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**Towards 2035: the impact of  
electromobility on consumer behaviour**

The strategy of premium carmakers to overcome customer biases and  
create a demand that does not exist.

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# Index

<b>Acknowledgements</b>	<b>6</b>
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<b>Abstract</b>	<b>8</b>
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## Chapter 1

**The theoretical perspective.**

**The roadmap towards 2035: European and Italian regulatory**

<b>framework to rule the transition.</b>	<b>12</b>
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1.1	The European Green Deal: an overview.	14
1.2	Fit for 55 and the focus on automotive industry.	16
1.3	Batteries and alternative fuels: the EU rules for a more sustainable power.	19
1.4	The Italian regulatory framework.	21

## Chapter 2

**The actual situation where the transition insert itself.**

<b>The background of the electromobility market.</b>	<b>24</b>
--	-----------

---

2.1	The cultural context.	25
2.2	The tangible context: analysis of the infrastructure.	29
2.3	The Smart Mobility market.	30
2.4	The evolution of the offer.	34
2.5	The survey of EV drivers.	36

## **Chapter 3**

### **The customer perspective: literature review.**

#### **Biases and scepticism towards electric vehicles. 40**

---

- 3.1 The economic perspective of the decision-making process:  
the link between rationality and behavioural economic. 40
- 3.2 Heuristics and biases: the literature review. 44
- 3.3 Customer biases and electromobility: the map of customer mindset. 49

## **Chapter 4**

### **The empirical evidence of the customer perspective: a survey**

#### **to understand which biases prevent people the most from EVs. 54**

---

- 4.1 Customer biases and electromobility: the overview. 54
- 4.2 Description of the sample. 57
- 4.3 Cluster 1: sales conversion inability. 62
- 4.4 Cluster 2: lack of trust in technology. 64
- 4.5 Cluster 3: living with the technology. 67
- 4.6 Cluster 4: desirability. 69

## **Chapter 5**

### **The perspective of OEMs: analysis of the strategy**

#### **of premium brands. 74**

---

- 5.1 The design-keeping of BMW towards 2035, how the brand is facing  
customer demand of EVs. 75
  - 5.1.1 From 2019 to 2025, the first strategy of BMW:  
Power of Choice. 75
  - 5.1.2 From 2026 to 2030, the NEUE KLASSE as the new

strategy of BMW.	80
5.2 Audi proposes a new ecosystem of product to face customer demand of EVs.	85
5.2.1 Unleash the beauty of sustainable mobility, consistently Audi.	86
5.2.2 Vorsprung 2030, PPE and a new naming strategy, the future of the Four Rings.	89
5.3 The strategy of Mercedes towards 2035, how the brand is facing customer demand of EVs.	92
5.3.1 Emotion and Intelligence, the values of Mercedes-Benz and the roadmap to achieve full-electromobility.	94
5.3.2 More visual, the aesthetic design of Mercedes-Benz vehicles.	97
5.4 THE player in the electric market: Tesla.	102
5.4.1 Not only cars, an innovation that concerns the entire business model.	104
5.4.2 Tesla marketing strategy: zero-budget and Elon Musk effect.	106
<b>Chapter 6</b>	
<b>Combining biases and strategies, the relation between demand and supply side of the electromobility market.</b>	<b>110</b>
<hr/>	
<b>Conclusions</b>	<b>124</b>
<hr/>	

**Appendix** **140**

---

Appendix 1 140

Appendix 2 151

**References** **162**

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*XVII.*

## Abstract

It is a well-known fact that one of the biggest arguments that is discussed nowadays since a few years is the issue of *climate change*, what it represents for nations and for the future generations.

Forbes in 2019 opens its article "*How does everyone feel about climate change?*" by stating that "*almost 90% of the world believes climate change is real*" (Conca, 2019), but different countries show different attitudes when talking about importance, triggering factors, future consequences and ability to cope with the changes this will bring. But what does *climate change* mean? It is defined as "*the long-term alteration of temperature and typical weather patterns in a place*" (National Geographic, n.d.). Concretely, this has an impact on nature in all its different forms.

The less predictability of weather patterns has consequences on farming first, food industry secondly and livelihood in the end. Consequences can be also seen through damaging weather events like hurricanes or floods that impact on infrastructures first, human security secondly and – again - livelihood in the end. Not to mention pollution, biodiversity and landscape alteration.

As can be deduced, climate change is a broad concept consisting of several factors. Since these are multiple, this thesis focuses on one of them, which is precisely the pollution generated by light vehicles on the road. This is not a scientific paper about addressing the issue, try to find a guilty and provide a *how to* guideline for solving the issue. But it is important to mention it because it is the starting point, this is the Big Bang of a demand that did not exist before and that is faced through Electric Vehicles (EVs).

Climate change and electric vehicles are two seemingly separate but profoundly correlated concepts, even if the relation between these two arguments can seem not the closest at first. On the popular imagination, climate is about nature and cars are about transportation, but sometimes two different concepts are still interrelated, it takes just a few more steps to the process to go from one to another.

In this case, cars are one of the main factors of pollution due to greenhouse gas (GHG) emissions (European Commission, 2018). These negative externalities have an impact on the



global warming, which is the long-term alteration consequence given by climate change, as stated in the National Geographic's definition mentioned above.

People cannot be indifferent on that; therefore, they need something to overcome the issue, but at the same time still be able to move from one place to another. This is the real *need*: the possibility to move, to reach another place. This is what a car does: it allows people to go from point A to point B; why people do not use other means of transportation then? There are airplanes, trains and busses. Here is the point in which the need becomes a *want*.

Most of the times, people do not simply want to move, but they want to do it freely in terms of timing and routes, accordingly to the schedule and time management. This is why people tend to prefer a car compared to a public mean of transport. Carmakers have increased this *want* even more by changing the perception from a *travel* to a *journey*, to make people enjoy not only the mere fact of reaching a destination but transforming the act of reaching it from something necessary, into something pleasant, "*Sheer Driving Pleasure*" as BMW's slogan ("Sheer Driving Pleasure": BMW Slogan History | BMW.Com, n.d.).

If this new way of thinking is considered and combined to the fact that everything should be *climate-friendly*, here it comes the concept of electromobility, which is made of electric vehicles and charging infrastructure.

There was no need for EVs, because already existing cars were *enough* to fulfil every segment's needs thanks to the so many models present in the market. Following this event, carmakers were able to leverage on the new need of sustainability to create a demand that did not exist before, and it is how they are dealing with final users' preferences that makes the change interesting.

To do so, they have also to consider the legislative part imposed by the European Union. This factor is helpful to stress the fact that this issue is so important to make the EU Parliament enact a law, the European Green Deal.

This thesis is structured following the perspective of the three main players facing the transition in the automotive market: the policymaker – i.e., European Union – that acts as a common floor; the customers, that represents the market from the demand side and – at the opposite – the carmakers, meaning the market analysed from the supply side. It starts by underlying the importance of the theme using the metaphor of the vicious circle and it presents the European legislation as the factor able to break it and be the

turning point. It would be counterproductive to neglect this point, since it dictates the parameters that must be respected by carmakers. Furthermore, it is useful to clarify more which is the route towards the change of 2035.

This is a purely theoretical paragraph, that states *how things should be* in a perfect world in which everything works smoothly. It is important to understand the *theoretical* mood of the section, because everyone is conscious that things can change, and deadlines can move. The war in Ukraine is just the last example, but also other unforeseen events - like inflation rate, pandemics and so on - can happen, having an impact on the milestone.

Before deep diving in the points of view from demand and offer sides, the paper presents the actual situation by providing an overview of the landscape in which the change towards electro mobility insert itself.

Thanks to a study conducted by the Politecnico di Milano, the paper talks about the viability, the urbanization and the charging situation in Europe and in Italy, to see how much of what stated in the Green Deal is implemented and the feasibility of the plan. Unlike the first chapter, the aim is to provide a picture of the *real* actual situation. This shows what carmakers are dealing with and allows to understand whether change is happening in parallel or whether there are bottlenecks.

Every change – by definition - brings something new which people are not used to, therefore lots of questions and perplexities arise; in this specific case, they are considered under the name of *customer biases* and have an impact on the purchasing process when thinking about buying an electric vehicle.

This paper stems from a desire to provide an answer to the main elements that restrain and prevent consumers from buying an electric vehicle, since this seems more like a *gentle imposition* than a *free choice* – due to the strict legislation. The second section of the paper addresses the customer biases, and a survey is used to provide empirical evidence on which ones are the most impactful in customers' mind.

As stated, this is not a *how to* guideline for solving the issue, but from a marketing perspective, it is interesting to switch the point of view from the customers' to the carmakers' one, to understand how they want to overcome the biases mentioned above and their strategy to address a demand that does not exist. To this end, three OEMs are

considered: Audi, BMW and Mercedes, which have always been rivals in the premium segment. I decided to focus on premium brands first because of my internship experience at BMW. Secondly, I would like to go *beyond the price* and see how carmakers compete on a marketing level which excludes the more *economic* part of it. I believe that if a customer can afford a car of the brands mentioned above, the price is not the main braking elements, because the income is quite above the average. Therefore, scepticism towards electric vehicles can be explained by other biases that require other marketing strategies by carmakers, rather than *just* focusing on price.

Since it is about electromobility, also Tesla will be considered in the analysis, as it is considered the Electric Giant – or the Electric Pioneer – leading the BEV market (Cache, 2023).

The aim of the last chapter is to find a relation between the demand and the supply side of the market - meaning biases and strategies. Numbers are supposed to tell the truth, since they are more objective than an opinion; therefore, the annual reports are used to have empirical evidence of the relation between marketing strategy and registrations. Starting from this, looking at the strategy of the company that seems more successful the main factors that allow to overcome those limits will be highlighted.

# Chapter 1

## **The theoretical perspective.**

### **The roadmap towards 2035: European and Italian regulatory framework to rule the transition.**

The issue of climate crisis is known to all, so much so, that sometimes this redundancy of the concept can be almost annoying, because it seems to be a *vicious circle* that everyone knows to be bad, but nobody where to start to stop it.

The term *vicious circle* has a purely negative connotation, as it is used to denote a harmful habit. By its definition, it is “*a set of cognitive, emotional and behavioural reactions that are established and follow one another in a circular fashion in an attempt to avoid stimuli perceived as dangerous*” (Agnelli, 2019).

Although they diminish fear in the short term, paradoxically, they make these stimuli even more feared and therefore to be avoided later on. All this happens automatically and involuntarily. To better explain this concept, I start using a simple example common to all on a daily basis.

People use some goods that are very different from each other: Fast Moving Consumer Goods (FMCG), technological devices, foodstuff, transportation means and so on. In a modern society, it is quite unlikely that they live without those goods, both because some of them are essential to survive and also because the standards of living slowly adapt to what is new on the market, therefore, it is difficult to imagine a life without internet, electricity and all the other comforts people are now used to.

On the other hand, those goods require to be produced in order to be used, and this might not always be done in the most efficient way – environmentally speaking; therefore, the more goods needed the more goods bought; the more people buy the more companies produce; the more they produce the more they might pollute.

Metaphorically speaking: a dog chasing its tail.

How to break the circle? As mentioned, it is a set of related habitual reactions, and - as every habit - they are repeated over time, they are automatically and done in a stable context (Encyclopaedia Britannica, 2023). Therefore, to stop them something that breaks the

routine and changes at least one of the conditions is needed (Wikipedia the free encyclopaedia, 2023).

Climate changes have always been there, but – accordingly to what stated by the scientists of the IPCC Climate Change 2021 – what surprises and frightens today is how quickly they are happening compared to the past (Fondazione CMCC, 2021.)

This report - provided by the CMCC Foundation and CNR – ISAC (2021) - gives empirical evidence about the fact that climate change finds its roots on the human activities. If you go back to the example I have just mentioned above about goods, this is even clearer.

On the other hand, there is a solution: “*to contain the rise in planet’s average temperature by 1,5° compared to pre-industrial period, emissions of CO<sub>2</sub>, methane and other greenhouse gases must be drastically and rapidly reduced*” (Fondazione CMCC, 2021.). Here is where the European legislation comes in: to find a starting point to stop the vicious circle of climate change and environmental degradation, or at least slow it down. To do so, it has released the European Green Deal, the roadmap to tackle climate change and achieve climate neutrality by 2050 (European Commission, 2022.).

The European legislation on climate change in force today actually began in 2014, the year in which *Climate Energy Framework* was issued. This text sets the objectives to be achieved in 2030, namely 40% reduction in GHG and a 32.5% increase in energy efficiency together with a 32% use of renewable energy sources (*Energy&Strategy, Politecnico Di Milano., 2023.*). This translates into better general performance given by lower energy consumption and coming mostly from renewable sources such as light, wind, water and tides, biomasses, waves and geothermal heat.

In the following years the legislation became denser. In fact, in 2018 the European Commission set out its vision for a zero-climate impact Union in 2050 through the *Long-term Strategy 2020*. The following year, in 2019, it introduced the *European Green Deal*, a strategy aimed at making the economy of Europe sustainable, in which there are no net GHG emissions. Time horizon: 2050 (*Energy&Strategy, Politecnico Di Milano., 2023.*).

In 2020 the *European Climate Law* makes the objective of the *Green Deal* binding and the text of the same undergoes a change, as the percentage of emissions reduction is revised to at least 55% by 2030. This change is approved by European leaders. The steps of this

strategy are described in the document called *Sustainable and Smart Mobility Strategy* (Energy&Strategy, Politecnico Di Milano., 2023.).

The measures include the spread of zero-emission vehicles, digitalisation, automation, connectivity and accessibility (European Commission - Have your say, 2020).

In 2021 the *European Climate Law* comes into force and *Fit for 55* is introduced, i.e. a package of proposals to update the Union's policies and make them consistent with the *Green Deal* target (Energy&Strategy, Politecnico Di Milano., 2023.). This document will be analysed more in detail in the next paragraph, because it is better to start from the *Green Deal*.

### **1.1 The European Green Deal: an overview.**

As the President of the European Commission – Ursula Von Der Leyen – stated on the 11<sup>th</sup> December 2019, the goal is to make Europe become “*the first climate neutral carbon continent in the World by 2050*” (The European Green Deal - European Commission, 2021).

At first this may sound like an ambitious goal, especially if you think that nowadays the European GHG emissions are roughly 941 million meters (EU's GHG Emissions Drop in Q1 2023 despite Rise in GDP: Eurostat | S&P Global Commodity Insights, n.d.), but this can exactly be the kind of big change needed to stop the vicious circle of climate crisis.

The benefits of the deal are manifold and affect the entire industry sector in many ways, since it is about moving towards a circular economy.

The industry takes place in buildings, therefore they must be renovated to be as much energy efficient as possible; what comes out from these buildings are – usually – products that must be made more durable in order to be Repaired, Reused and Recycled, as the rule of the 5R's of Waste Management says (Group & Smith, 2021).

To do so, workers must be trained for the transition, to ensure a clean technological innovation that preserves nature – air, water, soil and biodiversity – as well as human health and well-being.

As can be understood, this is a 360° program, because it is not just about the environment, but it aims to provide cheaper energy, smarter transport by increasing the public ones, new jobs and a better quality of life (European Commission, 2022).

It is clear that such a major change requires time, so the first milestone on the road to the carbon neutrality is set on 2030, when European CO<sub>2</sub> emissions will have to be reduced by 55% compared to 1990 (*The European Green Deal - European Commission, 2021*).

To strength the theme and confirm the leadership of the European continent, the EU Parliament involved the Climate Law and made the 2030 target legally binding and so is the climate neutrality goal of 2050.

As the European Commission is a legislative body, what a better way to achieve the objective than by enacting a package of laws known as Fit for 55. This package aims at regulating several fields of application (European Commission, 2022):

- Emissions from industry, transport and other sectors;
- Creating EU funds and allowances to support households in the green transition, especially regarding the increased cost of energy;
- Boosting circular economy to promote a sustainable consumption by establishing rules on packaging and regulating the right to repair;
- Creating a sustainable food system supervising the entire supply chain to promote the use of organic farming and regulate land use;
- Preserving biodiversity both for forests and their inhabitants.

This is the overview of the Green Deal and of the Fit for 55; now this big picture will be narrowed down more and more.

Starting from the circular economy, it has a wide field of applications, because it refers to ICT, batteries and vehicles, packaging and plastics, construction and buildings.

From now on, the focus of the paper will be purely on the automotive sector and the transition to electric vehicles.

## 1.2 Fit for 55 and the focus on automotive industry.

As mentioned previously, the Fit for 55 is a package of proposals to make the Union's policies consistent with the target established by the Green Deal. Regarding the transport sector this package contains six proposals listed below (*Energy&Strategy, Politecnico Di Milano., 2023*):

- *ETS Mechanism*, regarding changes to previously set GHG quotas. This mechanism sets a limit on the emissions allowed to EU calculated in numbers of quotas, each of which corresponds to one ton of CO<sub>2</sub>. Shares that can be sold or purchased on an ad hoc market.
- *Effort Sharing Regulation*: with the new one, the emission quotas that can be transferred between member states from 2026 to 2030 are reduced to 15%.
- *Regulation 2023/851*, GHG reduction for light vehicles until 2035, i.e. the objectives for new passenger cars. This regulation is of particular importance for this discussion, since the focus is purely on this type of vehicles. By 31<sup>st</sup> December 2029, the reduction of CO<sub>2</sub> exhaust emissions is expected to be 55% and then reach 100% by 2035. This restriction applies to manufacturers of more than 10k vehicles, such as those that will be analysed in the following chapters. Therefore, the types of vehicles fuelling functional to achieving this objective are BEV, FCEV, PHEV and hydrogen cars.
- Of particular relevance is also the *AFIR, Regulation of the Deployment of Alternative Fuels Infrastructure*. It defines the charging point as the interface capable of charging a simple vehicle at a time. This text lists three types of charging points: public – i.e., on public land – private with public access – i.e. on private land but with indiscriminate access – and finally private, i.e. on private land with private, exclusive access.

The power of the aforementioned points is divided into *normal charge* with alternating current (AC) up to 22kW and *fast charges* which can be both AC and direct current (DC). Fast chargers are the only ones to support DC charging types.



The text also sets the maximum distance between charging points at 60km and enables the possibility of ad hoc charging, i.e., the service that allows customers to use the infrastructure even without having a contractual relationship with the energy supplier. In practice, it is also possible that the supplier requires to download an app in order to enable tracking through cookies.

- *EPBD: Energy Performance of Building Directive*. The text provides a clear distinction between the *residential* and *non-residential* context and the related measures to adapt to the Green Deal.

The former is described as new buildings - or those with major renovations - with more than three adjacent or internal parking spaces; for these the plan is to install at least one charging point together with the wiring for future points. For non-residential buildings the number of parking spaces increases to five and always requires the installation of the charging infrastructure and wiring.

- *Revision Red II* updates the percentage of renewable sources to be used in transport to at least 29%.

As stated by the European Commission in *Reducing carbon dioxide emissions: EU targets and policies* (European Commission, 2018), cars and vans are responsible for the 15% of Europe's CO<sub>2</sub> emissions. To better understand the meaning behind a simple number, reference is made to the data provided by S&P in terms of GHG emissions: in Q1 2023 EU has produced 941 million meters, this means that roughly 142 million are attributable to the automotive sector (S&P Global Commodity Insights, n.d.). Furthermore, the transport sector has seen an increase in greenhouse gas emissions of more than 25% compared to 1990 levels. This means that transport accounts for about one fifth of the total emissions (European Parliament, 2018).

There are two main reasons why the Parliament has tightened the deadlines for the automotive sector. The first is the significance of these figures, which has further encouraged the legislative body to pay attention to how to develop the path to climate neutrality.

To be effectively implemented, every change requires a journey made of steps; 2050 is the arrival, but there are intermediate milestones along the path. According to the current regulations, new cars should not emit more than 95g of CO<sub>2</sub> per kilometre in average from 2021 onwards; the next step involves a reduction of CO<sub>2</sub> emissions by 55% compared to 2021 levels by 2030 to achieve the complete absence of emissions in 2035. *What's next* in a shorter period of time will be determined by the emission tests that reflect driving conditions (European Parliament, 2018).

In a few words, this means that by 2035 on the European market it will not be longer possible to place cars (or vans) with internal combustion engine. Please, note that what stated on the Fit for 55 applies only on *new* vehicles.

This policy has a huge impact on different players of the market; first of all, carmakers, because they have to develop new vehicles based on engines that do not produce any emission, namely electric or hydrogen. Secondly the government, who oversees building and developing the infrastructure to allow customers to charge their cars. Last but not least, customers that have to learn how to deal with this transition and they have to change their daily behaviour in order to adapt it to what electric cars require.

Combustion and electric engines are two different things, both on a daily basis and in terms of maintenance. The customer side will be analysed more in detail on a later stage in this paper.

The second reason why the deadline for automotive industry is – apparently - placed earlier than for the other sectors, is given by cars' life cycle.

The Dutch MEP Jan Huitema took part on a Facebook live to answer some questions regarding the new emission standards. When asked about the future of thermal combustion cars that will be on the road in 2035, he responded by stating that driving them will still be possible, because the regulation only applies to new vehicles registered (*Il divieto di vendita per le nuove auto a benzina e diesel nell'UE dal 2035 | Attualità | Parlamento europeo*, 2022). Since registrations of electric cars only account for 1.5% of the registrations (European Parliament, 2018), this is a more than legitimate question.

The MEP specifies that "*the new rules do not require that by 2035 all cars on the road will be carbon neutral*" (Huitema J., in Parlamento europeo, 2022); in fact, new cars bought now can be used until the end of their life cycle, and this is where the reason for the deadline

finds itself. *"Since the average lifespan of a car is 15 years, by 2035 we have to start to allow all cars to become carbon-neutral by 2050"* (Parlamento europeo, 2022).

This does not necessarily imply that electric engines will be the only players on the landscape of mobility, but rather that there will be room for improvement towards sustainable and alternative fuels.

You are therefore witnessing a change of direction in the automotive market, the main trend of which will be battery-electric cars, as they are more cost-efficient than the alternatives provided by hydrogen and green fuels. Nevertheless, batteries have downsides – in terms of weight for example – and this makes the other options to be considered as good alternatives (Parlamento europeo, 2022).

### **1.3 Batteries and alternative fuels: the EU rules for a more sustainable power.**

The spread of change in the mobility sector, has made the market of batteries very strategic. This novelty already started with the increase in use of ICT devices, but nowadays - thanks to electric vehicles (EV), light means of transportation (LMT) and industrial batteries - it has gained even more importance, making the need for regulation arising in order to prevent ethical and social issues.

At this stage of the changing process, it is worth to spend a couple of words in terms of their regulation, since they are often debated by market players and since they represent a downside of the electric cars (European Parliament, 2022).

When it come about batteries, it is about something which is not new to the market - rather than unfamiliar - especially when it comes about their use and the use in combination with vehicles. Therefore, it is perfectly normal some scepticism and lots of questions at the beginning.

The European Parliament wants to be as much transparent as possible, therefore it adopted an update of the EU's battery directive of 2006. As stated by the body, there are some key measures foreseen by the regulation: companies must fil a carbon footprint declaration and label for EVs, LMTs and for some rechargeable industrial batteries. The

categories mentioned above must also have a digital battery passport. Enlarging the point of view, economic operators must have a due diligence policy, to ensure the respect of human rights and that batteries are ethically sourced (European Parliament, 2023). As regards the battery itself, it must be designed as much user-friendly as possible, to allow customers to easily remove and replace them; last but not least, batteries should be produced in a way that ensures that the minimum levels of materials recovered and of recycled content are fulfilled (European Parliament, 2023).

Furthermore, the Parliament aims at ensuring that batteries respect some of the five Rs of Waste Management, in this case: Repurpose, Remanufacture or Recycle at the end of their life cycle (European Parliament, 2023). This trend is consistent to the *circular* way of doing proposed by the European Union in facing the transition management.

As mentioned above, batteries will not be the only player in the future mobility; alternative fuels will also play a role in reducing CO<sub>2</sub> emissions.

*“Alternative fuels are fuels or energy sources used to replace fossil fuels in the transportation industry, with the aim of contributing to the decarbonisation of the sector”* (European Parliament, 2022).

Concretely, you are talking about electricity, hydrogen and ammonia. What makes them *greener*, more sustainable and alternative, is the way they are produced. Indeed, they come from different resources, such as power and nuclear power plants, renewable energy sources – water, wind, organic compounds and nitrogen.

You are not only talking about renewable fuels – such as biofuels – but also the ones based on low carbon and natural gas – LPG, CNG, LNG, synthetic and paraffinic fuels. Nowadays, around 5% of cars and vans use alternative fuels and are currently registered in the EU (European Parliament, 2022).

Not only papers and laws, but also concrete actions; this is what completes the regulatory framework of the European Parliament. The importance of the support of the government will be even more marked in this paper and how it plays a crucial role in the vicious circle of electromobility. The keyword here is *infrastructure*.

Without it, everything regarding this transition cannot be applied, in fact – as mentioned – it is about electromobility, a concept that is concretised by electric vehicles *and* charging stations. As mentioned, thermic and electric engines have some differences, but fact remains that vehicles need to be powered. As stated by the European Parliament,

together with the Council, they agreed on mandatory targets for developing alternative fuel infrastructures and charging stations, both for cars and vans (European Parliament, 2022).

They stated what they guarantee building a sort of roadmap:

- By 2026 there will be electric charging points for vehicles with a power of at least 400 kW every 60 kilometres;
- By 2028 these charging points will increase the power up to 600 kW;
- By 2028 every 120 kilometres along the main EU transport network there will be charging stations for busses and trucks, up to 288 kW;
- By end of 2030 every authorized parking area for heavy vehicles will have at least one charging station;
- By 2031 there will be a hydrogen refuelling station every 200 kilometres.

The goal is to improve and make the whole user experience easier, this is why the bodies are working also on more user-friendly charging and payment methods (contactless or credit cards), greater information to inform customers about availability and types of fuels, waiting times for charging and – of course – prices.

*“More charging stations will lead to shorter waiting time and no more charging anxiety”*  
(European Parliament, 2022).

#### **1.4 The Italian regulatory framework.**

Since the Smart Mobility Report – analysed in detail in the next chapter - describes the Italian path towards the decarbonisation of transport in relation to the European and global trend, it is useful to make a brief mention to the Italian legislation on the matter (Energy&Strategy, Politecnico Di Milano., 2023.).

In 2020 with the *Integrated National Energy and Climate Plan* (Piano Nazionale Integrato Energia e Clima) Italy's energy transition strategies between 2021 and 2030 are determined. This is in terms of decarbonisation thresholds, renewable energy, efficiency and security, interconnectivity and infrastructure. In the same year, guidelines for the development of hydrogen in the next decade were issued, since – as already mentioned –

a single energy source may not support the entire transition. It is the document called *National Hydrogen Strategy* (Strategia Nazionale Idrogeno).

The following year stands out for the *Italian Long-Term Strategy* (Strategia di Lungo Termine Italiana) - which establishes the reduction of GHG with aim of achieving what is established in the Treaty of Paris – and the *National Recovery and Resilience Plan* (Piano Nazionale di Ripresa e Resilienza - PNRR), which allocates investments to respond to the Covid19 crisis and has among the decarbonisation of the economy.

It continues in 2022 with the *Plan for the Ecological Transition* (Piano per la Transizione Ecologica), which adopts environmental and energy policies in line with the PNRR. It ends in 2023 with the *Proposal of the New Integrated National Energy and Climate Plan* (Proposta Nuovo Piano Nazionale Integrato Energia e Clima - PNIEC) and the *Revision of PNRR*, in which the objectives and the investments are updated.

Among the measures to support E-mobility in Italy there are various incentives, legislative acts and documents in terms of vehicles and charging infrastructure.

Among these, two are particularly noteworthy, as they will also be mentioned later in the discussion. In terms of vehicles, a certainly important measure is the *Ecobonus*, i.e. a contribution for the purchase of electric cars. The objective established by PNIEC envisages 6.6 mln electric cars circulating on Italian soil in 2030. The funds have been divided into three emission bands: 0-20, 21-60 and 61-135 gCO<sub>2</sub>/km.

The problem lies in the fact that only the third segment has exhausted the funds made available (Figure 1), as well as that is the one of endothermic vehicles, indicating lack of demand on the part of the market itself, which - not even in the face of an incentive - has recorded the desired goal. This contribution, however, had a spending ceiling for each emission band of 35k, 45k and 35k euros respectively; furthermore, the applicant had to fall within the ISEE threshold of 30k euros in order to have the maximum contribution. It is important to note that the spending limits are not commensurate with the price of BEV cars on the market, and consequently the contributions. With the limit of 125 gCO<sub>2</sub>/km, Ecobonus exceeds the range of vehicles useful for reducing the emission factor of the fleet - which is around 95 gCO<sub>2</sub>/km for new cars registered between 2021 and 2024 (Energy&Strategy, Politecnico Di Milano., 2023).

Regarding the charging infrastructure, some main issues were addressed, such as widespread distribution on the highway, as charging is not easily possible. Just think about the position of the charging point on the car: not all vehicles have it in the rear and this represents a problem in terms of space, which – during rushing hours – is exacerbated. Secondly, the capillarity in terms of number and frequency in the territory, but also of power supplied, which impacts on time and usability of the infrastructure. Finally, an improvement in the service that increasingly shifts towards traditional fuels is necessary ((Energy&Strategy, Politecnico Di Milano., 2023).

A first attempt to overcome these problems is represented by the *Superbonus 110%*. It is a tax relief that allows to obtain a 110% tax deduction for all expenses incurred for the implementation of charging infrastructure for electric vehicles in buildings or installation of solar panels, in general measures aimed at carrying out interventions with the purpose to increase energy efficiency and consolidating buildings against seismic risk. This incentive, which began in 2020 with this maximum rate, is expected to remain in force in the following years with lower thresholds in terms of deductible percentage (Agenzia Entrate, n.d.).

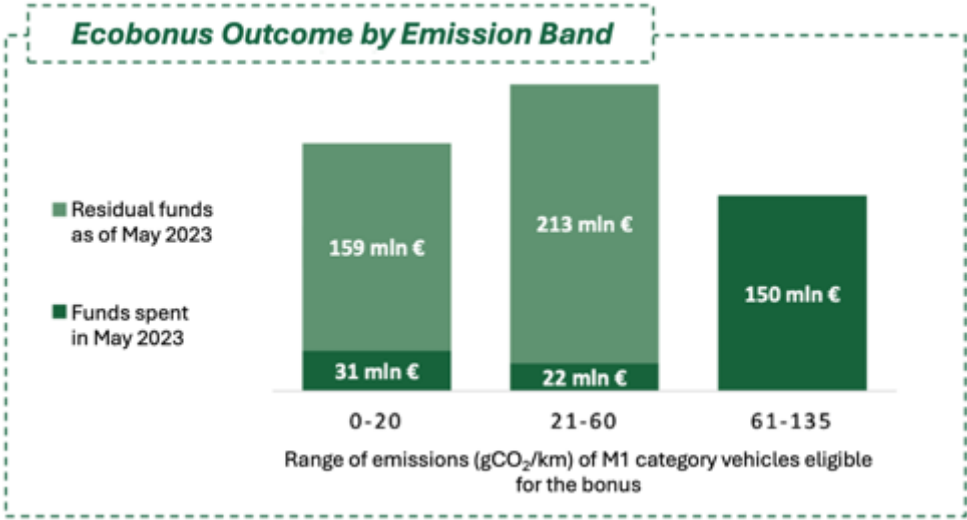


Figure 1 – The outcome of the Ecobonus divided by emissions band. The funds have been exhausted for the highest emissions band.

## Chapter 2

### **The actual situation where the transition insert itself.**

### **The background of the electromobility market.**

The aim of this chapter is to analyse where this transition insert itself, meaning the context seen from a double perspective: cultural and infrastructural.

Since this discussion is about understanding consumer behaviour to define how people react to a certain issue, the cultural dimension is used to describe the intangible part of the context. This is because the culture of a nation has an impact on the decision-making process, not for nothing in the previous chapter the phenomenon was analysed from a legislative point of view but with a purely European application. Each State has different needs that are given by the social and economic context and the level of development. Added to this is culture, which could be defined as a kind of *umbrella* under which the characteristic traits of a country are grouped, or as a *red thread* that serves as a common pattern in the ways of acting, thinking or behaving.

On the other hand, the second dimension – the infrastructural one - is much more tangible and purely relevant to the electromobility context considered. The aim is to provide an overview of the current state of the infrastructure context which forms the basis for a smooth and efficient transition. This second part takes a close look at the role of the policy maker.

Three main actors have been identified in this phase of change: the consumers, i.e. the market from the demand side, the car makers, i.e. the supply side, and the policy maker. This is for several reasons: firstly, it is almost unthinkable that a change of such important dimensions can be implemented without basic regulation; secondly - as shall be seen later - confirmed by the OEMs analysed, this transition needs to be supported in terms of infrastructure development. Starting from this point, it becomes clear that it is not merely a matter of *selling electric cars*; this is in fact a variable that enjoys a direct proportionality relationship with the development of the charging infrastructure. The need for the two factors to grow hand in hand can be traced back to the concept of the *vicious circle* that was mentioned before: without charging infrastructure is very difficult



to promote - not even sell, that comes after - electric cars and thus create this demand that already in itself is not there. So, if electric cars are not perceived as necessary, they are not asked for or bought, which leaves the market to the situation of a few years ago, that is, the one in which the largest slice of it is occupied by combustion engine cars and the residue is left to the most curious consumers or with different needs, such that they are led to use different types of engines. In doing so, the reduction of emissions is called into question, and you move towards the climate change scenario that causes dangerous environmental phenomena.

Once again, the example of how two seemingly distant events - such as the development of a charging infrastructure and environmental phenomena - are actually connected by a series of conditions whose minimal change affects the stability of the whole system.

