

# Automotive World MAGAZINE

Issue 40 | April 2023



Where is  
Microsoft in  
new mobility?

**TomTom** takes mapping to the next level | **Ivee** breaks the five-star barrier in ride-hailing |

US sets the scene for **EV** wave | Europe grants **e-fuels** exemption for ICE ban |

**Bosch** doubles down on mobility push | **Range Energy** takes electrification from tractor to trailer



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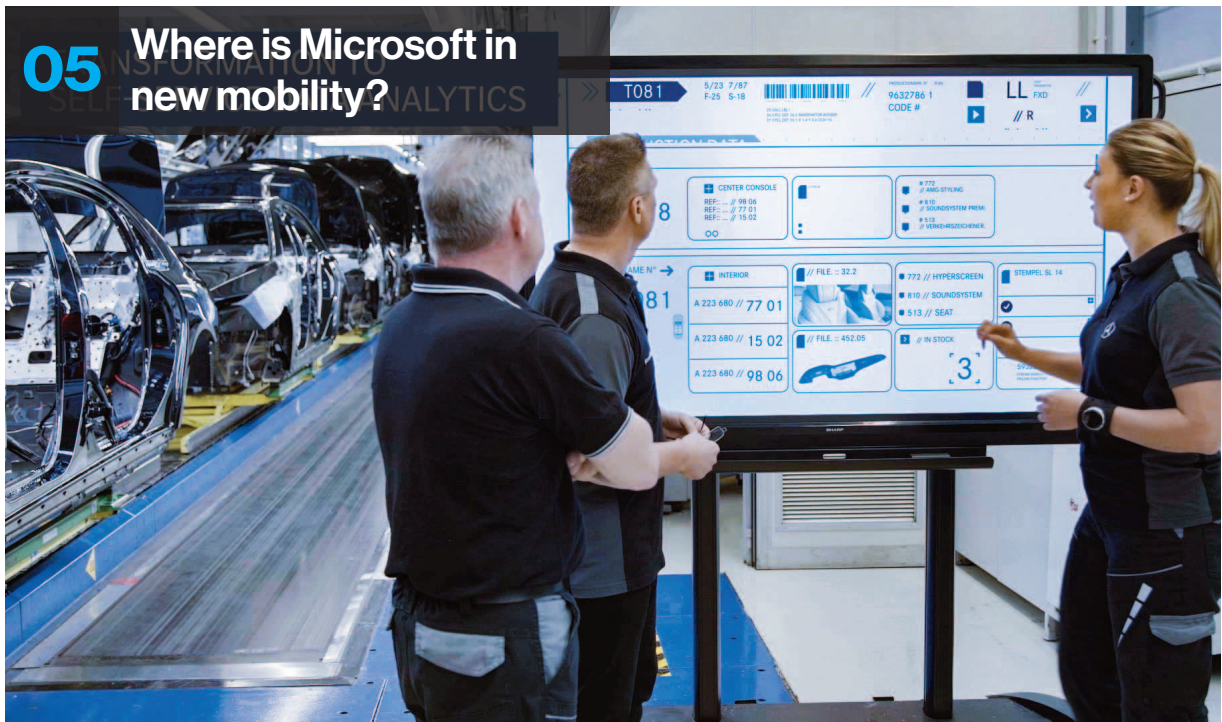
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**08** E-fuels might reduce competitiveness of some European OEMs

TomTom 2.0: where next for this mapping pioneer? **18**

**12** What does the AI Bill of Rights mean for mobility?

Morocco—the next country to make 1 million cars a year? **22**

**16** Automotive moves into the quantum computing fast lane

Are electric vehicles still the future of automotive? **26**

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Published in April 2023 by:

# Automotive World est. 1992

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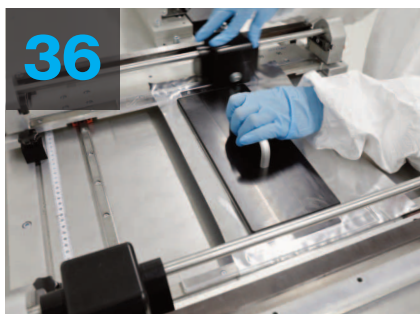
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**30** Nissan drivers could charge their brains at car dealerships

**34** Is this a six-star ride-hailing experience?

**36** EV batteries become a game of "in region for region"

**40** How will AVs reshape vehicle navigation?

**44** Will global brands continue to use Chinese plants for European supply?

**48** How the US set the scene for electric cars to flourish in 2023

**52** Where next for Bosch Mobility Solutions?

**56** Electrification spreads from tractor to trailer

# Where is Microsoft in new mobility?

The tech giant doesn't want to build cars or run mobility services, but its expertise underpins the sector's transformation. Megan Lampinen hears more

Software is transforming the automotive industry from a product focus to a service-based business model and ushering in an era of smart, clean mobility. The development ecosystem required for this is also evolving thanks to greater use of artificial intelligence (AI) and Industrial IoT. For Microsoft, the world's largest vendor of computer software and one of the leading players in cloud computing services, it's an opportunity to accelerate these transformative trends.

"Within automotive we serve as a tech-enabler," explains Sanjay Ravi, General Manager, Automotive, Mobility and Transportation Industry at Microsoft. His team is working closely with automotive, mobility and transportation

companies as they evolve into data- and software-driven mobility services providers. Its customers include heavy-hitters like General Motors, Stellantis, Volkswagen and ZF. The Microsoft brand might not appear on a vehicle or mobility service anytime soon, but more often than not its technology is underpinning an essential part of it. *Automotive World* sat down with Ravi to hear more about the tech giant's influence on the future of mobility.

## Where does Microsoft play within the automotive ecosystem?

We bring advanced capabilities around intelligent cloud and edge computing to support the needs of the automotive industry. We focus on building solutions around manufacturing, developer



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Mercedes-Benz is harnessing the MO360 Data Platform to make its car production more efficient, resilient and sustainable

want to provide all the capabilities in the car, assuming there is no connectivity to cloud. That supports the whole edge to cloud movement.

**Can you highlight some significant mobility projects at the moment?**

We are working with General Motors to create immersive AI-driven gaming experience in the car. Its Cruise unit is leveraging the Azure cloud and edge computing platform for autonomous driving. ZF is using Azure to support its work on autonomous shuttles, and Lynk & Co is bringing the Microsoft Teams experience safely into the car and building capabilities around it, generally allowing occupants to be safer and more productive in their vehicle.

productivity, the software-defined vehicle (SDV), and the sustainability of supply chains. We are not in the business of manufacturing cars or delivering mobility solutions. We do not want to monetise customer data. We don't push our brand into mobility services. Rather, we help companies build their brands using our technology. This entails partnering with a large ecosystem of other companies. We believe multiple players need to come together to drive innovation given the complexities that exist today.

**How does your expertise in cloud- and edge-based computing support the wider trends at play around connected, autonomous, shared and electric (CASE) mobility?**

CASE represents a once-in-a-century transformation. Everyone is building a digital platform to support an online presence, connected services or a mobility service. We bring hyperscale compute capabilities with intelligent cloud and edge technologies. As we get into autonomous vehicles (AVs), we



© Lynk & Co

Lynk & Co has Microsoft Teams built into the infotainment system of its O1 model

We are also helping to realise the role of the metaverse, working with Touchcast and Fiat on an immersive car-buying experience using a metaverse showroom. With this technology, someone can sit at home and still have a full 3D experience with the car using only a browser on a PC. Users can ask questions and converse with a human or an AI bot. This is game changing, and the technology is here and available today. We are also focussing on the industrial metaverse, which involves using our IoT and AI within manufacturing, to help people through production processes and to train factory floor workers.

**Microsoft had a strong presence at CES this year within the mobility section. What was your key message at this event?**

We want companies to regard Microsoft as their technology partner across all dimensions. We are designed to be a partner and not a competitor. Much of our focus at the event was on what can be done with the technology of today, with a few examples of what the possibilities of the future could be.

**What are your focus areas for 2023?**

We focus on driving innovation across the five elements of the automotive industry: the supply chain, manufacturing, retail, employee productivity and inside the vehicle. In today's economic environment, the challenge is to figure out how we can help companies do more with less. Driving cost out of the system is a priority for everyone. For example, you could take out 20% of the costs from manufacturing using some of our technology. We made an announcement with Mercedes-Benz in October 2022 about this; the company is introducing the MO360 Data Platform, connecting car plants to Microsoft Cloud. In this case, it should improve vehicle production efficiency by 20% by 2025.

**Are there any topics on which you are particularly passionate?**

We are passionate about the impact our group can make on society. We want to directly help make mobility safer, more sustainable, more productive and fun. These are the things that motivate us to continue innovation.

# E-fuels might reduce competitiveness of some European OEMs

The EU's decision to include an exemption for e-fuels in its post-2035 decarbonisation legislation could have deleterious effects. By Will Girling



In late March 2023, the EU finally approved a law to cement its widely publicised ambition to end the sale of CO2 emitting light vehicles by 2035. According to the official timeline, all internal combustion engine (ICE) vehicles must now have 55% lower carbon emissions from 2030 (compared to 2021 levels) and zero carbon five years afterwards.

However, rather than signalling the end of ICE in the region once and for all, a last-minute intervention from Germany

complicated the agreement. Focusing on CO2 instead of strictly tailpipe emissions, the industry leading country argued that an exemption should be made for ICE running on carbon neutral synthetic fuels (e-fuels).

Following weeks of debate, an agreement between Germany and the EU was struck on these terms. Despite some commentators calling for a [unified approach](#) that emphasises all-electric powertrains, ICE now has a route for sustained European market presence post-2035.

## A complex situation

Although the eventual solidification of the EU's CO2 reduction policy took a compromise, Pedro Pacheco, Vice President of Research at Gartner, tells *Automotive World* that it shouldn't be considered a full capitulation. "The process for approval of an EU law is quite complex. Given that some other countries were against the ICE ban, the EU had no choice but to concede to Germany's request." Not to do so would have risked not





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The 2035 full ICE ban was supposed to pass a strong and definitive message to European automakers that the future is fully electric

reaching the qualified majority needed for approval.

Nonetheless, by demonstrating that room for negotiation clearly exists, there is concern that this could subsequently have a negative effect on other green policies. For example, ING Senior Sector Economist Rico Luman commented that this might encourage automotive industry lobbying “that affects mutual confidence and sparks the risk of delay in legislative processes.” However, with disapproval concerning [Euro 7](#) recently voiced from the executive boards of Skoda and

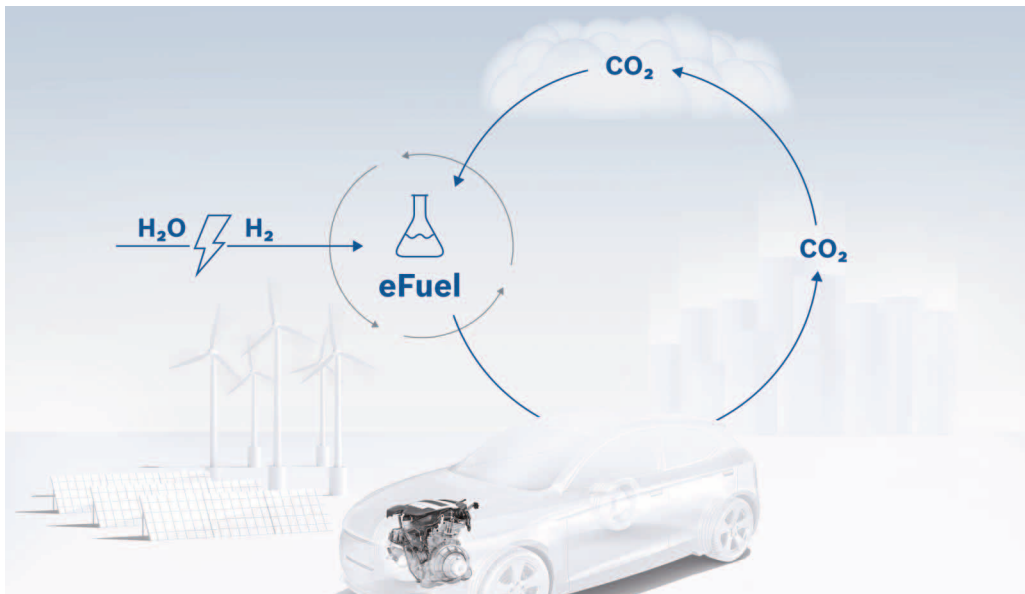
Iveco, a degree of continuing regulatory latitude might prove inevitable.

## E-fuels

Prior to the announcement of Euro 7 in Q4 2022, Stellantis’ Chief Executive Carlos Tavares called any focus on ICE a “diversion” from electrification. So, how beneficial is the development of e-fuels instead of focusing exclusively on electric vehicles (EVs)?

Pacheco states that creating an adequate supply of e-fuels could be achievable by 2035. One problem is that such fuels would represent a step backwards in terms of performance. “The entire well-to-wheel process, from production of the fuel to vehicle efficiency in turning fuel into kinetic energy, is quite low.” Gartner estimates that ICE running on e-fuels is 82% less efficient than battery-electric.

Another issue is affordability. Luman tells *Automotive World*



© Bosch

Bosch's diagram explaining the CO<sub>2</sub> neutrality of e-fuels: tailpipe CO<sub>2</sub> is removed from the atmosphere and combined with hydrogen (H<sub>2</sub>) to create a synthetic fuel

that e-fuels are likely to remain more expensive than electric alternatives until at least 2035. “On the other hand, battery EVs are set to be on par with ICE vehicles for most drivers in a few years—possibly 2026—and are expected to be the most financially attractive option by that time.” A study from the European Federation for Transport and Environment (T&E) estimated that a full tank of e-fuel in 2023 could cost more than €200 (US\$217).

Contemporary research also indicates that the broader accessibility of e-fuels is still a faraway prospect. In March 2023, the Potsdam Institute for Climate Impact Research in Germany released a report outlining the production of a new e-fuel made from green (sourced from renewable energy) hydrogen and CO<sub>2</sub>. This ‘synthetic gasoline’ cost US\$50 per litre wholesale, or approximately 100 times more expensive than fossil-fuel gasoline. While the Institute speculated that this price could be reduced significantly once economies of scale are in place, this initial cost

would make e-fuels prohibitively expensive for most consumers. It should be noted that analysis from PwC does not expect the global green hydrogen economy to reach substantial viability until 2050.

