



Electric Vehicles

Ready or Not, Here They Come!

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Welcome!

Electric Vehicles: Ready or Not, Here They Come!



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Today's Agenda

- Introduction
- Recent Industry Developments & Electric Vehicle (EV) Outlook
- Barriers Facing Broader Consumer Adoption of EVs
- Public Sector Policies Promoting EV Growth
- EVs as Industry Disruptors
- Autonomy: EV Game-Changer
- CFRA Auto Manufacturer Coverage
- Q&A

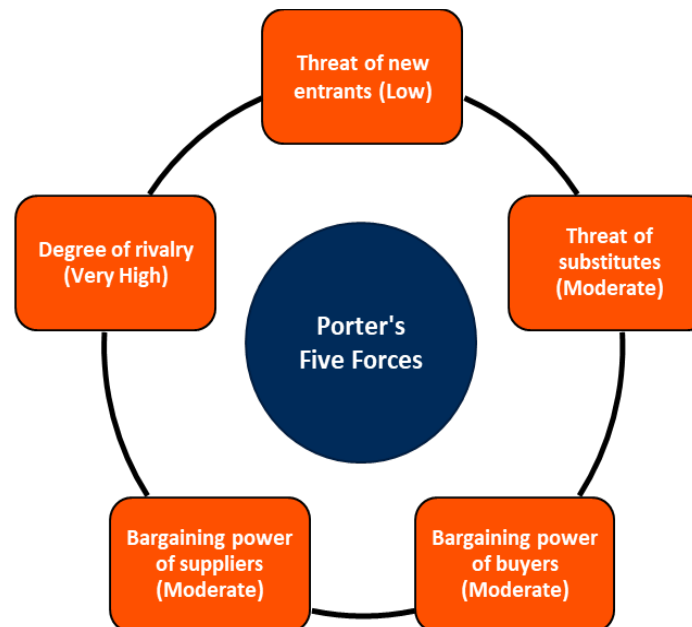


Recent Industry Developments & EV Outlook



Auto Manufacturing: A Challenging Industry

- The global auto manufacturing industry is mature, highly cyclical, and highly competitive, with high fixed costs, high barriers to entry, low margins, and low returns on capital
 - For these reasons, valuation multiples are among the lowest of any industry
- A value/income-oriented industry experiencing transformational disruption from EV/AV technology



Covid-19 Devastated Global Auto Sales

- **Global vehicle sales fell 13.9% in 2020, a drop worse than that seen during the Great Recession of 2008-2009**
 - We forecast a 9.0% rebound in 2021 and 4.5% in 2022

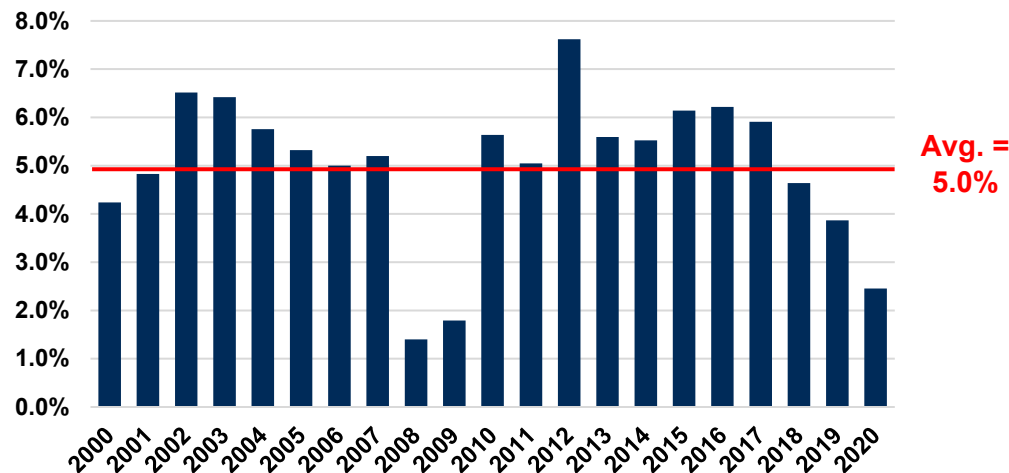
- **Factories around the world were shuttered for a month or more beginning in March/April 2020**

- **Auto demand bounced back sharply due to a variety of factors**
 - This led to major supply chain issues which are still reverberating

Auto Manufacturing: A Low Margin Industry

- **EBIT margins have averaged 5.0% over the last two decades**
 - During good times, margins can hit 6%-8%
 - During recessions, margins can drop to 1%-3%
- **In 2020, EBIT margins dropped to their lowest level (~2.5%) since the Great Recession**
 - Expected to rebound to 5.0% in 2021 and 6.3% in 2022

Average EBIT Margins of Global Automakers



U.S. Vehicle Prices Hitting Record Highs

■ U.S. new vehicle prices are hitting record highs

- The average U.S. new vehicle sales price was \$45,031 in September (+12.1% Y/Y), the sixth straight record high
 - The average sales price was above MSRP
 - Incentives at their lowest level in more than a decade

Average U.S. New Vehicle Price
(January 2013-September 2021)

