



# Electric Vehicle Industry Report

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# **Section 1: Industry Overview**

Section 2: Key Players

Section 3: SWOT Analyses

Section 4: Industry Player Recommendations

# Industry Overview



This industry report divides the EV industry into three supply chain segments: upstream battery manufacturing, midstream vehicle manufacturing, and downstream software creation, with an added overview of government policy.

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## Section 1: Upstream EV Battery Manufacturing

Section 2: Midstream EV Manufacturing

Section 3: Downstream EV Software Creation

Section 4: EV Government Policy

# EV Battery Industry Profile

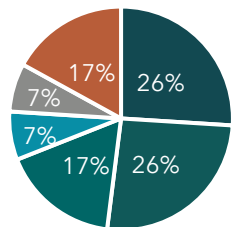


The EV battery manufacturing industry will see growth due to developments in technology and the manufacturing process, with prominent manufacturers in Asia and increased demand for EVs driving this growth.

## EV BATTERY INDUSTRY

- The EV battery market is projected to grow from **\$132.6B in 2023 to \$508.8B by 2033**.
- This registers a **CAGR of 14.4%**.
- Most of the growth will be in the **Asia Pacific area** with a CAGR of 13.8%, with Europe and North America also seeing growth.
- **Increasing EV costs, decreasing battery costs, and development in battery technology** will drive EV battery market growth.

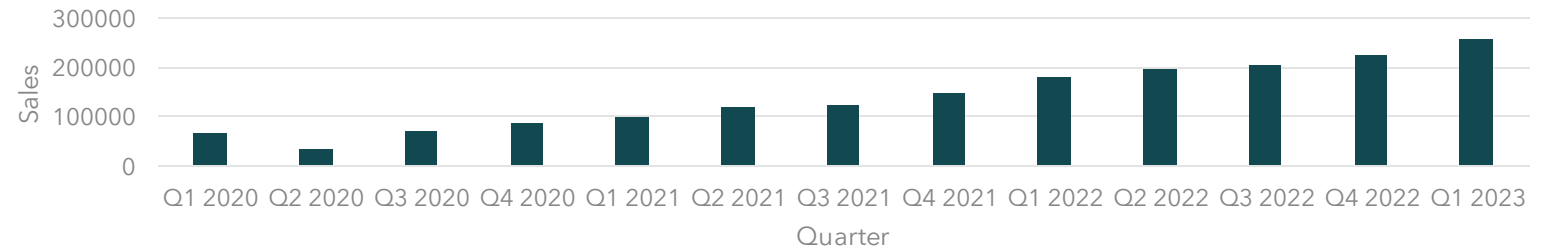
## MARKET SHARE



- CATL
- LG Energy Solution
- Panasonic
- Samsung SDI
- BYD Co.
- Other

*IEEE, Markets and Markets, RMI, Statista*

## Battery-Powered Electric Vehicle Sales in the US



### Process

Batteries require the extraction of raw materials, which usually contain **lithium, cobalt, manganese, nickel, and graphite**. These are highly concentrated outside of the United States. Once these are refined, manufacturers make cathodes and anodes that are used to make battery cells, which are made into modules and sold to automakers for usage in EVs.

### Market Trends

The EV market is expected to grow thanks to advancements in areas such as **electrode manufacturing, cell assembly, and pack integration**. The **cylindrical battery segment** is expected to drive this growth, as they are the cheapest to manufacture and are reliable and durable compared to pouch cells and prismatic cells.

### Manufacturers

The largest manufacturers for EV batteries are in the **Asia Pacific**, with many prominent EV battery manufacturers located in China and South Korea. **Contemporary Amperex Technology Co. (CATL), LG Energy Solution, and Panasonic** are the top three companies by market share in the EV battery manufacturing industry and are all based in Asia.

# EV Battery Manufacturers and EV Manufacturer Partnerships



Partnerships between prominent manufacturers of EV batteries and EV vehicles hinge on several factors and are common in the EV industry.

## Partnerships Overview

- Partnerships between EV battery manufacturers and EV manufacturers mainly center around **research and development (R&D) of new EV battery technology, manufacturing of battery components and fuel cells for EVs, and integration into vehicles.**
- Partnerships focus on **establishing manufacturing, R&D capacity, and expansion geographically.**
- Partnerships also depend on **how much companies will bet** on technologies in the area, with some companies scaling back as growth in demand for EVs slows.

## Current Partnerships

- **Ford Motor Company** partnered with the world's largest battery company, China-based **Contemporary Amperex Technology (CATL)**, in 2023, but recently scaled back investment in a battery plant in Michigan.
- **BMW** partnered with Croatia's **Rimac** on high-voltage electric vehicle battery technology, an attempt to challenge Asian manufacturer dominance in the field.
- **Honda** and **LG Energy Solution** have a joint venture to build an EV battery plant in the United States by 2025.
- **Battery manufacturing partnerships**, such as Tesla and Panasonic and Geely Auto and LG Chem, are common.

## Partnership Trends

- Volvo, BMW, Honda, and Nissan have recently made announcements of partnerships to **improve electric vehicle charging or manufacturing.**
- **NIO** recently partnered with **CATL** for long-lasting EV batteries.
- **Rising labor costs** and **a slowing demand for EVs** have impacted several partnerships between EV battery manufacturers and EV manufacturers.
- Projected EV sales are **expected to grow** in 2024 with **advances in EV battery technology**, hopefully driving partnerships.

[CNBC](#), [Honda](#), [Nasdaq](#), [Repairer Driven News](#), [Reuters](#), [The Joint Venture Alchemist](#), [Yahoo! Finance](#)

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# EV Industry Overview



Gaining preliminary insight on the process of manufacturing an EV, the current trends in the market, the key players, and the key consumers and their preferences is a useful first step in better understanding the EV industry overall.