## Who benefits?

The expense and inferior performance (compared to EVs) of e-fuels raises the question as to who will benefit from their post-2035 exemption from the EU’s laws. A [commentator from Bosch](#) expressed positive but cautiously vague praise to *Automotive World* for e-fuels’ potential in the industry’s quest for carbon neutrality. German Chancellor Olaf Scholz has been most vocal in his support—it was his insistence that created the EU exemption—and OEMs like Porsche have announced that e-fuels will be a component of a dual strategy that also includes e-mobility.

However, opposition to Scholz’s advocacy has been made by Alex Keynes, Clean Vehicles Manager at

T&E: “Chancellor Scholz is threatening to pull the rug from under the European Green Deal for the sake of saving polluting combustion engines.” Meanwhile, aside for “die-hard fans” of ICE and those who drive luxury vehicles, Pacheco considers synthetic fuels to have little practical value for the vast majority of customers.

At the same time, he does not expect OEMs to derive much substantial long-term gain from the decision either. On the contrary, it may actually prove deleterious for some companies. “The 2035 full ICE ban was supposed to pass a strong and definitive message to European automakers that the future is fully electric, and they must focus all their efforts on that. However, the continuation of ICE just strengthens the conviction of laggards to stick with ICE.”

Indeed, at a time when China and the US are presenting [strong competition](#) in the e-mobility space, it might even be counter-intuitive for the European industry to divert resources to ICE. Martin Jahn, Board Member for Sales and Marketing at Skoda, criticised elements of EU industry decarbonisation as threatening thousands of jobs, according to *Reuters*. The problem, counters Pacheco, is that continuing to focus on ICE when the two largest automotive markets are moving and legislating away from it will ultimately limit Europe’s own market scope. “As such, the risk of major layoffs some saw as a consequence of full electrification can still happen due to a lack of competitiveness in these global markets.” Defining a new electric future could prove more valuable than adjusting ICE propositions.

## A perfect trap?

Ultimately, Pacheco does not believe that the exemption won by Germany will lead to a reversal of electrification trends: those already invested in EVs will not change direction now. “However, this decision will work as the perfect trap for automakers that—until now—saw full electrification as a no-go.”

Although it conceded that battery-electric powertrains were likely to be the future of the light vehicle segment, consultancy firm Oliver Wyman [previously argued](#) that ICE had a valuable role to play in the meantime. It noted that ICE continues to represent the overwhelming majority of global car sales and will be necessary until EVs are accessible to all customers, which remains an [ongoing challenge](#). Companies such as Mazda and Bosch are utilising new technologies and techniques to reduce the CO2 per kilometre of engines. These efforts will need to continue if the EU’s 2030 target is to be met.

The challenge for synthetic fuel manufacturers will be to make their products cost effective enough in time to find a wide audience. With economies of scale neither currently in place nor affordable, Pacheco concludes that there is a distinct risk that focusing on e-fuel-powered ICE instead of EVs will be a detrimental strategy. “Synthetic fuels will serve to confirm the view of change-averse stakeholders that battery EVs are not the future, which could consequently cause a major loss of future competitiveness for their company,” he cautions.

# What does the AI Bill of Rights mean for mobility?

The voluntary guidelines are designed to protect consumers from potentially harmful developments posed by AI systems. Megan Lampinen investigates

**A**rtificial intelligence (AI) promises to revolutionise the mobility industry, but carries almost as much potential risk and concern as it does benefit. The concept of bringing human intelligence to inanimate objects has been around for millennia—the ancient Greek myth of Talos tells of a giant robot imbued with the life force of the gods. The field of AI was officially founded in the 1950s, but it has only recently begun to take off in the automotive sector with fleet management, traffic prediction, autonomous driving, speech recognition and more.

Growth has been rapid but largely ungoverned. “As automated systems develop, they offer the possibility for positive advancements—but unchecked, AI has led to unconsented surveillance, discrimination from algorithmic bias, and other foreseeable harms”—that’s the warning outlined by the authors of the Blueprint for an AI Bill of Rights, published in October 2022 by the White House Office of Science and Technology Policy (OSTP). The document is intended to guide the design, use and deployment of automated systems in a safe way.



## It outlines five key principles:

People should be protected from unsafe or ineffective systems.

- 1) People should not face discrimination by algorithms and systems should be used and designed in an equitable way.
- 2) People should be protected from abusive data practices via built-in protections and have agency over how data about them is used.
- 3) People should know that an automated system is being used and understand how and why it contributes to outcomes that impact them.

- 4) People should be able to opt out, where appropriate, and have access to a person who can quickly consider and remedy problems they encounter.

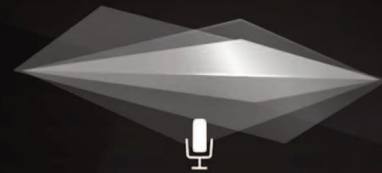
## Focus on automotive

The development has been closely watched by players across the AI ecosystem, including those active within mobility. Here, many companies are developing self-driving cars that use AI to navigate roads and make decisions in real-time. AI algorithms can also be deployed to analyse traffic data and make predictions about traffic patterns, helping cities and transportation agencies manage vehicle flow more efficiently. Others are harnessing AI



# Good evening

What can I help you with?



Please speak

to provide personalised routing and navigation advice, considering factors like traffic, road closures, and user preferences. Fleets are also using AI to optimise their scheduling and routes to reduce fuel consumption and improve efficiency.

In-vehicle facial and speech recognition also draw heavily on AI. Some of these systems came under scrutiny several years ago after various studies suggested they may be biased towards a specific gender and race. One study published in 2020 in the journal *Proceedings of the National Academy of Sciences* concluded that five popular automated speech recognition (ASR) systems demonstrated significant racial disparities. Essentially, they struggled to understand black speakers, making nearly twice the number of mistakes as they did with white speakers. This is the sort of algorithmic bias that the AI Bill of Rights hopes to address with its five principles.

“For the automotive sector, the primary focus of the document pertains to safety, user security and privacy, and algorithmic bias and discrimination,” explains Brian

Sathianathan, Chief Technology Officer and Co-Founder of AI-powered low-code software Iterate.ai. What does that mean in practical terms for automotive players?

“The call for greater protection will result in more scrutiny on AI-based systems and these eventually will begin to require third party certifications,” he predicts. Work is already underway to tackle the discrimination angle. “Providers of AI solutions and platforms have been building tool sets to help determine bias and discrimination in data. There will be standardisation in this space very soon,” Sathianathan tells *Automotive World*.

As for protection from abusive data practices, he points to GDPR and CCPA (the California Consumer Privacy Act) as “first steps in the right direction.” Moving forward, as the technology becomes more pervasive, he believes the industry will see more and more legislation from governments or standardisation from industry bodies.

Sathianathan highlights the Bill’s fourth principle—knowing that an automated system is being used and

understanding how and why—as key because “a basic understanding of this can help individuals make informed decisions and hold the system accountable for its decisions,” he states. “It can also help individuals better understand the potential biases and limitations of the system, and how those biases and limitations might affect the outcomes it produces. Overall, being aware of and understanding the role of automated systems in decision-making processes can help ensure that these systems are used in a fair and transparent manner.”

He also agrees with the importance of an opt-out clause for consumers, which “could give individuals more control over their interactions with AI-based systems and allow them to choose not to use these systems if they have concerns about their privacy or the potential biases of the algorithms.”

## **A backstop**

The guidelines were under development for about a year before they were published, and are not binding in any way. The OSTP describes them as “an overlapping set of backstops against potential harms” and is hopeful that companies will voluntarily use them to guide their developments. As with other safety-related issues, some players would have liked to see a more formal requirement. Alexandra Reeve Givens, President and Chief Executive of the non-profit Center for Democracy and Technology, commented that the “actions are valuable, but they would be even more effective if they were built on a foundation set up by a comprehensive federal privacy law.”

Essentially a whitepaper, the AI Bill of Rights joins the ranks of many other AI ethics principles that have been outlined by numerous organisations over the years, all pushing transparency. For Sathianathan, there is merit in the voluntary approach, as well as the broad language used by the Bill’s creators: “Since technology moves at a faster pace than legislation and actions taken by governments,

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Unchecked, AI has led to unconsented surveillance, discrimination from algorithmic bias, and other foreseeable harms

it’s important to provide a broader guideline and stay out of specifics, enabling inventors and technologists to innovate within that framework.”

Looking ahead, he emphasises that “it will be important for policy makers, companies, and individuals to carefully consider the potential benefits and drawbacks of opt-out options, and to develop approaches that balance the need for transparency and control with the practical realities of implementing and using AI-based systems.”

# Automotive moves into the quantum computing fast lane

Quantum computing is one potential route to accelerate progress in new energy technologies like EVs and fuel cells. By Simon McAdams

Cars have always fired the imagination, combining leading-edge technology and precision engineering to stay ahead of consumer demand. A recent survey by Ipsos found that over two-thirds of citizens (68%) across 34 countries support government spending on subsidies to make technologies including electric vehicles (EVs) cheaper. A global Accenture survey of car buyers and drivers found “sustainability is no longer a secondary concern”, with the majority

(64%) of respondents across seven countries rating themselves “sustainability-minded drivers”, most preferring that their next vehicle run on “new energy” sources such as batteries, natural gas, fuel cells or hybrid solutions.

Automotive companies are currently exploring quantum computing as one potential route to help them accelerate progress in new energy technologies. Quantum computers are already being explored for several challenges,

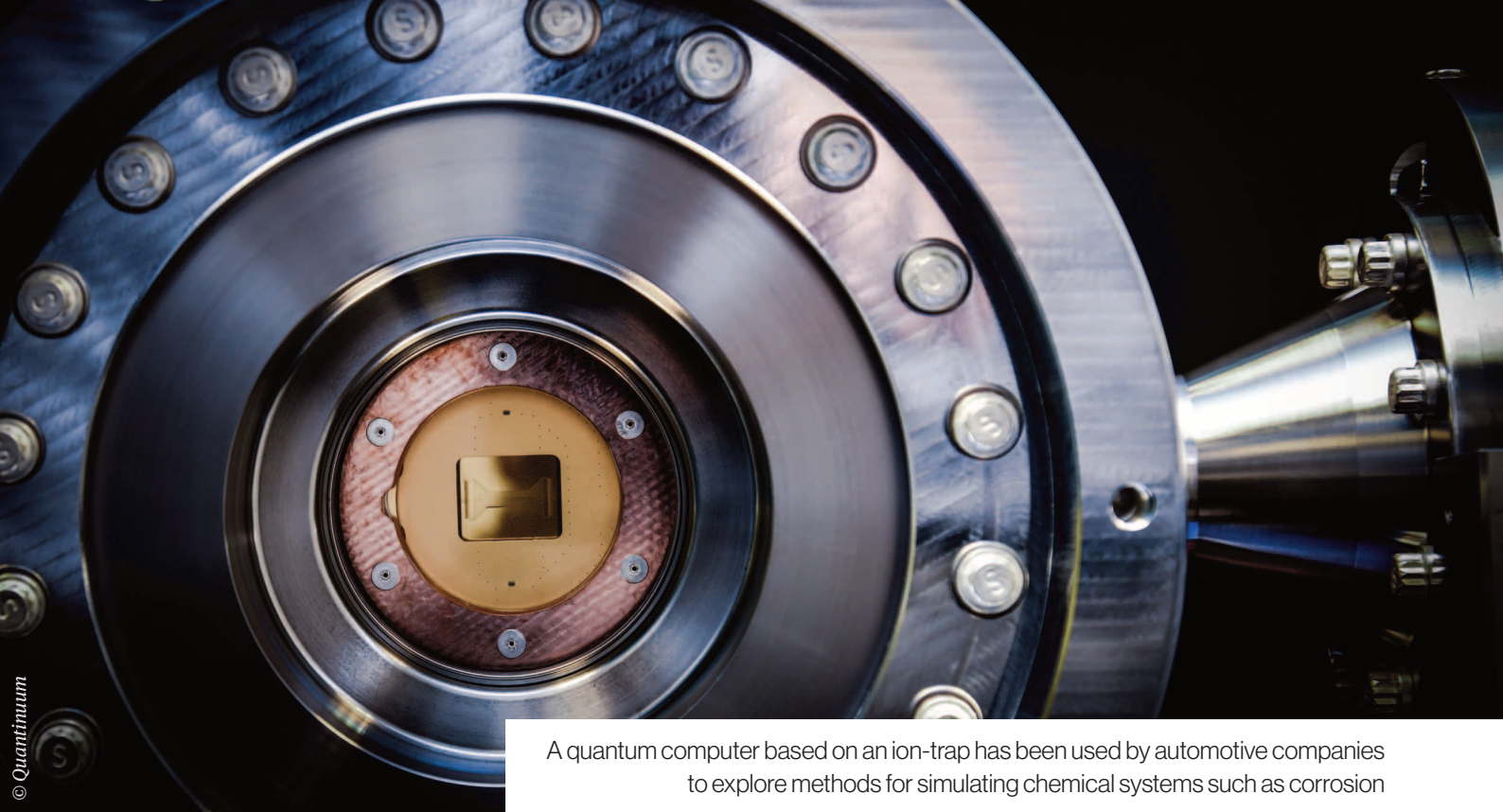
including simulating complex molecular and material systems to produce next-generation battery or hydrogen fuel cell technologies, improving the longevity of build materials, for example by improving their resistance to corrosion, and developing new methods to optimise manufacturing processes and vehicle routing.

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Many now expect that quantum computers will begin to outperform classical within a number of years

Multiple companies have made public their exploratory work in quantum computing, including Toyota, Volkswagen, BMW, Daimler, Hyundai, and Ford, with such companies investigating state-of-the-art quantum hardware and software systems and error mitigation methods that are required to run algorithms on today’s quantum computers. There is a wide recognition that, with so much investment now going into quantum computing by governments and across all major industries, it is





A quantum computer based on an ion-trap has been used by automotive companies to explore methods for simulating chemical systems such as corrosion

the right time to look ahead to where quantum computers may gain an advantage over their classical counterparts, and become capable of tackling certain problems that are intractable today, such as simulating complex molecular and material systems.

One example that reveals how quantum computers may offer progress is in catalyst design. Catalysts are a vital component in hydrogen fuel cells as they speed up the otherwise sluggish reaction between oxygen and hydrogen. Unfortunately, today's catalysts rely on platinum, making vehicles that use the technology prohibitively expensive. Hence, a better understanding of this process would accelerate the

development of catalysts that use less precious metals or instead rely on other earth-abundant inexpensive materials. This is easier said than done as current methods for computationally modelling such reactions make many approximations at the expense of accuracy. Whereas more accurate methods are only applicable to the smallest of problems due to the associated computational costs. Future quantum computers on the other hand provide the best of both worlds, allowing such complex problems to be modelled to the necessary levels of accuracy.

