A Work Project, presented as part of the requirements for the Award of a Master Degree in Economics / Finance / Management from the NOVA – School of Business and Economics.

TESLA: BEYOND OVERVALUED
Can the market price innovation?

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Abstract

In the upcoming ten years, the automotive Industry will undergo many changes due to various factors. Tesla is certainly at the forefront of the Industry, as we can confirm by the complete dominance of its vehicles in the EV market; it remains to be seen whether they will deliver the promises amounts. With the addition of the two new Gigafactory's and the constant improvement of efficiency, we believe Tesla will finally start delivering at their expected rate, raising their market share and profitability.

Keywords
Tesla, Automotive industry, Renewable Energy

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This report is part of the “Tesla: Beyond Overvalued report” (annexed) and should be read has an integral part of it.

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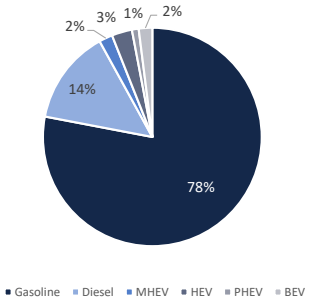
Automotive Industry

Exhibit 3: Breakdown of global car sales in 2019



Source: BCG

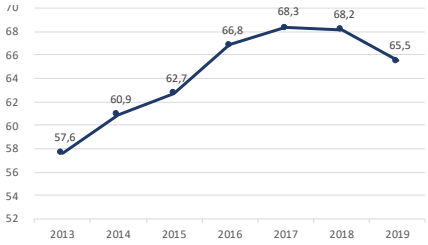
The 2010s were a decade of significant technological innovation, leading to a paradigmatic shift in how we relate to the auto industry. As these changes increase, **four main trends**[1] emerged that are currently shaping the Industry: (i) autonomous vehicles, (ii) connectivity, (iii) electrification, and (iv) shared mobility. Due to their nature, the commonalities between these trends seem to lead to a future where shared mobility becomes as regular as private vehicle ownership.

The existence of autonomous vehicles and higher connectivity will provide more data for governments to better plan future roadways, improve traffic management, and reduce accidents. To address the more pressing threat of climate change, some countries are pushing for a diesel ban, with EVs quickly gaining traction in the auto market: they are expected to represent up to 12% of total vehicle sales by 2025 and up to 20% by 2030.

***"You will be able to add your car to the Tesla shared fleet just by tapping a button on the Tesla phone app and have it generate income for you while you're at work or on vacation (…) since most cars are only in use by their owner 5% to 10% of the day"* – Tesla CEO, Elon Musk**

To deal with this rising demand, there were installed **7.3 million chargers worldwide** by 2019, the number of them which are publicly available having increased by 60% when compared to the previous year. Such policies will enhance shared mobility; electric chargers can also be installed in most places without significant city infrastructure changes. This, alongside technological advances, will enable the concept of **car-sharing**: the average car owner uses it for **only 5 to 10%** of its useful life, and being a highly depreciative asset, car-sharing may become an attractive option. Such trends reinforce each other, and together with the appearance of a new generation of customers, the future market should lean more towards connectivity and convenience, in detriment to vehicle ownership and its accompanying expenses.

Exhibit 4: Annual Worldwide Car Sales (2013-2019)



Source: German Association of the Automotive Industry

Globally speaking, there are **four dominant markets**: **China, the United States, Europe, and Japan**. It is worth mentioning that China while being the largest market for the past several years, seems to decline since 2018 according to global trends. This decline can be explained as a consequence of growing environmental concerns (e.g. diesel emissions), leading to various regulatory responses, together with the more significant proliferation of car-sharing platforms. Moreover, it expresses that we are in transition years where, although customers do not want

[1] According to PwC Report (2019), pp. 30; Available at: https://www.strategyand.pwc.com/de/de/studien/2019/digital-auto-report/digital-auto-report-2019.pdf (Accessed at: 15/11/2020)

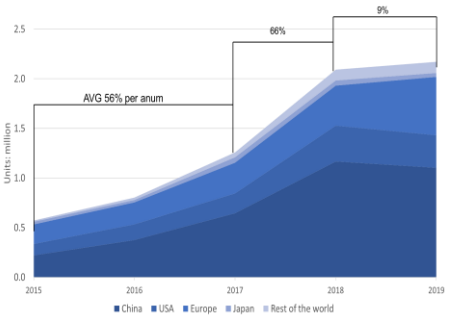
to invest in ICE, Evs are still too expensive. Therefore, we expected that this decline in car sales trend continuous till Evs start to be affordable.

***"The fear of OEMs is that a car will become a smartphone on wheels, with cars built around their entertainment value rather than their hardware value."* – Paul Fielden, IBM**

As car-sharing increases, carmakers may need to find other sources of revenue; a possible solution would be selling software, transforming cars also in a commodity device "smartphone on wheels"- Tesla already started this concept by offering software upgrades, such as an increase in horsepower or autopilot features, which can be purchased on the smartphone and the car will automatically download it and upgrade the vehicle.

EV Market

Exhibit 5: Global EV sales



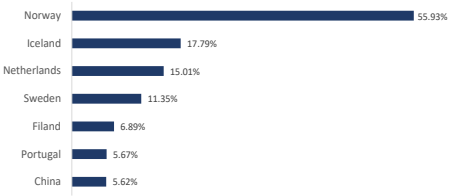
Source: International Energy Agency

As opposed to what we see in the ICE market, the demand for electric vehicles (hereafter, 'EVs') has been growing every year, even though there was an apparent increase in growth rates over the past six years, starting at 46% around 2014, peaking at 66% before crashing down to 9% in 2019. The reasons for this shift can be attributed to the fact that 2018 was an **exceptional year** with such growth rates unlikely to occur so soon; there is also **limited availability of new EV models**, driving customers to purchase the stronger performers, e.g. the Tesla Model 3 which accounts for 13% of global EV sales.

