GREEN MILES

GreenMiles

Sustainable Design, TPD4200
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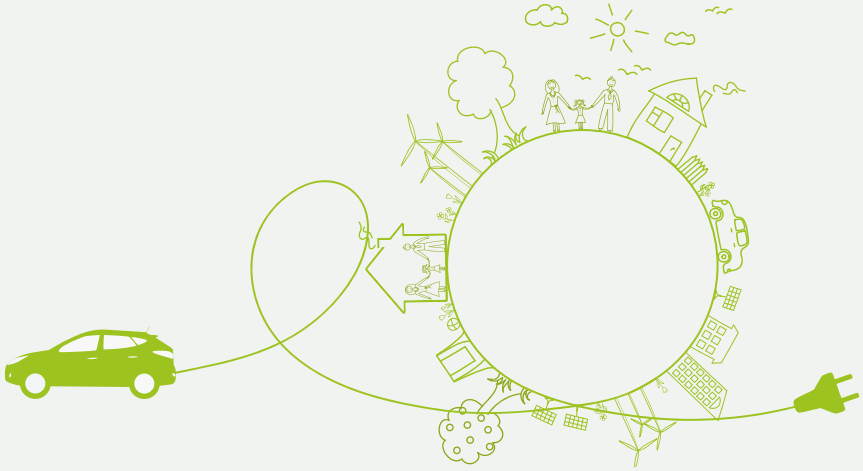
Content

Project Description



Introduction

Electric cars are seen as the future of transport and a major element needed for us to create a more sustainable future. In Norway, 64,5% of all new cars sold were electric (OFV, 2022) and more and more car brands are producing and developing electric vehicles. As the scale of production grows, the environmental impact will grow with it. So we want to find out how sustainable EV's really are and if there are any design solutions we can implement.

Background

The first car invented in 1828 was fully electric. At the beginning of the 20th century, cars began to rely more on gasoline or other fossil fuels. In 1901, the first hybrid car was produced. The demand for electric cars declined in the 1930s as the gas prices were more competitive. In the 1960s and 70s the gas prices increased and with it a newfound interest in electric cars. Then history repeated itself and the electric cars had a pushback in popularity in 1979, because the battery technology wasn't good enough performance wise compared to the combustion engine cars. In the 1990s the road towards the electric vehicle we have today, started. State regulations made it easier to produce them. Electric car batteries were invested in, and made more affordable for consumers.

A crucial part of the electric car (EV) is the battery, and usually these rechargeable batteries are lithium-ion batteries. These are liquid state batteries made up of several different metals, like lithium, manganese, cobalt and nickel, (a mixture called black mass). This makes it an energy demanding process to sort and recover all these materials to be reused once again.

Secondary research

Environmental impact of vehicles

Passenger cars are the biggest source of CO2 emissions within transportation, accounting for 41% of global transportation emissions that stands for 17 % of the global greenhouse gas emissions by all sectors. (SRD, 2022). So there is a big need for new technology within transportation to reduce harmful pollution, greenhouse gas and CO2 emission into the air.

Electric Batteries in transportation is the fastest growing technology and it is seen by many as the future of transport. But there are several other factors in today's battery technology that need to be solved in order to fit EV's into a circular economy and to make it a more sustainable, desirable and easier choice over petrol or diesel.