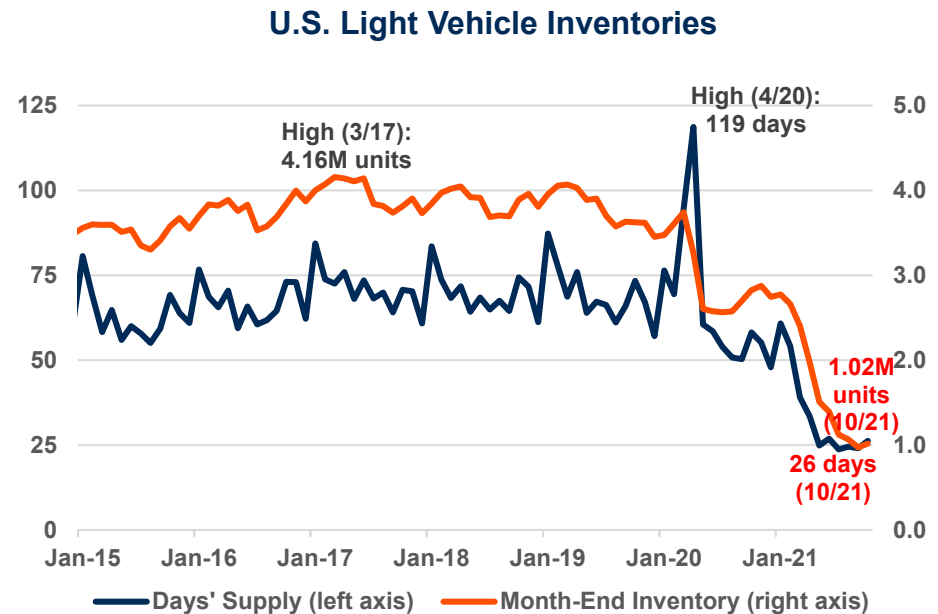


Uncharted Waters for the U.S. Auto Market

U.S. new vehicle inventories near record lows

- 26 days of supply at end of October versus an historic average of ~64 days
- Volumes likely to increase 9% Y/Y in 2021 (+14% absent semiconductor shortages)

Intel recently said chip shortages are likely worsen and estimated the supply/demand imbalance will persist for 1-2 years



Auto Semiconductor Content is High

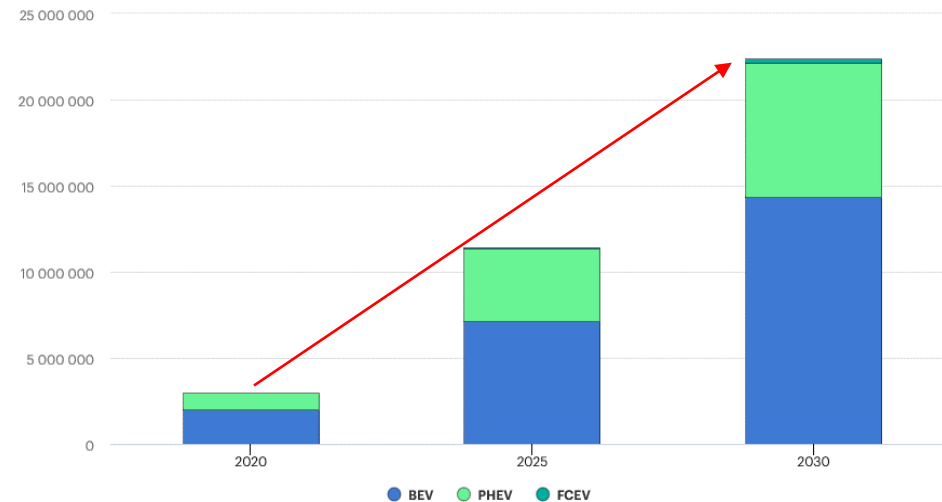
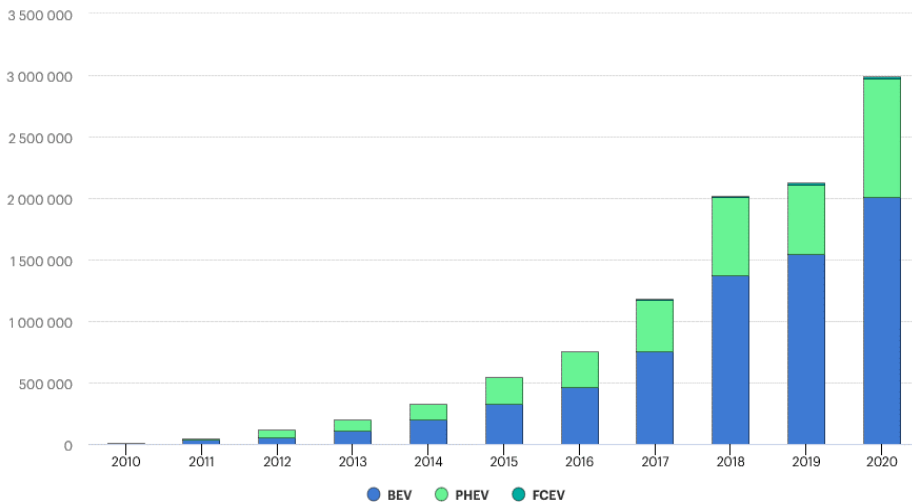
CATEGORY	SENSORS	THINK - CONTROLLER	ACTIONS
Connectivity	Cellular Wifi, BT, GNSS, NFC Smart Car Access	Connectivity Controller	
Autonomy (ADAS)	V2X Radar Camera Lidar	Sensor Fusion & Planning Controller	
Powertrain & Vehicle Dynamics	Motion & Pressure Speed Ultrasonic	Powertrain Controller	Engine, Transmission, Brake, Battery Management, Steering, Airbag, Suspension
Body & Comfort	Temp, Light, Humidity Switch Panels	Body Controller	HVAC, Interior Lighting, Doors, Seats, Steering Wheel, Mirrors, Wipers, Sunroof
Connected Infotainment	Radio & Audio Touch Displays Voice Recognition	eCockpit Controller	eCockpit, Amplifiers

