

THE GREAT INFLECTION POINT

A Look into the Future of Cars

TIME

A futuristic car interior is shown from the driver's perspective. The steering wheel is illuminated with a bright blue glow and features a central circular display. The dashboard and center console are also lit up with blue light, displaying various digital readouts and icons. The background is a blurred, high-speed view of a road with blue light trails, suggesting motion. The word 'TIME' is superimposed in large, red, serif capital letters across the center of the image.

The Great Inflection Point

A Look into the Future of Cars

From the assembly line to the showroom, the automobile industry has been an integral part of modern society for over a century. However, recent developments such as the increasing demand for electric and autonomous vehicles in a shift towards sustainability have forced the industry to adapt and transform like never before. Only in 2023, electric car sales worldwide are expected to leap by 35%, reaching the all-time record of 14 million. “The one main constant in this industry is that everything changes all the time,” as Martinrea’s CEO, Pat D’Eramol, tells us. It is a complex sector characterized by fast-paced developments, and one that has been shaping society in terms of transportation, job creation, and technological innovation in ways that the general public might struggle to grasp firmly. In this report, we bridge experts and the wider public on the main tendencies marking this epoch of the automobile industry, with insights from over 100 industry leaders across North America.

QUENTIN L. MESSER

CEO,
MICHIGAN ECONOMIC
DEVELOPMENT
CORPORATION (MEDC)



“Michigan is the place that put the world on wheels in many respects. While we are not immune to the talent gap challenge, we are incredibly well suited to offer a solution.”

VIC FEDELI

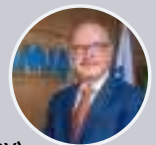
MINISTER OF ECONOMIC
DEVELOPMENT,
JOB CREATION AND TRADE,
GOVERNMENT OF ONTARIO



“Ontario has free trade agreements with 51 countries and products made in the province can be shipped around the world tariff-free. And with lowering the cost of business, we saw 85,000 new businesses open here in 2022 alone.”

JOSÉ ZOZAYA

PRESIDENT,
AMIA (THE MEXICAN
ASSOCIATION OF THE
AUTOMOTIVE INDUSTRY)



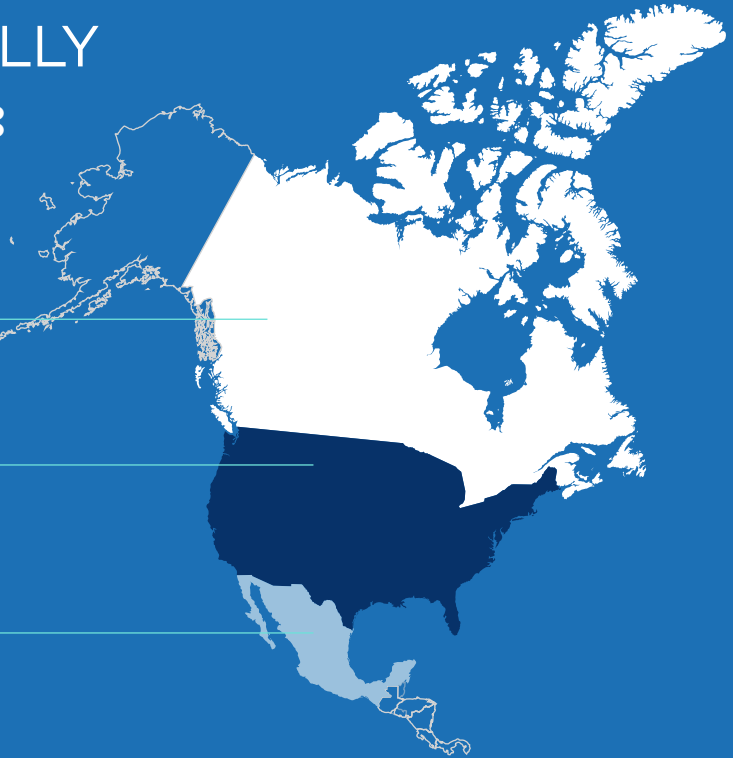
“Mexico ranks seventh in car manufacturing and fifth in car exporting worldwide. At the moment, we are exporting 90% of our total production, with 80% of the vehicles being shipped to the U.S. and Canada.”

