accessibility and Features. These characteristics are elaborated on, to define what the criteria means for the final concepts.

Criteria 1: Ensuring

From the different interviews and future context clusters, it becomes clear that the use and expectations of charging EVs is not clear and doesn't ensure the users a positive interaction. Even in the future price transparency, availability of chargers and stability of the grid remain problems during the charging experience. During the workshops it became clear that the new concepts should offer the user of a positive experience, by ensuring certainty while charging.

Characteristic 2: Accessibility

In the future EVs are accessible for everyone, because of dropping prices for second hand models. However charging and EV connections towards the energy household still remain in the basic situation for the happy few with a driveway and home charger. The new concepts should be useable for all EV drivers, with and without homechargers.

Characteristic 3: Features

In the future context a regular charging station of charging pass is not enough anymore for a customer, they are looking for integrated propositions, which offer additional features, to leverage the technical capabilities of the products. The new concepts should offer integrated features, combining different seperate EV products into a central proposition.

These design criteria are used as start for the new product concept workshop and will serve as measuring tools, to check the new concepts against.

4.3 NEW PRODUCT CONCEPTS

The final workshop is the new product workshop. The goal for this workshop is to end with concepts, to develop for consumer testing. The concepts from the workshop will be developed further.

Research question

The research question for the final workshop focuses on designing the new concepts for consumer testing: *"What concepts can be developed based on the design criteria?"*

Figure 24: Product interaction workshop in progress

Workshop

This workshop was split into two sessions, to leave room for extra insights. The first session (Figure 24) focused on brainstorming product concepts based on the selected analogy and product characteristics. This session was held live in the office, on paper and sticky notes. Based on the design criteria, the first brainstorm for conceptualization is held. From this brainstorm, 3 concepts were devised. These concepts were used as input for the second session.

The second session started with a recap of the first session. From this they selected the concepts and began filling in the concept templates, which zoomed in on the context of the concept and elaborated on the storyboard of the use of the concept. For this, a template is created, which is filled in during the session with the participants.

Iterations

The concepts have gone through multiple iterations, which can be seen in Appendix 8.3. The first iteration of the concepts consist of explanatory text to explain the concept. The second iteration consists of a filled in template to gain more insights in the concepts. The third iteration of the concepts is the final iteration with which the Develop phase is finished. This iteration consists of concept narratives and app screens, for users to gain more information about the concepts.

CONCEPT 1: HAPPY CHARGING

Explanation of concept

Happy charging makes it possible for users to charge their home solar energy surplus on the road at public chargers. In order to make this work, we need to look at the imbalance energy market in the Netherlands. This market is responsible for keeping the grid at a safe voltage. If there is an unexpected surplus or shortage, a bidding is created, to compensate this. For an energy supplier it is a solutions if within your customer portfolio the customers compensate for each other. If someone generates too much solar energy, someone else needs to consume this, otherwise it will be costly to create the bidding on the imbalance market. Homeowners in the vicinity of the imbalance point will get a notification Aswell to use their home charger for free. With Happy charging users will solve each others imbalance, but this will only work if enough users are on the platform. The platform is a connection between solar panels of the one user, with the charging pass app of the other user. Also charging stations of the homeowners in the vicinity are connected, to be able to use the surplus of the homeowner. The free charge of the EV driver is a one-to-one conversion of energy, but it is not their own green energy at the time of charging.

The name of happy charging comes from happy hours, where price drops are usual.

Ensuring

The happy charging concept ensures people better use of their own solar generation at home, while also ensuring people a charging spot for public charging. These certainties will create a positive experience for people charging.

Accessibility

The concept allows all EV drivers to profit better from their own solar energy, without having to have a physical connection between a charging station and solar panels. Even for people without solar panels, they are able to contribute to balancing the grid, by using up other peoples generated energy.

Features

The platform is a connection between solar panels of the one user, with the charging pass app of the other user. Also charging stations of the homeowners in the vicinity are connected, to be able to use the surplus of the homeowner. The free charge of the EV driver is a one-to-one conversion of energy, but it is not their own green energy at the time of charging. This concept combines all the different facets of the energy market and EV charging into an integrated proposition.

HAPPY CHARGING - NARRATIVE

To get feedback on the initial concepts, a narrative was written, for the consumer to imagine the use of the product. Underneath is the narrative used for happy charging. Figure 25 shows the mockup app screens used, to provide more visual context to the use of the app.

Just imagine…

Yesterday was a beautiful day with plenty of sun. The sun's power has put your solar panels to work, and they have generated a large amount of energy. Since you were not at home at that time to use this energy directly, the energy generated was fed back to the electricity grid. This is normal, but you know that you normally pay money for the energy that you return to the grid, you would rather have consumed this energy yourself.

This morning, during your drive to work, a notification arrives via your Happycharging app. The message reads: "Your battery is almost empty. There is a Happycharging charger available on the corner of Kerkstraat. If you charge here, you can use yesterday's excess energy. Do you want to charge there?". You click on: "Accept charging session" and the charger will be reserved for you. Kerkstraat is a little further than you would normally park, but you have indicated in the app that you want to charge a maximum of 10 minutes' walk from your destination.

You follow the route guidance and drive to the Happycharging charger on the corner of Kerkstraat. Upon arrival you will see that the loading spot is available for you. While your car starts charging, you go to the office to start your work day. The amount of energy that you supplied back into the grid yesterday is now loaded into your car. This is only possible at special times, the Happycharging app will send you a notification for this. This approach saves costs and maximizes the benefits of your solar panels.

You will receive a notification that the energy you generated yesterday has been charged in your car for free. If you want to charge more, the charger's regular rates apply. You decide to stop the charging session remotely, you can easily manage to drive home on this battery. By using Happycharging, you have charged part of your battery for free with yesterday's generated energy.
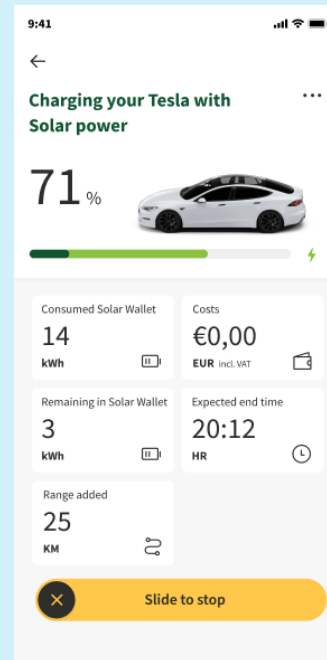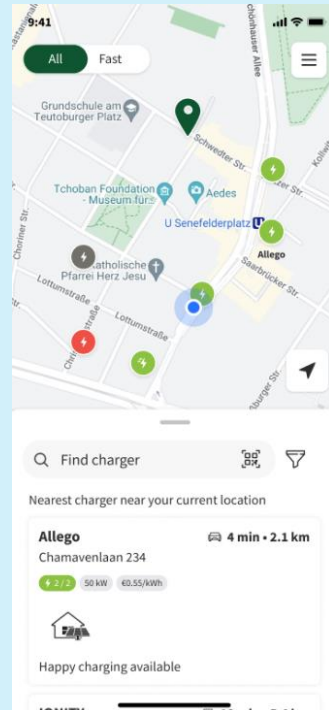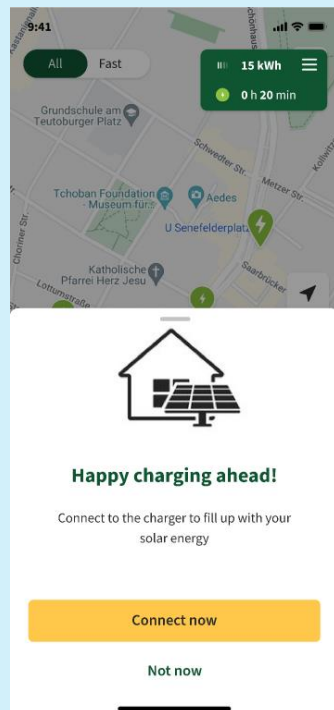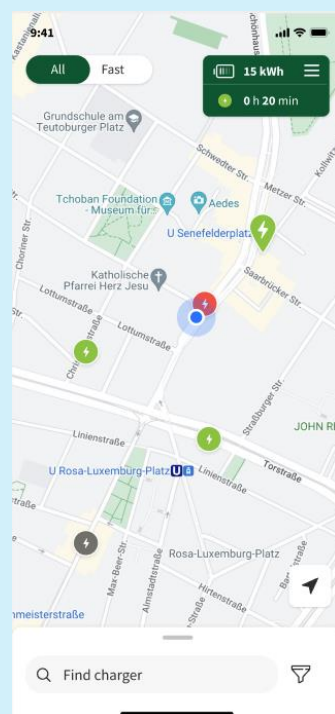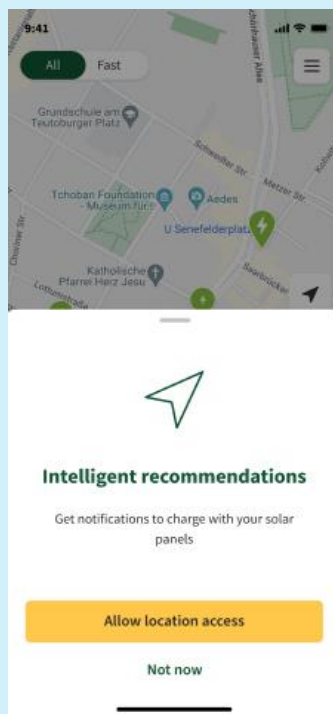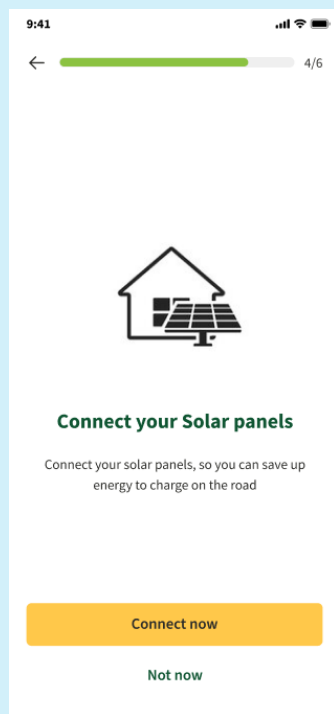
Figure 25: App screen images used during interviews

HAPPY CHARGING - FINDINGS

Happy charging feedback

Eight EV drivers were interviewed and asked about their findings on the concept Happy charging, based on the narrative an app screens. The results of the interviews are in Appendix 8.4.

All of the people that were interviewed were interested in using their solar energy on the road, however multiple interviewees wondered how it would physically work to charge your solar energy later in time and if it would be possible to validate if it is really your energy?

Seven out of eight interviewees would use Happy charging if it was real. Sidenote with this is that it is mostly financially driven, to save money on charging sessions, or save on solar generation costs.

The main questions during the interviews were:

- How does the exchange between solar generation at home convert to your charging sessions?

- How can business drivers be incentivized to use Happy Charging?

- How are the participating charging stations selected and the time blocks for Happy Charging?

These questions are used to sharpen the final concept of Happy charging.

Conversion of solar generation
The feedback regarding the narrative was to make clear what the conversion rate of solar generation at home, towards happy charging blocks is. On average, people use up 30% of their solar generation at home directly, the rest is supplied to the grid. A conversion rate of 1:1 would be to much of a risk for energy suppliers, so the solutions is to convert kilowatt-hours to kilometers. With an average consumption of five kilometers per kilowatt-hour, this is a better conversion rate

Incentive for business drivers
During the interviews, people also asked what the incentive is for business drivers to use happy charging, since they don't pay themselves for the charges. Even though this is a valid point, the focus for the concepts is consumer charging and not business charging. Besides that, business driver will still be able to download and use the app, since generating energy at the wrong time will cost money, with the declining "salderingsregeling".

Participating charging stations
To be able to have steady possibilities of happy charging, public CPOs need to allow this to happen. They will want to connect their chargers to the platform, since the energy is cheaper for them to buy in when the sun is shining a lot, and they will be able to send signals through the app to steer EV drivers into charging at the right time and place.

CONCEPT 2: COMMUNITY CHARGING

Explanation of concept

Community charging creates a platform that connects EV drivers and homeowners with charging stations, to create a broader EV charging network.

Evdrivers

EV drivers with community charging are able to find available chargers based on their estimated charging times. Is there no public charger available? A community charger will be selected. By parking and charging at another community member, EV drivers always have a charger available. With enough coverage of charging stations, EV drivers will never be to far from their destination. By charging on someone's driveway, the charging tariffs are often lower, than regular public charging. EV drivers are able to rate the charging spot at the end of the charging session, to notify other users of the quality of the location.

Homeowners

For people who have invested in a home charger, inviting other EV drivers to charge up, makes a lucrative income stream and earns back the investment quicker. By being able to set availability times, you always have your own charger available for yourself. Through the app times and prices are easily setup. By having people charging at times the homeowner is not charging, there is a higher chance of having a car connected when the sun is shining, so the car is charged with sustainable energy. Homeowners are able to rate the EV driver after the charging session, to prevent misuse at other's charging locations.

Ensuring

With community charging, users are ensured of having a charger available, even when regular public chargers are occupied. By having only the community charging at home owners, the social safety is easier ensured, so homeowners can have EV drivers charge more safely.

Accessibility

Community charging creates a benefit for EV drivers, home charger owners and even people who don't have an EV themselves, but have space for a charger. They are able to exploit their charger through the app. In comparison to Happy charging, community charging is more accessible.

Features

The platform is a connection between EV drivers and home owners with charging stations. Not only the people are connected, but the chargers have to be connected to the platform individually, but also to the owner of the station, so reimbursement of charging sessions is done automatically.

Narratives

For each perspective, a separate narrative is written, to test the concept with EV drivers. Separate app screens (Figure 26 & Figure 27) were provided, to visualize the experience.

COMMUNITY CHARGING NARRATIVE

EV driver perspective

Just imagine…

In the morning you leave for work with an almost empty battery in your electric car. As you drive through the city, you start to worry about finding a charging point. Unfortunately, there doesn't seem to be an available charging station nearby.

Fortunately, you have installed the Community Charging app, which offers a useful function to find private charging points. You decide to enable the Community Charging feature to see if there is a charging point available somewhere nearby.

The app starts searching and within a few minutes you will receive a notification: "There is an available charging point at Mr. De Vries's home, a 5-minute walk from your destination. The rates are lower than normal. Please note: a blocking rate applies from 2 p.m. Do you want to drive to this location?"

Because you have no other options and you would like to save costs, you decide to drive to the charger. After arriving at Mr. De Vries' house, you will see that the charging point is clearly marked and accessible without the need for personal contact. There is an instruction board with simple steps to connect the charging cable and use the charging point. You follow the instructions, connect the charging cable and payment is automatically arranged via the app.

You walk to work and get to work. During your working day you can monitor the progress of the charging session via the app. The app will send you reminders and updates about the time left before you need to move your car. Around noon you will receive a message that it is almost time to pick up your car.

You walk back to Mr. De Vries' house and take the charging cable from your car. The app confirms that the payment has been processed and the amount has been transferred directly to Mr. De Vries. Although Mr. De Vries was not present during the charging session, you received confirmation via the app of the use of the charging point.
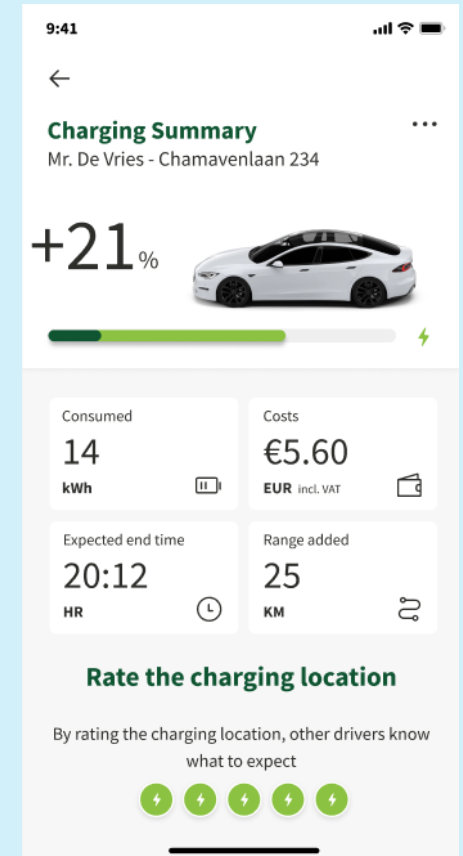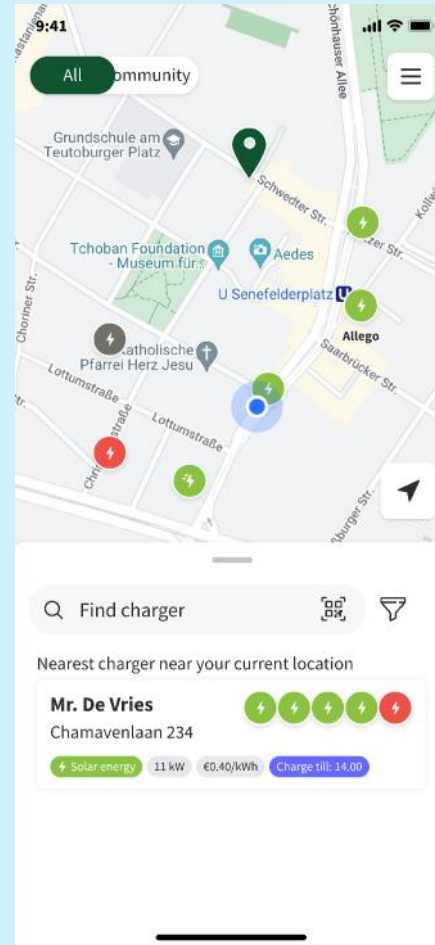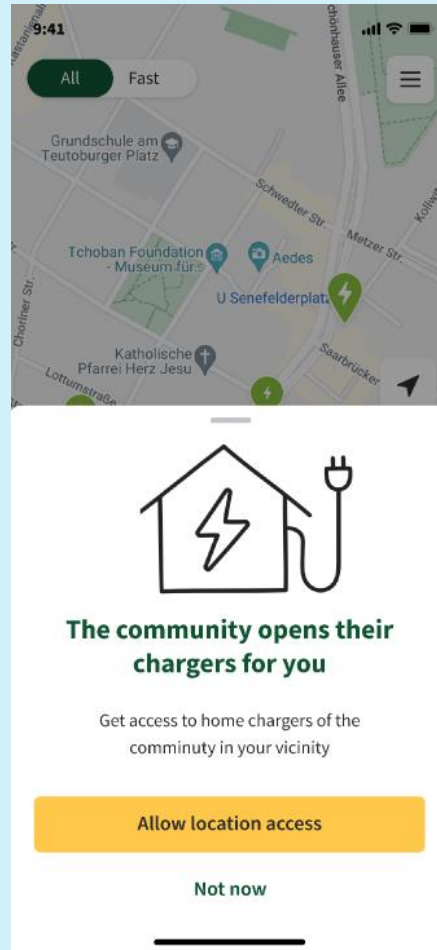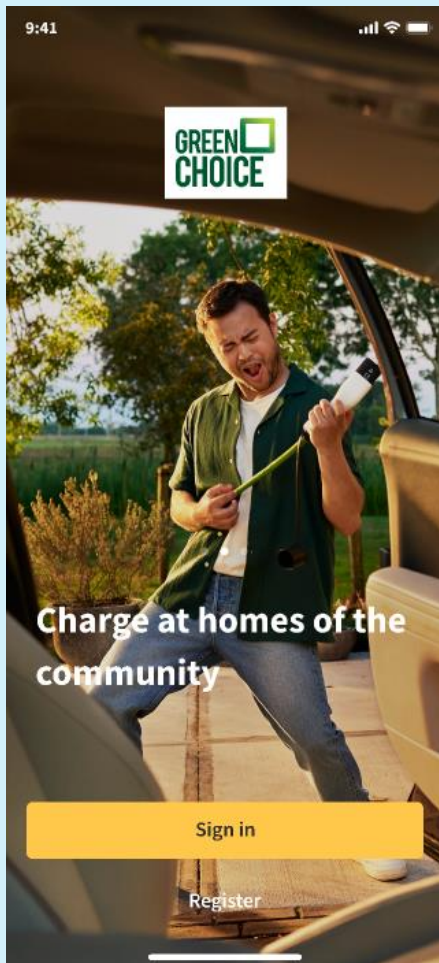
Figure 26: App screen images used during interviews