***"Over the next five years we anticipate Chinese players across the EV supply chain to aggressively enter the overseas market" –* UBS Analyst**

Nonetheless, in 2019, worldwide EV sales **exceeded 2,3 million**, boosting the global EV stock to 7,2 million. EV sales represented 2.6% of total car sales, increasing electric vehicles' percentage to 1% of the global car stock. To better understand EV sales, it is essential to analyze the markets where EVs become a dominant player. For example, China stands out globally not only in terms of production but of sales as well. In 2019, China represented 55% of worldwide sales and 47% of the global EV stock. This surge in popularity can be attributed to micro-EV's rise with small battery packs designed for short-range use; however, in comparison terms, it is some European countries that have the lead. Norway leads with 56% of new cars being EVs, Iceland 25%, and the Netherlands 15%, showing a much larger proportion of local EV market share than China's 5.2%.

Exhibit 6: Share of plug-in EV in new passenger car sales in 2019

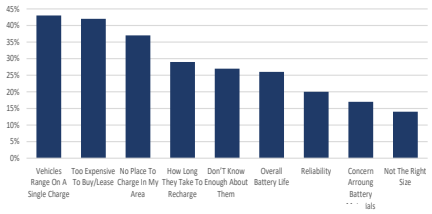


Source: ACEA, European Automobile Manufacturers Association

The United States, another major market, experienced a remarkable 80% rise in EV sales from 2018 to 2019, mainly driven by the launch of the Tesla Model 3. However, this growth suffered a downturn. Due to increased overseas deliveries, they were limiting available units for the local market. Other OEMs[2] successfully launched their own models, yet their strong performance was not enough to offset this.

[2] OEMs means Original Equipment Manufacturer which is defined "as a company whose goods are used as components in the products of another company, which then sells the finished item to users" according with https://www.investopedia.com/terms/o/oem.asp (last accessed: 15/11/20)

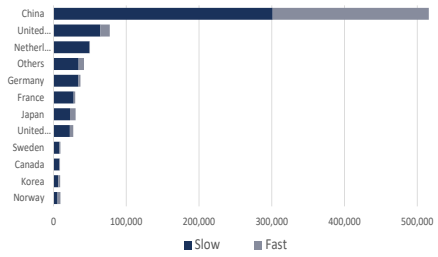
Exhibit 7: Reasons why consumers avoid EVs



Source: Autolist survey

***"The misconceptions that electrics faced at the beginning of this decade are still a major impediment to their success right now."* – Chase Disher, an analyst at Autolist**

Exhibit 8: N° of publicly available EV chargers in 2019



Source: International Energy Agency

Nowadays Super Charger installation play a decisive role in the future of EV Market. The OEMs capable of install more Super Chargers now, will benefit from not only Government support but more important will have already an established network of chargers when massive transition to Ev happens. Having a key advantage to others without a Super charger network.

With the above-mentioned in mind, to create a reliable forecast, it is necessary to delve deeper into EV's market **growth factors**. By using centered studies done by numerous entities[3] (NR), we modeled a system of customer priorities, in descending order:

(i) High Priority Factors: **Financial Performance and Benefits, Maintenance, Range & Charging and, Price.**

(ii) Medium Priority Factors: **Environmental Impact and Consumers[4] preferences.**

(iii) Low Priority Factors : **Technology.**

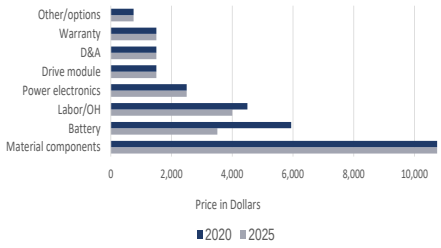
Range & Charging

Ranging anxiety is still the primary reason customers do not buy an EV. In places like China - where customers do not seem to suffer from this problem – mini-EVs with short-range batteries are on the rise. This "distrust" has been **proven to be exaggerated** as EVs slowly become more common. Reports show that 95% of car journeys in the US are **under 48 kilometers**, while 76% of all trips in the UK are between 3 and 5 kilometers, values much lower than the **average BEV[5] range (291km)**. Moreover, currently, high-end EVs have a range of 400+ kilometers. Thus, there is **no reason** to believe that range anxiety will be a future problem as OEMs increase EV range, and customers realize that they do not need long-range EVs. As autonomy is becoming less of an obstacle for some customers, different questions may arise, such as **availability of charging points** and **charging time anxiety**. **Charging station** locations have a noticeable **impact on customer decision** as they instill a feeling of greater freedom: in 2020, the electric vehicle industry achieved one significant milestone, installing one million charging plugs around the world. China alone accounts for more than 60% of publicly available electric chargers worldwide, followed by the US with 10%.

EV charging anxiety seems to be the **new range anxiety**, as the charging process's duration "depends on the **different charging modes and capacities"[6]**. Additionally, other technologies may cause confusion about compatibility across chargers; for slow charging, every brand uses a universal adaptor, but incompatibilities begin when it comes to fast charging. The most dominant brands have their **power stations**, namely Nissan CHAdeMO and Tesla Super Charger, and even with non-official adaptors, cars recognize that is not their brand's fast charge station and prevents the batteries from being charged.