NUMBER OF VEHICLES PRODUCED ANNUALLY IN **NORTH AMERICA:**

2 million
Canada

11 million
U.S.

4 million
Mexico



**500
billion**

generated in North America's automotive
sector in annual sales



**1.7
million**

people employed in the automotive
industry

Source: The National Automobile Dealers Association (NADA)



Policy Drives Change

The shift towards electric, software-defined vehicles, and automation is not just driven by consumer demand. Governments around the world are incentivizing these technologies, and are to a large extent the engine of this transition - particularly when it comes to electrification in North America. Here, several states and provinces have set targets for EVs sales, and introduced tax incentives for buyers.

Perhaps most notable among policies is the recent Inflation Reduction Act (IRA). With a staggering sum of nearly \$738 billion, the provisions within the IRA allocate a substantial \$391 billion solely for the advancement of clean energy, encompassing diverse sectors such as manufacturing, recycling, carbon capture, and

power generation. Among these provisions, a noteworthy \$13 billion is devoted to electric vehicle tax credits. The act is hence poised to have a significant impact on the automotive industry, whereby individuals who purchase a qualifying new EV between now and 2032 can receive a tax credit of up to \$7,500. The impact of the IRA extends beyond individual consumers to encompass commercial entities and government agencies, which can take advantage of a substantial tax break of up to 30% of the vehicle sale price or \$40,000. This provision aims to entice businesses and government bodies to update their vehicle fleets with battery-powered alternatives, promoting sustainability and reducing reliance on fossil fuels.





MARC BEDARD

FOUNDER AND
CEO,
LION ELECTRIC



THOMAS BECKER

CHIEF
SUSTAINABILITY
OFFICER,
BMW

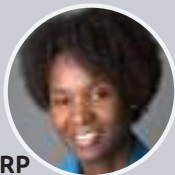


"Our strong suit is manufacturing EVs on both sides of the border (U.S. and Canada), and we are trying to buy local as much as we can. The closer you are to customers and suppliers, the better it is in terms of carbon emissions."

"Customers deciding for an EV require confidence in the fact that they will be able to use their cars, and such confidence depends on infrastructure. If customers know that they can charge at home, work and on the public roads, they will respond to the incentives - only policy can secure this vital confidence to become a certainty."

DR. LUISA MORENO

PRESIDENT AND
DIRECTOR,
DEFENSE METALS CORP



DAN BRDAR

CEO,
IDEAL POWER



"The Canadian government is showing support to the critical metals sector, having just issued a \$3.8 billion incentive over the next five years."

"At times, policy tries to pick winners in technology rather than letting the marketplace decide; as a result, we run the risk of misallocating capital."

Specific organizations such as public schools and local transportation services stand to benefit even more significantly - they may be eligible to receive a tax rebate equivalent to 100% of the vehicle cost. This adds to the EPA's (U.S. Environmental Protection Agency) new Clean School Bus Program, which provides \$5 billion over a period of five years (FY 2022-2026) to replace existing school buses with zero and low-emission models. A similar proposition was made in neighboring Canada. Marc Bedard, CEO and Founder of Lion Electric, an electric bus producer, tells us that "in Canada, we have the Zero Emission Transit fund which is similar to the \$5 billion EPA program for school buses over the next five years in the U.S."



\$13 billion

devoted to EVs tax credits as part of the Inflation Reduction Act's efforts to advance clean energy.