Source: CFRA, NXPI

Global EV Sales: Robust Growth Ahead

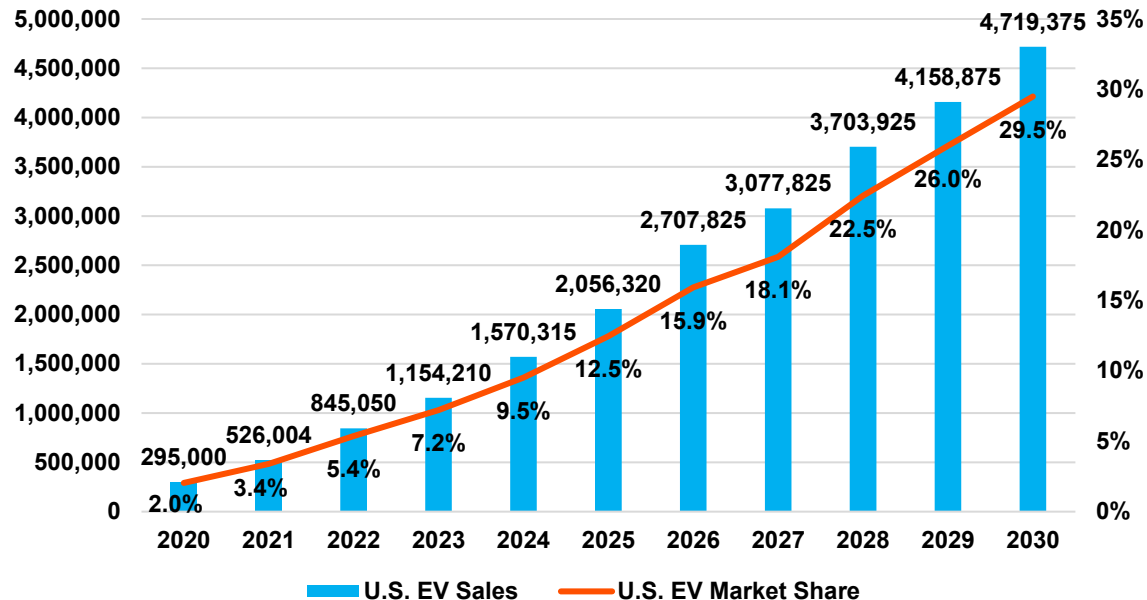
2010-2020

2020-2030E



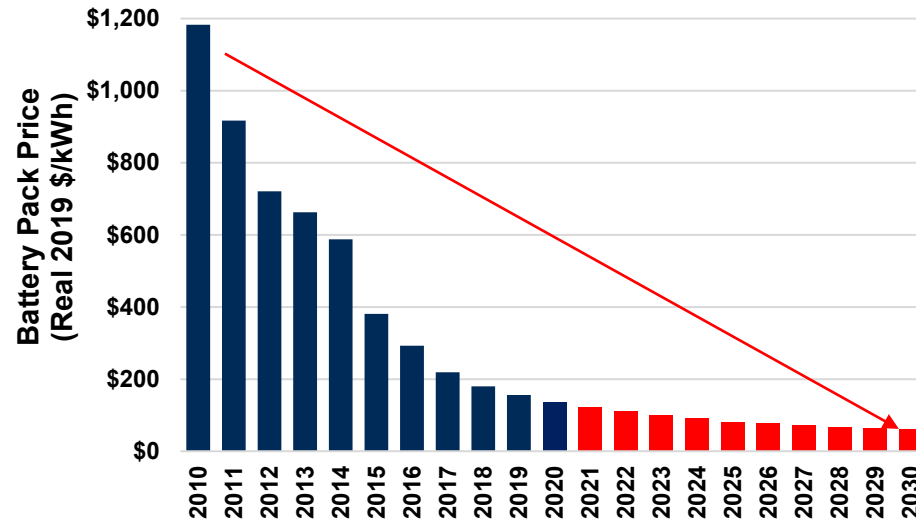
- **Global EV sales projected to grow from 3.0M in 2020 to 22.4M units in 2030**
 - Sales on pace to increase to 5.2M units in 2021
- **2020 market share = China 39%, Europe 46%, US 10%, All Other 5%**
- **2030E market share = China 40%, Europe 27%, US 11%, All Other 22%**

U.S. EV Market: 8x Growth Possible By 2030



- In 2020, U.S. EV sales totaled about 300K units (~2% of total new car sales)
- EVs as a percentage of U.S. new light vehicle sales estimated to grow from 3.4% in 2021 to 29.5% by 2030

Falling Battery Costs: A Game-Changer



- **Lithium-ion battery pack costs fell by 89% from 2010 to 2020**

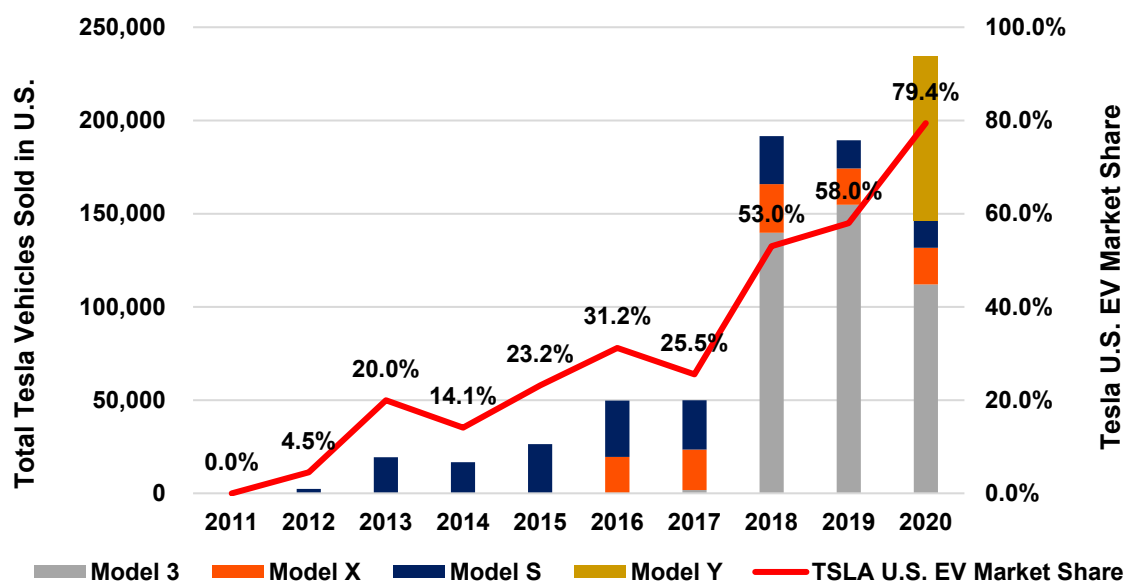
- Volume-weighted average cost hit \$137/kWh in 2020
- At around \$100/kWh, cost reaches parity with internal combustion engine vehicles (likely around mid-decade)
- We forecast costs will fall to \$61/kWh by 2030 (DOE goal = \$80/kWh by 2030)
- Battery costs = 20%-33% of total EV cost