[3] BNEF, Delloit, J.P.Morgan ,Mckinsey
[4] There are few models available that fit consumers preferences
[5] BEV- Battery Electric Vehicle: full electric vehicle with no secondary source of propulsion.
[6] As expressed by Ralf Sulzbach in his Article (….) https://autovistagroup.com/news-and-insight/ev-charging anxiety-new-range-anxiety/

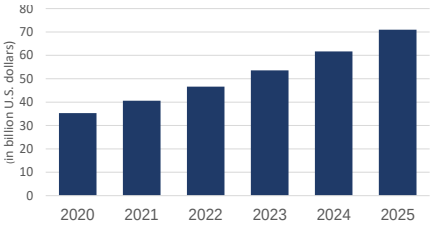
Exhibit 9: Model 3 cost breakdown



Source: Company reports

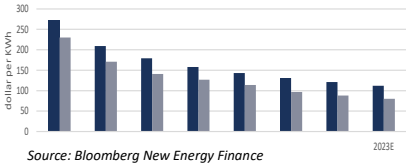
"While the development of lithium-ion technology is not a revolutionary process, step-by-step it is improving by 2%–5% annually. Sticking with this technology until a new disruptive technology comes along is the right thing to do." – CEO of AKASOL, Sven Schulz

Exhibit 10: Global Lithium-ion battery market 2020-2025



Source: The Insight Partners

Exhibit 11: Lithium-Ion battery pack costs



Source: Bloomberg New Energy Finance

Exhibit 12: Norwegian EV policy

	Volkswagen Golf	Volkswagen e-Golf
imported price	22,046	33,037
Co2 tax (113 g/km)	4,348	–
Nox tax	206	–
Weight tax	1,715	–
Scrapping fee	249	249
25% VAT	5,512	–
Retail Price	34,076	33,286

Source: Norsk elbilforening

Price

Price is another main reason why customers do not buy an EV, and so it is essential to understand what drives the cost of an EV. There are two clear short-term drivers that push prices either up or down: **battery cost and government incentives**. When compared with ICEs, we observe that apart from the "standard" costs (manufacturing, materials, etc.), it is batteries where OEMs can reduce prices, they account for roughly 20% of total costs and can be reduced significantly. As the ideal battery does not (yet) exist, it is essential to remember that there is a variety of batteries with different features which fit numerous applications.

There are four predominant types of rechargeable batteries, namely: (i) **lead-acid, (ii) nickel-cadmium** (Ni-Cd), (iii) **nickel-metal hydride** (NiMH), and (iv) **lithium-ion** (Li-ion)[7]. Nowadays, **Li-on batteries** are the dominant type used in EVs and, some argue[8] that will increase until 90% share of the EVs batteries market in 2025. Their popularity is that carmakers must consider specific characteristics when choosing the ideal battery for their EV, such as lifespan, safety, cost, performance, specific energy, and power. With this in mind, it is easy to understand why **carmakers prefer Li-ion batteries**. Their main advantage is their **140+ Wh/kg of power-to-weight ratio**, followed by a **higher energy density,** which allows a reduction on battery weight, increasing EV's range autonomy and a better performance. Their **exceptional charge cycle rate** means they are capable of being recharged consistently while possessing a high cell voltage and a better self-discharge rate. When compared to lead-acid batteries, **Li-ions** are three times lighter, **more powerful**, and have **a longer life-cycle**. These advantages come with a higher price tag, but the increase demand and research on Li-ion battery technology have been reducing production costs, as observed in ***Exhibit 11***.

Government incentives also play an essential role in EV prices: currently, EVs are **not cost-competitive;** thus, national and local governments are trying to **stimulate EV sales**. Even though this directly or indirectly influences their price, it is necessary to understand that such incentives will only affect prices on a short-term basis, since government intervention will not last forever.

There are several types of stimulus, *inter alia*, purchase deductions, tax credits and exemptions and, further benefits. These benefits can be exemplified with numerous policies like access to bus lanes to waivers on fees (charging, parking, tolls, among others). In China, for example, besides **tax exemption** from sales and import taxes, EV owners can benefit from **subsidies** of up to 60,000 yuan (about

[7] According with Cfr. Engineering.com
[8] Financial Times article: https://www.ft.com/content/b9395e8c-9321-4351-b98d-a664b1e99b03

$9,800), depending on local governments. In 2020, this plan will be extended until 2023 with progressive cuts on subsidies while excluding luxury EVs and hybrids.

In comparison, US incentives are divided at the federal and state level; the federal government offers a **tax credit** for new EVs ranging from $2,500 - $7,500 according to battery capacity. Subsequently, each state has its own approach regarding such incentives: income **tax credits, reduced rates, tax exemptions, or rebates,** regardless of whether the purchase was made with cash or through a loan.

"***Norway has done a lot to spur the electric vehicle market domestically. We see working together with other proactive governments as a key to a global transition to an electric fleet. The problem of climate change is clearly global, and we see electric vehicles as one of the important global climate solutions"*** **– Jens Holthe, Political Advisor to Norway's Minister for Environment**

According to each country, the European market shows different approaches: Norway, which has been promoting EVs since the 1990s, is the only country with **full tax exemption** on BEVs and heavy taxes on high emission cars. Stimulus like this has the purpose of making comparable ICE as expensive as its electrical counterpart. Germany also offers some of the most generous EV incentives, with **purchase grants** up to €9000 and other tax benefits.

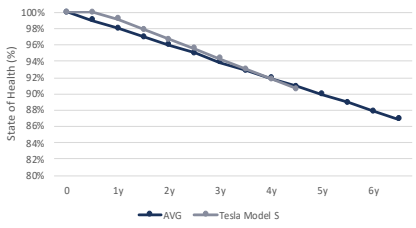
There are other **non-cash related governmental incentives,** which we will explain further as part of customer commodities, as these do not influence the price.