Source: U.S. Treasury Department

It is important to note that the tax credits provided by the IRA come with specific requirements and stipulations. Vehicles seeking eligibility for the full tax credit must meet certain criteria. Firstly, a percentage of the vehicle's battery components must be manufactured or assembled in North America, with the required portion gradually increasing from 50% in 2023 to reaching 100% in 2029. Additionally, essential battery minerals such as aluminum, cobalt, lithium, nickel, and graphite must be sourced and processed within the United States or a country under a free trade agreement with the U.S. The percentage of localized mineral sourcing rises from 40% in 2023, incrementally reaching 80% after 2026. Such policies, combined with the fact that the IRA's language enshrines subsidies for manufacturers, commercial electric vehicles and charging station enterprises, should mitigate some of the anxiety surrounding the imminent electrification of the industry. Valeo's CEO, Jeffrey Shay, identifies "EVs' high costs, a possible employment crisis due to self-driving delivery vehicles, raw material shortages, and an undeveloped charging infrastructure" as "some of the main issues linked to this green revolution" - all problems that the IRA will attempt to solve.

The Electric Wave

Government incentives are one aspect of the electrification movement; the other is a growing demand from consumers. As Schaeffler's Regional CEO Americas, Marc McGrath, affirms, "some communities are even advocating against the use of internal combustion engines due to increased noise and environmental concerns." These sentiments are reflected in the rising sales of EVs worldwide. In 2022, electric vehicles accounted for a modest yet noteworthy 5.7% of total new vehicle sales, a significant leap from the 2% recorded in 2020, according to the International Energy Agency. A thought-provoking report compiled

by BloombergNEF offers a glimpse into the future of transportation, where EVs are poised to dominate the global market. According to their analysis, it is predicted that 58% of all new passenger vehicle sales worldwide will be electric by 2040, effectively redefining the essence of mobility itself. In preparation for this imminent shift in consumer demand, OEMs such as Volkswagen are making strategic plans.



MARC MCGRATH
REGIONAL CEO
AMERICAS,
SCHAEFFLER

"We are becoming a main player in the electric mobility transformation and staying true to our heritage of pioneering motion."



Responsibly rounding out the future.

the automotive aftermarket's
connected ecosystem.



Ralf Pfitzner, Head of Sustainability at Volkswagen tells us that “our Group anticipates that by 2030, electric vehicles will account for roughly half of our global sales.” General Motors has also recognized this holistic movement and announced a \$35 billion investment in electric and autonomous vehicles (AVs) by 2025.

The transition to EVs impacts not only OEMs but also all companies throughout the supply chain. As the industry braces for new demands, manufacturing companies like GKN Automotive are transforming their operations. “We aspire to be at the forefront of technology, and that’s why we are part of this transformative process. We have shifted from pure steel manufacturing to producing auto parts and now progressing completely towards electric drive systems,” says Dr. Dirk Kesselgruber, the company’s Chief Technology Officer. Other segments of the supply chain that may not be immediately apparent are also driving this transformation to enhance EV technology.



FABRIZIO MARTINI

CEO,
ELECTRA VEHICLES



"The core component of electrification is the battery, which is approximately 50% of the value of an EV. An EV is basically a battery on wheels."

FRASER ATKINSON

CEO AND CHAIRMAN,
GREENPOWER MOTOR
COMPANY



"The demand in our sector has outstripped production today, and everyone that has a high quality product and a good distribution network is able to place it into the market."

SETH BERKOWITZ

PRESIDENT
EDMUNDS



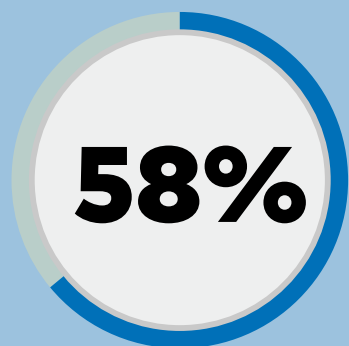
"We've seen how EVs are beginning to overtake SUVs in terms of research interest. Three years ago, there were zero entries for electric cars in searches on Edmunds while today six out of the top twenty most researched vehicles are EVs."