- **Top EV ranges now pushing 500+ miles**

- Long-range Tesla models and Lucid Air Dream Edition

Tesla: The Dominant U.S. EV Company

Tesla: U.S. Vehicle Sales By Model & U.S. EV Market Share, 2011-2020



- **Between 2014-2020, Tesla grew its market share in the U.S. EV market, from ~14% to 79% of total sales volume!**
- **First deliveries of the Model Y in March 2020 combined with lack of offerings from competitors helped boost market share even further**

The Long List of Failed EV Startups...

- **Aside from Tesla, breaking into the U.S. auto industry is so difficult that the last company to do so successfully was Chrysler - in 1925!**
- **Of the established U.S. auto companies, only Ford has never declared bankruptcy**
- **Fisker**
- **Coda**
- **Spyker Cars**
- **Detroit Electric**
- **Corbin**
- **Bright Automotive**
- **AMP**
- **Aptera**
- **Better Place**
- **Li-ion Motors**
- **HumanCar**
- **LeEco**

...And Discontinued EV Models

Manufacturer	Brand	Model	Discontinue Date	BEV/ PHEV	Type
Honda	Honda	Clarity PHEV	2021	PHEV	Sedan
Daimler	Mercedes-Benz	GLE 550e	2021	PHEV	SUV
Hyundai	Hyundai	Sonata PHEV	2020	PHEV	Sedan
Stellantis	Fiat	500e	2020	BEV	Coupe
Hyundai	Kia	Optima	2020	PHEV	Sedan
Honda	Honda	Clarity	2020	BEV	Sedan
Ford	Ford	Fusion Energi PHEV	2020	PHEV	Sedan
Volkswagen	Volkswagen	e-Golf	2020	BEV	Hatchback
Daimler	smart	fortwo	2020	BEV	Coupe
BMW	BMW	i8	2020	PHEV	Sports car
General Motors	Chevy	Volt	2019	PHEV	Hatchback
Volkswagen	Audi	A3 Sportback e-tron	2019	PHEV	Sedan
General Motors	Cadillac	CT6	2019	PHEV	Sedan
Ford	Ford	Focus Electric	2019	BEV	Hatchback
Ford	Ford	C-Max	2018	PHEV	Hatchback
General Motors	Cadillac	ELR	2017	PHEV	Coupe
Daimler	Mercedes-Benz	B250e	2017	BEV	Hatchback
Renault-Nissan-Mitsubishi	Mitsubishi	iMiEV	2017	BEV	Subcompact
General Motors	Chevy	Spark	2016	BEV	Subcompact
Toyota	Toyota	Prius PHV	2016	PHEV	Hatchback
Honda	Honda	Accord	2015	PHEV	Sedan
Honda	Honda	Fit	2014	BEV	Subcompact
Toyota	Toyota	RAV4 EV	2014	BEV	SUV
Coda	Coda	Coda	2013	BEV	Sedan
Fisker	Fisker	Karma	2012	PHEV	Sports car
Tesla	Tesla	Roadster	2012	BEV	Sports car
Toyota	Toyota	RAV4 EV	2003	BEV	SUV
Ford	Ford	Ranger	2002	BEV	Pickup
General Motors	General Motors	EV1	1999	BEV	Coupe
General Motors	Chevy	S-10 Electric	1998	BEV	Pickup

Note: BEV = Battery Electric Vehicle, PHEV = Plug-In Hybrid Electric Vehicle



Barriers Facing Broader Consumer Adoption of EVs



EV Hurdles: Too Few Chargers is #1 Concern

The top five factors holding consumers back from purchasing an EV:

- 1) Not Enough Public Charging Stations **48%**
- 2) Purchase Price **43%**
- 3) Driving Range **42%**
- 4) Not Enough Knowledge About EVs **30%**
- 5) Nowhere To Charge at Home **28%**

U.S. EV Charging Station Overview

- **Currently, there are 45,330 EV charging stations (non-residential) in the U.S. with a total of 111,583 outlets**
- **Lack of infrastructure has been a major impediment to more widespread EV adoption**
- **Infrastructure bill includes \$7.5 billion for new EV charging stations**

State	EV Charging Stations	EV Charging Outlets	State	EV Charging Stations	EV Charging Outlets
California	13,507	34,808	Hawaii	362	743
New York	2,719	6,679	South Carolina	336	774
Florida	2,342	5,749	Vermont	311	834
Texas	2,153	5,059	Indiana	300	834
Massachusetts	1,941	4,295	Oklahoma	279	992
Washington	1,570	3,793	Maine	265	552
Georgia	1,494	3,762	Iowa	253	534
Colorado	1,466	3,460	District of Columbia	243	685
Maryland	1,089	2,868	Rhode Island	236	533
Pennsylvania	1,037	2,455	Kentucky	198	477
Missouri	990	2,096	Alabama	196	495
North Carolina	982	2,365	Nebraska	169	356
Virginia	960	2,633	New Mexico	168	401
Illinois	908	2,282	New Hampshire	142	319
Oregon	895	2,149	Louisiana	140	339
Utah	864	1,837	Arkansas	135	412
Ohio	860	1,883	Delaware	112	279
Arizona	792	1,994	Idaho	103	260
Michigan	765	1,694	Mississippi	93	281
New Jersey	635	1,646	West Virginia	93	277
Tennessee	602	1,401	Montana	69	205
Minnesota	547	1,238	Wyoming	60	171
Connecticut	464	1,248	North Dakota	56	132
Kansas	459	942	South Dakota	50	147
Wisconsin	446	868	Alaska	47	83
Nevada	427	1,264	Total	45,330	111,583

Consumer Wants: More Public Chargers

Which state or federal policies, if enacted, would most likely increase your interest in purchasing or leasing a plug-in electric vehicle?