## **2.1 The cultural context.**

As mentioned, the focus is on Europe, which is a geographical region of the world, but that – due to historical, cultural and geopolitical factors – is considered a continent (Wikipedia the free encyclopaedia, 2024). Different ethnic groups of populations coexist on the same soil; this brings together languages, religions, habits and customs – in other words cultures – very different from each other. This is given by the multiple migratory phenomena that have generated an overlap of different people that have diversified the cultural framework. However, Europe is also a continent that has made diversity a virtue; in fact, thanks also to the favourable geographical conditions, it has achieved a good level of economic and technical development since ancient times (Enciclopedia Treccani, n.d.).

It can be stated that Europe is a continent that *“has maximum cultural diversity in minimum geographical distances”* (Kaplan, n.d., in Wikipedia the free encyclopaedia, 2024), therefore, one cannot easily speak of a *common culture* and often this diversity causes aspects - such as innovation, cultures and movements - come into conflict with each other (Wikipedia the free encyclopaedia, 2024).

The concept of *culture* is the typical one everybody knows what you are referring to, but almost nobody can define properly, because it is like an underlined assumption, something used to sum up or to draw a conclusion. In fact, there are several definitions. Matsumoto and Juang define it as the “*set of attitudes, values, beliefs and behaviours shared by a group of people*” (Matsumoto D., Juang L., 2012, in Ashmore et al., 2018), which makes the concept very clear and understandable, but Hofstede proposes a more interesting one for the purpose of the discussion. For him, culture is “*the collective programming of the mind which distinguishes the members of the group or category of people from another*” (Hofstede G., 1984, in Ashmore et al., 2018). I define it interesting because it introduces us more to the concept of *national culture*.

In this heterogeneous cultural context such as the European one, it is good to consider that divergences and affinities can coexist. This can be seen by considering behaviour in general as well as the evaluation of choices and – since you live in a globalized world in which the coexistence of different cultures and changes is in the order of the day – the concept of *national culture* can be defined as dynamic and constantly changing (Ashmore et al., 2018).

As emerged by the definition of Matsumoto and Juang, culture is very broad, so it is not difficult to think that it also concerns the transport sector, which is the subject of this discussion. Kuhnimhof and Wulfhorst identify *perception and lifestyle orientation* as one of the main factors that describe urban mobility and as a construct highly influenced by cultural background (Kuhnimhof T., Wulfhorst G., 2013, in Ashmore et al., 2018). This acts as a bias in the customer’s decision-making process, which is also affected by the impact of social status, the category to which s/he belongs and social norms. This is because nowadays the car – especially that of a certain level, like the brands discussed later – no longer only performs the function of means of transport; indeed, this function – although the main purpose of cars – is overshadowed and taken almost for granted. In modern society, cars have become a real status symbol (Bolt Blog, 2023).

The first cars introduced did not need a major marketing campaign to be perceived as a privilege that gave pride to those who owned them. The turning point came when the car became a mass product with the introduction of Henry Ford’s Model T. The model was designed for the mass market and therefore for a wide audience (Bolt Blog, 2023).

The prosperity after the World War II was fertile ground for the growth of market players, who therefore expanded the offer and began to differentiate the product; in this period, in fact, many luxury brands were born that sold a means not accessible to everyone to show the wealth and status of their owners, namely the high-end car. This is why in this regards it is about *selling a dream* (Bolt Blog, 2023).

The use of the car as a mean of communicating one's identity and lifestyle is something that has always continued over the years; you find it in Hollywood films and in open-air cinemas attended in a car. It is no coincidence that high-end brands offer a complete experience to the customers. What they communicate and how they do it to customers leverage emotions, sensations and meanings which that particular vehicle represents. In this way the driving experience – that is based on reaching a specific destination - is elevated, making driving an integral part of the reason for travelling and a desirable practice itself. This means that driving can be considered an activity as much as eating, sleeping, working, etcetera.

This reasoning leads back to the concept of *symbolism*, that means “*how people use objects and signs to signify something about themselves to third parties within the context of a society*” (Saussure F., et al., 1916, in Ashmore et al., 2018), which – together with the concept of national culture just mentioned - is a driver of behaviour (Ashmore et al., 2018).

This means that a sign has two meanings: an objective one – the *signifier*, the denotation – and the meaning that the displayer communicates with the symbol – the *signified* or connotation, which is deeper than what is shown at the surface level and what actually drives the behaviour (Saussure F. et al., 1916, Hjelmslev L., 1953, Barthens R., 1967 in Ashmore et al., 2018). If you drop the concept of symbolism within the sphere of mobility, it is possible to see how this mainly revolves around the concept of *private car*. In fact, it is seen as a sense of extension of the self and one's ego. At the same time, it represents comfort, speed, pleasure, power, protection, individuality and superiority. Furthermore, Choo and Mokhtarian linked the personality to cars; indeed, some people buy a specific model because it symbolises their personality (Choo S., Mokhtarian P.L., 2004 in Ashmore et al., 2018).

Although the transport sector is responsible for a good part of the GHG emissions and is therefore included among the factors that lead to climate change, it is a means of well-being and satisfaction of primary needs. In more developed countries, owning a car is an essential and determining factor for social inclusion; for this reason, emissions are

higher, and it is more difficult to reduce them, since this negative externality is associated with the benefit of inclusion to satisfy a need (Mattioli et al., 2020).

In this regard, people are working to try to decouple human needs from energy, because if the market does not want to give up the car in favour of public transport – for example – or does not want to make compromises in order to continue to satisfy needs, an alternative route is necessary. In some cases, it is about car-dependent transport system, that means high levels of car use have become a key factor in satisfying human needs. This can represent a factor of carbon lock-in, creating policy inertia towards climate change (Mattioli et al., 2020).

It should be noted that the temporal flexibility - given by the use of a private car - is perceived as an important convenience factor that contributes to an increase in personalised programming practices.

The final result is a marked need to have a private vehicle, in order to always be ready to satisfy all those needs – sometimes even unexpected ones – to make up everyday life schedule (Shove E., 2002, in Mattioli et al., 2020). This flexibility could also be defined as synonymous with freedom, as owning a private car frees from having to follow a schedule that does not fit our needs and therefore – for example – resorting to public transport. This is consistent to the concept of *people buying time* stated by Jarvis. The pressure given from the fact that people have to fit different activities into the day – such as working, caring for children, go to the gym, do the grocery, etc. - makes them willing to buy time by saving it using an available private vehicle (Jarvis H., 1999, in Mattioli et al., 2020).

As mentioned at the beginning of the paragraph, Europe is a very heterogeneous continent, therefore different cultures coexist, meaning different ways of perceiving the private car and – more relevant – BEV cars.

To this purpose, reference is made to Hofstede's model of the six dimensions of national culture: power distance, uncertainty avoidance, individualism/collectivism, masculinity/femininity, long/short term orientation and indulgence/restraint.

In this study made by Heffner and their collaborators only two dimensions are used, because the two indexes are correlated: the PDI - power differential - and COLL/IND, meaning collectivism/individualism index.

Usually, societies with higher difference in power differential are more collectivistic and they are categorised as developing countries due to their lower level of development

and vice versa. In societies where the power distance is high, people tend to give a huge importance to hierarchy, this is why they are more willing to emphasise their position through signs and behaviours. The example mentioned considers a society where there is a high PDI and people are more COLL, meaning that they are willing to sacrifice their own desires in favour of the collective ones to increase loyalty. In societies like this one mentioned the collective unit seeks for conformance normative cues (Heffner et al., 2007, in Ashmore et al., 2018).

On the other hand, the interviewees that belong to low PDI/IND societies associate a very positive meaning to owning an eco-car, in contrast with their general attitude against cars in urban areas. Since eco-cars are associated to environmental concern, they communicate affluence, education, healthy living and being informed. Such a positive attitude is so strong among this group of people that comes way before than the price or the economic ostentation; in fact, they consider the *environmental credentials* of the cars enough to justify the premium price. The interviewees stressed the fact that the decision to buy such a car was taken by themselves, without considering any pressure from the outside (Heffner et al., 2007, in Ashmore et al., 2018).

On the opposite side, meaning high PDI/COLL, there is no positivity in such a symbolism, since eco cars have not been *normalised* yet. The fact the society in the example is more collectivist, has an impact on the decision-making process, because only if the product mentioned is generally accepted, it will then be adopted.

In the case of eco cars, the fact that they have a very negative connotation makes the price gap not worth for people to be considered ecological. This suggests that in societies where symbolism is *a thing*, policy makers should leverage on this aspect (Heffner et al., 2007, in Ashmore et al., 2018).

Since Europe is a soil of different cultures, it is very likeable that different levels of PDI and COLL/IND coexist and therefore electric cars are perceived in a completely different way even though people are under the same jurisdiction of the European Union. This means a further implication: this context is a challenge, because it requires the policy maker to balance different needs, wants, tastes, habits, ways of reasoning and cultures (Ashmore et al., 2018).

## **2.2 The tangible context: analysis of the infrastructure.**

The second point of view used to analyse this transition phase is more concrete, better saying, tangible. Indeed, in this paragraph the infrastructural situation will be described. This is necessary because – as mentioned – together with customers and companies, also the government is an important market player. Although there are private and public charging possibilities available at the moment in the market, it can support this changing phase both with incentives and building the necessary infrastructure that contributes to the diffusion of electromobility. In fact, without a proper infrastructure in the background, this change cannot entirely take place.

To do so, a study conducted by the Politecnico di Milano will be used: the *Smart Mobility Report 2023*. It mainly considers the Italian way towards a zero-emission transportation sector, but it also makes comparisons with Europe and the rest of the world, to give the reader a term of comparison to better understand at which phase of the process the country is. This is the geo-political scenario of the transition.

The treatment of this topic within the report is broken down into six areas: the Smart Mobility market, the evolution of the offer, the survey of EV drivers, the evolution of the regulatory framework, the economic sustainability of electric mobility and concludes with an analysis of future mobility scenarios. For the purpose of this thesis, only some of these sections are considered in more detail, as the aim is to give a representation of the geo-political situation in which the transition takes place.

Please note that the data below are all derived from the report just mentioned.

Therefore, reference is made to the following source (*Energy&Strategy, Politecnico Di Milano., 2023*).

## **2.3 The Smart Mobility market.**

The topic of the Smart Mobility market is analysed by considering both the trend of electric cars and charging stations. In fact, as already mentioned, these are two variables that should grow hand in hand to ensure a smooth transition.

In 2022, there was a 4% overall drop in passenger car registrations in Europe, from 11.77 mln in 2021 to 11.29 mln. Nevertheless, within the European landscape, registrations of electric cars increased from 19% to 23% (Figure 2). Note that these figures for electric cars take into account both BEV and PHEV models.

As far as all-electric vehicles are concerned, European registrations amount to 1.6 mln vehicles representing 22.9% of the total registered vehicles with peaks in countries such as Germany, the UK and France.

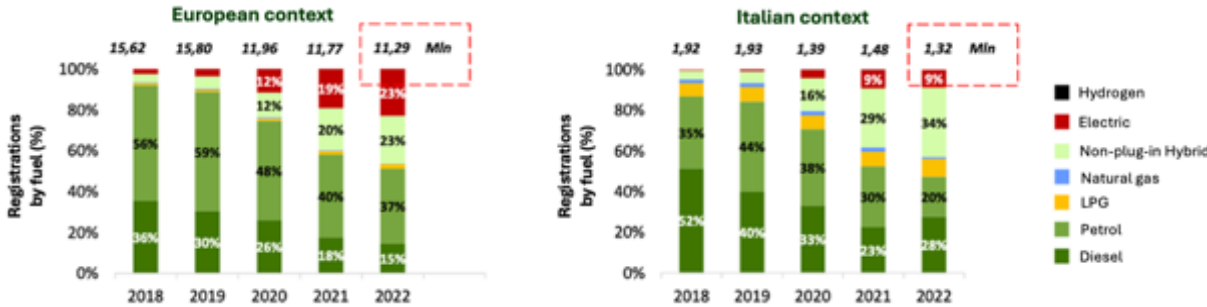


Figure 2 – The overall situation in cars registration and the different weight each engine has, both in Europe and Italy

Italy is bucking this positive trend of Europe. In fact, there is a decrease both in general vehicle registration and in purely electric vehicles. In this context, BEVs account for just 8.8% of the total registered and the podium is occupied by regions such as Lombardy, Trentino and Tuscany. These registrations mostly concern the A-segment, i.e. the *super-utility* cars. You are therefore talking about small, versatile and purely *city cars* like the Renault Twingo Electric, Fiat 500e or Smart EQ.

If you think about the urban conformation of the country, it is no coincidence that this is the most widespread type of car. In fact, the streets are mostly narrow, at the antipodes of a panorama like the American one, for example. This is because Italian history - but in general also that of the European continent - is made up of ancient civilizations that have developed in villages, so the first urbanization occurs at a time when the needs were different from those of today. The fact that to date the available electric car models are large has made them unattractive for a market taking place in an urban context such as Italy and Europe. This affects consumers' propensity to buy, because in their minds they concretise the use of these large vehicles in their daily lives, and this is inconvenient. In

fact, it is also a matter of context. To make a clear and easy example just think to the difference in car dimensions in Europe and in USA: a Dodge RAM fits the American scenario perfectly, while looking way too big in Italy, for example. The same applies for electric vehicles, such as a BMW i7. There are cars that are more noticeable when driven in a certain context.

This antiquity makes Italian cities a real historical heritage, so it is not so easy to demolish and rebuild to redesign mobility. In addition, you must also consider the morphological composition of the country that develops more than wide and is crossed by hills and mountains, except for the Po Valley (Tiso, 2020).

Although the fleet of BEV cars in circulation is not yet so developed and widespread, it is good to consider that it is about a gradual change and that – as also supported by some OEMs such as BMW – a single energy source is not enough (Arnold & Lemuth, 2013). In this regard, a growing trend regarding hybrid (non-plug-in) and LPG cars is visible, while hydrogen is present but still to a negligible extent.

As regards charging stations, a first distinction is made between *public* and *private* access. Below they are divided into *normal* and *fast* charging, *alternating* (AC) and *direct* current (DC). If the installation guarantees non-discriminatory access to users in terms of authentication, use and payment methods, it is considered a public access infrastructure (EMOBITALY, 2017).

Globally, in Europe and Italy there are respectively 2.6 mln, 450k and 40k public access charging stations, with a prevalence of those defined normal, i.e. with a lower charging power than fast models.

In Europe it is visible an increasing trend for level 2 alternating current charging stations, meaning with a power between 4kW and 18kW and with a voltage that tends to range from 208V to 240V. This type of station is intended for regular use, as it is better for the vehicle's battery in a long-term perspective. In fact, they provide energy as AC, but the on-board charger placed inside the car converts AC into DC to be accepted by the batteries. Note that batteries of cars can only accept DC. In this way, the presence of the converter affects the charging speed, which is lower than that recorded in DCs, which can support greater power and are – therefore – preferred (Hive Power, 2021).



Charging stations of this type - from now on referred to as AC - represent 89% of the total European charging points, with some exceptions in countries such as Norway, Bulgaria and Croatia, where peaks of DC stations are seen, i.e., direct current.

On European soil there is therefore a certain lack of homogeneity in the relationship between number of public stations per 100k inhabitants and electric vehicles (BEV and PHEV) per 100k inhabitants (Figure 3). Lack of homogeneity, that is visible also in Italy, where the north has the highest percentage of charging stations, equal to 69%. A large gap compared to the centre with 21% and the southern region with islands with 18%.

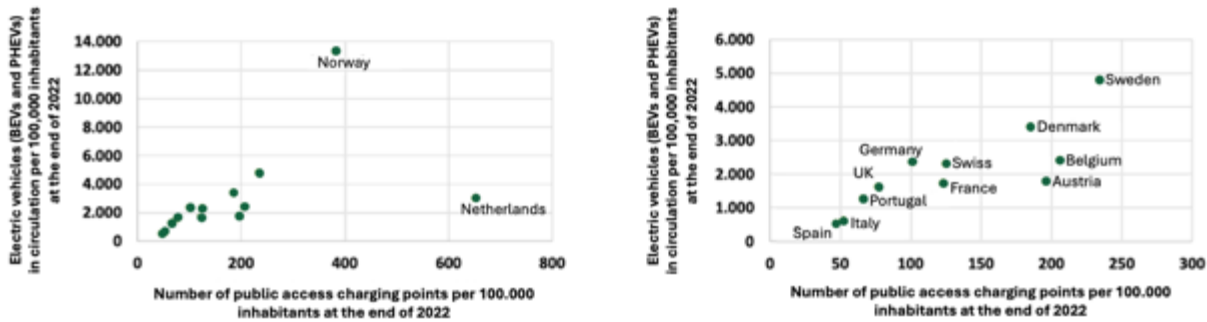


Figure 3 – The relationship between the number of public stations per 100k inhabitants and electric vehicles (BEV and PHEV) per 100k inhabitants in Europe. Norway and the Netherlands are the outliers.

The infrastructural situation of private access charging stations sees a completely different and noteworthy situation, particularly on Italian soil.

Compared to 2021, this type of infrastructure saw an increase of 170% reaching 370k points of which 90% are domestic and the remaining part corporate. This increase is due to an Italian government manoeuvre called *Superbonus 110*. In doing so, many private individuals outside business have taken the opportunity to install charging points on private land and this has had a considerable effect as demonstrated by numbers.

## 2.4 The evolution of the offer.

On the Italian scene, the offer sees a predominance of electric cars offered in segments C and D, although - as confirmed in the following chapter - car manufacturers are working to expand the portfolio in the coming years. As reported in the Smart Mobility Report 2023, in fact, in 2022 the A and top segments - E and above - have seen a substantial increase in the product portfolio compared to recent years. This has had an impact on the average price of available BEVs, which has seen a further increase, widening the price gap compared to combustion vehicles. This gap, on the other hand, does not necessarily represent a danger: firstly, because OEMs plan to have an electric vehicle proposition within each segment; secondly because regardless of the powertrain, it is a well-known fact that the higher segments have a higher price, as they are characteristic of the premium and luxury sector.

When talking about the monetary value of the vehicle - understood as the cost of production - geo-political events should also be taken into account, as these can have repercussions on the production chain. A recent example is the case of the war in Ukraine, which caused raw material prices to rise, and which had a significant impact on Audi's performance, for example. Events of this kind certainly do not have a positive effect, but it is equally true that they represent a temporary fluctuation, i.e., one that is potentially destined to reabsorb.

To sum up, the performance of BEVs is improving, but not the affordability. In Italy there is an expansion of the offer in the segments at the opposite ends of the range. This development is also visible with regards to batteries, which aim to increase autonomy even more and reducing charging times.

When talking about price increase, it tends to trigger a wake-up call in the consumer's mind and then - referring to the decision-making process of the following chapter - people look for answers to justify the purchase in such a way as to give the perception of being able to govern the situation and at the same time not to feel guilty.

An important justification is given by the increase in autonomy, which is very important for the market on the demand side. Personally, I will better explain this justification with the concept of consumption, since the one of autonomy is a relative concept that is influenced by various variables, such as driving style, type of journey or external

temperatures. In the smaller segments such as A and B, consumption fell in 2022, which is not the case in the higher ones. This is because D, E and upper segments are proper of bigger cars, that also involves greater consumption. This negative note is compensated by the possibility in terms of space to install larger batteries inside, therefore designed to support greater kW. The large battery is not only a virtue in this case, but it is also a necessity as the energy required to move larger vehicles is clearly greater.

From the beginning of this chapter, it was clear that there are always two concepts that go hand in hand: cars and charging. The offer therefore does not only concern vehicles and their autonomy, but also considers the different charging possibilities on the market. As stated previously, the majority of charging points in Italy are private. In this regard, there are two types of infrastructure: *Wallbox (WB)* and *charging stations*. The first type is defined as a unit that is installed on the wall and uses the home power socket to recharge. Most of these devices are designed to support a maximum power greater than 20 kW in alternating current. They are mostly equipped with a usually type 2 connector, which is a triple-phase plug with three additional wires to pass the current. This guarantees superior speed.

With reference to charging stations these are infrastructures equipped with one or more charging points with higher power than WB. These can have multiple connectors – usually two – of both types, AC and DC, respectively type 2 or CCS to support up to 350 kW, in normal (for AC) and fast (for DC) charge.

These differences are then reflected in the price based on the power supplied and the technological advancement of the infrastructure. With particular reference to WB - for example - *the smarter the higher*, meaning that if it is connected to an app and can be adjusted remotely, it is smarter and therefore the price is higher.

Another example is given by BMW Wallbox Gen 3, that can ensure maximum charging power to the car, but at the same time it is able to balance it with respect to the energy needs of the house, or which can be carried out at times that guarantee affordable rates (BMW.at, n.d.). This means that if there are other households appliances functioning at the same time as the vehicle is being charged, the amount of energy is balanced in such a way as to allow the appliances to function and the car to be charged. This is done without having to skip the current. In this way the consumer is faced with a choice that is less binding, in the sense that s/he does not have to sacrifice the wellbeing given by

air conditioning – for example – to recharge the car; what s/he sacrifices here is time, as the car will require a little more time for full charge, but it is a less drastic choice, it is not an *all or nothing* balance.

For both devices the market is not so concentrated since there are already a lot of players, 36 of which located in Italy, and this contributes to the low cost.

Always remaining within the offer in terms of charging, the other side of the coin is represented by the public one, which sees three main offer models.

The most used by operators (85%) is the *pay-per-use*, i.e., the supply of an X amount of energy at a certain price. In second place (60%) is the *subscription* in which customers enjoy a supply of predetermined quantity of energy over a certain period of time – usually monthly – at a fixed price. Finally, and also least used, is the *hybrid* mode, which sees a mix of the two types just mentioned.

In the case of public charging the rates also vary depending on the time slot in which the service is used; indeed, there is a decrease in the price during night and holidays, to discourage charging during the hours in which productive activities also require a higher level of energy. In this regard, i.e. that of charging, car manufacturers are also moving to expand the offer. This is the case of BMW which offers the *Active Tariff mode* for its customers. By paying a monthly fee, it allows customers to pay the same attractive price regardless of where they charge (BMW-public-charging.com, n.d.). It is an example of hybrid form, because it combines the subscription and a pay-per-use mode at a lower price that is the same for every charging station, unlike in the pure pay-per-use mode.

## **2.5 The survey of EV drivers.**

The Milan Polytechnic's Smart Mobility Report 2023 conducted a survey to investigate recharging habits, drivers and barriers to the use of electric mobility nationwide. For this purpose, it used a sample of 1,000 electric car owners, thus a very specific and targeted sample. Of these, 715 are BEV owners while the remaining drive a PHEV.

For the purposes of this thesis, this population sample study is taken into account because it describes the market from the demand side, i.e., the market context in which this transition to electric mobility takes place.

The fact that the sampling used in this study is so representative makes it even more interesting and gives it a truthful contribution for the purposes of the discussion and presents the market situation the policy maker must deal with realistically.

The results of this survey showed that - among many others - the main motivation for using the electric car is first and foremost a positive environmental impact, a factor that is a full twenty percentage points ahead of the runner-up. This suggests that there is not only good environmental awareness among BEV car owners, but that this issue is also relevant. Following on the other two steps of the podium are incentives to use and purchase BEVs, respectively; the former with reference to advantages such as free access to limited traffic zones and free parking, the latter to incentives such as the Ecobonus, meaning the contribution for the purchase of new vehicles made available by the Ministry of Business and Made in Italy mentioned in the previous chapter.

It is interesting how the latter differs by only 0.3% compared to the technical characteristics of the vehicle, which are on the fourth place (Figure 4).

If it is true that the car is also an emotional asset and that its function is no longer just that of acting as a means of transport, characteristics such as the displacement, power, engine and horsepower, but also the brand, the model, the version together with CO<sub>2</sub> measurements are important in the choice phase. This with particular reference to BEV owners, given that the environmental impact is the most important characteristic.

This means that for the sample interviewed, characteristics such as those just mentioned have - almost - the same importance as purchasing incentives. All this, if put into context with the fact that incentives are among the most determining factors in purchasing, makes their importance even clearer.

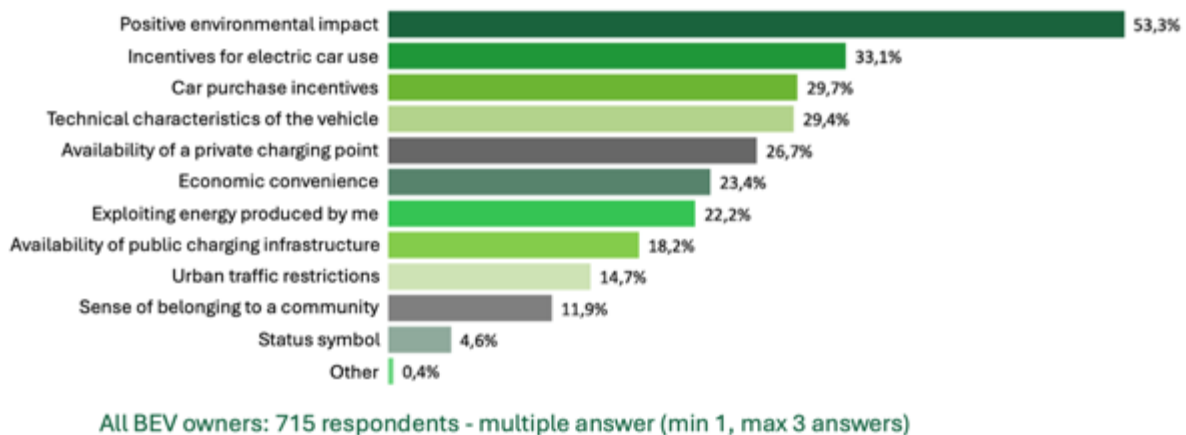


Figure 4 – The factors that most push the purchase of electric cars in Italy

As regards charging habits, in the survey these were analysed divided with reference to the three different typologies: domestic, corporate and public.

In terms of home charging, almost 90% of BEV owners carry out over 50% of their charging at home, almost half of which (46.2%) via WB or private/condominium column, mostly by increasing the power of the meter and in AC. Net of the 6% who do not have the possibility of recharging at home, the remaining part uses the domestic socket. This means that whoever has electric cars also has infrastructure; it is unusual to think that the two components are unrelated, so it is not just about *selling cars*, but it is about a *package* that includes vehicle, physical charging infrastructure and charging service, i.e. OEMs, WB or column supplier and energy supplier.

The policy maker covers a bit of the role of the *puppeteer*, since with its incentives it can directly manoeuvre these three players mentioned and indirectly the end customers. Finally, home charging users declare that they use public charging stations, but only during the day. In fact, WB are mostly used in the time slots 4-6pm or 8-12pm, for an average of 4-6 hours carried out 2-3 times per week.

Among BEV owners, therefore 715 of those interviewed, just over half (53.6%) declare that they have the possibility of recharging the car at work, in a time slot between 8am and 6pm. Those who have this possibility declare to use it mostly 2-3 times a week with an average of three hours.

Public infrastructure is also widely used, 69.1% of those interviewed declare to do that. If they do not is because of lack of capillarity, high costs and charging times that are

inconsistent with travel needs. This signals the presence of a window for the policy maker or in any case for those who work on infrastructure development: there is room for improvement. Such improvements would represent a significant benefit because 45% of BEV owners use public charging stations *at least* once a week and a large percentage declare they want greater development in points of interest, such as shopping centres, and in car parks. These improvements would therefore represent a good investment for the government in a long-term perspective and not a sunk cost.

To summarize: the context where this transition insert itself is very wide and complex. There are three main players: customers, companies and the institutions; each of them has different habits, needs and goals, meaning that customers aim at keeping having the opportunity to satisfy their needs, companies want to sell cars and the institutions both at reaching zero emission mobility and at the same time keeping an eye to their own business. Indeed, they can be considered as a *business* in a certain way, meaning giving incentives but with an eye on profitability.

The fact that European soil is populated by different cultures makes this transition even more challenging, since people sharing the same soil can have different attitudes and behaviours. The car is a product that has seen a shift in meaning towards the years, going from being a means of transport to a means of experience and a statement of freedom. This - combined to the differences in culture - increases the gap in the perception of the car itself and of electric vehicles more specifically. This implies that the audience the European Union is referring to, is varied and this is made tangible by the symbolism.

From a tangible perspective, there is room for improvement, even though some goals have already been achieved. In fact, BEVs and charging stations are growing across the whole continent, albeit at different speeds. In such a context there is no *one size fits all*, therefore it is about balancing trade-offs.

In the next chapters the other two players will be described, respectively customers and car makers, to analyse their perspective towards 2035.

## Chapter 3

### The customer perspective: literature review.

### Biases and scepticism towards electric vehicles.

#### 3.1 The economic perspective of the decision-making process: the link between rationality and behavioural economic.

Before dealing with customer biases that impact on customer choice, it is good to take a step back so to have an overview and better understand how this choice process takes place. To do so, the Neoclassical Theory – also called Utility Theory – is the starting point, a concept that is proper to microeconomics.

It originated around 1870 and one of its main exponents is the British Alfred Marshall, although there are other neoclassical schools, such as the Austrian and the French. This theory refers to the determination of variables such as price, production and income using the supply and demand model (Wikipedia the free encyclopaedia, 2023a).

The customer aims at *maximising* the utility and satisfaction by purchasing goods, but to identify the actual customer choice, you must add the budget constraint, because it determines what is achievable by the consumer. This limit reduces the possibilities of the customer, whose aim now becomes *optimizing* the utility/satisfaction.

Please, note that from now on utility and satisfaction will be used as synonyms to explain how the theory works, and that the paper will not go through the entire Utility Theory, because this is not the aim of the discussion, rather to just focus on the most important aspects that are related to that.

In Figure 5 there is a graphical representation of the concept.

The two axes of the graph represent the quantity of two different goods the customer would like to buy or to consume. The lines  $I_1$ ,  $I_2$  and  $I_3$  are the *indifference curves*, meaning the combination of good  $X_1$  and  $X_2$  that give the consumer the same level of



utility, therefore the customer aims at achieving the farthest curve away from the origin, because it means consuming the highest amount of the goods considered.

Given the budget constraint, customer purchases the bundle of goods that is represented by the point D, where the indifference curve touches the budget constraint, meaning: with that amount of available monetary resources, point D is the combination of goods that allows the customer to maximise the utility.

Unlike  $I_1$  and  $I_2$ ,  $I_3$  has a multitude of points which are not available because they are located outside the budget constraint, but - unlike the others - it has point D which provides a higher utility compared to the other indifference curves and that gives the same level of satisfaction as all the other points of  $I_3$ . Furthermore, it is feasible, because it is tangent to budget constraint (Pepall et al., 2016).

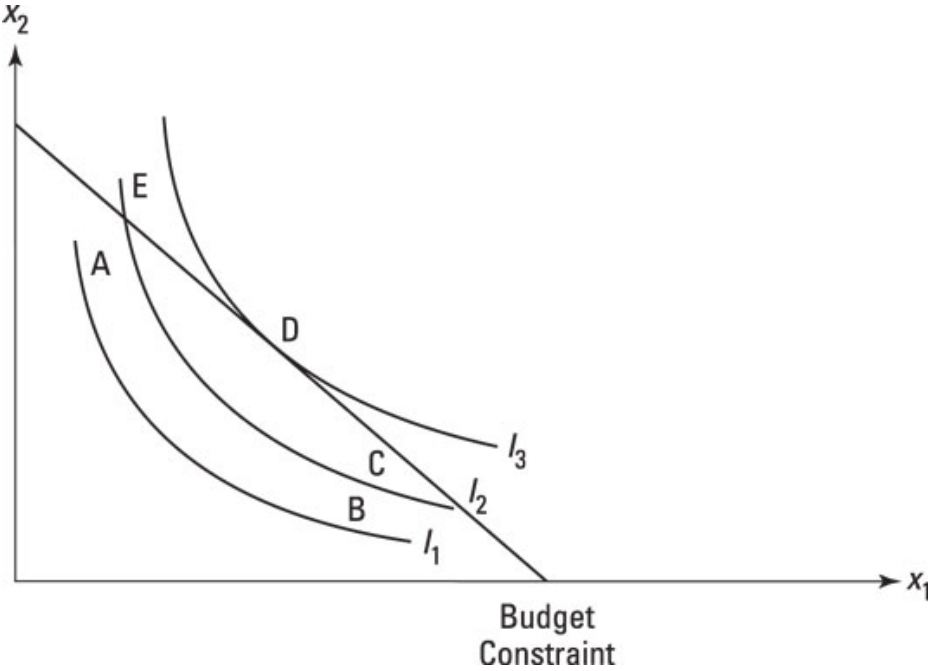


Figure 5 - The optimal point D is where the higher indifference curve touches the budget constraint

What is particularly relevant to the discussion are the postulates on the behaviour of firms and individuals; they are based on three fundamental principles: perfect rationality, utility maximisation and information transparency.

In detail, the decision process made by a perfect rational actor is very linear and simple: it starts with the problem recognition - for example the feeling of the need as the lack of something - then it follows with the information research, the alternative evaluation and selection, to end with the outlet selection and purchase.

The principle of perfect rationality implies that the *homo oeconomicus* always chooses the alternative that allows him to maximise his utility (Okopedia, 2014), i.e., that s/he is able to take what can be called a *first-best solution*, i.e. the *absolute best*. For this reason, this principle implies compliance with the third condition mentioned above, that of information transparency, so that all possible alternatives can be well evaluated (Okopedia, 2014).

It is immediate to think of criticism of Neoclassical Theory, in fact it can be considered as a purely theoretical model that dictates conditions according to the *best-case scenario*, the *if everything went well*. In the everyday and especially *real* context, you find yourselves in a situation where mechanisms intervene that break the perfection of the microeconomic model. First of all, the individual is not in a situation of full information transparency, and this prevents her/him from making the absolute best decision (Okopedia, 2014). Although nowadays, thanks to search engines, WOM and increased conscientiousness, the consumer is able to access much more information, it cannot be said that you are dealing with complete transparency. Of course, the customer can always verify the veracity of what is stated by the companies producing goods, and regulation has certainly made progresses in this regard, but not at the level stated by neoclassical theory.

Another factor that undermines the stability and robustness of the model is the complexity and uncertainty of the environment in which you move and where the scarcity of the resources must be considered. As mentioned at the beginning of the paper, the speed at which changes occur is sometimes more relevant than the changes themselves (Fondazione CMCC, 2021).