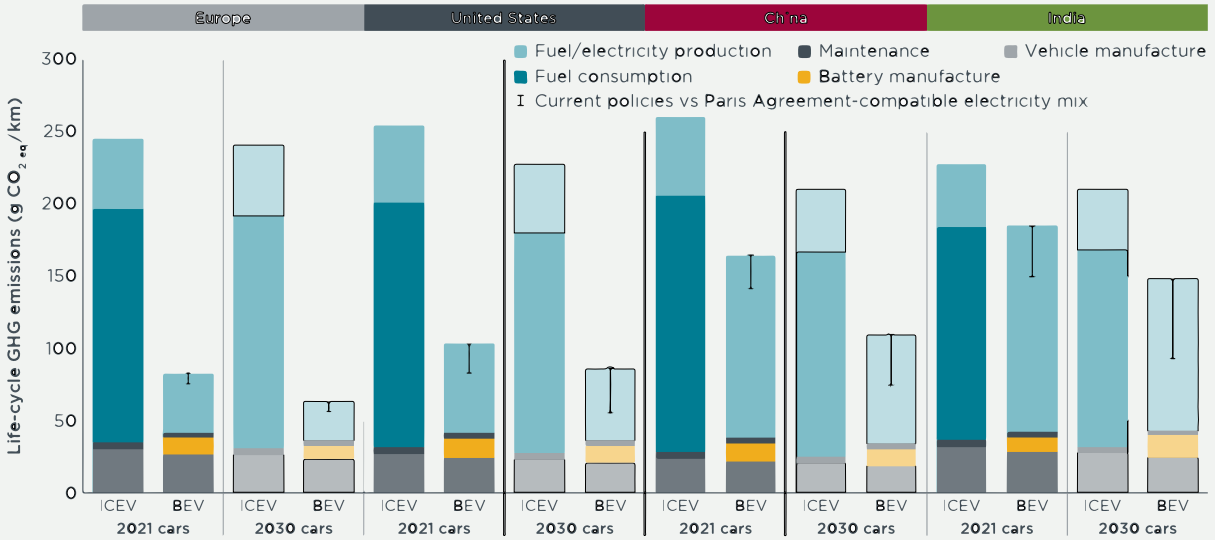


Figure ES.1 Life-cycle GHG emissions of average medium-size gasoline internal combustion engine (ICEVs) and battery electric vehicles (BEVs) registered in Europe, the United States, China, and India in 2021 and projected to be registered in 2030. The error bars indicate the difference between the development of the electricity mix according to stated policies (the higher values) and what is required to align with the Paris Agreement.

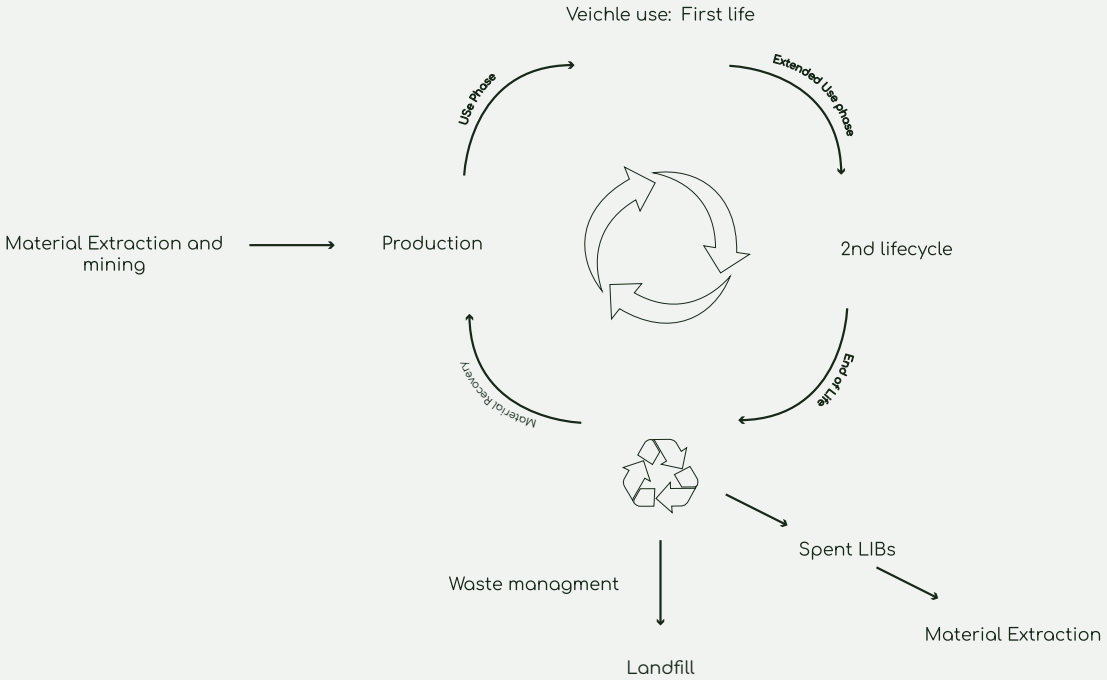
Lifecycle Assessment

The lifecycle CO2 emissions of medium segment battery electric cars produced in 2020 and used for 250,000 km would be between 18% and 87% lower than those of equivalent ICE vehicles in the five countries included in this report. The breakeven point is far sooner in France at 25,000 km, compared to 153,000 km in China By 2030, all countries will see this emissions breakeven point occur far earlier. (BloombergNEF 2021).

EV's have zero tailpipe emissions, but still have associated emissions from manufacturing and usage. Regulatory agencies in some countries are considering the possibility of using lifecycle CO2 emissions for BEV and ICE vehicles

As a result of the high efficiency of electric motors and the ability to generate electricity from low-carbon sources, electric cars typically have lower emissions in the use phase compared to similar ICE vehicles (ICCT, Georg Bieker, 2021).

The lifecycle of an EV is divided into four main stages, Material extraction and mining, production, use phase and recycling/repurpose.



Mining of raw materials

The raw material for electric batteries such as copper is mined mainly from countries such as China, Kongo, Argentina, Chile and Brazil. (Richard Backhaus 2021 Aug 27)
These are countries where there is an unethical work environment for the employees and they have been accused of deforestation and emission disasters.
The total material requirement (TMR) for making a BEV is a total of 70 Tons, which is higher than for ICEV that only processes 24 Tons of TMR.