Maintenance and Reliability

"With an EV, you don't have as many parts to replace on a regular basis, because there just aren't as many moving parts as in a gasoline-powered car," **– Gabe Shenhar, associate director of CR's auto test program**

As EVs are still a relatively new concept for most customers, this originates concerns about **maintenance costs and a lack of servicing centers**. A consequence of market immaturity is that there are not as many EV servicing centers compared to their ICE counterparts, and not every mechanic has the tools or the expertise to work on them. Nonetheless, some automobile manufacturers such as GM, Ford or, Nissan provide a service to Customers with electronic vehicles at any concessionaire. Whilst Tesla offers a more personalized and customer-friendly service by sending a specialist technician to the customer's address, if there is no dedicated service center in the area. Moreover, batteries, electric motors, and electronic components do not **require regular maintenance**, for example, **replacing engine oil**; also breaks do not to be replace often as **regenerative braking reduce breaks wear.** there are **far fewer moving parts compared to a conventional gasoline engine, reducing gear decay.**

Exhibit 13: Battery degradation comparison



Source: Geotab

However, the biggest concern comes with the reliability of the battery's life cycle. Batteries are the most expensive part to replace, but they do not need replacement as often as most people think. Many Tesla Model 3 owners[9] shared their battery

[9] For further information, available at: https://bit.ly/3a9q9YZ; https://bit.ly/3qZi7be ; https://bit.ly/3nrJVTu (last access: 20/11/2020)

performance after 100 thousand miles[10] of use, showing that their batteries only lost about 2%-5% range.

Financial Performance & Benefits

In terms of financial performance, every customer wants to know the answer to the question: "In the long term, is it cheaper to buy an EV or an ICE?". To answer this question, it is necessary to analyze their upfront cost, fuel costs, and maintenance during its lifetime.

Usually, EVs will have a **higher price tag when compared with their ICE** counterparts and competitors. It is in fuel and maintenance that we can see the most significant difference. A study[11] from UMTRI (University of Michigan's Transportation Research Institute) concluded that an EV would be on **average 56% cheaper** to operate. Maintenance, as mentioned previously, will also be cheaper for EVs. In order to conclude if EVs are effectively cheaper than ICEs, CAR&DRIVER[12] simulated a three-year cost analysis, comparing all the costs that an EV and ICE may incur, observing that maintaining an ICE is increasingly more expensive, and concluding that ICEs are **barely cheaper** in a 3-year range, meaning that in the long-run **it should be more affordable to purchase an EV if we use it for more than three years**.

Exhibit 14 Estimated Per-Mile Repair and

Powertrain Type	BEV	PHEV	ICE
0-50K Miles	$0.012	$0.021	$0.028
50K-100K Miles	$0.028	$0.031	$0.060
100K-200K Miles	$0.044	$0.033	$0.079
Lifetime Average	$0.031	$0.030	$0.061

Source: advocacy, consumer reports

Exhibit 15: Lifetime Maintenance Costs by

Powertrain Type	ICE	BEV	PHEV
Lifetime Maintenance and Repair Cost	$9,200	$4,600	$4,600
Lifetime Savings vs. ICE		$4,600	$4,600

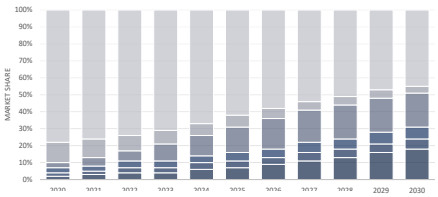
Source: advocacy, consumer reports

Exhibit 16: Three-year cost analysis

	Mini Cooper	Mini Ele.	Hyundai Kona	Hyundai Kona Ele.
Price	24,250	30,750	21,440	38,330
Maintenance Costs	3,839	2,970	4,091	2,970
Energy/Gasoline Costs	4,478	1,939	3,623	1,723
Depreciation	8,887	13,653	10,663	12,288
Ownership Cost Comp.	41,454	49,312	39,817	55,311
US EV Tax Credits	–	-7,500	–	-7,500
Final Comparison	41,454	41,812	39,817	47,811

Source: CAR&DRIVER

Exhibit 17: Global car sales through 2030 by powertrain type



Source: BCG analysis

Our CARG (29%) till 2030 and further growth till 2040, match Deloitte and BCG EV units sales Forecast

EV Market Forecast

To understand the evolution of the EV market, we analyzed the **industry growth factors**, together with industry reports[13] , to build a reliable forecast. As the EV market will suffer **massive changes in the next decades,** we modeled it **in ranges of ten years to better adapt it to industry changes**. We expect BEVs **sales to increase strongly until 2030** (CAGR 29%), as a consequence of future events explained in subtopics below; it is evident that BEVs already outperforming PHEVs globally; We therefore expect BEVs to account for 81% (25.5 million) of all new EVs sold in 2030. After 2030, we expect the sales growth to slow. **We are considering that some emerging markets will not be able to support the move to EV in the same way that developed countries do.** Moreover, with the progress on new reliable batteries, we believe that EV's secondary market will start gaining traction around 2030, **gradually slowing EV market growth**. For this reason, we expect a gradual decreasing after 2030, reaching 56 million sales in

[10] This is equivalent 160 thousand km.