BOB PURCELL

CEO,
VIA MOTORS



"The cost per mile for electric drive versus petroleum-based fuels is a five to one advantage and the much lower maintenance costs are also tipping the scale in a significant way."



of all passenger vehicles will be electric by 2040

Source: BloombergNEF

Semiconductor manufacturer Ideal Power aims to address the factors hindering mass adoption of EVs. According to its CEO, Dan Brdar, "Cost and range anxiety are the two main obstacles to EV mass adoption. Our technology can mitigate these issues by improving EV range by 8% to 10% and providing a lower-cost silicon alternative to silicon carbide devices. Semiconductors are particularly significant, as they represent the second most expensive component of an EV (up to 10% of the total car value)." Overall, it is evident that this transformation is occurring across the entire supply chain, with no segment wanting to fall behind.

The Missing Material

For all the excitement one can perceive in the voice of those involved in the electrification of the industry, some pressing issues remain unsolved, and few have concluding responses to them. This becomes evident when one examines the projected acceleration of EV production in both the U.S. and Europe, and juxtaposes it against the existing capacity of the supply chain responsible for procuring the critical materials required by this growth.



JASON LATKOWCER

CEO,
PAN AMERICAN ENERGY CORP

"China dominates the supply chain of critical minerals, particularly lithium, graphite, and other EV critical minerals. There is now a huge focus in North America on how we can create independence and determine our destiny when it comes to managing these critical minerals."

CEO of Umicore, Mathias Miedreich, is one of the few to recognize the magnitude of this problem, telling us that "when you match the announced buildup of EV production in the U.S. and Europe against the capacity of the supply chain to provide the necessary critical materials, there is a gap of 10% to 30%." What is the consequence of such a problem? Volvo's Head of Advanced Technology and Sustainability, Henrik Green, explains it in clear words: "Demand is currently higher than what we can supply, and our sales are thus supply limited."

Why is the supply chain of critical materials so complex? In essence, critical materials, including lithium, cobalt, rare earth elements, and nickel, are vital to the EV industry because they play a crucial role in the production of batteries, motors, and other key components.



40%

2023

% of EV battery minerals that must be sourced or processed domestically for U.S. buyers to qualify for a tax credit, under rules proposed by the U.S. Treasury Department

80%

2026



These materials are not only essential but also inherently scarce, often concentrated in specific regions of the world, which makes their extraction and procurement a complex endeavor. Furthermore, the process of refining and transforming these raw materials into usable components involves complex supply chains that span multiple continents. It is within this intricate web that the gap between the growing ambitions of EV production and the supply chain's capacity to keep up with escalating demand becomes apparent. On top of this, OEMs like BMW are implementing stricter standards regarding carbon emissions associated with these materials. As Thomas Becker, Chief Sustainability Officer at BMW tells us, "regardless of where they are produced, if suppliers want to work with BMW, we demand 100% renewable energy sources."

JAMIE LEVY

PRESIDENT AND CEO,
GENERATION MINING
LIMITED



"Copper is the cornerstone metal needed for the electrification of cars and palladium is needed for hybrid vehicles, for which the demand is growing by 20% per annum."

RAMA AYMAN

CEO,
MMG CAPITAL



"Vehicle and battery OEMs are interested in having their entire supply chain based on highest acceptable ESG standards, from resource mining all the way to car manufacturing."

JULIAN VICKERS

CEO,
NRG CAPITAL PARTNERS



"If we look at where the minerals that we need for the green transition are coming from, it is an interesting wake-up call. A lot of lithium is extracted in Chile, most nickel is mined in Russia, cobalt originates in the DRC, and most metal smelting and refining is done in China. We moved from a paradigm where Western economies were largely energy self-sufficient to one where they depend on other countries."

