

Automotive World MAGAZINE

Issue 29 | May 2022

Is the world finally ready for wireless EV charging?



Volvo explores wireless charging | **Mercedes-Benz** accepts L3 liability |
Lotus kicks off transformation with all-electric SUV | **Stellantis** doubles down on connected software |
Karl-Thomas Neumann backs **silicon nanowires** for electric future

100 reasons. One chip. Infinite impact.

Reason 18

**Save on sensors.
Save hundreds of millions of dollars.
Save lives.**

Reason 24

Power your entire in-cabin safety system with a single chip.

Reason 09

Watch your safety rating go up and your costs go down.



Reason 37

Develop leading-edge safety applications without the need for radar expertise.

Reason 51

Meet all the world's toughest safety standards with a single chip.

Reason 55

See and protect everyone with our chip's ultra-wide field of view.

prevent unnecessary hot car deaths.

Our best-in-class single chip sensor technology is transforming in-cabin safety, all whilst saving you money.

With this many reasons to choose Vayyar, there's no good reason not to.

► vayyar.com/auto/100-reasons-why



05

Is the world finally ready for wireless EV charging?



14



24



10

Better balance of mobility modes and working patterns will tackle congestion

Is the writing on the wall for Europe's PHEV market?

24

14

EVs become cash cows for European automakers

Could Russian sanctions improve European auto manufacturing?

28

20

Mercedes' L3 liability acceptance offers clarity and new questions

Silicon nanowires a 'breakthrough' for electric future, says Karl-Thomas Neumann

32

Copyright statement

© 2022 All content copyright Automotive World Ltd. All rights reserved.

This publication - in whole or in part - may not be shared, copied, reproduced, stored in a retrieval system, or be transmitted in any form by any means electronic, mechanical, photocopying, recording or otherwise without the prior permission of Automotive World Ltd.

Published in May 2022 by:

Automotive World est. 1992

Automotive World
1-3 Washington Buildings
Stanwell Road, Penarth,
CF64 2AD, UK

www.automotiveworld.com
T: +44 (0) 2920 707 021
support@automotiveworld.com

ISSN: 2634-9531

Registered number: 04242884

VAT number: GB 815 220 173

CEO & Managing Director:

Gareth Davies

Editor at Large:

Megan Lampinen

Contributors:

Freddie Holmes
Jack Hunsley
Christopher Dyer

Production:

Anmol Mothy

© Automotive World Ltd 2022



- 36** CASE evolution complicates mobility M&A
- 40** Stellantis targets ambitious connected software growth
- 44** Surging complexity hampers the evolution of in-vehicle networks
- 48** Aiyas capitalises on EV market shakeup in European offensive
- 52** EV profit relies on more than just sales
- 56** 'Edge as a service' to play vital role in automotive
- 62** New electric SUV leads brand transformation for Lotus Cars

Cover image courtesy of Volvo Cars



Is the world finally ready for wireless EV charging?

Volvo Cars explains how wireless charging fits into its brand image as well as the remaining headwinds to this innovative technology. By Megan Lampinen

Electric vehicles (EVs) could offer significant environmental and air quality benefits but only if the charging problem is effectively solved. The ultimate aim is to make charging as convenient and fast as filling up with gasoline or diesel; the trouble is that the industry is not there yet. Plugs come in various configurations that only work with certain stations. For drivers living in urban centres, on-street charging opportunities are few and far between. Long cables stretched out alongside busy city streets and crowded pavements can pose a safety hazard and an eyesore. Wireless charging could address some of these challenges and is attracting a growing list of big name automakers.

Tackling pain points

This approach allows EVs to charge by simply parking over a ground pad. Energy is provided from a magnetic resonance system in the ground; a vehicle parks over the spot and takes in the energy via a receiver embedded in its structure. The technology holds a particular attraction for fleet vehicles like taxis, with the promise of minimising time spent charging and thus optimising uptime.

Plenty of stakeholders are drawn to the convenience aspect and are investing time and money in it. In the UK city of Nottingham, nine electric taxis are currently participating in a wireless charging trial in a project funded by the Office for Zero Emission

BMW Wireless Charging enables electric energy from the mains supply to be transmitted to a vehicle's high-voltage battery without any cables





Volvo Cars is testing new wireless charging technology in Sweden

© Volvo Cars

Vehicles (OZEV). The vehicles—a mix of modified LEVC TX and Nissan Dynamo taxis—sport a special livery to

“

Wireless charging technology has clear commercial and consumer experience opportunities but most importantly could help address some accessibility challenges associated with charging an EV

promote the WiCET (Wireless Charging of Electric Taxis) branding, with the message, ‘This electric taxi

will charge wirelessly.’ For the project, Sprint Power developed an electrical distribution system, a power distribution module and a high voltage harness assembly that will enable the vehicles to receive the wireless charge.

“Wireless charging technology has clear commercial and consumer experience opportunities but most importantly could help address some accessibility challenges associated with charging an EV,” comments Abdul Chowdhury, head of innovation at OZEV.

Elsewhere in the UK, local company Char.gy is running a 12-month wireless charging trial using a fleet of ten modified Renault Zoe EVs. The project has started in Marlow but is expected to spread to nine additional locations across the country.

More recently, the Swedish city of Gothenburg announced it would launch a new three-year wireless charging pilot. Leading taxi operator Cabonline will run a small fleet of electric Volvo XC40 Recharge taxis that will charge wirelessly at stations across the city.



Taxi fleets and other high mileage applications could be a good fit for wirelessly charging

The automaker perspective

Volvo is just one of several big name automakers committed to an electric future. The company set a precedent when it became the first major premium car brand to commit to a hybrid or full-electric powertrain for its entire line-up. By 2025, it expects half of its global sales to be fully electric. Wireless charging could have a role to play within that vision.

Mats Moberg, Head of Research and Development at Volvo Cars, describes the Gothenburg pilot as “a good way to evaluate alternative charging options for our future cars.” The benefits, in his view, include an improved user experience with hassle-free charging as well as air quality benefits without the clutter of cables and power cabinets on the streets. He also flags ‘unlimited life and high durability of the infrastructure equipment’ as additional draws of a wireless setup. “We believe that wireless charging fits well into the Volvo brand image,” he reiterates.

In this instance, the wireless technology comes from Momentum Dynamics. Charging pads are embedded in the pavement along certain taxi ranks. The charging process starts automatically when the Volvo XC40 parks over a pad. The vehicles will use Volvo’s onboard 360 camera to guide drivers to the charging position. However, additional adaptations will be needed for the vehicles to fully facilitate the acceptance of a wireless power transfer. “It is very much an integration task to fit the new components into the existing vehicle,” Moberg tells *Automotive World*. “It is all about mechanical, thermal, electrical, and software adaptations.”

While this particular pilot involves a taxi fleet, other use cases could prove a good fit for wireless charging, such as car fleets in general that rack up substantial miles every year. “High mileage traffic can benefit due to higher usage factors,” Moberg emphasises. In the future, autonomous vehicles may require wireless charging capability, as there is no driver in the vehicle to plug it in. Some companies, including BMW, are targeting private consumers as well.

Long-term prospects

Various players, including automakers like Nissan, BMW and Renault, have been exploring wireless technology for many years. In fact, the BMW 530e inductive charging pilot programme was named 2020 Green Car Technology of the Year by Green Car Journal. However, it has yet to take off in any meaningful way. Cost levels and a clear business case have proven headwinds. So has a lack of standards. “Previously the lack of standards was a big

the industry was improving its efficiency, and the technology finally reached the point where systems with a 10-inch ground clearance could achieve 94% grid-to-battery efficiency.

With standards now in place, interest will likely grow and developments could gain momentum. There are still plenty of unknowns, including what users think of the experience. That’s what the ongoing pilot projects could help with. “The recently launched

“

Any invention related to the laziness of people will succeed in the end

obstacle,” says Moberg. “The standard is now set for up to 11kW, but not for charging with higher power yet.” In Volvo’s pilot, the wireless charging power will be more than 40 kW.

In autumn 2020, The Society of Automotive Engineers (SAE) finally outlined the first global standard for wireless EV charging, SAE J2954, but as Moberg notes it covers inductive-charging systems up to 11kW only. “Charging your EV should be as simple as parking and walking away—the wireless charging SAE J2954 standard gives freedom to do exactly that, safely and automatically,” Jesse Schneider, Chair of the SAE J2954 task force, said at the time of the announcement. The task force had started work on the standards back in 2007. During the intervening years

project within the frame of the Gothenburg Green City Zone initiative will tell us about the driver acceptance experiences of this technology,” notes Moberg. “We do this to learn and will base possible future decisions on the experiences we will gain through this project.”

So too will others. For now, plenty of industry players still regard wireless as an interesting academic exercise that remains too immature to pay much attention to. Finnish charging provider Kempower falls into that group, but its Chief Executive Tomi Ristamäki admits it has long-term potential, particularly for its convenience. “Any invention related to the laziness of people will succeed in the end,” Ristamäki tells *Automotive World*.

Better balance of mobility modes and working patterns will tackle congestion

The pandemic has created new travel patterns but the historic problem of traffic congestion remains. By Megan Lampinen



TomTom has been publishing its annual Traffic Index for more than a decade, shedding valuable insights into travel patterns and mobility challenges around the world. The pandemic and its associated lockdown measures dramatically altered road usage, offering a clear confirmation of the environmental benefits of removing vehicles from the road. But that comes at a huge economic cost, and as life slowly returns to pre-pandemic patterns, congestion levels are creeping up. What does this mean for looming environmental targets, transportation modes and mobility business models?

What happened to rush hour?

For the 2021 report, TomTom measured the congestion levels of 404 cities. 70 of them



exceeded 2019 levels, suggesting traffic has, more or less, returned to normal. As expected, the data has closely mirrored regional lockdown patterns. “Traffic has been a barometer, indicating when economies are closing because of restrictions, and when they are reopening,” observes Andy Marchant, Traffic Expert at TomTom.

A more long-term impact from the pandemic will likely play out on commuting times. For many years, peak periods of traffic coincided with the morning and evening rush hour. In several cities those peaks are starting to flatten out, resulting in an elevated level of congestion lasting for longer periods but never reaching the previous highs. The latest Traffic Index shows that peak hours shifted in 158 out of 404 cities, compared to 2019 levels.