## Manufacturing Process

- The manufacturing process of electric vehicles (EVs) involves a design phase that **optimizes for manufacturability**, followed by **validation of processes**, and **selection of qualified suppliers**. Production then scales up through the **New Product Introduction** phase, where the design transitions from development to production. After this, **mass production and continuous improvement initiatives** follow.

## Current Trends

- Current trends in the EV market include the adoption of advanced manufacturing techniques such as **additive manufacturing, precision machining, and automated assembly lines**, which enable the efficient production of complex components. Tesla, for instance, has innovated with 'gigacasting' to streamline production by creating **large sub-assemblies** - a novel technique.

## Consumers

- Consumers have demonstrated a growing interest in vehicles equipped with **regenerative braking systems, versatile charging capabilities, and advanced thermal management systems**, all aimed at ensuring optimal battery performance and longevity. Additionally, EV buyers are increasingly prioritizing the **environmental impact of their vehicles**, leaning towards manufacturers committed to sustainable production processes and materials.

## Key Players

- Key players include **Tesla**, an EV leader; **Toyota**, a pioneer in hybrid technology with vehicles like the Prius; **General Motors**, with models such as Chevrolet Bolt; and **Volkswagen Group**, whose aggressive push into the EV market is evidenced by its investment in charging infrastructure, strategic partnerships, and ambitious goals for electrification across its global operations.

# Consumer Trends in the EV Industry



The most important current and emerging trends in the EV Industry include consumer preferences for personalization, convenience, and flexibility, as well as affordability trends, charging availability, and competition with hybrid models.

## Statistics

- To understand consumer trends, it is essential to be aware of context and important background statistics. Electric car sales neared **14 million in 2023**, 95% of which were in China, Europe and the United States.
- 2023 electric car sales were 3.5 million higher than 2022, a 35% year-on-year increase, and **six times higher** than 2018.
- Electric cars accounted for around **18% of all cars sold in 2023**, up from 14% in 2022 and only 2% 5 years earlier, in 2018. These trends indicate that growth remains robust as electric car markets mature. Battery electric cars accounted for **70% of the electric car stock** in 2023.

## Preferences

- McKinsey's latest Future of Auto Retail Consumer Survey reveals that respondents who are inclined to purchase an EV are more likely to say that they **want more personalization than traditional car buyers**. They want a smaller set of preconfigured options, for instance, and the opportunity to **change configuration after purchase and before delivery**. Potential EV buyers also want more **simplicity, convenience, and price transparency**, including the ability to **prebook test drives** and **secure financing online**. OEMs that want to create an innovative and desirable brand impression could consider heeding these preferences as electrification accelerates.

## Barriers

- In terms of barriers, one important one is **affordability**. Even as prices come down, and the U.S. introduces tax credits, EVs remain much more expensive than their combustion counterparts. Another barrier is **charging issues**. Findings from a 2022 University of California, Berkeley study showed that **one-quarter of public chargers in the San Francisco Bay Area didn't work** due to "unresponsive or unavailable screens, payment system failures, charge initiation failures, network failures, or broken connectors". Additionally, the popularity of **hybrid models** is hindering the complete shift to EVs.



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# EV Software Industry Overview



The EV software industry has been steadily growing and is expected to grow parallel to interest in electric vehicles. Due to shifts towards the adoption of EVs, there has been development and interest in EV software.

## EV SOFTWARE INDUSTRY

- Is expected to **reach \$462B**, representing a **5.5% CAGR** from 2019 to 2030.
- **Size is expected to double** from \$238 billion to \$469B in 2030
- **Highest revenue generating segment is ECUs/DCUs**, followed by harnesses, controls, and more.
- EV Software industry is projected to continue growing as EV's become more popular.

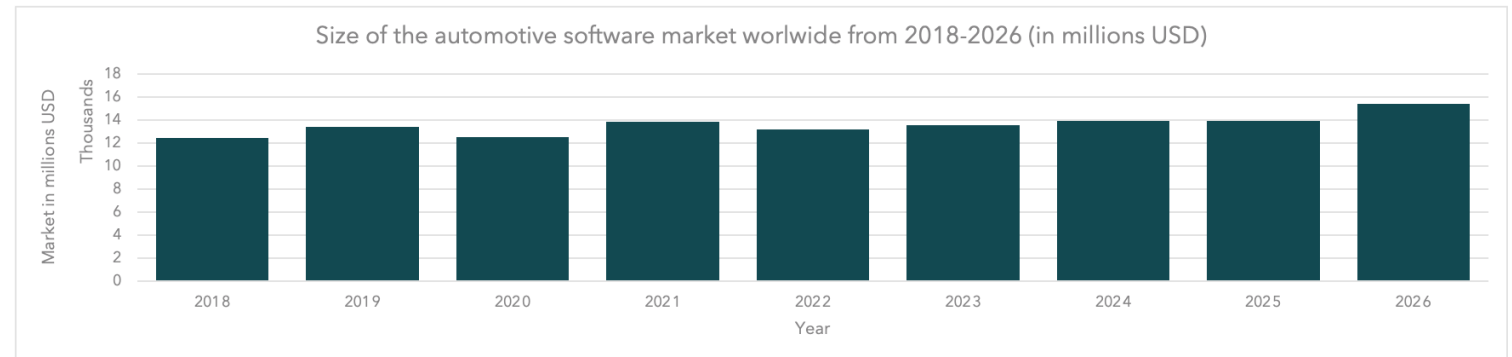
## MAJOR PLAYERS



RENESAS



*Statista, McKinsey, Bamboo, AppVentures*



### Technology

Can be **narrowed down to 6 types: digital cockpit, mobility solutions, self-driving cars software, digital twins, fleet management, and charging software.** There has been recent integration of AI and machine learning, big data, and V2G in developing EV software.