Today's quantum computers are not yet sufficiently large or stable to solve these problems,

so they do not yet offer an advantage over classical systems, but that time is getting closer. The reason so many automotive companies are now investing in quantum computing is that many now expect that quantum computers will begin to outperform classical within a number of years, and now is the right time to develop internal quantum computing expertise, identify suitable use cases, and design solutions in tandem with the evolving quantum software and hardware.

The adoption of quantum computing is in its early stages, but for automotive companies with an eye on future innovation, the time has come to start building the necessary foundations.

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*The opinions expressed here are those of the author and do not necessarily reflect the positions of Automotive World Ltd.*

*Simon McAdams is product lead at Quantinuum*

*The Automotive World Comment column is open to automotive industry decision makers and influencers. If you would like to contribute a Comment article, please contact [editorial@automotiveworld.com](mailto:editorial@automotiveworld.com)*

# TomTom 2.0: where next for this mapping pioneer?

The location data specialist offers a deep dive into its new Mapping Platform, designed to support a smart, electric future.  
By Megan Lampinen



Images © TomTom

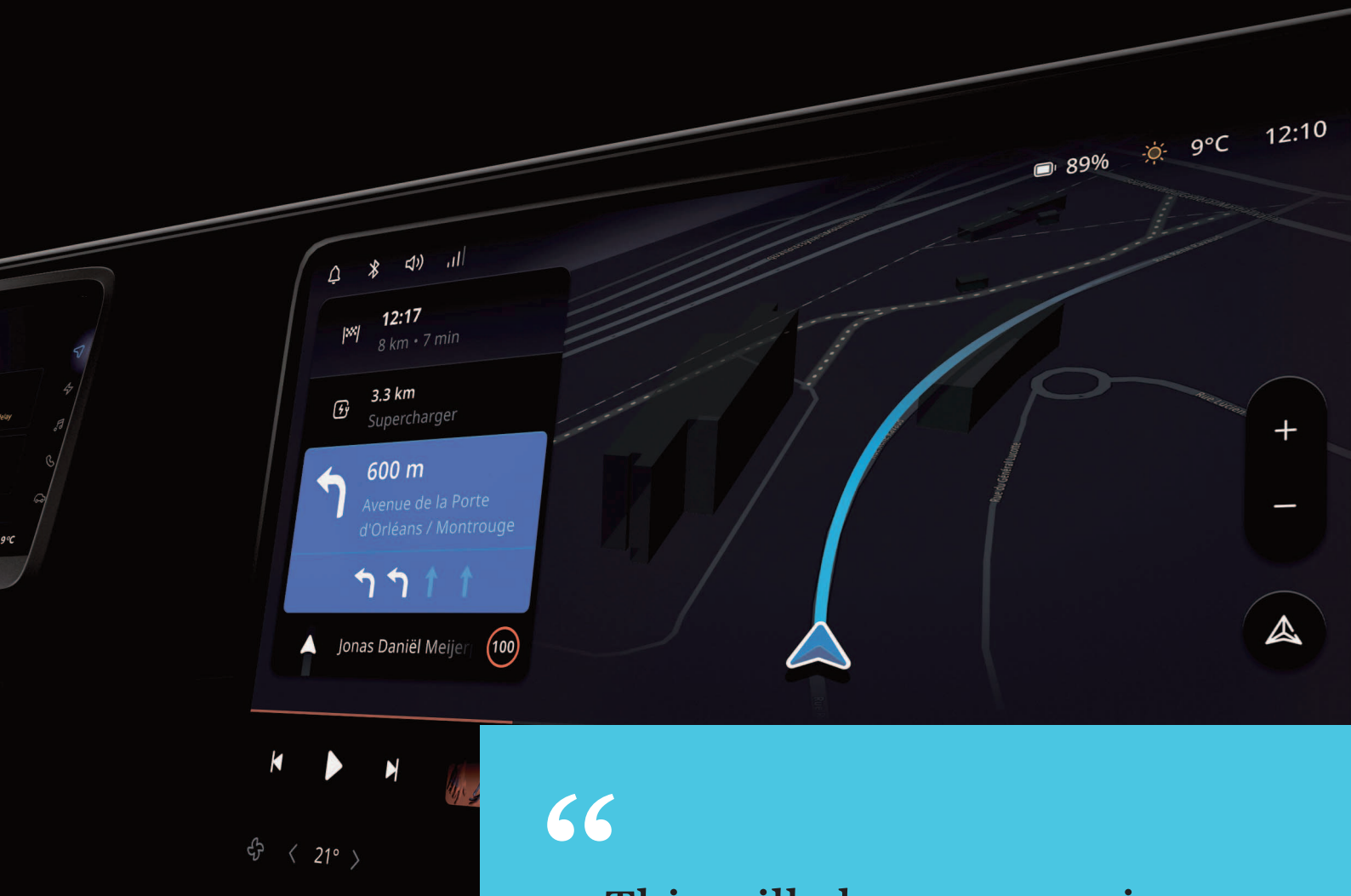
**T**he full promise of future mobility arguably hinges on mapping technology. That's a bold statement, but one that location data players, and their customers, are increasingly admitting. Humans have long relied on maps to navigate travel—the oldest known map dates from around 12,000 BCE. As these devices evolve into smart, adaptive sources of spatial intelligence, their application potential and importance multiply.

TomTom has jockeyed into one of the leading positions in today's digital navigation

technology market. Its GPS device made it into Time magazine's list of the 50 most influential gadgets of all time, coming in at number 22. Over the years, the company has expanded from simple navigation maps for turn-by-turn directions to maps that improve the functionality of advanced driver assistance systems (ADAS) and, more recently, High Definition (HD) maps for autonomous vehicles (AVs).

In November 2022, it announced its new mapping platform and geospatial data ecosystem

in the form of the TomTom Maps Platform. Corinne Vigreux, Co-founder and Chief Marketing Officer, described it as “the start of TomTom 2.0.” The development represents one of the most significant announcements in the company's history and paves the way for “the smartest map on the planet.” That's another bold claim from the marketing team, but one that Chief Product Officer Johan Land upholds. “This will change mapping and what our customers can do with maps in a significant way,” he tells *Automotive World*.



## The Maps Platform

This platform brings together three key elements, including a new flexible core map based on the OpenStreetMap (OSM) mapping community and what TomTom refers to as other “super sources of data”. That covers sensor-derived observations from vehicles on the road and probe data. The company has automated the integration of super sources in order to reflect the constant changes taking place to the mapped territory. “A map is a description of the world and everything in it,” says Land. “But the world changes so

quickly that you need to be intelligent about updating it. If it is not close to real time, the understanding of the world is not smart.”

The second piece of the platform is a software development kit (SDK) to help developers build applications

based on location data. The third and final component involves a dedicated location data ecosystem. Here, TomTom is going big: the promise is potentially the world’s largest, most diverse and valuable pool of geolocation data providers. “The map data of the whole world can be overwhelming, so

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This will change mapping and what our customers can do with maps in a significant way



TomTom launched a new map, mapping platform and ecosystem—collectively referred to as the TomTom Maps Platform

we show customers what is relevant to them, in a way that is easy to consume,” explains Land. That includes application programming interfaces (APIs) and services. “You don’t have to take a big blob of data and try to do something with it. You can come onboard with us very easily by just consuming our APIs or services that are relevant.” For automotive players, TomTom can even build the solution for them, up to and including a full integration into the car, with a navigation experience and payments for electric vehicle (EV) charging embedded into the navigation.

## Magical offering and experiences

TomTom is certainly not the only provider of such a platform, but it claims to be more open and flexible than others. “We are trying to not impose usage restrictions on our partners—that’s key in how we differentiate,” Land explains. “We don’t force any bundling of the products.” While many others just provide services, TomTom provides the raw data so users can modify it

and build unique experiences for their customers, a pivotal requirement among automotive companies.

Any company can participate in and contribute data to this map platform. “Most will have great quality map data on a single vertical, but need to balance that out with a fuller picture,” he notes. For instance, one company may know exactly where other businesses are located, but very little about the road networks. Another company might have detailed insights into safe pick up and drop off locations, but little else. By joining the platform and contributing the data in which they specialise, they can access everyone else’s grade-A data. “That creates a magically strong offering,” Land emphasises.

Another draw for businesses is the near real-time accuracy. With TomTom’s platform, that means ‘within minutes’, and Land describes this as “a big gamechanger”. Freshness comes into play with avoiding traffic jams, crashes and road closures, but also for EV drivers—it’s incredibly helpful to know not only the location of a compatible charge point but also whether or not someone is using it.

For consumers, the promise is a much richer visualisation, which all boils down to the data on hand. TomTom has access to vast amounts, but there’s an art to using that data effectively. “You don’t want to show too much information or it will distract the driver. Rather, we want to

highlight the things that are truly relevant for them in the immediate moment,” he says. “Consumers are very demanding. Digital natives are now coming into the market with high expectations. When we can offer detailed lane data, and tell you when one lane is blocked or another is moving faster, we can offer magical experiences. These magical experiences mean maps are more relevant now than ever.”

## Overcoming challenges

Location data is making its way into all sorts of services. Ride-hailing and delivery fleets rely on it for their very profitability, while automakers are harnessing it to attract and secure ever-more demanding consumers. Indian market researcher Fortune Business Insights forecasts the global location technology market will soar in value from US\$16.61bn in 2018 to US\$66.61bn by 2028.

Furthermore, trends towards electric and automated mobility are only increasing location data's importance within automotive. Not only does it help with charger availability, but it can also provide real-time insights on charging prices and local amenities around charging stations. Providing this sort of information could go far in addressing range anxiety for those new to electric motoring. “EVs more broadly are a very important part of why navigation is so pivotal today,” Land emphasises.

At the same time, the industry is incorporating more and more



With charging station data integrated with in-dash navigation, the EV's navigation system can indicate to the vehicle when there is a fast-charging stop planned on the route

automated driving functions. “The car's sensors will never be able to see around the corner, but the system still needs to set the speed and choose the trajectory with full visibility. Sensors will also never ever be able to see through a big truck they're sitting next to on the highway. Therefore, you need a map as the base truth,” says Land. “Then the sensors enrich that map to enable the car to make autonomous decisions.”

Where will the tailwinds of electrification and autonomy take navigation in the future? Land doesn't necessarily have concrete answers, but he is excited to be helping the industry usher in a new future. “TomTom invented the personal navigation market about 20 years ago,” he notes. “We are now helping the industry to overcome core problems [with EVs and AVs]. Accurate, real-time map data is at the heart of that.”

# Morocco—the next country to make 1 million cars a year?

Ian Henry explore the country's prospects as a major vehicle manufacturing hub





**M**orocco is home to major vehicle factories operated by Renault and Stellantis; Renault has two plants, one in Casablanca, dating from 1959, and a newer plant in Tangiers which opened in 2012. Stellantis has a factory in Kenitra which opened in 2019. The new Renault and Stellantis plants are the result of the country's strategic plan to develop an automotive manufacturing sector in the late 2000s. The Tangiers and Kenitra factories operate in tax-free zones, with no corporation tax levied for the first five years of operation and then only at 8.75% for 20 years thereafter. With labour costs as low as one-quarter as those of Spain (a days' sailing away), and the ability to export into the EU tariff-free through Morocco's membership of the Pan Euro Med (PEM) agreement, it is perhaps surprising that more car companies have not yet established production operations in the country.

## **Renault was the first to invest significantly in the country**

Renault made close to 350,000 Dacias in Morocco across the two plants in 2022; c255,000 were built in Tangiers, mostly for export to the EU, and c95,000 were made in Casablanca which is used for the local and regional export markets. The two Renault plants could make closer to 500,000 units per year. Renault's exports in 2022 totalled just over 295,000 units. The automaker plans to add electric vans to its production portfolio in the country, also mainly for export to Europe.

The Casablanca plant started life as a joint venture between Fiat and Simca (later acquired by Peugeot) for the assembly of Italian and French sourced kits. Fiat exited the venture in 2005, with Renault initially taking a 26% stake; it now owns the factory outright, having bought Peugeot out of the venture in the late 2000s. The factory currently makes the Dacia Sandero and Logan.

The Tangiers plant opened in 2012 and has a nominal capacity of up to 400,000 units per annum (upa) although this has not yet been fully used; this also makes the Dacia Sandero, as well as the Logan and the Dokker/Lodgy vans which have either ended production or will do so soon. The vans will be replaced by vans using the new Mobilize Duo brand which Renault is developing for the electric market. In the past there were reports that Nissan models could be added to the production line-up in Morocco but none of these reports have been transformed into actual plans.

## **Renault's success led to PSA (Stellantis) following suit**

Stellantis currently makes 150-180,000 gasoline-engine powered Peugeot 208s annually; with the Trnava plant in Slovakia recently having finished production of the 208, Kenitra is the sole production source for ICE version of this model for Europe, with electric versions made in Zaragoza in Spain. The Kenitra plant opened in 2019, with a capacity of 200,000 upa; Stellantis exported just over 124,000 vehicles from Morocco in 2022.

Stellantis recently announced a €300m (US\$321.5m) investment plan to more than double capacity there to over 400,000 cars; it can also make c50,000 electric quadricycles (the Citroen Ami and Opel Rocks-e, with Fiat version expected soon) on a separate assembly line. This latest investment is for the new “smart car” platform which Stellantis is using for “emerging markets”; this will include the next Citroen C3, with the expanded plant focused on new export markets rather than the current focus on exporting to Europe. Stellantis’ expansion in Morocco is part of a plan to build 1 million units’ annual capacity in the region, including a new plant in South Africa which it plans to open by 2025. It may also require factories elsewhere in the region to achieve the 1 million target.

## Who might be next?

There have been various reports or industry rumours of Chinese companies, notably Geely and Chery, considering factories in the country, as well as both Hyundai and Volkswagen. Hyundai is more likely to make buses or trucks in Morocco than cars, while Volkswagen is unlikely to make vehicles in the country—it has plenty of unused European capacity across its many brands and it is difficult to see why it would need further assembly capacity close to Europe, unless it was to make a major push into Africa. On balance, it would seem more likely that future investment in car manufacturing in Morocco would come from Chinese companies later in the decade.