COMMUNITY CHARGING - NARRATIVE

Homeowner perspective

Just imagine...

It's Wednesday morning and you're sitting at the kitchen table with a cup of coffee. You take a sip and open your phone to check out the Community Charger app. You have registered your charging station at home in the app, so that passers-by can also charge at your place. This way you earn back the investment in your charging station faster.

You set the times when your charging station is available today. You work from home, so it is convenient to open the charging station from 9 a.m. to 6 p.m. You set the rate at €0.40 per kWh, a fair price that other users also appreciate, given the positive reviews you have received. Everything is arranged with a few clicks, and the app does the rest.

Around noon you will receive a notification from the app: someone is on their way to use your charging station. Not much later you see from the window how the car arrives. The man parks his car neatly and follows the instructions on the sign at the charging station. You don't have to go outside or worry about payment, because everything is arranged automatically via the app. The man then walks away, probably to work or an appointment nearby.

You feel reassured that everything is going well. You know that if something ever goes wrong—like someone parking longer than allowed—you can easily report it via the app. Fortunately, that has not been necessary so far. The Community Charger app ensures that users follow the rules, and if someone doesn't, that person is banned from using other charging stations. The system is fair and protects both you and other owners.

At the end of the day you will receive a notification that the user's car is fully charged and that the charging session has ended. The payment has now been processed and the money has already been credited to your account. Everything went smoothly, without hassle, just the way you like it.

You open the app again to check the day and see that the user has given you a positive review. Tomorrow the charger will be available again for passers-by, as you have set this in the app.
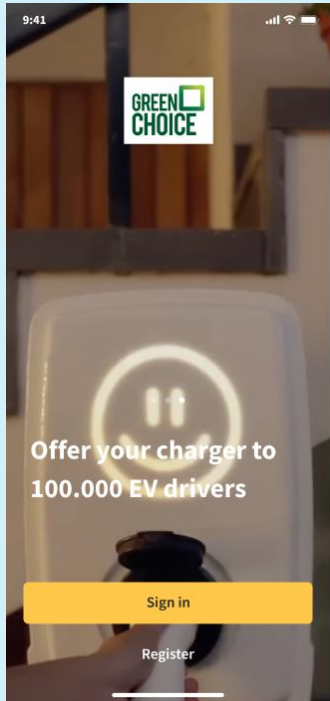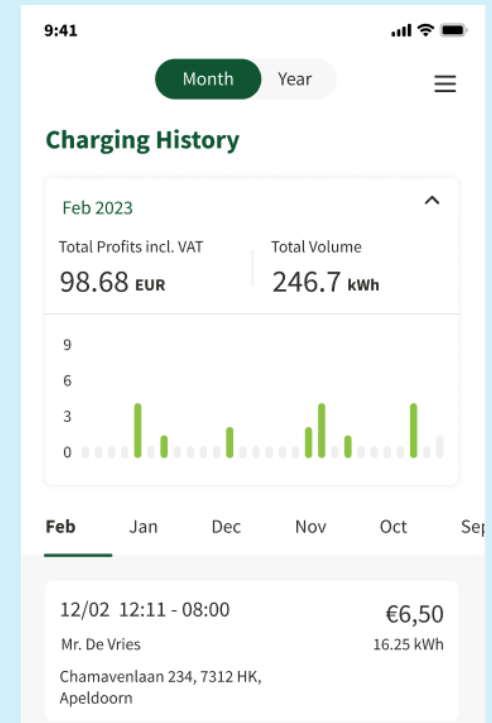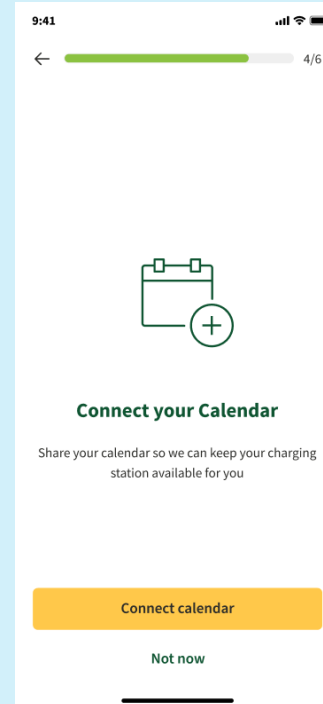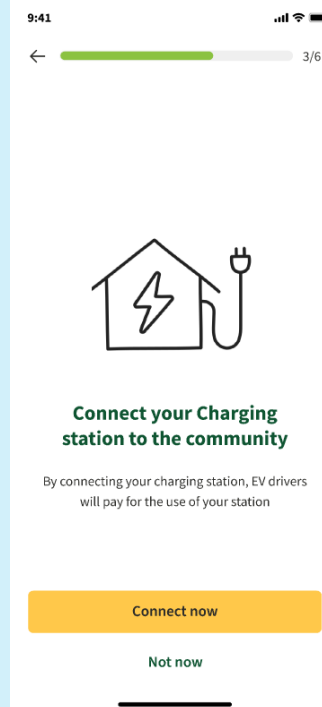
Figure 27: App screen images used during interviews

COMMUNITY CHARGING - FINDINGS

Community charging as concept sparked more conversation than Happy charging, because it was easier to imagine for the interviewees. The results of the eight interviews are in Appendix 8.4.

The benefit of having more charging stations available is identified by the interviewees, but the location of the charging stations determines the effectiveness of the community charger.

The homeowner perspective raised more concerns by the interviewees. They raised concerns about what to do if a car is not moved quickly enough and what repercussions are available to enforce positive behaviour.

The main questions to implement in the redesign are:

- What happens if you are not able to move your car at the end of the session?

- What kind of positive effect can a high rating create?

- How can we ensure both parties a positive experience?

These questions are used to sharpen the final concept of Community charging.

Unwanted charging
Main concern from the interviewees was what to do if an EV driver is parked longer than expected and the car is in the way on the property of the homeowner. Through the app, it is possible for the homeowner to control the charger and to unplug the charging cable of the parked car. With this it will be able for the homeowner to charge their EV. In regards of physical space, guidelines for the location of the charger will be communicated, so homeowners place the charger to serve two parking spots, one for themselves and one for another EV driver.

Rating system
Central in the concept of community charging is the rating system, which will ensure social security. By having homeowners rate the EV drivers, other homeowners are alerted to prevent certain EV drivers at their locations. The homeowner will be able to only allow EV drivers with a certain rating at their charging spot. This will limit the amount of traffic and thus income but ensure safety.

Positive experience
Charging should be a positive experience without any hassle or problems. By having strangers visit each others' places, the platform should be guiding both parties into a positive experience. From the homeowner towards the driver, an accessible and clear charging station to use and from the driver towards the homeowner respect towards the property that is made available. Some interviewees even spoke about additional services homeowners could provide to EV drivers, such as a vending machine.

4.4 CONCLUSION

The goal of the development phase was to develop concepts to fulfil the future vision statement:

In 2030, we envision providing our customers with their own sustainable energy always and everywhere in an intuitive way, by being able to use their sustainable energy outside of their homes with their Electric Vehicles.

Through workshops and customer interviews, two concepts have emerged:

- Happy charging

- Community charging

Both concepts created interesting findings through interviews, to take into account for implementation.

Consumers were interested in both concepts and the question to combine them was asked during multiple interviews. Since the base of both concepts is an app for finding chargers, it is possible to combine the two concepts into one app where the concepts are features next to eachother. From this choice has risen the final version of the concepts:

Greenchoice Chargeshare

Radical innovation

According to the description of Radical innovation by Veryzer ,radical innovation "involves dramatic leaps in terms of customer familiarity and use" (Veryzer, 1998). Most often this is created with the development of new technology for a market.

Greenchoice Chargeshare is a radical innovation in the mobility sector in regards of technology. Where they will be combining data from energy contracts with mobility data, to provide customers with their sustainable energy through charging sessions.

This concept will help the EV market open up and become more accessible for people without driveways or being a homeowner. By creating a platform where the product is a smart charging session, instead of a charging at home, the difference and limitations between charging on the road and at home are erased, leveling the EV market for consumers in respect of business drivers.

However, for customers Greenchoice Chargeshare will not feel as a radical innovation, since the familiarity and use is comparable to existing solutions.

In the next chapter, Greenchoice Chargeshare is put down as the final vision for the project goal: "*develop the vision on mobility for Greenchoice in the year 2030*"

In order to make the concept more concrete, a roadmap is created, to give insights in the different stages needed to implement the proposition.

5. DELIVER

Within the Develop phase, the concepts have made three iterations and are concluded with narratives and app screens as prototypes. To make the final iteration on the concepts, EV driver feedback is necessary. For this the narratives and app screens are used as conversation pieces in interviews. The feedback from these interviews are implemented in the final concept narratives and screens.

Image from Greenchoice brand kit

5.1 METHOD

The main goal of the project was to: "*develop the vision on mobility for Greenchoice in the year 2030*"

This part of the project delivers the outcome in the form of a final concept description and visual, and a roadmap of which each horizon is elaborated on.

Research question

The research question for this part of the project is: "*What does the final outcome of the vision on mobility look like?*

To deliver the final concept, a product description is written, together with a concept visual. Strategic fitment is described by discussing the concept with product developers within Greenchoice. Together with Greenchoice employees, viability and feasibility is decided. Desirability is based on new EV driver interviews, where Happy charging and Community charging is presented as features in one app. For this, three EV drivers charging in a parking in Rotterdam were shortly interviewed in line with the interview script, which was used earlier for the Happy & Community charging concepts.

Roadmap

To guide the implementation of the concept, a roadmap is developed with three horizons, which are elaborated individually and answer the questions what Greenchoice should do to make the concept work.

Imagery from brand commercial of Greenchoice

5.2 FINAL CONCEPT: CHARGESHARE

With Greenchoice Chargeshare, cunsumers are able to have one central app, for all their charging at home and on the road. Consumers who use Chargeshare are able to connect their residential energy contract, car, charging pass and solar panels so the use of sustainable energy is optimized. The Chargeshare platform will connect cars to sustainable energy, by controlling charging sessions in regards of timing and location.

Without homecharger
For people who don't have a homecharger, Chargeshare will collect the generated energy from their solar panels and convert it into chargable kilometers, which the user is able to charge on the road. The chargeshare app will guide the user towards the right charger and even opens up homechargers of other platform users, to broaden the charging network and ensure users that they will always have a charger available and always charge with sustainable energy.

With homecharger

For people with a homecharger, Chargeshare will give the possibility to open up the charger to the public, so other people are able to charge at your home, while you are not there. This will create a bigger possibility that an EV is connected to the home, while the sun is shining. The platform will automatically facilitate the reimbursement for the use of the charger.

Ensuring

The platform will ensure people without homechargers a charging location, where ever they go. With the connection to their solar panels, EV drivers are ensured they will charge with their own sustainable energy, at home or on the road.

Accessibility

The platform is accessible for al EV drivers, business or consumer and with or without a homecharger. The platform makes it easy for all users to integrate their energy products into one central app, to optimize the use of sustainable energy.

Features

The platform connects the energy household to the charging solutions, without any difference between charging at home and on the road. By connecting solar panels, home energy contract, EVs and chargers in a simple way, the platform is able to assist during charging to optimize a seamless experience for charging at home or on the road.

FINAL CONCEPT

Figure 28: Mockup of the concept Chargeshare in the Google playstore

CHARGESHARE - FINDINGS

During the interviews, the participants were introduced to the product narratives of Happy charging and Community charging, with the note that the narratives are features from one single app. The results the interviews about the concept Chargeshare are in Appendix 8.5.

The overall response was positive, and the participants were able to imagine themselves into the narratives. The participants were quite well familiar with driving an EV and identified different shortcomings of the concept. From the three interviewed EV drivers, two were mostly focused on the financial benefits.

Main points of feedback were the following:

- What are the possible financial gains with the app?

- What does the app add for people who don't drive that much?

- How can the app be more focused in it's goal?

For each question, a solution is thought of

Financial gains

For two out of the three interviewed EV drivers, financials would be a driver to use the app, but they want clarity in the amount of possible savings through the app. In the different facets of the app it is hard to estimate the personal savings for a user. A homeowner with a perfect charging location is going to create more revenue than someone with a remote location. Over time a calculator based on surrounding traffic should be able to calculate the expected amount of use of a calculator, to create insights in possible profits.

Consumer groups

The Chargeshare platform is most interesting for people who regularly charge, since the platform optimizes charging sessions for EV drivers, however for people who don't charge often, the Chargeshare platform doesn't provide an incentive to use it. When bidirectional charging becomes a reality, these people could plug in their car, to function as a semi permanent battery for the grid, but this is outside of the scope for this concept.

Feature focus

Finding charging stations, using solar energy publicly, being able to charge at other people's homechargers. All these features into one app might be overwhelming for users. This could be solved by letting customers select how they want to use the app, so the app can adapt the features bespoke to the customer. This should declutter the experience for a user.

5.2 FINAL CONCEPT - FITMENT

Greenchoice Chargeshare will be a platform for EV drivers, regardless if they have a homecharger or not. To verify if Greenchoice should aim for this product vision into the future, the strategic fit is checked. In order to check the product fitment within the company and for consumers, Viability, Feasibility and Desirability are examined.

Strategic fitment
The strategy of Greenchoice is to offer the next step in sustainability to all customers, through a platform for climate positivity, which offers integrated solutions.

With Chargeshare, Greenchoice is executing this strategy, by connecting smart charging session on the road and at home to the energy household. This integrated product is a fitting solution as extension for the platform for climate positivity in the mobility sector, since it will create the possibility for extra uses of charging stations publicly and at home.

For users with a charging station at home, the platform will create the possibility to open the charging station for other EV drivers making more use of the charging station, but also using more solar energy locally, when the owner themselves is not at home.

For users without a home charger, the platform will create the possibility to charge more sustainable on the road, by collecting the solar energy and turning it into chargable kilometers, to charge at public infrastructure.

Viability
The viability of the Chargeshare platform for Greenchoice is mostly dependant on the IT development costs. By combining public and home charging infrastructure in one platform, Greenchoice has more control on the use of electricity, to generate more energy market portfolio profits. The one time development cost in IT open up a recurring revenu stream for Greenchoice, making the idea viable in the long run.

Feasibility
In regards of feasibility, Chargeshare is more complex. The integrated product is based on external platforms for the separate assets, so Greenchoice needs to build database where data is aggregated from EVs, charging stations and charging passes, to combine this with the database for energy consumption. To build this, the internal IT department needs to start creating focus on external product connections towards a central platform.

Desirability
Desirability is distilled from the EV driver interviews. All of the three interviewed drivers are enthusiastic regarding the features in the app, but three main points of feedback were highlighted, to optimize the concept for customers. EV drivers are either more sustainability focused or financial focused, making Chargeshare a suitable concept for them, creating the ability to use their own sustainable energy on the road, creating financial savings while charging. Chargeshare is mostly interesting for people who charge more frequent.