### Process

Building EV software involves the development of systems that **manage and control aspects of the EV operation** including outlining requirements to **craft functionality, developing software architecture, writing and testing codes,** and **integrating with vehicle system.**

### Trends

There is an overall **trend towards a more centralized software and electrical/electronic architecture.** Power electronics will occupy the **high end of growth** in the software industry. **Autonomous driving will fuel software** and sensors segments, along with high-voltage harnesses.

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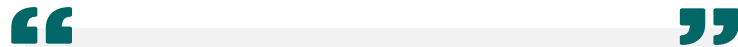
# EV Government Policy in the U.S.



There have been developments towards encouraging electric vehicles in the U.S. with policy incentivizing the purchase of electric vehicles through subsidies, infrastructure, development, and more.

## EV GOVERNMENT POLICY

- There has been a **push towards electric vehicles** and making it **more affordable** for Americans over the past few years.
- The U.S. Government set a **goal to make half of all new vehicles sold in the U.S. in 2030 zero-emissions** vehicles, and to build a **network of EV charging stations** across the country.
- The U.S. government signed the **\$1.2 trillion Bipartisan Infrastructure Law**, which includes \$7.5 billion for EV charging stations.



*"Today, the U.S. market share in electric vehicles is just one third the size of the Chinese market. The President's plan aims to change that, by investing over \$170 billion in the EV industry.*

*- Secretary of Transportation Pete Buttigieg*

### Bipartisan Infrastructure Law

A recent significant development in EV policy in the U.S. has been the **Bipartisan Infrastructure Law** which invests \$7.5 billion in EV charging. \$5 billion is meant to build a **"backbone" of high-speed chargers** spaced every 50 miles along freeways and highways through the **National Electric Vehicle Infrastructure Program**.

### State Laws

45 states and D.C. have some sort of **incentive for the use and ownership of EVs**. For example, Virginia recently passed an **EV rebate program**. Furthermore, zero emission regulations have accelerated EV adoption with **states like California** which led to a **reduction of greenhouse gases**.

### Cross-State Collaboration

EV efforts across state lines have been effective to **ensure charging infrastructure across highways**. The **Regional Electric Vehicle Midwest Coalition** has made bipartisan efforts to include decision makers from Illinois, Michigan, Indiana, Minnesota, and Wisconsin.

### Recent News

The Biden administration announced **plans to require 56% of new vehicle sales to be electric by 2032, along with 13% plug-in hybrids** or other partially electric cars. States like New Mexico are taking lead. New Mexico requires that by 2032, four out of five passenger cars shipped by manufacturers must have **zero emissions**.

## Key Takeaway

Due to public interest in sustainability and combatting climate change, there has been policy advocating for EVs. The US. has been making strides in policy to make EVs more accessible for Americans. This will lead to more productivity and demand for industry players.

[Statista](#), [U.S. Department of Transportation](#), [Econsult Solutions](#), [ABC News](#)



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# Key Players



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# Company Profile: Panasonic

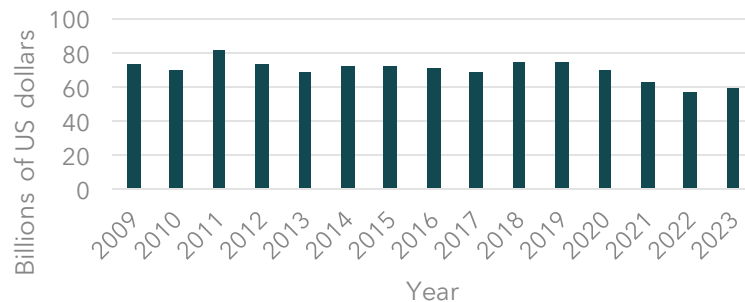


Panasonic is a key player in the EV battery manufacturing industry, producing many cylindrical batteries and capacitors for EV vehicles and working on new technological advances for further production.

## Panasonic

- Panasonic is one of the world's largest EV battery manufacturers, ranking **4th in market** share at **10%**, and is based in Japan.
- They began mass-producing batteries for EVs in **2004** and started **producing in the U.S. in 2017** in Nevada.
- Their **main customer is Tesla**, and they produce around **10% of all EV batteries globally**.

Panasonic's net sales in billions of US dollars



[Panasonic \(I\)](#), [Panasonic \(II\)](#), [Panasonic \(III\)](#), [Panasonic \(IV\)](#), [Statista](#), [Tesla](#), [Wired](#)

### Product

Panasonic initially designed **cylindrical lithium-ion batteries** for use in PCs, but now manufacture cylindrical, prismatic, pouch, and pin batteries for EVs. They also supply most of the world's **DC-link capacitors** that power EV inverters, adding to their position as a notable player in the global EV component market.

### Finances

Panasonic saw **declining net sales from 2020 to 2022**, although their sales rebounded slightly in 2023. This was due to an increase in Japan's consumption tax and the spread of the coronavirus pandemic. There were also a shortage in parts for manufacturing and a fluctuation in exchange rates.

### Recent News

Panasonic plans to **expand into Kansas** for future production of EV batteries. They also recently partnered with **H&T Battery Components** and **NMG** to expand production of lithium-ion batteries and increase their supply chain. Additionally, they partnered with **Sila** for silicon-powdered batteries that can improve the efficiency of EV batteries.

### Strengths and Weaknesses

Panasonic has **large capacity for battery manufacturing**, having many decades of experience in the area before starting making EV batteries. They also have **strong partnerships**, such as one with **Tesla** since 2009, that will drive growth in the future. A possible weakness is around **half** of their revenue comes from the market in **Asia**.

### Key Takeaway

Current partnerships with Tesla and other battery technology companies as well as increased expansion in the United States will contribute to Panasonic's future growth.