Phones-on-Wheels

The ongoing transition towards EVs has also sparked a notable emphasis on the emergence of software-defined vehicles within the automotive industry - some are even talking about modern cars as 'phones-on-wheels.' However, as the founder of software company Sibros, Hemant Sikaria, tells us “while it takes some of its features from phones, a car is a much more powerful piece of hardware (...)becoming such powerful machines, cars could do unimaginable things (like bitcoin mining) during their idle times and while connected to renewable energy sources. “ This shows us that cars might soon be - if they are not already - much more than a mobility tool. OTA (Over-The-Air) is another cutting-edge technology that is revolutionizing the automotive industry. With OTA, vehicles can receive software updates remotely, eliminating the need for physical visits to dealerships or service centers. This capability allows automakers to continuously improve and enhance their vehicles' functionalities throughout their lifespan. As the CEO of Airbiquity, Kamyar Moinzadeh, explains, “the more software you deploy, the greater is the risk of bumping into bugs or security issues [...] Our end-to-end platform not only provides OTA updates but it also allows us to manage the software over the entire life cycle of a vehicle.”





As the automotive industry embraces the era of software-defined vehicles, it is crucial to acknowledge that there is a flip side to this technological advancement - the issue of security and hacking. Upstream's Co-Founder & CEO, Yoav Levy, tells us that “hacking cars is much easier today than it was five years ago when you needed to connect a computer to the car or know all the CAN-BUS networks,” highlighting the growing vulnerability. This statement is further exemplified by a most bizarre anecdote mentioned by the same CEO that happened in Moscow, “where all Yandex cars were summoned to the same location, resulting in a massive traffic jam engineered by hackers.”



YOAV LEVY

CEO,
UPSTREAM SECURITY

“Especially as vehicles become more connected and more autonomous, cybersecurity will become a central pillar of this new auto market that we are now creating.”





With vehicles becoming more connected and autonomous, the need for robust cybersecurity measures becomes paramount. Maria Anhalt, CEO of Elektrobit, shares this preoccupation, telling us that “software has been improving little by little until it became the single most complex component under the hood of a car.(...) As software providers, we have a duty of care concerning human lives as the consequences of an automotive system failure are far greater than your smartphone going offline for a while.” The integration of software systems and increased connectivity expose vehicles to potential threats, necessitating a comprehensive approach to safeguard against cyber-attacks and unauthorized access. As the automotive industry explores the immense potential of software-defined vehicles, it must concurrently address the critical challenge of ensuring the security and integrity of these advanced technologies.

**STUART SCHUETTE**

PRESIDENT AND CEO,
AMERICAN TIRE DISTRIBUTORS

"We aspire to play a much more complex role in the automotive aftermarket - we think supply chains converge over time to drive out carbon, logistics and operating inefficiencies, and we are in a position to provide the necessary tools for that. Our retail customers, manufacturers, and partners will reap benefits from our marketplace, where they can easily access wholesale distribution, logistics as a service solutions, and digital tools to help them more seamlessly serve their consumers - keeping North America's drivers on the road."

DR. DIRK KESSELGRUBER

CHIEF TECHNOLOGY
OFFICER,
GKN AUTOMOTIVE



"The required speed of transformation is the biggest challenge at the moment. We are trying hard to keep a healthy balance between being on the lead of technology and remaining very prudent and selective towards future investment."

JEFFREY CHOU

CEO,
SONATUS



"Everybody has a digital life; the principal gateways into it are now the cellphone or the PC, but soon the vehicle will become one as well since it will become the most complex IOT device out there."

KAMYAR MOINZADEH

PRESIDENT AND CEO,
AIRBIQUITY



"Software management is a core pillar of vehicles going forward. Recent advancements with autonomous cars and over-the-air updates seemed more like wishful thinking a decade ago, but now that the data has broken loose change is inevitable."

XIAOCHUAN CHEN

CTO,
DAOAI



"AI brings the intelligence in traditional automation to a new level since it can use vision information to recognize parts exactly like a human would."

In addition to the advancements happening within the vehicles themselves, software is also playing a transformative role outside the cars, enhancing the automotive industry by offering more options and more information online than ever available before. Online resource page, Edmunds, exemplifies this by providing clients with valuable insights. As CEO Seth Berkowitz comments, "our editors drive 3,000 cars per year across over 500,000 miles, so there is a lot of effort and energy being poured into our ratings and reviews." The internet can prove a useful tool for consumers by making available such information, and showing that the digital world's impact on the industry is manifold.