5.3 SHAPING THE ROADMAP

Internal Conditions

For the final concept to be built in 2030, there are some internal conditions to be met, in order to succeed the concept. The basic systems in customer data management and invoicing should be opened for non energy customers to be registered. Currently the focus in IT development within Greenchoice is too much on energy related systems, instead of other products. For products as Chargeshare to work, Greenchoice IT should divide the focus and start implementing a central customer database.

External conditions

For Chargeshare to be even more successful there are a few conditions from outside Greenchoice, which will elevate the use of the product. With the current situation of the grid, there is a possibility the grid operators will limit the amount of charging stations, which will shrink the supply of available chargers and create a need for better use of existing infrastructure.

As of 2027 the current "salderingsregeling", where solar panel owners are allowed to sell back their generated energy towards the grid for the same price as their usage, will be stopped. This means that solar panel owners will get the market value of their electricity at the time of generation, which is much lower than they are used to. This will create the need to be using more solar generated electricity at the time of generation.
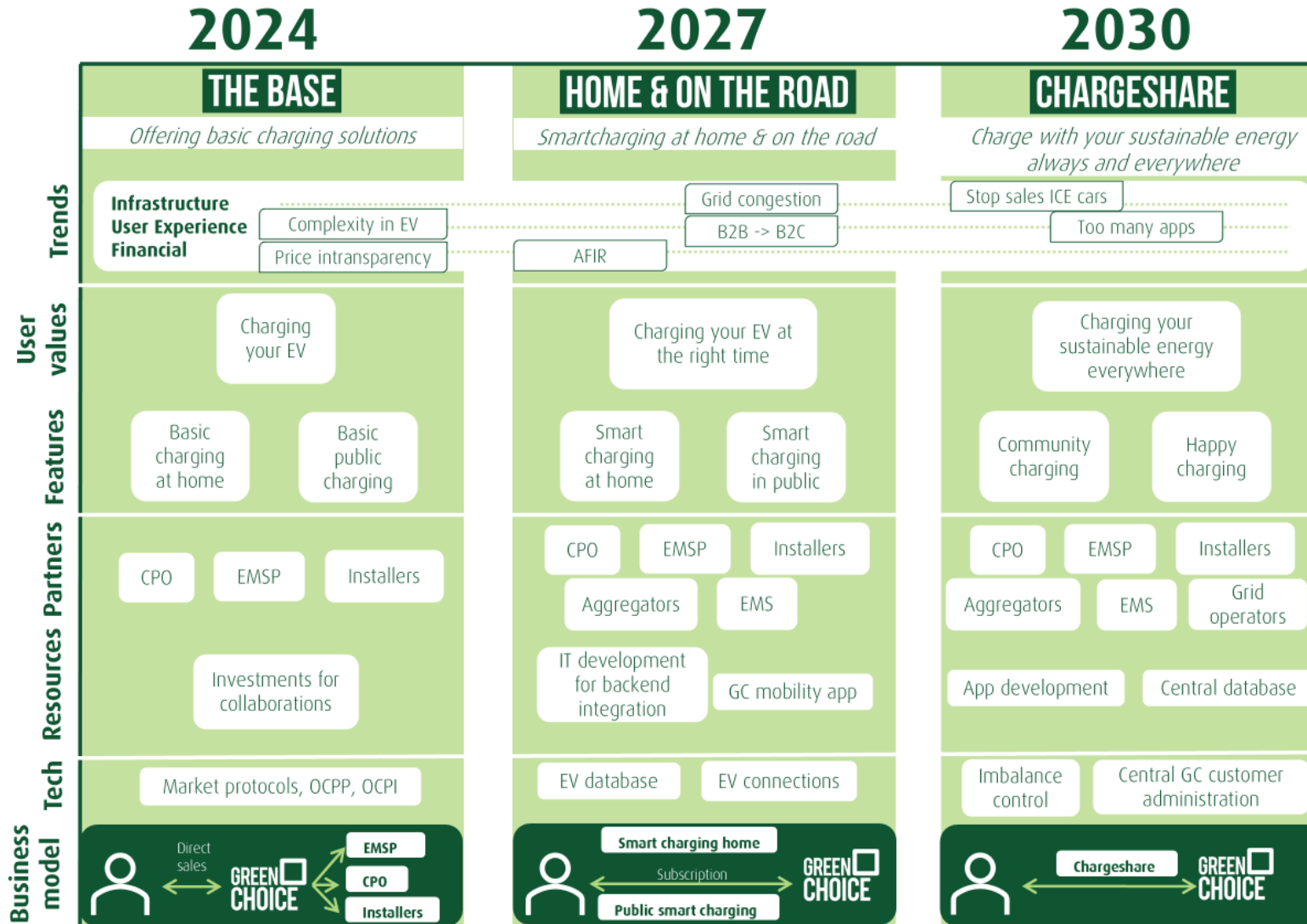
Stakeholders

Relevant stakeholders to contribute to the executing of this concept are the IT domain within Greenchoice, Product partners of Greenchoice and EV business owners within Greenchoice. The IT domain is responsible for building the infrastructure and communications between the different sub platforms of the individual products. The business owners of the relevant products need to come together and decide on the exact direction for the Chargeshare concept and collaborate with their external partners to prepare the sub platforms for the digital connections with the IT domain.

Time pacing

The time pacing for the roadmap are the years 2024, 2027 and 2030. The EV market is a tech driven market, where each year individual startups are coming out with new functionalities, however Greenchoice is not yet able to combine all these products in a central database. For Greenchoice to build a central database, two years is reserved, since this is comparable to similar sized projects in the past, which will make to company go from 2024 to 2027. To go to 2030, Greenchoice needs to combine the functionalities of the different sub platforms into one central EV platform. This will take approximately 3 years, since the product knowledge also has to grow within the company, to make the right choices during building.

5.4 ROADMAP

	2024 — THE BASE	2027 — HOME & ON THE ROAD	2030 — CHARGESHARE
	Offering basic charging solutions	*Smartcharging at home & on the road*	*Charge with your sustainable energy always and everywhere*
Trends (Infrastructure / User Experience / Financial)	Complexity in EV; Price intransparency	Grid congestion; B2B -> B2C; AFIR	Stop sales ICE cars; Too many apps
User values	Charging your EV	Charging your EV at the right time	Charging your sustainable energy everywhere
Features	Basic charging at home; Basic public charging	Smart charging at home; Smart charging in public	Community charging; Happy charging
Partners	CPO; EMSP; Installers	CPO; EMSP; Installers; Aggregators; EMS	CPO; EMSP; Installers; Aggregators; EMS; Grid operators
Resources	Investments for collaborations	IT development for backend integration; GC mobility app	App development; Central database
Tech	Market protocols, OCPP, OCPI	EV database; EV connections	Imbalance control; Central GC customer administration
Business model	Direct sales — GREEN CHOICE → EMSP / CPO / Installers	Smart charging home; Subscription; Public smart charging — GREEN CHOICE	Chargeshare — GREEN CHOICE

GREEN CHOICE

In 2030, we envision providing our customers with their own sustainable energy always and everywhere in an intuitive way, by being able to use their sustainable energy outside of their homes with their Electric Vehicles.

All features — Integrated into one app

Accessible smart — Even without homecharger

Ensured Charging — Always a charging solution

5.4 ROADMAP

2024

THE BASE

Offering basic charging solutions

During 2024, Greenchoice has partnered up with individual product suppliers for the EMSP, CPO and home charger products. This partner selection will be the foundation for the platform later. In regards of IT, there is still a big division between energy contracts and other products

The partners are selected on their API capabilities and similar vision on the market, to have long-term alignment.

Customers will be able to get the different mobility services from Greenchoice, however the features and way of use are still sub optimal for optimization of solar electricity use, or efficiency in public charger use.

Greenchoice needs to start projects to centralize the customer database, so energy contract and other products are centrally registered.

2027

HOME & ON THE ROAD

Smartcharging at home & on the road

In 2027, The products for mobility will be talking to a central database, however the products will still be separated into use for at home, or on the road.

Partners have built more API connections and are already integrated into the central database of Greenchoice.

Customers will experience seamless EV services for at home, or on the road. However, there is still a division between the two scenarios, since connections between assets are still done locally, keeping the dividing line between home energy use and public energy use divided.

In 2027 the standard proposition for Greenchoice Mobility will be to offer smart charging at home and/or on the road.

2030

CHARGESHARE

Charge with your sustainable energy always and everywhere

In 2030, Greenchoice has managed to create Chargeshare, an EV platform where not only the different assets of an individual customer are combined, but also customers themselves are combined into a community, helping each other charge and use their sustainable energy.

Greenchoice will have a central customer database, where customer data from all different sub platforms will be gathered for total customer information.

Partners have a crucial role in fulfilling the services of Greenchoice, being part of an integrated solution. Greenchoice needs focus on app development and connections within the central database. Also grid operators need to tag along in supplying information for Greenchoice to have more impact in controlling EVs.

Customers will be able to charge at each others charging station, charging as much with sustainable energy as possible. Also being able to save up their own solar energy into the app to charge them later at a public charging station.

GREEN CHOICE

In 2030, we envision providing our customers with their own sustainable energy always and everywhere in an intuitive way, by being able to use their sustainable energy outside of their homes with their Electric Vehicles.

All features
Integrated into one app

Accessible smart
Even without homecharger

Ensured Charging
Always a charging solution

5.5 CONCLUSION

The goal for the Deliver phase, is to round of the project and create deliverables for Greenchoice.

The research question for the phase was:

"What does the final outcome of the vision on mobility look like?"

The form of the deliverables is a concept description and visual, accompanied with development roadmap and explanation per horizon.

Concept – Greenchoice Chargeshare

With Greenchoice Chargeshare, Greenchoice creates a competitive advantage of other mobility providers, by combining energy contracts with mobility and removing the division between charging at home and on the road. With this proposition, consumers are able to profit from sustainable energy, even if they don't have a home charger or solar panels, by being able to charge at other people's home chargers, or charge with their own solar energy publicly.

Roadmap

The years for the horizons are 2024, 2027 and 2030, in line with the development time pacing of the market and IT domain of Greenchoice. The IT department of Greenchoice needs to shift their focus from being solely an energy supplier, to creating a platform.

The Chargeshare platform will be the EV facet of the total Greenchoice platform for climate positivity.

To be able to build the Chargeshare platform within Greenchoice, their needs to be a shift in mindset and better directive towards centralized integrated products. With Chargeshare, Greenchoice will have the first integrated product vision in the company.

6. DISCUSSION

6.1 SUMMARY

6.2 METHODS

6.3 WORKSHOPS

6.4 CONCEPT - CHARGESHARE

6.5 GOALS

To round up the project, a discussion section is written, zooming in on the different facets of the project and providing limitations and recommendations for future research. In the first part, the chosen methods and execution will be discussed. In the second part, the quality of the workshops will be discussed. In the third part the final concept and further recommendations for future development are written down. Finally, I will reflect on the total project and my personal learning goals in the project.

6.1 SUMMARY

Project goal

The goal of this project was to: *"develop the vision on mobility for Greenchoice in the year 2030."* By using a product vision development method and participation of product developers at Greenchoice, the vision on mobility is developed in a concrete and fitting way for Greenchoice.

Discover

The current context is investigated during the Discover phase, which highlighted several points of interest for both the energy market and mobility market.
In regards of the energy market, the amount of sustainable energy needs to rise, in order to succeed in (inter)national goals, however, imposes challenges in operational execution in the form of grid congestion and rising cost of infrastructure.
The mobility market originates from business leasing and the first infrastructure is aimed towards business services, such as reimbursement and charging passes. The mobility market is not yet sufficient in services for regular consumers in regards of price transparency and accessibility in solutions.

Define

To shape the future vision and find out where the main focus should be, clusters and an attitude grid were created. During workshops, fitment with strategy and values were sought in the selection of the attitude. Greenchoice wants *"For consumer EV drivers, there needs to be a solution to connect their EV to their energy household to prevent infrastructure problems and fulfil their need of connecting their sustainable assets in an intuitive way".*

Design direction

The problem statement provides guidance for the design direction. Based on the values and strategy of Greenchoice, the future vision statement sounds: *"In 2030, we envision providing our customers with their own sustainable energy always and everywhere in an intuitive way, by being able to use their sustainable energy outside of their homes with their Electric Vehicles."*

Develop

The vision statement is used during workshops to brainstorm for interaction characteristics, which were: Ensuring, Accessibility and Features. With these three criteria the concept brainstorm is checked. Eventually two concepts arose, Happy charging and Community charging. Both concepts were approved by consumers during testing and were combined into one single concept, since the base of the concepts was the same, an app.

The final concept is Greenchoice Chargeshare, so customers are connected to each other, to charge their own sustainable energy at home and on the road in a seamless way.

Deliver

The final concept of Greenchoice Chargeshare is delivered in the form of a concept description and visual, supported with a vision roadmap with elaborated horizons. This makes discussion and implementation easier for Greenchoice employees in the decision for future development.

6.2 METHODS

The methods used in this project were chosen before the project started and executed with best effort during the project. In this chapter the reason why the methods were chosen is discussed and recommendations for further research.

Double diamond

The method that was chosen to guide to overall structure of the project, is the Double Diamond by Design Council, z.d. This method is almost a standard within a design project, because of the diverging and converging manner of researching. For this project I chose it, because it makes the planning tangible and divides the project in four equal parts. In comparison to for instance a circular design method, the Double Diamond creates an easier scope, because of the lack of iteration in the process. Due to the size of the project scope and the available time, the Double Diamond fits better than smaller but more iterations. If the duration of the project was longer, my preference would be to use an iterative process, to make smaller but more incremental changes.

Vision in product design

To fill in the Double Diamond, the Vision in Product Design method by Hekkert & van Dijk (2011) is used. This method is chosen, because of the experiences in other projects and the fitment with the goal of the project. However, the method is more complex for non designers or people who do not use these kinds of methods everyday. The steps taken by the method are in the right direction and enforce the most creative solutions per step, but the steps themselves are ambiguous and hard to get right.

Narrative storytelling

To receive feedback on the concepts, the method Narrative Storytelling by Van Den Hende & Schoormans (2012) is used. This method is able to create a rich image in the mind of the reader, in order to receive feedback on the concept. The setup of this method is perfect for quick feedback and suits the project well. Prototyping is always a thin line between effort and results and Narrative Storytelling is able to create accurate results with limited effort.

Qualitative interviews

For customer testing, interviews were held where the interviewee reads through the narrative story and is asked basic questions per concept. This method was the easiest to set up but is not executed perfectly. The interviews should have been recorded and transcribed, so interesting details can be checked afterwards, instead of trying to write them down live. Also, the interviews were held anonymously, because no consent was formally formulated. This possibly creates a lack in credibility. If the planning for the project was longer, better interview settings could be created.

6.3 WORKSHOPS

During the project four workshops were held with the workshop group. In this chapter the way the participants were chosen is discussed and each workshop is elaborated on, what flaws were found and recommendations for future projects.

Participants

Within Greenchoice not a lot of people are working with mobility or EV products. Due to the complex nature of the different software and hardware links, a group of people was selected, who understands the complexity and has feeling for the average EV driver needs. In hindsight it would also have been good to tag along the development manager and the last product developer, to let them experience the methods and workshops.

Future context

As preparation for the future context workshop, Els and I did a lot of desk research and created the different context factors as input for the workshop. The participants were invited to add factors, but because there was already input, most people are not adding anymore. For the next project, the future context factors should be created with the workshop team before they start clustering. By this a more rich and diverse factor analysis should emerge.

During the first workshop the team had to get familiar with the method and divide the factors over clusters with a deeper meaning. Preferably this would have been divided into multiple workshops, to keep the creativity up, instead of overloaded.

Designing the interaction

The risk with the VIP method, is that the quality of the outcome is dependend on the previous choices. Because the first workshop was packed with assignments, while the group had still get to used to the method, the quality of the result was too low. This leads to a bad start, which is hard to correct later in the workshops. For this a more iterative approach, where the planning of workshops is done twice, or more is better. For future projects, this group is up to speed regarding the purpose of the different workshops.

New concepts

The workshop for new concepts was divided into two parts, because of the lack of time in the first workshop. Accidentally this was a great choice, since two iterations on the concepts could be made with the group, sharpening the idea from the first workshop a lot. However, the first workshops were planned at the same time, with a week interval, so the previous workshop was still fresh in mind. The second part of the new concepts workshop, was planned after three weeks, due to scheduling issues.

Facilitating

Facilitating of the workshops was done by myself. Even though I tried to be as neutral as possible, it is impossible to not have any influence if you are normally part of the team yourself. An external facilitator is better to keep a neutral position in the group.

6.4 CONCEPT – CHARGESHARE

The goal of the project is to develop a vision on mobility for Greenchoice in the year 2030. The result of the project is Greenchoice Chargeshare. Conditional for Greenchoice was to have an integrated platform concept, where the different mobility platforms (charging pass, charger and business charging) come together. In this chapter the limitations and recommendations for the concepts are discussed.

Happy charging

For Happy charging it is crucial to investigate the business case. Solar energy surplus is in the current context a big financial risk for an energy supplier. By offering advantages for solar energy surplus, the company will attract the heavy solar energy generators and possibly quite a big risk. The possibility of guiding EV drivers on the road to congestion locations, to charge the imbalance of the grid is interesting for an energy supplier, but the electricity connections of the public charge points are of the exploiter, so the imbalance charging will land in the portfolio of the exploiter instead of Greenchoice.

For future research, it is recommended to investigate the business case, to create a conversion rate between the home solar generation and the public charging session. Also, it should be investigated what part of the imbalance profits Greenchoice is able to receive for physically guiding EV drivers to the right charging station to charge the imbalance of the grid.

Community charging

One of the limitations for community charging is the availability of charging stations. If homeowners are too hesitant in connecting their chargers to the platform, there will be no locations for drivers to charge at. Crucial to solving this is to offer assurance to homeowners with a set of repercussions they can execute on the EV driver if they take advantage of the services that are offered.