“The rush hour that we’ve known from the past will change for sure,” Marchant tells *Automotive World*. That is predominately down to hybrid working approaches, with employees

coming into the office a couple days a week and working from home the remainder of the time. This is expected to stick around even as the immediate health concerns around COVID-19 abate. “Rather than

“
There are several levers to pull when tackling congestion and its environmental impact

necessarily seeing traditional rush hour die away, we will find that the traffic profile will differ day by day as people plan their specific days in the office,” he predicts.

To make the most of this evolving pattern, he suggests that cities and big employers within them start to collaborate. There is little point in every organisation taking Tuesdays and Thursdays as their work from home day, for example. If some took Tuesdays and Wednesdays, others Mondays and Fridays, it would effectively dissipate the volume of people driving into an area.

Los Angeles is an interesting case study. Traffic data there showed that flexible start and finish times for office workers had zero impact on traffic. “Congestion levels build in the morning and pretty much remain heavy right through the day,” observes Marchant. “What has the biggest impact is if you allocate certain days where people work from home. That takes out that volume of traffic completely.”

The cost of congestion

What are the risks if cities don’t address their congestion problems? That could take numerous forms, both in terms of economic loss and environmental damage. TomTom is taking steps to put a figure on the latter and has introduced a new emissions metric which it refers to as the cost of congestion. This is a calculation of the additional CO2 emissions caused by traffic, on top of what the cars would normally emit if the roads were free-flowing.

This is the first index to introduce the metric, and TomTom has initially focussed on Amsterdam, Berlin, London and Paris. To obtain this figure, it considers the fleet composition within each of these cities, looking at what percentage is diesel, gasoline, electric, etc. By

incorporating data on the volume of journeys and the amount of travel, it can categorise journey types per vehicle fuel type. Then it brings in its partner, the University of Graz in Austria, for details on the type of emissions caused by each type of vehicle powertrain. “From here we then start to calculate the CO2 emissions based on the vehicle makeups, the traffic congestion and the length of journeys taken in the city,” says Marchant.

For London in 2021, the total emissions were around 14.8 megatons of CO2, of which 2.2 megatons or 15% is a direct consequence of traffic. That means vehicles sitting in traffic with their engines running or are taking longer to conclude the journey are contributing 15% of the overall emissions. “That is pretty big,” he points out.

London had the biggest emissions figures of all four cities, though Paris was close behind at a total 13.8 megatons of CO2, 1.85 megatons of which came from traffic congestion. Berlin had 4 megatons, with 0.42 megatons from congestion, and Amsterdam 0.84 megatons, with 0.06 from congestion. These scores are influenced by numerous factors, including road network layout, other methods of transport and traffic in general. Amsterdam is well known for its bike culture and extensive bike path network, for example.

Mitigating the impact

The good news is that there are several levers to pull when tackling congestion and its environmental impact. Taking cars off the road with selective, coordinated office working

days is one. The impact from removing cars from the road during lockdown was huge, though that was unsustainable. “Literally overnight the traffic in Milan dropped 85% as people were not permitted to travel,” remembers Marchant. “That sort of decline in one day is enormous and wipes out a lot of the CO2 straightaway from all those vehicles because they’re just not on the road.”

Even small advances on this front could yield notable differences. For instance, boosting the EV share in London from today’s 4.5% to 5.5% would take out 155,000 tons of CO2 a year. That would be equivalent to planting a forest the size of Manchester. “That 1% shift in London has a huge impact, and if you can shift that 3%, 4%, 5%, then the numbers really start to build up. But

“

Other than taking cars off the street, electric is definitely going to have the single biggest impact

The trouble is that as soon as people resume normal life, everybody reverts back to old habits. “That signifies that there’s a big opportunity to look at creating a better balance between the car, other methods of transport—whether that be bicycle, public transport, etc—and working habits and patterns,” he suggests.

A shift to electric vehicles (EVs) is another lever that addresses not so much the congestion but the environmental impact. “Other than taking cars off the street, electric is definitely going to have the single biggest impact,” he asserts. That said, there’s a caveat: “It needs to be blended in a way that fits with the rest of the modelling and the rest of the strategy.”

with that comes the need for investment in networks that can support those EVs. Just substituting 50% of the existing fleet for electric doesn’t solve the problem. It just brings you a new problem.”

Marchant emphasises that there is no silver bullet to the congestion situation but is hopeful that a combination of measures will have a notable impact. “The whole purpose of the Traffic Index is that cities, planners, car manufacturers and businesses can use the data to help inform strategic decisions,” notes Marchant. “That can be around planning cities better in the future or deciding where to position their businesses.”



EVs become cash cows for European automakers

Having struggled with slim-to-no margins, electric vehicles are finally turning a profit for OEMs in Europe.

By Freddie Holmes

Electric vehicles (EVs) have been an expensive, time-consuming venture for more than a decade. In Europe, early efforts are beginning to pay off as major manufacturers report rising sales and falling production costs.

Among other factors, this is a result of new technology innovations that are helping to improve the energy density of batteries. At the same time, optimised manufacturing lines can now marry these large battery packs with dedicated EV platforms, which have been built from the ground up to house an electric powertrain. And with many EVs on the market today resting in the premium sector—or at least sold with premium trim options—the opportunity to boost profit margins with value-add services and features has been a significant boon.



Premium brands have weathered EV profit challenges better than most

“

Mid-range and entry-level vehicles will take longer to show comparable margins

Back in 2010, battery packs were more than US\$1,200 per kilowatt hour (kWh), pushing even relatively small packs close to US\$30,000. But prices have fallen significantly in a short space of time. Published in November 2021, BloombergNEF’s annual battery price survey found that prices were

around US\$132/kWh in 2021.

Importantly, packs have been far cheaper in China than in Europe at roughly US\$111/kWh in 2021. This has hampered profitability, but there are now positive signs coming from several European automakers.

Premium brands thrive

Although battery packs have been falling in cost, they remain the most expensive single item on the vehicle. This means that even models with base level trim and minimal creature comforts can be more expensive than a comparable top-spec internal combustion engine (ICE) model. For manufacturers that already sell in the premium sector, achieving profitability has come far easier. “EVs remain expensive as they are priced more like luxury vehicles than mainstream



Ford has found ways to cut costs in the Mustang Mach-E, and expects to find more down the line with other vehicles

vehicles,” observes Michelle Krebs, Executive Analyst at Cox Automotive. “This is one way that OEMs are addressing profitability with EVs.”

Audi expects its EVs to match ICE vehicle profitability by 2023 or 2024, for example. The company generated revenue of €53.1bn (US\$58.2bn) in 2021, up 6.2% year-on-year, with the share of BEV deliveries climbing from 3% to 5% during that period. Speaking at the automaker’s 2022 annual media conference in March, Chief Financial Officer Jürgen Rittersberger said this helped to boost sales. “The fully electric models launched in 2021 made a significant contribution to the increase in revenue,” he emphasised.

In the first quarter of 2022, Tesla delivered 310,000 units, up around

70% year-on-year. In January 2022, Tesla Chief Executive, Elon Musk, said in an earnings call that the company had hit “a critical milestone” following record deliveries of 936,000 EVs in 2021. “Our accumulated profitability since the inception of the company became positive,” he told analysts. In the fourth quarter of 2021, Tesla also achieved what Musk described as “the highest operating margin in the industry” at 14% based on generally accepted accounting principles (GAAP). It is an important distinction from non-GAAP reporting, which typically cast a more favourable view of a company’s financial performance.

Chief Financial Officer Zachary Kirkhorn added that for Q4 specifically, automotive gross margin, excluding credits, increased to 29.2%.

“This is our highest yet,” he said. Elsewhere, Mercedes-Benz reported in January 2022 that sales of battery electric cars surged 154.8% year-on-year in 2021 to a total of 48,936 units. A press release highlighted EV sales as a major boost to earnings during the pandemic.

Mass-market brands are also feeling the benefits of surging demand, and have set ambitious goals for EV output. Ford said in March 2022 that it aims to sell more than 600,000 EVs in Europe by 2026, achieving a 10% adjusted earnings before interest and taxes (EBIT) margin—a key metric for any company’s financial performance. By 2023, Ford aims to have a 6% EBIT margin in Europe. Maite Bezerra, Smart Mobility & Automotive Research Analyst at ABI Research, highlights that premium EV models often have similar returns to comparable ICE

cars, and that “mid-range and entry-level vehicles will take longer to show comparable margins,” perhaps between 2025 and 2030.

Fine-tuning

One of the barriers to EV profitability has been achieving economies of scale. Costs naturally begin to fall when any product is sold in higher volumes. With sales on the rise, profit margins may only increase to match—or beat—the kind of figures to which automakers have been accustomed.

This may be true, but automakers are not waiting around for volumes to rise. How the vehicle is made, and the technology it includes, can also make a real difference to earnings. Even small drops in price add up when there are hundreds of thousands of



vehicles being made. “New EVs—such as the Mustang Mach-E, VW ID.4, Kia EV6 or Hyundai Ioniq 5—are designed, developed and built to be EVs, with higher-volume sales targets and with fewer design and production compromises, which helps profitability,” explains Krebs.

Speaking in Ford’s Q4 2021 earnings call in February 2022, Chief Executive Jim Farley noted how the automaker has launched special cost-cutting investigations to boost EV profit margins. “We have a task force dedicated to lowering the bill of materials above and beyond just the usual declines in material costs,” he told analysts. In January, the team found a US\$1,000 per vehicle cost-cutting opportunity on the Mustang

Mach-E, for example. This, Farley said, was delivered through design simplification, vertical integration of the supply chain and leveraging Ford’s ability to scale production. “Our goal is to continue to improve our automotive EBIT margins even as we ramp up the mix of BEVs,” he emphasised.

“We believe automakers will be able to build and sell EVs at a profit as supply chains grow and mature, economies of scale improve, and consumer acceptance increases,” says Krebs. “We also believe automakers and suppliers will be able to, over time, reduce the cost of battery production and rely less on precious metals. That is a challenge on which the industry is very focused right now.”





© Volvo Cars

Green shoots

In the early days, both emerging and established automakers were struggling to make any money from EV sales. In 2014, the late Sergio Marchionne even urged consumers against buying the Fiat 500e as each sale was costing the automaker money. “If we just build those vehicles, we’ll be back in Washington for a second bailout because we’ll be bankrupt,” he said at the time.

“EV start-ups were definitely operating on a loss. It was only in 2021 that Tesla made profits without relying on emission credits,” observes Bezerra. “The scenario is likely worse for traditional carmakers with legacy ICE platforms and structural costs of ICE vehicle plants and processes.” Krebs agrees. “Early EV models were in some cases built and sold only to

help clear regulatory hurdles, and profits were not part of the equation,” she explains. “In many cases, the earliest EVs were simply modified versions of existing ICE-powered vehicles and built in low volume, with no economies of scale to speak of. The battery packs were very expensive and vehicle range was minimal at best.”