Environmental impact of battery production

The CO_2 emission per kWh of electric vehicle battery capacity is varying between 56 to 494 kg CO_2/kWh). Studies estimate that the battery cell production will be down to 40.5 kgCO_2e/kWh as the technology evolves. Other factors that help lowering the emission is the efficiency and scale of the production. The producers can also rely on new natural gas boilers for the heating and drying process and use clean energy for other parts of the production. Of course all parts of the upstream supply chain and transportation of the battery cells also need to use renewable energy and clean machinery in the mines. (Transport & Environment, April 2020) (Transport & Environment, June 2019)

Usage - Driving and using the electric car battery
When taking well-to-wheel emissions into account, all-electric vehicles emit an average of around 4,450 pounds of CO_2 equivalent each year. By comparison, conventional gasoline cars will emit over twice as much annually. - This is heavily dependent on your geographical area and whether the charging stations you use are powered by renewable energy resources.

While driving an EV, the car doesn't emit any CO_2 into the air. However, the energy source that powers the battery come from coal or other unsustainable energy sources. Which also raises the question how environmentally friendly EV's really are. The electricity used in EV's should therefore come from sustainable energy sources like wind or solar.

Recycling

The two main ways of disposing electric car batteries are mainly through reuse and recycling.

Reusing electric car batteries happens because even though an electric car battery may eventually not be able to hold enough charge for powering a car it can in fact be used for other things, such as for storing extra power generated at solar power stations.
The only minor environmental impacts that reusing can cause are mainly consequences of transporting the batteries or any energy used to repurpose them.

The main goal for recycling lithium-ion batteries is to separate the materials within the battery so precious earth minerals like lithium, cobalt, nickel, and graphite can be used again to make new car batteries and any aluminum or plastic can be reused or recycled separately.
As electric car batteries are currently very difficult to separate into different materials they have to be done via the 2 main processes explained below.

Pyrometallurgy

This process involves burning EV batteries at high temperatures to remove any unwanted plastics or organic matter, and results in only a fraction of the original material being recovered – usually just the copper, nickel or cobalt.
A common pyrometallurgical process for EV batteries is smelting, which is simple but also not very ecologically friendly as the process requires the use of pollution-causing fossil fuels.
It also causes lithium and aluminum to be lost, making it a far from ideal way to recycle electric car batteries. Research into recovering lithium through the condensation of smelter off-gas, however, is currently underway.

Hydro-metallurgy

The most common hydrometallurgical process for EV batteries is leaching, which is the process of soaking lithium-ion cells in strong acids to dissolve the metals into a solution.
The success rate of recovering materials, particularly lithium, is much higher using this technique, but it can be a more expensive and complex process.

Overall the current recycling processes used are unsafe and consequently cause damage to both humans and the environment and require a lot of energy from potentially fossil fuels to be able to separate the materials.
The ultimate process we would favor before these two would be to design the battery so that it can be disassembled easily, without neither needing to burn or leach the battery.

Design Method

Discover:

Define the target user/problem
Secondary research
Primary research
Market research
Mind mapping Interviews Observations

Explore and define:

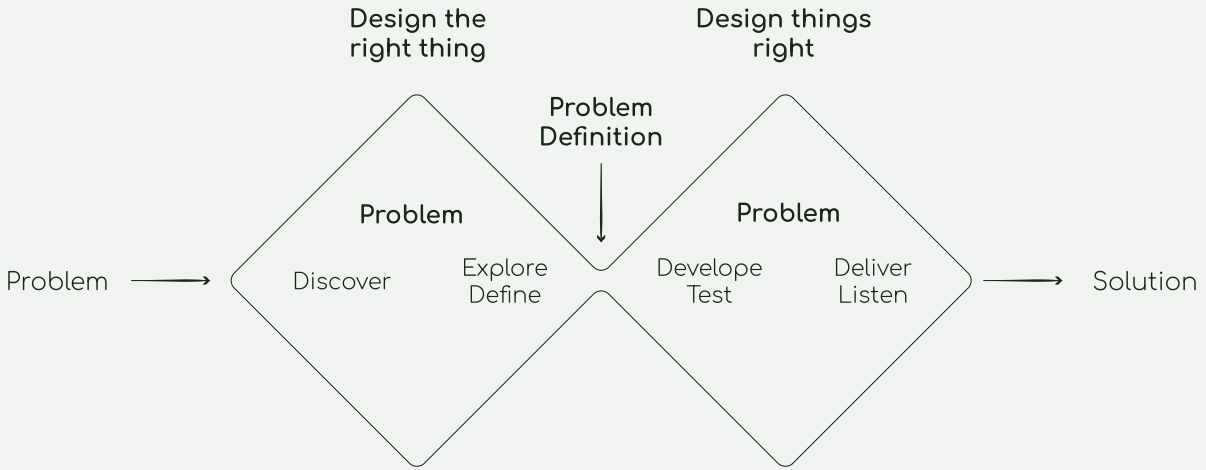
Problem statements
Personas
Information video -Sustainable design
Assignment 1

Develop and test:

Design brief - Sustainable design assignment 2
How might we - idea generating Dot voting
Concept mapping
MoSCoW
Heuristic evaluation
Competitor study

Deliver and listen:

Renderings
sketches
Early Prototypes/samples in Figma
Product Development
Poster - Sustainable design Assignment 3



Primary research

As part of our primary research we conducted several interviews to better define what are the main issues of sustainability within the electric car industry as well as understand where current consumers lacked information when purchasing an electric vehicle.