Secondly the locations of the available chargers is important. Charging stations in the middle of nowhere will not attract a lot of traffic.

It is recommended for future research to investigate the possibilities for homeowners to remove cars or at least free up the charging station for themselves. Also, the social side of the concept should be investigated further, do people want to remain anonymous, or do they want to get acquainted to have a better feeling for each other?

6.5 GOALS

Before the project started, different goals for the project to accomplish were assigned. The project had a main goal and during the project I had two personal goals. The goals are elaborated on, and the limitations and recommendations are discussed.

Project goal

The goal of the project was to develop a product vision and test results of this product vision with consumers. Personally, I think the goal of this project is accomplished, but the quality is still to be improved.

One of the main limitations is being employed by the assignment company and balancing between the needs of the company and the university for graduation. During the project weeks I was able to focus mainly on my graduation project, but there were still basic team activities and meetings I had to attend to.

Secondly one of the limitations of doing graduation at the company you are working for, is in the facilitating of the workshops. Each and everyone of the workshop participants is a close colleagues of mine, which sometimes made it hard to be a neutral facilitator.

Even though this experience is quite different than imagined, it is still recommended to other students. If you are able to reserve the time and freedom from the company you are working at, it is a great experience and a great possibility to show your academic side to the company you have been working for.

Communication

I can be very direct and sometimes I speak before I think, breaking more than I can build in a conversation. In this project I wanted to speak with people of all different layers of the company and I wanted to better myself in this competency to have a constantly positive outreach.

This goal was challenged during the facilitating of the workshops and the different presentation regarding the project. Within Greenchoice I have a broad network of colleagues who I work with and with this project it was a great experience to tag them along in the timeline and work alongside them in the workshops. Also, the Product & Pricing team was a great sounding board to check ideas with if they resonated or not.

Assertiveness

In my previous years in a startup business unit, the mantra was: If you want something to go well, do it yourself. This works for smaller purposes, but for this project I wanted to use my assertiveness to tag people along instead of doing all the work by myself.

By teaming up with Els, I was able to work more efficient, because she was able to guide me very well in my planning and execution. The Product & Pricing team was also very supportive and offered a helping hand in different facets of the project. By stakeholder management and regular updates, everyone was able to think along if the project was stuck.

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8. APPENDIX

Image from Greenchoice brand kit

8.1 CONTEXT INTERVIEWS

INTERVIEW 1

1. Private or business EV?

Private

2. Do you have a charging station at home?

No

3. What car do you drive?

Volvo v60

4. What do you think of driving EV?

I drive hybrid, so I have the best of both worlds. No range anxiety and still the comfort and smoothness of driving electric.

5. What is the best about driving EV?

Sound and ride comfort

6. What has to be improved about EV driving?

More affordable secondhand models. There is not a lot of choice for the affordable price range, so you are still spending a bit too much.

7. What has to be developed for EV driving?

Combination with energy, it is a lot of electricity that goes into the car, but I want to combine it with my solar panels, even though I don't have a driveway or homecharger available.

8. What has to be stopped about driving EV?

unclarity and uncertainty in governmental bodies. It is unclear if EVs will be taxed and what the legislation will be for home chargers in the future

INTERVIEW 2

1. Private or business EV?

Private

2. Do you have a charging station at home?
No

3. What car do you drive?
BMW I3

4. What do you think of driving EV?
It is the future of mobility, everybody should drive electric

5. What is the best about driving EV?
Regeneration during decelleration, with a bit of patience, you have a lot of control on the range your car is getting

6. What has to be improved about EV driving?

The charging infrastructure should be improved. There are not enough charging points available to provide for the growing number of EVs

7. What has to be developed for EV driving?
Faster charging should be made available. Now you can only charging within minutes at a fast charging station on the highway, but still this takes multiple minutes. There is no solution to charge quickly in cities and be on your way again in minutes.

8. What has to be stopped about driving EV?
Nothing

INTERVIEW 3

1. Private or business EV?

Business

2. Do you have a charging station at home?
No

3. What car do you drive?
Hyundai Kona EV

4. What do you think of driving EV?
The drive is fantastic, but charging takes a long time, because the car is the cheaper 1 phase edition.

5. What is the best about driving EV?
The ride comfort, there are no shifts in the gearbox, so it is completely smooth

6. What has to be improved about EV driving?

Public charging infrastructure in residential areas and faster service when charging points are broken.

7. What has to be developed for EV driving?
It is already quite well arranged for the business driver. Ensuring that public chargers are working is still a pain point. For private individuals, overview/transparency about charging prices is important, something should be developed for this. I want to plug my car into a charging station, if I see that the car that is connected is full.

8. What has to be stopped about driving EV?
Too many apps with different information

INTERVIEW 4

1.   Private or business EV?

Business

2. Do you have a charging station at home?

yes

3. What car do you drive?

Ford Mustang mach E

4. What do you think of driving EV?

Very nice, I have connected my car to my home through the charger, so it is a very futuristic system, which makes it very cool

5. What is the best about driving EV?

The car is equipped with all options such as adaptive cruise control. Automatic with fast acceleration

6. What has to be improved about EV driving?

Signs at places where you can fast charge. Now sometimes you still have to search and hope that you can find it. Not every fast charger accepts the charging card.

7. What has to be developed for EV driving?

There should be more fast chargers, also available in cities instead of mostly around highways.

8. What has to be stopped about driving EV?

Nothing, it is just easier and more sustainable than driving on fossil fuel

INTERVIEW 5

1. Private or business EV?

Private

2. Do you have a charging station at home?

yes

3. What car do you drive?

Tesla model 3

4. What do you think of driving EV?

Drive very smooth and simple compared to a gas car. You do have to watch the range, but for this I have got a home charger, so I always start the day with a full battery.

5. What is the best about driving EV?

Ease of driving, it is so simple and quiet driving, you no longer have to think about driving. It is also nice not to have to refuel, always have a full battery. the charging station at home is really crucial in this

6. What has to be improved about EV driving?

Fortunately, public charging is virtually unnecessary thanks to the home charger. Furthermore, more certainty about what kind of power goes into my car is better, now I don't know whether it is solar power or mains power. Normally you fill up and know your fuel costs, but this is more difficult when charging at home.

7. What has to be developed for EV driving?

Many apps are needed to drive electric. The Tesla app to open the car, Zaptec app for the charger, Energy supplier app for the rates and charging point apps if you have to charge publicly. Way too much. The range security is also too low, I don't dare go on holiday with the car, but for the Netherlands it is great

8. What has to be stopped about driving EV?

The apps and costs are really prohibitive. The apps do not yet work well together and it is impossible to determine how expensive charging is.

INTERVIEW 6

1. Private or business EV?

Business

2. Do you have a charging station at home?

yes

3. What car do you drive?

MG MG4

4. What do you think of driving EV?

The drive itself is fine, but in regards of range, I still get in trouble some days. For work I have to travel more than the range indicates, which means I have to fast charge, but that doesn't work well sometimes. Overall it is fine, but without a home charger, I would not have wanted to drive electric.

5. What is the best about driving EV?

Comfort and technology, there is little that can go wrong with the car. Previous business cars required maintenance, which is not so bad with EV. Furthermore, the charging station is nice, so I charge the car with solar energy at the weekend

6. What has to be improved about EV driving?

Eliminate excess apps. I have 3 different apps to find charging stations. The prices also differ here. In addition to my business charging card, I also have 2 separate charging cards in the car, just in case. I never had this problem with refueling.

7. What has to be developed for EV driving?

Bi-directional charging, so that I can charge my car with solar energy during the day and use the energy for the home in the evening. Reserving a charging station would also be nice, as it is sometimes a bit tight when it comes to charging

8. What has to be stopped about driving EV?

That one charging card works on a charger and the other does not. This is really not possible and inexplicable.

INTERVIEW 7

1. Private or business EV?

Private

2. Do you have a charging station at home?

yes

3. What car do you drive?

Mercedes EQB

4. What do you think of driving EV?

It is very nice, it is environmentally friendly and a comfortable drive. It gives a good feeling to contribute to a better world. Besides that the car is quick in acceleration, Im always the quickest at the stopping light

5. What is the best about driving EV?

No taxes for now, we don't drive that much, so it's a shame to pay a lot for a car that mainly stands still. We will also not have to worry about the environmental zones in Rotterdam in the future

6. What has to be improved about EV driving?

The range and charging security is sometimes too difficult. We don't go on holiday with the car now, because we simply don't dare to deal with the chargers abroad.

7. What has to be developed for EV driving?

Smart charging and such must be further developed, so that my car contributes to making the home more sustainable.

8. What has to be stopped about driving EV?

The ambiguities and differences in apps. availability and prices of chargers vary a lot

INTERVIEW 8

1.   Private or business EV?

Work

2. Do you have a charging station at home?
No

3. What car do you drive?
Hyundai Kona

4. What do you think of driving EV?
Fine, I drive electric for work, so I didnt choose to drive electric myself. I would rather have driven a gas or diesel car, so you don't have the troubles with charging constantly

5. What is the best about driving EV?
The quick acceleration is fun, but otherwise it's very easy to drive.

6. What has to be improved about EV driving?

I don't have a charging station at home, so I depend on the chargers in the area. They are often full or sometimes malfunctioning, so I cannot charge overnight and have to stop somewhere the next day to charge quickly, which is just inconvenient. Either the range needs to be larger, or more chargers.

7. What has to be developed for EV driving?
They really need to develop home charging without a driveway. It is much more difficult to drive electric if you always depend on public chargers. The benefits for people with a home charger are also much greater by combining it with solar panels and the like, you cannot benefit from this if you do not have a driveway.

8. What has to be stopped about driving EV?
Disruptions must be resolved more quickly. How can a refined electrical socket not work?

8.2 CONTEXT FACTORS

Image from Greenchoice brand kit

Context

Huishoudens kunnen verduurzaming betalen

Bij de berekeningen is rekening gehouden met behoud van een financiële buffer van minstens €10.000. Dat bijna alle huiseigenaren de verduurzaming van hun woning kunnen financieren betekent uiteraard niet dat ze dat in praktijk doen, omdat veel huiseigenaren een deel van hun spaargeld mogelijk voor andere doeleinden willen gebruiken. Daarnaast zijn onzekerheid over de terugverdientijd en onvoldoende bekendheid met gunstige leenmogelijkheden en de Investeringssubsidie Duurzame Energie en Energiebesparing (ISDE) nog steeds knelpunten bij de verduurzaming van de eigen woning

Mehlbaum, C., Schotten, G., & Lehtonen, L. (2024). Van crisis naar kans: verduurzaming van woningen na de energiecrisis. In *DeNederlandscheBank*. DeNederlandscheBank. Geraadpleegd op 24 april 2024, van https://www.dnb.nl/media/n5kjbq2r/dnb-analyse-van-crisis-naar-kans-verduurzaming-van-woningen-na-de-energiecrisis.pdf

Development - economisch

Context

Doelgroep – Man – 52 jaar oud

De gemiddelde EV rijder volgens het nationaal laadonderzoek is al meerdere jaren op rij voor 92% man en gemiddeld 52 jaar oud.

Wolterman, B., Duurkoop, T., Haarhuis, A., RVO, Zweistra, M., Hiep, E., & Van Biezen, M. (2023). Laden van elektrische auto's in Nederland. In Nationaal Laadonderzoek 2023.

development - demografisch
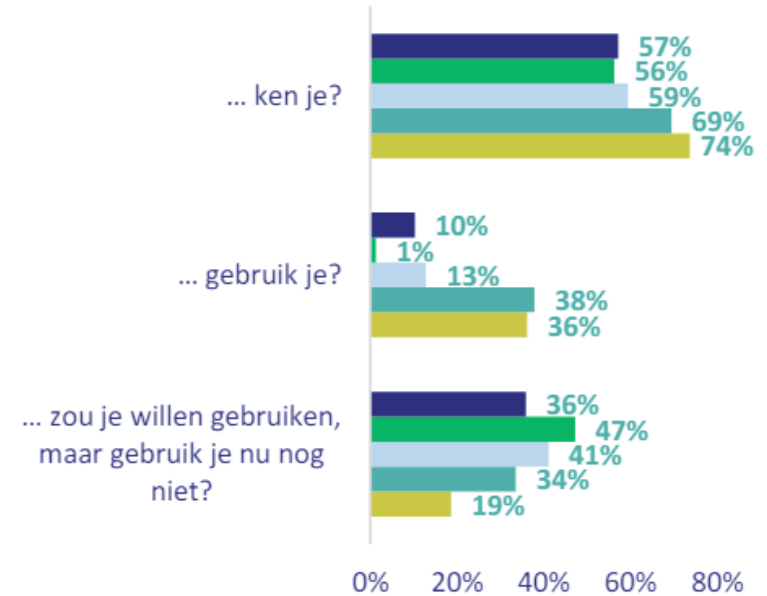
Context
Slim laden

De EV-rijder is bekend met laden op dag- of (goedkoper) nachttarief en met duurzame opwek. Opmerkelijk is dat een ruime meerderheid aangeeft (heel) graag gebruik te willen maken van bi-directioneel laden en van laden met dynamische prijzen, zowel thuis als bij een publiek laadpunt. Hier kan nog maar weinig gebruik van worden gemaakt.

Wolterman, B., Duurkoop, T., Haarhuis, A., RVO, Zweistra, M., Hiep, E., & Van Biezen, M. (2023). Laden van elektrische auto's in Nederland. In Nationaal Laadonderzoek 2023.

trend - technisch

Welke vormen van slim laden...
[N=2.930]

... ken je? 57% / 56% / 59% / 69% / 74%
... gebruik je? 10% / 1% / 13% / 38% / 36%
... zou je willen gebruiken, maar gebruik je nu nog niet? 36% / 47% / 41% / 34% / 19%

■ Laadsnelheid laten bepalen door de capaciteit van het netwerk (langzaam als het druk is, snel als er weinig vraag is)

■ Laden en ontladen (bidirectioneel laden**)

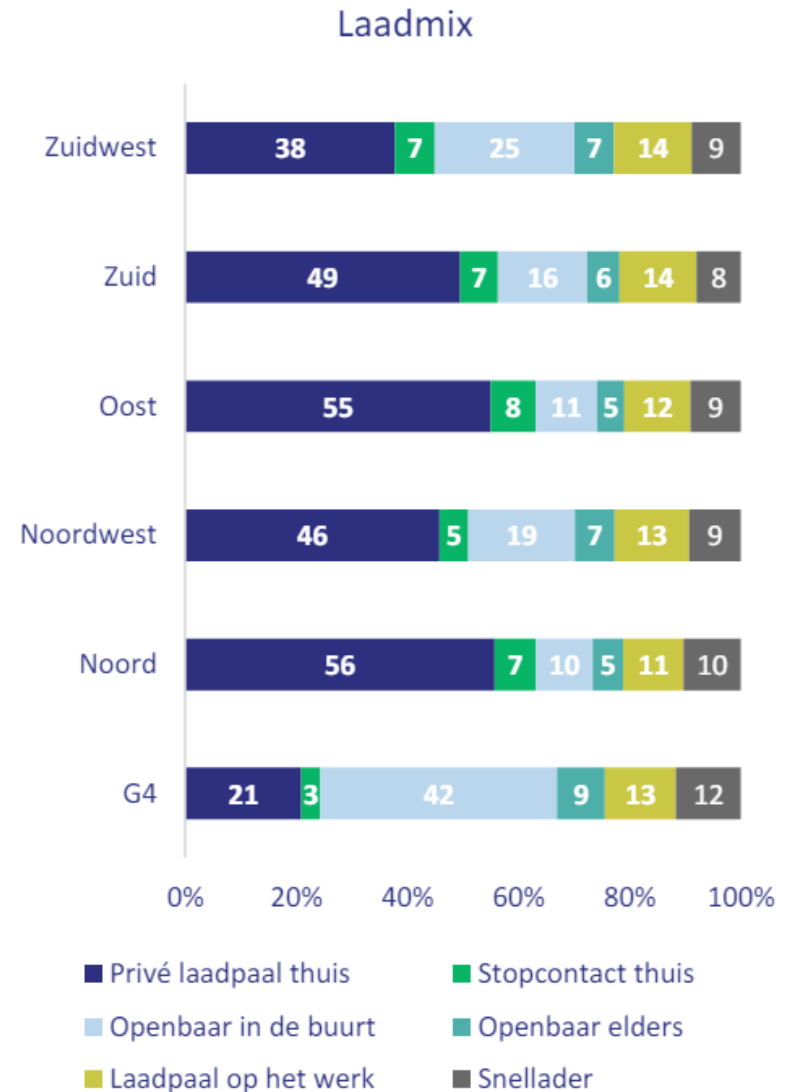■ Laden op basis van dynamische stroomtarieven* (EPEX)

Context

Laadmix per regio

De laadmix laat zien hoe er geladen wordt per regio. Hierin is terug te zien dat er in de randstad, G4, voornamelijk openbaar geladen wordt, terwijl in de rest van het land voornamelijk bij een prive lader thuis geladen wordt. Ongeacht regio is het aandeel laden op werk en gebruik van snellader even hoog.