Renault’s Tangier plant boasts zero carbon and zero industrial liquid emissions







The €300m investment in Kenitra will double the site's production capacity and introduce a "smart car" platform

## Morocco is the biggest producer in Africa

Together Renault and Stellantis can, and soon probably will, make close to 800,000 vehicles a year in Morocco; it would then only take a modest increase in one or other of these companies' operations there, and the start of production by one of the Chinese vehicle companies for Morocco to reach the symbolic 1 million units annual output level. Morocco is already the biggest vehicle producer in Africa, having surpassed South Africa's recent totals of 400-500,000; South Africa had made over 600,000 vehicles for a few years in the 2010s, but it will likely take the opening of the new Stellantis plant in South Africa to climb back over and above that 600,000 level. The Renault and Stellantis plants also already achieve local content levels of around 70%, highlighting a broader strength of the automotive sector in Morocco. This high level of local content makes Morocco especially well-

placed for negotiating tariff trade deals which typically demand local content levels of 55%.

## A strategic plan has born fruit

The Moroccan government decided it wanted an automobile manufacturing sector as part of its economic modernisation programme; it created an environment which encouraged foreign investment and ensured it had excellent access too to the nearby EU Single Market for its exports. The domestic market is far too small—at less than 200,000 units a year—to support the production of more than 500,000 vehicles a year, so ensuring ready access to a key market for the vehicle manufacturers in the country was essential. So far it seems that Morocco automotive plan has been a success, and with Stellantis expanding production, and Renault adding EV production, the country is well positioned to play a major role in vehicle production for the next decade and beyond.



# Are electric vehicles still the future of automotive?

Joe Davis considers the wider implications as British and European OEMs slow EV production due to costs

**T**he Advanced Propulsion Centre (APC), a non-profit body that helps fund zero-emissions vehicle

technology in the UK, has reduced its forecast for UK production of electric vehicles (EVs) in 2025 from 360,000 to 280,000. EVs remain considerably more expensive than their internal combustion engine (ICE) counterparts. Inflation, a cost of living crisis and affordability are legitimate concerns for consumers and go some way to explaining the APC's revised forecasts. So, what does this mean for the future of EVs?

## Return to ICE?

Might we see a boost in the sale of ICE vehicles as the immediate consumer response? They are a cheaper alternative to cash-strapped consumers, more readily available and with an established infrastructure and familiarity that consumers value. Smart Line's recent research suggests used car prices will fall by over 10% in 2023, making ICE vehicles an even more attractive proposition for consumers.

However, a return to ICE is not a long-term solution. Despite the challenges facing battery EVs, all cars and vans in the UK sold from 2030 must be hybrid or fully electric (with the former phased out by 2035). New ICE cars and vans will be banned. Europe won't be far behind. Additionally, car manufacturers remain committed to EVs and an EV-only model by 2030. In the longer term, this means that consumers' hands may be tied when it comes to purchasing a new vehicle.

## Acceleration to hydrogen?

Could automakers perhaps accelerate plans for the development of hydrogen vehicles?

The International Energy Agency, in its 'Future of Hydrogen' report from 2019, found that hydrogen enjoyed unprecedented momentum politically and from businesses, and there is an argument that this trend will continue. However, hydrogen technology and its extraction into fuel simply isn't an affordable, readily available alternative at present and therefore isn't an attractive proposition to vehicle manufacturers.

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We are simply too far down the line to reverse the ever-increasing reliance on EV

Arguably, the economic and technical inhibitors to hydrogen technology are even greater than those faced by the EV conundrum. It is for this reason that IP firm Murgitroyd considers battery EVs to be the preferred zero-emissions technology and why they will continue to be so over the next 10 to 15 years.

## EV perseveres?

So, how do stakeholders reverse the forecasted EV trend? Tesla has responded to concerns, amongst other financial considerations, by immediately reducing the price of its most popular models by up to 15%; potentially saving consumers up to £7,500 (US\$9,275) in the UK. This marks Tesla's recognition that, in light of growing competition, it must remain financially competitive. Consumers may be drawn by such a price reduction, but this is not without its controversy: some disgruntled consumers purchased their vehicle the day before Tesla announced its drop in prices and saw none of the benefit. Tesla's online sales model means that under the Consumer Protection (Distance Selling) Regulations, consumers are legally entitled to return their cars

within 14 days of delivery. Customers that want cheaper prices can refuse delivery or even return cars delivered up to a fortnight ago. Other manufacturers may be reluctant to drop their prices so significantly, especially in light of the financial squeezes that they themselves are feeling in their production costs.

The cost of manufacturing batteries for EVs is a material contributing factor to EVs' high cost. Indeed, BloombergNEF reported that the price of EV batteries rose for the first time in 2022 due to rising raw material and component prices, soaring inflation and an increase in demand. To ensure that consumers do not revert to ICE in the short-term, lawmakers should intervene with regulatory and financial support to further develop technologies and help build more UK gigafactories,

Tesla recently lowered the price of its models





© Ohme

thus lowering the cost to manufacture batteries. In theory, manufacturers would pass on this saving to consumers.

US lawmakers have incentivised such investment with the Inflation Reduction Act 2022. The UK should follow suit or risk being left behind, as is the case following the collapse of BritishVolt. Additional tax incentives on EVs would also break down some of the barriers to purchasing an EV. Company electric car schemes provide such an incentive but are not widely available and can be cumbersome. On 17 January 2023, the UK government announced its plans to maximise EV charging potential through the Electric Vehicle Smart

Charging Action Plan, but more needs to be done by lawmakers to widen the scope of such incentives and encourage the purchase of EVs.

## Committed

Despite the challenges facing us, and the impact these have on the sale of EVs, it is clear that EV remains the immediate future for zero-emissions vehicles. We are simply too far down the line to reverse the ever-increasing reliance on EV, and manufacturers and consumers alike know this. What is clear is that legal intervention is a powerful tool to overcoming some of these challenges. Let us hope that the powers-that-be deliver.

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*The opinions expressed here are those of the author and do not necessarily reflect the positions of Automotive World Ltd.*

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# Nissan drivers could charge their brains at car dealerships

**Nissan's Brain to Performance programme for racing drivers has a potential future application for road drivers. By Chris Eyte**

**N**issan has developed a brain stimulation programme for Formula E drivers that could be repurposed for non-racing drivers. Called 'Brain to Performance', the programme was launched in July 2021 with studies conducted at the University of Essex in England and the Campus Bio-Tech in Geneva, Switzerland. It was later tested at the New York City E-Prix in July 2022 before implementation for racing season nine (2022/2023) for the Gen3 electric car race era.

Lucian Gheorghe, Nissan's UX Innovation Senior Manager, leads the research team and continues to explore the programme's possibilities for mobility. He tells *Automotive World* that everyday drivers of Nissan cars will receive Brain to Performance treatment as a dealership service in the years to come.



### Can you explain what the ‘Brain to Performance’ involves?

Brain to Performance reviews how to accelerate the driving-related skills learning process and build bespoke training programmes. It is based on

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Our training programme uses the protocol devices to help different parts of the brain interact

applied neuroscience for magnetic and electrical stimulation to different parts of the brain. This helps the brain to be more balanced or in a

more ‘trainable’ status. This is primarily applicable for our Formula E drivers, and it is becoming an embedded part of their daily activities. Secondly, we see it also helping our non-racing customers who would like to increase their driving skills in the future.

### How do the programme’s protocols work?

What we are doing is leveraging well-established technology that we know is safe and has been used for a long time in medical applications. We set up two training protocols for the research. The first was made with WaveNeuro, a start-up in Los Angeles. We use a transcranial magnetic stimulation device before stimulator training and racetrack activity. It is a non-invasive neurostimulation technology that helps to focus the brain.

Then a second protocol, which is a transcranial direct current stimulation device tuned for Nissan by another company, PlatoScience in Copenhagen. This protocol increases the driver’s attention span during intense moments, so it is bespoke training for specific skills. For this electrical stimulation protocol, we worked with student drivers at the University of Essex.

### What were the results of the brain simulation studies?

We looked at helping them memorise the track and control the car better. We had a group of 20 students coming for ten weeks, one hour every week and driving in the same scenario. They were all told that the protocol would help them operate the car more proficiently. Meanwhile, we told the drivers in this student group that they would all be



**Lucian Gheorghe,**  
Nissan's UX Innovation Senior Manager

stimulated with this device but only half actually were. The results showed that those who were really stimulated learned both the tracks and how to use the cars 50% quicker than the unstimulated drivers, a clear increase.

In effect, our training programme uses the protocol devices to help different parts of the brain interact. This enables drivers to concentrate quicker and to stay in a concentrated state for longer periods of time.

### **How do you plan to upscale Brain to Performance for Nissan car dealerships?**

If this protocol can help our Formula E drivers become a little bit better, it means that I have a very good chance to improve our average customer a lot more. My plan is to build an easy-to-use Brain to Performance programme called 'Skill-as-a-Service' for dealerships, which can be self-administrated. For example, a customer comes into a dealership and instead of reading a book or

browsing a phone while their car has the oil or tyres changed, they can sit in a booth. Our device would do an automatic first assessment and then direct the customer to the correct Brain to Performance programme suitable for them.

This is what we are working on. At the moment, someone must be present to calibrate devices for brain activity measurements with our racing drivers. If we can automate that, and remove the assistant from the loop, we can offer a simple device to customers at dealerships. It means that someone will come to a Nissan dealership and gain not only a better car when changes are needed, but also go back a better driver with a more electrified driving experience on the way home.

### **How long would the stimulated effect last on the brain?**

We are accelerating the learning process; it's akin to learning a new skill. As long as parts of the brain helped by our training are used, the obtained skill level will not decrease. The participant will get better at driving quicker and that's all, basically. We would also help new drivers build their skills as quickly as possible. For example, a learner driver typically feels stressed for the first two years after passing a driving test. However, if they took part in the programme, they could feel confident within six months instead.

### **Is Brain to Performance a definite future reality for the mobility industry?**

I know there are other manufacturers who did a few studies into how the human brain works for driving, but I





am not aware of any automaker looking at training for brain stimulation. Nissan is the first to apply such devices in competitive situations—with our Formula E team. There are a number of possible applications for regular drivers, such as driving schools licensing the technology from Nissan.

It can also benefit truck drivers. This is not a Red Bull energy drink; it's not like intaking caffeine and driving for longer. In fact, if the skill level goes a notch higher, then the amount of energy used for driving will be lower. Then a truck driver would function at higher level for longer periods of time. As an illustration, it's akin to optimising a battery's operation.

My motivation is primarily to have something that reaches all of our customers in a few years' time. A major concern now is the

acceptability of the programme. People don't like being told they are not good drivers. If we say, 'let us make you a better driver,' they will not accept that. We need to formulate how to get our customers to buy into it to become better drivers. However, I am confident that people will like the programme once they have undergone it.

### **What are the next steps for your research?**

I will continue to support our Formula E team in implementing the day-to-day activities. But I'm also shifting the team's focus to simplifying protocols and attempting to have a standard driver training protocol in place for dealerships. Once we have something ready, we may begin rolling out the Brain to Performance programme for our customers.

# Is this a six-star ride-hailing experience?

Ivee wants to break the five-star barrier when it comes to fantastic user experiences in shared mobility.

By Megan Lampinen

Individual sound bubbles, mood-based lighting and haptic feedback—it doesn't sound like your average ride-hailing experience, but that's changing. The shared mobility industry is poised for notable growth in the coming years. McKinsey projects that spending on all forms of shared mobility globally could reach between US\$500bn and US\$1tr by 2030, which would be four to eight times the 2019 level. Investing in the next level of user experience could provide a huge return on investment for service operators.

## Choose your own adventure

Mobility software specialist Ivee (In-Vehicle Experience Enhanced) and automotive interior supplier Toyota Boshoku showed off their vision

of a new sensory experience for ride-hailing passengers at CES 2023. It's all about personal preference, with numerous options available through a touchscreen. "Many people will spend an hour every day in transit," notes Ivee Chief Executive Alex Giannikoulis. "What do they do with that hour? Our answer to that question is that they're going to choose their own adventure. Our mission is to help them make the most of their time on the go."

The setup closely resembles an online version of the infotainment systems offered on long-haul commercial airline flights. As soon as they sit down, passengers can adjust their desired settings and select if they want to watch a film or listen to music. An office setting provides privacy-enabled video conference calling for those

that remain in work mode. Riders that are tired or stressed after a long day may go for the spa-like experience offering a guided meditation audio (which comes out of speakers in the headrest) supported by ambient lighting. Then there's a theatre-like experience recreating the sounds of a cinema while vibrating seats accompany high-intensity scenes or explosions.

"Not only will you see and hear your content, you'll also feel your content," emphasises Giannikoulis. "This creates an immersive environment."

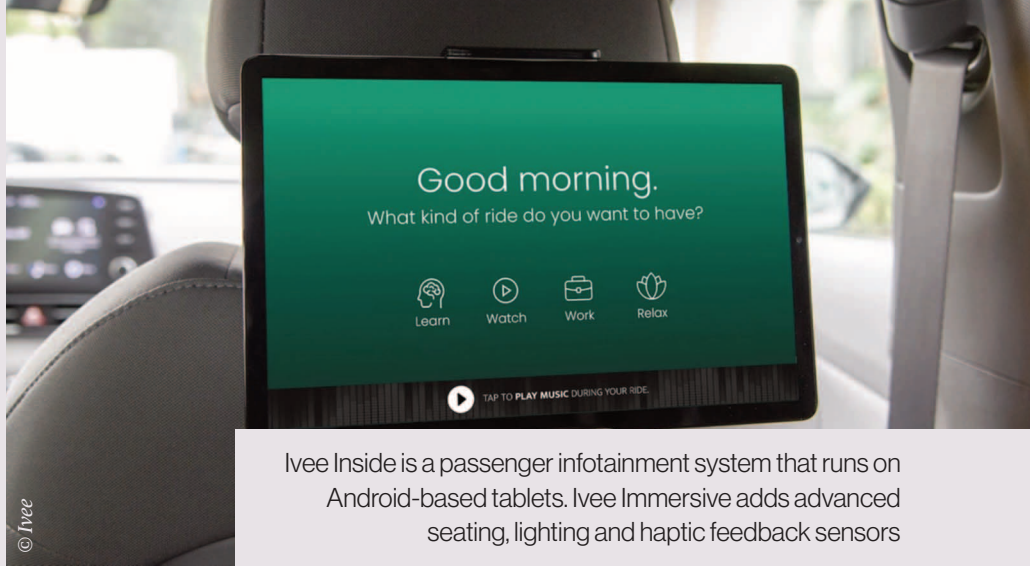
## The next level

Backseat infotainment offerings are not new in themselves but they usually come factory-fitted from automakers. Ivee has been offering an aftermarket

passenger infotainment system for ride-share vehicles—centred around an Android-powered tablet attached to the seat in front—for four years in the form of Ivey Inside. It is now stepping things up with the Immersive experience outlined above, adding in advanced seating, lighting and haptic feedback sensors. Teams from Ivey and Toyota Boshoku have been developing Ivey Immersive for just over a year. This too will be sold as an aftermarket option for existing vehicles running in ride-hail operations or similar fleets, with the promise of an easy installation. “If you’re a fleet that owns a bunch of Corollas, you don’t want to have to upgrade to an US\$80,000 Lincoln,” he notes. “You can just buy a cheaper upfit and it feels like a more unique experience.”