One person that we spoke to from the electric car industry is Roy Davies who is the founder of E-mobility search. Interviewing Roy was incredibly insightful and really highlighted for us that the main issue of sustainability with electric cars is in the life cycle of their batteries. Roy particularly highlighted to us the issues of the current mining and refinery process that are carried out to get precious materials for the manufacture of the batteries. "100 tons of Lithium iron ore is refined to only 4 tons of lithium meaning that 96 tons are thrown away and in a lot of cases are dumped into the sea". Roy showed us as a group that we needed to focus upon how we could put pressure on current car manufacturers to be more sustainable as the current processes used within the car batteries life cycles do not have the longevity to be used into the future.

We have also summarised the interviews we conducted in a table below so we can have a clear overview of the user's point of view.

Interviews

	Interviewed 1 - EV user from Norway	Interviewed 2 - EV user from Spain	Interviewed 3 - Potential user of EV, user of fuel car	Interviewed 4 - Potential user of EV, not owing any vehicle	Interviewed 5 - EV user from Spain
Why did/would you buy an EV?	Financially beneficial	Sustainability reasons. Decrease of pollution and noise in the cities.	Financially beneficial	Sustainability reasons	Sustainability reasons and financial benefits
Without those benefits, why would you not buy the EV?	"Range anxiety" - fear of running out of power	Charging time and low autonomy	Quality of the vehicle, I have the impression fuel powered cars are faster and safer.	Feel like it is even friendlier to use public transport.	Autonomy
Do you know about the emissions from production of EVs?	Yes, but I don`t know which is worse	Yes, but I feel it is still a better option that fuel cars	Of course producing them may have an impact, but don't know how high it is	I know there is a huge issue when it comes to recycling the EV batteries	Yes, but I would like to know more. I feel it is a hidden issue.
How do we make more people buy the most environmental friendliest cars?	Make a leasing or subscription service on only those cars that fits your premises for an ECO-friendly car	There is a lack of information and the car retailers are not encouraging the change to EV	Giving discounts for the most environmentally friendly options	Making the problem popular among the society, similar campaign as plastics in the ocean.	Banning the ones that are harmful for the environment.

The rest of the insights that we got from the interviews to the users are summarised in two personas. This exercise aims to describe the most popular feelings among EV users and potential EV users.

Persona 1

Demographics

- Luis, 47
- Barcelona Spain
- Architect
- Purchase level High
- Married, two kids (9 and 11)

Goals

Earn Money for his family
Have a successful career
Live a nice and healthy life
Make the world a better place

Behaviours/attitude:

Confident
Smart
self aware
Hard working
Family man

Problem Scenario

Luis is driving to work in his Passat through Barcelona. The air pollution in the city this day is terrible and he feel ashamed that he is contributing to this. He sees an electric car driving pass him but it doesn't give him any jealousy because he knows that that particular car is made in a country far away and that the battery does not have a good reputation.

Challenges

He is not proud of how much he commutes to work
Doesn't like the car he drives
Ashamed of his environmental impact
Too smart for his own good.
Always want to do better
Really needs a car to drive his kids to football practice

Solutions

Find a better way to get to work.
Make pushes that is better for his family and future generations
Make research on what is the best choice for him

Persona 2

Demographics

- Eva, 28
- Tomteråsen, Norway
- Owns her own BIO Coffee shop in Trondheim
- Purchase level Low/Medium
- Single

Goals

Travel the world
Be more eco friendly
Own a farm and to be 100% self sufficient
Be more informed about the environment

Behaviours/attitude:

Spontaneous
Not very bright but tries her best
Social
Caring

Problem Scenario

Eva is looking for ways to commute to work but she has trouble finding a reliable source of information about the different vehicles. The car manufacturers websites is just giving the information about the cars power output, acceleration and 0g CO_2 emission etc but not any information about the cars whole lifecycle. There is also no information about previous models nor

Challenges

Getting to work really early in the morning by public transport
Road tolls and gasoline prices is really high

Wants travel eco friendly but don't know what is the best solution

Solution

Car pooling
Find a reliable source of information about sustainable transportation
Find a car in her price range that is sustainable

Design analysis

Our group has divided our findings into the three categories that emerged from our analysis and research. Communication and information, realisation and trust.

Communication and information

There is little information from manufacturers about how sustainable their EV's are and for the consumer all EV seem to have the same sustainable impact and benefits. The materials used, production process reusability of every vehicle are not being communicated to the consumer.

Realisation

With lack of information and communication from car manufacturers about the environmental impact and sustainability of their vehicles, the consumption about EV's is highly miss-guided. There is clearly bad and good environmental choices when it comes to buying an EV but there is no clear communication about it which leads to a lot of miss-information and "green washing" from car manufacturers.

Trust

Car manufacturers in general have little trust among consumers and the word and promises from the companies is taken with skepticism. It's hard for a manufacturer to build up a trustworthy and good reputation, specially when it comes to sustainability and environmental impact.