The narrative has flipped as sales continue to surge, platforms are optimised and material costs fall. There are already positive signs for an industry that is only on the cusp of mass-market penetration. Europe is the second largest EV market in the world, behind China, with EV sales up 63% in 2021 to a total of 1.2 million units. European automakers are already starting to make money from EVs, and there is plenty more room for growth.



Mercedes' L3 liability acceptance offers clarity and new questions

Mercedes will accept legal liability should its Level 3 system be found responsible for a crash, but does this paint the full picture? By Jack Hunsley



Autonomous vehicle (AV) development has progressed much slower than many early proponents had expected.

Part of this delay has been the underestimated difficulty of developing sensing technologies and driving algorithms. However, even if the industry had mastered both hurdles within initial timelines, a third would have still stunted progress: regulation.

In this context, Mercedes-Benz's announcement in March 2022 that it will accept legal liability should its Level 3 Drive Pilot system be found responsible for a crash represents a huge step forward for Europe's autonomy scene.

Where does the buck stop?

In a crash involving exclusively human drivers, the party at fault is usually obvious. However, in a crash involving assisted or autonomous driving tech, could liability fall elsewhere? Rather than the human driver, is the automaker, the sensor supplier or even the programmers who wrote the driving algorithm at fault instead?

The complexity of this conundrum varies across the autonomy scale. For instance, in a Level 1 or 2 vehicle the human driver is still required to constantly supervise the vehicle's manoeuvres. This implies that even if the vehicle crashes while an assisted driving feature is enabled, the driving responsibility ultimately still falls on the human driver. In contrast, a Level 4 or 5 AV will never ask a human occupant to take control, implying that responsibility falls on the vehicle.

Level 3, however, is a grey area. SAE's autonomy scale notes that human occupants are "not driving when these

automated driving features are engaged" even if they are "seated in the 'driver's seat'." However, the system still requires humans to retake control if requested. With more OEMs now teasing upcoming Level 3 vehicle launches, exactly where liability will lie at this level is a question high on many players' agendas.

In Europe, Germany has become the first market to face this conundrum. In December 2021, Mercedes-Benz was granted government approval to deploy Drive Pilot, starting in 2022. The automaker's regulatory victory does come with several caveats that could set a precedence for wider European Level 3 deployment.

New questions

For starters, Mercedes' tech will only be deployable within Germany's borders. Drive Pilot can only be used on predesignated highways, totalling 13,191km of applicable road. There are also restraints on exactly how and when the tech can be used: Drive Pilot can only operate at speeds of up to 60kph (37mph) in areas of high traffic density.

Perhaps most interesting from a regulatory perspective, however, is Mercedes' acceptance of liability. That said, the OEM will not accept liability if the driver has "failed to comply with their duty of care." As Matthew Avery, Chief Research Strategy Officer, Thatcham Research told *Automotive World*, there are two key considerations as to whether this definition is met: how quickly a driver can reasonably retake control when asked and whether the OEM can prove they were doing something illegal should the driver fail to take over.

“Although Mercedes’ research would say the driver can retake control within two to three seconds, the regulation gives ten seconds,” observed Avery. “It will be interesting to see where Mercedes will ‘pitch’ how long it takes to regain control.” Understanding whether the driver is engaged enough to retake control is more difficult. Drive Pilot will allow owners to disengage from the driving task to check emails and consume media, but these functions are enabled via the vehicle’s integrated infotainment unit. It is not yet clear how laws banning the use of mobile phones while driving will translate into a Level 3 vehicle.

“It’s difficult for the vehicle to stop you using a mobile phone, especially if it is placed strategically,” said Avery. “The reason the regulation ties them into watching a particular screen is that it can be turned off immediately, but buyers will ask ‘if I can watch a film via the dashboard, why can I not use a tablet?’ People will find ways to beat the system.”

Another question is, when it comes to a lawsuit, what exactly constitutes a crash? Avery notes that automated vehicles, by regulation, must record data when the automated driving mode is activated and, in the event of a collision, the status of the system. “The problem with that is the regulation currently says data must be recorded in a ‘detectable’ crash,” said Avery, noting that most manufacturers will use the metric of whether airbags are deployed to make this distinction. “That only occurs in 5% of crashes,” he continued. “For most crashes, there will be no data. If there is no data, there is no way of understanding liability.”

Though it is theoretically already possible for developers to use different metrics to detect more minor

collisions, there will be a fine balancing act between detecting these crashes and reporting too many false positives, such as if the vehicle hits a large pothole. Avery notes proposals are being considered to amend the type approval process to cater for this, but that there is “not yet an understanding of what counts as a crash and what is the process of getting the relevant data” if proposed criteria are met.

An extension of this query is how those involved in a crash with an automated vehicle can access the data needed to press or defend a claim. “There’s no common protocol here,” said Avery. “This is a specialist process, probably something that only the OEM can do. If manufacturers can understand the data before anyone else they may be able to say ‘there’s no case to answer here’.” On this basis, Thatcham argues for an independent, neutral process to enable all parties—drivers, automakers and insurers—to have access to easily understood data. “We are still in discussion with the UN parties about the provision of data,” noted Avery.

More to come?

As for international Level 3 deployment, Mercedes-Benz now finds itself in a promising spot. Given that the German Federal Transport Authority granted system approval based on the United Nations’ technical approval regulation UN-R157, Mercedes-Benz says this “paves the way for offering such a system internationally, provided that national legislation allows it.” In particular, the use of UN-R157 could simplify the release process in markets including the other 26 European Union members states and the UK. Ola Källenius,

Mercedes' Chief Executive, added during a 2021 results call that the automaker is aiming to deploy Drive Pilot in the US by the end of 2022.

While Mercedes has set the ball rolling, it is unclear whether other manufacturers will swiftly follow suit. Using the UK as an example, Avery highlighted that amendments to the UK's Road Traffic Act are coming in January 2023 that will allow vehicles to operate autonomously up to the full speed limit of the road in question, and mandate that the vehicle can change lanes. "It is unlikely that another manufacturer will go through type approval until that is permitted," said Avery.

“

If manufacturers
can understand
the data before
anyone else they
may be able to say
'there's no case to
answer here'

This is not to say that companies will sit still, with players such as Volvo, Polestar and Nio all ramping up to deploy vehicles for the European market equipped with sensors that can cater to Level 3's demands. "In the next couple of years there will be quite a few manufacturers with those premium systems bringing Level 3 functionality into the market," Avery added.

There is also growing enthusiasm for tweaking European regulations to allow for more advanced 'hands off' Level 2 setups, similar to Cadillac's Super Cruise and Ford's BlueCruise. Both systems are currently exclusive to North America but, for European players unwilling to accept the liability of and/or invest in developing a Level 3 system, the introduction of Level 2 autonomy monitored via an in-vehicle driver monitoring system might prove a popular middle ground.

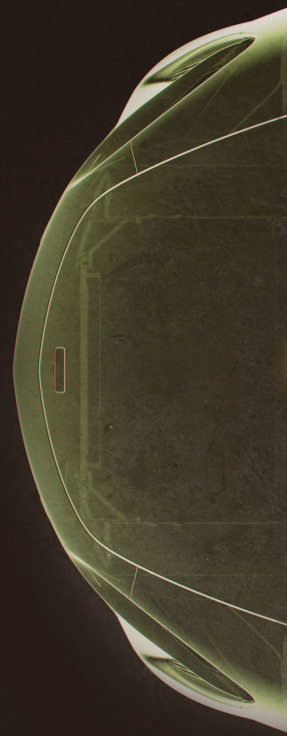
"Those systems are not permitted in Europe yet, but are likely to be from January 2024," Avery told *Automotive World*. "It's quite possible that manufacturers will prefer to go that way as it appears to offer most of the benefits of the vehicle driving itself with none of the liability issues."

Early days

AVs will continue to present unprecedented legal dilemmas as more advanced vehicles are deployed in greater numbers. However, the growing consensus is that automakers must be prepared to accept some liability if their technology is to reach customer hands. Though a daunting ask, this may prove a small price to pay for introducing theoretically safer vehicles onto Europe's roads.

And though Mercedes' liability acceptance and Level 3 deployment represent huge steps for AV proponents, it is important to remember that it is still incredibly early days for this level of autonomy. There will be plenty of learnings and mistakes made as the industry, government and vehicle owners get to grips with how Level 3 works day-to-day.

Is the writing on the wall for Europe's PHEV market?



Growing concerns about the accuracy of PHEV emissions testing could put the tech out to pasture earlier than expected.

By Jack Hunsley

Plug-in hybrid electric vehicles (PHEVs) are a popular choice for many consumers. Offering the option to drive exclusively on either the internal combustion engine (ICE) or battery power, many manufacturers advertise these models as an ideal stepping stone from pure ICE models to electric mobility. On paper, they yield far lower emissions than ICE vehicles, but, in real-world driving conditions, is this the case?