Wolterman, B., Duurkoop, T., Haarhuis, A., RVO, Zweistra, M., Hiep, E., & Van Biezen, M. (2023). Laden van elektrische auto's in Nederland. In Nationaal Laadonderzoek 2023.

trend – demografisch

Laadmix

Regio	Privé laadpaal thuis	Stopcontact thuis	Openbaar in de buurt	Openbaar elders	Laadpaal op het werk	Snellader
Zuidwest	38	7	25	7	14	9
Zuid	49	7	16	6	14	8
Oost	55	8	11	5	12	9
Noordwest	46	5	19	7	13	9
Noord	56	7	10	5	11	10
G4	21	3	42	9	13	12

Legend:
- Privé laadpaal thuis
- Stopcontact thuis
- Openbaar in de buurt
- Openbaar elders
- Laadpaal op het werk
- Snellader

Context

Doelgroep – verschuiving van zakelijk naar particulier

Op basis van dit onderzoek kunnen we allereerst concluderen dat de tweedehandsmarkt voor BEV's inmiddels op gang is gekomen. Het elektrische autopark is nog jong. De tweedehandsmarkt is afhankelijk van het aantal elektrische auto's in het wagenpark, en dat is nu nog laag. De occasionverkoop groeit mee, maar het aanbod hierin is nog zeer beperkt in vergelijking met de occasionmarkt van fossiele brandstofauto's. Daarom functioneert de BEV-occasionmarkt anders dan die van de fossiele brandstofoccasions.

Terwindt, M., Uitbeijerse, G., Faber, R., & Kennisinstituut voor Mobiliteitsbeleid, KiM. (2023). De tweedehandsmarkt voor elektrische personenauto's.

development – economisch

Context

Groei in de markt nodig

Er is nauwelijks sprake van uitstroom van BEV's uit het Nederlandse wagenpark. Het gevolg is dat het aantal BEV's in Nederland gestaag toeneemt. Die toename is in de jaren 2020-2022 echter constant gebleven. Om de kabinetsambities met betrekking tot de forse verlaging van de CO_2-uitstoot in de mobiliteitssector te halen moet deze toename nog verder groeien. Bovendien streeft het kabinet ernaar dat autobedrijven in Nederland vanaf 2030 geen nieuwe brandstofauto's meer verkopen. Volgens een aangenomen Europees wetsvoorstel mogen nieuwe auto's en bestelwagens in Europa vanaf 2030 geen uitstoot meer veroorzaken. Om het huidige wagenpark in 20 jaar geheel te vervangen, moet de totale jaarlijkse instroom van het BEV-wagenpark toenemen tot ongeveer 450.000 auto's per jaar.

Terwindt, M., Uitbeijerse, G., Faber, R., & Kennisinstituut voor Mobiliteitsbeleid, KiM. (2023). De tweedehandsmarkt voor elektrische personenauto's.

State – economisch

Maatregelen	Rijksoverheid	Gemeentes / Provincies	Commerciële partijena	NGO
Situationele maatregelen				
1 Consument meer inzicht bieden in de TCO	(x)			x
2 Voorfinanciering bieden (voor auto of thuislaadpaal)	x		x	
3 Kostenverhouding tussen conventionele auto's en EV's veranderen in het voordeel van EV	x			
4 Bij lease de kloof dichten tussen elektrische auto's en auto's met een verbrandingsmotor	(x)		x	
5 Consumenten informeren over de beschikbaarheid van laadpalen en laadkosten	(x)	x	x	
6 (Gemeentelijke) regelingen voor laadpaalinstallatie gelijktrekken	(x)	x		
7 Kopers van elektrische auto's "ontzorgen" op het gebied van een thuislaadpunt		(x)	x	
8 Nationale en internationale dekking van laadpunten optimaliseren	x	x	x	
9 Streven naar uniform (Europees) laad- en betaalsysteem	x			
10 Informatie bieden over actieradius in de praktijk	(x)			x
11 Alternatieven voor EV's faciliteren bij sporadisch afleggen afstanden groter dan de actieradius	(x)	(x)	x	
12 Beleid gericht op huishoudens met meer dan één auto als kansrijke doelgroep	(x)		x	
Psychologische maatregelen				
13 Groot aanbod EV's om meer automobilisten te bereiken			x	
14 In communicatie over EV's ook rekening houden met emoties			x	
15 Volgende groep van potentiële particuliere EV-gebruikers aanspreken	(x)		x	x
16 Gebruikservaring laten opdoen	(x)	(x)	x	x
17 Het kennisniveau van autodealers in kaart brengen	(x)			x
18 Zorgen dat elektrische auto's als zodanig herkenbaar zijn	x	x	x	x
19 Zichtbaarheid laadpunten vergroten	x	x	x	
20 Objectief informeren over de duurzaamheid van EV's	(x)		x	x
Sociale maatregelen				
21 Publiekscommunicatie over groei aantal elektrische auto's	(x)			x
22 Elektrische autorijders en organisaties met EV's als rolmodel benutten	x	x	x	x
23 Overheid (zichtbaar) voortouw nemen met EV's voor eigen wagenpark	x	x		
24 Stimuleren en faciliteren van 'duurzame' sociale netwerken	(x)	(x)		x

Context

Slimladen – dynamisch tarief

Met slim laden speel je in op de wisselende stroomtarieven. Op het moment dat de tarieven het laagst zijn, laad je je auto op aan je laadpaal thuis. En wanneer de tarieven hoger liggen, probeer je juist zo min mogelijk energie te gebruiken. Op die manier kun je tussen de 25 en 75% besparen op je jaarlijkse laadkosten. Om slim te kunnen laden, heb je een dynamisch energiecontract nodig.

Laadkompas. (z.d.). https://laadkompas.nl/financieel/slim-laden/
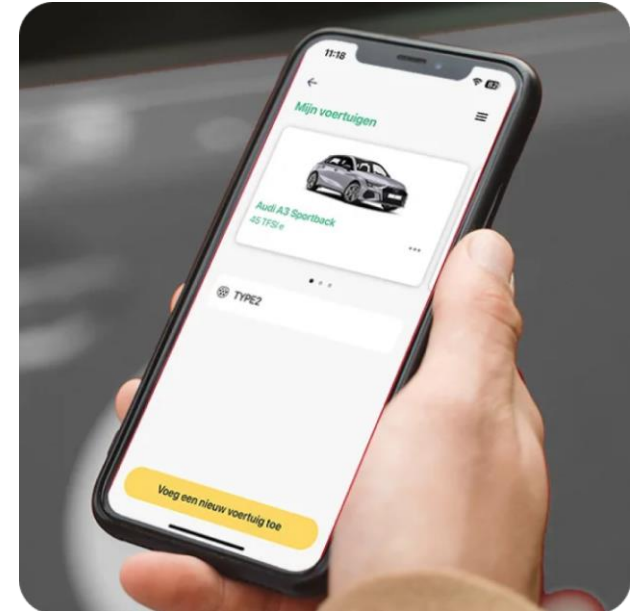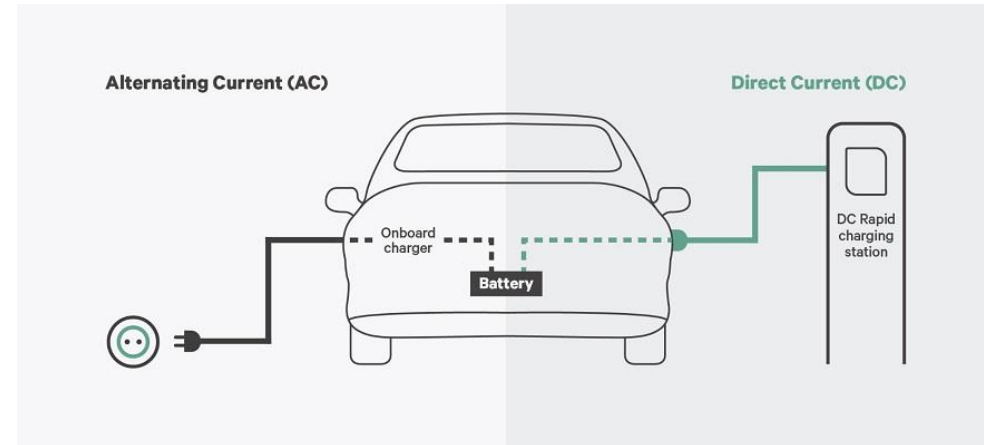

trend - technisch

Context

Bidirectioneel laden

Wanneer je regulier een elektrische auto oplaadt, gaat de elektriciteit van de meterkast door de lader de auto in. Bij bidirectioneel laden, kan de elektriciteit ook van de auto naar de lader en vervolgens de meterkast. Zo kan je de auto gebruiken als energieopslag aan de woning. Op dit moment zijn er weinig laders en auto's die dit kunnen. Verwachting is dat dit toe gaat nemen.

Team, W., & Team, W. (2021, 31 maart). Why Bidirectional Charging is The Next Big Thing for EV Owners. New. https://blog.wallbox.com/why-bidirectional-charging-is-the-next-big-thing-for-ev-owners/
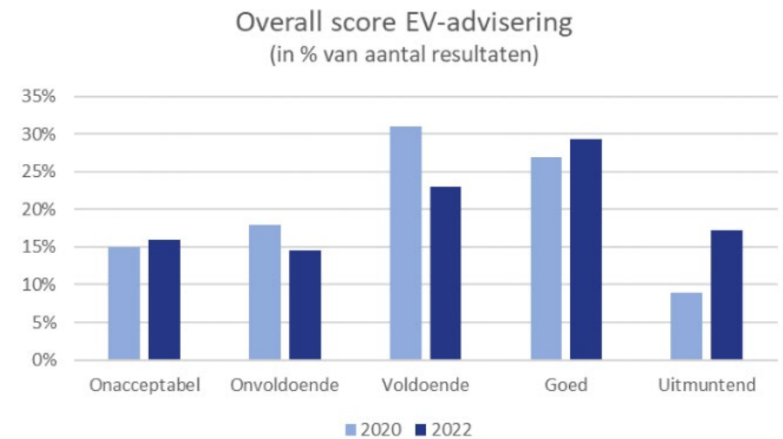

trend - technisch

Context

Advies elektrisch rijden

De kwaliteit van het advies over elektrisch rijden wisselt sterk. Vergeleken met ons eerdere mystery shopping onderzoek is duidelijk dat de groep die "onacceptabel" scoort gelijk is gebleven, maar dat in de andere categorieën een stevige verbeterslag heeft plaatsgevonden van voldoende naar meer "goed" en "uitmuntend. Nog steeds is een deel van de verkopers te karakteriseren als echte "EV-ambassadeurs" en een deel als een "EV-amateur".

Vereniging Elektrische Rijders. (2022). VER mystery. In Onderzoek 2022 (pp. 2–7). https://www.evrijders.nl

Overall score EV-advisering
(in % van aantal resultaten)

State - sociaal

Context

Complexiteit EV rijden

We zien dat de algemene kennis over (de voordelen van) een elektrische auto veel beter op orde is. Elektrisch rijden gaat echter voor een groot deel niet over de auto maar over opladen, laadpassen en laadinfrastructuur. De EV-koper heeft zich juist hierin verdiept en gaat uit van een verkoper die hier professioneel in kan adviseren.

Vereniging Elektrische Rijders. (2022). VER mystery. In Onderzoek 2022 (pp. 2–7). https://www.evrijders.nl

State - sociaal

Context

Laadtarieven ondoorgrondelijk

De prijs voor het opladen van een elektrische auto bij een publiek laadpunt is vooraf vaak onduidelijk. En verschilt per gebruikte tankpas of app. Het vergt een hele studie om voordelig elektrisch te tanken. Dat constateert de Consumentenbond op basis van een steekproef.

Donat, J. (2022, 31 januari). Prijzen openbare laadpalen onduidelijk. Consumentenbond.nl.
https://www.consumentenbond.nl/nieuws/2022/prijzen-openbare-laadpalen-ondoorgrondelijk

# State - economisch

Context
Angst over stroomprijzen

Afgelopen jaren zijn de energieprijzen alle kanten op gegaan. Aan het begin van de Coronacrisis zijn de prijzen sterk gedaald, maar door de oorlog in Oekraine is de energiecrisis ontstaan en zijn de tarieven voor thuisladen sterk omhoog gegaan. 68% van de Evrijders maakt zich zorgen over stijgende stroomprijzen.

Lane, M. & Shell Recharge Solutions Europa. (2022). EV Driver Survey Rapport 2022.

Ik maak me zorgen over de stijgende stroomprijzen en wat dit betekent voor de kosten van mijn elektrische auto

68%
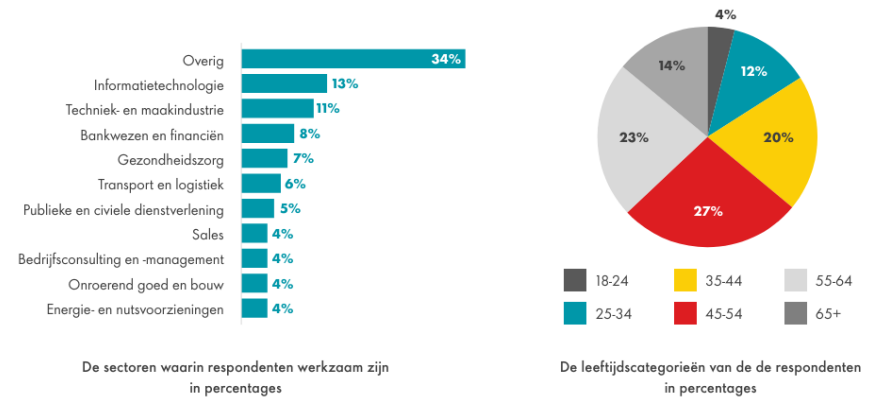Eens

14%
Oneen

7

State – Sociaal/economisch
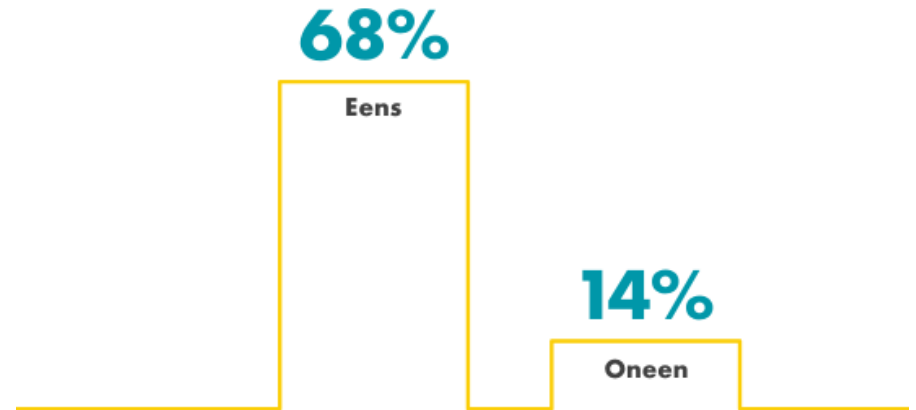
Context

Early adaptors

De EV Driver Survey is dit jaar ingevuld door 14,991 berijders die op dit moment elektrisch rijden, in vijf markten: het Verenigd Koninkrijk (2.853), Frankrijk (1587), Duitsland (6.272), Nederland (4.145) en België (134). Het grootste aantal participanten werkt in de IT sector. Op basis van de leeftijd en sector doen we de aanname dat EV rijden nog in de early adaption fase is.

Lane, M. & Shell Recharge Solutions Europa. (2022). EV Driver Survey Rapport 2022.

Fig. 2: Demografische gegevens
EV-rijders zijn vaak IT- en techniekprofessionals van middelbare leeftijd

De sectoren waarin respondenten werkzaam zijn in percentages

De leeftijdscategorieën van de de respondenten in percentages
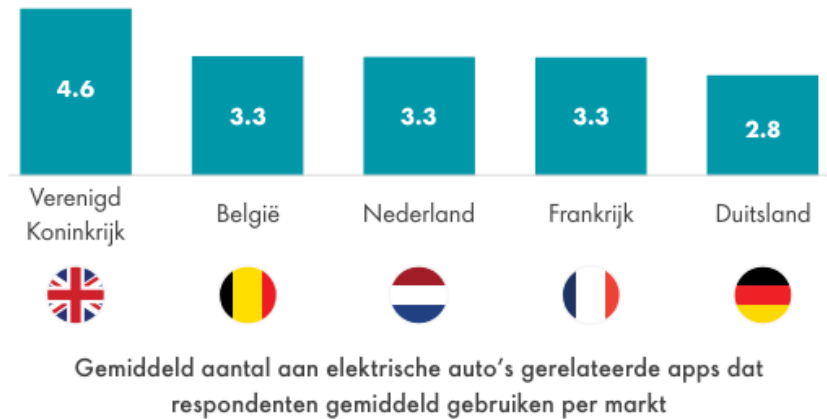
State – demografisch

Context

Te veel apps

De enquête laat ook zien dat er redenen tot bezorgdheid zijn als het gaat om het aantal apps, zowel laadpas-apps en als andere apps die bestuurders van EV's nodig hebben, waaronder apps voor aanvullende EV-functionaliteiten of navigatie. Dit krijgt minder aandacht in de branche, mogelijk omdat de opkomst van de markt van elektrisch rijden samenviel met een toch al enorme toename in app-gebruik in het dagelijks leven.

Lane, M. & Shell Recharge Solutions Europa. (2022). EV Driver Survey Rapport 2022.

Fig. 4: EV-rijders in het Verenigd Koninkrijk gebruiken veruit de meeste apps

Gemiddeld aantal aan elektrische auto's gerelateerde apps dat respondenten gemiddeld gebruiken per markt
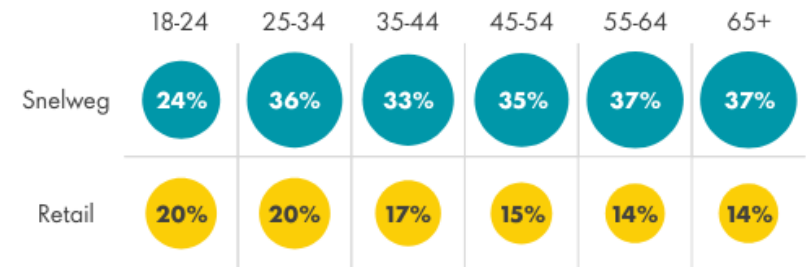
State – technisch

Context

Te langzaam laden

Zo vinden EV-rijders dat de laadsnelheden op publieke locaties te laag zijn. Op de vraag of de laadsnelheid op publieke locaties voldoende is, antwoordde slechts 47% van de Nederlandse respondenten dat alleen publieke laadpunten langs de snelweg dat inderdaad zijn. Dit aantal daalde naar 11% voor locaties in Nederlandse winkelgebieden en bij horeca. Leeftijd heeft een grote invloed op deze vraag. Jongere berijders zijn bijvoorbeeld minder vaak tevreden met laden langs de snelweg en oudere berijders zijn minder vaak tevreden over laden in winkelgebieden. De lage tevredenheidscijfers in het algemeen zijn een reden voor de branche om zich zorgen te maken

Lane, M. & Shell Recharge Solutions Europa. (2022). EV Driver Survey Rapport 2022.