- **Public charging stations along highways 42%**
- **Discounts to install a home charging station 37%**
- **Discounted charging rates from your electric utility provider 35%**
- **Rebates at the time of purchase or lease 34%**
- **Rebates as tax credits 30%**

Consumer Wants: More EV Model Variety

Percentage of U.S. drivers who either agree or strongly agree with the following statements:

- Automakers should make a variety of vehicle types (like sedans, minivans, SUVs and pickups) available as plug-in electric models **71%**
- Electric utility providers should offer discounts to charge EVs at times when electricity demand is low **68%**
- Incentives and tax rebates for plug-in EVs should be available to all consumers, including high income **60%**
- My state should invest money to increase the availability of plug-in EV charging stations **55%**

Lower Operating Costs a Big Plus

Which attributes would most encourage U.S. drivers to purchase a plug-in electric vehicle?

- **Costs less to charge than fueling a gas-powered vehicle 21%**
- **Lower maintenance costs than gas-powered vehicles 17%**
- **Purchase price similar to a gasoline-powered vehicle in the same class 17%**
- **Ability to charge at home 11%**
- **Higher reliability than gasoline-powered vehicles 11%**



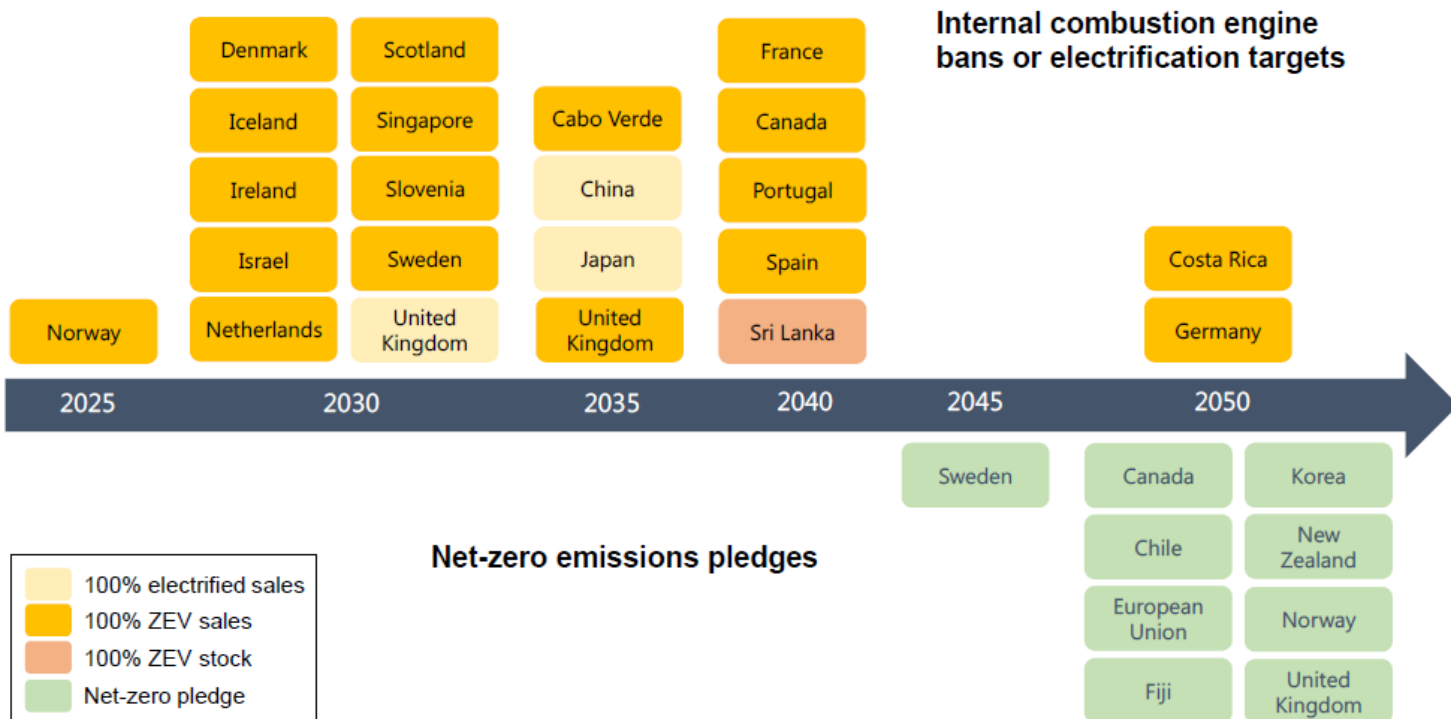
Public Sector Policies Promoting EV Growth



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Countries with Electrification Targets or ICE Bans

- More than 20 countries have electrification targets or ICE bans, and 8 countries plus the EU have announced net-zero pledges



U.S. EV Proposals Have Stalled

- **As a candidate, President Biden proposed a number of programs which would have significantly boosted EV sales. Most appear unlikely to pass:**
 - 1) Tax incentives to stimulate EV supply and demand
 - 2) Consumer rebates for the trade-in of older, less fuel-efficient vehicles
 - 3) Make government fleet purchases EVs
 - 4) Increase investment in EV infrastructure and research

U.S. Infrastructure Bill: EV Spend Disappoints

- **The \$1.2 trillion infrastructure bill includes only \$7.5 billion for the installment of EV charging stations across the U.S.**
 - But AlixPartners estimates it would take \$50 billion to build a U.S. charging network capable of serving the number of EVs expected by 2030
 - Tesla could be the biggest winner from the bill
- **The bill also includes \$7.5 billion for the purchase of electric school buses and hybrids**
- **The fact the bill includes no tax credits, rebates, or other incentives is a major setback for EV growth**