For these reasons you move from the concept of absolute rationality to that of *imperfect rationality*, also called *limited or bounded rationality*.

This concept was introduced by Herbert Simon around the middle of the 20<sup>th</sup> century. According to this model, decisions are taken with the aim of achieving the greatest level of satisfaction rather than maximisation, in fact solutions chosen are those that are

sufficiently good, those that would be called *acceptable* in the decision-making context in which individuals find themselves, which does not make them necessarily the best possible solutions (Okopedia, 2014).

In everyday life people are faced with a very complex environment in which events are strongly correlated with each other and very often the small change of a single apparently minimal condition has widely divergent repercussions on a much larger scale of factors, a bit as stated in the *Butterfly Theory* - also called *Chaos Theory* (Vernon, 2017). The human mind, on the other hand, is not able to consider and process this complexity in its entirety (Okopedia, 2014), therefore it is not possible for men to make the absolute optimal decision.

This does not mean that the human mind is limited itself, but rather that the research process is long and expensive, and all this effort is not always necessary. In most cases people are satisfied with a decision made in the minimum amount of time and with the minimum level of cognitive effort used (Okopedia, 2014).

It can therefore be stated that the sub-optimal situation - i.e., the satisfactory and less accurate, but at the same time cheaper and faster - situation is preferred over the absolute best solution. This is why the model of limited rationality is used to explain human choices, because it proposes a more realistic behavioural model (Okopedia, 2014).

A study conducted by the University of Leicester shows that the brain is making 35.000 decisions every day, each with a different level of complexity and importance to the decision-maker (Marples, 2022). In example what to have for breakfast, what to wear to go to the office, whether to go to the gym, where to invest money, whether to buy or rent a house, etcetera. Imagine having to consider all the possible options and information related to each of these decisions every day. The mere fact of making all of them during the day requires a huge effort, so it is immediately clear that the quick and low-cognitive effort solution is the one automatically used in most of the cases.

Most of the times you are not even aware that you are actually *deciding* something.

When contextualising the decision-making in the purchasing process, 95% of decisions is made unconsciously, as stated by Gerald Zaltman, professor at Harvard Business School (Zaltman G., n.d., in Harris, 2015). The fact is that "*people buy on emotion and justify with logic*", to further support the limited human rationality described previously (Zaltman G., n.d., in Harris, 2015).

In reality, the decision-making process is more complex than that, in fact the author takes three actors into consideration.

He starts from subconscious, where decisions are made through a deeply empirical mental processing system that follows its own logic. The second player is represented by emotions: these are the vehicle that communicates subconscious/intuitive decision to buy to the conscious mind. Here the process ends with the mind that searches for rational reasons to justify the emotional signals. This gives people the illusion to have a reason to buy and that they have the control of their actions, so they can feel safe and secure (Harris, 2015).

For these reasons, it makes sense to speak about *Behavioural Economics*, a concept developed by Daniel Kahneman and Amos Tversky. It is defined as the study of the psychological mechanisms and biases – other than rationality – that govern human decision-making behind an economic outcome (Fox, 2015).

In conclusion, it can be stated that people are not rational agents, but creatures driven by habits, instinct and feelings that make decisions based on psychological biases rather than rational considerations.

### **3.2 Heuristics and biases: the literature review.**

The starting point is that people - as irrational human beings - make decisions based on psychological biases. To better define what this means, reference is made to the work of Daniel Kahneman, an Israeli American author, psychologist and economist. Specifically, the focus is on his book *Thinking, Fast and Slow* (2011).

It is divided in two sections: the first one describes two ways the brain forms thoughts and their characteristics. In the second one, it focuses more on heuristics and biases as an explanation to support the emotion-driven decision-making process.

This paragraph is structured accordingly to the book.

*System 1* and *System 2* is the name given by Kahneman in his book to the two models of thought. In the lines that follow their differences are highlighted.

The first one - *System 1* - is fast, automatic, frequent, emotional, stereotypic and unconscious, therefore, it is mostly used to take daily quick decisions or to answer very simple questions. Among these you can state the ones that involve the five senses, like determine which object is at a greater distance or to localise the source of a sound, display disgust when seeing an image or tasting something bad. But also, easy actions like to drive on an empty road, solve 2+2 or read a text on the billboard (Kahneman D., 2011, in Wikipedia the free encyclopaedia, 2023). The downside is given by its impulsiveness that makes it subjected to be more error prone.

On the other hand - *System 2* - the more reliable one. It is slow, effortful, infrequent, logical, calculating and conscious. It is needed when taking complex decisions or thinking about something more structured like difficult math calculations. It can involve our body as well, because it is used to recognise a sound, sustain a faster walking rate rather than a normal one or to look for something specific (Kahneman D., 2011, in Wikipedia the free encyclopaedia, 2023).

As mentioned, they are one the opposite to the other, but both needed, because in those 35.000 average daily decisions people must take, there are for sure some easy and some more complex one and – without knowing – they use the brain in this way.

The second part of the book refers to heuristics and biases as an explanation of why people struggle to think statistically and - therefore - they sometimes use emotions (Kahneman D., 2011, in Wikipedia the free encyclopaedia, 2023).

Cognitive heuristics are rules of thumb, decision-making shortcuts used to reduce the complexity of making judgements (Fox, 2015). This can be considered useful, since – as mentioned - people have to deal with a lot of decisions on a daily basis; this implies they have to evaluate lots of alternatives and therefore making judgements. The downside is that sometimes heuristics lead to systematic errors also called biases. This theory became so important that resulted in an explanation for some puzzling aspects of the behavioural side of decision-making process (McKean, 1985 in Shanteau, 1989).

*“In making predictions and judgements under uncertainty, people do not appear to follow the calculus of chance or the statistical theory of prediction. Instead, they rely on a limited number of heuristics which sometimes yield reasonable judgements and sometimes lead to severe and systematic errors.”*

(Kahneman and Tversky, 1973 in Shanteau, 1989).

In his book Kahneman identifies six main biases:

- *Anchoring*: the tendency to be influenced by irrelevant numbers (Kahneman D., 2011, in Wikipedia the free encyclopaedia, 2023). This bias is also called *priming*, meaning that the exposure to a first stimulus influences the response to a later.  
If you take a bowl full of small balls and you ask people to estimate how many of them are in there and you give them some numbers as a benchmark, they will be highly influenced by those numbers when answering. It can be concluded that people tend to rely on known things to assess the value of unknown ones.
  
- *Availability*, also known as *if you can think of it, it must be important*. It is related to the probability of events, meaning: the easier it is to recall consequences of something, the more people perceive those consequences to be (Kahneman D., 2011, in Wikipedia the free encyclopaedia, 2023). You tend to prefer and believe on what is easy to perceive, understand or hold.  
This is what insurance companies can play on for example, because people in this case make judgements about the probability of events depending on the ease to think about them.
  
- *Conjunction fallacy* is a bias related to System 1 since it comes out of instinct. This part of our brain is prone to substitute a difficult question with an easier one (Kahneman D., 2011, in Wikipedia the free encyclopaedia, 2023).  
Here an example. Scenario A describes a person X who has a university degree, while in scenario B the same person X has both a university degree and a good job. Which scenario is more probable?

Since the typical stereotype is to associate a degree with a good job, most of the respondents will choose scenario B, even if it is not always the case that a person has a good job because of university. The psychological component is called *representativeness heuristic*, and it is a mental shortcut used by the brain to make associations between information. This is a bias found in HR topics for example, when there is the tendency to choose or prefer a person that is like the recruiter and therefore having the job.

In other words, the conjunction fallacy is an error in reasoning whereby people associate a greater probability to two events combined together rather than to just one of those happening alone (Drew, 2023).

- *Optimism and loss aversion: "avoiding pain is a stronger motivator than seeking pleasure"* (Tanya, 2019). This bias is related to having the control of lives - or at least the illusion to have it (Kahneman D., 2011, in Wikipedia the free encyclopaedia, 2023).

Going back to what has been stated in the previous paragraph when talking about the decision-making process, in the conscious mind people search for rational reasons to justify emotional signals, therefore they try to justify choices, to give them a meaning not to feel guilty and to have the sensation of control (Harris, 2015).

This is translated by Kahneman as WYSIATI - *What You See Is All There Is*. This means that – when making decisions – the mind deals first with *Known Knowns* already observed; secondly, it deals with *Known Unknowns* and finally – and also *maybe* I would say – *Unknown Unknowns*, i.e. phenomena never faced before and which relevance is unknown (Kahneman D., 2011, in Wikipedia the free encyclopaedia, 2023). Human nature makes people more sensitive to negative losses rather than positive gains, which leads them to be more conscious.

- *Framing*, how choices are presented, the context (Kahneman D., 2011, in Wikipedia the free encyclopaedia, 2023). The situation can be the same, but how alternatives are presented changes the perception to the customer.

This can be a quality proper of salesforce, because it helps to consider the half-full glass rather than the negative sides and to point the attention of the customers to other features of the product, to see things from another perspective.

Depending on the context, this bias can also be called *mental accounting*, as a mental way of narrowly framing and assess the value of things.

Supposing I am a taxi driver; during a day I can have two ways of making money: work until I reach my goal of 500 euros – for example only during the rush hours, or I can work 8 hours and see how much I have earned. At the end of the day, I have done my task - which is working to earn money - but in the first scenario I value the free-time more because I decide to spend only the necessary time to reach my goal; in the second one I value more the working time, because I decide to earn as much as possible scarifying my free-time.

- The last bias presented by Kahneman is given by *sunk cost*.

An ordinary-life example is helpful to better understand what it is about. You are at the cinema, and you realise that you do not like the movie you are watching. Logically, you should leave the hall, but the fact that you have already paid for the ticket increases the chances of staying in that room to watch the movie.

This is because you have already incurred a cost, you have invested some money - albeit minimal in this case. Therefore, this investment already made makes you less inclined to lose it and – therefore -stop watching the movie. As Kahneman would say, people tend to “*throw good money after bad*” (Kahneman D., 2011, in Wikipedia the free encyclopaedia, 2023).

In a certain sense it can be said that also this bias is control-related: people want to avoid feelings of regret, therefore they justify choices and have the control on what they are doing.

Since the concept of *fear* was mentioned when talking about *Optimism and loss aversion*, it makes sense to close the circle with the *Prospect Theory* also given by the author in question, David Kahneman. In fact, the psychologist adds the cognitive biases just listed to Daniel Bernoulli’s Utility Theory, in order to have a more truthful representation of the actors’ behaviour.

This theory suggests that people tend to weigh the prospects of gain and loss differently. Prospect theory stems from loss aversion, which means that people perceive the loss more than an equivalent gain value. This asymmetry is very relative, almost subjective, because the reference benchmark is determined by the individual who is evaluating the



choice in that moment (Kahneman D., 2011, in Wikipedia the free encyclopaedia, 2023).

Furthermore, s/he is influenced by external and internal factors which inhibit her/his perceptions and distance her/him from what is the rationality - where for external factors you can state other opinions or macroeconomic events for example, and by internal ones you can say previous personal experiences or feelings.

It all depends by the degree of risk aversion that a person has, because s/he might prefer a lower certain outcome rather than a higher uncertain one.

To summarise: there are numerous evidence that state against the neoclassical theory of perfect rationality. This is because people are subjected to external and internal stimuli that impact the way they make choices, the so-called heuristics and biases. This is even reinforced by the fact that people must deal with a lot of decisions daily and therefore it would be time- and energy-consuming to evaluate all the possible alternatives. Thus, you cannot talk about decision-making process without considering all the shortcuts the brain takes to arrive to a final choice.

In the next paragraphs that follow the literature is concretised in the electromobility sphere by providing empirical evidence about the correlation between eco-consciousness and EV mindset, and by analysing concretely the biases customers face when thinking about electric vehicles.

### **3.3 Customer biases and electromobility: the map of customer mindset.**

According to several reports quoted below and to the Smart Mobility Report 2023 described in chapter 2, the outlook for the electric market is very rosy. In general, the demand for such vehicles is growing year on year at a rate of 55% (Miller et al., 2023) and sees 2022 as the year in which a sales record of 10 million units was recorded (Virta, 2023). Forecasts for 2023 see a continuation of this positive trend, with 14 million electric cars expected to be sold by the end of the year, representing a 35% growth over the previous year's levels (Miller et al., 2023).

Focusing on the first half of the current year, it can be noted a 40% increase in sales of electric and hybrid cars (Figure 6), that benefits the entire car market, which sees a recovery of 11% compared to 2022 (King, 2023).

This recovery is due to multiple factors: in the first half of 2022 there was a major bottleneck in spare parts due to supply-chain disruptions, macroeconomic events, geopolitical uncertainty, high commodity and energy prices (Virta, 2023), an event that impacted not only vehicle production itself, but also inventories and repairs.

The execution of accrued orders and the consequent fulfilment of pent-up demand led to a strong increase in the first half of 2023, so the rest of the year will remain on this trend, but its intensity will diminish, as the market will be faced with what could called *usual, normal* demand, i.e. not caused by extraordinary events (King, 2023).

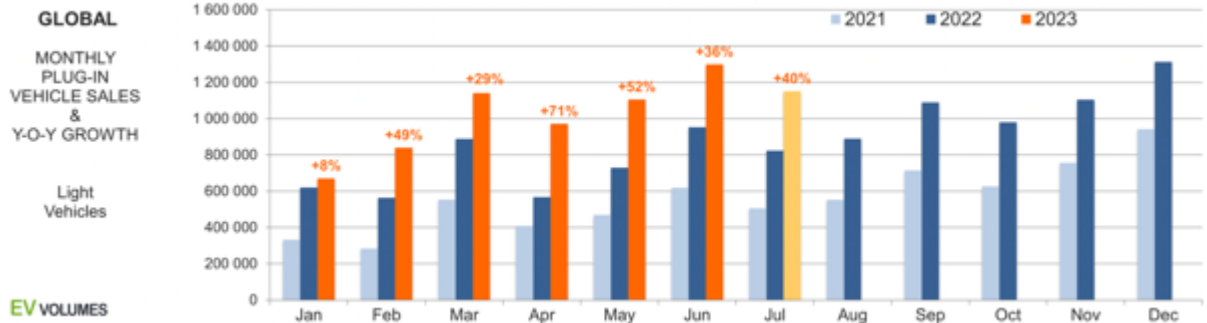


Figure 6 – The increase of 40% in 2023

*“But for all the hype around the EV revolution, in many major markets across the world, EVs still only represent a modest percentage of the total number of vehicles purchased.”*

(Miller et al., 2023)

Here is where the scepticism topic insert itself.

The latest EY Mobility Consumer Index report considered 14.500 participants over 20 countries and mapped the consumer mindset towards EVs in 2023. Five different consumer segments were created, based on the attitudes toward EVs, sustainability, cost-consciousness and mobility preferences.

Figure 7 reports the results of this target segmentation.

At the two extremes of the normal distribution curve, you find two opposite attitudes: *EV Sceptics* - normally eco-doubters, naturally conservative and risk-adverse – and *EV Enthusiast*, who are committed to sustainability and risk-seekers. Respectively they seek affordability and performance.

In between there are *EV Persuadables* and *EV Considerers*, with more nuanced views. The first segment is more prudent, people seek for guidance and are still budget-minded, while the others are also budget-concerned, but differently because they are value-oriented and therefore this curiosity makes them risk-takers seeking expert-consultation (Miller et al., 2023).

Why respondents belong to one segment rather than another is due to multiple reasons. Starting from the left side of the normal distribution curve - i.e. those who are not so optimistic about electromobility - the Sceptics and the Reluctant.

According to the study considered, in these segments there is a lack of confidence with respect to climate change. Respondents define it as almost exaggerated, so they do not count sustainability as an important factor influencing their purchasing choices. From a demographic point of view, they belong to the boomer generation with a strong attachment to the heat engines they grew up with, so the weight of habits here is very much in evidence. These people are also budget-concerned, and they do not belong to a high-income class, which makes them even less prone to pay a premium price (Miller et al., 2023).

At the other end of the scale an environmental commitment is visible and EV Enthusiasts rank sustainability as a top factor of influence when it comes about transportation. 63% of them have at least an undergraduate degree, but stating a link to this high educational level of the interviewed would be a conjunction fallacy, because there is no direct connection between those scenarios that can happen independently. It can be said that their studies made the attitude that seeks information more evident and makes them EV evangelists. Income-wise they are very wealthy, they are least cost-conscious segment that is more inclined to choose premium segment cars with a premium price (Miller et al., 2023).

Persuadables and Considerers are defined “*The fertile middle ground*” (Miller et al., 2023).

They value the environment, they have a good educational level, but less monetary resources compared to the Enthusiasts. They tend to calculate and schedule upfront, and this consciousness makes them weight differently charging time and range of kilometres, two linked themes. These two groups are very similar and more open to influence since they are not positioned at the extreme sides of the curve (Miller et al., 2023).

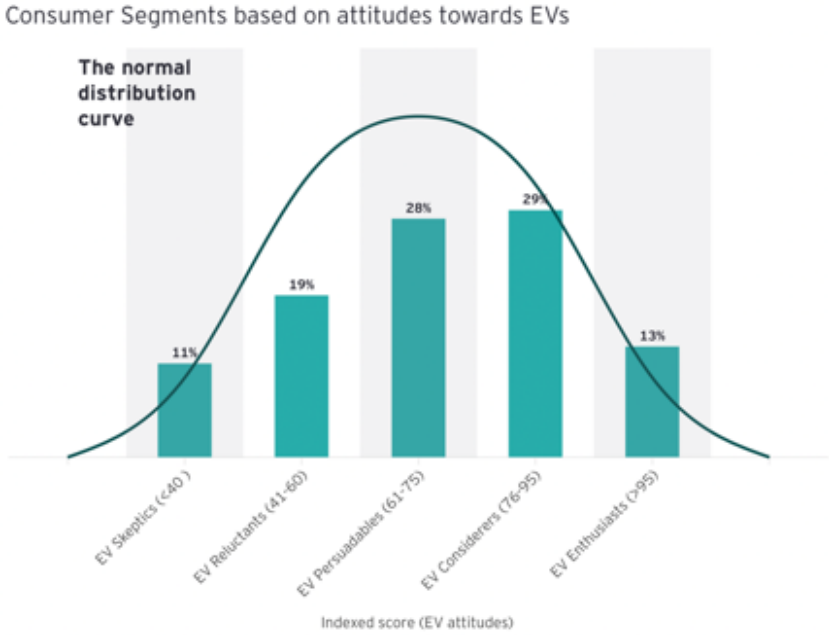


Figure 7 - The target segmentation of the latest EY Mobility Consumer Index report

As you might imagine, these segments have evolved over time and Figure 8 proves it. The share of EV Enthusiasts has constantly increased, probably because some Persuadables and Considerers shifted into that segment. Nevertheless, Skeptics and Reluctants increased in 2023. This suggests that some unconvinced people remain so (Miller et al., 2023).

These data can be viewed under a double perspective: as a common floor, there is for sure room for improvement, but not all the efforts made so far have been vain. Despite this, there is a percentage of people harder to shift.

In the next chapter the most common biases that Skeptics, Reluctants, Persuadables and Considerers might face when it comes about buying an electric vehicle are listed. This

represents the starting point which OEMs and dealers should focus on to encourage more buyers into EVs.

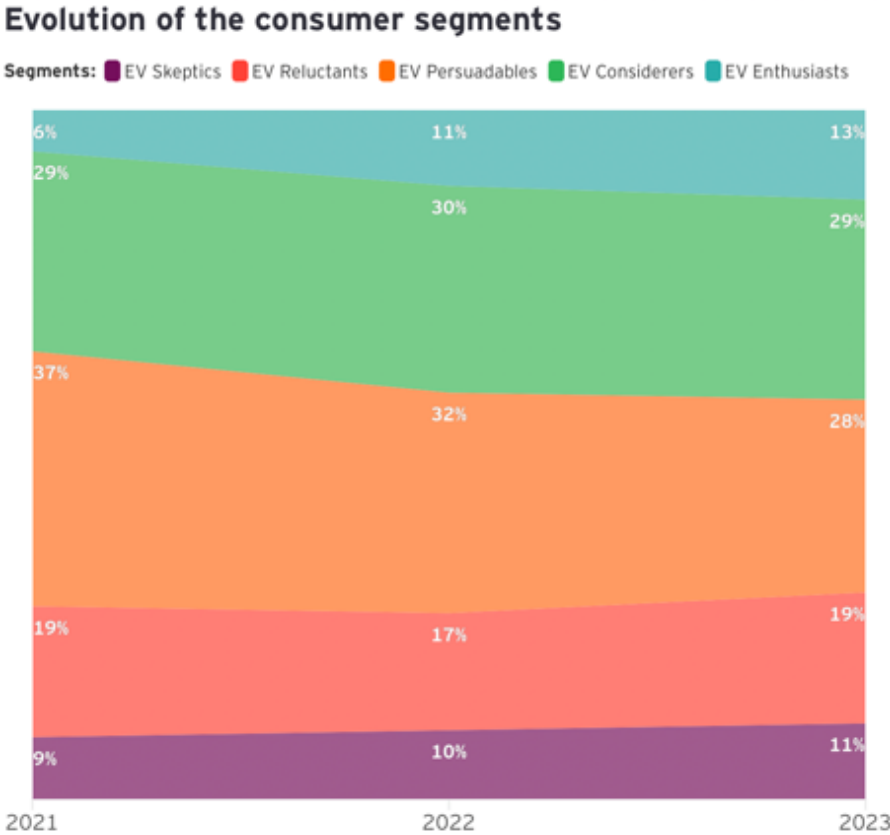


Figure 8 – The evolution of the consumer segments

## Chapter 4

### **The empirical evidence of the customer perspective: a survey to understand which biases prevent people the most from EVs.**

#### **4.1 Customer biases and electromobility: the overview.**

When it comes about electromobility there are several categories of bias that should be considered and that are involved in the purchase decision. Since the European goal is very ambitious in terms of market share of EVs, it is important to understand the consumer perception towards electromobility. This will allow OEMs and dealers to develop an efficient strategy to meet market's requirements (Krishna, 2021).

This paragraph is done following the contribution provided by Krishna G. in the article *Understanding and identifying barriers to electric vehicle adoption through thematic analysis* (2021). I chose to take this article as a guideline, because it refers to the contribution of Sheller M. *Automotive emotions: feeling the car* (2004), an approach that I found interesting and unusual. She includes the role played by intangible factors like emotions and desirability. She argues that driving can be defined as "*corporeal engagement [...] producing feelings of happiness, excitement, or anticipation*" (Sheller M., 2004, in Krishna, 2021). This is crucial to car purchasing, especially when it comes about premium brands as the ones considered in the document. They develop their strategy almost entirely on the feelings that driving transmits to people; to make an example, BMW's slogan is "*Sheer driving pleasure*", and this is what transforms a car from a mean of transportation - that takes you from point A to point B - into something more. Starting from this document I have structured a survey to provide empirical evidence about the relevance of the biases listed in the article. The aim is to evaluate the perception of customers towards EVs and the criticalities that prevent – or have prevented – people from buying such cars. On a later stage in this document, by

comparing the strategies of some car manufacturers, you will understand how OEMs are dealing with those limits.

The survey was submitted to a random sample of potential *consumers of tomorrow*; therefore, the interviewees are not necessarily people who own an electric car, but the sample was made up of people of all genders and ages who in the future will be able – or will have – to deal with such vehicles. Specifically, I followed the *snowball effect approach*, i.e. sharing the survey with family, friends and colleagues with the request to forward the questionnaire received. Both for reasons of time and of lack of a totally reliable database, the target does not have a specification in terms of correlation with the electric market, in fact it does not turn to experts in the sector. However, this also represents a point in favour because it shows the average level of knowledge present on the market today. Since the questionnaire administration time was short and as I do not have data from customers who currently own an EV, the sampling – by necessity – is revised, it is a *convenience sampling*. Aware that this can affect the robustness of the data, the results of this survey must be contextualized and interpreted according to these premises.

Since it is in the interest of my study to have different perspectives, I chose to develop two versions of the questionnaire, one in Italian and one in English, in order to broaden and differentiate the sample. The text can be found in the Appendix section, in both languages (Appendix 1, Appendix 2).

The survey is divided in four sections: it starts by defining in broad terms the interviewed person, looking at demographic and cars' data, and the country s/he comes from, to give a context to the other sections.

The second one focuses on the perception of the electrification process, noting that from 2035 it will no longer be possible to place new cars on the market with Internal Combustion Engine (ICE) and specifying that next EU's goal is to reduce CO<sub>2</sub> emissions by 55% in 2030.

Section 3 focuses on the attitude when thinking about an electric vehicle. I listed the bias mentioned below and asked to rate some statements using a Likert scale from 1 (totally disagree) to 5 (totally agree). The section is structured following the thematic analysis used in the article of Krishna and Sheller to group the biases in four different but - as will be understood – linked clusters. Concretely, the authors used expressions from online

customers' discussion to have a complete overview of all the factors related to the biases and stereotypes considered. This is because - according to them - opinions generated by users through eWOM have a higher degree of reliability and trust.

In the last section - the fourth one - the respondent had to consider three main brands of the automotive segment: Audi, BMW and Mercedes. They were also compared to Tesla, since it is the main player in the electric segment. I asked to classify the brands with reference to three attributes common to all: reliability, aesthetic design and technological innovation, to gather feedback regarding the perception in customers' mind regarding the entire range of vehicles and with reference to BEVs only. This section was developed both out of curiosity and because of my internship experience.

I am currently in Salzburg working in the marketing department of BMW Vertriebs GmbH, which is the headquarter for central and south-east Europe; in fact, it supervises nine markets, such as Austria, Bulgaria, Czech Republic, Greece, Hungary, Poland, Romania, Slovakia and Slovenia. Then it reports to the central HQ based in Munich.

The purpose was to see how BMW positions itself compared to its main competitors first - Audi and Mercedes - and with reference to Tesla then. Tesla was chosen both because BMW aims to be perceived as the top electric car brand in customers' mind, and because it is considered as the benchmark when it comes about EVs. Since it was the pioneer and it has a high technological development rate, it makes sense to mention it.

The internship had for sure an impact in the choice of the premium segment, but I also wanted to go *beyond the price*, meaning looking at all the other reasons that impact customers' choices, to have a further explanation of the scepticism, rather than *just* a matter of price. Although price reduction is considered as the most important triggering factor for the diffusion of EVs (Cecere et al., 2018), I assumed that people who can afford cars of the brands mentioned above, have a middle-high income level, therefore they can afford a premium price; thus - if they do not want a BEV - is for other reasons you should investigate, not for a budget constraint.

This is a paragraph that states biases and concrete evidence, avoiding any judgement of truthfulness and agreeability.

The biases identified in the article *Understanding and identifying barriers to electric vehicle adoption through thematic analysis* (Krishna, 2021) are divided in four main clusters:



- Sales conversion inability
- Lack of trust in technology
- Living with the technology
- Desirability.

Each of them is analysed separately to understand what it refers to. Furthermore, I will also provide practical evidence that mocks at the implications of the survey.

## **4.2 Description of the sample.**

As mentioned, by necessity a convenience sample is considered, meaning a population of random potential *consumers of tomorrow*. It is a group of people of all genders and ages who in the future will be able – or will have – to deal with such vehicles.

A total of 153 replies were collected, of which only 149 were considered valid, as the people who took part in the questionnaire answered most of the questions in it. The choice to exclude the 4 responses from the sample was made because they were considered as compilation attempts, since – analysing the recorded results – the responses entered related only to the first section – that of demographic data – or did not report any response. All other feedback was considered valid as it answered more than 80% of the questions in the questionnaire.

The target population consists of 34% people under the age of 30 and 8% over 60. Therefore, the intermediate group of respondents between 31 and 60 years of age represents almost 60% of the sample. It should be noted that the questionnaire was not administered to persons under the age of 18 - as they do not possess a driving license and are therefore unable to answer certain questions as they had no driving experience - and that this age distinction is made because I assume that in the age range between 30 and 60, people have a more or less stable job, i.e. one that allows them to make purchases such as a car.

The population considered has almost entirely a medium-high level of education, i.e., 48% claim to have a high school diploma and 42% a university degree; it should be noted that no distinction was made between Bachelor, Master or a Combined degree,

since they are considered equivalent in terms of affluence to the *degree* bracket for the purposes of study. Figure 9 displays the demographic results of both questionnaires.

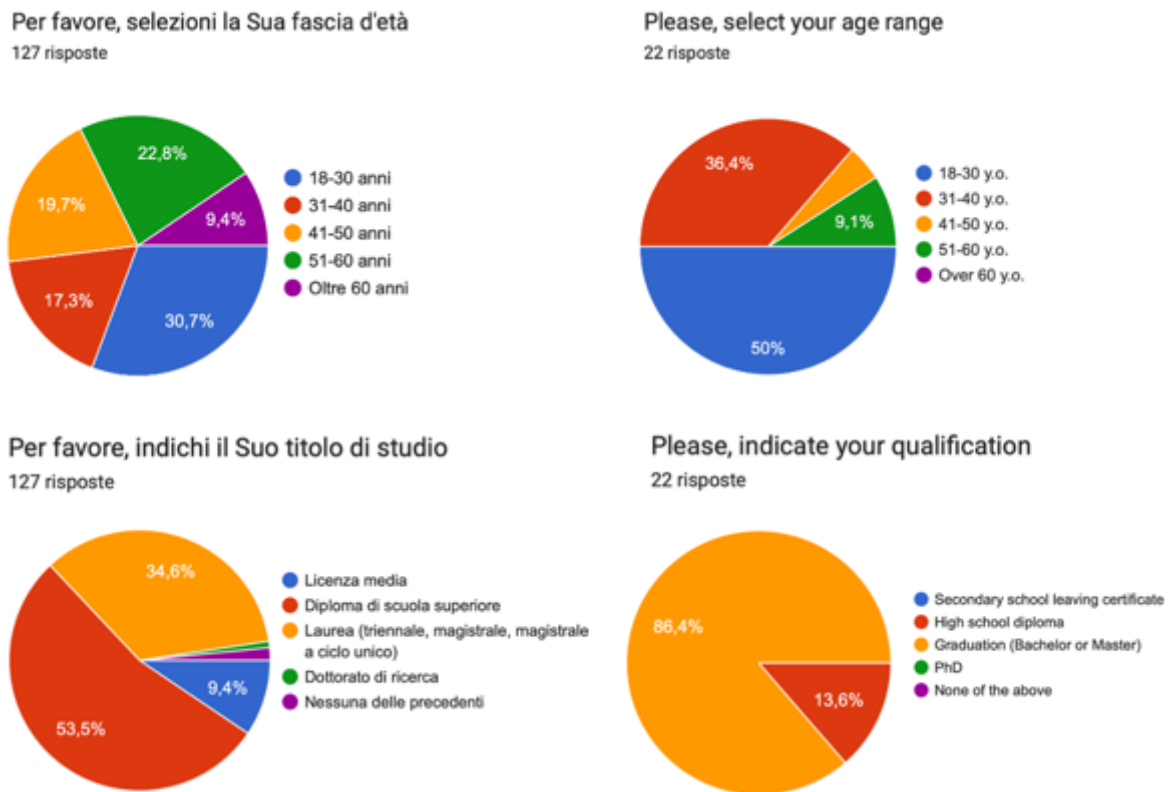


Figure 9 – Graphical representation of demographic data of the sample, both the Italian and the international one.

Finally - as far as the demographic description is concerned - the sample sees a clear predominance of respondents from Italy, followed by Austria, France, Germany and Greece. Of 149 respondents, 30 stated that they live in the city centre and as many as 84 *close* to the city centre, where *close* means a distance of between 5 and 15 kilometres, i.e. an amount that may imply - but not necessarily on a regular basis - the use of a car to go to places of interest such as offices, supermarkets and shops, which - as stated by 46 people - are located in the city centre. The results showed that as many as 112 respondents in the sample use the car on a daily basis, 80 of whom live in- or near the city centre. If you link this figure to the fact that a total of 114 people live within a small radius of the city centre (30 people in- plus 84 close to it), you see that 70% of this

portion of sample use the car as their primary means of transport. Hence the conclusion that the topic being discussed and the automotive sector itself have a certain relevance, in fact the car seems to be *the choice* and not the alternative.

When asked to select the phrases that best describe the streets of the country of residence, there was a clear dominance of the statements *The traffic jam during peak hours is a real issue*, *Streets are narrow in the city centre* and *Most of the principal activities (offices, supermarkets, shops, etc.) are located in the city centre* in the results. This confirms that reaching that part of the city is essential for daily activities, hence the creation of the traffic jam; city centre which develops on narrow streets, as stated in the study of Tiso discussed in chapter 2 (Tiso, 2020) and as confirmed by interviewees. This implies that urban conformation of the countries considered is not always congenial to large cars such as those of the C and D segments, which – reporting what was stated in the study of chapter 2 – are the segments that see the greatest diffusion of electric options in the Italian panorama at least (*Energy&Strategy, Politecnico Di Milano., 2023*). Hence the conclusion of a supply-side deficiency that needs to be addressed.

As mentioned above in the description of the structure of the questionnaire, in the first section - in addition to these data - questions were also included with reference to both owned and electric cars. With particular reference to the later, the purpose of this section is to analyse the perception that the interviewees have regarding their current diffusion in the country of residence. Since – as discussed – the concept of electromobility sees the coexistence of the electric car and charging infrastructure which cannot be separated, the same questions were asked with reference to charging stations. Generally, it is possible to see how the sample interviewed sees a low – if not very low – percentage of electric vehicles in circulation in the country of residence. From a European perspective – despite the portion of respondents being lower than the purely Italian one – it is possible to note a tie in the percentage of diffusion of electric vehicles, ranging from 0-10% and 11-30%; in fact, both ranges record a score of 45.5%. Within the Italian scenario, the situation takes on a more negative connotation; indeed, 71.4% of those interviewed stated that the percentage of BEVs in circulation in their opinion is equal to 0-10% range. These results are not surprising, as they are in line with what was stated by the study conducted by the Politecnico di Milano in the Smart Mobility Report 2023; in fact, it too presents a more a negative situation if you refer only

to Italian panorama. What makes it even more obvious are the answers given by the part of the sample represented by people resident in Italy to the question asking to indicate the type of engine owned by the cars belonging to their family unit. As can be seen in figure 10, the prevalence of thermic engines over other types is overwhelming: diesel accounts for almost 62% and petrol for around 55%, when only two respondents own BEVs and 22 hybrids. In fact, of this percentage of ICE car owners, the majority declare themselves satisfied with the engine of their car and 53% of them declare that they have never thought about purchasing a car with full electric engine.