[11] According with: https://www.energysage.com/electric-vehicles/costs-and-benefits-evs/evs-vs-fossil-fuel-vehicles/ (last access: 19/11/20)

[12] This information is available in this website which provides some industry insights: https://www.caranddriver.com/shopping-advice/a32494027/ev-vs-gas-cheaper-to-own/ (last access: 16/11/20)

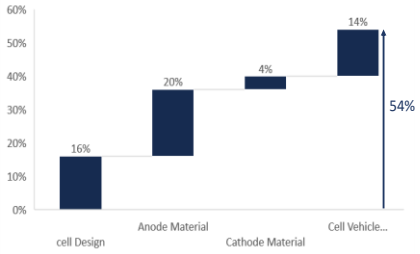
[13] There are a lot of reports of Industry; Cfr. McKinsey https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/reimagining-the-auto-industrys-future-its-now-or-never (last access: 04/11/20)

2040 this way accounting for 50% of total car sales. Beyond 2040, we predict that Evs will be a well-established industry; therefore, we expect their growth to point towards Economy growth[14].

Range & Charging Forecast

It is realistic to expect the next few years to be **outstanding in terms of battery range**. Based on their research, Tesla announced during "**Battery Day**" a promising plan to improve their battery system's density, even though they are already ahead of the rest of the Industry: the average EV range being 291 kilometers, Tesla's Model S averages 640 kilometers. They expect to be able to **boost battery range by 54%** (***Exhibit 18*Error! Reference source not found.**) in u pcoming years, this way achieving their milestone of a thousand-kilometer range. To indulge the market and confirm their progress, Tesla will launch an upgraded Model S 800-kilometre range in 2021, while their Roadster (currently on pre-order) already promises 1000 kilometers. Experts at CleanThecnica[15] speculate that the average EV range will be around 440 kilometers by 2020, climbing to 640 kilometers by 2028. Thus, we expected Tesla to dominate the market in the upcoming years with their high performance and low-cost batteries, while other OEMs are will be focused on HEVs and not BEVs.

Exhibit 18: Range increase



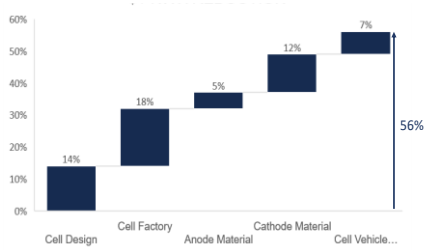
Source: Company Reports

"As battery production scales to match growing demand for EVs, along with greater investment in battery technology and manufacturing efficiencies, we will likely continue to see automakers regularly update BEV battery range (frequently with no price increase) every 2–3 years." - Loren McDonald, EV expert

Charging station's global market value is projected to reach **USD 27,7 billion by 2027** from an estimated **USD 2.5 billion in 2019**, at a **CAGR of 34.7%.** This is due to an increase of **governmental investments** across the world as well as those by major players such as Tesla (USA), ABB (Switzerland), Siemens, and Bosch (Germany), which have strong distribution networks worldwide.

Price

Exhibit 19: $/KWH Reduction



Source: Company Reports

As it was referred previously and displayed in ***Exhibit 19*** **cutting down on battery costs is the most efficient way to reduce prices**, and that is where OEMs will focus. Tesla's "**Battery Day**", while relevant as an event to explain battery cost reductions, was also where they announced their plan[16] to **reduce battery costs by 56%** in three years. They plan to achieve this by scaling up battery production and **improving technology**: this will enable them to create and sell a robust EV model for around $25,000. We expect the remaining EV market to be able to "catch up" Tesla's prices by the late 2020s.

Public incentives in developed countries are expected to **start contracting** around 2025, while EVs are expected to be able **to match most if not all customers'**

[14] The excel model was deliberately extended till 2052 with the purpose of controlling 40s market growth.
[15] For further clarification: https://bit.ly/2LFAWzX
[16] All the information referent to Battery Day 2020, available at: https://www.tesla.com/da_dk/2020shareholdermeeting (last access: 20/11/20)

Price will not be a future excuse to do not buy an EV, as Tesla expects to be able to sell a USD 25,000 EV which can be pushed even further to below USD 20,000 with government incentives.

"The current battery pack is about maybe 300,000 to 500,000 miles. The new battery pack that'll probably go into production next year is designed explicitly for a million miles of operation." – Elon Musk, Tesla CEO

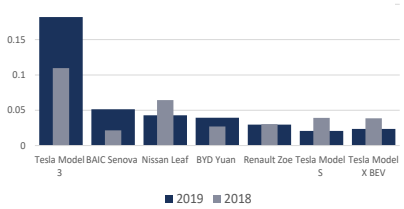
expectations, being able to effectively compete against ICEs. As a common example, Norway has identified a national goal that by 2025, all new car sales should be zero-emission vehicles. China, as previously mentioned, has extended their 2015 plan until 2022 while cutting off support for luxury EVs and gradually lowering their tax benefits over the years.

Maintenance & Reliability

Maintenance and repair costs are expected to gradually **become smaller** as more engineers and mechanics become certified to work on EVs. Moreover, during Tesla's "**Battery Day**", they released a report showing that using the latest Li-ion battery technology, they would be able to produce batteries that would last 1 million miles (1.6 million kilometers) before needing to be replaced. Such batteries would be a true "wrench" in the auto industry, as it would establish proof of reliability, attracting more customers, and **create a robust secondary market around 2030, where we predict the EV market to start slowing down, as referred above.**

Tesla Competitive Analysis & Risks

Exhibit 20: Global BEV market share by model

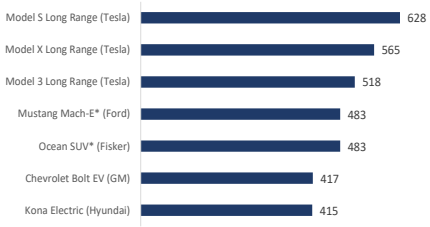


Source: Bloomberg

Tesla is truly "racing ahead" when it comes to EVs: it leads in almost **every competitive advantage;** also, the majority of them have been strengthened even more with the Battery Day. Along the year's Tesla have been building their reputation and branding, which became a really valuable asset as most consumers prefer Tesla cars, as shown in Exhibit 18.This is a consequence of Tesla's EVs clear advantages, generated a strong EV customer base, created a high demand for Tesla on the EV market, which in turn led to the Tesla Model 3 being the most sold EV around the world. Moreover, if we look at the EV luxury segment, no other OEMs come close to Tesla sales. This demonstrates that even customers who are willing to spend a premium for an EV will, most of the time, choose Tesla, reflecting this way that consumers are aware that Tesla is "ahead" of the Industry.