U.S. Tax Credits: Only Some EV Models Qualify

- **In the U.S., Internal Revenue Code (IRC) Section 30D provides a federal tax credit for Qualified Plug-in Electric Vehicles**
- **The tax credit begins to phase out over a 12-month period after the manufacturer sells 200,000 EVs**
 - Currently, EV purchases are eligible for a \$7,500 federal tax credit until the manufacturer has sold a total of 200,000 eligible EVs on a cumulative basis for sales beginning January 1, 2010
 - Only Tesla and GM have hit that threshold

Manufacturer	Total U.S. EV Sales (Jan. 2010-June 2021)	Sales Needed To Reach 200,000
Nissan	144,913	55,087
Toyota	127,593	72,407
Ford	134,195	65,805
BMW	118,119	81,881
Stellantis	46,978	153,022
Honda	36,852	163,148
Mercedes-Benz	24,401	175,599
Kia	20,003	179,997
Volkswagen	18,277	181,723

Proposed Changes to IRC 30D (CEAA)

- **Congress will soon finalize and vote on the Clean Energy for America Act (S. 2118), which contains several proposed changes to IRC 30D**
 - Currently has only 3% chance of being enacted, per Skopos Labs

Proposed Changes to Plug-In Electric Drive Vehicle Credit IRC 30D		
Proposed Change	Effective Date	Notes / Potential Impact
Manufacturer sales cap phaseout at 200,000 EVs sold is eliminated.	May 25, 2021	Purchasers of a qualifying EV after May 24, 2021 can apply the tax credit on their 2021 tax return for GM and Tesla EVs, which currently do not qualify.
MSRP must be less than \$80,000 to qualify for any tax credit.	January 1, 2022	Cap is based on MSRP. Unclear if it refers to model variants or lines. Actual purchase price of EV may be well north of \$80,000. MSRP likely does not include the cost of delivery fees.
Electric vehicles with final assembly in China are not eligible for any tax credits.	January 1, 2022	Would affect models imported from China by OEMs. Could impact OEMs including Volvo, Kandi, Polestar, Byton, BYD, NIO, Xpeng, and others.
Tax credit becomes refundable.	January 1, 2022	If taxpayer owes less than the amount of EV tax credit, IRS will reduce the owed taxes to zero and pay the remaining amount of the credit to taxpayer.
\$2,500 additional tax credit for qualifying EVs with final assembly in the US.	January 1, 2022	Currently only 14 of the 55 EVs available in the US also have final assembly in the US, but this could nearly triple to ~23 by the end of 2022.
\$2,500 additional credit for vehicles assembled in a US facility where workers are represented by a labor organization	January 1, 2022	5 EVs available today are assembled in US plants with union representation and will likely only increase to 9 by YE 2022.
EVs without final assembly in US will not qualify for ANY tax credit.	January 1, 2026	Currently roughly 25% of EVs have final assembly in the US, which could increase to 35% to 50% by 2026.
Base credit increases to \$5,000 from current \$2,500.	January 1, 2026	Under the current formula (which is not proposed to change), any EV with a 10 kWh battery or larger would qualify for the maximum \$7,500 tax credit.
OEM EV sales cap eliminated and replaced with tax credit phaseout after US government certifies new EV sales represent 50% of total annual sales of new passenger vehicles.	TBD / Likely ~2030-2033	New credit phaseout would affect all OEMs equally. Credit phased out entirely 4 years after US reaches 50% of new vehicle sales being BEVs and PHEVs. Credit likely disappears completely in 2035 at the earliest.



EVs as Industry Disruptors



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Sub-industries Poised for Disruption by EVs

- **Auto manufacturers**
- **Gas stations**
- **Aftermarket parts retailers**
- **Parts & equipment manufacturers**
- **Repair & service shops**
- **Auto dealerships**

Many non-automotive industries also affected: oil and gas, fuel additives/petrochemicals, plastics, chemicals, steel, heavy equipment, and more

EVs Have Much Lower Maintenance Costs

- Lifetime maintenance and repair costs of EVs are about half those of traditional gas-powered vehicles
- EVs don't require oil changes
- Batteries, motors and associated electronics also require little to no regular maintenance
 - Brake wear also significantly lower due to regenerative braking

Car Type	Lifetime Maintenance and Repair Cost	Average Cost Per Mile
Battery Electric Vehicle	\$4,600	\$0.031
Plug-in Hybrid Electric Vehicle	\$4,600	\$0.030
Gas-Powered	\$9,200	\$0.061

...But All-in Ownership Costs are About Average

- **The current all-in cost of electric vehicle ownership falls near the midpoint of average ownership costs for all vehicle types**
 - BEVs had the lowest fuel (3.67 cents/mile) and maintenance costs (7.46) of any vehicle type, but higher “other costs” caused the total cost of BEV ownership to come in near the midpoint of the nine vehicle types included in the study
- **Plug-in hybrids offer significantly better value**

Vehicle Type	Fuel Cost (¢/mile)	Maintenance Cost (¢/mile)	All Other Costs (¢/mile)	Total Cost (¢/mile)	Comments
Small Sedan	7.15	8.39	34.56	50.10	Lowest overall driving costs
Plug-in Hybrid EV	5.20	8.19	40.93	54.32	Second lowest fuel and maintenance costs
Small SUV	8.27	9.48	38.00	55.75	Lowest to insure
Medium Sedan	8.31	9.56	40.36	58.23	Overall costs fall in the middle of the pack
Battery Electric Vehicle	3.67	7.46	49.66	60.79	Lowest fuel and maintenance costs
Medium SUV	11.25	10.11	45.55	66.91	Highest maintenance costs
Minivan	11.22	9.42	46.70	67.34	Second lowest to insure
Large Sedan	11.43	9.69	53.43	74.55	Second highest fuel costs
Pickup	15.23	8.80	51.36	75.39	Highest overall driving costs