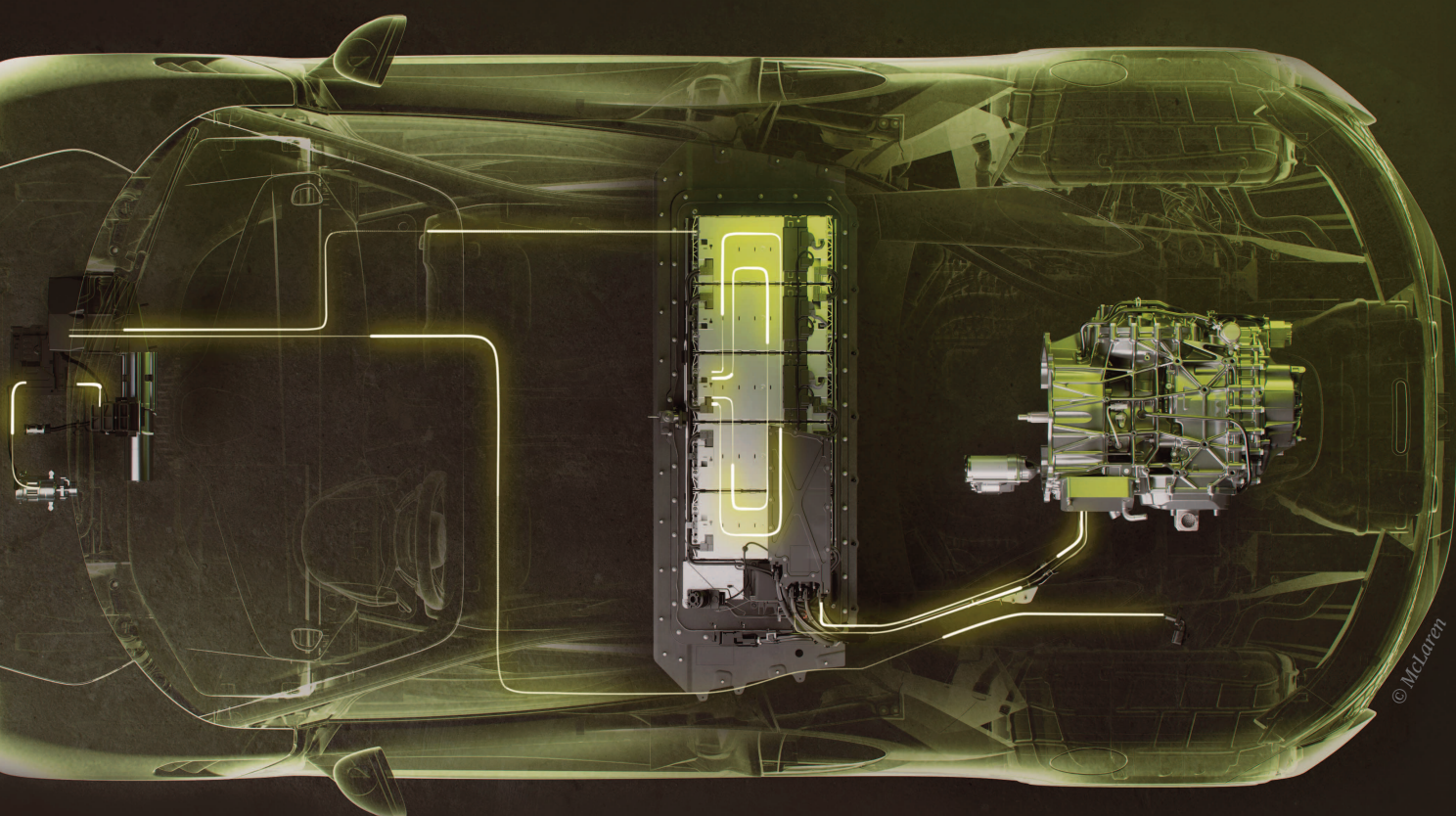
Drawbacks

For many industry experts, PHEVs are a flawed technology. Their gripe boils down to the formulas used to assess emissions test results. Put simply, they argue that the current procedures in place in Europe vastly overestimate how often owners charge their PHEVs and how efficiently they drive them.

“If you have an ICE, it emits roughly the same amount regardless of what you do, as

does any vehicle using a single source of power,” Nick Molden, Chief Executive and founder of Emissions Analytics, told *Automotive World*. “When you have a dual system, you cannot predict how those two power sources will interact until someone drives the vehicle.”

This conundrum is particularly problematic for PHEVs, Molden continued, noting that their emissions can range from nothing, if run solely on their battery, to even greater than ICE



equivalents, should the battery be totally depleted, given the extra weight on board. “The only sensible approach with PHEVs is to try to force people to charge up,” Molden added. “If you could force people to charge up at least 50%, then it is worth having them. Anything less, then it is not.”

Molden’s opinion is by no means unique. For instance, in 2020 Transport and Environment (T&E) went as far as to suggest Europe was headed toward

another Dieselgate scandal courtesy of automaker reliance on PHEVs. It argued at the time that PHEVs were essentially a “compliance trick” used to help OEMs meet ever-tightening average fleet emission targets.

Collaborating with Emissions Analytics in August 2020, the duo found that PHEVs from numerous automakers all recorded worrying gaps between their type approval emissions and real-world testing results. The worst offender was BMW’s

X5. Emissions Analytics found that in its most efficient configuration—full battery, starting in electric vehicle (EV) mode only—it produced 42.3g/km of CO₂ compared to its WLTP value of 32g/km. Driven on just its ICE, the X5 produced 384.6g/km over the same cycle.

European regulators, however, are aware of these complaints, with the European Commission considering a rejig to its evaluation process. Currently, PHEVs are emissions tested both



in charge depleting and charge sustaining modes with the vehicle's overall emissions result determined using a weighted 'utility factor' (UF). Put simply, the UF is the assumed distance share of driving completed in charge depleting mode relative to the total distance driven. Naysayers argue that it is currently set way off the mark. "Analysis of real-world PHEV usage data shows that the UF used in the type approval regulation is too high," said Jan Dornoff, a Senior Researcher at the International Council on Clean Transportation (ICCT). "This results in too low official CO2 emissions values that are not at all representative of emissions observed in the real world."

Like T&E and Emissions Analytics, ICCT has also completed studies assessing real-world PHEV emissions output, arriving at very similar conclusions. A study published in September 2020, for instance, concluded that, on average, PHEV fuel consumption and tailpipe CO2 emissions were approximately two to

four times higher than type approval values. In line with Molden's thinking, ICCT also found that the tests would benefit by better replicating how often and to what degree a typical owner recharges their vehicle.

Worth the effort?

Assuming these organisations' conclusions are accurate, regulators could perhaps be forgiven for this oversight. As Dornoff notes, the PHEV testing procedure had to be decided when there were "almost no PHEVs" on the road and thus assumptions had to be made about charging frequency. However, though he welcomes the European Commission's efforts to rejig the process, Dornoff and others still have key concerns with the proposed amendments.

One worry is the gradual introduction of a more realistic UF that is based on real-world usage data. "The starting point will be today's already too low UF that will be in place until 2024 and

then a linear transition to a revised UF over a number of years,” said Dornoff. He added that this ‘number of years’ has not been defined in the Commission’s proposal.

Molden has even greater concerns. While ICCT’s Dornoff is optimistic that the amendment could eventually result in more accurate CO2 emission measurements for PHEVs, Molden believes the Commission’s efforts could be better spent elsewhere. “It’s a waste of time,” he said. “They may argue that we now have real-world data from in-built telematics, but even if changes are based on that data it would be better to not use it for labelling but rather to change owner behaviour to provide a direct incentive to charge up.”

He’s also concerned that changes to how PHEV results are determined and displayed could confuse consumers. “You have to be very careful when you change how things are labelled,” Molden said. “People often question whether they should buy a new or used vehicle or a one-year-old vehicle versus a three-year-old vehicle. If they suddenly find that the labelling changed two years ago then there’s no way to compare.” He ultimately doubts that the Commission’s proposed amendment will come to fruition: “You do not want to fiddle around with the label without a very good reason. It would be a lot of trauma for not a lot of outcome. They might be saying that they are looking at it, but whether anything is going to happen I somewhat doubt.”

Time is ticking

As for the future of PHEVs, the outlook is that this stepping stone technology may be on the out anyway, with some

automakers already starting to wean themselves off PHEVs. Mercedes-Benz, for instance, announced in September 2021 that it is preparing to end PHEV development in 2025 to fully focus instead on pure battery vehicles. It confirmed at IAA 2021 that it will not dedicate any further funding for PHEV development too.

“

Analysis of real-world PHEV usage data shows that the UF used in the type approval regulation is too high. This results in too low official CO2 emissions values that are not at all representative of emissions observed in the real world

Despite the concerns, it is worth remembering that PHEVs are not automatically a flawed technology in every instance. Molden, himself a PHEV owner, notes that should these vehicles be regularly fully charged they can get at least close to the current emissions figures advertised. However, he still projects a difficult future for the tech. “PHEVs are likely to become a niche technology in the medium to long term,” he said. “The market will split primarily between BEVs and full, non-plug in, hybrids.”



Could Russian sanctions improve European auto manufacturing?

With European automakers weaning their dependency away from Russian resources, the new vehicle market could see unanticipated technical innovation. By Christopher Dyer

The impact of Russian sanctions on the European automotive industry continues to grow.

Manufacturers with a strong presence in the region are already struggling to cope with the low availability of parts, as import-export rates squeeze Russia's material supply and inflate component costs. The conflict has damaged manufacturers' confidence not only in the Russian automotive industry but also in the industry's capacity to produce and export vehicles efficiently.

For instance, Volkswagen Group's plants in Kaluga and Nizhny Novgorod are shutting down production until further notice, despite investing €1bn (US\$1.097bn) into development since 2007. Renault is also reportedly looking to transfer ownership of AvtoVAZ, which produces Lada vehicles, to a local investor despite the recent reiteration of reinforced cooperation across the Renault Dacia sub-brand. At the same time, Stellantis has also ceased production of light goods vehicles, such as the Peugeot Expert at its Kaluga plant, citing supply problems.

Since Europe is one of its largest export markets, sanctions have prevented Russia from selling materials like steel, palladium—a metal used in catalytic converters—and aluminium to manufacturers. Igor Korovkin, Executive Director of the Association of Russian Automakers, comments that this could precipitate a rapid transition for European manufacturers, impacting material and component availability, as well as overall vehicle costs. He suggests that “the sanctions will have an impact primarily on the market for passenger vehicles, leading to a limited number of vehicles available for sale and



Volkswagen's plants in Russia are ceasing production until further notice, despite €1bn of investment since 2007

disrupting the number of model choices.” He adds that “with some delay, the market gap can be filled by Asian manufacturers which are actively promoting the development of vehicle production in many countries across the Euro-Asian Economic Union,” but cautions that the transition is likely to be a long-term process.

Precious metal problems

European manufacturers are shifting away from Russian material use, as more sanctions are limiting the viability and availability of exported material for automotive manufacturing. Germany, for instance, is one of Russia's largest aluminium and steel customers in Europe placing US\$355m worth of orders annually on average, roughly 29% of the country's export, according to the International Trade Administration. However, since the conflict began in February 2022, Chancellor Olaf Schulz has ordered an embargo on all Russian steel. This approach is being replicated by other European countries to protect their domestic manufacturing industries

while also attempting to reduce the value of Russian materials. A McKinsey study suggests that inhibiting Russia's ability to trade with the automotive industry is fuelling fears of a global shortage of precious metals integral to vehicle manufacturing, such as steel and palladium, 38% of which globally is produced in Russia.