The company aims to roll out Ivey Immersive in Q2 2023 with one confirmed launch partner. Giannikoulis is hopeful of securing two more by the end of the year.

The payback on the initial investment could be significant. The company estimates that the Ivey experience will improve customer satisfaction and loyalty to a specific operator. In financial terms, that could result in an increase of earnings per vehicle of about 20%. “These operators are seeing something like 3% margins,” notes Giannikoulis. “Moving steel across town—especially empty—is very expensive.



Ivey Inside is a passenger infotainment system that runs on Android-based tablets. Ivey Immersive adds advanced seating, lighting and haptic feedback sensors

Anything that can add value will be a help to them.”

## Future mobility

Ivey estimates that 82 billion minutes are spent every year in ride-hailing vehicles. In a future of driverless vehicles, that could be just the tip of the iceberg. In such an environment, user experience may prove to be central means of brand differentiation. “You either compete on price—fast and cheap—or quality,” Giannikoulis tells *Automotive World*. “The experience layer is what’s going to differentiate.”

But achieving that vision is taking longer than many players originally expected. “People are realising that the developers are not getting to self-driving as planned, so the focus is turning to what can we do now,” he notes. For Ivey, there is plenty of room for further advancement in the meantime. The company is currently exploring greater levels of personalisation and intelligence, such as ways for

the user profile to move with the rider from car to car. That means the film they only watched halfway through yesterday could resume exactly where they left off when they get in a new ride today.

It is also gathering data on users to build a more accurate profile of them. This include what settings they start when they first get in, whether they change them later in the journey, and so on. “It will become more intelligent and more predictive to help with the journey and provide a better experience,” he emphasises.

The overall aim is to set a new standard for customer experience. “Why does a ride-hail environment or a ride have to naturally stop at a five-star experience?” asks Giannikoulis. “That’s an artificial ceiling. The layers of experience can increase, and they will. Six-star, seven-star, eight-star—what does that look like? We are starting to design that with Ivey Immersive and it just continues to grow.”

# EV batteries become a game of “in region for region”

**As the EV market gains momentum, access to and control over electric powertrains and batteries becomes a crucial concern for regions.**

**By Roland Berger**

**T**he green transformation of society is gaining speed and the mobility sector is leading the charge. Out of the six-fold increase in lithium-ion battery demand between 2022 and 2030 (see Figure 1), a whopping 80+% is due to light vehicles and commercial vehicles. With personal and commercial mobility moving towards electrification at an ever-

increasing speed, access to and control over electric powertrains, batteries and battery raw materials becomes a crucial concern for nations and regions.

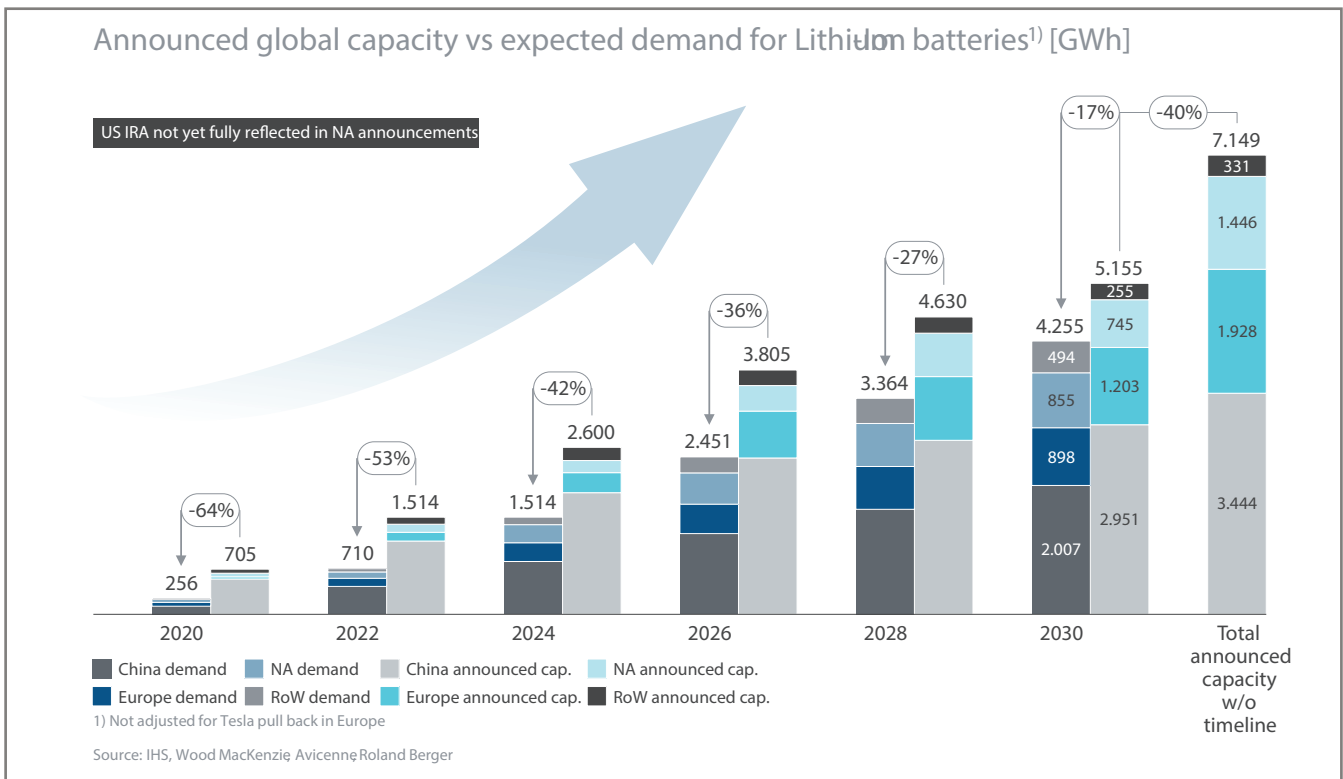
It is hardly surprising then, that President Joe Biden and European Commission President Ursula von der Leyen held talks recently to understand how to co-operate on critical minerals used for

electric vehicles (EVs) and government subsidies. Both understand the criticality of ensuring access to mobility free from potential political coercion. A lesson that countries such as Germany or Italy had to learn the hard way as the war in Ukraine disrupted what were believed to be safe, cheap sources of fossil fuels from Russia.

The main challenge that both leaders face is Chinese dominance in electrified powertrains. While lots of discussion has focused on rare earth metals mining and processing in the past, the Chinese footprint in processing lithium, nickel, manganese, cobalt, natural and synthetic graphite accounts for 40+% to in some cases 80+% of global capacity. Focused industrial policy has created a national moat in electrified powertrains that will take at least a decade to overcome. In addition, innovations such as cell-to-pack or LFP batteries are driven by leading Chinese companies increasing the dependency of Western players on their Chinese suppliers.

Given a testy relationship between China and the West exacerbated by Russia's aggression in Ukraine and a more and more centralised decision making process in China, the risks of this dependency have become painfully obvious. Yet on paper, the US and Europe seem to be doing alright in the mid-term. By 2030, we predict based on current announcements that

**Figure 1: Caused by political incentives, current cell manufacturing announcements exceed the expected demand**



Europe will have more than enough battery capacity while the US will fall short by about a 100 GWh pre-IRA (see Figure 1). Yet, European capacity forecasts have to be taken with a grain of salt. Nearly one-third of the announced projects needs to be considered as high risk, as these projects are driven by start-ups. Not all of these will materialise due to missing operational experience, availability of production equipment, scarcity of talent, lack of secured sales volumes/anchor clients, supply constraints for critical materials and financing challenges. Both regions are driving the investment in regional battery gigafactories to ensure regional supply and build up regional capability in electrified powertrains. Yet, their

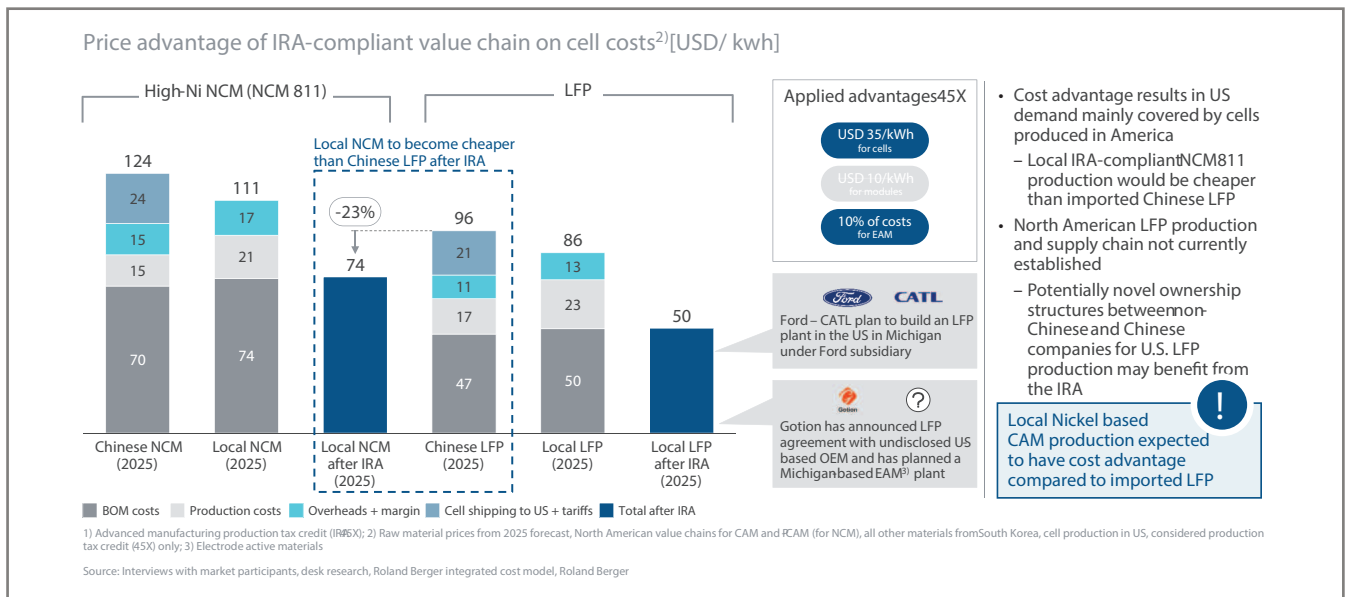
approach differs in practice and the projections carry different amounts of risk.

The Biden administration has taken a “carrot” approach to driving the de-carbonisation of the economy. The US\$460bn Inflation Reduction Act (IRA) is a massive subsidy programme that combines decarbonisation goals with the intent to re-industrialise the American heartland. The US IRA heavily incentivises local production of batteries through transferable tax credits while demanding a compliant supply chain. With an incentive of US\$35/kWh for locally produced battery cells, US\$10/kWh for battery modules and 10% of the production costs for electrode active materials and critical minerals, US-produced battery cells are

cheaper than their Chinese counterparts (see Figure 2). In addition, credits for qualified commercial clean vehicles (US\$7,500/vehicle through Class 3, US\$40,000/vehicle for Class 4 and above) dramatically improve TCO-performance of electrified vehicles and will drive demand by fleets eager to fulfill their SBTi targets. Beyond de-carbonisation, Foreign Entity of Concern restrictions on applicable critical minerals (extraction, processing or recycling) limit the opportunity for Chinese, Russian, Iranian and North Korean companies to operate effectively in the US.

Europe is more focused on the regulatory “stick” compared to the US. Stringent emission regulation, for example, for heavy commercial vehicles, has

**Figure 2: IRA AMPC1) incentives will make cells produced in the US be more cost-competitive than Chinese cells – Chinese LFP will be more expensive than local NCM after IRA**



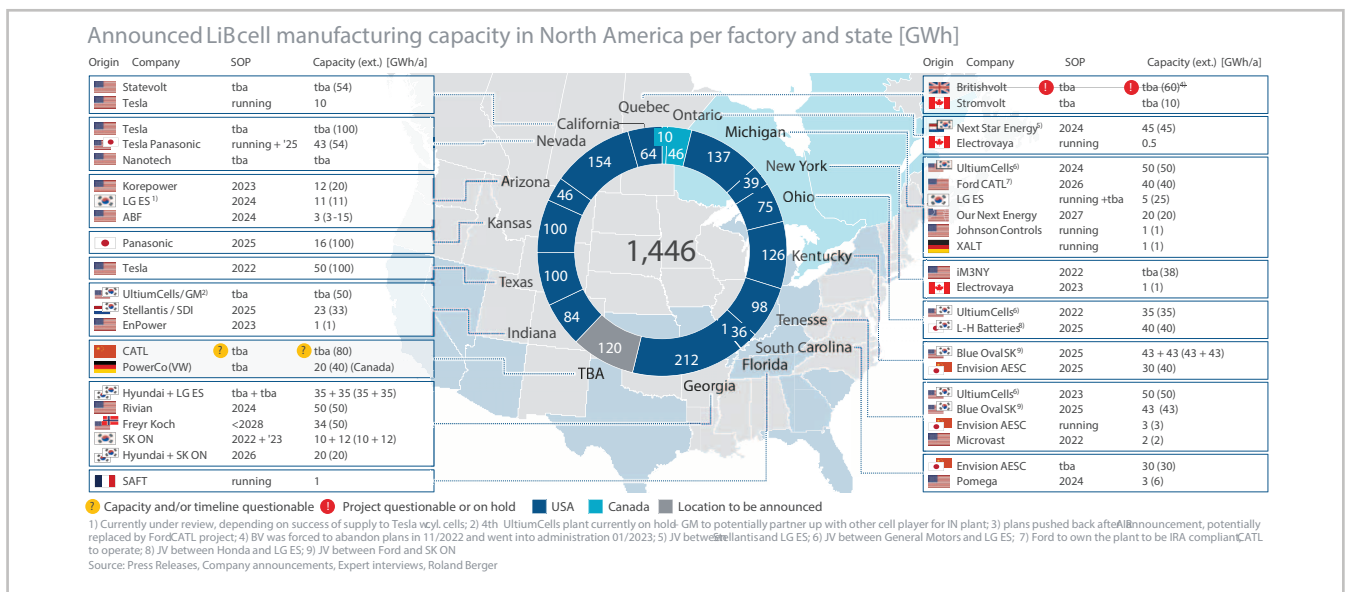
forced OEMs to invest in ZEV concepts. The requirement to reduce CO2 emissions by 15% in 2025 and 30% in 2030 has driven the need to electrify interregional traffic. Currently, increasing the 2030 target to a 45% reduction is being discussed which dramatically increases pressure on OEMs.