Auto Parts Products at Risk from EV Growth

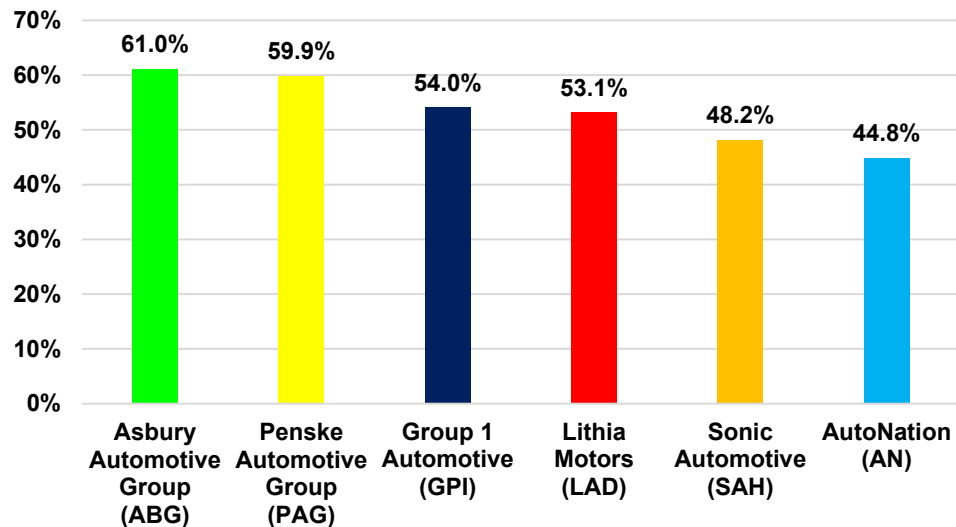
- Entire product lines of auto parts are at risk of becoming obsolete in the long-term
- Products most at risk in **red**
- Products used in both electric and internal combustion engine vehicles in **green**
- In our view, Engine Maintenance products face greatest risk

Parts and Batteries	Accessories and Chemicals
<p>Batteries and battery accessories Belts and hoses Brakes and brake pads Chassis parts Climate control parts Clutches and drive shafts Engines and engine parts Exhaust systems and parts Hub assemblies Ignition components and wire Radiators and cooling parts Starters and alternators Steering and alignment parts</p>	<p>Air conditioning chemicals and accessories Air fresheners Antifreeze and washer fluid Electrical wire and fuses Electronics Floor mats, seat covers and interior accessories Hand and specialty tools Lighting Performance parts Sealants, adhesives and compounds Tire repair accessories Vent shades, mirrors and exterior accessories Washes, waxes and cleaning supplies Wiper blades</p>
Engine Maintenance	
<p>Air filters Fuel and oil additives Fuel filters Grease and lubricants Motor oil Oil filters Part cleaners and treatments Transmission fluid</p>	