The Promise of Autonomy

In tandem with the emergence of software-defined vehicles, automation stands as another profound trend permeating the fabric of the automotive sector. The realm of autonomous vehicles (AVs) holds the tantalizing potential to revolutionize transportation as we know it, offering transformative benefits that range from reduced traffic congestion and heightened safety, to enhanced fuel efficiency and a more harmonious coexistence with our urban environments. However, it is vital to acknowledge that the journey towards fully autonomous vehicles is still in its nascent stages, marked by a labyrinth of obstacles and challenges that demand dedication and ingenuity to surmount. The AV industry will not develop a fully self-driving car until 2035, according to a recent prediction from research firm GlobalData. We expect the timelines for deploying fully autonomous vehicles (Level 5) to be pushed back over the next few years.

However, autonomy is slowly permeating the industry, with tools such as ADAS (Advanced

up to
\$400 billion



estimated revenue generated by
autonomous driving in the
passenger car market by **2035**

Source: McKinsey

Driver Assistance Systems) - referring to a set of technologies designed to assist drivers and enhance vehicle safety by providing features such as collision avoidance, adaptive cruise control, and lane-keeping assistance - already being used worldwide. Examples of automation already happening are seen through companies such as Steer Tech, that bring automation to parking: "Steer Tech is able to fulfill all the routine activities that happen in logistics and last-mile delivery yards, as well as in rental car facilities.





The vehicles are able to drive themselves from and back to the parking spots and pass through several processes,” says Anuja Sonalker, the company’s CEO. Nvidia, for its part, highlights the power of virtual reality and synthetic data in the development of autonomous vehicles. VP for Automotive, Danny Shapiro, affirms, “we are using virtual reality and synthetic data to create scenarios that the average driver will probably never see – we can run the software and hardware in a car through a simulation to test the millions of challenging scenarios and then fix the software before it goes on the road.”

Expected to hit the road first, autonomous trucks hold the potential to revolutionize the logistics industry. According to the CEO of Torc, a subsidiary of Daimler, “autonomous trucks will be available at scale by the end of this decade. We will probably start with slow volumes by the middle of the decade, and then grow step by step.” By leveraging advanced technologies like sensors and AI, autonomous trucks can optimize fuel consumption, reduce traffic congestion, and address challenges such as driver shortages and fatigue-related accidents. However, the integration of autonomous trucks will be a gradual process, requiring careful considerations of regulations, infrastructure, and public acceptance. Collaborations and partnerships among stakeholders will be vital to drive innovation and successful implementation.

DR. STEFAN HECK

CEO AND FOUNDER,
NAUTO



"We use AI to develop technologies that aid, rather than replace human drivers. We provide them with safety mechanisms that preempt risks you or I might take unconsciously while driving, such as falling asleep at the wheel, or getting distracted by our smartphones."

PETER VAUGHAN SCHMIDT

CEO,
TORC ROBOTICS



"I do think that autonomous trucks will be available in the U.S. at scale by the end of this decade. There are a lot of technological advancements working together to make autonomous driving a possibility now that were not available 10 years ago."

ALEX DALYAC

CO-FOUNDER AND CEO
TRACTABLE



"Like any other powerful technology, AI can be used both for good and for bad. The algorithms that have been training on all the information on the internet, cramming it into one entity that amounts to millions of human brains, offer us tremendous possibilities."

Automation can also transcend the individual car itself. Cavnue introduces a digital model of roadways that optimizes conditions in real-time and provides guidance to vehicles and drivers. According to its CEO, Tyler Duvall, their approach involves “creating a digital model of a roadway that analyzes and optimizes road conditions in real-time, shares information, and provides proactive guidance to vehicles and drivers, which supports enhanced safety, efficiency, and road operating environments.” Cavnue’s effort is echoed by similar companies, such as Derq. “We use existing traffic cameras to generate predictions in relation to the potential time of a future crash, the detection of crash hotspots and the identification of pedestrians who are jaywalking,” says Georges Aoude, CEO of Derq. By leveraging these technological advancements and innovative approaches, the automotive industry is propelling the development of autonomous vehicles. As automakers continue their research, collaborations, and rigorous testing, the vision of fully autonomous vehicles on our roads within the next decade becomes increasingly plausible. This ongoing pursuit of innovation and safety sets the stage for a profound transformation in how we perceive, experience, and interact with transportation.