Fig. 3: Oudere berijders zijn minder tevreden over de laadsnelheden bij winkels en horecagelegenheden

	18-24	25-34	35-44	45-54	55-64	65+
Snelweg	24%	36%	33%	35%	37%	37%
Retail	20%	20%	17%	15%	14%	14%

Percentage dat vindt dat bij deze locatie het laden 'snel genoeg' is

State – technisch

Context

Bereidheid uitgesteld laden

Dit is met name het geval als de veranderingen in gedrag leiden tot milieuvoordelen. Als de vraag over slim laden (dat onder andere de laadsnelheid in lijn brengt met de toevoer van duurzame energie) wordt geformuleerd als een slimme dienst, ondersteunt twee vijfde het idee. Maar als gepland laden wordt beschreven in de context van de totale belasting van het net, verdubbelt dit aantal zich naar vier op de vijf respondenten. De enquêteresultaten tonen duidelijk dat EV-rijders bereid zijn zich in te zetten als er duidelijker gesproken wordt over hoe het gebruik van laadinfrastructuur kan bijdragen aan duurzaamheid en netflexibiliteit.

Lane, M. & Shell Recharge Solutions Europa. (2022). EV Driver Survey Rapport 2022.

Principle – sociaal

Fig. 21: EV-rijders zijn heel flexibel in hun laadmomenten, vooral als ze hiermee bijdragen aan duurzaamheid

	2021	2022
Zou bereid zijn om een laadsessie later te plannen om een piek in de energievraag te voorkomen	73%	79%
Zou geïnteresseerd zijn in financiële voordelen als de accu van mijn elektrische auto mag worden gebruikt ter ondersteuning van duurzame energieopwekking	67%	66%
Denk dat slim laden een goede manier zou zijn om meer mensen enthousiast te maken voor elektrisch rijden	59%	59%
Zou bereid zijn om een langere laadtijd te accepteren om het landelijke gebruik van duurzame energie te helpen maximaliseren	57%	57%
Zou bereid zijn om iets meer te betalen voor een laadpunt met slimme diensten	47%	41%

Percentage dat het eens is met elke stelling

Context

AFIR – laden zonder laadpas

De AFIR is een verordening van de EU om de lidstaten te verplichten beleid te maken op de infrastructuur voor elektrische auto's. Onderdelen van de verordening zijn:

Zorgen voor een minimale infrastructuur zodat het voor alle vervoerswijzen en in alle lidstaten mogelijk wordt om voertuigen op alternatieve brandstoffen te laten rijden;

Zorgen voor de volledige interoperabiliteit van de vervoersinfrastructuur;

Zorgen voor volledige gebruikersinformatie en betalingsmogelijkheden voor alternatieve brandstoffen en andere infrastructuur.

Van Hulst, W. (z.d.). Verordening betreffende infrastructuur voor alternatieve brandstoffen (AFIR) - Europa decentraal. Europa Decentraal. https://europadecentraal.nl/onderwerp/vervoer/verordening-betreffende-infrastructuur-voor-alternatieve-brandstoffen-afir/.

Development – Politiek

Context

OCPP 2.0.1

OCPP is het industrie protocol voor de communicatie tussen laadpalen en laadpassen voor het betalen van de geladen stroom. De huidige standaard is OCPP 1.6 en komende jaren start de uitrol naar OCPP 2.0.1, dit zet de deur open voor nieuwe platform ontwikkelingen zoals:

Buiten ontwikkelingen op het vlak van data beveiliging, ontsluit OCPP 2.0.1 ook mogelijkheden voor alternatieve betaalwijze op de lader.

Daarnaast geeft het nieuwe protocol ruimte in de communicatie voor plug en charge en smart charging.

Open Charge Alliance. (2023). What is new in OCPP 2.0.1.
https://openchargealliance.org/wp-content/uploads/2023/07/new_in_ocpp_201-v10.pdf

Development – Techniek

Context

Plug en charge

Normaal gesproken als je een auto in het openbaar wilt opladen, moet je een laadpas gebruiken om de laadsessie te starten en te stoppen. Bij de plug & charge techniek, fungeert de auto als laadpas. Je stopt de kabel in de auto en de lader en de lader herkent de auto als laadpas. Dit levert meer gemak bij het laden van auto's.

Van de Wetering, G. D. S. (z.d.). Plug & Charge: Wat je als EV-rijder moet weten over ISO 15118. Vandebron. https://vandebron.nl/blog/over-plug-and-charge

Development – Techniek

Context

Autoloze steden

Gemeenten voeren autoluw beleid om uiteenlopende redenen. Veelal zijn dat het verbeteren van de kwaliteit van de leefomgeving, het stimuleren van lopen en fietsen, het verbeteren van de verkeersveiligheid en het verduurzamen van mobiliteit. Ook het vrijmaken van ruimte voor andere stedelijke functies, zoals groen of verblijven is een reden.

In minder dichtbevolkte gebieden zijn deze voordelen vaak kleiner, omdat ruimtegebrek een minder groot probleem is. Bovendien weegt het belangrijkste nadeel van een autoluw beleid, namelijk de verminderde bereikbaarheid per auto, daar juist zwaarder. Inwoners van deze gebieden zijn immers vaker afhankelijk van de auto.

Ministerie van Infrastructuur en Waterstaat. (2023, 26 september). Veel gemeenten zetten in op autoluwe stad. Nieuwsbericht | Kennisinstituut Voor Mobiliteitsbeleid. https://www.kimnet.nl/actueel/nieuws/2023/09/26/veel-gemeenten-zetten-in-op-autoluwe-stad#:~:text=Doelen%20van%20autoluw%20beleid&text=Veelal%20zijn%20da t%20het%20verbeteren_of%20verblijven%20is%20een%20reden.

Development – Sociaal
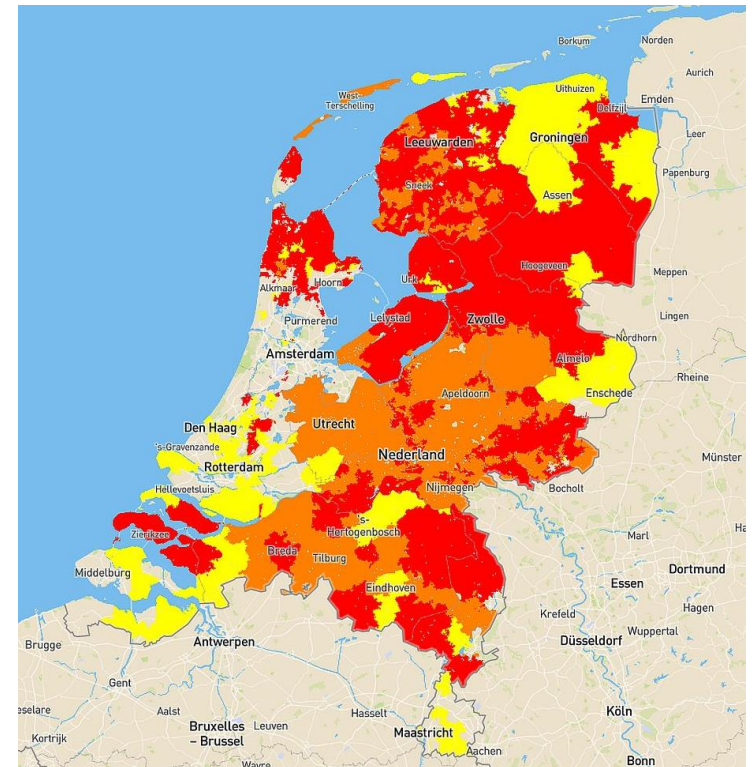
Context

Net congestie

n een groot deel van Nederland is het elektriciteitsnet zo goed als vol (netcongestie). Dit komt omdat de vraag naar en het aanbod van elektriciteit sneller groeien dan de uitbreiding van het elektriciteitsnet. Het kabinet neemt maatregelen om het net sneller uit te breiden en slimmer te gebruiken. Onder andere zodat huishoudens en bedrijven ook de komende jaren zoveel mogelijk verder kunnen verduurzamen.

Ministerie van Algemene Zaken. (2024, 25 april). Kabinet neemt maatregelen tegen vol elektriciteitsnet. Duurzame Energie | Rijksoverheid.nl. https://www.rijksoverheid.nl/onderwerpen/duurzame-energie/kabinet-neemt-maatregelen-tegen-vol-elektriciteitsnet-netcongestie
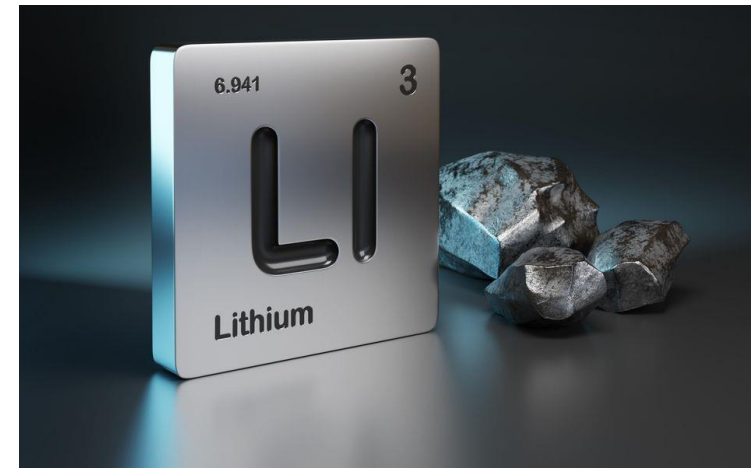

Principle - Technisch

Context

Grondstoffen accu's EV

De accu is nog lang niet duurzaam genoeg om twee redenen. Allereerst heb je voor accu's grondstoffen nodig, zoals kobalt en lithium. Kobalt komt maar op een beperkt aantal plekken ter wereld voor; naar schatting wordt tweederde van de kobalt gewonnen in de Democratische Republiek Congo. Mensenrechtenorganisaties doen regelmatig verslag van de slechte arbeidsomstandigheden in deze mijnen. Vaak vindt er ook kinderarbeid plaats. Ook aan de winning van lithium in bijvoorbeeld Bolivia en China zitten flinke schaduwzijdes, wat betreft mensenrechten, arbeidsomstandigheden, waterverbruik en aantasting van natuur. Dat willen we natuurlijk niet en moet anders. Ten tweede komt bij de productie van accu's nog steeds veel CO_2 vrij. Gemiddeld veroorzaakt het productieproces van de accu meer dan de helft van de totale uitstoot.

https://natuurenmilieu.nl/publicatie/elektrische-autos-en-accus-dit-is-wat-je-moet-weten/

Principle - Politiek

Context

Meer verbruik aan de woning

Uit profieldata onderzoek van Greenchoice klanten met een energiecontract en laadpaal aan huis, blijkt dat een lader aan huis ervoor zorgt dat het verbruik gemiddeld met 1500 kWh stijgt. Dit extra verbruik kan gebruikt worden om netcongestie tegen te gaan, wanneer de zon schijnt en de auto aan de lader staat.

Principle - techniek

Context

2030: geen fossiele brandstofmotoren verkopen meer

Om haar klimaatdoelstelling te bereiken om tegen 2050 klimaatneutraal te zijn, neemt de EU maatregelen om de uitstoot van auto's te verminderen, aangezien het wegvervoer goed is voor één vijfde van de CO_2-uitstoot in de EU. In juni 2022 steunde het Europees Parlement het voorstel van de Commissie om tegen 2030 geen CO_2-uitstoot van nieuwe auto's en bestelwagens meer te hebben. De tussentijdse emissiereductiedoelstellingen voor 2030 worden vastgesteld op 55% voor auto's en 50% voor bestelwagens.

De Nederlandse Europarlementariër Jan Huitema (Renew), die het rapport over de herziening van de EU CO_2-normen voor nieuwe auto's en bestelwagens opstelde, deed in juli mee aan een Facebook live over de nieuwe emissieregels, waarop deze Q&A is gebaseerd.

EU-verbod op de verkoop van nieuwe benzine- en dieselauto's vanaf 2030 uitgelegd | Onderwerpen | Europees Parlement. (z.d.). Onderwerpen | Europees Parlement. https://www.europarl.europa.eu/topics/nl/article/20221019STO44572/eu-verbod-op-de-verkoop-van-nieuwe-benzine-en-dieselauto-s-vanaf-2030-uitgelegd

State - Economisch

8.3 ITERATIONS

1ST ITERATION: CONCEPTS

Based on the characteristic **Ensured Accessibility**, three concepts were brainstormed. Happy Charging, Community charging and Optimal charging were written out in the first iteration by the project group.

Happy Charging

To prevent congestion in the grid on sunny days or when there is a lot of sustainable generation, Charge point operators will send signals through the app, to alert drivers of happy hour tariffs. By connection your car during a happy charge session, you gain credits for the loyalty system. The charge point operator prevented grid congestion and is able to offer the customer a customer share. Through this, the EV driver is able to charge cheaper and contribute to a more stable grid.

Community Charging

By community charging, people are able to register for a community platform for EV driving with Greenchoice. There will be two groups of customers in the community, EV drivers and Charge point providers. In order to maximize their investment in their charge point, people are able to register their private charge point in the community and rent it out to EV drivers. EV drivers have access to a broader range of charge points, to prevent range anxiety. Charge point providers have the ability to schedule the availability of their charging station, so they experience no impediments of the community.

Optimal charging

With optimal charging users are supported to use as much of their own sustainable generated energy, by charging publicly exactly what they need, so they can charge fully at home, while their solar panels are charging. By this, the app will automatically set a limit to the amount of electricity that the car will charge, in order to optimize the battery to have the maximum charge at home.

2ND ITERATION: CONCEPTS

The second session started with a recap of the previously thought of concepts. From this a choice was made to drop the optimal charging concept, since this only works for people with a home charger, but in 2030 the vast majority of people who drive an EV won't have a home charger. The concepts Happy Charging & Community Charging were explored further.

For the second session a template was made to fill in the concepts and create more depth. The template starts with the questions:

- What? What is the concept, what is the problem, what is the solution?

- How? Hoe does the concept work?

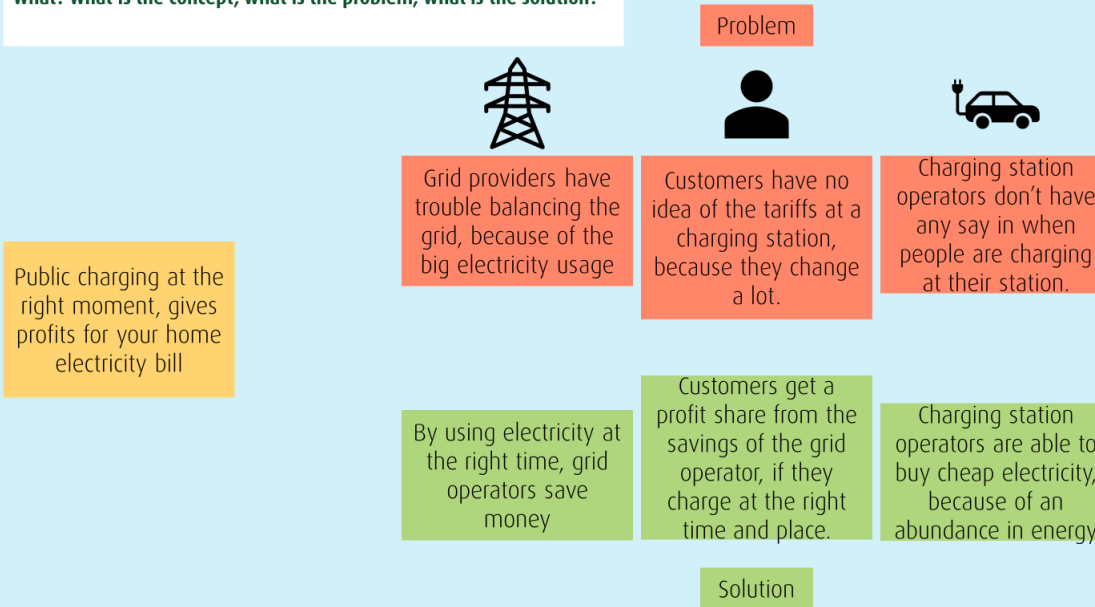- When? When does the customer use our concept?

To create better insight in the concept for the user, a storyboard was created per concept.

2ND ITERATION: CONCEPTS

Happy Charging
What? What is the concept, what is the problem, what is the solution?

Problem

Grid providers have trouble balancing the grid, because of the big electricity usage

Customers have no idea of the tariffs at a charging station, because they change a lot.

Charging station operators don't have any say in when people are charging at their station.

Public charging at the right moment, gives profits for your home electricity bill

By using electricity at the right time, grid operators save money

Customers get a profit share from the savings of the grid operator, if they charge at the right time and place.

Charging station operators are able to buy cheap electricity, because of an abundance in energy

Solution

Gerrit is driving towards its destination

He receives an alert about a happy charging block ahead

He selects the charger he wants and reserves the spot

He arrives at the charger and starts happy charging!