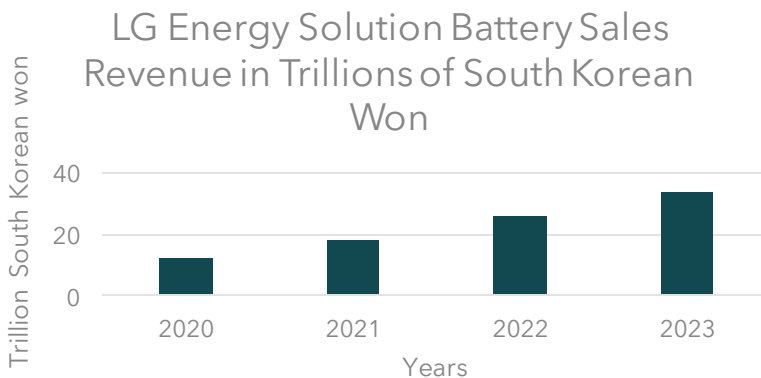
# Company Profile: LG Energy Solution



LG Energy Solution is another key player in the EV battery manufacturing industry based in South Korea, having established partnerships with key car manufacturers in the industry to drive company growth.



- LG Energy Solution is a split-off from **LG Chem**, the largest chemical company in Korea, and is **14%** of the market share for EV battery manufacturers.
- LG Energy Solution focuses exclusively on manufacturing **pouch lithium-ion batteries** for EVs, **energy storage systems**, and **information technology**.
- LG Energy Solution has manufacturing sites in the **U.S., South Korea, China, and Poland**.



[LG Energy Solution \(I\)](#), [LG Energy Solution \(II\)](#), [Statista](#)

## Product

LG Energy Solution produces **pouch battery cells, modules and packs**, and **battery management systems**. Their battery modules consist of high-nickel **NCMA** (nickel, cobalt, manganese, and aluminum) pouch cells. LG Energy Solution also focuses on **thermal management** for its NCMA batteries.

## Finances

LG Energy Solution saw their revenue **nearly double** from 2020 to 2023, with its main products being batteries for smartphones and laptops, EV batteries, and energy storage systems (ESS). As they are a **recently established entity** in 2020, there is not much financial data available yet.

## Recent News

LG Energy Solution has joint ventures with **Hyundai Motor Group** and **Honda**, forming the first joint venture between a Korean battery maker and Korean car maker and a Korean battery maker and a Japanese car maker. They recently signed a supply agreement with **Toyota**, another prominent car manufacturer.

## Strengths and Weaknesses

LG Energy Solution is a split-off from LG Chem, so they were able to **successfully manufacture batteries** due to previous resources. Additionally, they have **partnerships with big carmakers** in Asia, including Hyundai, Honda, and Toyota. They additionally focus on a **broad range of products**, not just EV batteries.

## Key Takeaway

Partnerships with notable car makers in Asia as well as future expansion into the U.S. will drive LG Energy Solution's growth.



# Key Players



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# Company Profile: Tesla

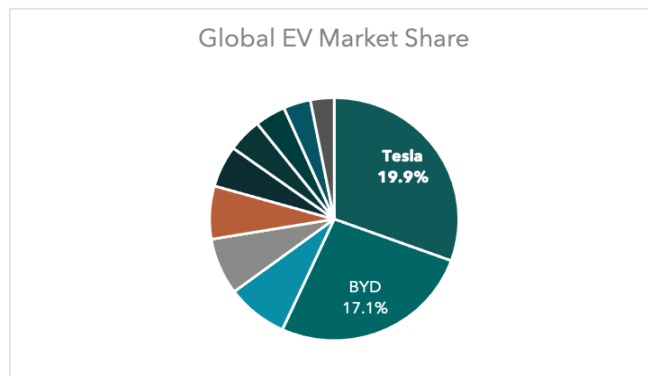
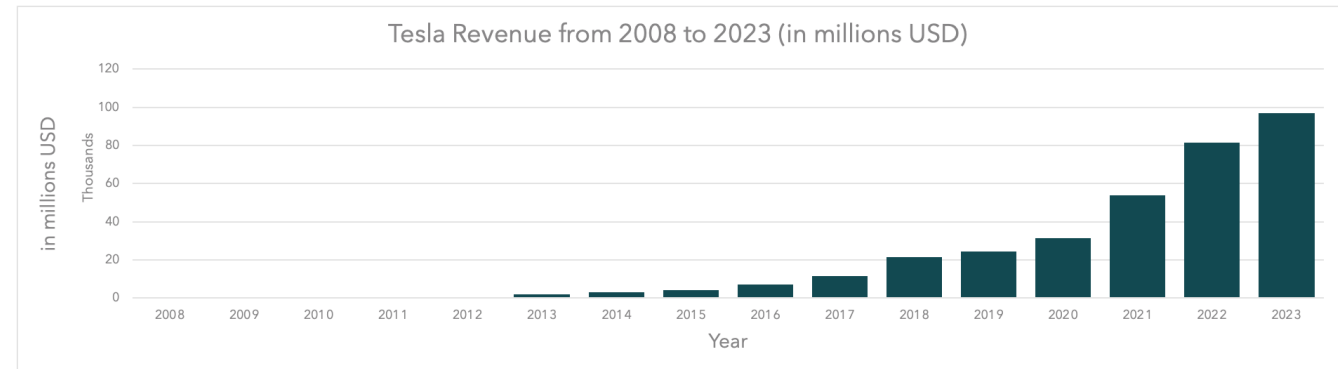


Tesla is an industry leader in the electric vehicle industry and is expected to continue innovating in this industry. They specialize in electric cars and are investing in decarbonizing the transportation sector.



**TESLA**

- **Total Market Cap:** \$535.98B
- Tesla makes up **19.9% of the global market share** on electric vehicles
- Tesla **sales in the U.S. were down 13.3%** year over year.
- Tesla is a major industry player with a large market share on electric vehicles.
- Tesla is a household name and is focusing on R&D in other alternative energy sources.