Design Conceptualisation and Brain storming

We brainstormed to find some different solutions to the problem, both technical solutions like creating a new battery package, vehicle, recycling system and other non technical solutions that involved more focus on regulation, communication and information. We re-looked into the technical details and research on electric car batteries to see if we could find any loopholes or improvements that could be made in the mining, production, usage and recycling process.

New Battery platform

- Develop a new battery platform of dismountable solid states batteries that fits into a circle economy

New Car

- Who doesn't want to design a new car?

Disposal/recycling Reusing system

- Creating certified recycling facilities or organisations that are the only ones allowed to conduct the processes and which conduct all of the sub-process on one site so as to reduce the negative impact of transportation.

- In terms of reusing the batteries we also believe that the batteries when they become unusable for electric cars can also be used for storing electricity such as produced by solar energy plants. The rare earth materials that are within the batteries can also be reused to help create more batteries in the future, consequently generating a circular process for the production of the batteries.

Laws and regulation

- Laws and regulations to make car firms responsible for both the disposal of their electric car batteries and for them to in general use recycled materials with target rates for certain materials.

- Overall Regulating a standardised way of recovering materials (cooperation between manufacturers would also be ideal to implement with this)

Selection of final idea

We realised that finding a technical solution of a more sustainable EV battery or improving the recycling process is highly complicated and technical. From our research and interview discussions we found out that the information about how sustainable EV batteries really are is limited. We consequently then shifted our focus more towards what information is available about electric vehicles and how companies or third party organisations rate EV's.

We decided that we would put our focus on a system that certifies the whole electric vehicle and therefore make consumers more aware of how sustainable an EV is before they purchase it. So we widened our focus from not only the battery but to the whole vehicle in terms of assessing sustainability. We performed a competitor study of other kinds of certifications within the transportation industry. We also looked to other sectors to see how they operate, how they are founded and governed, how they work with third party certifiers etc.

To further understand the system and its different functionalities, we used MoSCoW to differentiate the functionalities into hierarchies. After further analysis throughout the process, we changed some parts of the MoSCoW but the core functions remained the same.

GreenMiles

Users

The GreenMiles certification is aimed towards consumers that are looking into buying an electric vehicle and car manufacturers who are making these vehicles. The manufacturers will want to have the GreenMiles certification on their vehicles to increase their reliability, impression of environmental responsibility and ethical communication toward consumers. The consumers will look towards a vehicle with GreenMiles certification because they want to feel that their purchase is entirely sustainable.

Analogy

You're at the supermarket to buy some chocolate. You're in the candy aisle but can't decide what bar to buy, the cheaper one looks sweet but it's not clear where the ingredients are from and you get the feeling that it's not a good buy. So you take the one with a FairTrade certification, it's a bit more expensive but it makes you feel like you did a good purchase and reassured that the ingredients and working conditions for the farmers are good. This is a similar storyline that we want to create with the concept of GreenMiles.

MSCW

Must

- Clearly communicate what it stands for: what cars are qualified for our certification
- Be informative
- Be ethical
- Be trustworthy
- Be independent/unbiased
- Provide both quantitative and qualitative information for the user and manufacturer

Could

- Show the consumer a custom choice for them considering: intended usage, appearance, top speed, range etc.
- Show any incentives that are related to the purchasing of an electric vehicle for the area of purchase
- Provide options that can actually be purchased near the users geographical location

Should

- Cooperate with Forbrukerrådet / NAF / Statens vegvesen/ Miljøverndirektoratet
- Consider a users geographical location and financial situation when suggesting options.
- Display all the certified manufacturers (*)
- Simple but powerful and aesthetic design

Won't

- Not provide a ranking of the "best cars"
- Force the user to make a certain purchase
- Display or use uncertified information
- Allow for advertisements

Stakeholders

Solving this issue would not only have an impact on consumers that want to buy an electric car but also stakeholders within the car industry and governing bodies. We made a stakeholders map to see who may be effected by our solutions and what areas/user we need look further info.

GreenMiles Team and partners

Employees
Researchers
Partners

Consumers

The solution will have an impact on consumers who is looking to either buy a car or ways of transport. Companies that want to lower their carbon footprint will also look into ways of making their transportation more sustainable

Industries

Mining
Transportation manufacturers
Recycling facilities

Governing bodies

UN,EU
Country leaders
Private investors

Certifiers and partners

The GreenMile certification should be tested by an independent 3rd party certifier to boost reliability among consumers and stakeholders. We did some research and found INTERTEK that is a 3rd part certifier that carry out quality testing for products, processes and systems. (Intertek, 2022)

GreenMiles would also want to partner with the FIA (Federation Internationale de l'Automobile). This is due to the fact that the FIA could massively help in terms of marketing and growing the presence of GreenMiles within the automotive world and they previously have supported similar organisations with funding to get them off the ground.