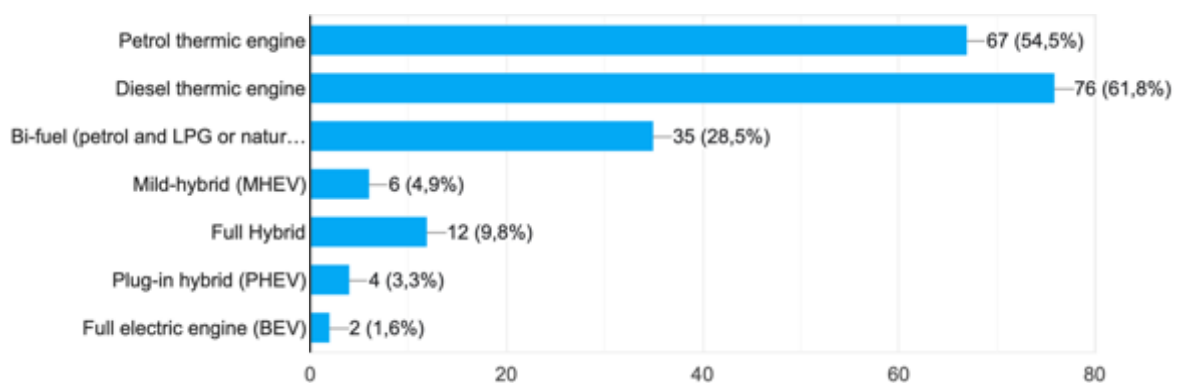


Figure 10 – The percentage of engines of cars owned by Italian respondents

When asked if there are many electric vehicles in circulation, there is no doubt that the answer is negative; just as there is no doubt that the quantity is increasing. When it goes to evaluate the willingness by asking *The percentage of electric vehicles should be higher* or *I wish there were more electric vehicles* the answers are very uncertain - that is - there is no value on the Likert scale used to rate these statements that prevails in a particularly evident way over the others. And it is precisely here that this study finds its reason, to discover the impacting factors that prevent this demand from developing. Similar story for charging stations: negative rating regarding presence accompanied by an increasing trend regarding diffusion. However, in terms of willingness here you find an overwhelming trend in which the highest values on the Likert scale 4 and 5 – partly agree and totally agree, respectively – are the most popular, especially with regard to foreign nations. In fact, in both scenarios – Italian and abroad – there are percentages of 48% and 54.5% respectively of positive responses regarding the presence of a charging

station in relation to one's home, therefore within a radius of one kilometre. This highlights the positive effect of State interventions. This not only implies that these have been useful, but that these are necessary – although not sufficient – conditions for the development of electromobility. In fact, there is still a good percentage of respondents who say they do not have a charging station near their home, and this certainly impacts to some extent on the purchase decision of the vehicles considered.

The sample used proves sensitive to the topic of climate change, perceiving it as relevant. When narrowing the field to the transport sector and connecting the latter to the topic of climate change, the data suggests a certain degree of uncertainty on the part of interviewees. In fact, 75% of them do not believe that this process of electrification of the automotive market is useful for reducing CO<sub>2</sub> emissions. This is made visible by the fact that the clear predominance of the highest values – 4 and 5 – of the Likert scale with which they were asked to evaluate this utility is lost. The reason lies above all in the fact that respondents say that there will be phases of the process that will pollute anyway, for example the production and disposal of batteries, for which the change is only *fairly* worth it.

If the role of the European Union is added, this uncertainty is even more evident. In this context I would call it *lack of trust in the institution*, especially from the Italian point of view compared to the foreign one. Leaving aside 23.5% who say they are not aware of the European Green Deal, the remaining part of the sample declares they have a certain degree of knowledge about it, more or less in depth. However, the majority of the interviewed rated the seriousness with which the European Union is taking the issue of climate change with a score of 3 out of 5; note that 3 is the central value of the Likert scale used, therefore the audience does not lean towards either extreme. This suggests that interviewees recognize the European commitment – in fact most of them are aware of the Green Deal – but at the same time are doubtful about its effectiveness.

The pressure imposed by it is not so overwhelming in the sample; in fact - if it were necessary to change one's vehicle - only 10 people of those interviewed would do so due to the pressure of European legislation. This further underlines the degree of resistance consumers have towards this change. It is no coincidence the majority of the responding audience answers *No* to the question *Do you think we will achieve the object of full electric fleet by 2035?*, despite being a percentage of users who opens a window towards

complete electrification, but over a long period of time. As in every change, here too there is a percentage of outliers who answer the question with a complete and convinced *Yes*, but it is truly negligible (7%).

In the following paragraphs the most commonly encountered biases – according to the study of Krishna and Sheller (2021) – will be analysed and the empirical evidence collected following the administration of the survey will be provided.

To evaluate these biases a cluster of statements was proposed, for each for which the level of agreement had to be expressed using a Likert scale with values from 1 (totally disagree) to 5 (totally agree). I chose this method to frame the respondents towards the model used in the study in such a way as to have a useful metric to make some comparisons, if necessary.

The scale used can be defined as *short* in a certain sense; this is to limit the uncertainty in the answers given and avoid having intermediate values that hinder the ability to draw conclusions. In order not to limit the audience too much, I chose to keep 3 as an intermediate value to indicate a neutral position, i.e., not tending towards either agreement or disagreement. Since the sample is not totally reliable for the reasons above - but it is a convenience sample - I have chosen to add the *Do not know* option, as I take into consideration the fact that not everyone may have had the opportunity to gain experience in the field of electromobility or have in-depth knowledge of the automotive market. In this way the questionnaire is less discriminatory and can be completed by everyone. In fact, this survey asks for a set of opinions in the form of statements, according to what might be one's own experience, thought or perception.

Please note that the explanation of the clusters below is derived from the study just mentioned. Therefore, reference is made to the following source (Krishna, 2021).

### **4.3 Cluster 1: sales conversion inability.**

There are some factors out of the buyer's control, rather due to the inability of companies to convert *potential* customers to *actual* consumers and that affect people

who are ready to purchase in the last stages of the purchasing process. For sales conversion inability it is about topics such as supply, choice of vehicles and dealers.

When buying a car, a factor that has an impact is the *waiting time*. For some luxury brands this can be very long and sometimes there are also waiting lists or specific requirements that must be met to obtain the car. Think about brands such as Ferrari or Lamborghini; in this case the waiting time gives a sense of luxury and exclusivity which is proper of the brand. This is the exception.

Normally, customers tolerate a waiting time, but when it becomes too long, it might be frustrating, so some of them start to switch orders, ask for their deposit back or cancel the booking. Unfortunately, there are some macroeconomic factors that are outside the control of the car manufactures, as we mentioned above in 2022 with the spare parts. The study of Krishna states that people consider waiting period for BEVs too high compared to ICE cars, thus - as a consequence - inventories are considered too low.

Not to mention *used market for EVs*. There are many reasons why people turn to second-hand cars, however consumers state a low availability for BEVs.

This is quite understandable from my perspective: electric cars are newer compared to ICE vehicles, therefore people are starting using them in recent years, there was not the actual time for a car to become used. What is interesting in my opinion is that people state this low market range also for new BEVs; there is a lack of segments of products and therefore low market choice.

From a carmaker perspective, *dealers* are at the bottom of the network, because they are the ones executing the guidelines given by the headquarter, but their capillarity makes them very important, especially because they deal with customers directly, they have a real feedback and feel the market from a reliable source. Since they have a direct impact on the customer experience, they can influence the purchase decision. Here it comes the *frame bias*: how choices are presented.

It was noted that some customers found them reluctant to sell an electric vehicle, misinforming clients. Here a double perspective: the downside for the dealers given by lower income that derives from after sales services and the new concept of online dealerships to avoid the issue just mentioned. Molesworth and Suortti stated that people

prefer the online services as regards the informative part, but when it comes about price they rely more on a personal contact (Molesworth & Suortti, 2002).

With reference to this cluster of biases, a certain level of ignorance in the sample considered is perceived. It almost seems that the market does not know what to expect because the predominant values in the answers are the neutral 3 or the *I do not know* option. No real peaks or large differences in the other values of the Likert scale.

Keep in mind that in this section market biases on the demand side are analysed, i.e., potential buyers of electric cars, regardless of their position in the sales funnel.

In my opinion, this result is not surprising because - when referring to Sales Conversion Inability - factors such as waiting time, the second-hand market and supply are taken into consideration. As mentioned, these are outside the control of customers - which is the same audience that filled the survey - thus the absence of knowledge is justified.

It is interesting to note that there is instead a common line mostly against the sale of cars online; as analysed later in the discussion, this is a strategy already in use by some OEMs or in any case a trend under development in the car market.

I believe that in this case the presence of a market niche that can act as a guinea pig but also as a reference through WOM can prove decisive in directing the market towards a movement in favour or otherwise of electric vehicles. Unfortunately – however - this requires a certain amount of time which may not be compatible with the milestone proposed by the European Union.

#### **4.4 Cluster 2: lack of trust in technology.**

Lack of trust in technology is one of the most impactful themes identified by Krishna. Basically, the *level of technology* achieved so far is not considered ready for daily usage. Like in the *conjunction fallacy* bias, people tend to associate autonomy to electric vehicles, even though those two concepts are independent. The right association should be made between cars – in general – and range, because every car has a certain amount of range, despite the engine. The fact is that – when it comes about electric vehicles – this relation seems stronger.



People also fear of *hacking, theft of the vehicle itself and of data* due to the high level of integration with smartphone and information they put in the car - like personal data, destinations, timing of travel and residence. Again, this is not proper of BEVs, it is a feature also ICE cars have, even though the combination Technology&Electric seems stronger than Technology &Cars or Technology &ICEs. It is on the carmaker to be transparent and present features like operating systems or autonomous driving as a plus, an added feature, rather than the core concept.

Battery technology implies also a matter of *safety*, and people find a high risk on this. The first concern is about the nature of battery to explode during an accident, especially because most of the batteries used nowadays are the Lithium-Ion based. Secondly, the lack of noise is perceived by unsafe. The driver does not realize the speed until s/he looks at the speedometer and this is distracting, since drivers have to remove the eyes from the street. To this regard, technology is also helpful – not only with BEVs, but with cars in general. In fact - in modern vehicles - most important information about the speed, navigation or relevant road signs are presented on the head-up display.

Paradoxically, some people define *BEV technology not sustainable*, not so much for the vehicle itself, rather than for the process of producing batteries. The requirements of mining for manufacturing batteries, their components and the lack of options to recycle batteries represent a huge question mark for customers.

This reduces the trust in the entire transition highlighting the phenomenon of indirect pollution: people are forced to change all the vehicles with the promise of reducing emissions, but are they recovering the ones they are saving from driving by producing and dismissing batteries? And what about the energy needed to power the batteries? Many countries are still dependent on non-renewable sources which release GHG emissions. Last but not least in terms of pollution is the theme of life cycle of the vehicle: people are willing to change the car once it cannot work anymore. Thus, since the lifespan of BEVs is considered shorter, they will be forced to change car more often and – therefore – polluting more.

Since – as stated – this technology is still pretty new, there is a problem of *reliability* in terms of degradation of the batteries with time. People feel the rate cannot be calculated

and this could lead to a drop in performances implying that BEVs cannot be fully exploited under different weather and performance conditions.

Unreliability is also perceived when it comes about forecasting the trip beforehand, this represents a huge challenge. The infrastructure is still considered lacking and unreliable in terms of availability, equipment, voltage.

All those elements support the fact that the technology is immature, and this prevents people from buying, because they do not want to be "*guinea pigs*"; the car is something really needed from some of them and a huge investment depending on the level of income. This is why people tend to prefer the *known* ICE cars.

The results of the survey make it clear that the problem is not technology itself, the public is now used to live with it, just think of the quantity of technological devices used daily: from the telephone to the computer, from household appliances to home automation. These devices also had a time when they were classified as novelties and when there was scepticism; the fact is that they gradually became part of everyday life and now people can no longer do without them. This also applies to cars, which had a technological development that is growing since years and that has improved the benefits a vehicle can provide; as an example: development of more advanced operating systems, redeemable seats, autonomous driving, cruise control, lane control, etcetera. This coexistence with technology has meant that it has become a habit, a hygiene factor that is no longer surprising, on the contrary, its absence is now. Therefore, when respondents were asked whether they had any insecurities in terms of electric vehicles and hacking, danger to privacy and greater ease in terms of theft, the answers were mostly strongly disagreed.

I believe that exposure to technology has predisposed the mentality to accept the fact that some personal data may be required to access technological support, so much so that people are no longer shocked about it.

The problem – if you want to define it that way – is found when the technology is expressed in terms of batteries. What is considered in this case can be summarized in one word: security. To the statement *I believe that batteries are unsafe when it comes to an accident*, 48.5% responded by assigning a value of 4 (partially agree) or 5 (totally agree), almost one in two respondents. In my opinion this is mainly due to the shape of

the batteries themselves which contain a large percentage of lithium, which – if exposed to extreme weather conditions or subjected to large impacts – can leak, making it highly flammable. This exposure to a higher level of explosion and fire risk than traditional cars is a wake-up call for buyers.

Remaining in the field of batteries, although progress is recognized in this regard, the fact of having to plan the journey in advance is an issue that worries drivers. In fact, 54% of them declare that they have a certain resistance to the electric vehicle for this very reason. As stated previously in the article, for many the car is synonymous with freedom, a sensation and an advantage for which not everyone is willing to compromise, as it guarantees the possibility of meeting all daily commitments or it allows you to reach a destination in an amount of time and in a way free from downtime, detours to look for the charging point and waiting for it to be free. The fact that even in the case of long-distance journey - for example - it is the journey that adapts to the driver's needs in terms of time and duration and not vice versa it is a benefit that takes on considerable importance. In Krishna's study this worry even translates into real anxiety, because it represents an unexpected event that requires management.

Finally, the third factor that affect the Lack of Trust in Technology bias is the recycling of batteries and their components at the end of their life cycle. This is a fact that shows a certain coherence with the responding audience, since – as underlined above – it proves sensitive to the topic of the climate crisis and this makes even more sense since it states that in this process of change there will be phases of the process that pollute anyway, reducing the merit of the change itself towards electromobility.

#### **4.5 Cluster 3: living with the technology.**

When it comes about living with the technology, things do not become easier at all. Here there is a matter of expectations managements. People already have a benchmark given by ICE cars, and they expect BEVs to maintain the standard at least.

The most popular issue is the *cost of purchase and ownership*, not just for premium brands, but generally speaking. People believe technology is overpriced, therefore either

it maintains the standards of ICE vehicles, or it has better feature, or there are not so many chances that people will switch.

Moreover, there are a lot of costs that run around the car: maintenance, insurance and running costs of electricity that is still very volatile. Furthermore, people believe these will not be balanced when selling the car, because the depreciation value is perceived greater than the gain.

Another important point when dealing with technology are the *infrastructure issues* that arise. Lack of points on the way and on parking spaces, less availability in the countryside compared to the city centre, approval by the landlord as regard home-chargers, electricity bills and charging cues that impact waiting time even more, are factors that prevents people buying those vehicles.

Starting from this last point, it is immediate to understand that *recharge duration* is an issue. Usually, people refuel their vehicle quickly. As stated in the article, the ideal timing would be maximum five minutes and they are not used to wait longer.

Recharge duration and battery range are very related concepts, because bigger battery means higher range but higher charging time at the same time, so it is not so simple to manage this trade-off. *Range* means the distance that an electric vehicle – in this case - can cover with a single charge. Although needs given by use differ among drivers and – depending on this - people weight differently these two features, the issue is bigger than it seems leading to anxiety while traveling. Modern operating systems inside the vehicles are developed to signal to users when and where to charge the cars, the type of connectors and the price of energy. The problem arises when you move from theory to practice, because according to the perspective of the car that seems to do everything there should be no anxiety on the part of the driver. The fact is that the column may be under maintenance or may not be free, thus increasing the waiting time. Another relevant factor is that not all cars have the charging socket positioned in the same place on the vehicle, and this could become a problem in terms of space.

On the other hand, it can be said that just as there are factors outside the control of the customers, there are also some outside the control of carmakers. Therefore, by developing cutting-edge OSs they want to facilitate coexistence with technology.

When addressing the Living with Technology bias, the results that emerged in terms of price gap, maintenance and insurance are negligible as they do not provide any relevant

data on which to focus. The other three points, namely the infrastructure, the range and the charging time, instead provide a vision consistent with the themes that emerged in the analysis of the previous biases and with the discussion.

Starting from the first point, the possible lack of charging infrastructure gives rise to a feeling of anxiety which graphically translates into a peak in the highest values on the Likert scale; this concept is linked to the freedom referred to in the previous bias and emphasizes that the combination of electric vehicles and charging stations cannot be separated. This is why it is about electromobility, which is a broader concept than the mere vehicle.

In this section – however - there is a positive glimmer of light, in fact 55% declare they would be more inclined to purchase such a vehicle if the battery range was greater and 52,7% if the charging time was shorter. The difference between the two percentages is minimal, but if you think about the fact that some car manufacturers are implementing gaming solutions inside the vehicle to lighten the burden of charging time and if you combine this with the fact that charging can be carried out during lunch break, working hours or while at home, this small difference makes sense. This also indicates that it is true that there is some reluctance towards this change, but the position is not firm and immutable.

#### **4.6 Cluster 4: desirability.**

The last barrier is represented by desirability, which is also the most heterogeneous one. This attribute is what characterizes premium and luxury brands and shifts the perception from a mere object into something emotion related.

Desirability features are not only game changer, but also, they provide the emotions through which the intention to buy is transmitted from the unconscious to the conscious part of the brain, so they cannot be underestimated.

By definition, those characteristics are not essential to make the vehicle working, rather to make it preferable. They are not tangible and therefore very subjective.

As mentioned by Sheller, driving is a matter of corporeal engagement (Krishna, 2021). You could say that for some people cars have a soul given by *sounds and vibrations* that

connect the car to the driver, they inspire love and for these reasons the act of driving itself is a de-stressing activity that acts like a therapy. On the contrary, electric cars are considered more sterile because people feel a void. This emotional attachment appeals a symbol of freedom, something that embraces the inner child.

This connection with the car is enhanced by the fact that *repairing* and working on vehicles manually are activities made also outside the workplace and are considered as a real hobby that makes this romantic relation tangible. Some people buy imperfect cars with the aim to repair them, to have a hands-on approach that cannot be said for electric vehicles, since there is not so much knowledge about them.

This DIY way of doing is so popular that creates sense of belonging for some passionate people, so much that it turns into a lifestyle. This lifestyle can be cultural related, especially for who is committed to old-school cars and values the heritage given by past.

Another desirability issue is connected to the *bad image* provided by electric vehicles, which are not seen for *common men*, rather for aliens and – thus – undesirable. The electric culture lacks authenticity and it is considered not enough stable over time, rather it is something that goes with trends, while ICEs are timeless. This is really far away from the car as an idea, and it is considered more like a mean of propaganda rather than a lifestyle to embrace and that has its values.

One of the most popular items is the *sound*, something people really care of, so much so to make a lot of changes to enhance it and to state that it cannot be replaced. It is strongly associated with the culture, but mostly *the louder the better*. Exhaust note, turbo whistles, redlining, pops and crackles are all engaging factors that increase the overall driving experience. It is worth nothing that almost every brand has its *noisy* product range: Audi with RS, BMW with M and Mercedes with AMG. This builds a segment of customers that is important to the companies, so much that they develop not only cars, but also lifestyle products for them. It is a sort of very passionate and attached to the brand niche, because of the sensation people experience while driving those cars. The connection car-driver is even stronger.

What makes a vehicle desirable is also the *fun* that it provides while driving. When talking about driving pleasure or de-stressing therapy, every user can give her/his own

connotation: for some people it is fun to shift the gear to be more engaged, for some others the fact that the car shifts itself and the driver can just enjoy the trip is very pleasant; again, it is a matter of perceptions, habits and feelings.

The fact that on BEVs there is no plan B when it comes about the gear, reduces the desirability of those vehicles.

It could be said that the five senses are involved when it comes about cars, as just mentioned the ears for the sound, the hands used when DIY the car and now the eyes for the aesthetic side.

*Fugly*, *wacky* and *cheap* are the adjectives through which people describe electric cars; they all seem to look towards the feature, not caring about the fact that they are perceived with lack of presence. To make things worse, is the fact that almost all cars look alike, as stated in the example of Figure 11.

In terms of *performance*, it was already discussed a lot about, regarding the batteries, the driving conditions, the obsolescence, etcetera. Technically speaking, the only good point in this regards BEVs seem to have, is the acceleration, for this reason they are defined as *one-trick ponies*. The weight given by batteries and the fact that they do not corner well, make people think that this technology will not replicate the all-around performance of conventional vehicles. However, with the rise of e-motorsport it is possible that EVs will have comparable performances with time.

The desirability of electric vehicles is called technological level, fun in modifying the cars, aesthetic design and performance. All features which – according to the data collected in the questionnaire – do not seem to have a huge impact in decision-making process. In fact, the evaluation of the statements is very low. The opposite case, however, is given by the possibility of polluting less by driving a totally electric vehicle as a factor which instead acts positively on consumers' perception of BEVs.

One might think that at this stage of change these features are still considered secondary, because it is clear that the focus is much more pragmatic, i.e., on a daily use level. It cannot be ruled out that in the future, when the technology is more consolidated, these features will take on greater importance; it is no coincidence that the first cars

sold themselves, but when the product reached a certain maturity, people focused on details that differentiated the products to keep their life cycle alive.

It is clear that in the premium sector this discussion loses a bit of value because in order to position themselves in a segment of this type, cars take into account these more or less tangible distinctive characteristics – such as design for example – and make them a real feature that elevates the vehicle and improves the driving experience. In fact, the premium context does not only look at having a vehicle that has good performances, but also the design, and the technological level of the operating systems.



Figure 11 – Tesla Model S and Mercedes EQE  
The chassis has a very similar shape

The proposed study has some weaknesses, which is why it would be interesting to repeat it in the future, both to remedy these shortcomings and to see how the data changes as the technology becomes more consolidated.

Specifically, I am referring first and foremost to the quality of the sample used. This one reports the average level of knowledge of the market and therefore the most widespread one, since users of electric vehicles do not yet represent a predominant percentage of the automotive industry. In fact, the respondents do not belong to a group of experts, as already reported at the beginning of the chapter in the description of the sample. An



interesting development could be given by the administration of the same questionnaire to a group of people who have used electric cars both on a daily basis and for a few years already, in such a way as to have more truthful feedback also given by accumulated experience. The questions entered also refer to events that do not occur immediately, for example maintenance or experience with the used car market. At the same time, events that occur more frequently are considered, among these charging habits, the use of vehicle for trips of a different nature and route planning are clear examples; in this regard it would be interesting to note whether this new technology – understood as battery – has been inserted in a positive or negative way into the sample's routine. Moreover, once the use of technology has consolidated, it could be observed whether and to what extent the factors linked to emotional sphere of vehicles – desirability cluster – have become more relevant and constitute a factor of product diversification. Another development that would be interesting to observe concerns the brands analysed. In this regard it could be seen how perceptions of them have changed both in terms of ranking and in qualitative terms in consumers' mind, in order to see if and how the market shares have changed. Maybe other brands could be integrated. It goes without saying that the study should be recontextualised taking into account the technological developments in the field, the level of market knowledge, the expansion of the market offer as well as the infrastructure. Speaking of infrastructure, its development should also be taken into consideration and could constitute a future object of analysis, both qualitative and quantitative.

## Chapter 5

### **The perspective of OEMs: analysis of the strategy of premium brands.**

In this chapter the strategy of three premium brands in the automotive sector is analysed, meaning Audi, BMW and Mercedes. In particular, the focus is on how they are satisfying a demand which did not exist - namely that of electric vehicles - at least a demand that was not so pronounced.

The fact that the European goal of carbon neutrality is so binding, puts OEMs (Original Equipment Manufacturers) in a position where they must create the *need* - which by definition is the lack of something (Enciclopedia Treccani, n.d.) - and make customers feel this void.

The aim is to understand how electric vehicles can be the mean to satisfy the need to procure what is lacking to achieve a given end, or what is deemed useful for the attainment of a state of material or moral well-being (Enciclopedia Treccani, n.d.). Given end that is identified by the Green Deal, which - in this case - results in zero-emission mobility, and material or moral wellbeing that depends very much on consumer behaviour, habits and preferences. For example, the feeling given by less pollution produced.

It goes without saying that when it is about electric vehicles, reference is made to Tesla as well, so it will be mentioned during the discussion. This is because Tesla has been a player with a considerable role in the automotive market, not only at the level of the car itself as a product, but also in terms of business model, initiating a direct sale one that is now taken as a benchmark by many other brands, including Mercedes - already - and BMW starting from 2024. As a pioneer in the electric market, Tesla enjoys a very high level of knowledge and innovation that has enabled it to achieve a considerable competitive advantage in terms of technology. This is why many OEMs tend to compare their sales volumes with Tesla and why it is worth considering.

The following paragraphs aim at understanding how the brands considered are working to trigger this need for conversion to electric in consumers. To do this, strategies at corporate, marketing and product portfolio level are considered.

## **5.1 The design-keeping of BMW towards 2035, how the brand is facing customer demand of EVs.**

Looking at the BMW's range of vehicles, it is easy to see how the German carmaker is coping with the transition to market electrification. Certainly, one of its strengths is the design of its vehicles and this is why it has wanted to develop its strategy by keeping it as a fix point and enter the market with *Power of Choice* strategy that will be discuss in a few. The iconic kidney grille and the clean lines of the chassis give a sophisticated look to the vehicles that express the brand's commitment to timeless beauty (Cross, 2023).

The fact that the brand attaches importance to this transition has been evident since 2013, when the i3 - the vehicle designed to redesign mobility and one of the first electric for the mass production and mass market - first appeared on the market.

To further highlight the importance of the full electric portfolio, the company groups all the models under the same *BMW i* label, indicating that – like *BMW M* vehicles – this entity is part of the group identity – because the typical features mentioned are immediately recognizable - but with a different purpose: to improve the electrification of the market. This importance is also made evident from the outset when one looks at the model section within the website. At the top of the list is *BMW i*, the BMW sub-brand dedicated to cars with a 100% electric motor. This portfolio is considered to be growing as the Munich-based carmaker has just launched the new iX2 model and plans to launch – among the other models - the touring version of the i5 in spring 2024.

### **5.1.1 From 2019 to 2025, the first strategy of BMW: Power of Choice.**

With the introduction of the i3 the company thus showed itself to be a pioneer in the electric segment, but in the early 2013 the market was not sufficiently prepared for this kind of change, as BMW had set out to address a demand that was not there already. This flop did not stop the German carmaker from innovating, so much so that eight years later – in 2021 - it is presenting itself to the market with three remarkable and 100% electric models: BMW iX3, BMW i4 and BMW iX.

BMW iX represents a real turning point for the German car manufacturer. It is considered a new interpretation of the concept of Sports Activity Vehicle (SAV). From a production point of view, it was conceived from the outset for purely electric mobility, and this allowed to create a vehicle unprecedented in the segment (Brunckhorst, 2021). For example, the absence of the gearbox – and therefore of the central tunnel – makes the interior cabin of the car very spacious eliminating all obstacles between driver and passenger seats. This production technology will be kept by the manufacturer and applied in the newly introduced electric vehicles of the portfolio.

On the other hand, the aesthetic design of BMW iX3 and BMW i4 just mentioned hardly deviates from BMW's usual standard. This is because the strategy undertaken in 2019 by the brand is called *Power of Choice*. The reason for this strategy stems from the need to balance a trade-off: on the one hand keeping the customer at the centre, and on the other the looming issue of sustainability. This is why BMW wanted to take a pioneering role in this field by expanding its range of electric vehicles (Reithofer N., 2019, in BMW-Group-Annual-Report-2019, 2020). The company had to keep a customer - who was not asking for an EV - central and at the same time push him towards the new trend.

In the first years of this electrification process there was a lot of uncertainty in the market. This is quite normal when such big changes happen; the fact is that decisions have to be made in order to respond appropriately and shape the trend.

*“What does BMW stand for? What drives us? What are we working towards? And how can we achieve our goals?”* (Zipse O., 2019, in BMW-Group-Annual-Report-2019, 2020). To those questions, only values of the company can be a good answer, especially because *“everything today is interconnected”* (Zipse O., 2019, in BMW-Group-Annual-Report-2019, 2020), therefore, a change in a condition has consequences on many other things – to take up the butterfly theory mentioned previously.

In an interview for the Harvard Business Review the Professor Shirley Lu defined BMW strategy as a *flexible powertrain* one (Shirley L., 2023, in Harvard Business Review, 2023). In her speech, in fact, she explains that the final decision should be left to customers because of their different habits: *“if you are a customer and you want a particular type of car, you should be able to choose having an electric battery inside or an internal combustion engine inside”* (Shirley L., 2023, in Harvard Business Review, 2023).

If you pay attention to BMW portfolio, it can be seen that from an aesthetic perspective there is no huge difference between EVs and ICEs. Basically, the change is hidden under the chassis. The company is keeping the design of the cars and changes the engine that moves it; this – of course, is not to LCIs.

This was confirmed in the annual report of 2019 by the Chairman of the Board of Directors Oliver Zipse, who stated: “*we offer our customers the Power of Choice. Customers choose the vehicle segment that best suits their living environment – we provide the right drivetrain to go with it*” (Zipse O., 2019, in BMW-Group-Annual-Report-2019, 2020).

Visually speaking the brand adds the *i* beside the model’s name - e.g., i4, iX3, etcetera - which is in the back of the car, and it adjusts the design of the iconic double kidney grille. This is also due to the features of electric vehicles: they require less cooling than thermic ones, therefore there is more leeway with the design (Alaniz, 2020). This is one of the most recognizable designs in the automotive industry and what keeps the brand identity visible in products, this is why it is something that changed over time, but never disappeared.

This *design-keeping strategy* is consistent in all the segments in which the brand places its cars, i.e. UKL, KKL, MKL and GKL - respectively Untere-, Kleine-, Mittlere-, Große-Klasse. Here an example of the comparison between BMW iX1 and BMW X1 that belong to the UKL segment (Figure 12).

This consistency has an impact on customers’ perception, because they can realize they are driving a BMW and it helps to keep the emotional attachment, whether the customer is loyal. On the other hand, it helps to attract new users and let them feel *what is BMW* about. People looking at the cars on the street can easily recognize them because of these features, maybe not the exact model - if they are not that much into cars - but for sure they will know it is about a BMW.



Figure 12 – On the left BMW iX1, on the right BMW X1. Same design, different engine and design of the kidneys.

The fact the company leaves the final decision in terms of engine type to customers is due to the fact they want to keep flexibility and meet customers' needs regardless of what they are looking for. This does not mean BMW does not take the electrification process seriously, on the contrary the brand also aims at being transparent. The culture of *not overpromising* is part of it, therefore whenever they make a statement, either they make sure they can deliver it, or they do not promise at all. This is also the reason why BMW – unlike Audi or Mercedes -has not signed a declaration where it announces a date to ban ICE (Shirley L., 2023, in Harvard Business Review, 2023). What the company is doing in the meantime to increase customers' awareness and trust in EVs, is to start the communication campaign by promoting the electric engine and then – eventually – the option of thermic one. The roadmap is to have one BEV in five vehicles by 2024, which will become one in three in 2026 (Zipse O., 2023, in Ullrich, 2023).

*“There is no one-size-fits-all for the mobility of today and tomorrow [...] that's why we need different solutions: on the one hand to meet our customers' wide-ranging needs. On the other, to comply with very different regulatory requirements in countries around the world”.*

(Zipse O., 2023, in Ullrich, 2023).

You have to consider that it is about a brand that has made sporty cars a relevant part of the group identity and fleet, and that operates worldwide, meaning with customers with different habits and preferences. From an analytical point of view this means combining the variability of mobility of today with customers' preferences and habits, keeping into considerations differences that in some contexts are more evident than in others (Zipse O., 2019, in BMW-Group-Annual-Report-2019, 2020). This is also supported by Mr. Zipse: BMW does business around 140 markets worldwide, therefore it is not the best option to put all the eggs in one basket, and the company must be openminded to take differences into consideration and not make plans that apply only to Europe (Zipse O., n.d., in Goppelt, 2022). The CSEU Region - i.e., the central and south eastern Europe branch under the control of Campus Salzburg where I am doing my internship - is a clear example. There are markets where there is a very strong preference for M cars, the sporty line of BMW; therefore, the company needs to develop a strategy that also suits those requirements. At the same time, there are other ones that are dealing with an infrastructure problem, because there is a shortage of charging stations which makes electric cars less attractive and so they opt for more *traditional* engines.

At this point of the situation the company has two options: just go with a full electric fleet, or trying to satisfy those segments of customers that have those characteristics mentioned; all while trying to comply with European law.

Not every market is like China - where BEV demand is growing rapidly - or Japan which is a fertile soil for BMW iX5 Hydrogen and hybrid vehicles (Zipse O., 2023, in Ullrich, 2023).

The fact is that at the basis of the electric market there is a problem, namely that of coping with a demand that does not exist because the market is full of cars that work and satisfy various customer segments; therefore the Power of Choice was not effective in the long term, because customers did not feel the need of buying an electric vehicle, it was just an option in a pool of already valid ones.

So how could sustainable mobility be made attractive for BMW? To this purpose the strategy of BMW is very clear. The magic formula is made of three key success factors (Zipse O., 2023, in Ullrich, 2023):

- A diverse range of products, with a clear focus on ramping up e-mobility;
- Digitalization of products and of the company;
- On point preparation for the NEUE KLASSE.