[Cox](#), [Reuters](#), [Statista](#), [Tesla](#), [Visual Capitalist](#)

<b>Product</b>	Tesla rolled out its <b>first EV Model S in 2012</b> and have released new models since then. They mainly focus on electric cars but have been working on electric trucks and <b>decarbonizing the transportation sector</b> through airplanes and more.
<b>Strategy</b>	Tesla's strategy is to <b>enter the high end of the market</b> , where customers are expected to pay a premium, and then drive market price down lower as further manufacturing and investment is conducted. All <b>free cash flow is invested in R&amp;D</b> .
<b>Recent News</b>	Tesla told suppliers it wants to <b>start production of a new mass market EV codenamed "Redwood" in mid 2025</b> . Production is expected to start in a Texas factory, along with other manufacturing facilities later. These models will include a <b>\$25,000 entry-level car</b> .

# Company Profile: BYD



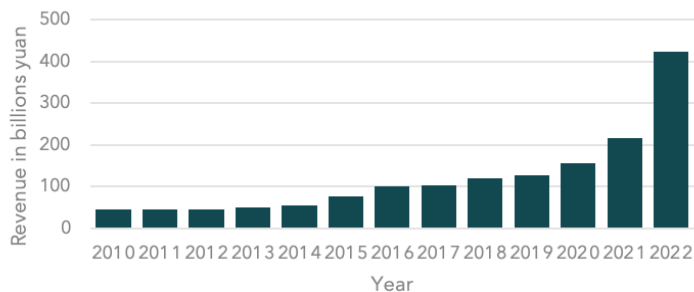
BYD is based in China and has a large presence in the global EV market. They are the world's largest EV manufacturer but are planning to continue to expand their international presence.



BYD

- BYD is based in **Shenzhen, China** and is **expected to overtake Tesla in terms of global market share** in the upcoming years.
- BYD's subsidiary **BYD Auto is the world's largest EV manufacturer.**
- BYD has a revenue of around CNY 324.9B.
- BYD is an industry leader in Asia and across the globe.

**BYD Group Revenue from 2010 to 2022**  
(in billions yuan)



[BYD \(1\)](#), [BYD \(2\)](#), [Electrek](#)

## Product

BYD Auto manufactures **battery passenger electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs)** also known as new energy vehicles (NEVs). They also produce **electric trucks and buses**. BYD also produces other vehicles but is growing in popularity due to their electric vehicles.

## Strategy

BYD is characterized by its **vertical integration** which leverages BYD group's experience in producing batteries and electric motors and electronic controls. **BYD Company and Toyota** signed an agreement to create a joint company for R&D to design and develop BEVs.

## Market Position

BYD concluded 2023 with **record-breaking sales volume** and was listed among the global top 10 of car sales. BYD is the **best-selling car brand and manufacturer in China**. Their international presence expanded significantly with **exports growing by 334.2%** across over 70 countries on six continents.

## Recent News

BYD is planning on launching its next gen **Blade EV battery** which will offer a **longer range and life-span**, along with being a more cost-effective option. This new battery will **reduce power consumption per 100 km**, which will promote longer range and performance.

## Key Takeaway

Overall, BYD is an industry leader in the global EV market and is expanding its presence internationally through partnerships and exports. BYD is expected to continue growing and further R&D in electric vehicles.

# Company Profile: Hyundai



Hyundai is an automotive manufacturer increasingly expanding into the EV market, offering a unique value proposition that attracts both consumers and investors, through design innovation and long-term investments.



## HYUNDAI

- Automotive manufacturer known for **its cars, SUVs, and increasingly, electric vehicles.**
- Hyundai holds approximately **8.9%** of the global automobile market as of 2023.
- Hyundai posted revenues of ₩130.91T (approximately \$105B) for 2023.
- They particularly target the younger demographic and use a **value-based pricing strategy** that offers premium features at an **accessible price point** which distinguishes it from competitors.



*“Under IONIQ, we will offer customer centric EV experiences centered on connected lifestyle solutions in line with our ‘Progress for Humanity’ company vision.”*

– Michael Cole, CEO of Hyundai Motor Europe

[Hyundai, Driven Wheels](#)

### Differentiation Strategy

Hyundai differentiates itself through **design innovation**, often being among the first to adopt aggressive and distinctive styling in new models. They focus on high-quality, feature-rich vehicles at competitive price points, and are making a strong push into the electric vehicle market with its **dedicated EV brand, Ioniq.**

### Growth Strategy

Hyundai is committed to investing **\$7.4B in the U.S. by 2025** to foster innovation, including electric vehicles and smart mobility solutions. They are exploring future technologies such as **hydrogen fuel cell vehicles, autonomous driving, vehicle-to-everything (V2X) communication, and augmented reality (AR) navigation.**

### Strengths and Weaknesses

Some strengths include **rapid adaptation to market trends** and **strong performance in safety and quality rankings**, as well as an **extensive market presence in Asia**. In contrast, one of their weaknesses is that their brand perception in Western markets still trails competitors like Toyota and Volkswagen, according to Driven Wheels.

### Recent News

Hyundai announced a **partnership with Uber** to explore launching an **air-taxi service** by 2028, with aircraft designed to cruise **120mph at a 1,500-foot altitude**. This will initially be for suburban into inner city travel for 25-40-mile trips. They also have plans to introduce 23 new EV models and sell 1 million EV units worldwide by 2025.

### Key Takeaway

Hyundai is a dominant player in the global automobile market and differentiates itself via a value-based pricing strategy, design innovation, quality products, and strong market presence in Asia.

# Company Profile: Toyota

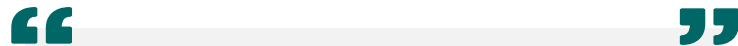


Toyota is an automotive manufacturer specializing in a wide range of vehicles, with innovative plans to expand further into the EV market and continue differentiating itself from its competitors.