Another key partner to help GreenMiles develop and grow would be the Norwegian government and specifically the Norwegian Ministry of Transport. Their involvement would help to make in the long term the standards that are set by GreenMiles as legislation that Norwegian automotive manufacturers would be enforced to meet. With time the aim would also be to partner with other governments internationally to grow GreenMiles on a global scale.

How to get recognition and trust

The main key for us to gain trust by consumers and influential stakeholders within the automotive industry is via communication and especially marketing. The main way that an organisation that is setup similar to us (FairTrade) got themselves recognised by consumers was mainly through communication. We know that with initial funding from potential partners such as the FIA, Government, investors we can help to spread the word through marketing about what GreenMiles is all about. To gain recognition we would aim to create partnerships with influential stake holders such as the FIA and Ministry of Transport as these are already respected organisations.

To also get recognition and trust by the consumers and within the industry, we look to collaborate with other organisations and bodies that works towards the same goals and are already respected globally.

ISEAL is an organisation that supports sustainability systems in sectors from deforestation, marine, human rights, mining and textile. Other members are organisations like FairTrade, Rainforest Alliance Responsible Jewelry Council and more.
ISEAL help their members by:

- Defining credible practice for sustainability systems based on emerging global consensus
- Convening forums for collaboration, sharing of experience and collective action
- Delivering expertise, advice and training
- Facilitating and promoting innovation to strengthen sustainability systems.

Competitors/inspiration study

FairTrade

Fairtrade is an international organisation that certifies products based on their environmental impact, workers conditions etc. The organisation is well recognised around the world and is a member of Iseal. They focus mostly on products such as food and textile. (FairTrade, 2022)

Good Enviormental Choice “Bra Miljöval”

Good environment choice label is a Swedish non profit organisation that started to focus on labeling unbleached paper, mercury free batteries and laundry products but have now expanded to other products such as passenger transport, goods transport electricity supplies, insurance and more. On their website https://www.bramiljoval.se/produkter/ you can search for all the products and services that meets the criteria for their label. (Bra Miljöval, 2022)

EPA SmartWay

The United States Environmental Protection Agency (EPA) SmartWay program test and rate transportation systems in the US and globally. From personal transport to consumer products, supply chain etc. They also certify the 20% lowest-emitting passenger vehicles each model year, based on greenhouse gas and smog ratings. (EPA, 2022)

Car Answers "bilsvar.se “

Bilsvar is a Swedish based free service from the Swedish Consumer Agency that rates and compares different car models in regards to efficiency, emission, safety, economy technology etc. They have no labeling, just rating and comparison of car models. (Swedish Consumer Agency, 2022)

Logo and design profile

We wanted to create a friendly but powerful logo that you can trust and that gives you a sense of responsibility and sustainability. Since GreenMiles is not only focusing on just the car itself but also the environment and workers conditions, We wanted the nature and humans to have a central role in the label and a style that reaches a wide audience. The colours and typography is green, informative and brings a clear message to the consumer.

We worked on several different logos, fonts and colour pallets and

Typography

Title - Comfortaa Bold 36pt

Sub Title - Raleway Light 26pt

Body - Raleway 12

Quotes - Raleway Bold Italic 12

Logo

GREENMILES

GREENMILES

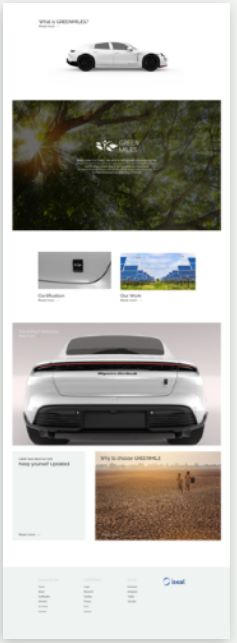
GREENMILES

Colours

www.greenmile.net

The website grenmiles.net is a platform for consumers and companies to read more about our labeling/ certification. There people can read about our work, cooperations, regulations and requirements. We also have a search tool to find our certified products and services.

We worked on the prototype for the website in Figma where we did different iteration and layouts of the pages