With reference to the first point, the goal is to increase the product range of all the main models by having at least one all-electric vehicle in them, then improving the digital part with high quality assistance controls, such as Highway Assistant, digital vehicle key available also for Android and the multimedia offer with Bundesliga games and streaming capabilities, which – in my opinion – are particularly interesting when it comes about waiting time and charging the car.

The third is the NEUE KLASSE: a big turning point innovation for BMW. With it the brand will move far away from the Power of Choice, as this will be only about BEV platforms and models. Due to its importance, it is discussed in the next paragraph.

### **5.1.2 From 2026 to 2030, the NEUE KLASSE as the new strategy of BMW.**

*“The NEUE KLASSE is more than just another BMW-brand car. It is a whole new generation of products”.*

(Zipse O., 2023, in Ullrich, 2023)

At the core of this project there are three main pillars of this transformation: electromobility, digitalization and circularity, therefore this innovation will have an impact along the entire value chain, from design, to development and production, to distribution, with the aim to humanize individual mobility and to make it intelligent and responsible (BMW Group, 2023b).

What does *humanize* mean? For BMW it is about adapting to driver’s habits, suggest destinations or entertainment programs, provide information, news calendar entries or social media posts, it is about *“integrating the customer’s everyday digital worlds into the vehicle at all levels”* (Weber F., 2023, in BMW Group, 2023).

This is made tangible by the interiors of the cars that lead the driver to another world. The combination of digital and analogue will be used in head-up display, where the user can see all useful information like contents of communications system or augmented-reality projections (BMW Group, 2023).



It is not the first time that the brand faces such a huge transformation, a journey that started in 2021 with the introduction of BMW i Vision Circular (Figure 13), the first vehicle entirely designed using recycled materials following the logic of the four Rs of the environment: Rethink, Reduce, Reuse and Recycle.

The next phase of the transformation will start in 2025 with the production of the fleet made of BMW i Vision Dee and BMW Vision Neue Klasse (Figure 13). Among the special features of these vehicles, it is worth mentioning the improved efficiency that will grant a longer range of batteries with lower consumption (BMW Group, 2023), in line with market requirements as shown in the results of the survey. To do so, the company will use round battery cells to better match the architecture of the vehicles, with sixth generation lithium-ion cells that will improve energy density and charging speed. Like BMW iX, these new vehicles are all conceived to be electric from the beginning, therefore also the interiors are designed accordingly, meaning with a huge amount of space that is occupied only by seats, steering wheel and a huge display. Starting with BMW iX and referring to the interior, this new design will be adopted for all new electric vehicles introduced to the market by the brand. It will thus be one of the features marking the transition from the Munich company's first electric vehicles to the NEUE KLASSE. Considering a five-year timeframe for the development of a new vehicle, this timeframe is the reason why this interior layout is not yet present in models such as the i4 or i5, for example, but is already present in the BMW Vision Neue Klasse concepts discussed.

*BMW Panoramic Vision* is the name of the new head-up display which is proper of the NEUE KLASSE and it is developed as an answer to ensure safety while driving. As was mentioned when talking about customers' biases, the absence of sound could be risky since people may not realize the speed they are going, and they are forced to remove the eyes from the street to look at the speedometer. The brand states the mission to solve the matter under the motto "*eyes on the road – hands on the wheel*" (Torsten, 2023).

The BMW Panoramic Vision occupies all the length of the windscreen to interact with all the people sit in the car and it is on the driver to choose which information s/he – or the passengers – wants to see (Torsten, 2023). Again, another example of the centrality of the customer for BMW.

Exterior wise, the kidneys will still play a big role. This feature will be kept by the company, but the design will be adapted to fit with the mood of the new vehicles. With

this new era, it is not *just* about kidneys and brand perception anymore, it is about lights and technological improvements. In BMW i Vision Dee the grille forms a mix of physical and digital – phygital - surface on which the car visually expresses the emotions through animated facial expressions (BMW.ie, 2023).



Figure 13 – BMW i Vision Circular - the first vehicle designed using 100% recycled materials - BMW Vision Neue Klasse and BMW i Vision Dee - the fleet of the BMW Vision NEUE KLASSE

For the brand, the NEUE KLASSE represents a means to speed up the electrification of the market, in the knowledge that it is not the only player in it. In fact, this boost must be supported by an expansion of the charging infrastructure that must keep pace with the increase in models available on the market and new types of batteries, factors that will lead to a growth in demand for battery-powered vehicles in the future (Sansovini, 2022). A future that is not so far away from now and that became tangible at the IAA Mobility 2023, the international motor show that took place in Munich. At the BMW Pavilion it was possible to see the concepts of BMW i Vision Circular, BMW i Vision Dee and BMW Neue Klasse, together with the BMW i7 Protection, BMW i5 and BMW iX5 Hydrogen, a real deep dive in the future of the brand.

Among the names of the models just listed, one of them has a feature the other ones do not have: the *hydrogen*. Indeed, another important and noteworthy pillar in BMW's race towards zero-emission mobility is the use of hydrogen. Unlike the other brands analysed in this discussion, BMW presents this additional building block as “*the missing piece in the jigsaw*” (Zipse O., in Frangoul, 2023).

Fuel Cell Electric Vehicles (FCEVs) are powered by an electric motor, but – unlike Battery Electric Vehicles (BEVs) – they produce the electricity themselves thanks to their own power plant – the fuel cell - on board, which can convert hydrogen in the fuel tank into electricity. Basically, in the fuel cell the hydrogen - that comes from the tank - meets the oxygen that comes from the ambient air. The chemical reaction produced, that is called reverse electrolysis, produces electrical energy.

This energy can flow to the electric motor that drives the vehicle or it charges the battery where the energy is stored until it is needed for driving (Figure 23) (Arnold & Lemuth, 2013).

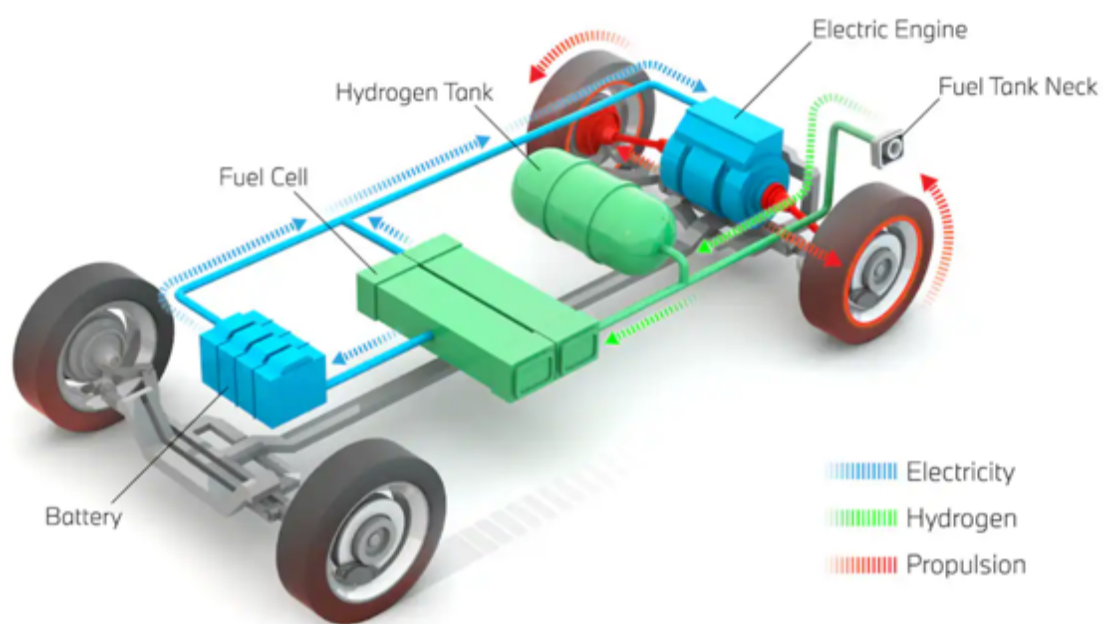


Figure 23 - In the fuel cell of an FCEV, hydrogen and oxygen generate electrical energy. This energy is directed into the electric motor and/or the battery, as needed.

So, zero local emissions, a dynamic driving experience, short refuelling time, possibly more refuelling stations – since they are cheaper to create - and a reasonable price in the long run since the knowledge provided by the developments in BEVs can be used, creating a scale effect. Certainly, the cons are not slow in coming, since hydrogen is produced using electrical energy, therefore here comes the vicious circle: if energy does not come from renewable sources, you have not really achieved the goal of a neutral carbon footprint. As regards hydrogen production, the downside is also given by how

much is wasted in terms of efficiency of the chain, also considering transportation and storage, activities that are more complex and effortful than it is for diesel or gasoline. On the other hand – unlike oil - no fields are required, hydrogen can be produced everywhere, because it only needs electricity and water (Arnold & Lemuth, 2013).

Hydrogen is a real case of the dog biting its own tail: there is potential, but much depends on how the process is managed upstream, and this requires that not so much the end product - which is hydrogen itself - as the entire production chain is sustainable. Nevertheless, BMW saw potential on this technology, so much so to develop the BMW iX5 Hydrogen. The brand drew on its experience with heat engines to develop analogies for hydrogen engine components - all with the help of the Japanese car manufacturer Toyota (Frangoul, 2023).

This represents an opportunity for the brand, especially in such a huge change where *“no single technology will be enough to enable carbon-neutral mobility worldwide”* (Zipse O., in Arnold & Lemuth, 2013).

To summarize: for BMW the customer must remain the focus during this transition. The brand started by giving her/him the Power of Choice, but now it aims at guiding her/him during the electromobility journey, towards a new era of individual mobility represented by NEUE KLASSE, which – as explained – it is more than a car. This change is not only in driving scope, but it is also about connectivity and being driven, this is why the new era of BMW is about phygital vehicles.

The brand is relying on features that keep the emotional attachment to the brand and triggers the customer that – in this way – can appreciate the step further made by the company towards innovation.

## 5.2 Audi proposes a new ecosystem of product to face customer demand of EVs.

Also in this context, I start from the website to analyse the brand strategy. The choice is not random but is made because - for the purposes of the discussion - I identify it as the brand's business card for the customer. After all, nowadays it tends to be the case that the moment an interest in a certain product arises in the customer, the website is one of those sources most used to seek information or - more simply - to get an idea and see if the demand finds a possible answer in the offer. On the website the mutual interest is quite logical, because customers visit it for configuring a vehicle or to look for updates, in general to gather information. This means that there is a certain type of attitude towards the brand and its products. It is in the interest of the brand to have visitors and to get them to the lowest part of the sales funnel; therefore, it should take the chance to display the information needed and answer their questions.

The difference in the portfolio compared to the previously analysed brand is glaring, as well as with respect to the strategy. Audi is in fact creating a new ecosystem of electric vehicles under the name *e-tron*. To fit into this category, vehicles must have rechargeable batteries integrated into the floorplan and an electric motor (Audi Italia, n.d.).

Unlike BMW, Audi clearly states a date to ban models with combustion engine: “*after 2026 we will no longer launch new models with combustion engines, and we will stop producing cars with combustion engines in 2033*” (Duesmann M., in Garsten, 2023). The milestone, therefore, is divided in two main steps, the first one in 2026 - only related to launches - and the second one in 2033 that refers to the whole production (Garsten, 2023). The goals of the company are pretty ambitious to be achieved in such a short amount of time, if you consider that currently the fleet has only three full electric models - with different packages, of course - furthermore, only in the high-end class of products and two out of three are SUVs, so the product range is not so wide.

Why is this significant gap in Audi's production compared to competitors? The CEO Duesmann presents three events particularly significant for the German automaker: first of all, the stop of production due to the lack of supply of wiring. Since most of the

production sites of this crucial component are located in Ukraine, with the beginning of the war several factories have closed. They have not fully recovered from this problem. Secondly, starting from the tension between Russia and Ukraine, the increase in the price of electricity had a significant impact on production costs.

The third strike is given by the logistic field that has seen an interruption of the shipments. The CEO says the company lost two ships that were shuttling in the Atlantic Ocean; therefore, many vehicles were lost.

The combination of these three factors led Audi to an unsatisfactory financial and production result. Despite this, the brand proved resilient, recording a good economic result in 2022 (Garsten, 2023). It goes without saying that the research and development activities in these years have gone into the background, since the company could not even ensure the *known* models, so the coming years are a great test for the brand to remain competitive in the market.

It is immediate to think that such an ambitious goal must necessarily have a good plan behind it, and in this respect Audi's response is not slow in coming. It aims at bringing 20 new models onto the market by 2025, of which half with electric engine (Amann, 2023). Furthermore, the CEO states that the company will have an eye on China, since it is *the* market for electric vehicles; he is not afraid of being transparent, in fact, he admits that Audi still does not have an appealing product portfolio for that country, nevertheless the company is working on it (Duesmann M., in Amann, 2023).

### **5.2.1 Unleash the beauty of sustainable mobility, consistently Audi.**

Purposefully, systematically and with full effort, this is what *consistently* means to the brand (Audi Financial Report 2019, 2020).

This commitment is translated into eight mission fields that serve to the brand to improve its strategy:

- A seamless customer journey exploiting every touchpoint possible is what makes the goal of *consistently customers*. The customer satisfaction is immediately stated in Audi's financial report of 2019; therefore, they start by talking about people.

- Then the focus goes immediately to the products, to explain how the brand aims at providing the *beauty* to the market. *Consistently electric* states the commitment of the brand towards electrification.  
To have a zero-emission market, you need customers to buy cars, therefore – as a carmaker – it has to allow people to find what they are looking for. For this reason, at this stage of the process Audi plans to deliver 20 models by 2025, 10 of which BEVs. To spread awareness and create enthusiasm it plans to channel a huge percentage of the marketing budget to e-tron campaigns.
- *Consistently connected*, the open and digital ecosystem of data. They want to have the highest percentage of connected vehicle share.
- To achieve carbon neutral mobility the brand acts *consistently sustainable* along the whole production chain. Not only with reference to the production itself, but Audi refers to a concept of sustainability that delas also with employees and – again – people. Integrity and compliance are at the basis of this goal.
- This is also reported in the fifth field of Audi: *consistently team*. To be more agile such a huge transformation cannot be made by one person, therefore they switched into a flatter hierarchy.
- How to do so? By remaining *consistently focused*. The aim is to go for what is essential and worth it. This implies that the brand works only on what supports the strategy and leaves out what is unnecessary.
- As a part of the Volkswagen Group, it is essential to act *consistently synergetic*. By doing so, they can exploit technological developments, use economies of scale and increase the speed at which changes are made, due to the acquired knowledge. Not by chance the *consistently Audi* strategy is part of the Volkswagen’s TOGETHER 2025+ following the vision of “*shaping mobility – for generations to come*” (Audi Financial Report 2019, 2020).  
This commitment towards synergies will also be visible when the Premium Platform Electric (PPE) will be presented.

- As any other business, also Audi must have a look at the economic side of the strategy, not only to have the means to pursue the strategy and keep innovating, but also to communicate a positive image to the stakeholders. This is why the last objective is called *consistently profitable*. This is crucial for a company that aims at placing itself “*at the forefront of the changes that will create this new form of mobility*” (Audi Financial Report 2019, 2020). This is made possible by the financial side of Audi’s strategy: the Audi Transformation Plan, ATP. It has the aim to ensure the availability of economic basis to finance future investments with the company resources.

This is how Audi enters the electric car market. It is 2018 and the carmaker from Ingolstadt launches the Audi e-tron SUV, a car that in 2023 will be called the Audi Q8 e-tron. The German company does not betray its premium soul, in fact the vehicle has a four-wheel drive, virtual exterior mirrors and Amazon Alexa on board (Dall’Ava, 2018). Audi's proposition is certainly very *very* premium; in the launches that follow, in fact, it always emphasizes its high-end positioning. A case in point is the Four-Ring manufacturer's second electric vehicle, the Audi e-tron GT, since the first electric vehicle more *accessible* economically will come in 2021 – as far as a brand like the one considered can defined *accessible*. That – in fact – is the year of Audi Q4 e-tron. The designer Marc Lichte defines the e-tron GT as the most beautiful car he has ever designed (Lichte M., n.d., in Corsani, 2021).

If you refer to the *consistently Audi* strategy, this is a perfect example of *consistently synergetic*, because it shares the production platform J1 with the Porsche Taycan (Gemelli, 2020). Such a high-end vehicle requires a high-end platform, in fact J1 is designed for high-performance cars where the battery has a lower part that allows the car to have a lower centre of gravity that results in better stability on the road. The fact is that the battery has a lot of weight and therefore needs to be placed low down, otherwise the vehicle would lose stability. This is not a feature specific to Audi but is specific to all electric vehicles.



## 5.2.2 Vorsprung 2030, PPE and a new naming strategy, the future of the Four Rings.

What comes next in Audi's strategy is scanned by this trilogy: Vorsprung 2030, PPE and the new naming system for cars.

Audi fans will immediately relate the name of the *Vorsprung 2030* strategy to the brand, as it has always been identified with the slogan *Vorsprung durch Technik*, or *Progress through Technology*. In this way, the brand declares the continuation and evolution of a statement that has characterized it for more than 50 years.

The aim is to “ensure that Audi remains viable long into the future” (Duesmann M., 2021, in Audi MediaInfo, 2021), and to this purpose the financial support given by Audi

Transformation Plan (ATP) is fundamental. The recall of these iconic slogans for the brand represents the roots of this new strategy, firstly because it is its foundation, and secondly because only with Progress through Technology can problems such as those faced nowadays in this transition phase - carbon emissions or global warming - be solved.

The metaphor of the tree does perfect justice to this image of Audi's strategy, which rests on 50 years of solid roots and has a *crown* to be written. In fact, the *Vorsprung 2030* strategy is not totally defined, because - as argued at the beginning of this paper - this is an era of rapid change (Pieh S., 2021, in Audi MediaInfo, 2021), so future adaptations of the plan are considered according to the scenario represented by market conditions.

In an era where mobility is revolutionizing, Audi understands *Vorsprung* - Progress - as a broad concept that does not consider only vehicles, rather holistic mobility solutions capable of ranging from last-mile management to charging infrastructure (Hoffman O., 2021, in Audi MediaInfo, 2021 and Magni, 2021). This is because the brand wants to innovate with a purpose, meaning creating something that is useful to keep the world moving and for the customers especially, thanks to intelligent hardware and after-sales business that will contribute to the creation a customer-centric vehicle that will immediately make them feel what driving an Audi feels like (Hoffman O., 2021, in Audi MediaInfo, 2021).

For sure there are already some pillars in this plan, the branches of the tree - to return to the metaphor just used.

As mentioned at the beginning of the paragraph, all the new models launched by the Four Ring brand will be fully electric and with this plan it clearly states a date to ban ICE from its offer: 2033. Therefore, starting from the beginning – almost – of the new decade Audi will no longer produce vehicles with thermic combustion engine (Audi MediaInfo, 2021). This means that - starting from 2026 - Audi's portfolio will *also* - not *only* - include BEVs alongside the thermic ones; therefore, until 2033 there will still be room for ICE vehicles (Magni, 2021).

This electric improvement will be supported by the increase in use of a platform called Premium Platform Electric, the PPE.

The house of the Four Rings is also the house of the four platforms, in fact it includes among its production systems for electric cars:

- *MBL EVO*: the starting point of Audi's transition. This platform is a shared one that includes ICE models, like the Audi A8 for example. Due to the different engine, for the e-tron line the company built a dedicated chassis and body and this makes it the most used one so far (Electric Has Gone Audi, n.d.).
- *MEB*: this is the most compact of Audi's electric platforms, in fact it will be used for the majority of the company's BEV cars. Like the MEB, it was also born from a combustion engine platform, the MQB. The new electric Audis build on this platform will have greater space for passengers and luggage (Gemelli, 2020).
- *J1 Performance Platform*: with this platform Audi increases the high-end level of the segment, it is no coincidence that it is developed together with Porsche and used for Audi e-tron GT and Audi RS e-tron GT, which are on the highest segment of the brand portfolio (Electric Has Gone Audi, n.d.).

Unlike the PPE - which will be discussed shortly - it is less universal because it is specifically designed for high performance cars, like the ones just mentioned.

On the other hand, like the PPE, it benefits from a high voltage charging system to ensure fast charging; to quantify, 80% in 20 minutes. As previously mentioned for the Audi e-tron GT, the J1 architecture includes a lowered part of the battery, which guarantees the sportiness of the vehicles (Gemelli, 2020).

- *PPE*: designed for the full-size and luxury models like Audi A6 e-tron and Audi Q6 e-tron, thus not used for mass production yet (Electric Has Gone Audi, n.d.). Porsche's influence is also visible here, a bit like a continuation of the *consistently synergetic* plan mentioned above; in fact, this platform was developed by the two carmakers together. PPE has a scalable and flexible – meaning modular - architecture that can be configured to fit sedans, station wagons, crossovers and SUVs. This is a model that brings together the best practices used in previous ones, such as the large internal space of the MEB and the ultra-fast charging of the J1 (Gemelli, 2020).

There is another platform that will be used by the Volkswagen Group by 2026 and it is the Scalable Systems Platform (SSP). It represents the next generation of fully electric, digital and scalable mechatronic platforms (Electric Has Gone Audi, n.d.), probably more along the lines of BMW's NEUE KLASSE.

From this it can be deduced that Audi already has a concrete action plan for its race towards electric, but most of the innovations will start in the next few years.

What will Audi do in the meantime? This elimination will take place gradually.

Of course, the brand will work to reduce CO<sub>2</sub> emissions because the first aim – to remember - is to develop solutions to keep the world moving (Magni, 2021).

What is actually interesting - from a marketing point of view - is that the brand will change the name of the cars to distinguish electric from endothermic. According to the Ingolstadt company, this new nomenclature will make it easier to identify cars: even numbers will be proper of electric cars, while endothermic ones will have odd numbers (Perelli, 2023).

It will be no coincidence that until now both Q8, Q4 and the new all-electric model due out in 2024 – like Q6 - have all had even numbers.

Oliver Hoffmann - the Head of Technical Development and member of the Board of Management of Audi AG - said that they decided for a clearer strategy. Rather than having the traditional Q5 and the Q5 e-tron in the portfolio, they will introduce the Q6 (Hoffmann O., n.d., in Perelli, 2023).

Let me show you an example: next year the new A6 e-tron will be launched. As you can see from the name, the vehicle in question will be electric, in fact, it carries the e-tron next to the number that identifies it. Currently there is already a model called Audi A6, but equipped with a thermal engine, so following this new strategy of Audi, the current A6 will become A7 and the future A6 e-tron will simply take the name of A6 (Perelli, 2023). A strategy that is in some ways questionable if you think about the potential confusion that this could create in the minds of consumers, who are accustomed to referring to Audi models in a certain way. By doing so, the brand does not treat electric cars as a separate label of the range of vehicles it offers - as in the analysed case of BMW, although BMW integrates them into the overall portfolio, creating the electric version of an already existing model. At the opposite, Audi gives the consumer the perception of creating a completely new vehicle. This is why BMW *also* offers electric, while Audi masks the option under the guise of a new vehicle and therefore its strategy involves the creation of a new ecosystem.

### **5.3 The strategy of Mercedes towards 2035, how the brand is facing customer demand of EVs.**

Entering the Mercedes-Benz website, you perceive the competition with another brand that compete within the same market segment. Indeed, the brand welcomes visitors with the slogan *Die Neue E-Klasse* (Figure 14), which shows not a few similarities with the name of BMW's future NEUE KLASSE strategy.

In contrast to Audi, the Mercedes-Benz electric portfolio is already richer and more diversified. In fact, opening the offer to both sedans and SUVs.

So how does a visitor come to find a Mercedes-Benz vehicle? Within the German site, the models are subdivided both by nomenclature and vehicle type; this allows the consumer to have a general overview of all models in the range. The consumer can explore them all, go directly to the one that interests her/him - subdivision by *Modell* - or choose the vehicle type that best suits the needs - subdivision by *Fahrzeugtyp* - and let the brand offer him a different choice of engines.

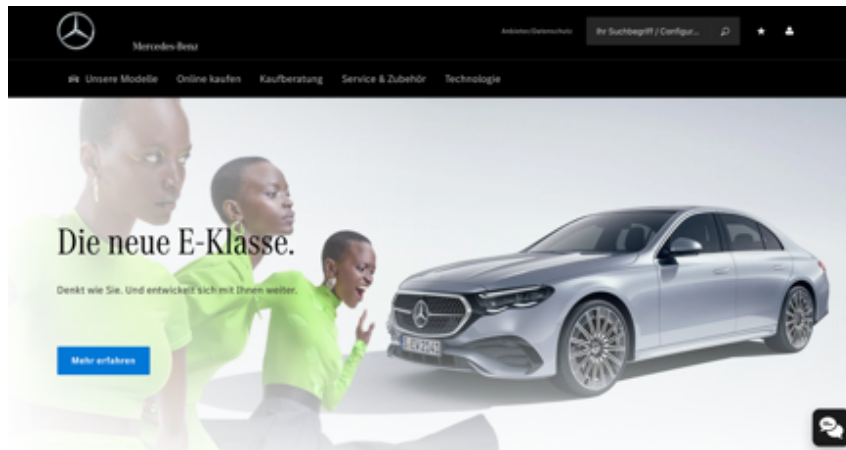


Figure 14 – The first page of Mercedes-Benz.de website

This strategy is more in line with BMW's trend than Audi's, and this suggests that the competition between the two German car manufacturers is well marked.

A different example is the official Mercedes-Benz Italy website, where electric vehicles are grouped as such, inviting the consumer to discover this - seemingly stated as *different* - range of vehicles. In this way, electric cars are presented both as a separate ecosystem and integrated into the vehicle type proposition (SUVs, Sedans, etcetera). In the version of the website used today, the EQA model – for example - is included in both the SUV and electric categories. This clearly establishes the presence of electric vehicles within the product portfolio, but at the same time allows consumers to find them as an additional option to thermic models.

A very important aspect to highlight within the Mercedes-Benz strategy is the move to the *direct sales model*, a step that the other two brands examined have not yet taken yet, although it is planned. The website becomes a true e-commerce offering visitors the opportunity to become prospects first and leads later within the same digital platform. Visually, the layout is reminiscent of a classic online shopping site; the cars are presented with more information than on the sites analysed so far: consumption, fuel type, gearbox topology, availability, purchase price and leasing instalment, as well as even more specific information in terms of packages included, optional extras or CO<sub>2</sub> emissions. To further enhance the user experience, when using this new digital interface, the availability of vehicles in that segment is also stated.

This change to a direct sales model is very much in line with Tesla's business model, and the fact that other brands are entering into this further transition - at a time when change is already the main protagonist - suggests that for car manufacturers you can almost speak of a revolution. A change that comes from the outside - namely the need to introduce *new vehicles* - and from the inside, given by the revision of the business model. In a few years the automotive scenario is therefore moving from endothermic vehicles purchased in a physical shop - the dealership - to hybrid cars first, and finally to fully electric ones purchased online.

### **5.3.1 Emotion and Intelligence, the values of Mercedes-Benz and the roadmap to achieve full-electromobility.**

Intelligent electric mobility - meaning attractive design, emotional driving experience, safety and sustainability: this is how Mercedes-Benz intends to reflect its values of *emotion* and *intelligence* on the electric vehicles (Mercedes-Benz Group, n.d.-a). The brand is facing the transition towards E-Mobility with E-models called EQX, meaning EQ plus the segment they belong to.

Mercedes-Benz enters the electric market with the first fully electric sedan, EQS. Since this is only the beginning, it makes sense that the brand used modular technology in production, thus in fact laying the foundation for the mass production of its electric fleet. As stated by Mercedes-Benz - MB from now on - one of the first objectives is to have a fully electric vehicle in every segment of the range as early as 2022. The brand defines the approach to electric as *holistic*, which includes not only the vehicles themselves, but also "*a comprehensive range of everything to do with electric mobility*" (Mercedes-Benz Group, n.d.-a).

The package – therefore - includes:

- *All-Electric Power* that allows the customer to benefit of a smooth driving experience without any emissions.

- *Advanced Technology* that makes the experience more enjoyable through augmented reality navigation, driver assistance and premium sound systems.
- The brand ensures *high standards of performance* no matter the electric engine using an instant torque delivery, that impacts on the acceleration and ensures a sporty driving experience that satisfies also the customers who requires it.
- The binomial of *Long Range and Fast Charging*. This guarantees long-distance travels with a single charge and the ease of finding charging stations thanks to the MBUX locator or the app.
- Last but not least – and the most interesting point for this discussion – the so defined by the brand *Premium Design*, a feature thought to meet the highest standard of luxury, also considering the materials (Fletcher Jones Motorcars, n.d.).

To speed-up the transformation process, MB's strategy to transition goes from *EV-first* to *EV-only* and states that the automaker will become an all-electric car manufacturer from 2030 (Quattroruote.it, 2023).

This ending date applies only to production, not selling. In fact, the brand defines the electric engine as an *alternative* for every model, because the company will still offer ICEs based on legacy platforms that allow those vehicles to reduce CO<sub>2</sub> emissions (Lye, 2021). Investments in ICE will for sure be reduced, but this does not mean that ICEs will not be sold anymore in the near future.

Like BMW, it also recognizes that it is not the only player of the market, in fact it continues announcing the strategy by stating politics as a decisive development factor in providing the needed infrastructure, thus this will happen "*wherever market conditions allow*" (Quattroruote.it, 2023).

This change in the name of the strategy is given by the fact that - starting from 2025 – all new vehicles will be fully electric, where *new* means newly launched. On the way, the roadmap includes to offer BEVs in every segment of the brand portfolio; to do so – like Audi – MB will rely on different production platforms like Mercedes-Benz Modular Architecture (MMA) and Mercedes-Benz Electric Architecture (MB.EA). The portfolio of the brand includes also performance vehicles underlined by AMG - Aufrecht, Melcher,

Grossaspach - and vans; therefore, the company will use AMG.EA and VAN.EA respectively (Lye, 2021).

It is by stating its strategy that MB takes the chance to introduce to the world Mercedes-Benz Vision EQXX, *the* next step of the company (Figure 15). A concept car that combines a full-sized accumulator on a compact production model to vehicle aerodynamics studies (Sciarra, 2021).

As said earlier, for the purpose of this discussion the design of MB's vehicles is of particular relevance, as it is a distinctive feature of these products and on which the manufacturer focuses heavily to maintain that feeling of luxury typical of the brand. Even in the case of the Mercedes-Benz EQXX, it is worth focusing on this aspect, as the vehicle in question combines design and technology, precisely the result expected by Mercedes-Benz.



Figure 15 – Mercedes-Benz Vision EQXX

The Mercedes-Benz EQXX boasts a low, tapered chassis that tapers at the rear, with flush glass, a dark rear window and roof that actually host solar panels. A vehicle with an aftertaste of the past, but which at the same time winks at the future, sending a clear message to the present: it can be done (Ungaro, 2022). Vision EQXX makes you think of BMW Vision Neue Klasse - not only because of the name - but more so because of the futuristic design that declares the projection of these companies towards a tomorrow that is not at all distant (Ungaro, 2022).



Interior wise the sensation is tunning. The width of the passenger compartment is entirely lost by a thin and curved screen of 47.5". The air diffusers transform into three small jewel-reactors, which stand out in this white tone that covers the passenger compartment. The seats are very thin and, as with the door panels, are covered with particular textures. Alcantara, microfiber, leather and refined materials of non-animal origin stimulate the touch. To this purpose, the Star used cacti and mushrooms roots (Ungaro, 2022).

Not to mention the technical characteristics of this vehicle which - when it comes to batteries - seems to have no rivals. In fact, the car manufacturer declares a range of 1.000 km with one charge. All without a huge battery but combining vehicle aerodynamics which - thanks to its featherweight and good displacement - allows for noteworthy performances. Battery which - among other things - does not include a dedicated cooling system; in fact, it will use dynamic air from A/C, which is why it has compact dimensions (Ungaro, 2022).

There is a lot on Mercedes-Benz's plate, a varied yet comprehensive offering that allows the brand to range across different segments so that there is something for every consumer. A proposal that takes the form of vehicles, but also includes technological studies, innovations, values and the future. MB starts with a realistic proposal given by the vehicles of the EQ range - EQA, EQB, EQC, EQE, EQS, EQT\_CLASS and EQV - to meet the imminent transition, but it is aware that this is not just a *phase*: it is the continuation of a change that is destined to revolutionize the automotive landscape and for this reason it is already thinking about *what will come next*, and this is represented by EQXX.

### **5.3.2 More visual, the aesthetic design of Mercedes-Benz vehicles.**

Earlier the Mercedes-Benz's Premium Design was presented as a point relevant to this discussion, namely, trying to understand how carmakers are creating interest in the electric market. In other words, how they are satisfying a demand that is currently not there or - at least - not as developed.

The design discourse is very interesting because it allows to make a comparison with - for example - BMW, which - as mentioned in the relevant paragraph - makes design its mainstay so as to maintain the *pleasure* of driving a BMW vehicle regardless of the engine underneath. This does not apply to Mercedes-Benz. Indeed, the brand deviates from this and revolutionizes the design of its electric fleet.

Here the highlights of the EQ line.

*“The Mercedes-EQ lineup promises to deliver an aesthetic all its own”* (Mercedes-Benz Surrey, n.d.), which means a futuristic style that combines aerodynamic lines and high-tech influences. Concretely, this translates into flowing, dynamic lines on the outside, enclosed in the front by an all-round line of LED headlamps, as well as in the rear, which is also fully illuminated. A glow of light that the brand likes so much that it has also been reproduced inside the cabin. Speaking of the interior, in fact, the dashboard is entirely covered in light trails (Mercedes-Benz Surrey, n.d.).

The common floor of the brand in terms of design is clearly stated by the Chief Design Officer Gordon Wagener: *“our goal is to build the most desirable cars in the world, for the brands of the Mercedes-Benz Group”* (Wagener G., n.d., in Mercedes-Benz Group, n.d.), ambition that is reached through the approach of *Sensual Purity; a bipolarity of emotion and intelligence*, a clear statement of luxury that embraces all brands of the group.