TOYOTA

- Toyota is an automotive manufacturer specializing in a wide range of vehicles, from **sedans and SUVs** to **hybrids and electric vehicles (EVs)**.
- In June 2023, Toyota executives announced commercialization and full-scale mass production plans for **solid sulfide electrolyte-based batteries**.
- Their solid-state battery allows for a **932-mile range** and up to 10-minute charging time.
- As of 2023, Toyota holds approximately **10.6% of the global automobile market share** and reported revenue of ¥31.4T (approximately USD \$240B) for the fiscal year ending March 2023.



*"Depending on the region, there's a high need for BEVs, and there's greater and faster demand for green energy. And for those areas, BEVs are a compelling solution."*

- Koji Sato, CEO of Toyota

[Toyota](#)

## Differentiation Strategy

Toyota is renowned for its pioneering work in **hybrid technology**, evidenced by its best-selling Toyota Prius. They emphasize **reliability and efficiency** in its vehicle lineup, which has built a **strong brand loyalty**, and focus strongly on sustainability, aiming to offer an **electrified version of every model in its lineup** by 2025.

## Growth Strategy

Toyota is investing heavily in **autonomous driving technology** and partnering with tech companies to advance its capabilities. Via a three-pronged approach of **'electrification, intelligence and diversification'**, they plan to spend \$13.5B by 2030 to develop batteries and battery supply systems for electric vehicles.

## Recent News

Toyota recently announced **total investment of \$10B** in its flagship Kentucky facility for **battery electric vehicle (BEV) and electric SUV manufacturing**. They hope to integrate next generation batteries and sonic technology to achieve a vehicle cruising range of **1,000km**, one of the goals of their **'next generation battery EV strategy'**.

## Innovation

To produce more stylish designs, AI will be used to support **aerodynamic performance**, while designers will focus on expressing natural sensibilities. Their Arene OS and full OTA (over-the-air) applications will deliver **'exciting surprises and fun' to their customers**, with technologies that can only be achieved by a carmaker.

## Key Takeaway

Toyota successfully differentiates itself from its competitors to continually attract consumers and has devised an extensive growth strategy to further develop their EV manufacturing capabilities.

# Key Players



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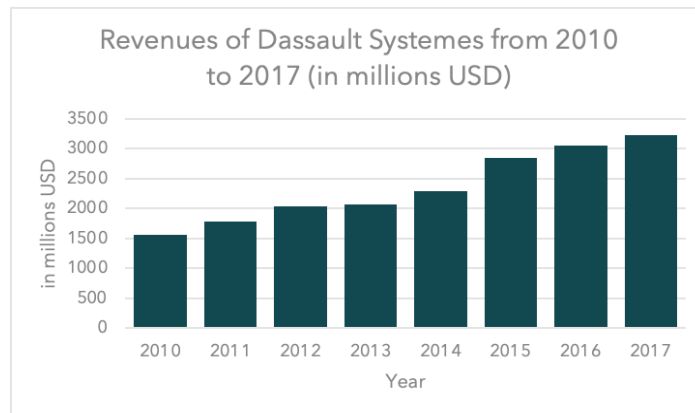
# Company Profile: Dassault



Dassault is a French software company that is a leader in the EV software industry. They have seen growing profits and revenue in recent years due to growing interest in electric vehicles and sustainability, in general.



- Dassault is a **French multinational software corporation** that develops software for **3D product design, simulation, and manufacturing**.
- They are a **leader in the EV software industry** and spun out of Dassault Group.
- Dassault was named **Forbes' World's Most Innovative Companies**, among other accolades.



[Dassault, Reuters](#)

<b>Product</b>	Dassault specializes in <b>battery engineering, electric drive engineering, power electronics engineering, and full vehicle engineering</b> . They developed an EV software called <b>3DEXPERIENCE</b> , offering a 360-degree product development ecosystem that combines design and capabilities for a more efficient product.
<b>Market</b>	Dassault has a <b>market cap of \$54.27B</b> and a <b>revenue of \$6.46B</b> . They expect a <b>revenue growth of 8-10%</b> this year and are expected to grow as interest in EV software grows. The overall quarterly <b>software revenue was \$1.48B</b> and revenue is expected to <b>grow 7-8%</b> in the first quarter of 2024.
<b>Strategies</b>	They are focusing on <b>electric cars</b> and pushing sustainability in a <b>new era of travel</b> that is efficient, affordable, clean, and green. They are connecting <b>internal disciplines on a united collaborative platform</b> to pull ahead of competition, drive down costs, and design safer vehicles.
<b>Recent News</b>	Dassault recently <b>partnered with BMW</b> to bring the <b>3DEXPERIENCE</b> to its future engineering platform. With this new platform, BMW engineering disciplines will be working on a virtual twin of a vehicle that can be configured for the variants of each model with <b>integrated data</b> . Furthermore, BMW Group can migrate data from Dassault software to their future EVs.

## Key Takeaway

Overall, Dassault is an industry leader in the EV software industry and unleashed a special product called 3DEXPERIENCE, which has attracted companies like BMW.



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# SWOT Analyses



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# EV Battery Manufacturing SWOT Analysis



The EV battery manufacturing market is expected to grow in the future, with the main issues being shortages of materials used and competition from Asian manufacturers.

## STRENGTHS

- Most battery materials used for electric vehicles can be **reused**, saving possibly wasted material.
- The **demand for EVs is still expected to increase**, albeit at a slower rate, in the future.
- The demand for EV batteries **grew by around 80%** in 2022, indicating a still-growing market.

## WEAKNESSES

- Electric cars use **173 kg more** lithium, nickel, copper, and other materials compared to petrol cars.
- **Lithium demand already exceeded supply** as of 2022, with 60% of lithium demand being for EV batteries.
- Consumer demand for EVs is **expected to slow**, causing automakers to scale back or delay EV plans.

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- Strong incentives exist for manufacturers to build batteries in the U.S., as the **Inflation Reduction Act** encourages purchases of electric vehicles.
- Expanding into **alternatives to lithium-ion**, such as lithium iron phosphate or nickel cobalt aluminum oxide batteries, is a good option.