Korovkin says this is debilitating production capacity for new and existing models of vehicles assembled in Russia, increasing waitlists and model shortages as a result. This is also "precipitating a price rise within the whole European vehicle production value chain, contributing further to rising vehicle costs for consumers." He continues, saying that "the only certainty facing the European sector is that a cutback in production by companies such as Volkswagen, Mercedes, and to an extent Stellantis will limit their European value as more consumers struggle to purchase and take collection of their new vehicles." Looking forward, Korovkin anticipates that supply chains will remain disrupted through 2030, as more manufacturers struggle to retain productive output. He also expects that production facilities will see a shift towards "a low-level—less than 50%—of localisation of automotive component production," across Europe and Russia.

Component uncertainty

Russian sanctions are also likely to affect component availability for new vehicle manufacturing. While Russia does not have a large domestic microchip industry, it retains a close partnership with Chinese suppliers and Taiwan's TSMC. Korovkin

comments that "as European manufacturers shift towards Asiatic countries such as China and India for components, new vehicle markets could see a deeper presence being developed by native Chinese suppliers," bringing with it an influx of new technology into the European automotive industry.

Korovkin warns, however, that as China holds a monopoly over chip and circuit board manufacturing, manufacturers could soon occupy a vulnerable position within the conflict. "If the West places more sanctions on Russian suppliers, dependency rests on Chinese material and component producers." He anticipates that this could provoke China to cut off Western manufacturers from Chinese component imports as a response. This could mean that new passenger vehicle markets may see a rise in vehicles with more limited features. Component shortages could also shift Europe's automotive industry towards more software-based architectures, replacing microchips with software and system-on-a-chip solutions. American companies already providing this service, such as Sonatus, are seeing the trend grow with companies like Hyundai taking this approach to mitigate the effect of the ongoing chip shortages.

Fuel sanctions

Another area Russian sanctions have hit hardest has been the soaring price of oil and gas, leading to rising gasoline and diesel fuel prices and a greater awareness by the European Union of its dependency on Russian fossil fuels. "The conflict has enhanced interest in hydrogen and electric vehicles (EVs) as more drivers look to mitigate the impact of rising



The invasion has also meant soaring gasoline and diesel fuel prices in Europe

fuel costs on their budgets,” says Sam Akehurst, Professor and Deputy Academic Director at the Institute of Advanced Automotive Propulsions Systems at the University of Bath, UK. He comments that while the conflict has increased costs and the difficulty of extracting precious metals for battery manufacturing in Europe, “it’s also enhanced the viability of an EV.”

He suggests that the rising cost of fuel is signalling not only to consumers “but to manufacturers also that EVs and hydrogen fuel cell vehicles remain a more reliable and increasingly profitable market, despite some component and material shortages.” He also says that as European manufacturers wean dependency away from Russian fuels, “more suppliers and manufacturers are likely to invest what would have been spent on Russian resources into alternative fuels.” A 2022 study by LMC Automotive confirms that consumer trends of EV and hydrogen vehicle adoption could be accelerated by the fuel and component crisis, driving more automakers to offer new

alternatively fuelled vehicles. However, the study also reinforces Korovkin’s suggestion that a rapid departure from Russian resources could further contribute to the European automotive industry’s current shortages.

Next steps

The future of the European automotive industry remains in the balance. In the short term, sanctions are forcing manufacturers to reconsider their vehicle ranges and capabilities of producing high-end luxury models to scale. In the long-term, however, automakers are shifting their focus away from Eastern European investment and back towards an Asia-facing supply chain that could facilitate a more rapid advancement towards enhanced technical integration into vehicle architectures. Despite this, costs could increase, meaning the new vehicle market could face a downturn in revenue as more manufacturers suffer component and material shortages.

Silicon nanowires a ‘breakthrough’ for electric future, says Karl-Thomas Neumann

When a long-time industry veteran throws his weight behind a start-up, it’s worth looking into, writes Megan Lampinen

California-based start-up OneD Battery Sciences is powering ahead with its potentially revolutionary SINANODE platform for electric vehicle (EV) batteries. This collection of technologies is used to produce silicon nanowires fused directly onto the commercial graphite particles found in the anodes of EV batteries. The impact: potentially tripling the energy density of a battery’s anode while halving its cost per kWh. The higher energy density increases battery range while nanowires shorten

charging time, both key metrics in EV uptake and acceptance.

Technical challenges have so far limited silicon’s use, with only modest improvements in battery performance realised. The ability to efficiently add larger amounts of silicon could be game-changing.

Over the last three years, graphite suppliers, cell makers, and EV manufacturers have been testing SINANODE with commercial EV-grade graphite in anodes. Most recently,

OneD began the construction of its first pilot plant, located in Moses Lake, Washington. This plant will be equipped to enable various makers of EVs to customise and optimise silicon-graphite anodes for use in their upcoming batteries using the SINANODE technology process.

To help steer the scale-up is automotive industry veteran Karl-Thomas Neumann, who joined the board of directors in March 2022. He brings with him more than 30 years of industry experiencing, including leading positions with Volkswagen AG, Opel, Continental and Polestar. Neumann has seen first-hand what industry incumbents need to realise their future mobility visions, and has been working closely with several deep technology start-ups in the areas of AI, software and semiconductors. With OneD, his contribution could help usher in the era of electric mobility.

After decades with leading industry giants, what drew you to the start-up scene?

Automakers are making large investments in the next generation of batteries and solid-state technology. However, players in the EV race are confronted with unprecedented challenges. While it's never been more crucial for consumers to purchase EVs, automakers have been faced with supply chain disruption and have struggled to produce fast-charging EVs at a low cost. I felt it was crucial to leverage my automotive experience by joining as a board member to



Silicon nanowires are electrical wires orders of magnitude smaller than human hair



key automotive players to drive forward the mass consumer adoption of EVs.

What attracted you to OneD Battery Sciences?

I've always been selective and forthcoming about the companies I join. I did more due diligence before signing on to this board because this was not a topic in which I was as well-versed, but I recognised its intended impact. Battery technology will be the great differentiator in winning the EV race. After six months of due diligence, I knew joining OneD's board was the right move as it is a process that can be enabled now versus focusing on a technology that's too advanced and far away.

What's the significance of its SINANODE platform?

SINANODE is a manufacturing step that simplifies the process of using silicon technology to meet the market demand for more efficient and cost-effective EV batteries. OneD effectively does this by using silicon nanowires to supercharge graphite

coating which in turn, offers a scalable business model by utilising the existing EV supply chain process. I've seen an array of manufacturing processes used, but none compare to what OneD's SINANODE platform achieves in directly addressing drivers' needs. It is a truly unique way to empower key customers to take control of their EV technology roadmap and drive adoption in their supply chain.

What do you hope to contribute to the company?

Battery technology is what the combustion chamber used to be: it is the great differentiator for OEMs today and well into the future. I wanted to work closely with OneD's leadership and help guide the company's transition from pilot- to large-scale production, providing automakers the technologies needed to meet consumer demands for the next generation EV experience: longer range, faster charging and lower cost. With more than 30 years of automotive industry experience, I hope to share my vision for the future of EVs with OneD and leverage my

experience with OEMs' global supply chains.

How does this approach to improved EV battery technology compare to other innovators at work today?

OneD has created the only manufacturing process that simplifies the process of using silicon technology to create more efficient and cost-effective EV batteries. But more than that, it's a technology that will adapt to a current manufacturing process

effectively adding just the right amount of silicon into EV batteries with its SINANODE platform.

Pilot programmes are kicking off next. What will be involved in this stage?

Each SINANODE pilot uses one CVD machine, which will produce up to 340mWh per year at a variable cost of about US\$1.20/kWh, and has the capacity to deliver pre-production annual capacity of batteries for up to

“

Battery technology is what the combustion chamber used to be: it is the great differentiator for OEMs

and can be enabled today; it's not an investment into technology in the future that will need to be tested, piloted, and scaled before it can make a true impact.

How disruptive is it to current EV battery strategies and investments?

SINANODE stands out for its ability to be a value-add to current supply chain processes in place with automakers. While silicon has been seen as a highly engineered expensive material, OneD has found the solution for breaking this cost barrier and

3,400 EVs. Testing is underway and I and OneD are very excited to share results when the time comes.

Could this technology prove a game-changer for the industry?

Definitely. The SINANODE platform is the breakthrough technology needed to produce competitive EVs that meet market demand for high performance. It is the one Silicon Valley company that will provide leading EV makers with the necessary silicon technology to compete and meet the market demand for better and less expensive EV batteries.



CASE evolution complicates mobility M&A

Potential deal makers need to be asking a new set of questions as they scout the market for merger and acquisition opportunities.

By Megan Lampinen

Mobility players are facing growing pressure to evolve in new directions, adapt new technologies, and deliver new products and services. To do so, many are seeking to bring in outside skillsets and assets through mergers and acquisitions (M&A), and activity in this space is heating up.

Global consulting firm Charles River Associates (CRA) estimates that 2021 was the most active year on record in terms of M&A within the mobility sector. “It is white hot right now,” says Enrique Glotzer, Principal at CRA. “There is so much activity going on.”

That has been driven by several factors, including changes in consumer behaviour and preferences, tighter government emissions regulations and incentives around zero-emission technologies. The shift to electric mobility has had a particularly strong influence on behaviour, with considerable focus on electric vehicle (EV) batteries and charging infrastructure.

The move to more automation in general, as well as connectivity between equipment and IoT devices, are other hot spots of M&A, as is shared mobility. Within this latter market there has been notable attention around the various platforms that connect users of transport and transport vectors. Serious money is being invested here. In early March, Berlin-based micromobility operator Tier Mobility acquired Ford's Spin business, and with it Spin's 50,000 e-scooters and e-bikes. The terms of the deal were not disclosed, but Ford paid US\$100m for Spin back in 2018.

Complications

While M&A activity levels are increasing, the deals are simultaneously becoming more complicated. That's due to the scope of the change underway. Because the ecosystem is evolving so quickly, it becomes more difficult to set a value on any one asset. "When it comes to due diligence exercises and trying to put a value on a business, you just can't use the old assumptions anymore," explains Glotzer. "What worked a few years ago has to be changed."

He recently ran into this situation himself while performing a due diligence exercise around a fuels pipeline, one that would transport



Tier Mobility recently acquired Spin from Ford

liquid fuels like diesel, gasoline, and kerosene. Traditionally, value would be based on a set of assumptions on demographics, population growth, vehicle penetration, etc. In this case, the companies involved could not use that model because they saw that EV adoption was increasing at an exponential rate. They asked CRA to look into aspects such as where the country stood in the adoption of EVs, how could that speed up over time and the potential impact of that on the value of this pipeline.