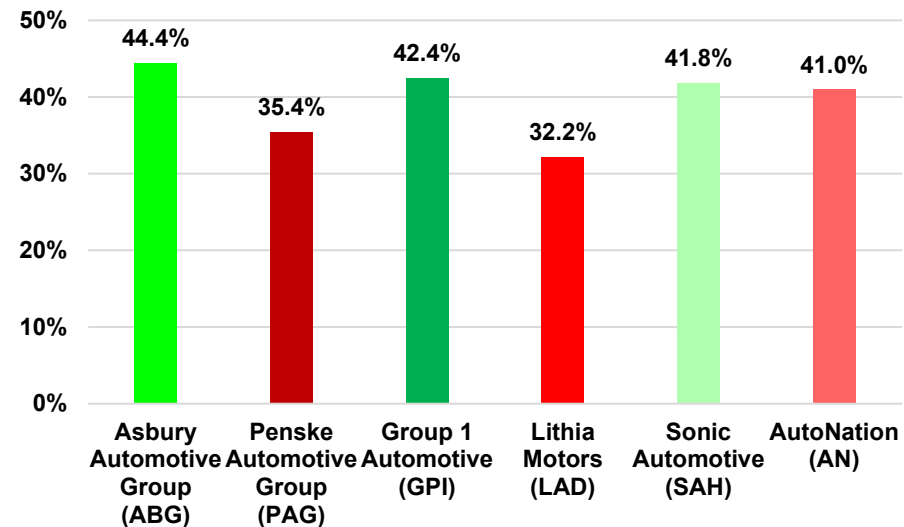
Also a Threat to Auto Dealerships

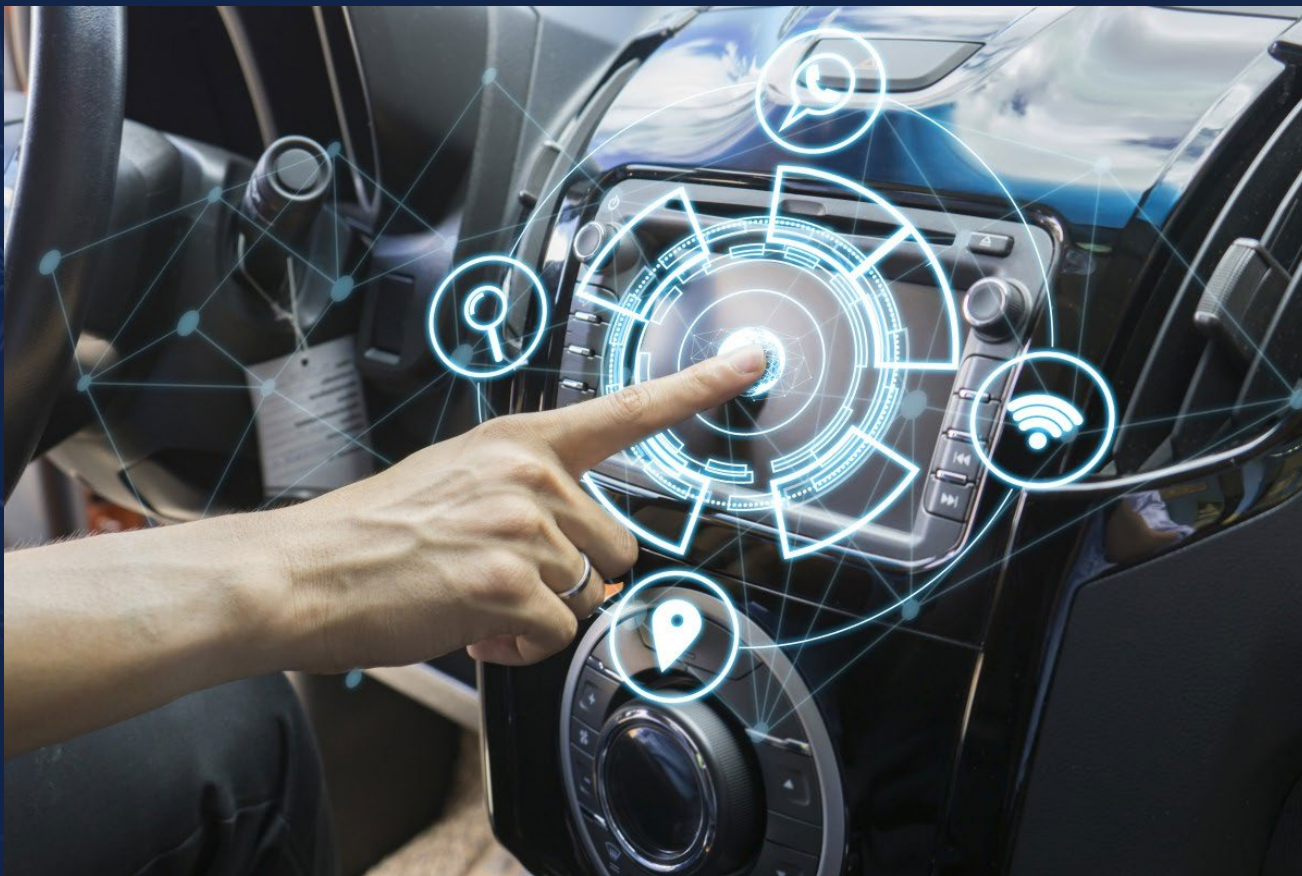
- Auto dealers' parts and service segments are highly profitable
- Parts and service segment gross margins ranged from 45%-61% in 2020
 - Compare to used and new vehicle sales, which typically have margins in the mid-to-high single digits

**U.S. Auto Dealerships: Parts & Service Segment
Gross Margin %, 2020**



**U.S. Auto Dealerships: Parts & Service Segment
as % of Total Gross Profit, 2020**





Autonomy: EV Game-Changer



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Autonomy: EV Game-Changer

- **The number of EV models available in the U.S. expected to more than triple over the next three years**
 - From roughly 40 in 2020 to 127 models in 2023

- **Battery range on the verge of surpassing single-tank fuel driving range and costs should continue to come down, making EVs increasingly competitive**

- **More charging stations to be built and improved charging times**

- **With a more competitive EV landscape, the autonomous driving capabilities of various vehicles will become a key differentiator**
 - Some have more advanced autonomous driving features than others

The Five Levels of Vehicle Automation

Level	Description	Human Role	Vehicle Role
0	None	All driver control	No autonomous functions
1	Limited + Safety	Almost all driver control	ABS, traction control
2	Limited, Active Safety, Convenience	Mostly driver control	Lane keeping, emergency braking, adaptive cruise control, parking assist
3	Significant Autonomy	Driver can disengage completely at times	Advanced controls in simple conditions (highway, slow-moving congestion, good weather)
4	High Autonomy	Driver not needed in some locations or conditions	Full conditional autonomous capabilities, more difficult conditions/locations not autonomous
5	Complete Autonomy	No driver needed	Autonomous driving in all locations/conditions possible, driver controls (brakes, steering wheel) not necessary

← **Where we are today:
Somewhere between
Levels 2 & 3**

Autonomy: Significant Obstacles Remain

■ Safety

- Humans are extremely good drivers and vehicles are safer than ever, with a fatal collision once every 100 million miles traveled (a 99.999999% safety rate)

■ Technological

- Bad weather, uneven terrain, difficulty identifying and anticipating movement of moving objects

■ Financial

- Development costs are extremely expensive

■ Legal / Regulatory

- No federal standards to replace state laws/voluntary guidelines, insurance liability

■ Public Perception

- Consumer distrust, cybersecurity fears

Autonomy: Still More Dream Than Reality

- **Level 5 autonomous vehicles are farther from becoming a reality than most experts thought a few years ago**
 - Progress toward Level 5 will likely be gradual
- **AV development costs will continue to weigh on earnings for major automakers, but some R&D necessary to compete long-term**
- **Further consolidation likely:**
 - 2016 – GM buys Cruise
 - 2019 – Volkswagen and Ford buy Argo AI
 - 2020 – Amazon buys Zoox; Aurora buys Uber’s ATG self-driving car division

“It’s an extraordinary grind...because it has to be done safely over and over and over again; 99% accuracy is nowhere good enough when talking about a fleet of vehicles, multiplied by thousands of passengers, and some would argue that the companies got way ahead of themselves when it comes to methodology and safety.” –Waymo CEO John Krafcik



CFRA Auto Manufacturer Coverage



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Auto Manufacturers & EV Pure Plays

Auto Manufacturers

Ford Motor Company (F)

Honda Motor Co., Ltd. (HMC)

General Motors (GM)

Volkswagen AG (VOW3 GY)

Toyota Motor Corporation (TM)

Hyundai Motor Co. (005380 KS)

EV Pure Plays

Lucid Group, Inc. (LCID)

Tesla, Inc. (TSLA)

Fisker Inc. (FSR)

Nikola Corporation (NKLA)

Q & A



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