He receives a notification that the charging session finished

He goes to the car and plugs out the charger.

He receives loyalty points, because of Happy Charging!

With loyalty points, he can get discounts on his energy bill!

2ND ITERATION: CONCEPTS

Community Charging
What? What is the concept, what is the problem, what is the solution?

Problem

GREEN CHOICE

Customers opening their home chargers to use for other customers as public chargers

Public charging stations are a divided through concessions

Grid providers have trouble balancing the grid, because large number of energy generation

Homeowners have solar panels and a home charger, which is not optimal used, because of a lack of timing

EV drivers have a shortage in accessible charging stations

By placing chargers on customers ground, Greenchoice can provide charging infrastructure

By using electricity at the time of generation, grid operators save money

By letting other people use your charging station, homeowners can use their solar panels optimally and earn money

By opening the home charging infrastructure to users as public infrastructure, more charging stations are accessible

Solution

Gerrit is driving towards its destination

He is looking for a charging station, but there is none

He selects community charging and finds one!

He parks his car and starts charging in the driveway

He is charging with PV power generated by the house

The owner comes back at 14.00, so he plugs out.

Through the app he pays the owner of the charging station

By community charging he gets a cheap & green charge

8.4 CONCEPT INTERVIEWS

INTERVIEW 1

1. What is your experience with electric driving?

WDR: driving electric cars for work with pool cars, once a week. My father also drives electric, and she uses them too. Not planning to buy electric myself because it often causes hassle. The hassle is often about charging passes and the car's range. Charging stations that are occupied, even though the apps say they're not. Charging cables that get stuck, etc. Because of this, I consciously choose not to buy an EV for now.

2. What is your first impression of Happycharging?

Sounds like a good idea. Solar energy is often generated when you can't use it yourself, and this solves that problem.

3. Can you describe what Happycharging would do for you?

It takes care of things; it thinks for you. It provides a solution for using your own solar energy.

4. What appeals to you the most about Happycharging?

That it prevents you from losing money while generating energy.

5. What is unclear or confusing about Happycharging?

No, the storyline is clear enough. Is it actually about public charging points? That's what I assumed.

6. What do you feel is missing in Happycharging?

Not something specifically missing, but for expansion: being smarter with your energy surplus. It feels like there's more potential.

7. Would you use Happycharging?

Yes, anything that saves me money in regular use. Even walking a bit further isn't a problem. It could depend on the person's fitness.

8. Do you have any further feedback about Happycharging?

Maybe people would make different choices in bad weather. No one wants to walk farther in the rain. People could also just keep an umbrella in the car.

INTERVIEW 1

9. What is your first impression of Community charging?

Also a smart idea, but a bit more complex than Happycharging. One person could inconvenience another. The homeowner might be inconvenienced by the EV driver.

10. Can you describe what community charging would do for you?

Earn extra money if you have your own charger, or save money if you can charge at someone's home.

11. What appeals to you the most about community charging?

From the homeowner's perspective, selling your generated energy to passersby is very interesting. From the EV driver's perspective, Happycharging is more appealing than community charging. One just solves an availability problem for you, while the other saves you a lot of money.

12. What is unclear or confusing about community charging?

What happens if I, as a driver, don't leave on time, and what can a homeowner do if users stay too long? There should be a hefty penalty for that. I'm hesitant to sign up as a homeowner due to the risk of the car staying on the charger. Does the homeowner get the revenue from the charging session? Does the user pay the homeowner?

13. What do you feel is missing in community charging?

It's inconvenient that you have to deal with time slots when the charger is available. Worst-case scenario story. It's not explained: why would people want to rate?

14. Would you use community charging?

If the above issues were addressed and satisfactory, then yes, as a homeowner. As an EV driver, it would depend on the rate and the walking distance; there should be an overview.

15. Do you have any further feedback about community charging?

Everything has been mentioned. Add that there's a positive consequence for those who leave a review. Also, a positive consequence for receiving a good review.

INTERVIEW 2

1. What is your experience with electric driving?

DK: I don't have an EV myself, but my parents do, and I also drive an EV for work. It's pleasant, especially with a hybrid since you can just keep driving even if the range is small. Haven't had any range issues with fully electric yet.

2. What is your first impression of Happycharging?

Positive, it's great that you can charge with your own generated power. Question: I first return it to the grid and pay for that, then I charge it for free. Do I still have to pay for the energy I returned? I'm using the grid as a battery then.

3. Can you describe what Happycharging would do for you?

Use the advantages of a happy charger compared to a regular charger because it saves you costs. But only privately, as I don't have those costs for business use.

4. What appeals to you the most about Happycharging?

That you feel like you're really using the power you generated. Not wasting your sustainable energy and paying for it.

5. What is unclear or confusing about Happycharging?

It's confusing that you first pay for the returned energy and then use your own power again; this feels a bit odd.

6. What do you feel is missing in Happycharging?

Not really anything. It's already an advancement over current technology.

7. Would you use Happycharging?

Yes, privately. I wouldn't go out of my way for business use. Because of the private cost savings, it's interesting, especially if you can quantify how much energy you have left. This needs to be tangible.

8. Do you have any further feedback about Happycharging?

No, it's clear as it is.

INTERVIEW 2

9. What is your first impression of Community charging?

Nice concept, especially if you, as a homeowner, get extra discounts when you need to charge somewhere else. Also, you should make sure people don't use your driveway as a trash bin.

10. Can you describe what community charging would do for you?

Peace of mind, knowing there are enough chargers, especially in places where there aren't many in the city.

11. What appeals to you the most about community charging?

Especially as a homeowner, that your solar energy is put to good use and even paid for. As an EV driver, knowing you can always charge somewhere, and even shop around for cheaper chargers.

12. What is unclear or confusing about community charging?

Nothing, as long as the app is well-designed. It would work like a shared scooter: you reserve a charger, and then you can use it.

13. What do you feel is missing in community charging?

As a homeowner, you want assurance that people really follow the rules, like with Uber, where someone with less than three stars can't come by.

14. Would you use community charging?

Yes, reserving the charger for a specific time provides a lot of certainty. However, planning around departure times can be tricky. If meetings or events run long, it gets difficult.

15. Do you have any further feedback about community charging?

Good concept to encourage people to charge locally, to really use locally generated energy.

INTERVIEW 3

1. What is your experience with electric driving?

KVT: driving an electric car privately with my partner. Fantastic car, but the range is always a hassle, you can't go on vacation with it. If I had known that, I would have bought a hybrid. For commuting, it's great, but for longer trips, you really need to plan everything in advance.

2. What is your first impression of Happycharging?

I don't quite understand yet how it works. It might be useful, but I'm not sure if I would use it.

3. Can you describe what Happycharging would do for you?

When your panels generate energy, you still pay to return it to the grid, but then you can take it back. If you simplify it, it's only a cost-saving solution given the current return rates. It doesn't seem like a way to manage your energy return efficiently. Managing your return better at the moment within your household is more effective.

4. What appeals to you the most about Happycharging?

Cost savings are nice; it seems like a quick solution for the current return fees.

5. What is unclear or confusing about Happycharging?

It's not clear to me how this is connected to your meter. How does the conversion of your returned energy into a charging session work? What is the conversion rate, so to speak? You're still producing energy at home that you can't use, which adds pressure to the grid.

6. What do you feel is missing in Happycharging?

What I mentioned above, and the fact that there's still a range within which you park further away. I prefer convenience, walking 10 minutes when it's not necessary is really inconvenient.

7. Would you use Happycharging?

Maybe as a temporary solution, if it's fully developed and the conversions are clear. Do all charging points participate? What happens if someone arrives at the charger during my reservation?

8. Do you have any further feedback about Happycharging?

It depends on more explanation and enough coverage. If it's not usable often enough, it will fade away. It feels more like a feature in a larger app.

INTERVIEW 3

9. What is your first impression of Community charging?

I think that if I have an almost empty battery, I wouldn't want to charge at a regular station. If I'm on the road with an almost empty battery, I want fast charging, so I can always leave spontaneously. It's not unthinkable, but the charging speeds are just a bit too low. In rural areas with fewer chargers, this is really great. Charging from a regular socket is far too slow. A solution for when you're not in your own region, for example when you're away or in Belgium/BENELUX. It's more of an emergency measure.

10. Can you describe what community charging would do for you?

If you're stressed about charging your battery and you can always charge somewhere, this is a good solution. Also, because it's easy to search in a limited area. It takes the stress out of charging.

11. What appeals to you the most about community charging?

Peace of mind, another layer of certainty. You never have to search for a charger. It would probably be more for daytime use since homeowners mostly charge at night themselves. For users, it would be nice to filter by availability times.

12. What is unclear or confusing about community charging?

Clear story, but the exact details about how the costs will work out are still open. How do the payments work, etc.?

13. What do you feel is missing in community charging?

Nothing really, it's a clear story. Especially for less densely populated areas with fewer charging stations, this is a good solution.

14. Would you use community charging?

Yes, as an emergency solution in less populated areas. Also nice to avoid parking fees in urban areas.

15. Do you have any further feedback about community charging?

None, everything is already said

INTERVIEW 4

1. What is your experience with electric driving?

BL: Drove a lot of electric cars a few years ago. At that time, the technology wasn't fully developed, and range issues were a big problem. Overall, I had a positive experience if the car is used as intended. Now, I've driven many different electric cars, and it's much easier. The availability of charging stations has also greatly improved. What's especially important for me is that I can now take active vacations with my mountain bike, though these trips need to be planned in advance.

2. What is your first impression of Happycharging?

It seems like a kind of virtual battery. It's a nice concept, especially to manage grid congestion and streamline everything. The idea of reserving chargers and having the app actively think along with you is neat. Overall, it's a cool idea.

3. Can you describe what Happycharging would do for you?

I can't install a charging station at home, but if my solar panels could store energy in this virtual battery, that would be a good solution. It might even be worth adding more solar panels then.

4. What appeals to you the most about Happycharging?

I really like the idea, especially how the app thinks along with you to charge your car efficiently, so you don't have to figure it out yourself.

5. What is unclear or confusing about Happycharging?

I'm curious about what happens if everyone stops their charging sessions remotely but leaves their car parked. You'd still end up with too few charging spots.

6. What do you feel is missing in Happycharging?

I want to know in advance how it's determined when you can use Happycharging, so I can plan accordingly.

7. Would you use Happycharging?

At the moment, it's not 100% necessary for me because I don't have solar panels. Also, I don't have a private EV, so it doesn't really matter.

8. Do you have any further feedback about Happycharging?

As long as the net metering system is in place, this isn't super interesting. Can you possibly use this to control smart devices in your home?

INTERVIEW 4

9. What is your first impression of Community charging?

Nice idea. The funny thing is, everything is presented as if you're commuting to work, but I work in a very remote area, so I imagine using this when visiting people. It's a good way to reduce the pressure on the public charging network. I'm not sure how comfortable I'd feel about having people park on my driveway though.

10. Can you describe what community charging would do for you?

It would expand the public charging network for me. It could be an option in the future to provide my own charging station, to recoup the investment faster. But I'd want to define clearly where it's placed.

11. What appeals to you the most about community charging?

The cost savings and the ability to earn money back. The idea of creating a community where people help and support each other, but also monitor each other through a rating system.

12. What is unclear or confusing about community charging?

I'm curious about how enforcement will actually work. What happens if someone stays too long? If someone charges for too long and I can't charge, then that car just needs to go. The money won't help me.

13. What do you feel is missing in community charging?

Concrete actions in case of issues. It's also important to have some sort of emergency plan in place. What if someone damages the charger or if it breaks down?

14. Would you use community charging?

Not really useful in an industrial area... but maybe if I'm visiting someone or if I could charge at neighboring businesses, that would be cool.

15. Do you have any further feedback about community charging?

Nope, thats it.

INTERVIEW 5

1. What is your experience with electric driving?

I drive a private Tesla for both work and personal use. Primarily driving electric is really fantastic—super easy and comfortable due to the technology. With the home charger, I never worry about charging. I almost never charge away from home, and the sustainability aspect is also a plus.

2. What is your first impression of Happycharging?

Exciting! Especially that you can still use the energy you've generated. I'm just not sure if I'd park 10 minutes away—this often doesn't fit into my schedule. But if I plan for it, I could probably adjust. What does the charger look like? It almost never happens that I drive to work with an almost empty battery.

3. Can you describe what Happycharging would do for you?

It allows you to use the energy you generate later. However, it's not exactly my solar energy being stored. I would want to be sure that I'm not just getting gray energy. I need to be certain that it's still 100% green energy.

4. What appeals to you the most about Happycharging?

What it ultimately does is make EV driving easier and more attractive, which is a great way to encourage positive behavior.

5. What is unclear or confusing about Happycharging?

Can I leave my car parked there all day? I don't want to walk 10 minutes in the middle of the day to pick up my car. The idea that you might drive to work with an almost empty battery seems strange to me. That scenario doesn't really make sense. It would be more interesting if it were on the way back home. Also, it's not clear how it works if I generate 10 kWh of 100% green energy at home and then load that energy back tomorrow. There's a bit of skepticism—it feels too good to be true.

6. What do you feel is missing in Happycharging?

Transparency about energy generation. Nothing else.

7. Would you use Happycharging?

I'd try it out, but the added value would be small since I have a home charger. What does hold me back is the need to log into apps, and the possibility of being logged out. It feels a bit fragile if you have to depend on it. A physical token would be a nice alternative

8. Do you have any further feedback about Happycharging?

The steps in the app should be really simple. I don't want to spend too long setting everything up. Also, it's important that it feels reliable enough to provide so much information and link accounts. I trust GC because it's also my energy provider, but it needs to be clear.

INTERVIEW 5

9. What is your first impression of Community charging?

Happycharging is more interesting because it ensures that excess energy doesn't go to waste. That's not really the case with community charging. The combination of both could be interesting. The idea of leaving with an almost empty battery in the morning doesn't happen if you're paying attention. I find it complicated to make a charger public. If I had known that, I would have installed my charging point closer to the driveway entrance. Setting the price is also tricky—I'm not exactly sure what I pay for my electricity. It's also awkward that as a user, you can see whose charger it is. I wouldn't want people knowing my name when they come to charge.

10. Can you describe what community charging would do for you?

It feels like an unnecessary emergency solution. With proper planning and knowing your car well, this shouldn't be necessary. However, it could be a way to ensure that my generated energy is consumed at the moment, so it doesn't go to waste.

11. What appeals to you the most about community charging?

It would be great if I could let others use my charger when my solar panels are generating energy. I prefer using the solar energy immediately; otherwise, it feels like it's being wasted.

12. What is unclear or confusing about community charging?

Why would the charger be blocked starting at 2:00 PM? What is that based on? Do I need to set that up for every day? I also find it odd that strangers would come onto my driveway. My partner has a protective job, and we don't want strangers showing up uninvited. Privacy is quite important to us.

13. What do you feel is missing in community charging?

What's the flexibility in removing the car? What if I'm unexpectedly delayed? Also, the availability of both concepts is scarce and unpredictable.

14. Would you use community charging?

I'm unsure. There are still quite a few concerns that prevent me from being enthusiastic about it right away.

15. Do you have any further feedback about community charging?

The concept would fit better if, for example, you had an appointment outside of home. But even then, I'd prefer to charge at home. Maybe I'd use it on the way home to have a more relaxed drive.

INTERVIEW 6

1. What is your experience with electric driving?

BF: Business electric driving with a company charging station at home, fully electric for 2 years now. It was a bit awkward at first because of the need to plan more due to range, but now I'm completely used to EV driving—it's become second nature.

2. What is your first impression of Happycharging?

Innovative, a great solution to use your excess energy instead of sending it back to the grid without needing a battery. I am curious, though, about what the app would cost.

3. Can you describe what Happycharging would do for you?

It would offer cost savings and convenience. The app checks where it's best for me to charge, including making reservations. It sounds like a lot of convenience and cost savings.

4. What appeals to you the most about Happycharging?

The smart use of energy generation. It provides control by allowing you to make use of your own energy generation instead of wasting it. It feels like you have a choice.

5. What is unclear or confusing about Happycharging?

No, everything is clear.

6. What do you feel is missing in Happycharging?

It seemed like it's only available for public chargers. Is it possible to use it later at your own charger?

7. Would you use Happycharging?

Yes, I think so, but I wouldn't need it much due to my home charger.

8. Do you have any further feedback about Happycharging?

No, not really.

INTERVIEW 6

9. What is your first impression of Community charging?

Convenient, it offers more opportunities for charging. The blocked times are somewhat restrictive though.

10. Can you describe what community charging would do for you?

If you work near a residential area, you'd have unlimited access to chargers. You'd always have enough range for work or appointments.

11. What appeals to you the most about community charging?

The anonymity aspect—you don't have to knock on someone's door. Especially if the homeowner is expecting you, it makes the whole process very easy for both parties. Also, being able to see via the app that a charger is available for you to use is a plus.

12. What is unclear or confusing about community charging?

Everything is clear. The concept is well explained.

13. What do you feel is missing in community charging?

Fast charging options. But people don't install those at home…

14. Would you use community charging?

Yes, definitely as an EV driver—it's totally fine. As a homeowner, I'd like to know more about what happens when someone overstays their parking. Ideally, the car would be lifted and removed when the time is up.

15. Do you have any further feedback about community charging?

No thats it.

INTERVIEW 7

1. What is your experience with electric driving?

TVDM: I've been driving electric for 5 years, never had a home charger. EV driving has really improved over the years. I drive a lot, but you can drive efficiently. You do need to plan your trips, especially long ones. Charging infrastructure, both nationally and internationally, has improved greatly. The variety and quality of cars have also improved. Public charging costs, however, have increased significantly.

2. What is your first impression of Happycharging?

Great, it's nice that you can use your excess solar energy later. It's helpful that you don't need a battery. The cost of the service will be a factor. It's also convenient that the service takes care of finding a charger for you. It's good to see the savings from the concept right away.