Self-driving start-up Voyage was acquired by Cruise last year

That's what Glotzer and his team did. The rough conclusion: the price it sold for was much lower than originally expected. The same will hold true for numerous other businesses tied in to new mobility trends like EVs. "If you go in with the old assumptions you might end up overpaying for something, or you may not correctly price in all the potential value and you under price it," Glotzer tells *Automotive World*.

Other considerations

Potential acquirers also must ask where a particular asset sits in the value chain and the economics of that link of the value chain. Take EV batteries, for instance. That chain stretches from mining the lithium or nickel through to the battery chemistry, its manufacturing and down to the automaker assembly. "You must understand where the value is, and whether there is value to integrating assets or keeping them apart," he notes. That could vary by region. In some places it will make sense to buy into one area of the value chain and expand out; in others it will not.

And along with the value chain integration or fragmentation, there are also issues around resilience: where value chains may be at risk. Understanding that will be very important, especially given the current volatility around war in the Ukraine.

New business models can also be hard to accurately value, and prospective buyers must understand the underlying economics of the business. EV charging is one example. This has attracted considerable M&A activity, with many buyers looking at not enough targets. "It tends to have high valuations even though the economics may be challenging in certain markets," notes Glotzer. While the EV market is projected to grow quickly, utilisation rates of charging stations could be very low. "If you spend thousands of dollars on a charging station and it only gets used 5% of the time, you're never going to get that money back," he emphasises.

At the moment, Glotzer believes quite a few of the valuations coming out of the market are "a bit high," partially because of the supply-demand imbalance but also the know-how gap. "Many investors and automotive

manufacturers have been caught off guard by the speed of the EV transition,” he says. “Five years back, nobody was talking about EVs other than Tesla, and now every manufacturer is basically completely doing a 180. That has created a big gap in what companies can do or have in terms of capabilities and resources.” Most are now looking to buy that in order to catch up. With such an imbalance, valuations are understandably high.

Uncertainty

With all these considerations, mobility M&A deals and the due diligence they demand have become more complicated. Ten years ago, if Ford wanted to buy Renault, it was pretty straight forward. The key questions would be around the synergies, the growth outlook, factors that could prove an upside in value, etc. Now things are not so clear. “Some of the manufacturers that are leading today may not be leading in a few years if they can’t get their capabilities and plans in place, if they cannot get their hands on enough batteries, and so forth,” he cautions. “There is considerably more uncertainty and many more factors to consider.”

As well as the technology outlook, prospective M&A players need to consider changing consumer preferences, value chain resilience, supply chain risk, regulatory developments and incentives. It is a risky business, but also a potentially lucrative one. “There will be a huge change in how people move,” Glotzer predicts. “In the next 20 years, every car will switch from diesel or gasoline to electric. Meanwhile, automation will unlock numerous opportunities

for companies.” Autonomous driving will also usher in massive change in the market.

Advice and outlook

Given all this risk and uncertainty, Glotzer has some advice for investors, including comparing different markets. For example, with EVs he suggests players look at those regions that are further ahead in terms of EV penetration and see what has worked there and what hasn’t. It’s also important to keep an eye on the macro drivers, one of which is regulation. In Europe, that means the Fit for 55 initiative and what it could herald for emission taxes and carbon prices. The flip side to that is the incentives; some countries offer hefty sweeteners on EV sales while others offer none. “If you include big incentives you’re going to have overnight growth in those markets,” he says.

All things considered, mobility-related M&A should remain strong over the next few years. Numerous incumbents are still playing catch-up on CASE trends and the supply chain is poised for considerable turbulence. New battery technologies are looming on the horizon, which could really shake things up.

For mobility companies, the aim is to ensure they don’t miss out on opportunities but that they also don’t overpay on their bets. There’s plenty to lose, but also plenty to gain. “The risk is the biggest for the more traditional players,” he says. “Some of them will make it through, some of them won’t, and there will be new companies emerging. Twenty years ago, Apple was nothing compared to what it is today. Who knows what it’s going to be in the future?”

Stellantis targets ambitious connected software growth

The automaker is aiming to generate as much as €20bn in revenue through its software technologies. By Jack Hunsley

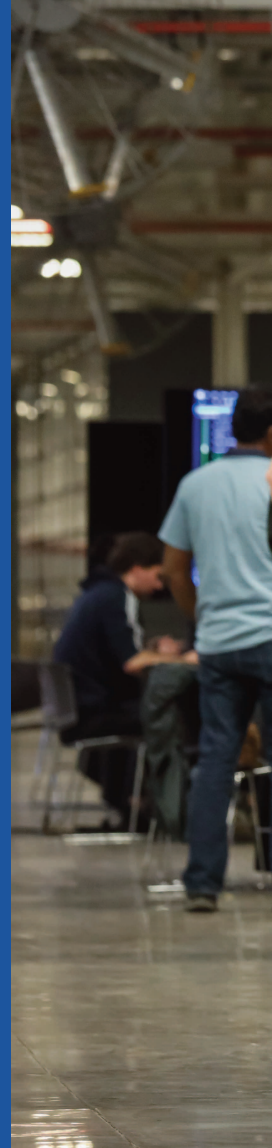
Though exact job titles vary from company-to-company, the typical set of automotive C-suite roles has remained practically the same since the industry's inception. The fact that Stellantis opted to add a Chief Software Officer to its ranks in 2021 only further underlines the growing importance of connectivity in today's industry. Yves Bonnefont has now been in this role for 16 months, joining Stellantis' top employee echelon after serving seven years as Chief Executive of DS Automobiles. During this period, he has already played a key role in moulding the automaker's software strategy.

Speaking to media during an April 2022 roundtable, Bonnefont touched on Stellantis' growing connectivity ambitions. "The industry is

undergoing a tremendous pace of transformation and we at Stellantis want to lead that," he said. "This is why as part of our Dare Forward 2030 plan we decided to transform Stellantis into an automotive tech company." This plan leans on four key pillars: electrification, software, autonomous driving and Stellantis' tech venture fund, which has dedicated €300m (US\$323m) to make selective tech-based acquisitions.

Connected foundation

Stellantis already has a solid connected foundation from which to start, with 12 million connected vehicles worldwide already on the road. As Bonnefont added though, the aim is to keep pushing, and there





will be several key metrics to judge how successfully the OEM can achieve its goals.

“

The industry is undergoing a tremendous pace of transformation and we at Stellantis want to lead that

For example, Bonnefont said that Stellantis expects to have 34 million connected vehicles operating by 2030.

The aim is also to be rolling out as many as 400 million over-the-air (OTA) updates by this date to its car parc annually, up from the 12 million updates Stellantis deployed in 2021. “This strategy of always keeping our products fresh and up to date by introducing new features for our drivers is at the centre of everything we do,” he added. “This is enabled by the software architecture of the vehicle and its connectivity.”

Stellantis is considering offering an array of revenue-generating avenues on this front. These include subscription services based around concepts such as connected navigation, electric vehicle charging, fleet management and driving monitoring. Features will also be made available to purchase permanently



Yves Bonnefont,
Chief Software Officer, Stellantis

with Bonnefont stressing his desire to allow users flexibility in what they can access via their vehicle. “We want our customers to upgrade their vehicle with new features either permanently or for specific periods,” he said, noting, in particular, the potential for second-hand buyers to enable features that original owners might never have touched.

There are also ambitions to make better use of customer and vehicle data to mould Stellantis’ future connectivity strategy to best cater to evolving customer demands. “Data is the fuel for AI and as we develop new features we want to make sure we get the fuel we need for that,” said Bonnefont. AI will also be able to understand and adapt the in-vehicle experience depending on the current situation. “Our smart cockpit will be able to understand the context in

which you’re using the car, such as whether you’re alone in the car or with friends or are you on a weekend trip or are you driving to the office?” said Bonnefont. “Based on this, it will be able to customise your human machine interface.”

Hurdles

Despite Stellantis’ ambitions, the OEM understands that transitioning in such a way is no easy task. To allow for this shift, Bonnefont noted how Stellantis is aiming to upskill 1,000 of its existing employees every year. These ranks will also be bolstered by an “intensive stream of external hiring” from industries including gaming, semiconductors and the general technology sector. “It is all about capability-building and bringing new features for our customers and ultimately generating growth for Stellantis,” he added.

This is unlikely to be enough, however, and thus why Stellantis is also wanting to partner with strategic collaborators. The latest in this vein is Qualcomm, which it will lean on to help enable its vast connected plans. As the duo detailed at the roundtable, their partnership will see Qualcomm’s Snapdragon tech deployed in millions of vehicles across Stellantis’ 14 brands, with these chips to be used for a variety of use cases ranging from telematics to 5G-enabled functionality.

“This will ultimately better meet the needs of our customers’ lifestyles through safe, personalised, and always-connected features,” said