This approach is described as a philosophy that embraces the values of the brand, especially with regards to the range of its vehicles, which – as mentioned several times – are marked by EQ, which means emotion and intelligence for the manufacturer.

For a brand like MB which links its name to the term *luxury*, design is fundamental. After all, the world is full of cars and of companies that can manufacture them; so, what distinguishes MB's vehicles and makes them stand out from the crowd? The *contour*.

A MB customer buys a luxury experience the company delivers in the style of its premises also through the vehicle itself, which is designed according to the brand's logic, that of *Sensual Purity* (Mercedes-Benz Group, n.d.).

When you refer to the range of Mercedes-Benz's electric vehicles, it is about new technology, new inspiration and new design, which – in the case in question – takes the name of *One Bow Line*, or rather a single arched line that designs the roof and it joins the

front and rear of the vehicle, “*a visible manifestation of aerodynamics*” (Wagener G., n.d., in Nastri, 2023).

The stylistic innovation was introduced in 2021 with EQS and then influenced all vehicles of the Mercedes-EQ sub-brand introduced subsequently (Eisenstein, 2021). In the case of EQS, the cab-forward design features a one-piece clamshell hood that rises aggressively to flow into a steeply raked windshield. The visual impact almost resembles a bow; therefore, it deviates from a traditional layout (Robert Lesnik, n.d., in Eisenstein, 2021). Since the brand promotes emotions and intelligence, all this effort has its reason. Here is the phrase “*a visible manifestation of aerodynamics*” just quoted: the *drag coefficient* is 0.20, far better than what has been used until now (Eisenstein, 2021). This coefficient indicates how much the car can cut through the air and the lower number indicates the better performance.

Motor1 confirms that the Mercedes-Benz EQS is among the best on the market, second only to the Dutch Lightyear 0 sedan (Gemelli, 2023). What MB declared is true: Mercedes-Benz EQS has paved the way for large-scale diffusion of the One Bow Design.

If you have a look at its electric fleet from the side, it is possible to see that most of the vehicles have this new shape that resembles a *moon* not only looking at the chassis, but also with reference to the windows. A design feature that has always been present, but which became *exasperated* with the introduction of Mercedes-EQ line (Figure 16).



Figure 16 – Mercedes-Benz EQS and Mercedes-Benz S-Class

It is immediate to notice how the front corner of the window no longer points to the centre of the front wheel – as in E-Class and S-Class – but rather goes further, giving the classic round – lunar – shape mentioned above (Figure 17).

The question arises spontaneously here: why so much effort in renewing the design of the cars? Better said: the mere fact of having to restructure the drivetrain is complex, so why investing so much in this feature as to make it become a distinctive sign of the Mercedes-EQ line? The answer is not slow in coming and it is given by Gorden Wagener, the Chief Design Officer of Daimler AG.

*“The design takes on the function of the translator. [...] We have transformed the traditional luxury of Mercedes-Benz into modern luxury, reinterpreted the brand with the star and made it fascinating, tangible and, above all, desirable for young customers.”*

(Wagener G., n.d., in Mercedes-Benz Pressecenter, 2018).

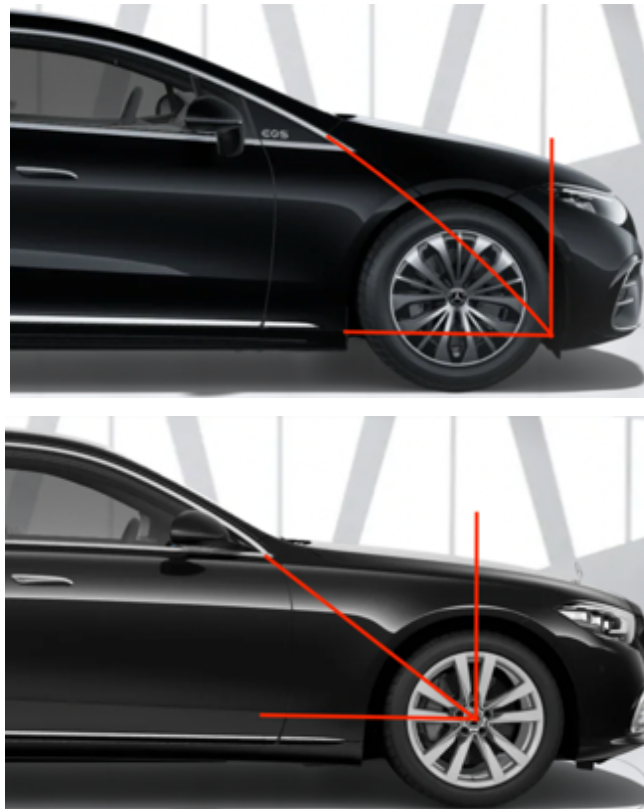


Figure 17 – Difference in angle of the front corner of the window

For MB the focus is on customers, since they are the ones experiencing the product - not just driving it. It is essential to have feedback from them regarding the product itself, but also concerning the brand, to make sure they deliver the image they aim to communicate. Mercedes-Benz stands for *luxury*, and this is consistent among all its divisions: Mercedes-Maybach represents *ultimate luxury* – since it is the most high-end segment; the sporty Mercedes-AMG delivers *performance luxury*, and the new EQ shows the way into the *future progressive luxury*. As stated by Wagener, today customers use design products as a statement of their personality; therefore, it is a way to show their lifestyle. But customers are divided into different segments served by different products, and – thanks to the multiple sub-brands of MB – everyone can highlight her/his own individuality (Mercedes-Benz Pressecenter, 2018).

As discussed in this phase of the transition, companies are addressing a demand that must be awoken, and MB does it through emotions, intelligently, “*because before the customer finds out about innovation and technology, the design alone arouses desire*” (Wagener G., n.d., in Mercedes-Benz Pressecenter, 2018).

This is another example of how the company uses its values to achieve its goals, with the aim of creating “*a consistent recognizable appearance and an independent brand world*” (Wagener G., n.d., in Mercedes-Benz Pressecenter, 2018), despite how the customers enter in touch with the company.

Consistency along the touchpoints and their amount are two key features. This is why Wagener describes the design as another touchpoint to communicate with customers, not just as a mean to develop products. This is also why it requires such an effort and the reason why Mercedes-Benz uses it as a feature when it comes about electromobility.

It can be concluded that - in terms of design - the similarity between BMW’s strategy and that of MB is a little more evident with respect to Audi. Both brands use it to define their identity and make the products immediately traceable to the brands. Because for them saying *I saw a car* is not the same as *I saw a BMW/MB*.

The aesthetic design of these two car manufacturers represents a real marketing strategy within the premium car segment. In the first instance they show that luxury is not necessarily ostentation but can very well be elegance and simplicity.

Second, customer centricity; everything is designed and studied to offer a tailor-made driving experience, tailored to customer’s needs; this is evident in the interior

architecture – which is driver-focused – in the Hyperscreens and in the possibility of finding every engine in every segment, even if they are still in a work-in-progress phase in this regard.

Finally, both brands show that innovation and aesthetics can coexist harmoniously (Cross, 2023).

Aesthetics can play a pivotal role in defining the brand and make products or services objects of desire. In the car industry this is evident. BMW and Mercedes-Benz have turned it into a mean to tell their stories of elegance, driver-centric luxury and innovation (Cross, 2023).

#### **5.4 THE player in the electric market: Tesla.**

In a discussion of electromobility, one cannot fail to mention Tesla, since the brand can almost be defined as a synonym for the term *electric car*. What better name since the company's one is a tribute to Nikola Tesla, the well-known physicist and electrical engineer whose patents formed the basis for electric AC motors (Wikipedia the free encyclopaedia, 2024).

Unlike the brands analysed so far, Tesla's history has a very recent origin. In fact, it was not born during the post-World War II period of prosperity, but was founded in 2003 in San Carlos, California by Eberhard and Trappenning and saw the entry of Elon Musk - as main investor - a year later, in 2004 (Cuofano, 2023).

A gamble that has lasted only - or already - twenty years.

Tesla's stated goal is the creation of high-performance electric vehicles for the mass market (alVolante.it, n.d.). At the time of foundation, the plan was to outsource many of the components of the cars themselves and from this create an electric vehicle. The company immediately realized that this strategy was not winning, as problems with the quality of the components were a major detriment to the company. Tesla decided to internalize production within the *Gigafactories*, a key factor in enabling Tesla to mass produce (Cuofano, 2023).

This production typology is present today after years of innovation, research, development and strategy. At the time of the launch, Musk's strategy was to “*accelerate the advent of sustainable transport by bringing compelling mass-market cars to market as soon as possible*” (Musk E., n.d., in Zucchi, 2022).

To do this, Tesla used the opposite approach, i.e., it did not start with a relatively affordable vehicle, but leveraged a mix of design and performance that created a vehicle capable of attracting the market's attention, a compelling machine that would offend demand for electric vehicles (Zucchi, 2022).

Indeed, Tesla entered a market already established and supplied with the *Tesla Roadster*, a sport car and – certainly - not cheap; the price in fact was around 250k dollars. The choice was not accidental but was made to target a niche market characterized by high-end consumers ready to pay a premium price.

This constitutes the starting point for achieving the objective of broadening the focus and addressing targets that have different price limits, so “*to drive down market as fast as possible to higher unit volume and lower prices with each successive model*” (Musk, 2006).

A promise kept, since the Tesla Roadster was followed by models such as the Tesla Model S sedan, the Tesla Model X SUV and the respective smaller versions Tesla Model 3 and Tesla Model Y (alVolante.it, n.d.).

Tesla therefore started with a vehicle that can be defined as *for the few* - in fact it was designed to compete with Porsche and Ferrari (Musk, 2006) - renowned market players in the luxury sector.

This choice was made because - as CEO Elon Musk explains - for a start-up that had never built a car before and had only one technological iteration and no economy of scale, it was not possible to mass market the first vehicle (Zucchi, 2022). Almost every new technology has a high initial cost before it can be optimized first and then scaled up, because it lacks the learning economies to do so (Musk, 2006). The first product would have been expensive no matter what, so the company decided to build a sport car, which seemed to have the best chance of being competitive with petrol alternatives (Zucchi, 2022).

Tesla's approach is precisely *cascade*, in fact the free cash flows obtained from the sale of the first model were invested in research and development in such a way as to increase the knowledge necessary to reduce the costs incurred for the production of subsequent

models. In other words, it is thanks to the investment made by that initial wealthy market niche that other segments now also enjoy Tesla vehicle within their reach, today and in the future (Musk, 2006).

#### **5.4.1 Not only cars, an innovation that concerns the entire business model.**

Tesla's pioneering character is not only visible in its vehicles. The company did not invent electric cars per se, but already in 2008 it presented itself to the market with the Tesla Roadster model (Figure 18), making concrete a product that until then was still too *futuristic* before any other player.

This counter-current and first-mover attitude can also be seen with regards to the business model proposed by the brand, which sees the *electric* in itself as a product, not just the vehicle. It is no coincidence that the business model refers to sales, services and charging. Tesla immediately sends out a clear signal: cars and infrastructure are not separate concepts. In this regard, Tesla created its own supercharger network which boasts a global presence. Since infrastructure has always been a question mark and a factor that has a certain relevance in customers decision-making - once this was understood - the brand decided to take care of it, to give owners of Tesla vehicles an advantage and to the remaining part one more reason to choose Tesla over its competitors. At these charging stations, drivers can recharge their car in approximately 15 minutes at an advantageous price, with the aim of accelerating the rate of adoption of these vehicles. This is in line with the mission of the company which is to accelerate the advent of sustainable transport (Zucchi, 2022).

Within Tesla's strategy there are two key words: *internalization* and *speed*. As already mentioned in the analysis of the previous brands, this trend towards a direct sales model is being established. Tesla thus started from the beginning - that is - without any dealership license but dealing with customers directly through a network of showrooms owned by Tesla. This is another example of *in-house*, from production in the Gigafactories to the sales steps. By doing so, any conflict of interest between sellers is eliminated, since they all contribute to the success of the brand and not at the single dealership level (Zucchi, 2022). This is crucial to have an eye on margins and to avoid that



the price of the car differs a lot between dealerships; as mentioned, margin is very important for an innovative company like the one mentioned, that reinvests it in R&D to gain even more competitive advantage. Furthermore, the direct control of the sales channel allows an advantage in terms of speed of the product development.



Figure 18 – The first generation of Tesla Roadster

As far as service is concerned, the after-sales one is considered. In some areas, Tesla employs *Mobile Service Support*, which are mobile technicians who make home visits or provide remote support. This is made possible by the level of technology inherent in Tesla's vehicles; for example, Tesla Model S can upload data wirelessly, so that technicians have the information needed to operate the vehicle remotely without any physical interaction (Zucchi, 2022).

The vehicles of this brand benefit from a new and technologically advanced hardware and software architecture that is superior to the average market standard. This also has a positive effect on the ability to update and optimize vehicle performance, because everything operates in the same product architecture (Furr & Dyer, 2020). A bit like Apple, but for cars.

The fact that Tesla was born electric certainly gives it an advantage over its competitors when it comes to vehicle architecture. Concretely it consists of a flat battery pack at the

base of the vehicle which lowers the centre of gravity increasing stability in driving, two electric motors - front and rear - no transmission and so on. This structural change of the vehicle involves the abandonment of old platforms - due to the modification or introduction of new ones - as in the case of Audi. Furthermore, it is no longer just a question of competing on a hardware level, but also of specializing on the software side (Furr & Dyer, 2020). In other words, modifying an already existing system is more complex than being born with this new predisposition.

This is not meant to diminish Tesla's strategy and success, especially since it took time to be profitable. Tesla is the source of profit it is today after several years of being negative. What is remarkable is the speed with which this profitability was recorded: just think that in 2019 - meaning after sixteen years of life - the company had a profitability of around 20 billion dollars, when Audi, BMW and Mercedes accounted for 56 mln (Audi Financial Report 2019, 2020), 92 mln (BMW-Group-Annual-Report-2019.Pdf, 2020) and 94 mln euros (Daimler Annual Report 2019, 2020) respectively.

#### **5.4.2 Tesla marketing strategy: zero-budget and Elon Musk effect.**

Not only high-performance vehicles and a business model that revolutionizes the way you see cars from top to bottom, but also a *zero-budget* marketing strategy. This is in fact one of the many peculiarities of Tesla that makes it known to the market. It is therefore interesting to see how a brand that fits into a saturated market and boasts centuries of history manages to stand out from the crowd.

Compared to the brands analysed previously, Tesla's marketing strategy is diametrically opposite. In fact, the brand does not benefit from a real budget to spend on advertising and social media (Cuofano, 2023). It can be said that *it lives on income* in a certain sense; an income which is given by its relative novelty on the market with a totally different proposal and which has caused division given that up until not long ago it was the only player actually in the electric market.

Furthermore, the extravagance of its CEO Elon Musk, who finds a way to get people talking about himself in his communication and business ways and - consequently - in one way or another about the brand. In fact, he is known as the owner of Tesla, PayPal

and Space X. Despite this, there is no doubt that Tesla has completely shifted the automotive sector towards electric.

According to what is reported in a Harvard Business Review report, there are moves implemented by the company that do not have the actual intent of increasing revenues, but rather bringing attention to the company and having the support of stakeholders: this is called *innovation capital*. These moves include, for example, the launch of Tesla Cybertruck or Tesla Roadster 2.0 (Furr & Dyer, 2020).

Leveraging the success of past projects - such as those just mentioned of PayPal and Space X - means using them as a proxy for the success of Musk's future projects. In a Tweet he stated that "*Roadster will include roughly 10 small rocket thrusters [...]. Maybe they will even allow a Tesla to fly*" (Musk E., n.d., in Furr & Dyer, 2020). He is not serious, but he links his latest innovation - the Tesla Roadster - to another successful one - the thrusters. In this way the link creates a positive halo around the company to keep having support of investors, customers and employees (Furr & Dyer, 2020). This is crucial to keep the company alive, both monetary-wise but also in the minds of the customers.

This way of communicating is defined *impression amplifier*. By presenting the Cybertrucks concretely on stage or parking the Space X in front of the National Air and Space Museums, he wants people not only seeing but really feeling what he is talking about; therefore, he materializes the idea to overcome scepticism creating a huge buzz (Furr & Dyer, 2020).

The CEO of Tesla Motors is certainly a public figure capable of making people talk about himself and attracting attention. In this way he also indirectly does for the company, which in some ways has always benefited from him, despite Elon Musk being a controversial character that not everyone agrees on.

The moment buzz forms around a public figure it creates a sort of *halo effect* because people look at who this person is, what he does and - in the case of Elon Musk - in addition to PayPal, Space X and Twitter, also the name of Tesla comes out. In this way the brand's image is directly subordinated to that of the character. If the company offers products of a certain type which already enjoy a good reputation - in other words, which sell themselves - the effect is successful.

It can therefore be said that Elon Musk is a real influencer of Tesla's marketing strategy generating hype (Cezim, 2024).

His influence can be summarized in five points (Chaurasia, 2023):

- *Innovative communication style* through tweets that create public interest, buzz and have consequences on stock prices – as in the example of the thrusters mentioned above.
- *Brand storytelling* through narratives that make people feel what Tesla is about and that allow to elevate the meaning of the car to create brand loyalty.
- *Personal branding* given by his controversial attitude, as discussed.
- The ability of keeping people engaged towards *product teasers* that generate excitement among Tesla fans.

What is noteworthy is that this ability to do marketing is present not only when the company is doing good, but also in times of crisis, which – for a character like Musk – is essential. His transparency, willing to address issues and taking responsibility helped in keeping trust in the brand. When the window of the Cybertruck was broken in front of the audience, he reacted with irony by saying “*not too bad, there is room for improvement*” (Bloomberg Technology, 2020) and proposed trying the experiment again on the rear window, even though he was visibly embarrassed.

The fact Tesla does not have a real marketing budget does not mean that it does not have a marketing strategy. In fact, it uses various external communication channels, including: the website – as it is the main platform for the sale of vehicles; the WOM between customers who have already adopted Tesla products and new buyers, in order to encourage a sense of belonging to the Tesla community. PR to ensure that the audience remains updated on the company's new product specifications, innovations and projects in order to increase loyalty towards the brand. It also uses physical presence through showrooms, but in particular through charging stations, initially designed only for Tesla users. This is particularly noteworthy, as no other market player had done it before and was waiting for the intervention of the policy maker (Chaurasia,

2023). The company also uses the YouTube channel by posting videos to highlight the features of the cars and to let people see what behind-the-scenes is, meaning the company's operations (Cezim, 2024).

The marketing strategy of Tesla is noteworthy, because it does not rely on traditional advertising forms, rather it uses WOM and many other techniques to create buzz around the products and emotional connection with the audience. It is a mix of awareness, promotion and social engagement given also by the help of the CEO.

This zero-budget strategy is done because the company believes that it is better to invest in technology to have a product that can sell itself, rather than spending millions on advertising; it is a matter of choice about where to invest the revenues.

## Chapter 6

### **Combining biases and strategies, the relation between demand and supply side of the electromobility market.**

Within the survey presented in the previous chapters, the last section was included to understand how the premium brands considered in this discussion are perceived by the respondents. This analysis was conducted both by directly comparing the brands with each other - and therefore asking respondents to draw up a ranking based on precise reference attributes - and taken individually, i.e. asking them to choose from a range of adjectives which ones best represented the brand analysed.

Since any brand communicates with the market and tries to emphasize some attributes, it is interesting to understand if the image it tries to promote is consistent with what is perceived in consumers' heads.

Due to the fact that the majority of respondents that come from other countries - Austria, France, Germany and Greece - are made up of my work colleagues at the Salzburg Campus of BMW Vertriebs GmbH, the commented results of this section refer to the answers given by the Italian public, i.e. 127 inputs. This is done to try to eliminate potential biases that could affect the results. In fact, if you look at the ranking questions, BMW sees a preference in absolute terms compared to all the other brands, an advantage that is less marked in the survey proposed to the Italian public.

I asked to classify the brands with reference to three attributes common to all: reliability, aesthetic design and technological innovation. These questions were asked twice for attribute: first referring to the entire range of vehicles and the second time considering only electric ones, to see if there are any changes in terms of perception with specific focus on BEVs, as main subject of this paper. In this second variant there were four options to rank, in fact Tesla was also added to the three premium brands analysed - Audi, BMW and Mercedes-Benz.

Among the results of the survey a certain consistency on the part of the interviewees in classifying the brands can be noted: BMW sees a higher preference both in terms of the brand itself and in terms of reliability and aesthetic design of the entire range of vehicles

offered. This greater preference is lost when the focus shifts towards electric vehicles only: Tesla in fact leaves not the slightest doubt and it is positioned at the top of the interviewees' preferences in all three attributes assessed – reliability, aesthetic design and technological innovation (Figure 19). BMW and Audi follow, while Mercedes-Benz closes the ranking.

Please note that in Figure 19 the questions are shown in English for the sake of consistency of the paper, but the results are for the Italian respondent audience.

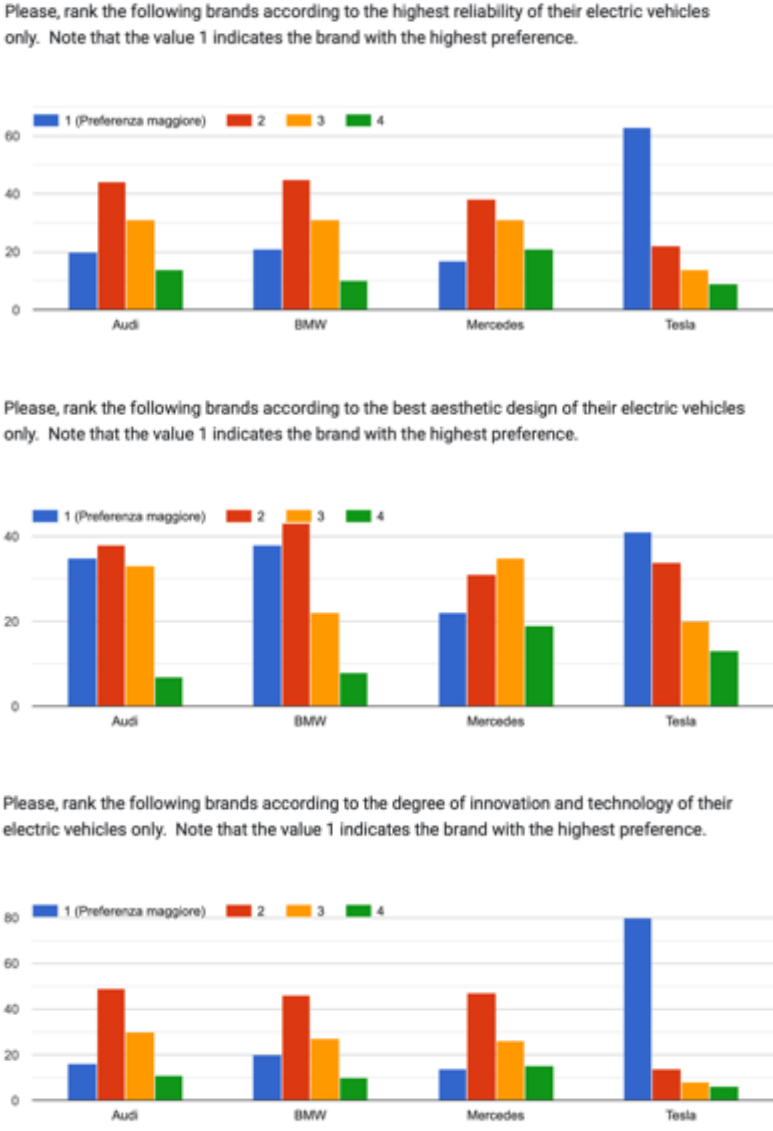


Figure 19 – The evidence of the preference towards Tesla when it comes about electric vehicles

These results make it clear that there is a pool of brands to choose from, and then there is Tesla, an outlier in the electric market which sees other market players, but these - to date - have not held such a large share to be considered competitors or rivals anyway. It is good to pay attention to the fact that what has just been stated is valid *to date*, in fact the electric automotive panorama is slowly transforming. This is understandable as it is necessary for other brands to remain competitive on the market.

If you leave apart Tesla for a moment and you consider the other three premium competitors that were not born electric, BMW has the majority of preferences. In a premium segment like the one considered, BMW has been synonymous with excellence (Cache, 2023). It can be defined as a *complete* brand, because it includes a proposal for the lower ranges satisfied by the models of the UKL segment – for example BMW 1 series – as well as medium range vehicles – BMW X3 – up to the luxury given by cars such as BMW 7 series. To complete the proposal, there are options that satisfy lovers of sportiness with the *BMW M* vehicles and customers looking for electric with the *BMW i* range.

Nevertheless, for each of these ranges there is more or less marked competition with other brands that challenges its market leadership: Audi, in fact, with the RS range challenges the BMW M one, while Mercedes-Benz offers vehicles that exude luxury and opulence, thus competing with vehicles from BMW's GKL segment (Cache, 2023).

To this usual competition – which has been present in the market for a long time – there is a new one with Tesla, the Electric Giant – or the Electric Pioneer – for range, performance and autonomous driving technology (Cache, 2023). If it is true that BMW sees one more competitor, at present Tesla sees three potential ones, because both Audi, BMW and MB are introducing new proposals onto the market. This may represent a wake-up call for the company, in fact these electric vehicles - offered by brands that enjoy a good reputation with good range and similar prices – may represent an obstacle for Tesla, which could become even more significant as the technological development increases (Tae, 2018).

The distinction between brands is also present in the minds of customers; in fact, when it comes to choose which adjectives best describe the brands considered, while Audi,



BMW and Mercedes share sportiness – a little less marked for MB – the reliability and expensiveness of their cars, Tesla is described using different words.

Innovation, avant-grade and pioneering, this is how Tesla positions itself in the minds of consumers. It is interesting to see how – *ceteris paribus*, given the same number of usable adjectives – in the case of Tesla these attributes - which can be defined as *less tangible* and more brand-related - come first, and only well afterwards do attributes more linked to vehicles, such as those mentioned for the other brands in terms of price, reliability and safety.

The image that Tesla has given to the market initially concerns the brand itself, as an umbrella that includes a set of products with a certain quality, but the brand comes first. It would be interesting to see if and how the perception changes in a few years, when the products and the brand acquire greater maturity.

Numbers are supposed to tell the truth, since they are more objective than an opinion, it is not a matter of tastes. The aim is to find a relation between the biases and the strategies by analysing the company that seems to be more successful, to understand how it is trying to overcome those limits. For this reason, annual reports are used to have empirical evidence of the impact of the strategies mentioned above on deliveries. The reports considered refer to the period from beginning of the year to the end of Q3 2023 (30<sup>th</sup> September 2023), as the latest update available and consultable at the time of drafting this paper on the website of the various companies. The final reports will follow in the next months, but for reasons of time not compatible with the preparation of the thesis, I choose to use the data available at the end of the third quarter of 2023. This is also done to provide empirical evidence that is as reliable and up to date as possible. Also note that the data reported below refers respectively only to Audi, BMW, Mercedes-Benz and Tesla vehicles, meaning leaving out the other brands belonging to the different groups, such as Bentley and Lamborghini in the case of Audi, MINI and Rolls-Royce as regards BMW and the van segment of the Mercedes-Benz brand.

According to what was declared by the car manufacturers analysed in their annual reports in the period considered, deliveries as of 30 September 2023 amounted to 1,387,036 units for Audi (Audi Quarterly Update - Q3\_2023, 2023), 1,621,267 units for BMW (BMW - Q3\_2023, 2023) and 1,529,793 units for Mercedes-Benz (Mercedes Benz Interim Report - Q3\_2023, 2023). Note that these numbers refer to all vehicle deliveries made by the

brands, therefore regardless of the type of engine of the cars. With reference to the electric vehicles only – however – numbers are slightly different, even though there is a positive trend for the three brands compared to 2022.

Keeping the same order of analysis and starting from Audi, the company declares that the share of EVs in brand's deliveries is 9% and that it registered an increase in deliveries of +59.8% compared to 2022 coming to count 123,040 units in Q3/2023. A significant percentage of this growth is given by Audi Q4 e-tron (Audi Quarterly Update - Q3\_2023, 2023).

The second brand analysed is BMW, which – as just reported – sees deliveries exceeding 1,5 million units. Of these 13.4% are electric cars, meaning 217,138 units. Noteworthy is the change compared to the previous year, when electric cars delivered were 99,004 units, which means a positive change of +119.3%. The credit goes to the sales of BMW i4 and BMW iX, as well as the more recently introduced BEVs - such as the BMW iX1 and BMW iX3 – that contributed to the positive result. It can be said that the first two models maintain a good level of diffusion in the market - being the first vehicles of this type introduced by the Munich company - but the success is also due to expansion of the product portfolio (BMW - Q3\_2023, 2023). This increase highlights the importance of working on expanding the product portfolio as a key factor to increase both the financial result of the company and its market share, as well as the transformation towards a mobility made up of electric vehicles. Confirmation also given by 36.4% of those interviewed, who say they want more choice when it comes to new electric cars.

The third brand is the one which – according to what was analysed previously – sees a strategy in its approach to electromobility that is most similar to that of the brand just analysed. It is about Mercedes-Benz. In 2022 the gap between the two OEMs was narrow, MB recorded deliveries of 95,688 units. However, during 2023 this gap widened, and MB now has 174,471 units of which represent almost 12% of total deliveries (Mercedes Benz Interim Report - Q3\_2023, 2023).

When I said before that there is a market in which certain brands compete and then there is Tesla which can operate without feeling excessively pressured by other players, this is also confirmed by numbers regarding deliveries. Tesla counts only in Q3 – therefore in the period from July to September – 435,059 units delivered, which becomes 1,324,074 if Q1 and Q2/2023 are also taken in consideration (TESLA - Q3\_2023, 2023). In terms of numbers, Tesla is just below the total allowed units of Audi, a well-

known brand in the premium sector that boasts much more years of history and experience in the industry in general, but not in the electric field. Therefore, numerically speaking, Tesla presents itself on a par with more mature brands, but – unlike them – it achieves this result with only one type of engine and only four models.

The fact that Tesla has a leading result in the electric market is not surprising, since the company was created to satisfy *this* market. Nevertheless, it succeeded, and this must be acknowledged to the brand.

If Tesla is removed from the pool of brands analysed for a moment, you can say that BMW is the brand that has convinced the most; its deliveries of BEVs are higher than those of the other two brands analysed, also in percentage terms compared to total deliveries of cars. Note that this choice to always consider Tesla as a brand that is not really integrated into the same market share as the others is made because the company was born electric, while the others share the fact of having to adapt/transform into companies producing cars also electric and which, therefore, use a production process that *has been or is being* adapted. This change – as already mentioned previously – requires more effort than being born with an adequate predisposition.

By analysing customer biases, it was understood that what most hinders consumers from using electric vehicles is scepticism about technology - therefore the battery itself - because it involves a change in habits that have been used to for quite some time.

As stated several times previously, in terms of performance Tesla offers high quality vehicles. Since BMW leads the ranking just mentioned in terms of preference among premium brands even when it comes to electric – excluding Tesla – it makes sense to analyse these two brands directly. In this regard, two different types of vehicles are compared, namely an SUV and a sedan, in order to see the performance differences of the flagship vehicles of the two brands considered.

Starting from SUVs, the Tesla Model X and BMW iX are considered. Starting once again from autonomy, Tesla Model X covers between 543 and 576 kilometres (Tesla Motors, n.d.), while BMW iX 435 kilometres with the xDrive40 version up to 633 in the xDrive50 one (BMW.it, n.d.). In terms of consumption the BMW iX has a range between 19.4 and 21.9 kWh/100km depending on the engine – xDrive40/50 and M60 respectively (BMW.it, n.d.) – while Tesla Model X is between 19.1 and 20.8 kWh/100km (Tesla Motors, n.d.). Greater

range than the sedans presented later justified by the larger size of the battery required by the bigger dimension of the cars.

As for charging, in direct current the Tesla Supercharger allows for very fast charging – 15 minutes – up to 282 kilometres (Tesla Motors, n.d.), while the BMW iX is around an average time of 31-35 minutes with SoC 10-80% (BMW.it, n.d.). In alternating current, the time required is longer, because the power is lower, and the car must transform the current from alternating to direct one. With the same power considered – 11kW – the average times declared are as follows: 8.6 hours for Tesla Model X (e-Station, n.d.) and between 6,25-7,5 hours for BMW iX (BMW.it, n.d.).

In this first example in which data relating to the SUV models of the two brands are reported, no calculations were deliberately. I limited myself to present the information as displayed on the websites. This is to demonstrate that - for a consumer entering the electric market - those mentioned are just numbers, whose interpretation – and consequently value – is left to the her/him. It is therefore necessary to educate people regarding the approach to this new motorization - especially on the website - as it is one of the main touchpoints with the customer. Once again, the concept of framing.

As regards the sedan category, the Tesla Model S and BMW i4 are compared. In terms of autonomy, Tesla Model S has an average capacity of 600-634 kilometres (Tesla Motors, n.d.), while the BMW i4 covers 479 kilometres in the eDrive35 version up to 585 kilometres in the eDrive40 one (BMW.it, n.d.). Personally, I prefer the concept of consumption rather than range, as the second depends on a series of subjective variables – such as driving style and type of journey – which significantly impact on the performance of the vehicle. Autonomy is a somewhat fictitious concept, but certainly more understandable to the user because it is provided as a given number since it does not require calculations, as consumption does. In this regard the performance of BMW i4 appears better than that of Tesla Model S; in fact, the first car has a consumption range between 15.9 and 18.4 kWh/100km (BMW.it, n.d.) depending on the version, while the second is positioned between 17.5 and 18.7 kWh/100km (Tesla Motors, n.d.).

However - when referring to daily use - it is necessary to also consider charging times. In this matter, a distinction is made between many factors: whether charging occurs in direct or alternating current, the State of Charge (SoC) - which depends on the external temperature, the individual driving profile and the use of auxiliary users. In the case of

BMW, the website declares average time calculated at a temperature of 23°C and specifies that after a journey these may undergo changes (BMW.it, n.d.). Furthermore, variables such as capacity of the battery, speed of the charging point and energy absorption capacity must be considered to make a proper comparison.