3. Can you describe what Happycharging would do for you?

It would provide convenience by eliminating the need to search for chargers myself. Savings by not needing to buy a home battery. It could mean I wouldn't even need a home charger, as I could "store" my solar energy digitally. The price of the service and the availability of Happycharging slots will determine if I still need a home charger or not.

4. What appeals to you the most about Happycharging?

The name—it just sounds fun. And it's really easy to use. The simpler, the better.

5. What is unclear or confusing about Happycharging?

The concept is clear. I'm curious about the exact costs and how it works. How does the energy flow? I generate 100% green energy, but do I get exactly that back?

6. What do you feel is missing in Happycharging?

Show the differences between using and not using Happycharging. That would convince me more quickly of its benefits.

7. Would you use Happycharging?

Yes, I would. I have too many solar panels and no battery or home charger option. So I'd definitely use it if it helps me save on feed-in tariffs.

8. Do you have any further feedback about Happycharging?

I'd be willing to pay between 5-7 euros. I'd look at the feed-in tariffs I need to pay and how it aligns with the net metering system. If the finances work out, it'd be silly not to use it.

INTERVIEW 7

9. What is your first impression of Community charging?

It seems like it already exists, but it doesn't seem regulated, and no one seems to use it. I always check in the app what type of charging point it is. Often chargers are behind gates or on private property, and I wouldn't charge there. The concept is nice, though.

10. Can you describe what community charging would do for you?

As a business driver, not much—I don't pay for charging, so the rates don't matter to me. The scenario also reflects a lack of planning. You wouldn't go to work or an appointment unprepared, so the situation doesn't occur often. I could imagine this happening in Germany or Belgium.

11. What appeals to you the most about community charging?

The idea of giving each other reviews is good—it ensures safety. Both parties are motivated to behave properly because of this.

12. What is unclear or confusing about community charging?

What is a blocking fee? The stories don't seem consistent—one person says the blocking fee starts at 2 PM, and another says 6 PM.

13. What do you feel is missing in community charging?

A sort of minimum fee to avoid price competition in a street. Otherwise, you get a kind of market competition among neighbors. I also miss some sort of homeowner insurance—what happens in case of damage or other issues? Can additional services be offered at charging locations? It'd be nice if, for example, you could use a toilet.

14. Would you use community charging?

As a business driver, no, but I can see why it'd make sense for individuals due to cost savings and the possible availability of many chargers.

15. Do you have any further feedback about community charging?

Explain the blocking fee further—what's the difference between the regular fee and the blocking fee? What happens if I stay too long or give/receive poor reviews?

INTERVIEW 8

1. What is your experience with electric driving?

BL: 3 years driving EV, with very positive experiences. Despite not having a home charger, there are plenty of public chargers nearby, which makes it very convenient. The car has a large range now, so planning trips is easier. Having access to so many chargers ensures the car is always fully charged. However, when my lease ends, I wouldn't get a new EV due to fluctuating government policies making it too expensive.

2. What is your first impression of Happycharging?

I understand the concept. I'm missing the "unhappy flow"—what happens if there's already a car charging or if things don't work as expected?

3. Can you describe what Happycharging would do for you?

Cheaper electricity. It improves the business case for investing in solar panels. It also contributes to sustainability by using excess energy at the right time.

4. What appeals to you the most about Happycharging?

That it uses my own generated energy. The convenience is also very appealing—it feels like total peace of mind, as if I'm always charging my car at home at the right moments.

5. What is unclear or confusing about Happycharging?

The financial aspect is confusing, but maybe that's not needed right now. What happens if someone else is already at the charger?

6. What do you feel is missing in Happycharging?

A feature that ends the charging session once my own energy has been used. Do people get fined if they don't use their reserved time slot? Reserving spots at DC fast chargers would also be ideal.

7. Would you use Happycharging?

Yes, under the conditions mentioned, like walking distance and Happycharging availability.

8. Do you have any further feedback about Happycharging?

No, everything's been covered.

INTERVIEW 8

9. What is your first impression of Community charging?

Why wait? This idea has much more potential than Happycharging because you're letting others charge using your solar energy. The term "community charging" is misleading though—it's more about sharing, like a postcode energy cooperative. It would be great for and by Greenchoice customers.

10. Can you describe what community charging would do for you?

As a homeowner, not much, since I don't have a home charger. If I did, I'd happily let others charge so my sustainable energy gets used. As a driver, it's nice to have more available chargers and meet people while charging. It's kind of like Lync & Co, where you can rent or use your car yourself. It makes sense for personal use, but for business purposes, it's different—maybe if you're visiting somewhere without nearby chargers.

11. What appeals to you the most about community charging?

The efficiency. The chargers and the need for them already exist. It creates an extra coverage network, which is perfect. It's also fun to think about what additional services people could offer while charging.

12. What is unclear or confusing about community charging?

Are you considered an entrepreneur if you sell electricity?

13. What do you feel is missing in community charging?

The only downside is that it's mostly for the wealthy—they're the ones with driveways who can earn extra. How willing are they to have strangers on their property for just a few euros?

14. Would you use community charging?

Yes, absolutely. Even if I had a driveway, I'd be happy to offer more to others.

15. Do you have any further feedback about community charging?

No additional feedback.

8.5 CHARGESHARE INTERVIEWS

INTERVIEW 1

1. What is your experience with electric driving?

JDR: Has had an EV for business use for several years. Probably about 5 years now, this is the second EV lease car. Now driving a Mercedes, previously a Hyundai. Big difference in how the cars have developed. Initially, it was much more exciting to drive an EV for a whole day, now it's quite easy. Sometimes there are issues with charging in cities with faulty chargers or charger availability.

2. What is your first impression of Chargeshare?

Very extensive EV app like this! It needs to be well-structured; otherwise, it becomes too extensive. Will everything be free later on? It would be nice if you could make it free with the profits from smart charging. He also has a charger at home, but only one car can fit in the driveway. It would really be a problem if a car stays there too long. He would consider public charging if it becomes more profitable than home charging.

3. Can you describe what Chargeshare would do for you?

People can charge at his place when he's not home, hopefully using as much solar energy as possible. When he's on the road, Chargeshare ensures he gets a notification when to charge and where to do it. He wouldn't use it much if the cost is charged to his employer.

4. What appeals to you the most about Chargeshare?

Hopefully, I can sell my solar panel energy to passersby who charge at my place. But does this create some sort of market dynamics in the neighborhood when multiple people put their chargers online?

5. What is unclear or confusing about Chargeshare?

The app seems very extensive now and doesn't seem to have a clear goal anymore. It might be better if you could input your situation, so the app adjusts its functionalities based on your specific needs.

6. What do you feel is missing in Chargeshare?

How much will it cost, and how much will it generate? What happens when you use this with your business car? Can you also link another charging card so that my employer still pays for the charging, but you get the profits?

7. Would you use Chargeshare?

If your employer continues to pay for the electricity, but you can keep the profits, it makes sense. Otherwise, not so much for me. Sharing solar panel energy by allowing people to charge at home is useful for avoiding feed-in fees.

8. Do you have any further feedback about Chargeshare?

It seems very broad, maybe create a bit more focus?

INTERVIEW 2

1. What is your experience with electric driving?

JK: Has had a Dacia Spring for a few months as a kind of grocery car. Doesn't drive many kilometers, so range doesn't matter. Charging about once every two weeks is enough. In Rotterdam, charging stations are often full, but because of the low mileage, it's not a problem.

2. What is your first impression of Chargeshare?

It would be awesome if you could charge more with green energy! Right now, it's almost impossible to know what type of electricity you're charging with, so it would be great if that could be better tracked.

3. Can you describe what Chargeshare would do for you?

For her, it doesn't matter much, as she doesn't drive many kilometers, so there's not much to contribute. She almost always uses the same charging station because it's close to her home. She doesn't have her own solar panels or charging station, so it doesn't benefit her much otherwise.

4. What appeals to you the most about Chargeshare?

Carrying along your solar energy with you is really cool. Even if you don't have solar panels yourself, it's great to know that your energy is being used better.

5. What is unclear or confusing about Chargeshare?

No idea how the concept of carrying your solar energy would work or how it all works now, but energy matters are always quite complicated.

6. What do you feel is missing in Chargeshare?

What can I specifically get out of it? You want it to be for everyone, but if you don't have solar panels or a charging station or even drive many kilometers, then it's not very useful. So, it's not really for everyone.

7. Would you use Chargeshare?

Not in the current situation, because the car is not used much. However, it's nice that there's more focus on sustainability in charging.

8. Do you have any further feedback about Chargeshare?

If you can think of something she could use, she would definitely use it!

INTERVIEW 3

1. What is your experience with electric driving?

JVDB: EV for his own business, drives a lot, and this is his first EV. He only chose it because he could also install a charger at home. The range is usually sufficient throughout the Netherlands. Internationally, it's less well organized, but things are improving.

2. What is your first impression of Chargeshare?

Great idea. Hopefully, this will help reduce charging costs. Interesting how people always say they want to make their own choices, while so much is already pre-determined and massaged into the process. I would definitely use this to save on costs. Normally, when you're charging, your car is actually only charging half the time; the other half, it's already full.

3. Can you describe what Chargeshare would do for you?

I could recover the cost of my charger faster by letting other people use it. He could also charge up his solar energy surplus while on the road.

4. What appeals to you the most about Chargeshare?

Finances, that's what interests me the most. Why pay for things when you can make money from them?

5. What is unclear or confusing about Chargeshare?

He would like more clarity on how it works and what control you have over your home charger. What if he suddenly has to pay to charge at home? That's not the intention.

6. What do you feel is missing in Chargeshare?

A timeline on how exactly this is going to work would be helpful. What actions does someone have to take to charge at your home, and what do you need to do to receive the profits?

7. Would you use Chargeshare?

Yes! He has already chosen to drive electric because of the cost savings, and with this, it becomes even cheaper to drive an EV.

8. Do you have any further feedback about Chargeshare?

No.

8.6 PROJECT BRIEF

IDE Master Graduation Project

Project team, procedural checks and Personal Project Brief

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

- Student defines the team, what the student is going to do/deliver and how that will come about
- Chair of the supervisory team signs, to formally approve the project's setup / Project brief
- SSC E&SA (Shared Service Centre, Education & Student Affairs) report on the student's registration and study progress
- IDE's Board of Examiners confirms the proposed supervisory team on their eligibility, and whether the student is allowed to start the Graduation Project

STUDENT DATA & MASTER PROGRAMME
Complete all fields and indicate which master(s) you are in

Family name	Labee	7153
Initials	M.R.	
Given name	Max	
Student number	4667301	

IDE master(s): IPD ☐ DfI ☐ SPD ✔

2nd non-IDE master:

Individual programme *(date of approval)*:

Medisign ☐

HPM ☐

SUPERVISORY TEAM
Fill in he required information of supervisory team members. If applicable, company mentor is added as 2nd mentor

Chair	Ellis van den Hende	dept./section	Resp. Markt. & Cons. Behav.
mentor	Tobias Hebbink	dept./section	Meth. & Org. van Design
2nd mentor	Els Hoenkamp		
client:	Greenchoice		
city:	Rotterdam	country:	Netherlands
optional comments			

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

! Chair should request the IDE Board of Examiners for approval when a non-IDE mentor is proposed. Include CV and motivation letter.

! 2nd mentor only applies when a client is involved.

APPROVAL OF CHAIR on PROJECT PROPOSAL / PROJECT BRIEF -> to be filled in **by the Chair** of the supervisory team

Sign for approval (Chair)

Ellis van den Hende

Digitally signed by Ellis van den Hende
Date: 2024.04.22 15:19:20 +02'00'

Name Ellis van den Hende   Date 22 apr 2024   Signature

CHECK ON STUDY PROGRESS

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

Master electives no. of EC accumulated in total _____ EC

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

★	YES	all 1st year master courses passed
	NO	missing 1st year courses

Comments:

Sign for approval (SSC E&SA)

Robin den Braber

Digitaal ondertekend door Robin den Braber
Datum: 2024.04.26 12:08:51 +02'00'

Name _____ Robin den Braber

Date _____ 26 apr 2024

Signature _____

APPROVAL OF BOARD OF EXAMINERS IDE on SUPERVISORY TEAM -> to be checked and filled in by IDE's Board of Examiners

Does the composition of the Supervisory Team comply with regulations?

YES	★	Supervisory Team approved
NO		Supervisory Team not approved

Comments:

Based on study progress, students is …

★	**ALLOWED** to start the graduation project
	NOT allowed to start the graduation project

Comments:

Sign for approval (BoEx)

Monique von Morgen

Digitally signed by Monique von Morgen
Date: 2024.05.01 09:58:08 +02'00'

Name _____ Monique von Morgen

Date _____ 1 May 2024

Signature _____

Name student Max Labee

Student number 4,667,301

PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT
Complete all fields, keep information clear, specific and concise

Project title Developing the vision on mobility for Greenchoice in the year 2035

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

Introduction

Describe the context of your project here; What is the domain in which your project takes place? Who are the main stakeholders and what interests are at stake? Describe the opportunities (and limitations) in this domain to better serve the stakeholder interests. (max 250 words)

Greenchoice is a Dutch energy supplier, which started delivering green energy to its customers as one of the first in 2001. After more than 20 years as an energy supplier, relying on the sales of gas and electricity, Greenchoice has started a strategic recalibration. The new strategy focusses on shifting from a regular energy supplier to a platform for climate positivity, for customers to find their next steps in sustainability.

Greenchoice is shifting in business model and diverging their product portfolio. The team driving the product development is the Product and Pricing team, responsible for bringing specific market and tech knowledge of the new products. The team is new within the company and also responsible for introducing new products.

One of the new product categories is Electric Mobility. Greenchoice Electric Mobility serves customers with solutions for electric mobility, such as charging passes for public charging, home charging stations and backoffice software for business compensation of electricity use at home.

Currently these products are seperate propositions, similar to other competitors in the market. By combining the EV products, together with the energy supply contracts, intersting propositions could be made and a competitive advantage should be gained over the competition.

➡ *space available for images / figures on next page*

image / figure 1

image / figure 2

Problem Definition

What problem do you want to solve in the context described in the introduction, and within the available time frame of 100 working days? (= Master Graduation Project of 30 EC). What opportunities do you see to create added value for the described stakeholders? Substantiate your choice.
(max 200 words)

These EV products are currently seperated propositions, providing customers with the basics, however the propositions are not future proof in regards of changing EU directives. By combining these products in a new proposition would create a competitive advantage for Greenchoice. By testing the new ideas in an early stage along consumer needs, would mitigate risk in long term development. One of the challenges is the online expression possibilities, since the energy market is constantly evaluated by the Authoriteit Consumenten Markt (ACM). The new propositions need to be EU directive and ACM proof.

Greenchoice currently doesn't work with a structure of creating a product vision and formulating a roadmap. In their strategic shift from a regular energy supplier to a platform for sustainable products, their product development methods should evolve as well. There is a oppurtunity to implement a more academic and structured way of working for product development.

Assignment

This is the most important part of the project brief because it will give a clear direction of what you are heading for.
Formulate an assignment to yourself regarding what you expect to deliver as result at the end of your project. (1 sentence)
As you graduate as an industrial design engineer, your assignment will start with a verb (Design/Investigate/Validate/Create), and you may use the green text format:

Create a product vision on Electric Mobility for Greenchoice to improve the product-market fit of their Electric Mobility products and evaluate new products and propositions of the product vision with consumers

Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

The project will be consisting of different parts:
Research: execute market (competition, porter 5 forces) and trends analysis, company analysis (SWOT) and consumer interviews. By facilitating a workshop for the product and pricing team I want to validate these analyses.
Vision creation: develop workshops for the product and pricing team with the VIP method, to create a future vision for Greenchoice Electric Mobility
Consumer testing: create prototypes (using i.e. storytelling) for consumer testing to evaluate with consumers

Project planning and key moments

To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a **kick-off meeting, mid-term evaluation meeting, green light meeting** *and* **graduation ceremony**. *Please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any (for instance because of holidays or parallel course activities).*

Make sure to attach the full plan to this project brief.
The four key moment dates must be filled in below

Kick off meeting	16 Apr 2024

Mid-term evaluation	4 Jun 2024

Green light meeting	13 Aug 2024

Graduation ceremony	29 Aug 2024

In exceptional cases (part of) the Graduation Project may need to be scheduled part-time. Indicate here if such applies to your project

Part of project scheduled part-time	
For how many project weeks	
Number of project days per week	

Comments:

Motivation and personal ambitions

Explain why you wish to start this project, what competencies you want to prove or develop (e.g. competencies acquired in your MSc programme, electives, extra-curricular activities or other).

Optionally, describe whether you have some personal learning ambitions which you explicitly want to address in this project, on top of the learning objectives of the Graduation Project itself. You might think of e.g. acquiring in depth knowledge on a specific subject, broadening your competencies or experimenting with a specific tool or methodology. Personal learning ambitions are limited to a maximum number of five.
(200 words max)

I'm currently working as a product developer at Greenchoice, with the focus on electric vehicles. As a developer in the organization, I stumble upon the sluggishness and visionlessness of the company. I feel the urge to use the methods and disciplines of the faculty, to create more structure in the innovation process of Greenchoice.

Throughout my working years, the competencies I have constantly been corrected on, are my way of communication and assertiveness. Although these are also my core competencies, they also have a downside if used incorrectly.

Communication: I can be extremely direct and sometimes I speak before I think, breaking more than I can build in a conversation. In this project I will need to speak with people of all different layers of the company and I want to better my self in this competency to have a constantly positive outreach.

Assertiveness: In my previous years in a startup business unit, the mantra was: If you want something to go well, do it yourself. This works for smaller purposes, but for this project I want to use my assertiveness to tag people along instead of doing all the work by myself.