Stellantis has embarked on an ambitious software strategy

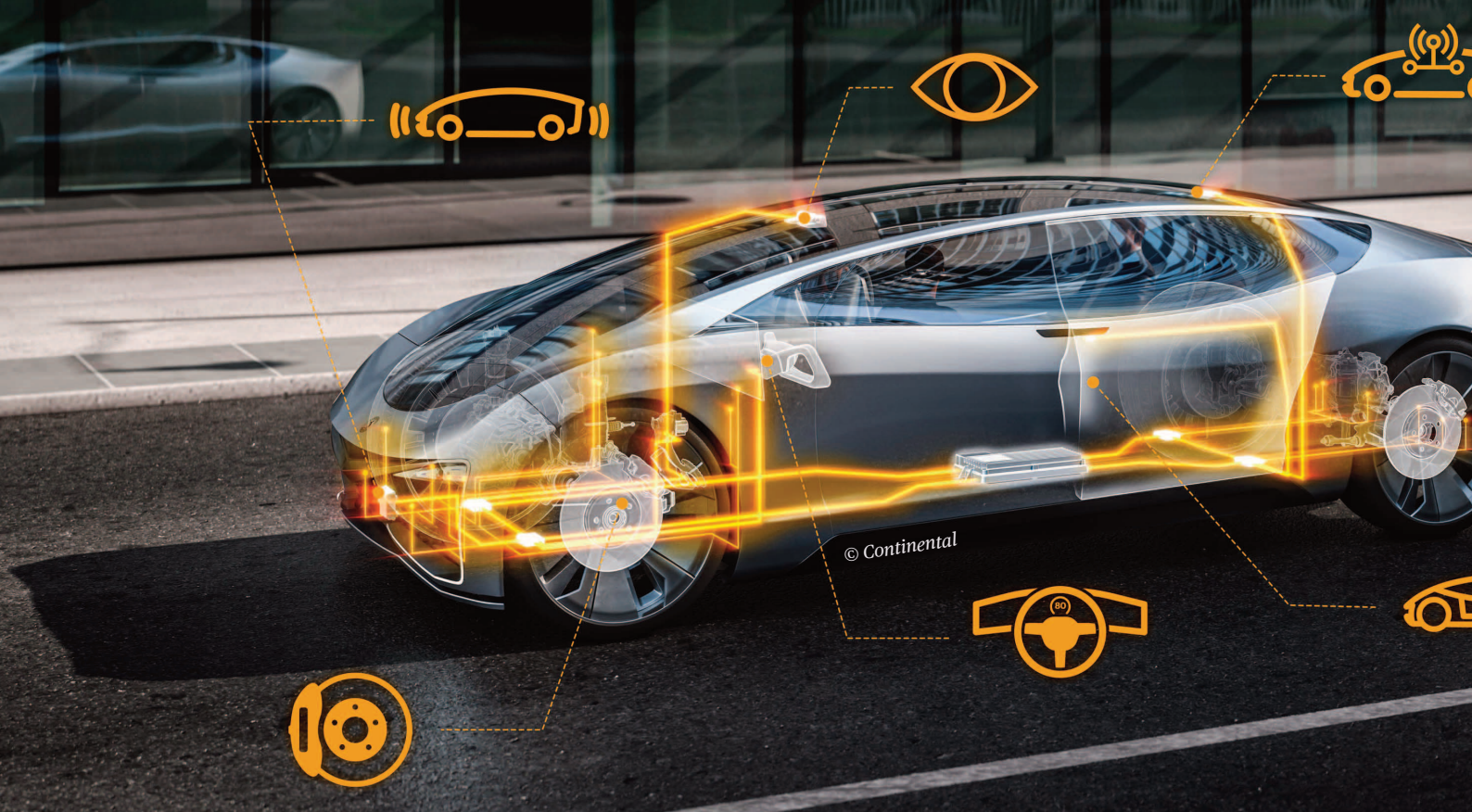
Carlos Tavares, Stellantis Chief Executive, on the announcement. He added that Qualcomm's help will allow Stellantis "to vertically integrate key elements of our new platforms and more closely manage the complete electronics supply chain to provide access to the best technologies" and to "enable the fulfilment of Stellantis' volume potential."

"We consider this collaboration a big milestone for us," added Enrico Salvatori, Senior Vice President and President of Qualcomm Europe. He also noted his belief that Stellantis stands as a particularly valuable partner given the automaker's understanding of Qualcomm's own technology roadmap and the changing connectivity demands of automotive users.

Ultimate flexibility

The next step in Stellantis' connected roadmap appears to centre heavily around OTA updates. On this front, the automaker has huge ambition, with Bonnefont adding that he sees a future where drivers can even remotely add enhanced autonomous driving to their vehicles.

"Let's say you buy a used car that is equipped with a Level 2 autonomous driving system," he concluded. "If you want to improve that to have more functionality and go to Level 2+ you can do that, even though those features maybe were not available when the car was initially purchased. This is a whole new world of possibilities for cars."



Surging complexity hampers the evolution of in-vehicle networks

The underlying architecture is more complex than it has ever been. What steps can the industry take to streamline things? By Freddie Holmes



The network of cables, computers and sensors inside a modern vehicle have allowed automakers to offer unrivalled levels of performance and functionality. The move has not been without its challenges, with new demands in terms of processing power, packaging and security. The industry is taking steps to reduce the amount of hardware under the skin of the car, but it may take time for the surge in complexity to abate.

Simon Schnurrer is a Partner in Oliver Wyman's Automotive practice who has a background in automotive electrical/electronic (E/E) architectures. Speaking to *Automotive World*, he explained how different parts of the vehicle communicate today, and how changes to the in-vehicle network will be reshaped by the emergence of over-the-air updates, autonomous driving and electric powertrains.

How would you describe the current in-vehicle network?

Many vehicle functions nowadays are the result of several electronic control units (ECUs) working together and exchanging data. The amount of data being exchanged across this network has exploded and is fundamentally higher than it used to be. At a very generic level, you have sensors, ECUs and actuators. All three elements of the E/E architecture must communicate.

For example, let's say the adaptive cruise control (ACC) receives information from the car's sensors that it is close to the vehicle in front. It then tells the engine's ECU to reduce the throttle and notifies the braking system to slow down. It also needs to send a signal to activate the brake lights. There is a deep interconnection between the vehicle's ECUs, and a lot of the information being distributed is safety-relevant.

What has this surge in 'data chatter' meant for the in-vehicle network?

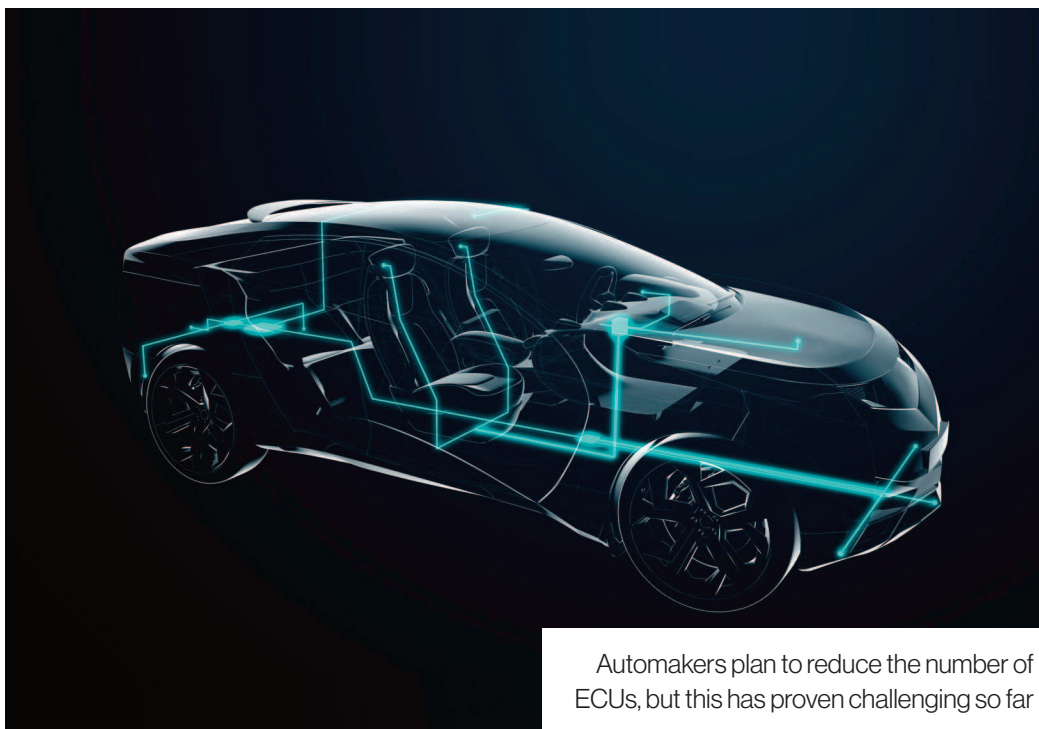
The number of ECUs has increased massively in recent years. Premium OEMs currently have around 60 to 80 ECUs per vehicle, but this number can be as high as 100 to 120. Everyone in the industry is trying to bring that number down, but in the last few years it has in fact increased as additional functions are added to vehicles. For example, there are now ECUs dealing with ambient lighting

“
It is a very interconnected operation with multiple ECUs

in the cockpit, which might also be linked to the infotainment system to sync with the driver's music choices. We see that even for these kinds of 'entertainment' functions, the automakers have had to introduce additional ECUs. In general, however, there is an overall trend toward domain controllers or supercomputers that can replace several of these older, smaller ECUs.

The push to consolidate ECUs has been going on for some time. When might we see the trend take hold?

It may take some time for the wider market, but premium OEMs are at the forefront of this movement and we can already see there is a strong



Automakers plan to reduce the number of ECUs, but this has proven challenging so far

consolidation of complexity. Tesla uses fewer ECUs on its vehicles, for example, so there is clearly a way of doing it. In two to three years' time from now, I expect the number of ECUs in most vehicles will be considerably consolidated. The cost pressure is very high, and there is a growing logic around having a high performance computer (HPC) on the vehicle that is able to provide a wide array of functionality, enabled by software when the customer wants it. However, we won't see the number of ECUs dropping from 100 down to just a handful in one cycle—it will take time.

The rise in ECUs has enabled vehicle functionality to skyrocket. However, has this created any obvious challenges in the meantime?

We do see some problems that relate to the wire harnesses, for example, which are tasked with linking all of these ECUs. Another issue with this decentralised topography of ECUs is that if you need to replace or upgrade things as the vehicle ages—or if the ECU

becomes swamped by too much data—it is difficult to bring the vehicle up to speed again. Even the OEMs that are planning for the long term with their ECUs have struggled in this regard: their ECUs often do not have enough memory to accommodate the additional functions they want to deploy via over-the-air (OTA) updates. It can be a bit of a nightmare to change even one ECU, let alone tens of ECUs.

What proportion of the in-vehicle network is wired versus wireless today?

It is hard to give an exact split, but automakers typically want to have wired networks where they can—although of course, everything beyond the vehicle has to be wireless. On-board the vehicle, automakers are trying to save on the amount of cabling needed by reducing the number of ECUs; sensor fusion is also allowing automakers to group this kind of cabling together more efficiently as 'local nodes.'



When it comes to E/E complexity, things may get worse before they get better

What concerns are there with regards to cyber security?

The purpose of the network is to exchange signals that are coming from the sensors or from the ECU to enable vehicle functions. This rarely involves just one ECU—it is a very interconnected operation with multiple ECUs. There is data that is safety-critical which is prioritised over other data, which might be around comfort or entertainment, but may still be part of the same bus system. When you open up the safety-critical parts of the network to other parts of the vehicle, that creates new levels of risk.

New ECUs, HPC and domain controllers are reshaping the in-vehicle network. What role will legacy technologies such as automotive ethernet play moving forward?

It is difficult to move away from standard technologies. The innovation cycles are different to consumer

electronics and it takes much longer. You typically have a mix of very new and very old technologies on the vehicle, which only adds complexity, to be frank.

Is the in-vehicle network currently the most complex it has ever been?