On the respective websites of the companies treated, information stated are the following: using DC the Tesla Supercharger allows charging up to 322 km in 15 minutes, allowing you to acquire half of the declared autonomy. To give a comparison, the distance between Brussels and Paris is 320 kilometres (Tesla Motors, n.d.). BMW in DC requires an average charging time exactly double, 30 minutes (BMW.it, n.d.).

When it is about DC you consider a higher voltage given by the charging station and a higher absorption capacity of the vehicle's battery given by the predisposition to this type of current. It should be noted that electric car batteries are designed to absorb this type of current – which is also why charging times are shorter. In the case of AC – however – it is necessary to use a transformer inside the car which converts the current from alternating to direct - so that it is accepted by the battery - and this process takes time. Please, note that this transformation process is done automatically by the vehicle, therefore no actions needed from customer side.

When it comes about DC, charging curves are considered; in fact, the charging speed changes based on the SoC, reaching different peaks depending on it. This is why the estimated time to charge a battery that starts from a low SoC percentage is generally less than - or equal to - the filling time of the range from 80% to 100%. This is why it takes only 15 minutes to Tesla Model S to charge but note that this is up to 322 km; therefore, it can be deducted that timing might be the same, but how it is communicated to customers makes the difference. It is a case of framing, the bias stated by Kahneman (Kahneman D., 2011, in Wikipedia the free encyclopaedia, 2023).

To use a metaphor, it is like filling a bottle from the sink: with an empty or semi-empty bottle the water is poured in at its maximum power or in any case at a higher speed; as you get closer to the brim, the speed at which the water is put into the bottle is reduced, so that it does not spill out. As regards the batteries of electric cars charged in DC, the reasoning is similar. Please, see the images below which show the charging curves for BM i4, Tesla Model S and Tesla Model X. Since – especially for BMW i4 – the website used does not specify which version it refers to, I assume that the curve declared is given by average of the values of the versions (Figure 20).

Last but not least, in DC the situation is quicker to manage because the charging station is more powerful and the absorption capacity of the car's battery is greater, reaching around 200kW/h on average, therefore the charging time is much shorter than with AC.

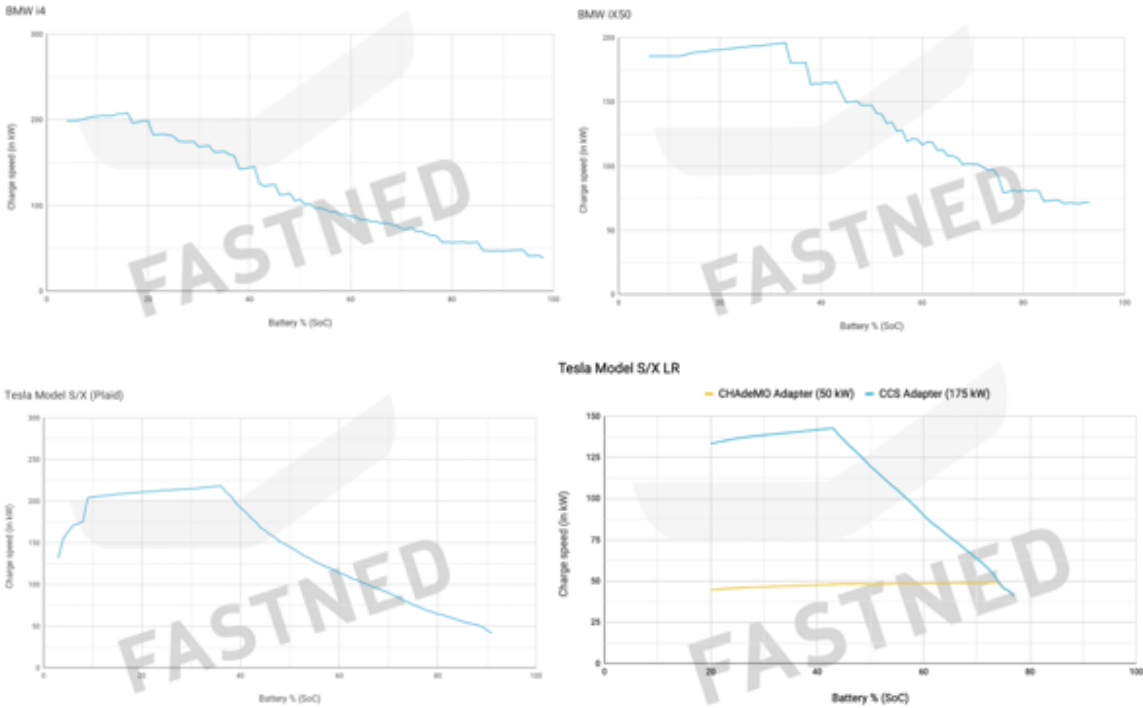


Figure 20 – Comparison of charging curves for BMW i4, BMW iX xDrive50, Tesla Model S and Tesla Model X Plaid, Tesla Model S and Tesla Model X (Fastnet, 2023)

As for charging in AC, if a power of 11kW is considered to both cars, the average declared times are as follows: 8,6 hours for Tesla Model S (e-Station, n.d.) and between 7-8,5 hours for BMW i4 depending on the version. (BMW.it, n.d.).

Why is this difference? When talking about AC, it is good to clarify that there is nothing similar to charging curves just described for DC, because the power supply does not undergo these large fluctuations. However, it is important to clarify that the charging station has its own power which may or may not differ from the one supported by the car's battery. In any case, the car is always in charge; this means that even if the charging station - or the WB - may have a higher power, the battery will always recharge according to the times given by its absorption capacity. Here is an example.

Consider a battery with a capacity of 80kW/h charged in AC using a charging station that delivers 22kW/h. The absorption capacity of the battery is equal to 22kW/h. Under these conditions, the time taken to fully charge is approximately 4 hours. If – however – the absorption capacity of the battery is 11kW/h, the time required will be exactly double, i.e. 8 hours. This is because – as stated previously – the car takes the lead. Please note that the example is made by keeping the same capacity as regards the battery. In real life, this data can differ; therefore - when comparing cars - this is also a variable that must be considered to make a proper comparison.

To give a better idea of the difference between DC and AC in terms of charging times, it is as if you were to throw a bucket and a demijohn into the swimming pool, both having the same capacity. The bucket fills immediately, while the carboy has a neck that slows down the force with which the water enters and consequently increases the filling time. Think of direct current as the example of the bucket and alternating one as that of the demijohn, where the bottleneck is represented by the type of current that must be transformed, as described.

It is immediate to perceive how – with more explanations – concepts appear different, customers are able to make comparisons and make a choice based on performances.

Upon closer inspection, the process is not entirely new because - even in the case of a combustion engine - there is a tank capacity and a certain consumption that guarantees a certain level of range. The fact is in that case the refuelling method is one and requires approximately the same time frame in all service stations. Therefore, it can be concluded that what people are not used to, is this reasoning in terms of absorption capacity of the battery and the proper of the column; this is reflected in the timing. The goal would be to increase battery's and absorption capacity, meaning how to fit more kW in a space that should be maintained or even reduced. The batteries already occupy all the space underneath the vehicle, so an increase in size is not feasible. Not to mention the weight they already entail. This is a very dynamic field, that needs developments not only with reference to cars, also in the charging infrastructure.

A cluster of particular relevance for the purposes of this thesis is desirability, because – as mentioned previously – premium brands leverage attributes that not only concern the technical characteristics of the machines, but also highlight the vehicles from an

emotional perspective. According to the survey results, these attributes appear to be of secondary importance at this stage of change; in fact - as mentioned – consumers still focus on practical aspects. For example, design – which was discussed extensively in the discussion – does not seem to be a problem for the sample interviewed, who 62.3% (91 out of 146) do not believe that this reduces the desirability. This is inferred from the rating of the statement *The design of EVs is not very desirable*.

A direct conclusion could be that the brands analysed are investing resources poorly if they focus so much on an attribute considered to be of little relevance. However, this must be contextualised in what has always been considered premium and on which the brands in question have leveraged, characteristics which also include the design of the cars. That is, BMW has been defined as synonymous with excellence, Audi with sportiness and Mercedes-Benz with luxury. Tesla instead describes itself as The Electric Pioneer (Cache, 2023).

One of the fundamental pillars that BMW wanted to maintain even during this phase of crisis is to meet customers' needs. Starting from this, I think BMW has understood the speed with which this change towards electromobility must occur; not at the speed of Tesla, but in any case it has implemented its strategy to react promptly as possible to such a change of scenario. I also think that BMW has understood the extent of this change and its weight in consumer habits by offering solutions for enthusiast - i.e. the BMW i line - and accompanying the most sceptical by maintaining the BMW features - meaning double kidney grille, the interface of the operating system, the internal architecture and so on, but at the same time keeping them in line with evolving trends. I believe that this is the main difference between BMW and the other brands analysed in this paper: keeping the focus on the brand and on timeless features that have contributed to the success of the vehicles and transfer them to electric ones. This is how BMW started to address the demand for electric vehicles, which is a demand that does not exist – or it is not so well-developed, at least: it creates the desire of a BMW – meaning, a car with unmistakable and known features - but electric. In this way the brand grants the good quality of the vehicle.

When approaching – if not purchasing – an electric car, people find themselves having to process much more information given their unfamiliarity with such a car and - in a



situation of limited rationality such as the one considered - it is not possible to take into consideration all the variables that impact on the final decision.

If a consumer has to buy a new car, there are considerations and information s/he already has- both given by personal experience and situations that occur in everyday life that the customer has already had to deal with. Please, remember that cases like the one described in chapter 3 are considered, meaning in which individuals must make many decisions over the course of the day - which have a different level of complexity - therefore they turn out to be time-consuming and effortful.

With the *Power of Choice* strategy BMW almost wanted to *reassure* customers by sending the message that – regardless the engine – the driver has a BMW. In this way the image of the vehicle is elevated towards a means of pleasure and comfort which can make this transition more pleasant; in fact, what remains and what matters for the brand is the pleasure of driving, hence the slogan *Sheer Driving Pleasure*.

As stated earlier in this paper when talking specifically about BMW strategy, I mentioned that basically in the *Power of Choice* the aesthetic design is maintained, therefore the change is hidden under the chassis of the car. This is a clear example of maintaining the strengths of the brand to transform changes in opportunities.

The fact is that this is a marathon, not a sprint, therefore companies are in the middle of a triangle made by the European legislation - that defines the schedule - the customers - with their needs and habits - and the business itself that requires a certain yield to be considered profitable. This is done – like in the example of Tesla – to keep this transition alive, doable and to make it more affordable for everyone, by developing economies of scale and knowledge that allow to consolidate the technology in order to be spread. This means that other changes may occur, because there are events out of the company's control and each phase of the milestone can lead to unexpected circumstances that will affect how to achieve the final result, which – to date – is a fleet of new fully electric vehicles by 2035.

What is also good about BMW is its electric portfolio that covers most of the segments – from sedan to big and small SUVs – thus capable to satisfy many targets. The fact is that this transition is not happening smoothly. Therefore, the *Power of Choice* strategy is not the best option in a long-term perspective, because if electric engines are not wanted or

perceived as necessary to face this climate change, they will not be the first choice for customers. In fact – as stated in the survey – people are sceptical also because they believe there will be other phases of the process that will pollute anyway.

BMW understood that it is fundamental to be perceived as an electric brand in customers' minds, this is why it introduces the new models by communicating the BEV version at first and it is expanding the product portfolio by focusing on the entire product range, not just on one product category. This requires more effort - since more platforms must be adapted to properly construct the vehicles - but at the same time this allows the company to speak to a greater audience with different tastes that prefer different types of cars. By doing this, electromobility is for every customer, regardless tastes and preferences, needs and wants.

It is possible to say that with this strategy BMW has accompanied its customers during this transition, introducing them to something new but with the awareness and security of driving a car that counts hundreds of years of history. This means relying on timeless features that guarantee the good performance of the vehicle. By doing so, people can be more confident when it comes about doing the last mile and buying the car.

In the next years the brand is planning to do a step further, introducing the novelty of the NEUE KLASSE, meaning products that are more than just vehicles. An important feature of these cars is represented by the fact that they are more integrated with the driver's life because this is another attribute that can make the difference and can be considered as synonym of premium, widening its meaning. I believe that this change in perspective is made in a second phase first because the company needed to acquire the technological knowledge to build such vehicles; secondly, because at this stage of the process the market has more knowledge in terms of electromobility, therefore the mindset has already been shaped for this change. By doing so, BMW has tried to make a smooth transition accompanying the customers to a gradually more visible and perceptible change.

In addition, I also believe that at this stage of change in such a premium segment it is difficult to give a definition to the adjective *premium*. Whereas in the past this was associated with attributes such as material quality, vehicle robustness, reliability, design, and technological innovation, today it is unclear how this takes shape in electric vehicles. There are many possibilities: battery range, consumption, vehicle performance,

vehicle digitisation – meaning how much the vehicle is integrated in people’s life - and whether these attributes are in addition to or replace previously used synonyms. It can be concluded that connotation is very subjective, and OEMs need to understand *who considers what*, meaning which of these attributes is most in line with consumers' definition of premium for electric vehicles. This is why it would be interesting to repeat the study in the future: to see if the perceptions associated with brands have changed and if the biases have a different impact within consumers' car habits.

## Conclusions

The thesis fits into a current context of change, specifically it takes into consideration one of the facets of ongoing climate change, an issue described using the metaphor of the *vicious circle* that I remember being “*a set of cognitive, emotional and behavioural reactions that are established and follow one another in a circular fashion in an attempt to avoid stimuli perceived as dangerous*” (Agnelli, 2019).

This topic is particularly relevant today, not so much for the fact that it is happening - climate change has always existed - but more for the *speed* with which it is occurring (Fondazione CMCC, 2021). A speed that demands equally rapid actions.

Specifically, the paper focuses on the effects of the automotive sector and on the transition that is leading to the growth of the electromobility market. The importance of this facet of the change is strengthened by the fact that the transportation sector accounts for about one fifth of the total emissions (European Parliament, 2018).

To address the topic, it starts from a general perspective given by the European regulation and then it narrows the field proceeding with the discussion. In fact, the focus is on the strategies implemented by three premium brands competing in the automotive market to create a demand for electric vehicles or - more generally - electromobility, which to date is not very developed. For this purpose, the theme is outlined through three points of view, i.e., one for each market player – policymaker, customers and OEMs.

The paper starts with a theoretical perspective given by European legislation in such a way as to have a reference benchmark, what the situation should be and what the roadmap is in an optimal condition, i.e., free of events that can threaten its success. European legislation on climate change was introduced as early as 2014, intensified in the following years, until it became binding in 2020 with two legal texts that stand out among the others: the *European Green Deal* – as a general guideline to support climate change in its entirety – and the *Fit for 55*, a package of proposals to make the Union’s policies consistent with the provisions of the Green Deal, in other words how to reach these objectives. More specifically, it addresses issues related to the automotive sector in question. This includes concepts such as the percentage of CO<sub>2</sub> emissions allowed, the

definition of charging points, type of current and how to modify residential and non-residential contexts to have a predisposition for sustainable mobility.

The objective established by the European Union – as declared by Ursula von der Leyen – is to make Europe become “*the first climate neutral carbon continent in the World by 2050*” (Von Der Leyen U, in The European Green Deal - European Commission, 2021).

If the field is reduced to the effects caused by the car market this translates into a milestone as follows: cars newly placed on the market must not emit more than 95 gCO<sub>2</sub> per kilometre on average starting from 2021, a limit which must be reduced by 55% by 2030 until complete elimination by 2035. I remind you that this last date was established by estimating the average life of a vehicle at 15 years; in this way – when cars need to be changed out of necessity – users will have choice of zero-emission ones available. In this regard, the solution is provided by batteries and alternative fuels, the latter described as energy sources used to replace that provided by fossil fuels (European Parliament, 2022). This is because to support such a large transition, a single energy source may not be sufficient.

As mentioned, the mood of the first chapter is purely theoretical to state how the transition should happen. In fact, the objective established by the European Union can be defined as ambitious, even more if it is contextualised in a scenario in which this need for electric vehicles does not exist, hence the lack of demand within the market. A case in point is the Italian one which - despite the provision of funds to incentivise the purchase of zero-emission vehicles - does not see the use of this money to the extent expected.

Nevertheless, measures implemented by the government – such as Ecobonus and Superbonus – aimed at making this transition smoother should be recognised.

This is a possible explanation supporting the fact that European legislation has become binding: it should be noted that a change in the habits of users of private vehicles is being taken in consideration. The one examined is a routine that has existed for centuries and the time frame in which this should change is just ten/fifteen years; therefore, making the legislation binding is a strategy adopted by the Union to match these two contrasting aspects.

In the second chapter the phenomenon is analysed from another point of view, that is giving a real overview in which the objectives listed in chapter one must be implemented. In this regard, a double perspective is used given by an intangible

dimension – represented by culture – and a tangible one, i.e., infrastructural development. This is because both dimensions have an impact on the decision-making process, behaviour and evaluation of choices, i.e., they impact on *consumer behaviour*. The main territory to which this study refers is the European one, which – from a cultural point of view – presents itself as challenging. In fact, within the continent different ethnic groups coexist, which means that there is no common culture. The definition proposed by Matsumoto and Juang makes this challenge evident; in fact, they describe culture as the “*set of attitudes, values, beliefs and behaviours shared by a group of people*” (Matsumoto D., Juang L., 2012, in Ashmore et al., 2018).

Combining this concept with that of mobility, they state that there are two factors that describe urban mobility, and which are highly influenced by culture itself: perception and lifestyle orientation. This is what makes the car in itself a status symbol and a means of communication that reflects the personality and the ego, which are exasperated to the point of an extension of the self and one’s ego when talking about a private car (Choo S., Mokhtarian P.L., 2004 in Ashmore et al., 2018). In this way the meaning of the object itself is elevated, because the car model chosen – or towards which one is oriented – defines to some extent what type of person the driver is. In fact, especially in the context of premium brands, it is about *selling a dream* (Bolt Blog, 2023).

This association pertains to the sphere of symbolism, that means “*how people use objects and signs to signify something about themselves to third parties within the context of a society*” (Saussure F., et al., 1916, in Ashmore et al., 2018), another driver of behaviour. This makes clear why a car is an asset that takes on particular importance for some, especially the private one. The latter in fact can be seen as a means to satisfy needs – such as social inclusion and time flexibility – that lead to carbon lock-in creating policy inertia. Hence the concept that *with a car people buy time* (Jarvis H., 1999, in Mattioli et al., 2020). Since Europe is a soil where different cultures coexist, electric vehicles can be perceived differently. This implies that this continent is challenging because it requires to balance different needs and tastes.

Changing perspective and using a more concrete one, the focus switches to infrastructure. It enjoys a direct proportionality together with electric vehicles, as together they build the concept of electromobility, and these two dimensions are supposed to grow hand in hand. This can be traced back to the concept of vicious circle.

Hence the role of the policymaker to support the transition in building the infrastructure needed or providing incentives. To have a reliable overview of the global situation – but above all European and Italian – the Smart Mobility Report 2023 drawn up by the Politecnico di Milano was used. This report is divided into different sections, but for the purposes of this discussion the focus fell on three main of these, as they are more similar to the topic covered. In particular the smart mobility market, the evolution of the offer and the survey of e-drivers. Below are the main results of these three sections.

Starting from the first – i.e., the smart mobility market – the trend in registrations and infrastructure development is analysed. There is a growing trend regarding the European market for registration of electric passenger cars, which constitute 22.9% of the total registered in 2022. A growth which – however – is not homogeneous. This is understandable given the cultural differences in terms of perceptions just mentioned when talking about culture. Italy is not aligned, in fact registrations of electric cars are facing a negative trend and constitute just 8.8% of the total.

From an infrastructural point of view, the reported situation is different and sees positive trends especially in Italy. In fact, there has been a 170% increase in private access charging points. This is a positive effect of the Superbonus government incentive. The negative side in this context has a different nature and is represented by the urban conformation of the country and the continent. They derive from ancient villages with narrow streets that have become heritage, thus making difficult to modify their conformation in favour of an easy traffic for large cars – such as the majority of electric ones in the market so far (*Energy&Strategy, Politecnico Di Milano., 2023*). From this, it can be deducted that the infrastructure is *one of* the factors that affects the consumer's final choice, but the variety in the vehicle offer also has its weight.

In this regard the report describes an extension of the range of full-electric passenger cars in segments A, D and above, which – excluding segment A – are mostly large. Alongside this, there is also an improvement in the performance of the batteries compared to the first prototypes introduced on the market, thanks to the technological development in terms of range and charging times. This extension of the offer does not only concern cars, but also the charging infrastructure, which – thanks to the introduction and diffusion of devices such as Wallbox – is also seeing an upward trend. Charging is mostly carried out via pay-per-use method, although others such as

subscription or hybrid mode are available. This represents an opportunity for OEMs, as in the analysed case of BMW and its Active Tariff mode (BMW-public-charging.com, n.d.). The third and final analysed section of this report presents a survey conducted on a public of e-drivers and defines the environmental impact together with the incentives for use and the availability of private charging points as the main driving factors in the choice of a full-electric vehicle. The interviewees state that they mostly recharge the vehicle at home given the low capillarity and the prices of the public infrastructure, as well as the incompatibility in terms of time, since they state they leave the car charging on average from 4 to 6 hours.

The paper continues with the point of view of consumers, understood as the automotive market on the demand side. In this regard, it analyses the encores that prevent them from approaching this transition. To strengthen this point of view and give a little more concreteness to the data, I used a questionnaire administered to a convenience sampling, with the aim of understanding which of these biases have the greatest weight. The analysis of the consumer's perspective begins with considerations arising from the literature review and remains consistent with the way in which the previous section was treated, i.e., starting from a more theoretical perspective – that explains how things should be – to end in a real context.

To understand how the decision-making process occurs, you start from Neoclassical Theory – also called Utility Theory. It explains the determination of variables such as price, production and income using the supply and demand model (Wikipedia the free encyclopaedia, 2023).

Accordingly to what it states, the customer purchases the bundle of goods where the higher indifference curve touches the budget constraint, meaning the amount of goods achievable with the monetary resources available and that allow the customer to achieve the highest utility. This concept works under the assumptions of perfect rationality, utility maximization and information transparency, that make decision process linear and simple. This allows the *homo oeconomicus* to take the first-best solution. The one just described is a purely theoretical situation; in fact, in reality people are in a situation of imperfect, limited, bounded rationality. As a consequence, they take *acceptable* decisions that provide the greatest utility as possible. Due to the huge amount of decision every player has to make on a daily basis (Marples, 2022), it is also a matter of



effort and time; therefore, people tend to accept suboptimal decisions that are cheaper and faster. The fact is also that they “*buy on emotion and justify with logic*” (Zaltman G., n.d., in Harris, 2015). This process takes place in the subconscious, then emotions act as a driver to transport the decision just made to the conscious mind to give it a reasonable explanation and reduce the feeling of being guilty (Harris, 2015). This reasoning links to the concept of *Behavioural Economics*, that is defined as the study of the psychological mechanisms and biases – other than rationality – that govern human decision-making behind an economic outcome (Fox, 2015).

People are driven by instinct, habits and feelings that make decisions based on psychological biases rather than rational considerations.

To better understand this concept, the work of Kahneman in his book – *Thinking, Fast and Slow* (2011) – comes to help. He describes the human brain divided into two systems: the first – *System 1* – is fast, automatic, frequent, emotional and unconscious, therefore it takes impulsiveness and a major propensity to be error prone. This is the system used to take quick daily decisions. The second one – *System 2* – is more reliable and useful for complex choices, as it is slow, effortful, infrequent, logical, calculating and conscious (Kahneman, 2011, in Wikipedia the free encyclopaedia, 2023). They are at the opposite, but both needed since the nature of decisions can be heterogeneous.

Proceeding with Kahneman’s book, heuristics and biases are presented, i.e. the shortcuts in making decisions that – sometimes – can lead to biases, the systematic errors. The author identifies six types of biases: anchoring, availability, conjunction fallacy, optimism and loss aversion, framing and sunk cost (Kahneman, 2011, in Wikipedia the free encyclopaedia, 2023). It is unrealistic to talk about decision-making process without considering all the shortcuts the brain takes to arrive to a final choice.

The next step consists in combining these concepts with the electromobility market. The broader perspective is given by the EY Mobility Consumer Index that maps the consumer mindset towards EVs. It shows that there are different segments based on the attitude towards these cars, sustainability, cost-consciousness and mobility preferences: EV skeptics, reluctants, persuadables, considerers and enthusiasts.

The percentage of customers in the segments has evolved over time because people changed their opinions: an increase in EV enthusiast, skeptics and reluctants can be seen, meaning that people start to take a stand.

When talking specifically about biases, there are several categories that should be considered and that are involved in the purchase decision, because they have an impact in the decision-making process and make people involve System 2 to do some more considerations before actually purchasing.

The survey mentioned was structured following the contribution provided by Sheller in the article *Automotive emotions: feeling the car* (2004), because it includes the role of intangible factors - like emotions and desirability - together with technical features of the cars, that are crucial points for premium brands. This was also made because the aim of the paper is to go *beyond* the price and understand which biases prevent – or have prevented – people from buying an electric vehicle so far. The questionnaire was submitted by necessity to a convenience sample; therefore, results must be interpreted according to premises. It is divided in four sections: customer and country profile, attitude towards electrification in general, electric vehicles and towards three main premium car brands.

149 valid answers were collected, both from Italy and other European countries. In the following lines describing the sample and the main results of the sampling, it will be clear the relevance of the topic discussed and the consistency with the studies mentioned previously in the other chapters.

It is interesting to note that 114 people live in a small radius from the city centre – meaning maximum 15 kilometres – of which 70% use the car as the primary means of transport, even if they live close to an area where public transport is supposed to be efficient. Hence the conclusion of the relevance of the topic discussed, because the car appears to be *the choice* and not the alternative.

The sample has a prevalence of ICE car owners satisfied with the engine the vehicles have and not willing to change it. Among the Italian side of the sample, 53% never thought about purchasing a BEV.

When asked to evaluate the willingness to the diffusion of BEVs, answers are uncertain; meaning that there is no value of the Likert scale - used to rate the statements - that prevails among the others. Moreover, the pressure imposed by European Union is not perceived so overwhelming. If people must change their car, only 10 of respondents would do it because of it. In fact – as mentioned before – the fact that EU legislation is binding finds its reason in this consumer behaviour and reluctance in changing.

The biases identified were grouped in four clusters: sales conversion inability, lack of trust in technology, living with technology and desirability. Here only the main results are listed, since a more in-depth overview is presented in chapter 4.

As regards the first cluster – sales conversion inability – it refers to factors out of customers control, meaning: waiting time considered too long for BEVs, used market with low availability and misinformation given by dealerships. A certain level of ignorance can be noted in these matters looking at the results of the survey. This is not surprising because – as mentioned – they are out of buyers' control, that is the same person that filled the survey; thus, results collected are not very interesting for the purpose of the discussion.

The same issue in terms of relevance of results applies to the fourth cluster, although meaningful from a premium brand perspective. It is emotion related because it considers features that are very subjective and linked to culture, but that make the car preferable. What makes it desirable – according to the eWOM used by Krishna and Sheller in their analysis – is given by sounds and vibrations, DIY of repairing and modifying cars, the aesthetic design, the sound of the engine and the fun in driving provided by shifting the rear. Indeed, there is no option for electric vehicles, since the engine does not need it for mechanical reasons.

What impacts the most the mind of customers and prevent them from buying an electric car is presented in clusters number two and three: lack of trust in technology and living with it, where – as will be noted in a few – for technology you mean battery.

The level of technology is not considered ready for daily usage. It was found out that the problem is not technology in itself, as people use many different devices nowadays and are used to data usage and protection. This habit reduces the fear of hacking and piracy. The problem arises when technology means battery, i.e., security in accidents, recycling and planning the journey in advance, which most of the interviewees agree with; in fact, for 54% of them it represents a real problem and a reduction of freedom.

When it comes about living with technology, issues such as price gap, maintenance and insurance are negligible; what matters are infrastructure, charging time and range.

The lack of infrastructure gives anxiety because it impacts freedom, since people have to stop, adapt the journey and face some unforeseen events they do not want to deal with.

Then charge duration which is related to range; these concepts go hand in hand by now,

meaning with this level of technology. More than 50% of interviewees would be willing to buy an electric vehicle if the range was greater and charging time lower.

Changing perspective and following the one of the third player in the market – companies - the strategies of Audi, BMW and Mercedes-Benz are taken into consideration, to analyse the market from the supply side and see how they are creating and satisfying a demand that does not exist at the moment. Since it is about electric cars, reference is also made to Tesla, as the player with a considerable role in this market. The aim is to analyse the strategies to understand how brands are working to trigger the need for conversion imposed by European union in consumers.

The initial one of BMW can be defined as a design-keeping strategy, officially named with *Power of Choice* and introduced in 2019. It sees the design as a fix point, meaning the iconic kidney grille and the clean lines of the chassis as signs of timeless beauty (Cross, 2023). This strategy stems from the need to balance a trade-off: keeping the customer at the centre while keeping pace with the changes given by electromobility. With this strategy the change is hidden under the chassis, in fact the company keeps the aesthetic design of cars and changes the engine that moves it. As stated by the Chairman of the Board of Directors Oliver Zipse: “*customers choose the vehicle segment that best suits their living environment – we provide the right drivetrain to go with it*” (Zipse O., 2019, in BMW-Group-Annual-Report-2019.Pdf, 2020).

This design-keeping strategy is consistent among all the segments of the brand – meaning UKL, KKL, MKL and GKL – which, although having a considerable product range, plans to increase it in the next years introducing more full electric models in each of them in order to make electromobility meet every preference of customers. The consistency has an impact on their perceptions, because they realize they are driving a BMW regardless the segment and the engine, thanks to the design features. On the other hand, this consistency is also needed by a brand like BMW, as it operates worldwide and – therefore – it must combine different tastes, habits and perceptions.

This is part of the magic formula through which BMW is aiming at facing the transition, that - in detail - is made by a diverse range of product with a focus on e-mobility, digitalization, and NEUE KLASSE.

The latter is considered as a revolution in BMW scenario. Indeed, it relies on three pillars: electromobility, digitalization and circularity, therefore it will have an impact on

the entire value chain, with the aim to humanize individual mobility and make it intelligent and responsible. By *humanizing* the brand means to adapt mobility to driver's habits and integrate her/his everyday digital world in the vehicle.

This change in the value chain implies also improvements in technology as well. To address the scepticism related to daily use and trust in technology mentioned before, the German carmaker will use round battery cells with sixth generation lithium-ion that increase charging speed and range.

It is worth to mention the aesthetic feature of the iconic double-kidney grille, as it is the starting point when presenting BMW. In fact – as one of the main distinctive features of the brand – it will be present in the NEUE KLASSE fleet as a phygital surface.

Unlike the other brands that will be analysed, BMW does not state a date to ban ICE – because of its culture of not overpromising; but – unlike them as well – it is investing in other technologies – like hydrogen – as “*no single technology will be enough to enable carbon-neutral mobility worldwide*” (Zipse O., in Arnold & Lemuth, 2013).

To face the electromobility transition Audi proposes a new ecosystem of products under the name of e-tron. At the moment the portfolio counts only three models and not such a wide range, because of macroeconomic events that affected the results of the brand in the past years. Nevertheless, it showed resilient, thanks to a good result in 2022 and willing to show commitment towards this transition; in fact, it states 2033 as the date to ban ICE cars production. The brand translates this commitment into the *consistently Audi* strategy, meaning a package of eight mission fields with the aim to provide beauty to the market while maintaining the premium soul that is proper to the brand (Audi Financial Report 2019, 2020). These missions cover the business in its entirety: from customer journey, production, sustainability, team organization, synergies with other brands - like Volkswagen and Porsche - and financial performance.

What comes next in Audi's strategy is given by the trilogy of Vorsprung 2030, PPE and the new naming system for cars. Starting from the first pillar, it is related to the historical slogan of the company *Vorsprung durch Technik*, where *Vorsprung* – i.e. progress – is understood as a broad concept that applies not only to vehicles, rather than to create holistic mobility solutions with the aim to keep the world moving (Hoffman O., 2021, in Audi MediaInfo, n.d.). The electric improvements that this plan will bring are concretised through the use of four production platforms: MBL EVO, MEB, J1 and PPE

especially. The first two are not born electric, therefore a specific line will be introduced because of the different production requirements of BEVs; while J1 is the same used by Porsche for the Porsche Taycan and designed for high-end cars. PPE will bring a modular architecture configured to fit every type of car – sedan, station wagon, crossover and SUV – this is why it is emphasized.

With reference to the third point, the brand declared it will change the name of the cars to distinguish electric from endothermic ones, to make them easier to identify: even numbers will be proper of electric models, while odd of endothermic ones (Perelli, 2023). This strategy could lead to an initial confusion in customers' mind, since they are used to a certain name system, but – by doing so – Audi gives the perception of creating new vehicles not new version of already existing ones – like in the case of BMW, for example. The electric option will be offered under the guise of a new vehicle, hence the creation of a new – apparent – ecosystem.

The strategy of Mercedes-Benz (MB) proves to be more in line with BMW's one, both in terms of how vehicles are displayed on the website, development of the product range and slogan *Die neue E-Klasse*.

Talking about website and unlike BMW, the brand already shifted into a direct sales model, meaning that the website has the interface for online purchasing in terms of layout, information display, stock locator and availability of vehicles.

To face this transition phase MB changed the name of its strategy from *EV-first* to *EV-only*, because – like BMW – newly launched vehicles will be fully electric made of different platforms, like Audi. This change only applies for production and not selling; indeed, for the brand electric engine represents an *alternative* to the thermic versions of the model that will still be sold.