As the pursuit of automation marches forward, an air of excitement intermingles with a sense of responsibility. The ethical implications of autonomous driving, the integration with existing infrastructure, and the acceptance and trust of the general public are but a few critical considerations that demand robust discourse and thoughtful deliberation. Yet, the collective ambition of automakers, researchers, and policymakers converges on a shared goal: to unlock the potential of autonomous vehicles, cultivating a future where mobility is redefined, inefficiencies are eradicated, and safety and sustainability reign supreme.



15% **by 2030**
ADAS

The growing adoption of advanced driver-assistance systems could reduce the number of accidents by about 15%

Source:
Automotive Management Online



Buckle Your Seat Belt

The landscape of transportation is being reshaped before our eyes, with significant shifts in various areas. One of the most striking developments is the rise of software-defined vehicles, where the power of sophisticated software is harnessed to control and manage functions that were traditionally reliant on hardware components. Moreover, the promise of autonomous driving looms on the horizon, painting a future where vehicles can navigate and operate with minimal human intervention, revolutionizing not just individual transportation but also freight logistics and public transit. The wide-scale adoption of electric vehicles has become the pressing and conspicuous aspect of this transformation. The urgency to embrace electrification is driven by environmental concerns and the need to reduce carbon emissions. The fate of electrification, to a large extent, hinges on the availability of critical materials, the development of charging infrastructure, and the willingness of consumers to embrace this new paradigm. The industry finds itself at a crucial juncture, where the success or failure of electrification will be determined sooner rather than later. What is certain is that we are in for a truly exciting ride.



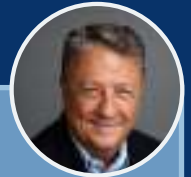
Final Thoughts



WILLIAM LI

FOUNDER, CHAIRMAN, CEO,
NIO

"The high lithium prices we saw in 2022 demonstrate a significant momentum in sales that has not been affected by policy, by which I mean the US \$1,500-subsidies paid for each vehicle and the minor tax exemptions for consumers. In other words, we are at a point at which the market is not affected so much by policy and government measures as it is by the organic increase in demand and consumer needs."



MIKE DARROW

PRESIDENT AND CEO,
TRUECAR

"The younger generation from 16-30 is indeed much less interested in owning a car due to all the rideshare and transport options available. I do, however, believe that as this generation gets older, takes on jobs, and starts families, the need to have a vehicle of their own is going to increase."



JEAN FRANÇOIS CHAMPAGNE

**PRESIDENT,
AIA CANADA**

"North America has a whole generation of people that made the automobile a part of their status. As I grew up, owning a car was a sign of accomplishment and freedom, and we are still seeing this effect to this day."



RICH PORRELLO

**CONSUMER FINANCE GROUP,
HUNTINGTON BANK**

"New technologies, whether electric or hydrogen, do not change how we finance vehicles. It could change the risk profile which is important to how we manage values, but what the vehicle is at the end of the day does not change."



VASILIS GREGORIOU

**CHAIRMAN AND CEO,
ADVENT TECHNOLOGIES**

"While hydrogen fuel cell vehicles currently account for a small fraction of global vehicle sales, the industry is increasingly seen as a viable alternative to battery electric vehicles, particularly for heavy-duty applications such as trucks and buses."



RAPHAEL DECLERCQ

**CEO,
POWERFLEX**

"California hosts about half of America's EVs. Sun is overabundant there and some of the energy produced gets wasted; one way to avoid this is to store the energy in the millions of EVs that will be parked in public lots."