The final goal is that all new cars and vans sold in the EU as of 2035 should not produce any CO2 emissions at all.

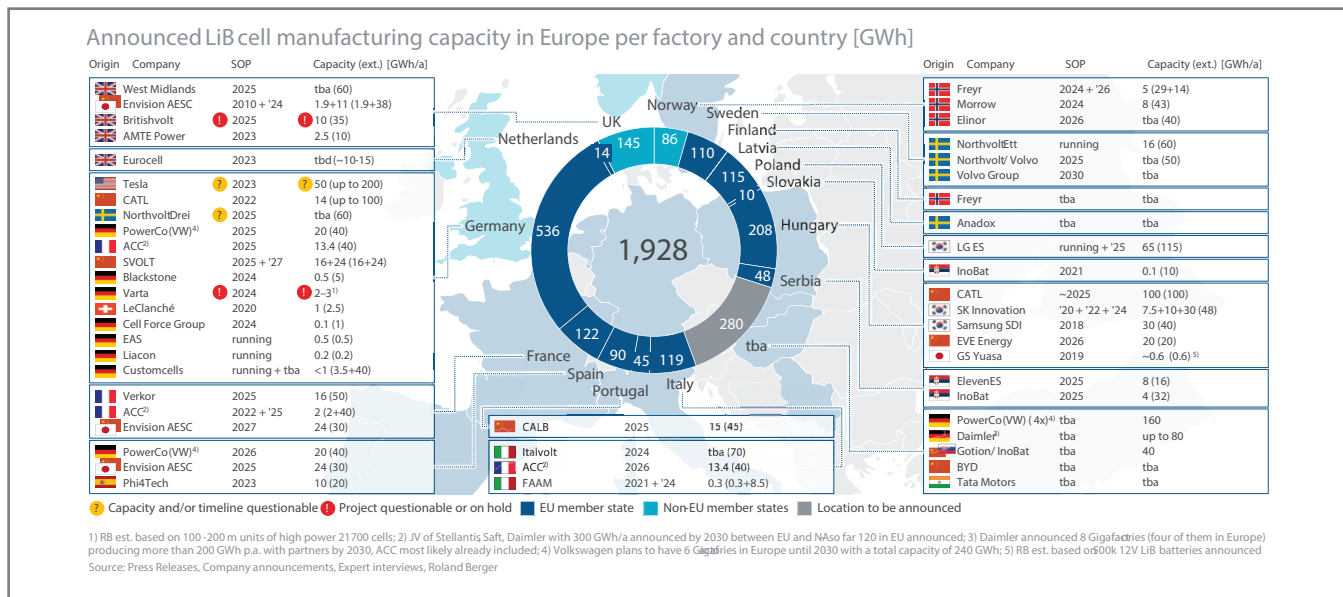
Yet, given the American precedent, the regulatory stick is not sufficient for Europe. Large incentives in the US compound escalating energy

prices and the general uncertainty due to the Ukraine crisis on the old continent. Tesla was the first to move investments back from Europe to the US, a precedent that is not tenable for the EU. As a consequence, the EU is in the process of developing the Green Deal Industrial Plan to

**Figure 3: Total announced capacity in North America by 2030 is ~750 GWh with announced extensions up to >1,4 TWh – High share of JVs between OEMs and cell producers**



**Figure 4: Strong competition in Europe expected w/ total announced battery cell production capacity of up to 1.9 TWh (1.2 TWh until 2030) – Market likely to consolidate**



support de-carbonisation on a large scale and to address some of the competitive disadvantages that the block faces vs the US.

Differences between the US and Europe are not limited to governments alone. From an industrial perspective, North American and European OEMs are following slightly different strategies as well. As can be seen in Figures 3 and 4, US OEMs mainly partner with established cell producers to build up gigafactories. European players also go at it alone and transform the capability set of their companies to attempt to own what they consider critical differentiation possibilities in cell design and chemistry. While the jury is still out regarding which approach will ultimately be successful, the

space will continue to be exciting.

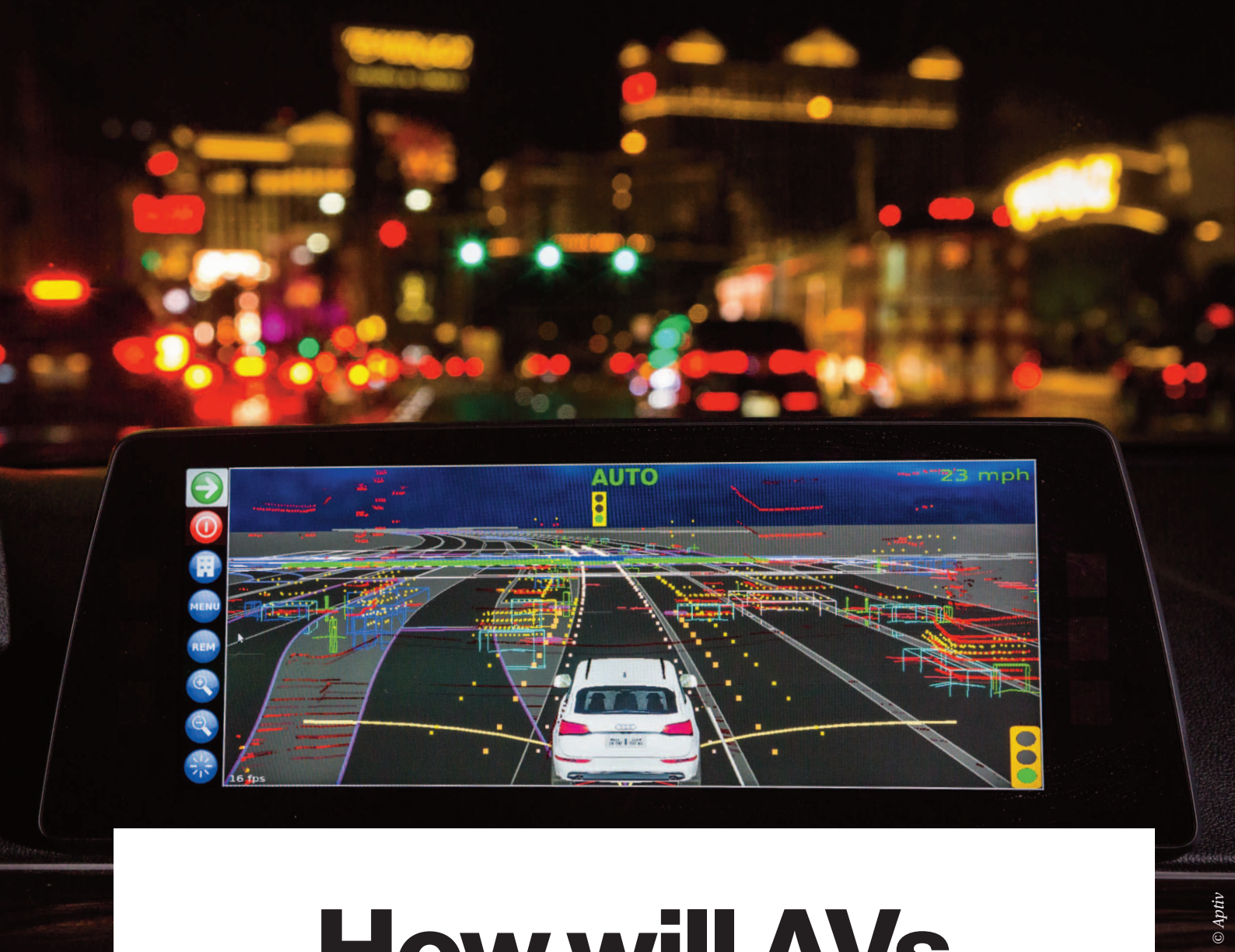
The world of batteries and electric powertrains will be a “in region for region” game in the foreseeable future. While disagreements between the US and EU may exist on the size of incentives or on who gets to be included, both blocks will find a common way especially given the overall challenging geopolitical environment.

So what about China? As seen in Figure 1, Chinese capacity outstrips domestic demand. Part of this capacity will continue to push onto the European market which is perceived to be more open compared to the US. However, China will also cement its role in penetrating other export markets such as Southeast and South Asia and otCurrent

vehicle navigation tech broadly falls into two categories: standalone devices and integrated. While dedicated GPS devices largely commanded the market in the 2000s, the emergence of cheap or free-to-use smartphone navigation apps challenged their necessity. Indeed, by the early 2010s, GPS tech developers such as Garmin and TomTom were partnering with OEMs like Renault and Fiat to deliver integrated dashboard systems instead.

However, in the rapidly evolving mobility landscape of the 2020s, the ubiquity of smartphones now challenges the value of integrated systems too. her regions where low-cost, high-quality batteries are the need of the day to drive a sustainable future.

About the authors: Wilfried Aulbur is Senior Partner, Isaac Chan is Partner and Tim Hotz is Principal at Roland Berger



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# How will AVs reshape vehicle navigation?

The merits of standalone navigation tech could soon be displaced by the revolutionary advantages of integrated solutions in AVs. By Will Girling



**C**urrent vehicle navigation tech broadly falls into two categories: standalone devices and integrated.

While dedicated GPS devices largely commanded the market in the 2000s, the emergence of cheap or free-to-use smartphone navigation apps challenged their necessity. Indeed, by the early 2010s, GPS tech developers such as Garmin and TomTom were partnering with OEMs like Renault and Fiat to deliver integrated dashboard systems instead.

However, in the rapidly evolving mobility landscape of the 2020s, the ubiquity of smartphones now challenges the value of integrated systems too.

## Customer value

“The adoption rate of phone-based navigation has increased dramatically over the last decade,” says Simon Teng, Senior Director of Automotive Go-To-Market (APAC) at Arm. Arm is a software and semiconductor design company focusing on the development of the metaverse, cloud computing, and next-gen automotive solutions. As of 2023, online consumer database Statista estimates there are 6.92 billion smartphones in the world, meaning approximately 86.34% of the global population has one. With smartphones able to grant the user instant access to a wide variety of updated maps and real-time traffic reports, integrated technology can no longer offer value by simply providing the same service. Furthermore, can automakers justify the R&D costs of developing an in-built system?



The Renault R-Link multimedia system includes TomTom GPS and mapping as an integrated feature

On the other hand, Garmin emphasises the benefits of integrated navigation over phones—including fewer driver distractions, offline functionality, and a user experience optimised for use in vehicles. Similarly, Teng adds that integrated navigation tech has evolved specifically to deal with the needs of drivers, instead of being a ‘jack of all trades’ solution. “For example, integrated navigation systems can use vehicle information to estimate the location of the vehicle while driving in a cell signal blackout area. Also, navigation systems with integrated cameras can give the driver a cohesive heads-up display experience.”

More importantly, he emphasises to *Automotive World* that focusing on the delivery of the most accurate, real-time navigation experiences possible will be critical to deciding the issue. While it is currently uncertain which form will ultimately prove the most popular, the development of autonomous vehicles (AVs) could provide automakers with a potent advantage against standalone systems.

## AVs reshape navigation

In recent years, [AV technology's progress has been mixed in](#) passenger vehicle applications. However, in a January 2023 report, McKinsey & Co's base model predicted that 37% of cars sold in 2035 will have SAE Level 3 capabilities or higher. This rises to 57% in the analyst's accelerated model. Along with this general advancement in self-driving capabilities will come a new relationship between customers and navigation tech: the emphasis will shift to the vehicle's own capabilities.

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AVs have the potential to bring a level of accuracy, safety, and interactivity previously unachievable in vehicle navigation

“A fundamental part of AVs is to build the environmental model through sensors and mapping information in real-time,” says Teng. The integrated navigational capabilities of AVs will invariably be more complex and detailed than any

device-based solution could be—this is crucial for an operational safety perspective. Furthermore, developments in vehicle connectivity are making integrated vehicle navigation increasingly more detailed than app-based alternatives. In particular, he highlights the transition to software-defined vehicles, with centralised computers in electric/electronic [\(E/E\) architectures](#) and cloud-native software. “This architecture transition will provide a consolidated platform for functional safety and real-time requirements across all subsystems in the vehicle, including the navigation system,” he says. Through this new architecture, sensor data can be used to build increasingly more accurate maps for AVs.

“The more accurate the model, the safer the AV system. Therefore, high-definition 3D mapping becomes an essential technology in AVs.” It is also a technology experiencing rapid global market growth: worth US\$3.8bn in 2020, 3D mapping is forecast to double in value by 2025, according to MarketsandMarkets Research. The parallel development of artificial intelligence (AI) and machine learning technology, both of which are used in [AV system testing](#), will further reinforce 3D mapping. Google, for example, uses AI for enhanced image and route analysis for its AV platform, Waymo.

## Evolving through to 2030

In addition to changing drivers' relationship to integrated/standalone solutions, developing AVs can improve the fundamentals of vehicle navigation tech. Recognising that safe autonomous operations depend on

the accuracy of vehicle positioning, Arm partnered with GPS solutions provider Swift Navigation in 2019 to address the inadequacies of general global navigation satellite systems (GNSS). Using high-precision navigation signals and HD mapping, the two companies were able to enhance positioning accuracy from the typical industry standard of within 5m to less than 10cm.

While AVs might ultimately revitalise integrated navigation tech, the journey to the end of the decade will require significant investment. “First, the industry will need a high-performance, safety-ready, and software-defined platform as the base of AV navigation,” he advises. “This platform should use advanced semiconductor technologies to achieve high-performance and low-power consumption requirements.” Next, improvements to data accuracy will be necessary as mapping shifts from 2D to 3D, standard definition to HD, and meter- to centimetre-level resolution. “There will also need to be innovations to maintain map accuracy and updates,” Teng continues. “This is achieved by uploading the local data from a mass deployment of vehicles to the cloud. Next, the uploaded data is integrated into the map through a cloud-located AI model. Finally, the vehicle map data is updated through connected services.”