*Die neue E-Klasse* is a strategy that takes the shape of vehicles grouped in the EQ range to meet the transition towards electromobility. Mercedes-Benz is aware that this is not just a phase or a trend, rather than a change in the entire industry; thus, this is why it is thinking about the next steps to remain competitive in the market and Mercedes EQXX is a concrete evidence of this commitment.

Attractive design, emotional driving experience, safety and sustainability, this is how MB reflects its values of *emotion and intelligence* on electric vehicles, that form the ecosystem of EQX models - EQ plus the segment they belong to. The brand aims at

having a holistic approach, i.e. “*a comprehensive range of everything to do with electric mobility*” (Mercedes-Benz Group, n.d.). This also refers about keeping the *Premium Design* to meet the highest standards of luxury that the brand presented is synonymous with, both exterior- and interior-wise (Fletcher Jones Motorcars, n.d.).

The one of Premium Design is a more visual strategy, indeed “*the Mercedes-EQ lineup promises to deliver an aesthetic all its own*” (Mercedes-Benz Surrey, n.d.). Concretely this is reflected in flowing dynamic lines enclosed in the front and in the rear by an all-round line of LED headlamps. This is consistent to the *modus operandi* of the company, that has always promoted the approach of *Sensual Purity; a bipolarity of emotion and intelligence*, a clear statement of luxury that embraces all brands of the group (Wagener G., n.d., in Mercedes-Benz Group, n.d.). With specific reference to MB’s EVs, this design takes the name of *One Bow Line*, a single arched line that designs the roof and joins the front and the rear of the vehicle with all its implications in terms of aerodynamics (Wagener G., n.d., in Nastri, 2023), as proved by the drag coefficient. Visually, the design of the electric fleet of Mercedes-Benz resembles a *moon*.

All this effort in the design is made because – according to Gorden Wagener, the Chief Design Officer of Daimler AG – it takes the function of a translator as a statement of the personality (Mercedes-Benz Pressecenter, 2018), as discussed in the study of Choo and Mokhtarian when presenting the cultural perspective of the transition (Choo S., Mokhtarian P.L., 2004 in Ashmore et al., 2018). Design is very important as it can be the first touchpoint with the customers, indeed it arouses desire before finding innovation (Wagener G., n.d., in Mercedes-Benz Pressecenter, 2018).

After analysing the strategies of the three brands it can be concluded that - in terms of design - the similarity between BMW’s strategy and that of MB is glaring. It is proposed as a means of communication used both by carmakers – in terms of brand identity – and by customers – when showing their personality through the vehicle.

Aesthetics can play a pivotal role in defining the brand and makes products or services objects of desire. In the car industry this is evident. BMW and Mercedes-Benz have turned it into a mean to tell their stories of elegance, driver-centric luxury and innovation (Cross, 2023).

As discussed, the last brand analysed in this paper is represented by Tesla. In a document about electromobility it is impossible not to mention it, as it has been almost the only player in the market for quite some time.

The goal of the company is the creation of high-performance electric vehicles for the mass market (alVolante.it, n.d.), and - for the purpose of mass-market them - internalization of production process in *Gigafactories* was a key factor.

The brand entered the market creating Tesla Roadster, a compelling car with a mix of design and performance which was sold to a high price. This choice was made to target a niche of high-end customers who were ready to pay a premium price, in order to gain margin and reinvest it in R&D activities to gain the learning economies needed to scale the production. This strategy is also explained by the fact that - at that time - Tesla was a start-up, so it was impossible for it to enter the market with a mass production, since - as stated - economies were not yet developed. There is also a positive side here: the fact of being born electric, meaning that the company already relies on production platforms that are ready to build electric vehicles, it does not have to modify already existing ones designed for ICE cars. This pioneering commitment is also visible in the sales model, which is direct from the beginning, meaning without dealerships that act under license. The brand has also a different business model compared to competitors. In this regard, it offers the electric in itself as a product encompassing sales, services and charging, i.e., electric vehicles, maintenance and Tesla charging network. By doing so, the company sends the message to the market that electromobility is a concept made of different products, not cars only. It is worth mentioning that - before any other player in the electric market - Tesla was the only one developing its own structure without waiting for the intervention of the policy maker. It understood this could have been a game changer in the choice of customers, therefore useful to accelerate the advent of sustainable transport (Zucchi, 2022), which is the mission of the brand.

When presenting Tesla's marketing strategy, it is not surprising that also this is different from competitors. The name is *Zero-budget marketing strategy*, because there is no real budget to spend on advertisement and social media. The company relies on its newness in the automotive industry and on the fact that has had no competitors for some years. Moreover, its CEO effect, Elon Musk. Despite being a controversial character, he is a real influencer for the company, because he finds a way to get people talk about him and - consequently - about the company. He leverages on success of past projects achieved by



his other companies – PayPal and Space X, as an example – as a proxy for success of new ones, generating a positive halo effect around Tesla. This is called *impression amplifier*, since he materializes the idea in front of the eyes of the customers. In this regard, there are some moves implemented by the company that do not have the goal of increasing revenues, rather than bringing attention to it. This is called *innovation capital* and include - for example - the launch of Tesla Cybertruck or Tesla Roadster 2.0 (Furr & Dyer, 2020). These unusual marketing strategy in the case of this company works because it relies on products that already enjoy a good reputation. This does not mean that Tesla does not have a strategy, rather than it combines common means – like website, WOM, PR, showrooms and YouTube – to unusual ones, such as the tactics mentioned or the Tesla charging network, creating a mix of awareness, promotion and social engagement.

The last chapter of the paper is done to combine biases and strategies to shape the relation between demand and supply side of electromobility market. It starts by presenting the last section of the survey, in which respondents were asked to classify brands depending on three attributes common to all: reliability, aesthetic design and technological innovation. Tesla is at the top of the preferences in all attributes addressed, while BMW, Audi and Mercedes-Benz follow respectively.

If Tesla is removed from the options, BMW has the highest rank. Indeed, it can be defined as a complete brand offering a wide variety of solutions that – with the advent of Tesla – sees one more competitor mining its market share. The fact that Tesla is not perceived as integrated in the market as the other brands – indeed it seems not sharing the same target of premium electric customers – is reflected on how people perceive those brands: Tesla is described with adjectives like innovation, avant-grade and pioneering, while the others with sportiness, reliability and expensiveness.

Numeric-wise this trend is confirmed, as stated by deliveries reported in the quarterly report as of Q3/2023. Tesla is just below the total reached by Audi within the same period, but these deliveries are made using one engine type and just four models. While Audi is a brand which counts much more years of history and experience in the automotive sector. Again – removing Tesla – there is BMW with BEV deliveries that count for 13.4% of registrations.

Analysing the biases, it was understood that what hinders the most from BEVs is technology – meaning, batteries. Due to the results just mentioned, BMW and Tesla were compared in terms of performance looking at their flagship models: BMW i4 and BMW iX for the first brand, while Tesla Model S and Tesla Model X for the second one. When trying to make the comparisons, in one case less data were provided to keep faith to what stated in websites by companies and highlighting the potential framing bias present in the platforms. In the other comparison more explanations were provided to allow the reader to understand the data provided. This is to demonstrate that - for a consumer entering the electric market it is necessary some education regarding the approach to this new motorization - especially on the website - as it is one of the main touchpoints with the customer.

Upon closer inspection it was understood the daily use of a vehicle in terms of refuelling is not entirely new, because people already do it for ICE cars following one known process. Therefore, it can be concluded that what people are not used to, is the reasoning in terms of absorption capacity of the battery and the one proper of the column; this is reflected in the timing. To answer people's needs in terms of ranging and charging times, the goal would be to increase battery and absorption capacity, meaning how to fit more kW in a space that should be maintained or even reduced.

What BMW did in the meantime from a production point of view was to keep the focus on timeless features transferring them to EVs, trying to send the message that what the customer is driving is a BMW regardless the type of engine. This solution entered in conflict with the fact that the transition was – and is – not happening smoothly.

Therefore, if electric vehicles are not perceived, they are not wanted. This is why the Power of Choice strategy was not successful in the long term. The intermediate step was to communicate the electric engine of every new model first, before jumping into the NEUE KLASSE. This change will be made after because there is progress on both sides of the market, keeping the European legislation as a fix point: BMW acquired knowledge, while the market awareness.

The brand started by hiding the change under the chassis, and it plans to keep going revolutionizing the design without betraying the iconic features - like the double-kidney grille. This way, it uses design to communicate to customers that this car is a BMW - as a proxy of quality of the vehicle - allowing them to show their personality towards a car,

but at the same time giving the message that who is driving a BMW is a customer future-oriented, sensitive to sustainability and circularity; basically, what NEUE KLASSE vehicles are made of. This is in line with the statement of Wagener, when defining design as a means that arouses desire before customers find innovation (Wagener G., n.d., in Mercedes-Benz Pressecenter, 2018).

By doing this BMW is ensuring a smooth transition accompanying the customers to a gradually more visible and perceptible change.

Nevertheless, there is an important issue the premium segment must face during this transition, meaning the new definition of *premium* when it comes about electromobility. Today it is unclear what this is about, as there are many possibilities: battery range, consumption, vehicle performance, vehicle digitisation and whether these attributes are in addition to or replace previously used synonyms of material quality, vehicle robustness, reliability, design, and technological innovation.

It can be concluded that connotation is very subjective, and OEMs need to understand which of these attributes is most in line with consumers' definition of premium for electric vehicles. This is why it would be interesting to repeat the study in the future: to see if the perceptions associated with brands have changed and if the biases have a different impact within consumers' car habits.

# Appendix

## Appendix 1

### **Verso il 2035: L'impatto dell'elettromobilità sul comportamento del consumatore**

Questa indagine mira a valutare come vengono percepiti gli autoveicoli elettrici e le criticità che ne impediscono – o ne hanno impedito – l'acquisto.

La compilazione del questionario è completamente anonima e richiede circa 20 minuti del Vostro tempo.

#### **Sezione 1 - Profilo del Consumatore e del Paese di provenienza**

Questa sezione si propone di esaminare i dati demografici, per delineare – a grandi linee – la persona intervistata.

1. Per favore, selezioni la Sua fascia d'età:
  - a. 18-30 anni
  - b. 31-40 anni
  - c. 41-50 anni
  - d. 51-60 anni
  - e. Oltre 60 anni
  
2. Per favore, indichi il Suo titolo di studio
  - a. Licenza media
  - b. Diploma di scuola superiore
  - c. Laurea (triennale, magistrale, magistrale a ciclo unico)
  - d. Dottorato di ricerca
  - e. Nessuna delle precedenti
  
3. Per favore, indichi il Paese in cui risiede (es. Italia)

4. Quanto è lontana la Sua residenza rispetto al centro città?
- Vivo in centro città
  - Abito non molto lontano dal centro città (5-15 km)
  - Abito a più di 15 km rispetto al centro città
5. Secondo Lei, qual è la percentuale di **autoveicoli elettrici** in circolazione nel Paese in cui risiede? Per favore, si considerino solo autoveicoli elettrici, ovvero alimentati interamente da batterie.
- 0-10%
  - 11-30%
  - 31-50%
  - 51-70%
  - 71-90%
6. Ci sono stazioni di ricarica vicino a casa Sua? Si noti che per *vicino* si intende nel raggio di 1 chilometro.
- Sì
  - No
  - Non ne sono a conoscenza
7. Indichi in una scala da 1 (completamente in disaccordo) a 5 (completamente d'accordo) quanto è d'accordo con le seguenti affermazioni relative agli **autoveicoli elettrici**. Per favore, risponda pensando al Paese di residenza che ha menzionato sopra.
- Ci sono molti autoveicoli elettrici sulle strade
  - La percentuale di autoveicoli elettrici dovrebbe essere maggiore
  - La quantità di autoveicoli elettrici sta aumentando
  - Vorrei che ci fossero più autoveicoli elettrici
8. Indichi in una scala da 1 (completamente in disaccordo) a 5 (completamente d'accordo) quanto è d'accordo con le seguenti affermazioni relative alle **stazioni**

**di ricarica.** Per favore, risponda pensando al Paese di residenza che ha menzionato sopra.

- a. Ci sono abbastanza stazioni di ricarica
  - b. Il numero di stazioni di ricarica dovrebbe essere maggiore
  - c. Il numero di stazioni di ricarica sta aumentando
  - d. Vorrei che ci fossero più stazioni di ricarica
9. Per favore, selezioni gli aggettivi che meglio descrivono le strade del Suo Paese di residenza. È possibile scegliere più opzioni tra quelle presenti.
- a. Le strade sono strette nel centro città
  - b. La pendenza delle strade è molto elevata
  - c. I paesi sono collegati da autostrade, circonvallazioni o superstrade
  - d. L'ingorgo del traffico nelle ore di punta è un vero e proprio problema
  - e. Le strade sono molto larghe
  - f. Il limite di velocità è un fattore rilevante
  - g. I limiti di velocità sono adeguati
  - h. La maggior parte delle attività principali (uffici, supermercati, negozi, ecc.) si trova nel centro città
  - i. È vietato entrare in auto nel centro della città
10. Quante auto possiede all'interno del Suo nucleo familiare?
- a. Nessuna
  - b. Una
  - c. Due
  - d. Tre
  - e. Più di tre
11. Con riferimento alla domanda precedente, per favore selezioni tra le seguenti opzioni il tipo di motore della/e autovettura/e del Suo nucleo familiare. È possibile scegliere più opzioni tra quelle presenti.
- a. Motore termico a benzina
  - b. Motore termico diesel
  - c. Bi-carburante (benzina e GPL o gas naturale)

- d. Full Hybrid
- e. Ibrido plug-in (PHEV)
- f. Motore completamente elettrico

12. Se **non** ha scelto “*Motore completamente elettrico*” nella domanda precedente, ha mai pensato di acquistare un’auto con questo tipo di motore?

- a. Sì, l’ho fatto
- b. No, preferirei noleggiarne una prima di acquistarla
- c. No, per niente

13. In una scala da 1 (totalmente insoddisfatto/a) a 5 (totalmente soddisfatto/a), quanto si ritiene soddisfatto/a del motore della Sua auto?

14. Quanto è probabile che cambi la Sua auto? Può scegliere più di un’affermazione.

- a. Non sto pensando di cambiare l’auto
- b. Sto pensando di cambiare la mia auto nei prossimi anni (1-2) a causa del nuovo Regolamento UE
- c. Sto pensando di cambiare la mia auto nei prossimi anni (1-2) perché è alla fine del suo ciclo di vita
- d. Devo cambiare la mia auto nei prossimi anni (1-2) a causa del nuovo Regolamento UE
- e. Devo cambiare la mia auto nei prossimi anni (1-2) perché è alla fine del suo ciclo di vita

15. Quanto spesso usa la Sua auto?

- a. Quotidianamente
- b. Pochi giorni alla settimana (2-3)
- c. Solo per viaggi a lunga distanza
- d. Mai

## Sezione 2 - Atteggiamento verso l'elettrificazione in generale

L'obiettivo dell'Unione Europea è ridurre le emissioni di CO<sub>2</sub> del 55% nel 2030. Dal 2035 non sarà più possibile immettere sul mercato auto nuove con motore a combustione interna.

16. In una scala da 1 (totalmente irrilevante) a 5 (totalmente rilevante), quanto percepisce il cambiamento climatico come rilevante?
17. In una scala da 1 (totalmente insensibile) a 5 (totalmente sensibile), quanto è sensibile al tema della crisi climatica?
18. Quanto ne sa del *Green Deal* europeo?
  - a. Non ne ho mai sentito parlare
  - b. So che esiste, ma non so bene di che cosa si tratti
  - c. So che si tratta di una legge europea che regola le misure per affrontare l'attuale crisi climatica
  - d. So tutto sull'argomento
19. In una scala da 1 (per nulla seriamente) a 5 (molto seriamente), quanto pensa che l'Unione Europea stia prendendo sul serio la questione del cambiamento climatico?
20. Pensa che riusciremo a raggiungere l'obiettivo di una flotta completamente elettrica di veicoli nuovi entro il 2035?
  - a. Sì
  - b. Sì, ma non nel 2035
  - c. No
21. In una scala da 1 (totalmente inutile) a 5 (totalmente utile), quanto pensa che questo processo di elettrificazione sarà utile per ridurre le emissioni di CO<sub>2</sub>?
22. Pensa che lo sforzo per l'elettrificazione valga la pena? Può scegliere più di un'affermazione.



- a. Sì, ne vale assolutamente la pena
- b. Ne vale abbastanza la pena
- c. No, perché ci saranno fasi del processo che inquineranno comunque
- d. No, troppo sforzo per un piccolo cambiamento

### **Sezione 3 - Atteggiamento verso i veicoli elettrici**

Di seguito sono raggruppati i pregiudizi più comuni che influenzano le scelte dei consumatori quando si avvicinano ad un veicolo elettrico. L'obiettivo è capire quale di questi hanno maggior impatto.

#### **Bias n.1: incapacità di conversione delle vendite**

La preghiamo di valutare le seguenti affermazioni da 1 (totalmente in disaccordo) a 5 (totalmente d'accordo).

- 23. Sono disposto/a a sopportare un tempo d'attesa maggiore per un veicolo elettrico
- 24. Ritengo che le scorte di autoveicoli elettrici siano estremamente basse
- 25. Ritengo che il valore delle auto elettriche usate sia inferiore rispetto a quello delle auto a motore termico usate
- 26. Credo che le auto elettriche usate possano avere una seconda vita
- 27. Il mercato delle auto elettriche usate non sarà una buona opportunità commerciale
- 28. C'è una vasta scelta quando si acquista un'auto elettrica nuova
- 29. Vorrei che ci fosse più scelta quando si tratta di auto elettriche nuove
- 30. Ritengo che i costi di manutenzioni degli autoveicoli elettrici siano più bassi
- 31. Il concessionario mi ha dato informazioni scoraggianti sugli autoveicoli elettrici
- 32. Sono disposto/a ad acquistare un autoveicolo online

#### **Bias n.2: mancanza di fiducia nella tecnologia**

La preghiamo di valutare le seguenti affermazioni da 1 (totalmente in disaccordo) a 5 (totalmente d'accordo).

- 33. Credo che gli autoveicoli elettrici siano vulnerabili alla pirateria informatica
- 34. Credo che gli autoveicoli elettrici possano essere rubati più facilmente

35. Credo che la mia privacy possa essere compromessa dalla tecnologia di un autoveicolo elettrico perché ha accesso a molti dei miei dati
36. Ritengo che le batterie non siano sicure in caso di incidente
37. Mi piace il fatto che gli autoveicoli elettrici siano silenziosi
38. Ritengo che questa assenza di rumore non sia sicura
39. Penso che stiamo facendo enormi progressi per quanto riguarda la durata delle batterie
40. Mi occupa la mancanza di opzioni per riciclare le batterie e i loro componenti alla fine del loro ciclo di vita
41. Non mi fido degli autoveicoli elettrici perché devo calcolare il viaggio in anticipo
42. Le stazioni di ricarica domestica possono subire blackout

### **Bias n.3: vivere con la tecnologia**

La preghiamo di valutare le seguenti affermazioni da 1 (totalmente in disaccordo) a 5 (totalmente d'accordo).

43. Credo che il divario di prezzo tra gli autoveicoli elettrici e le auto a combustione interna si stia riducendo
44. Credo che gli autoveicoli elettrici siano più costosi da mantenere e riparare rispetto a quelli a motore termico
45. Credo che le polizze assicurative per gli autoveicoli elettrici siano più costose
46. La mancanza di infrastrutture di ricarica mi mette ansia durante la guida
47. Sarei più disposto/a ad acquistare un autoveicolo elettrico se l'autonomia della batteria fosse maggiore
48. Sarei più disposto/a ad acquistare un autoveicolo elettrico se il tempo di ricarica fosse inferiore

### **Bias n.4: desiderabilità**

La preghiamo di valutare le seguenti affermazioni da 1 (totalmente in disaccordo) a 5 (totalmente d'accordo).

49. Credo che la tecnologia degli autoveicoli elettrici sia peggiore di quella "vecchia scuola"
50. Gli autoveicoli elettrici non possono supportare modifiche, quindi non sono divertenti

- 51. Il design degli autoveicoli elettrici non li rende molto desiderabili
- 52. Gli autoveicoli elettrici sono scarsi in termini di prestazioni
- 53. Il fatto di poter inquinare meno con un'auto elettrica la rende più desiderabile

#### **Sezione 4 - Atteggiamento verso i tre principali premium brand di auto**

In questa sezione si prendono in considerazione tre marchi del segmento automobilistico premium: Audi, BMW e Mercedes. Questi saranno messi a confronto con Tesla, brand principale del settore elettrico.

- 54. Per favore, con riferimento **al marchio nel Suo complesso**, classifichi le seguenti marche in base alla Sua **preferenza**. Si noti che il valore 1 indica il brand con la preferenza maggiore.
  - a. Audi
  - b. BMW
  - c. Mercedes
  
- 55. Per favore, considerando **l'intera gamma di autoveicoli**, classifichi le seguenti marche in base alla maggiore **affidabilità** di teli vetture. Si noti che il valore 1 indica il brand con la preferenza maggiore.
  - a. Audi
  - b. BMW
  - c. Mercedes
  
- 56. Per favore, con riferimento **ai soli veicoli elettrici**, classifichi le seguenti marche in base alla maggiore **affidabilità** di teli vetture. Si noti che il valore 1 indica il brand con la preferenza maggiore.
  - a. Audi
  - b. BMW
  - c. Mercedes
  - d. Tesla

57. Per favore, considerando **l'intera gamma di autoveicoli**, classifichi le seguenti marche in base al **miglior design estetico** di teli vetture. Si noti che il valore 1 indica il brand con la preferenza maggiore.
- Audi
  - BMW
  - Mercedes
58. Per favore, con riferimento **ai soli veicoli elettrici**, classifichi le seguenti marche in base al **miglior design estetico** di teli vetture. Si noti che il valore 1 indica il brand con la preferenza maggiore.
- Audi
  - BMW
  - Mercedes
  - Tesla
59. Per favore, con riferimento **ai soli veicoli elettrici**, classifichi le seguenti marche in base al **grado di innovazione tecnologica** di teli vetture. Si noti che il valore 1 indica il brand con la preferenza maggiore.
- Audi
  - BMW
  - Mercedes
  - Tesla
60. Tra i seguenti aggettivi, scelga quelli che meglio descrivono il brand **Audi**:
- Design senza tempo
  - Stravagante
  - Classico
  - Affidabile
  - Sportivo
  - Emozionante
  - Sicuro
  - Piacevole
  - All'avanguardia

- j. Gioia
- k. Costoso
- l. Economico
- m. Innovazione
- n. Pulito
- o. Pioniere

61. Tra i seguenti aggettivi, scelga quelli che meglio descrivono il brand **BMW**:

- a. Design senza tempo
- b. Stravagante
- c. Classico
- d. Affidabile
- e. Sportivo
- f. Emozionante
- g. Sicuro
- h. Piacevole
- i. All'avanguardia
- j. Gioia
- k. Costoso
- l. Economico
- m. Innovazione
- n. Pulito
- o. Pioniere

62. Tra i seguenti aggettivi, scelga quelli che meglio descrivono il brand **Mercedes**:

- a. Design senza tempo
- b. Stravagante
- c. Classico
- d. Affidabile
- e. Sportivo
- f. Emozionante
- g. Sicuro
- h. Piacevole

- i. All'avanguardia
- j. Gioia
- k. Costoso
- l. Economico
- m. Innovazione
- n. Pulito
- o. Pioniere

63. Tra i seguenti aggettivi, scelga quelli che meglio descrivono il brand **Tesla**:

- a. Design senza tempo
- b. Stravagante
- c. Classico
- d. Affidabile
- e. Sportivo
- f. Emozionante
- g. Sicuro
- h. Piacevole
- i. All'avanguardia
- j. Gioia
- k. Costoso
- l. Economico
- m. Innovazione
- n. Pulito
- o. Pioniere

## **Appendix 2**

### **Towards 2035: the impact of electromobility on consumer behaviour**

This survey aims at evaluating how electric vehicles are perceived and the criticalities that prevent – or have prevented – the purchase.

Please, note that the survey is completely anonymous and takes about 20 minutes of your time.

#### **Section 1 – Customer and country profile**

This section aims at looking to demographic and cars data to outline – in broad terms – the interviewed person.

1. Please, select your age range
  - a. 18-30 y.o.
  - b. 31-40 y.o.
  - c. 41-50 y.o.
  - d. 51-60 y.o.
  - e. Above 60 y.o.
  
2. Please, indicate your qualification.
  - a. Secondary school leaving certificate
  - b. High school diploma
  - c. Degree (Bachelor or Master)
  - d. PhD
  - e. None of above
  
3. Please, type the country where you reside (i.e. Italy)
  
4. How far is your residence from the city centre?

- a. I live in the city centre
  - b. I live not far away from the city centre (5-15 km)
  - c. I live more than 15 km from the city centre
  
5. In your opinion, how much is the percentage of *electric vehicles* on the road in the country where you reside? Please, consider ***only*** electric vehicles, i.e., powered entirely by batteries.
  - a. 0-10%
  - b. 11-30%
  - c. 31-50%
  - d. 51-70%
  - e. 71-90%
  
6. Are there charging stations close to your house? Please, note that for *close* you mean within 1 kilometre.
  - a. Yes
  - b. No
  - c. I do not know
  
7. Please, rate from 1 (completely disagree) to 5 (completely agree) your level of agreement with the following statements regarding **electric vehicles**. Please, note that you should answer thinking about the country of residence you mentioned above.
  - a. There are many electric vehicles on the street
  - b. The percentage of electric vehicles should be higher
  - c. The amount of electric vehicles is improving
  - d. I wish there were more electric vehicles
  
8. Please, rate from 1 (completely disagree) to 5 (completely agree) your level of agreement with the following statements regarding **charging stations**. Please, note that you should answer thinking about the country of residence you mentioned above.
  - a. There are many charging stations on the street



- b. The percentage of charging stations should be higher
  - c. The amount of charging stations is improving
  - d. I wish there were more charging stations
9. Please, select the adjectives that better describe the roads of your country of residence. You can select more than one option.
- a. Streets are narrow in the city center
  - b. The slope of the streets is very high
  - c. Villages are connected by highways, ring roads or expressways
  - d. The traffic jam during peak hours is a real issue
  - e. Streets are very wide
  - f. The speed limit is a strict factor
  - g. Speed limits are adequate
  - h. Most of the principal activities (offices, supermarkets, shops, etc.) are located in the city centre
  - i. It is forbidden to enter the city centre by car
10. How many cars do you have in your family?
- a. None
  - b. One
  - c. Two
  - d. Three
  - e. More than three
11. With reference to the previous question, please, select among the following options which type of engine the car(s) of your households has.
- a. Petrol thermic engine
  - b. Diesel thermic engine
  - c. Bi-fuel (petrol and LPG or natural gas)
  - d. Full Hybrid
  - e. Plug-in hybrid (PHEV)
  - f. Full electric engine (BEV)

12. If you have not chosen "*Full electric engine*" in the previous question, have you ever thought about buying a car with that engine type?
- Yes, I have
  - No, I would prefer to rent one before buying
  - No, not at all
13. On a scale from 1 (totally dissatisfied) to 5 (totally satisfied) how satisfied are you with your car's engine?
14. How likely are you to change your car? You can choose more than one statement.
- I am not thinking about changing my car
  - I am thinking about changing my car in the next years (1-2) because of the new EU Regulation
  - I am thinking about changing my car in the next years (1-2) because it is at the end of its lifecycle
  - I have to change my car in the next years (1-2) because of the new EU Regulation
  - I have to change my car in the next years (1-2) because it is at the end of its lifecycle
15. How often do you use your car?
- On a daily basis
  - Few days a week (2-3)
  - Only for long distance travels
  - Never

## **Section 2 – Attitude toward electrification in general**

Please, note that from 2035 it will no longer be possible to place ***new*** cars on the market with internal combustion engine and next EU's goal is to reduce CO<sub>2</sub> emissions by 55% in 2030.

16. On a scale of 1 (totally irrelevant) to 5 (totally relevant) how relevant do you perceive climate change to be?
17. On a scale of 1 (totally insensitive) to 5 (totally sensitive) how sensitive are you to the climate crisis?
18. How much do you know about the *European Green Deal*?
- I have never heard about it
  - I know it exists, but I do not really know what it is about
  - I know it is a European law to regulate the steps to face the current climate crisis
  - I know everything about the argument
19. On a scale of 1 (not at all seriously) to 5 (very seriously), how seriously do you think the European union is taking the issue of climate change?
20. Do you think the goal of full electric fleet by 2035 will be achieved? Please, note that it is about ***new*** electric vehicles.
- Yes
  - Yes, but not in 2035
  - No
21. On a scale of 1 (totally useless) to 5 (totally useful), how useful do you think this electrification process will be in reducing CO<sub>2</sub> emissions?
22. Do you think the effort for electrification is worth? You can choose more than one option.
- Yes, absolutely worth it
  - Quite worth it
  - No, because there will be steps of the process that pollute anyway
  - No, too much effort for a small change

### **Section 3 – Attitude towards electric vehicles**

The most common prejudices that influence consumer choices when approaching an electric vehicle are grouped below. The aim is to understand which of these have the greatest impact.

#### **Bias n.1: sales conversion inability**

Please, rate the following statements from 1 (totally disagree) to 5 (totally agree).

- 23. I am willing to put up with a longer waiting time for an EV
- 24. I believe the inventory of EVs to be extremely low
- 25. I believe the value of used EVs will be lower compared to used thermic engine cars
- 26. I believe used EVs can have a second life
- 27. The market for used EVs will not be a good business opportunity
- 28. There is plenty of choice when buying a new EV
- 29. I wish there will be more choice when it comes about new EVs
- 30. I believe the maintenance costs for EVs are lower
- 31. The dealer gave me discouraging information about EVs
- 32. I am willing to buy a vehicle online

#### **Bias n.2: lack of trust in technology**

Please, rate the following statements from 1 (totally disagree) to 5 (totally agree).

- 33. I believe EVs are vulnerable to hacking
- 34. I believe EVs can be stolen easier
- 35. I believe my privacy may be compromised by the technology of an EV because it has access to a lot of my data
- 36. I believe batteries are unsafe when it comes to accidents
- 37. I like the fact that EVs are silent
- 38. I consider this silence unsafe
- 39. I think huge progresses regarding battery range are being made
- 40. The lack of options to recycle batteries and their components at the end of their life concerns me
- 41. I do not rely on EVs because I have to plan the trip beforehand
- 42. Home charging stations can face random blackouts

### **Bias n.3: living with the technology**

Please, rate the following statements from 1 (totally disagree) to 5 (totally agree).

- 43. I believe the price gap between Es and thermic engine cars is reducing
- 44. I believe EVs are more expensive to maintain and repair than thermic engine ones
- 45. I believe insurance policies for EVs are more expensive
- 46. The lack of charging infrastructure makes me anxious when driving
- 47. I will be more willing to buy an EV if battery range would be higher
- 48. I will be more willing to buy an EV if charging time would be lower

### **Bias n.4: desirability**

Please, rate the following statements from 1 (totally disagree) to 5 (totally agree).

- 49. I believe EVs technology is worse than the “old school” one
- 50. EVs cannot support modification, therefore are not funny
- 51. The design of EVs is not very desirable
- 52. EVs are poor in terms of performance
- 53. The fact that I can create less pollution with an EV makes it more desirable

## **Section 4 – Attitude towards three main car brands**

In this section three main brands of the premium automotive segment will be considered: Audi, BMW and Mercedes. They will also be compared to Tesla, the main player in electric segment.

54. Please, considering **purely the brand itself**, rank the following brands according to your **preference**. Note that the value 1 indicates the brand with the highest preference.

- a. Audi
- b. BMW
- c. Mercedes

55. Please, rank the following brands according to the **highest reliability of all their vehicles**. Note that the value 1 indicates the brand with the highest preference.

- a. Audi
- b. BMW
- c. Mercedes

56. Please, rank the following brands according to the **highest reliability of their electric vehicles only**. Note that the value 1 indicates the brand with the highest preference.

- a. Audi
- b. BMW
- c. Mercedes
- d. Tesla

57. Please, rank the following brands according to the **best aesthetic design of all their vehicles**. Note that the value 1 indicates the brand with the highest preference.

- a. Audi
- b. BMW
- c. Mercedes

58. Please, rank the following brands according to the **best aesthetic design of their electric vehicles only**. Note that the value 1 indicates the brand with the highest preference.

- a. Audi
- b. BMW
- c. Mercedes
- d. Tesla

59. Please, rank the following brands according to the **degree of innovation of their electric vehicles only**. Note that the value 1 indicates the brand with the highest preference.

- a. Audi
- b. BMW
- c. Mercedes

- d. Tesla

60. Please, select among the following adjectives the ones that best describe **Audi**:

- a. Timeless design
- b. Extravagant
- c. Classic
- d. Reliable
- e. Sporty
- f. Exciting
- g. Safe
- h. Pleasant
- i. Avant-grade
- j. Joy
- k. Expensive
- l. Cheap
- m. Innovative
- n. Clean
- o. Pioneer

61. Please, select among the following adjectives the ones that best describe **BMW**:

- a. Timeless design
- b. Extravagant
- c. Classic
- d. Reliable
- e. Sporty
- f. Exciting
- g. Safe
- h. Pleasant
- i. Avant-grade
- j. Joy
- k. Expensive
- l. Cheap
- m. Innovative

- n. Clean
- o. Pioneer

62. Please, select among the following adjectives the ones that best describe

**Mercedes:**

- a. Timeless design
- b. Extravagant
- c. Classic
- d. Reliable
- e. Sporty
- f. Exciting
- g. Safe
- h. Pleasant
- i. Avant-grade
- j. Joy
- k. Expensive
- l. Cheap
- m. Innovative
- n. Clean
- o. Pioneer

63. Please, select among the following adjectives the ones that best describe **Tesla:**

- a. Timeless design
- b. Extravagant
- c. Classic
- d. Reliable
- e. Sporty
- f. Exciting
- g. Safe
- h. Pleasant
- i. Avant-grade
- j. Joy
- k. Expensive



- l. Cheap
- m. Innovative
- n. Clean
- o. Pioneer

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