## OPPORTUNITIES

- The biggest EV battery manufacturers are **located in Asia**, with heavy dependence on Asian consumers.
- Most lithium production is in **Australia and Chile**, so these countries have the biggest impact on supply.
- **Nickel is at a risk of shortage** due to other industries, particularly stainless steel, having high demand.

## THREATS

*CNBC, Environmental Defense Fund, IEA, McKinsey, The Guardian*

# SWOT Analyses



This industry report divides the SWOT analysis of the EV industry into three supply chain segments: upstream battery manufacturing, midstream vehicle manufacturing, and downstream software creation.

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## Section 1: Upstream EV Battery Manufacturing

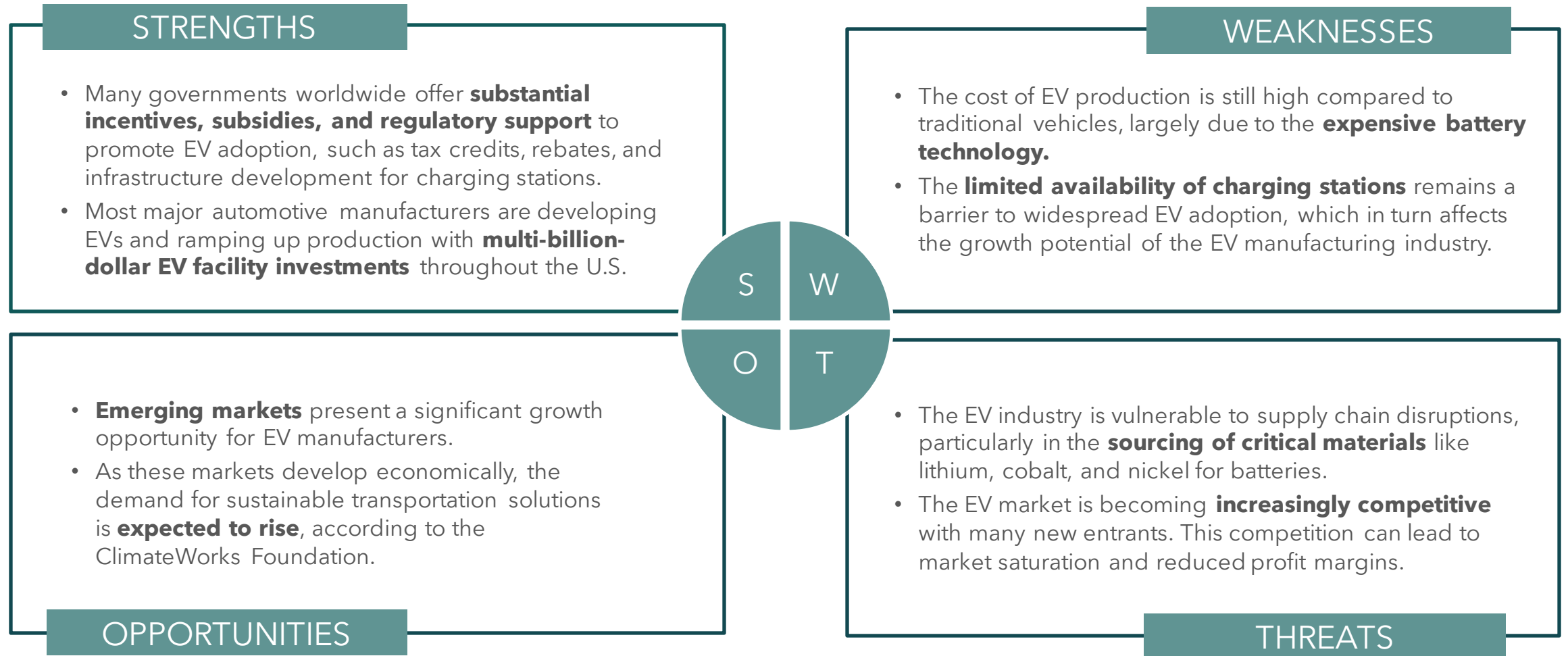
## Section 2: Midstream EV Manufacturing

## Section 3: Downstream EV Software Creation

# EV Manufacturing SWOT Analysis



The prospects of the EV manufacturing industry largely depend on those of the EV industry as a whole, though several points specific to EV manufacturing, including investment packages and emerging markets, play an important role.



[CBRE](#), [MDPI](#), [ClimateWorks](#), [BCG](#)