The result has the potential to be transformative: AVs could grant the automotive industry a chance to present navigational information to drivers and passengers in new ways, particularly by incorporating augmented reality (AR) and virtual reality (VR). Glimpses of this future already exist—from the Mercedes-Benz User Experience Augmented



Video Navigation platform to the [Audi-holoride partnership](#). In the latter case, rather than providing an ‘escape’ from the cabin, this ‘motorverse’ uses live vehicle movement data to shape and enrich the virtual experience instead. While this innovation is currently only available for passengers, attaining Level 4 AV capabilities could allow a driver’s experience of navigation to be increasingly shaped by the possibilities of AR/VR. Indeed, a May 2022 study published in the *Scientific Review* suggests that incorporating multisensory feedback into GPS systems can improve a driver’s navigational accuracy and precision.

Teng concludes that AVs have the potential to bring a level of accuracy, safety, and interactivity previously unachievable in vehicle navigation. By utilising integrated navigation’s core advantage—the vehicle itself—the automotive industry can provide a far more valuable solution than a smartphone app could ever achieve.



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# Will global brands continue to use Chinese plants for European supply?

European brands show no signs of moving their sourcing away from China. By Ian Henry



**C**hinese-made cars are increasingly common on European roads; most of these are made by Chinese companies, notably BYD, Nio and the former UK marque MG. Analysis by PWC suggests that by 2025, Chinese imports into Europe could reach 800,000 a year and even with continued exports from Europe to China, Europe is likely to be a net importer of vehicles from China. Many, if not most, of these imports are electric vehicles (EVs), reflecting China's domination in the battery supply sector. The lack of free trade deals between China and the EU or the UK means that import tariffs are payable; and while most Chinese brands operate in the small and most price competitive segments, the addition of a 10% tariff at the port of entry, in turn leading to a 6-7% price rise at the point of sale, does not make Chinese-made cars uncompetitive.

## **Cost competitiveness leads to Chinese advantage in small car production**

The lower cost of production in China versus Europe, as well as better battery availability, mean that Chinese vehicle manufacturers can offer price competitive vehicles in segments in which the European vehicle companies find it increasingly difficult to make money. Chinese brands sell into the A- and B-segments especially; they are taking advantage of European vehicle companies reducing their offerings in these segments (eg Ford stopping the Fiesta, Peugeot and Citroen stopping the 108 and C1 respectively, and

Smart moving production to China). We can expect more Chinese marques to appear in Europe, to fill the gap created by the exit from these segments by the European companies.

## **Some larger cars also come from China...**

However, there are also some significant imports of larger and more expensive cars too, from the Chinese arms of European brands especially, as well as US disruptor Tesla which has a large manufacturing operation in China. In recent years, we have seen the BMW iX3, Citroen C5X, DS9, Volvo XC60 and S90 and the Tesla Model 3 and Model Y all come into Europe from China.

Moreover, while industry executives such as Stellantis' Carlos Tavares cite the risk to European vehicle production from the Chinese, there is no sign yet of European brands, including Stellantis, stopping sourcing from China. Indeed, if anything it is increasing. The question is for how long will this continue?

Dacia is sourcing its entry model, the Spring, from China (Romania and Morocco being too expensive locations for producing this model). Cupra, the brand which will eventually replace SEAT, is now importing the Tavascan, a compact electric crossover, from a VW joint venture plant with Chinese company JAC in Anhui. In this case, imports from China are taking place because of capacity constraints at Volkswagen plants in Europe; capacity in Europe is being allocated instead to the Volkswagen ID5, Audi Q4 e-tron and the Skoda Enyaq IV.

In the large vehicle segments, Volvo and BMW are the key importers from China into Europe. Volvo started supplying the XC60 from China to Europe in July 2019; originally Volvo had intended to supply XC60s to the US from China, but political and trade disputes between the two countries led to the imposition of additional US tariffs on Chinese-made cars; this meant that Chinese imports into the US faced 25% tariffs versus 2.5% tariffs on vehicles coming from Europe. Consequently Volvo switched production allocations such that Volvo China now supplies the European market, with these imports facing a 10% tariff, less than the 25% US tariff on Chinese-made models; meanwhile

US supply of XC60s now comes from Sweden, with these European-made models facing a 2.5% tariff in the US, again lower than would be the case with Chinese imports. Meanwhile, the low volume, but higher-priced S90, a large sedan, is made only in China and the few models sold in the US face the 25% tariff.

Meanwhile, BMW started producing the iX3 EV in October 2020, with China currently the only global production location for this model; the next version of this model, along with a coupe version, iX4, is expected to be made in Europe at the new BMW plant in Hungary. BMW will also source a new electric Mini from

BMW i3 production in Shenyang, China



China from 2024, but for Europe at least, this is also likely to be a relatively short-lived practice as UK press reports and private industry briefings suggest that electric versions of the next generation of Minis will be made in the UK from 2026 or 2027.

Stellantis imports the low volume DS9 (since 2016) and the new C5X (since mid-2021); both models are made in China, which these models' main market, at least for now. The C5X could be made on the same line as its sibling vehicle, the C5 Aircross, in Rennes in western France, while future large DS models are expected to be made at Melfi in Italy alongside new large models for Opel and Lancia from later 2025 or early 2026.

Tesla's imports into Europe from China have increased strongly in the last couple of years, although here too, imports should decline once Tesla gets its German factory up and running at full production rates. Chinese content on any European production is likely to remain high in the medium term as Tesla is delaying battery production in Germany; continued use of Chinese made batteries, from CATL and BYD, is likely to continue.

## How long will China remain a supply source for international brands?

This is perhaps the key questions: while China will continue to export its domestic brands to European and elsewhere, the role of China as a production source for the likes of BMW, Cupra, Stellantis and Tesla is more open to debate. Established brands have used their Chinese

plants for supplying Europe especially for a combination of reasons, including production constraints in Europe and the lack of battery supplies in Europe.

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China's cost and other production advantages over Europe are not limited to the small car shipments

However, European vehicle companies are accelerating their own transitions to EV production and are rapidly expanding their local battery supply chains. Through the mid-2020s, we expect the current situation to change, with European brands and Tesla moving their European supply back to Europe. What the current situation shows, however, is that China's cost and other production advantages over Europe are not limited to the small car shipments. Europe and the US will very likely continue to need tariffs as a form of competitive mitigation against China; don't expect any trade deals between the EU and China to conclude a zero-tariff arrangement any time soon.

# How the US set the scene for electric cars to flourish in 2023

**The US could soon lead the EV push, but barriers remain, and success depends largely on political will and battery recycling, argues Aidan McClean**

America has been slow to adopt and provide for electric vehicles (EVs) compared to Europe. This does not come as a surprise considering that the US has had a long-standing love affair with large capacity internal combustion engines, a plentiful supply of oil to fuel them, and a powerful lobbying industry to fight on their behalf in Congress and the White House.

However, in 2023, thanks to Biden's major policy wins, the foundation has been set for serious progress to be made in preparing for EVs. This is mainly thanks to two policies; the Inflation Reduction Act (IRA), which is one of the largest policy packages ever passed and certainly the biggest boost to America's climate action, and 2022's Bipartisan Infrastructure Law (BIL). Additionally, states themselves as well as legacy car manufacturers are also taking

action to improve their EV charging infrastructure and to promote EV adoption by consumers and businesses alike.

Together, these four factors mean that the US is set to make a big leap in both the responsible production and use of electric cars and chargers. However, three barriers remain.

Firstly, there are many attempts by fossil fuel industry lobbyists





and regressive politicians to drag the climate crisis into the political by painting corporate responsibility and climate action as ‘woke’, and by arguing that the typical US consumer should not have to pay for tax incentives or charging stations that benefit EV drivers. For example, Wyoming is set to ban the sale of EVs by 2035 to preserve their oil and gas industries, and due to concerns around lack of infrastructure and critical minerals.

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There are many attempts by fossil fuel industry lobbyists and regressive politicians to drag the climate crisis into the political by painting corporate responsibility and climate action as ‘woke’

Secondly, America must rapidly start to source EV components and batteries in the US or from countries that have a free trade agreement

(FTA) with the US. This is essential if consumers and manufacturers want to qualify for the IRA’s incentives. Yet, it remains an incredibly difficult



Tesla currently leads the US EV market

© Tesla

task considering China's dominance of battery and component manufacturing, and the current state of supply chains for essential minerals such as cobalt and lithium. These are mainly mined in poor conditions in sub-Saharan Africa, with much of the world's supply outside of America's FTAs.

One key to tackling this, as well as the third barrier to America's widespread uptake of EVs, is domestic EV battery recycling—which must be significantly ramped up. The advantages of this are obvious; it reduces supply chains' impact on the climate, makes EVs cheaper for consumers, and ensures a domestic supply of critical elements. Battery recycling en-masse is more than possible, but it is not easy.

## EV tax incentives

The Inflation Reduction Act is a massive bill with a raft of implications for healthcare, infrastructure, environmental policy, and more. Most important, in the context of improving EV infrastructure, is Section 30D—the Clean Vehicle Credit. This will mean that, beginning in 2023, EV manufacturers will no longer face the 200,000-unit-per-manufacturer cap on Government-backed tax break incentives.

All new vehicles will be eligible for a tax credit of up to US\$7,500 delivered at the point of sale—half of which is eligible if the car meets the critical mineral sourcing requirements, and the other half for the battery component sourcing requirements.

However, from 2023, 40% of an EV battery's minerals must be produced in the US or by a FTA partner, and 50% of the components will need to come from the US. This requirement will increase to 80% for minerals and 100% for components, in 2027 and 2029 respectively. Taken together, all of these measures will supercharge both the uptake of electric cars and their domestic production. However, some critics argue that the economic protectionism may impact how many cars qualify for incentives, and ultimately, the subsequent uptake and positive climate impact.

## Electric charging infrastructure

In early September 2022, all 50 US states were approved for an initial US\$1.5bn in federal funding to provide EV charging infrastructure for 75,000 miles of highway. In total, the BIL allocates a total of US\$7.5bn for charging infrastructure, including US\$5bn for states to deploy charging stations and a US\$2.5bn competitive grant programme for specific community programmes.

The IRA also provides its own boost to charging infrastructure, with an EV charging station credit, formerly known as the 'alternative fuel refuelling station credit', to help drivers and businesses cover the cost of charging stations. For individual/residential uses, the tax credit covers 30% (up to US\$1,000 per unit) of the cost of the equipment. For commercial uses, the tax credit covers 6% (up to

US\$100,000 per unit) of the cost of the equipment.

## Non-federal action

It is not just the White House and the federal government that is providing the foundation to the electric revolution; many states are themselves preparing for a rapid acceleration in EV adoption. For example, only last month, California approved US\$2.2bn of investment to double the number of electric chargers in the state.

An essential component to a successful rollout of EV infrastructure is that private companies follow federal and local action with their own investment. Tesla has long had a global network of electric chargers, but legacy manufacturers are now getting involved too. Most recently, for example, General Motors confirmed plans to install up to 40,000 electric vehicle chargers across rural America.

## The stage is set for the electric revolution

The US has some way to go before it catches up to Europe. However, thanks to a series of far-reaching, bipartisan-supported policies at the federal and state level, which have subsequently given private capital and legacy car manufacturers the confidence to invest in the electric revolution, the US will soon overtake Europe in charging infrastructure and uptake of electric cars.

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*About the author: Aidan McClean is Co-Founder and Chief Executive of UFODRIVE*



# Where next for Bosch Mobility Solutions?

One of automotive's most influential suppliers outlines its investment roadmap. By Megan Lampinen

**E**ngineering and technology giant Bosch is pushing hard on the new mobility front. Today its Mobility Solutions unit is the Group's largest business sector and hard at work helping automakers to realise a connected, automated, shared and low-carbon future.

Drawing on more than 130 years of experience with vehicles, it currently spreads its attention across several pivotal trends reshaping transportation. From sensors to hydrogen and quantum computing, the company is making its mark on future mobility.

Overseeing this charge is Arun Srinivasan, Head of Mobility Solutions. Srinivasan sits down with *Automotive World* to highlight some of the more significant product launches and potential investment areas for the future.

## Sensing

Bosch considers itself a pioneer in microelectromechanical (MEMS) sensors, which first found widespread application in the automotive industry. Here they are pivotal in detecting what's happening in the immediate environment, both inside and outside the vehicle. The company has been making MEMS sensors for 27 years and today, an average of 22 of these sensors can be found in every car.

2023 will see the launch of several new sensor-based innovations for mobility including the RideCare Companion. This solution was recognised with a Best of Innovation Award from the Consumer Technology Association and is set to play a critical role in improving occupant safety. It consists of a camera, a wireless SOS button, and cloud-based data services, which can be used by drivers to contact Bosch associates in the event of an incident. The associate can then gain access to the vehicle camera feed to assess the situation and request help if needed. Srinivasan sees this sort of assistance as particularly appealing for applications like taxi and ride-



The RideCare Companion offers features that can make ride-sharing drivers and users feel safer

share, and further down the road, autonomous vehicles.

Another big sensor-based safety system launching this year is Off-zone Crash Detection. This is designed to mitigate the impact of a side collision, which can happen when changing lanes or crossing intersections. About 17% of road incidents in the US happen because of people changing lanes. With this solution, smart sensors and a new software algorithm detect the exact angle of impact in a side collision and trigger the right airbag. “This came about as a consequence of a real-life incident in which one of our associates was involved,” says Srinivasan. “In that case, the side impact didn’t correctly deploy the right airbag.”

He concedes that other players are exploring similar solutions to those outlined above, but thinks Bosch has “something unique in the way we combine these services with AI and use the smart camera technology within the vehicle itself.”

In the future, Srinivasan is keen to explore new applications for sensor technology, such as air quality

sensing to detect driver alcohol and drug consumption. “Bosch is not involved here but it is an area that will have meaningful applications of such technology going forward,” he says. Then there are the opportunities of connecting sensors directly to emergency services to help first responders. The idea is that sensor data could convey the seriousness of the collision and the condition of the occupants to ambulance drivers and EMTs. “That’s a wholly unexplored area, and one we should be able to leverage easily for the sake of occupant and driver safety,” he enthuses.