Range & Charging

Exhibit 21: EV range of selected MY 2020 electric vehicles (in Km)



Source: MSN; Motoring Research

Tesla leads the way in terms of range and autonomy – **and not by a small margin**. While the **average in the Industry is 290 km**, the **non-Tesla EV with the longest range has 508 km autonomy, which is still less than 134 km than the Tesla Model S**. It is worth mentioning that this advantage is not to project false beliefs into a singular model, since Tesla holds[17] the top 4 of the EVs with the longest range. Moreover, Tesla will push this advantage even further with the 2021 Roadster model to a massive 1000 km range, which in spatial representation means Berlin-Paris or Miami-Atlanta in a **single charge.** Such incredible range

[17] Available at: https://cleantechnica.com/2019/12/12/tesla-model-s-has-almost-twice-the-epa-range-of-porsche-taycan-373-miles-vs-201-miles/

Tesla CEO announced that they slowed down the Superchargers deployment, due to the new V3 model production but is now ramping up

autonomy is the main basis to how Tesla will be able to **disrupt the Truck sector** with their **already prototyped Semi 2,** which raise some concerns if Trucks could really make the **transition to EV** considering that it is an industry where **logistics are key**, therefore leaving no room to wastes of time such as refueling/recharging frequently. In terms of chargers, which can be a decisive factor at the time of purchase of the EV, Tesla comes on top once again, in a survey done by the Auto Express[18] to rank each public ChargePoint providers in four key areas: Charging cost, charging speed, ease of use and reliability Tesla is **ranked Top in every category**. The company has been **consistently adding**[19] more Charger/Supercharger stations with an average of a thousand charging connectors every quarter for the past three years. On the technological side, Tesla also provides the **fastest OEMs charger (250 kW).** Even though Tesla has no longer the monopoly of fast charging, it is still on top of technological advances and distribution.

Price

"About three years from now, we're confident we can make a very compelling $25,000 electric vehicle that's also fully autonomous," – Elon Musk, Tesla CEO

Historically, **price is not an advantage**, mostly due to their initial focus on the luxury segment, **intending to charge a premium to finance R&D**. However, with the launch of the middle-range segment (Tesla Model 3) Tesla started their path to being **cost-competitive**. As announced, Tesla expects to be able to launch a model in three years range with a starting price of around $25.000, which can go below $20.000 depending on Government incentives. This release will certainly shake the market as it will cost half of Model 3 current price, this being the most sold EV in the world; also, it is worth mention that the new model (Model 2) will not lack any of the current Tesla advantages. Elon Musk has consistently expressed Tesla's commitment to offering affordable models up to the predominance of EVs on the roads.

Maintenance & Reliability

The one million miles battery is certainly a sign of nowadays batteries reliability potential, however the announcement left two big questions to answer: how much will it cost? Is it possible to mass production?

When it comes to reliability, Tesla also has the upper hand: the battery and drive warranty of their Model S and Model X can last eight years or 240.000 km, while most OEMs offer 60.000km to 150.000km or three to eight years. In addition, with the announces in **Battery day**, Tesla will **certainly perform better** than their competitors in the coming years, with the introduction of multiple battery improvements - **being battery the Achilles heel of EVs,** the promise of being able to boost battery life to **one million miles** obviously increases customer confidence in the short-time, and if proven, the long-term value of such battery would **disrupt the whole Auto Industry** as having an EV would be not just environmentally

[18] Full survey scores: https://www.autoexpress.co.uk/news/352089/best-chargepoint-providers-2020
[19] The data about Tesla charger growth is provided in the Excel Report

friendly but tremendously **cost saving**. This technological advance can put Tesla at the top of customers' trust, reenforcing, even more, their EV brand.

Additionally, Tesla's cars are **minimalistic:** they just have a pedal, the steering wheel, and a tablet where the customer can control every function of the car. The car is adjustable to every taste, making it is perfect for car sharing.

***"The extreme difficulty of scaling production of new technology is not well understood. It's 1,000% to 10,000% harder than making a few prototypes. The machine that makes the machine is vastly harder than the machine itself,"* – Elon Musk, Tesla CEO**

Risks

The main issue that can potentially hurt Tesla's car business is the **execution risk**: the failure to **increase production**. Tesla car production relies on complex machines, and their goal is to improve automation and efficiency to the limit, trusting most of the production to those machines. This strategy may reduce costs and increase production; however, it can be an investment in machinery that is both **difficult and time costly to scale**. Another potential risk is being **heavily dependent** on the lithium extraction market, which has been a target because of its negative impact on the environment; such exposure can potentially hit both production and price. Both risks can lead to a drop in the company's delivery capacity, damaging its credibility.