Vehicle label

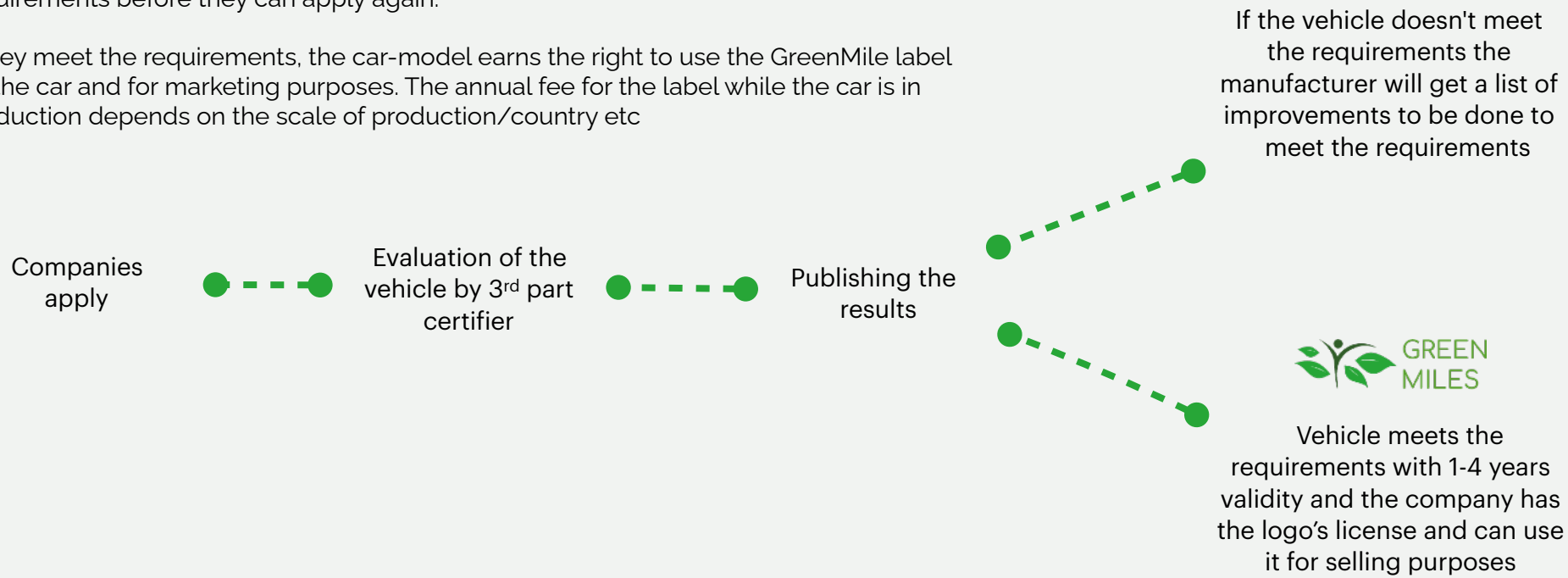
The GreenMiles Certification label is given to a vehicle that passes all the criteria for that production year. It should be placed on the the back of the car for clear visibility but so that doesn't effect the main design and aesthetics of the vehicle in a negative way. The label should be a powerful and recognisable symbol that gives you an immediate feeling of trust, authority and sustainability. If a car model meets the requirements for the label, the manufacturer can also use the label in for marketing and selling purposes but ONLY for that specific car model.

GreenMiles Requirements and milestones

How to get certified

The application for a GreenMile certification is straight forward and simple. The car company apply for the certification for the specific car models and pay a consulting/ application fee for 100 000-500 000€ depending on the scale of production, working hours etc. The car model then goes through testing via our 3rd party certifier that checks all the requirements for the label. The manufacturer is then notified with the results and gets direct feedback on improvements. If the car model doesn't meet the requirements, they will get a full list of improvements and consultation on how to meet the requirements before they can apply again.

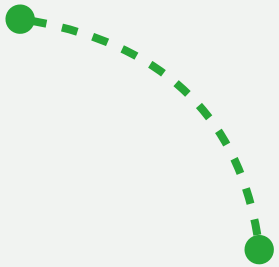
If they meet the requirements, the car-model earns the right to use the GreenMile label on the car and for marketing purposes. The annual fee for the label while the car is in production depends on the scale of production/country etc



Timeline

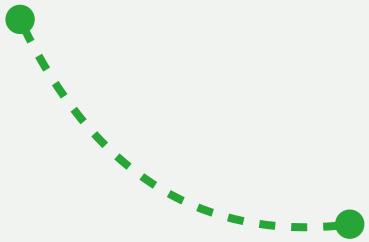
2022
Definition of the requirements for 2022

- All material and components of the vehicle must be 99% sustainable.
- 75% of all transportation during the product lifecycle must be 0g emission.
- 75% of all supply chain must be sustainable



2026
Definition of the requirements for 2026

- All material and components of the vehicle must be 99% sustainable
- 99% of all transportation during the product lifecycle must be 0g emission
- 85% of all supply chain sustainable



2030

Definition of the requirements for 2030

- Mining and extraction of raw materials down to 0%
- All material and components of the vehicle must be 100% sustainable
- 100% of all transportation during the product lifecycle must be 0g emission
- 100% of supply chain must be sustainable
- All batteries should be used within secondary applications as long as they follow the requirements
- 0 grams/mile greenhouse gas emission
- The whole lifecycle process must take place at the manufacturers site

User Testing and Feedback

Once our idea was better defined and we then designed some mockups showing the main points of our proposal. We then did some tests to potential users of our solution to gain their feedback. In general, the concept has interested and enlightened a lot of people. This phase has also made evident the information we found originally during our primary research. The analogy of buying a FairTrade labeled product as mentioned in **Analogy** was a relatable story to a lot of consumers and they would like to see this kind of information displayed via label on electric cars rather than hidden away on a manufacturers website. It was also commented that it sounded like a "cool" concept to have a label like this on your car.

From our user testing, we saw that there is a real need to inform consumers about the environmental impact of EV's. The general assumption is that all EV's are the same and by buying an EV you are instantly making an entirely environmentally friendly purchase. By showing consumers our solution, they become more aware of the problem and consequently are more open about doing more research when purchasing an EV.