## From engines to electrolyzers

Bosch is also playing a major role in propulsion systems, both legacy and future. As part of project QuEST (Quantum Exact Simulation Toolkit), it is using quantum computing to research material alternatives to rare earth elements for carbon-neutral batteries and fuel cells. “It is still early days, but much will happen in the quantum computing world over the next five years,” he predicts. “By 2025



Off-zone crash detection uses a range of sensor data and a new software algorithm to detect additional previously uncaptured crash scenarios, which commonly occur during lane changes, merging, and crossing intersections. Thanks to additional zones of detection, airbags can be deployed in a timely manner

Srinivasan. “Electrification is not the only game in town. In some cases [battery electric setups] are unaffordable and potentially unviable given the duty cycles of these long-distance heavy-duty trucks. Hydrogen will have a significant role to play.”

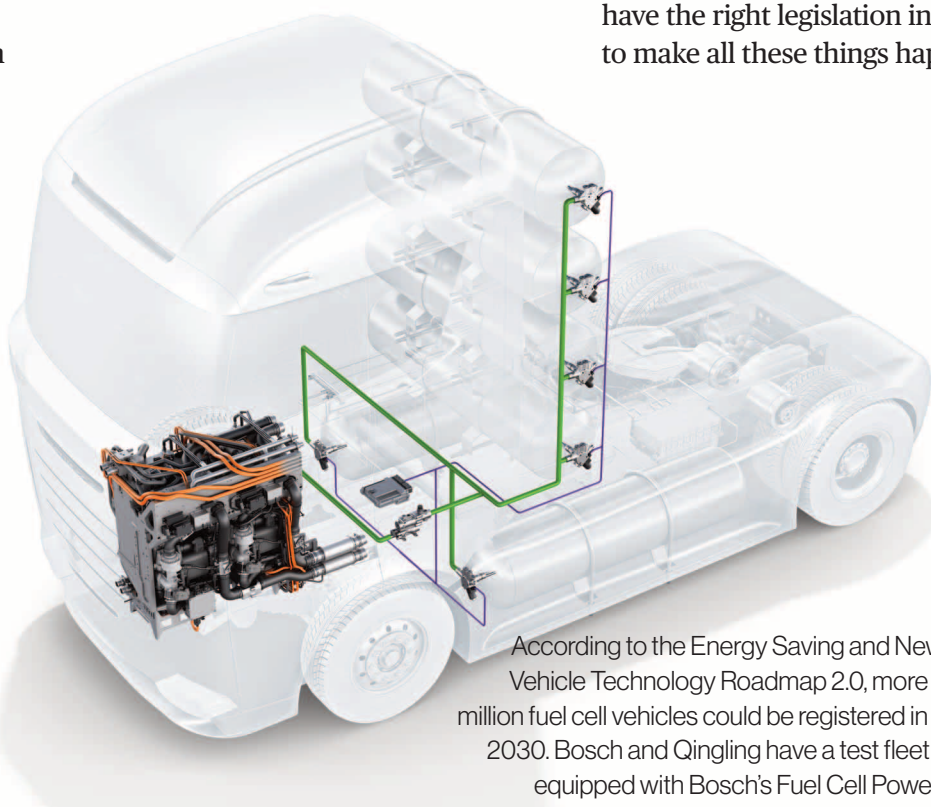
But that doesn’t mean Bosch is turning its back on internal combustion engines (ICEs). “The ICE has a lot of life left in it,” he insists. The details of [the Euro 7 standard](#) were only recently announced, and this should extend the life of the ICE for some time. “Bosch will be the last person standing in the ICE space,” he adds.

we will begin to see some of the results of this project being published and deployed. These sorts of things explode quite significantly once you unearth the potential.”

electrolysers by the end of the decade. These devices split water into hydrogen and oxygen using electrolysis. “We need a multi-pronged approach to zero emissions,” says

Srinivasan suggests that part of the solution to carbon neutrality with ICE may lie in e-fuels, though he is cautious in his commitment here: “What role e-fuels will play in that zone is unclear, because we need to have the right legislation in place to make all these things happen.”

Elsewhere on the clean mobility front, it has been working with Chinese trucking company Qingling on fuel cell trucks and established a joint venture, Bosch Hydrogen Powertrain Systems (Chongqing), specifically to develop and assemble fuel cell systems for the Chinese market. Hydrogen in general is a major new focus area and the Mobility Solutions business will invest up to €500m (US\$530m) in the development of



According to the Energy Saving and New Energy Vehicle Technology Roadmap 2.0, more than one million fuel cell vehicles could be registered in China by 2030. Bosch and Qingling have a test fleet of trucks equipped with Bosch’s Fuel Cell Power Module

## Trucking apps

Another potentially big area for Bosch Mobility Services is truck parking. Commercial long-haul drivers can waste a lot of time searching for a secure location to park overnight, sometimes with no luck. In Germany alone it is estimated that there is a shortage of 14,000 secure trucking parking spaces along the country's motorways. The Secure Truck Parking booking platform helps drivers find free overnight parking and reserve a space online.

The company likens this offering to a hotel booking portal: its customers are the drivers and dispatchers, the hotels are the truck stops, and the beds are the secure parking spaces. The idea is to provide a growing number of related services as the industry requires them. For instance, as fleets become electric, these spots will start to incorporate charging facilities and Bosch will likely update its booking offering to reflect that as well. "We certainly believe that if you were to electrify trucks, then it's in these yards that you will end up charging them," he notes. "There will need to be solutions around that. These are areas which we are still pushing."

## Software-defined cars and electronics

The Mobility team is also investing heavily in software-defined vehicles, and many of its 40,000 software engineers are focussed specifically on this space. "We have the ability now to lay the foundation stone for what will be computers on wheels in the 2026+ timeframe," he states. "That's where we will see a significant

deployment of our resources." Bosch is leading the publicly funded Software-Defined Car project, which kicked off in August 2021 and brings together 13 companies and research institutions to determine standard rules and processes for the various electronic players across the vehicle.

At the same time, Srinivasan expects to see Bosch increase its research efforts into vehicle electronics. In June 2021 it opened a €1bn wafer fab in Dresden, Germany, representing the largest single investment in the company's history. The facility was opened by then Federal Chancellor Angela Merkel, who commented at the time: "The new Bosch wafer fab will boost our capacity in microelectronics. Microelectronics is the basis for nearly every promising technology, for applications of artificial intelligence, for quantum computing, and for automated and connected driving—which is also a Bosch specialty."

Srinivasan notes that Bosch has been innovating in semiconductors for some time, adding: "As more and more electronics make their way into vehicles, that's a space which we will definitely pursue through research, investment and production."

## Finding solutions

The Mobility Solutions team clearly does not lack inspiration, and Srinivasan exudes energy and enthusiasm for the many projects underway and in the pipeline. "We are all about finding solutions to the market's and mobility's challenges," he emphasises. "That's a huge space and there'll be a lot of innovation ahead."



# Electrification spreads from tractor to trailer

**Range Energy's electrified trailers could slash the carbon footprint of the heavy transport sector.**  
**By Megan Lampinen**

**C**ommercial transport is under pressure to decarbonise, and quickly. Rising fuel costs are eating away at operators' already thin margins while looming emissions targets threaten financial penalties for non-compliance. Considerable investment and manpower is directed towards new aerodynamic cab designs and battery electric propulsion, but this is only half the story—literally. Behind almost every tractor is a trailer, and it's here that Range Energy hopes to revolutionise the industry.

The Silicon Valley start-up is developing electrified trailers that work with both diesel and electric vehicles. With the former they promise significant fuel savings—roughly 40%. When used with the latter, they boost battery range. It's a solution designed to offer both near- and long-term benefits as the industry steadily moves towards an electric future.



It's still early days for Range, which is currently testing prototypes but hopes to have a handful of powered 53-foot trailers in customer hands running test pilots by the end of 2023. Founder and Chief Executive Ali Javidan brings extensive experience at some big name mobility pioneers—including Tesla, Google and Zoox—and a passionate drive to not only create game-changing technology but also a ground-breaking company.

### **What do you hope to accomplish with Range Energy?**

When it comes to electrification, everybody's focused on the power units; nobody's thinking about the trailer. With our trailer system, we are helping commercial transport move into electrification without any technical headaches. Our trailer system is very simple: a small sensor in the kingpin, a battery pack and a drive system with an embedded e-axle that comes from a standardised supplier. These are all things that the industry can easily adopt. We're not asking them to work with a new form factor that requires them to change how their forklift drivers operate.

### **How big of an environmental impact can trailers have today?**

It depends on the operation and how those trailers are used and serviced, and their age. There can be a swing in efficiency as much as 7% to 10%.

### **How much extra weight does your system add?**

A 53-foot trailer weighs around 14,000lbs, and we're adding about 4,000lbs. These things have capacity for about 60,000lbs. We're essentially taking up the payload



© Range Energy

**Ali Javidan,**

Founder and Chief Executive, Range Energy

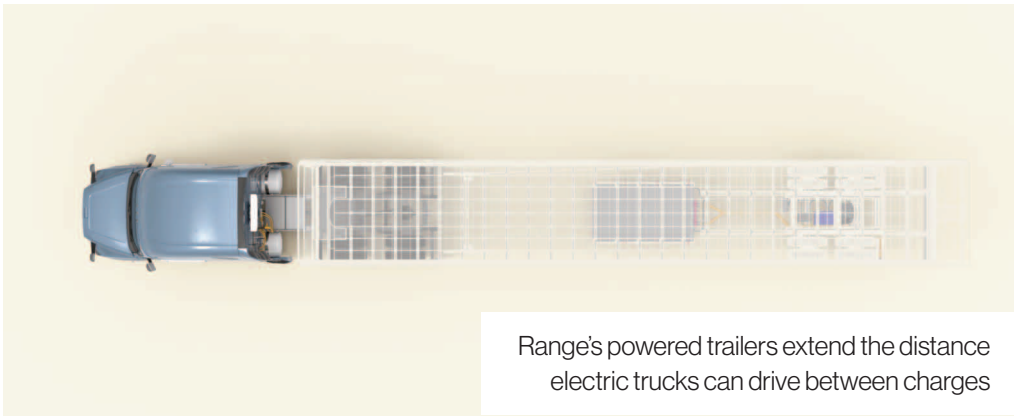
capacity of two pallets. But the net payload add is in fact closer to 2,000lbs, because once you add electrification to your system you get a 2,000lb allowance.

### **What's the overall impact of using your powered trailers?**

I can't yet estimate how much CO2 I'm going to remove from the environment, but I can offer an idea. A standard diesel tractor hooked up to a fully-loaded 53-foot dry van trailer gets 41% better fuel economy than it does with a passive trailer. In general, we can look at around a 40% reduction in greenhouse gas emissions for whatever operation takes on this technology.

### **How did you derive those figures?**

When we first started, we built numerous energy and kinematic models around how the trailer system, stability control algorithms and torque ramp should work. We also looked at the power and efficiency profile through a drive cycle with an activated trailer and different torque augmentation levels. We now have two prototype trailers on the road correlating those models. At the same time, those models are



Range's powered trailers extend the distance electric trucks can drive between charges

virtually testing the 53-foot Class 8 case. We're testing many, many different scenarios.

### **Can you share any findings from physical tests?**

In one we took a pretty aggressive route with our controls algorithms and torque augmentation, and we ended up on a 300-mile drive from San Francisco to Los Angeles, using a Rivian model towing our bumper pull trailer. We ended up extending the range of the Rivian by 12 miles on the drive down, because the trailer was doing all of its own work.

### **Could it be that the trailer was pushing in some cases?**

It was pushing only in the cases where the Rivian was going down a hill, collecting regen, and the trailer was also pulling regen. But the system was trying to hold a nominal negative force, and so basically the whole system was regenning through the truck, helping itself. Notably, we uncovered a new version of an algorithm that helps understand what needs the regen more, and modulate the regen between the trailer and the vehicle based on the total capacity that's in the battery and the power system.

### **How do you imagine charging the trailers will work?**

We're leveraging the dwell time as the trailers back up into the loading dock. Essentially, we charge while the forklift is going in and out loading and unloading the truck. We don't have to take up extra floorspace in the yard to facilitate charging. On top of that, the trailer acts as a charging gateway, so when you're at the dock you can leave the truck hooked up and then charge through the trailer into the truck.

### **What's the biggest obstacle right now?**

It's supply chain, specifically getting the attention of some of the key supply partners away from the likes of Daimler so that we can get components. However, that is not a blocker. We have begun our supply chain risk assessment and we have mitigations for all of the big high-risk items.

### **What is it you are most passionate about with Range Energy?**

I've spent the last seven years of my career learning how great organisations are built, developed, grown and scaled. In addition to great

technology, I'm obsessed with building a company that celebrates the individuality of its employees. Our innovation is driven by empathy, that's inward facing as much as it's outward facing. We want to know what makes employees happy and what doesn't make them happy. We treat each other with respect and empathy.

### **What are some common leadership mistakes you've seen?**

The most foolish thing I could do as a Chief Executive is say, "This is how I've done it in the past; this is how we're going to do it from now on." Whether you have one minute of experience or no experience on something, I want to hear why you think differently. You may have some life experience that ends up being important to us five years from now, so let's take a pause and think.

### **This approach may produce happy employees but what about the productivity aspect?**

One of our biggest mottos is 'speed is the ultimate weapon.' My investors cannot believe how fast we're going. But I don't want productivity; I want creativity, because the creatives are the ones that make the most efficient processes. We are only a year old but we have a fully built-out shop with multiple prototypes. We are obsessed with speed, with prototyping early, and with enabling graceful, intelligent failure.

### **What's your roadmap for deployment?**

By the end of 2024, we will have deployed a small pilot of ten to 20 trailers with at least a couple of customers. Then we aim to turn the factory on and start delivering in the

hundreds—and then quickly in the thousands. We have plenty of demand to fill those orders, starting today.

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We can look at around a 40% reduction in greenhouse gas emissions for whatever operation takes on this technology

### **Do you have your sights on other product areas down the line?**

We've only scratched the surface. The same foundational architecture works on everything from a small 16-foot bumper pull trailer—that could represent a boat trailer—all the way up to a 53-foot trailer. It is just a different class of component as you move up and down the weight range. We're very purposefully going after the 53-foot dry van market, because that's where we think we can have the biggest impact on carbon footprint reduction.

### **Would you consider this a game changer for the sector?**

I know it's a game changer, even if I sound cocky. I've been told it's a game changer by the biggest players in the game. One of the biggest truck operators in the world told me it was the most refreshing thing he heard in years.