Tesla CEO admits that excessive automation was a mistake and that cause serious production problems

Tesla Transportation Segment Analysis

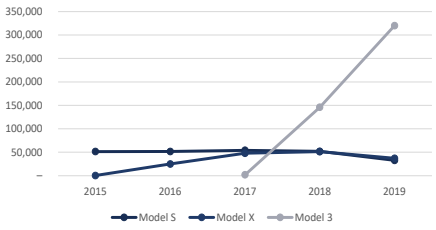
Automotive revenues

A better way to understand Tesla's revenues in the automotive sector is by analyzing its long-term strategy[20]. In the beginning, with the production of luxury vehicles, Tesla has had **three primary purposes**: **(i) to prove that the EVs can perform equally or better than other ICEs**; **(ii) collect an incentive to finance R&D to reduce costs; (iii) the ability to develop affordable vehicles**. Nowadays, Tesla is in the second phase of its plan: moving its core revenues from luxury vehicles to **mass production vehicles** while simultaneously building the infrastructure to enter the massive production phase. This stage started in 2017 with the introduction on the market of the first Tesla mass vehicle (Tesla Model 3). Since this launch, we can witness a reduction in luxury unit production and a **significant increase in mass model production**. In this sense, Tesla continued its second phase by launching a second vehicle for the masses in January 2020: Model Y. Almost at the same time, Tesla started its third phase of its plan investing in the opening of Gigafactory 3 (2019) as well as the opening of Gigafactory 4 and 5 in 2021 to consolidate mass production. The mass production phase is the last of this long-term plan, which aims to maintain a **small percentage** of its production as luxury vehicles, intending to allocate these revenues to finance R&D and

"*When someone buys the Tesla Roadster sports car, they are actually helping pay for development of the low cost family car.*" "*When someone buys the Tesla Roadster sports car, they are actually helping pay for development of the low cost family car.*" – Elon Musk, Tesla CEO

"This kind of electronic platform, with a powerful computer at its core, holds the key to handling heavy data loads in tomorrow's smarter, more autonomous cars. Industry insiders expect such technology to take hold around 2025 at the earliest." – Nikkei Business

Exhibit 22: Tesla Deliveries by Model



Source: Company Reports

[20] Tesla Motors Master Plan: https://www.tesla.com/blog/secret-tesla-motors-master-plan-just-between-you-and-me

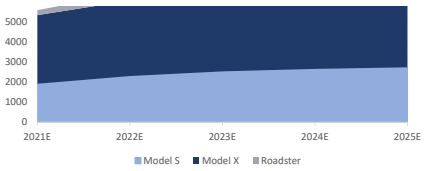
produce VEs even **more affordable**. Being the main focus on mass production, we expect this phase to be consolidated in 2023 with the five fully functional Gigafactories and the release of the most affordable Tesla vehicle: Model 2.

Automotive Revenues Forecast

To develop a reliable forecast, we decided to break it down into three parts. First, since we have reliable information about Tesla's plans[21] for the next five years, such as expected model production, prices, and costs, it is worth mention that we used detailed information about those factors to **each specific model** having this way a solid forecast of revenue generated by each model, this is important for multiple reasons: **accurately predict revenues,** and as explained in the *Automotive revenues* section Tesla plans on shifting strategy between the luxury and mass segments along the years; therefore it is essential to be able to forecast each model revenue independently since our forecast relies on the **number of cars produced and their prices**. To calculate these segment revenues, we build a model based on vehicle production and prices. Historical data indicates that Tesla has a **high demand**, selling an average of 98% of produced vehicles; however, we expect Tesla to lower their average selling/produced vehicles in the upcoming years to around 95% in the base-case due to the increase in productions and some initial problems in the supply chain. Considering all the information above, revenues were calculated by multiplying each model production for the selling/produced ratio of 95% on the base-case and then by their respective model price. Between 2020 and 2025, we expect Tesla to have a **massive impact** on the EV market controlling around **30% of the global market share**; this estimative results from our model as we forecast independently both the global BEV units sold as well as Tesla units sold, with the purpose to enhance our model.

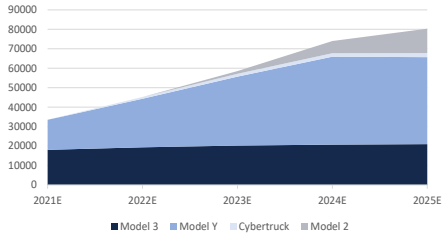
It is important to highlight that Tesla currently only have profits due to the regulatory credits that they sell to other companies, however this regulatory credit will not last forever

Exhibit 23: Luxury segment revenues (in millions)



Source: Own Estimations

Exhibit 24: Mid-Range segment revenues (in millions)



Source: Own Estimations

After 2025, Tesla's information becomes **limited** and, consequently, the future **more uncertain**. As a result, our model begins to depend on the **expected market share alongside the BEV market forecast**. We predict that Tesla will start to gradually **decrease** its massive market-share as an effect of multiple events, namely: (i) a strong EVs market growth; and (ii) hefty government incentive to purchase EVs. These events will lead to the advent of competition, resulting in other OEMs slowly catching up with Tesla's strengths. We expect that the **slowdown trend** will continue until the end of the 2030s while maintaining a considerable market-share, as we believe Tesla will continue to be at the top of the EVs market. Beyond the 2040s, we expect Tesla to grow with the Industry correlatively.