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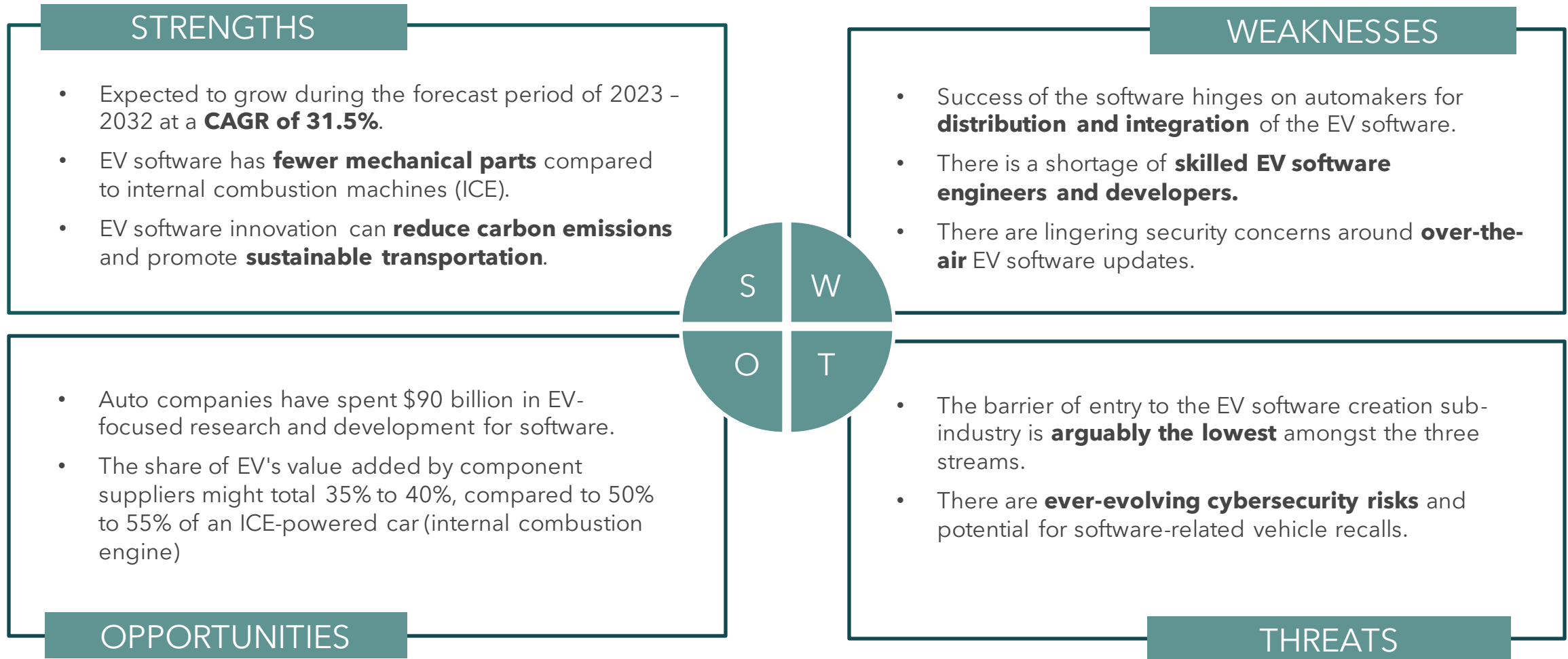
## Section 2: Midstream EV Manufacturing

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# EV Software Creation SWOT Analysis



The EV software industry is expected to grow and there has been a proliferation of research in this industry. As such, there are several opportunities for development. However, there are high levels of competition among EV software companies.



[CBRE](#), [MDPI](#), [ClimateWorks](#), [BCG](#)



Section 1: Industry Overview

Section 2: Key Players

Section 3: SWOT Analyses

**Section 4: Industry Recommendations**

# Overall Recommendations for EVs – Batteries



EV battery manufacturers should explore new battery materials and technologies to increase efficiency and sustainability while partnering with energy technology companies and car manufacturers.

## Sourcing

- Experts forecast a **lithium shortage** in the 2030s due to lithium's role in transportation and energy storage.
- Lithium-ion batteries are the most common batteries used for EVs, so this is an issue for current EV battery manufacturers.
- **Sodium-ion batteries** hold potential as having **less environmental impact and less cost to manufacture**, but issues with low energy density require more research to be done into improving such technologies.
- The Inflation Reduction Act incentivizes **sourcing materials for EVs and EV batteries from U.S. manufacturers**.
- Alternatives to lithium-ion batteries and increasing manufacturing capacity in the U.S. has benefits for manufacturers.

## Technologies

- **Solid-state batteries** offer advantages compared to current lithium-ion batteries, including **less risk of failure, less flammability, higher energy density, and a faster charging cycle**.
- As a good solid-state electrolyte has not been found yet, **more work into the area is needed**.
- Alternatives to traditional lithium-ion nickel manganese cobalt batteries, such as **lithium iron phosphate batteries**, cost less to manufacture and are growing in market share.
- Alternative technologies to current lithium-ion batteries could increase energy density and are important to explore.

## Partnerships

- A majority of the largest EV battery manufacturing companies are based in Asia and have **notable partnerships with major car manufacturers** like Hyundai or Toyota, increasing their growth in the field.
- EV battery manufacturers based in the U.S. could make **partnerships with major EV vehicle manufacturers**, such as Tesla, Volkswagen, General Motors, and BMW, to expand production.
- **Partnerships with other technology companies** such as NVIDIA, Intel, or Microsoft would help develop more efficient and cheaper EV battery technologies for battery manufacturers, revolutionizing the field.

[BBC](#), [Center on Global Energy Policy](#), [EV Magazine](#), [IEA](#), [MIT Technology Review](#)



# Overall Recommendations for EVs – EV Manufacturing



Given the SWOT analyses of specific EV manufacturing companies as well as the EV manufacturing industry at large, EV manufacturers should consider vertical integration, embrace technology, and convert manufacturing facilities.

## 1 Vertical Integration

- To **streamline operations and reduce dependency on external suppliers**, new companies should consider investing in **vertical integration**. This will allow companies to **better control the supply chain**, from raw material procurement to final assembly, ensuring quality control, and reducing production costs. Companies can do this by **acquiring or partnering more closely** with suppliers and **developing in-house capabilities** for critical components like batteries and semiconductors.

## 2 Advanced Technologies and Artificial Intelligence

- New companies can gain a competitive edge by **embracing advanced technologies** such as **automation, 3D printing, and artificial intelligence**. In the EV industry, which is projected to grow more and more saturated, such differentiators are key for EV manufacturers wishing to **stay ahead of their competitors**. For established manufacturers already in the market, they should continuously invest in **upgrading their production lines** with the latest technologies and look for ways to optimize productivity and efficiency.

## 3 Conversion of Manufacturing Facilities

- Converting **traditional internal combustion engine (ICE) plants** into **EV manufacturing plants** allows automakers to leverage existing production infrastructure and expertise rather than **building new facilities from scratch**. Converting an existing plant can also be **less expensive and time consuming than building a new one** and can **reduce the overall carbon footprint** of the manufacturing process. Indeed, there is already a growing trend for companies to convert traditional internal combustion engine (ICE) production facilities into EV manufacturing plants.