From our user testing of the website prototype in Figma we got general good response, it was informative and simple layot. They also liked the function to search for certified car model on the sight. We could maybe work more with the “stock photos” and to put even more information on the website.

Ethics

In regards to ethics, throughout our data collection especially within primary research we made sure to conduct interviews within a manner of where both parties were agreed on how the data and research would be used. We always made sure particularly within interviews that the participants had full clarity on what we were asking and investigating overall as part of our project.

In relation to ethics of GreenMiles we would aim that throughout the development of the solution that no bias is allowed and that GreenMiles cannot be influenced especially in terms of the standards it sets. GreenMiles aims to hold car manufacturers accountable so we can create a more sustainable world for the future and within this focus of sustainability also comes the importance of human rights. Thats why GreenMiles would want to as part of the standards make sure that workers, employees, and stakeholders involved within the mining, manufacturing, and recycling of the electric cars are well looked after and not exploited in any manner. Ultimately the battle for sustainability also requires an element of focus on human rights across the world and so thats why GreenMiles as a solution would always aim to make decisions that are both ethical and sustainable.

Conclusion and discussion

We started the semester choosing a topic to work with the aim to try and improve elements of the topic from a sustainable point of view. From the beginning we knew that EV vehicles was a challenging topic and that it would be hard to make an impact on the car itself, however, we were all very interested in the topic and willing to work hard to come up with a solution.

The research showed us that there are many companies working on this issue. We saw two tendencies: companies that would “green wash” and companies who really want to make change and come up with a solution for the issue. This phase also made evident that we had no resources to come up with a re-design of a more sustainable vehicle. So at this point, we decided to focus on other problems related to our main issue: the environmental impact of EV vehicles.

Through the interviews we detected there was a feeling of the industry not providing enough information to consumers. This insight showed us an opportunity in the market. There is a major need to communicate the information regarding EV's environmental impact in an easily digestible way for potential consumers.

At this point, we decided to create a certification designed to label the EV's that meet the requirements established by the organisation. This proposal not only shows the user the right choice in an easy way, but also puts pressure on the manufacturers that will want to be able to label their cars with our certification.

Our goal was make people more aware of the problem and to have an impact in their choice of vehicle through design and aesthetics. Hopefully the label will be able to create a domino effect where more people will want to have the label on their chosen car to show how environmentally conscious they are. This will enforce manufacturers to act as well, in making their brand certified, so to keep their popularity and generate growth. In summary there will be an exponential growth overtime of cars with our certification. The power of a symbol is not to be underestimated, it can have a lot of impact on how people act, what choices they make and how a brand or service is communicated. We believe that GreenMiles label do just that and we are very proud of our solution.

Sources

- Martin Thoresen, elibil.no, 4. january 2022 https://elbil.no/rekordsterkt-elbilar/

- Published by Statista Research Department, Feb 22, 2022
https://www.statista.com/statistics/1185535/transport-carbon-dioxide-emissions-breakdown/

- Published by Statista Research Department, Feb 22, 2022
https://www.statista.com/topics/7476/transportation-emissions-worldwide/#topicHeader__wrapper
- Natural resource use of gasoline, hybrid, electric and fuel cell vehicles considering land disturbances. March 2021
Shoki Kosaiab mfl

- Battery Raw Materials - Where from and Where to? Richard Backhaus 2021 Aug 27
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8390110/

-Resources, Conservation & Rec. 2021
Shoki KosaiKenyu MatsuiKazuyo MatsubaeEiji YamasueTetsuya Nagasaka

https://www.sciencedirect.com/science/article/pii/S0921344920305711

- ICCT Briefing (FEBRUARY 2018)
https://theicct.org/sites/default/files/publications/EV-life-cycle-GHG_ICCT-Briefing_09022018_vF.pdf

- Bloombergm (February 16, 2021)
https://about.bnef.com/blog/the-lifecycle-emissions-of-electric-vehicles/

- ICCT, Georg Bieker (July 20 2021)
https://theicct.org/wp-content/uploads/2022/01/Global-LCA-passenger-cars-FS-EN-jul2021.pdf

- Transport & enviorment, (April 2020)
https://www.transportenvironment.org/wp-content/uploads/2020/04/TEs-EV-life-cycle-analysis-LCA.pdf

- Transport & enviorment, (June 2019)

https://www.transportenvironment.org/discover/batteries-wheels-role-battery-electric-cars-eu-power-system-and-beyond/

- FairTrade, (April 2022)
(https://www.fairtrade.net)

- Naturskydsföreningen (April 2022).
https://www.naturskyddsforeningen.se

- EPA SmartWay (April 2022)
https://www.epa.gov/smartway

- Bilsvar, (April 2022)
https://www.bilsvar.se

- ISEAL (April 2022)
https://www.isealalliance.org/about-iseal/who-we-are

INTERTEK - https://www.intertek.com/automotive/electric-vehicle/battery-certification/