[21] Tesla disclosure their 5-year production plans in Shareholder Deck, available at: https://ir.tesla.com/

Services & Others revenues

Exhibit 25: Services and Others Gross Margin

Source: Own Estimations

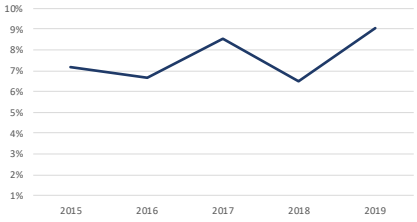
Services and Others revenue consists of non-warranty after-sales vehicle services, such as Autopilot, FSD features, and over-the-air software updates, repair & maintenance, and access to Supercharger network, sales of merchandises, used vehicles, components, and trade-in vehicles. This segment historically represents a considerable average of 8% of total revenues; however, Tesla has been **failing to generate profit from this business segment**; a possible reason for the consistent losses may be that **it was never intended** to generate profit in the first place. Tesla's disclosure about this segment is **minimal**; nevertheless, they did specify that used vehicles were the major part of this segment. In our opinion, this segment's initial strategy is driven by **brand improvement** and new vehicle sales through overpaying vehicle trade-in.

In the case of Tesla, our model suggests that Autopilot/full self-driving (FSD) revenue can reach only 6% of sales by 2025, but nearly 25% of gross profit. We believe this would be extremely meaningful for a company whose core business is automotive sales." – Morgan Stanley

In a summarized way, we believe Tesla to be a company that is willing to **lose money** in a short time frame by bringing a larger number of vehicles on the road to reach its goal of brand awareness. **Such loss will be compensated in the long term through the sale of software**.

Services & Others revenues forecast

Exhibit 26: Ratio of Tesla services revenue to total revenue



Source: Company Reports

It is essential to understand Services & Others drivers and how they will develop to have an accurate forecast. Initially, as explained in *Services & Others revenues, currently is mostly driven by* trade-in vehicles; therefore, we expect the historical 8% of Transportation revenues (we believe to be more accurate than total revenues) to continue till 2025, as part of Tesla strategy to improve branding and sales. Beyond 2025, we expect this segment percentage per revenue to **decrease** as sales grow. In this way, we also believe that Tesla will reduce its operations on trade-in vehicles considering that it is not profitable and is becoming more dependable on other **higher profitable drivers** such as software updates.

As refereed in Automotive Industry, vehicles may become smartphones on wheels, and Tesla is already ahead on this, selling software upgrades, for example, autopilot[22] and acceleration boost[23], with a cost of $7,000 and $2,000 respectively; this strategy is extremely profitable due to its high margins.

Automotive Competitors

To analyze Tesla's competitors, we need to divide it into two segments, **Luxury and Mid-range vehicles**. Tesla has Model X the company's first SUV, Model S,

[22] Tesla Autopilot is a suite of advanced driver-assistance system

23 Acceleration Boost is a software upgrade which lower the sedan's 0-100 time from 4.4 seconds to 3.9 seconds

Exhibit 27: Auto Competitors

Category	Tesla	Competitor
SUV	Model X • Price: $79,990 • Range: 491 Km • Top-Speed: 262 km/h	Mercedes-Benz EQC • Price: $67,900 • Range: 450 Km • Top-Speed:180 km/h
Sports Luxury Car	Roadster • Price: $200,000 • Range: 1000 Km • Top-Speed: 400+ km/h	PorscheTaycan Turbo S • Price: $185,000 • Range: 463 Km • Top-Speed: 260 km/h
Sedan	Model 3 • Price: $39,990 • Range: 423 Km • Top-Speed: 209km/h	Nissan Leaf • Price: $34,190 • Range: 243 Km • Top-Speed: 158km/h

Source: Own Estimations

the luxury sedan, and Roadster, the sports car in the luxury sector. For the Mid-range, Tesla has **Model 3,** the affordable sedan, and the **most sold EV in 2019**.

Traditional luxury auto manufacturers have been **struggling in competing** with Tesla; both Model X and Model S are **best sellers in this category**, performing better in almost every aspect: *(i)* Range; *(ii)* Performance; *(iii)* Safety.

In terms of Mid-Range, Model 3 completely dominates the market; in 2019 was the most sold EV worldwide, selling 3x more than the second most sold EV (BAIC EU-series).

This powerful dominance in the EV market results from the lack of belief and effort from the other traditional automakers in EVs. We can observe that as traditional automakers continue to increase their hybrid production, mostly due to consumers' range anxiety, limiting their effort in EVs.

COVID effects on EV.

"Government responses to Covid-19 will influence the pace of the transition to electric vehicles"
-The IEA - November 2020

The pandemic has been the greatest challenge to the global economy since the second world war. Indeed, it badly affected the industry; it is expected that the global sales of the automotive sector will decrease by 20-25% compared to the pre-pandemic expectations. Whereas in countries that highly suffered from the crisis, the drop in sales can go up to 45%.

From a microenvironment perspective, the COVID-19 crisis didn't affect the purchasing power of consumers only; However, it has also decreased oil prices, resulting in lower gasoline prices, **which will decrease the total cost of ownership for the internal combustion engines (ICE) cars; Nevertheless, the cost will still be in favor for EV.**

Governmental policies can also affect the EV market since some governments have increased the incentives to buy electric cars as part of the stimulus package they are issuing to help the economy recovering. For instance, the subsidies for purchasing an EV is around 10000$ in Germany and varies between 2000 and 3000 in China.

The pandemic has also pushed many automakers to close their Manufactories. Nevertheless, As the companies are starting to reopen it, some prioritize producing EVs to satisfy the high demand and fulfill the regulatory requirements - such as the UE goal of reducing CO2 emissions.

In many countries, the demand for EVs has stayed stable during the pandemic comparing to ICS's. Even though the sales for EVs have decreased, we've seen an increase in EVs' market share, especially in China and Europe.

Tesla is considered as the only EV automaker that was able to increase its sales in March 2020. It had higher demand compared to other companies because of its online selling model. As for other automakers that adopt an in-store retail model, the lockdown negatively affected their demand and, subsequently, their sales.