Yes, for sure. And we are not at the end of it yet. With the growing functionality that is running on these networks, the level of complexity continues to go up. The number of ECUs will eventually decrease but there is still growing complexity across the network in general. For example, you now need to integrate software coming from an array of different companies on a single ECU, which is obviously not something traditional automotive suppliers are prepared for. There must be new levels of standardisation to handle all these different layers inside the car's ECUs moving forward. EVs may bring an opportunity to reduce the overall number of ECUs, but the influx of autonomous driving will drive complexity

Aiways capitalises on EV market shakeup in European offensive

Growing electric vehicle momentum in Europe is attracting a range of new players. By Megan Lampinen

Europe is slowly heading towards an electric future. Over the past five years, sales of electrically-chargable cars in the region increased ten-fold, reaching 1.7 million units in 2021 and accounting for 18% of the total market. The trend has prompted radical model strategy revisions among industry incumbents and awakened the interest of new and overseas players.

Aiways Automobiles Company is one of the more recent arrivals in Europe and epitomises the sort of ambitious new mobility player jockeying for position. It has based its European headquarters in Munich, Germany and in 2020 became the first Chinese start-up to introduce an electric vehicle (EV) in Europe with the launch of the U5 SUV. Its European order book is now open to not only Germany but also the Netherlands, Belgium, Denmark, France, Switzerland, Spain, Portugal, Italy and Sweden. The line-up will soon expand with the introduction of the electric U6 SUV-

Coupé. Just how big an impact could this brand, and others like it, make on Europe's light vehicle market?

Ideal timing

Established in Shanghai in 2017, the Chinese automaker focuses exclusively on electric cars and its name stands for 'Artificial intelligence (AI) is on the way,' so it is certainly tapping into the prevailing megatrends. Alexander Klose, Vice President of Overseas Operations at Aiways and the man overseeing its European launch, believes the current fluctuation around the shift to electrification makes this the perfect time for a European market offensive.

"The biggest challenge in taking any car brand to Europe in the olden times was the number of competent, well-established





© Aion



© Aion

Sharing the same platform as the U5, the U6 will be a fully electric SUV coupe

competitors in the internal combustion engine (ICE) field,” he tells *Automotive World*. “That number has reduced over the last 20 years as some brands withdrew from Europe. There is now a new field open for us because we are entering the EV sector, making it a completely new game. Nobody really knows whether it’s an advantage or a disadvantage in this ecosystem if you are an established player in ICE.”

The shift to EVs clearly shakes up the established order, in many cases putting newbies on the same footing as century-old household names and EV specialists alike. “Even companies that have been around in the EV sector for ten or more years are still making changes to their cars or to the business model, which means they’re basically at the same point we are in terms of our development,” Klose emphasises.

Competition

If the playing field is—theoretically—wide open, lines of rivalry could be blurred. When Aion participated at the 2019 Geneva Motor Show, it was located opposite the hall from Audi,

which was spotlighting its e-tron model. “About half of the interviews asked us how we would compare ourselves to the e-tron,” comments Klose.

While he finds it difficult to pinpoint direct rivals, Klose believes Aion’s models are similar to the electrified models on offer from the likes of Audi and BMW. “There’s not as much of an established perception out there in the EV market as there is for ICEs. One of the reasons is because the engine isn’t determining the vehicle as much; in the past that was a major differentiator for some of these brands,” he adds. “There seems to be a general breakup of the established order in terms of brand competitors.”

EVs may not have an engine but they do have a propulsion system, and range is at the heart of their appeal for many buyers. Some players like Lucid believe that the more range the better, despite the expensive and heavy battery that requires. Others follow the philosophy that most journeys are short and that the EV should provide just the range needed for a daily commute and nothing more. Aion takes a stance in the middle ground. It

offers a 63kWh battery with a WLTP range of about 400km. “With the current network of charging stations, that’s good enough to get anywhere around Europe,” says Klose. “At the same time, it’s not too heavy so we’re much lighter than some competitors.”

By avoiding an expensive battery, Aiways can keep its prices more affordable. Its aim is to build a car that is “accessible to everybody and that can really spread the usage of EVs,” insists Klose. While the 63kWh falls in the sweet spot, it is considering offering a smaller battery at a cheaper price and a larger one for a premium.

This philosophy of accessibility also plays out in the simplicity of the line-up. The European offering consists of just one model with two trims and three colours. Klose spins this as a way to streamline the buying process so consumers can focus on the joy of driving.

Simple, profitable

The line-up may be limited today but it won’t be for long. The aim is to launch one new EV model every year. That sounds ambitious but it helps that these vehicles will be based on the same platform. “At some point we will need to have another platform just to be bigger or smaller, but at present we’re in the midsize region and we can expand up or down,” he notes.

The launch cadence is made possible in part by a simplification of powertrain options, with Klose adding: “We have one powertrain and that will be it. No talking about a 1.4 litre to a 5 litre. In the old days it was even from three cylinders up to 12 cylinders. No need for any of that.”

With this simple, affordable range, Aiways hopes to attract a wide demographic. Interest so far has come from older buyers and young families alike. “We get everyone at present,” he says. That may be due in part to the shortage of EVs as automakers struggle to turn out enough vehicles in the wake of supply chain disruptions. If buyers face long wait times at their favourite brand, they may look elsewhere including to new players like Aiways.

When it comes to the purchase process, Aiways is working with an untraditional range of ‘retail partners’. That may be a multi-brand car dealer but not necessarily. In Germany, it works with an electronics retailer. In both cases the brand can harness existing buildings, as the aim is to keep investment outlay to a minimum. EVs promise considerably lower maintenance costs, which is great for buyers but not for aftersales or the general dealer business case. “We think the whole distribution model will change; exactly how it does we don’t know. We put a big focus on not having any of our local partners invest too much into brick and mortar,” says Klose.

Making a sale is one thing; making money on an affordable range of EVs is another. Analysts have warned that the hefty investment involved in this segment could mean that automakers face a ‘profit desert’ initially. Klose, however, is confident there is a solid business case here. “We have designed and built this vehicle to be electric and that gives us a certain advantage over other brands. We focused the cost to be exactly what we needed.” He concedes that the battery remains a cost challenge but hopes that will gradually decline over the coming years. “EVs will be a business where you will be able to make money as well as you did on the ICE side,” he insists.



EV profit relies on more than just sales

From charging and digital services to collaboration and manufacturing gains, there are plenty of levers that could increase EV profitability. By Jack Hunsley



The automotive industry is a lucrative business for many stakeholders, with multi-million-dollar deals and valuations regularly grabbing headlines. However, the seismic shift from a century's worth of internal combustion engine (ICE) dominance into an industry more heavily influenced by electric vehicles (EVs) has changed the financial status quo. All major automakers and their associated suppliers are now being asked to prepare to abandon their ICE expertise and instead turn a profit in an electrified industry.

Some players are thriving in this challenge, and none more so than Tesla. In April 2022, the EV pioneer reported another record quarter, posting a staggering US\$18.8bn in revenue, up 81% year-on-year. [Not bad for a company that as recently as 2019 appeared to be at the mercy of Wall Street](#). Though legacy automakers are working quickly to release competing models and services, there is some way to go for these stakeholders to be posting such successful quarterly results based on a solely electric portfolio.

Balancing act

A key issue for these players so far has been the use of previously ICE-bespoke platforms for their first generation EVs, a situation necessitated by the need to meet urgent average fleet emissions targets. As Pedro Pacheco, Senior Research Director at Gartner, told *Automotive World*, this approach “has hindered the performance and, hence, commercial success” of legacy players. Though practically all such automakers are preparing to release EV-bespoke platforms in the next few years, Pacheco believes they will still “need time to break even.”

Another issue, elevated by the pandemic and the semiconductor shortage, has come from the supply chain. “Other automakers are struggling compared to Tesla, as reflected in the common practice of either raising their prices or shutting down EV production in the face of restricted microchip supply,” said Karl Brauer, Executive Analyst at CarExpert.com. He also noted that elevated costs for raw battery materials such as lithium, nickel and palladium are also squeezing already thin EV profit margins. “Tesla is showing a strong profit, but it benefits from having more control over its supply chain and a wealthy customer base willing to pay Tesla’s high prices,” he added.

These supply issues tie into another automaker conundrum: the continued profitability of their ICE portfolio. As Brauer noted, traditional automakers “are struggling with how much to invest in traditional vehicles, which offer higher profits and are less microchip dependent, versus investing in EVs.” Though eventually the tide will turn, thanks to more restrictive ICE legislation and further improvements in EV supply and component cost, few players are yet able to take advantage of the lower long-term cost benefits EVs are expected to yield. “EVs have fewer moving parts and should be less expensive to produce and service after they are sold, but those opportunities depend on efficient production, stable raw material costs and sufficient sales to amortise the cost,” said Brauer. “With the exception of Tesla, most automakers are not yet benefiting from these advantages.”

Pacheco also highlighted the strong risk aversion among legacy OEMs. “Many insist on being in both camps at the same time and that is only

slowing them down in comparison to pure players like Tesla,” he said.

“However, automakers who go full-out on the BEV formula with a fully dedicated platform and technology can leverage several cost-cutting opportunities. An EV powertrain is much simpler than an ICE and its assembly can be almost fully automated.”

Potential levers

It is not all doom and gloom, however. There are some potential levers players could pull to eke out a profit for their electrified products in the near term while overall costs reduce. Pacheco and Siraj, for instance, pointed towards EV charging. “I believe there is still much to explore in terms of

“

Tesla is showing a strong profit, but it benefits from having more control over its supply chain and a wealthy customer base willing to pay Tesla’s high prices

However, moving aggressively in this EV-only direction is no guarantee of success, as underlined by the struggles of other EV-bespoke start-ups. “Even start-ups like Rivian who are technology forward are yet to mass-produce vehicles, and recent supply chain issues could mean this is still several years away,” said Anila Siraj, Managing Director, Alternative Fuels at consultancy Kalibrate. Profitability, she said, hinges significantly on scaling up. For instance, Siraj praised Volkswagen’s efforts, stating that the automaker is “hot on the heels” of Tesla. “It plans to launch 70 new EV models by 2028 and spend US\$34bn, as well as manufacturing an EV or hybrid version of every vehicle in its line-up, anticipating that the bigger scale will bring better margins and better customer demand.”

digital services aimed at improving the overall EV user experience, which is still rather clunky,” said Pacheco. “Automakers with greater vision will be able to deliver energy services that enhance the profitability they can extract from EVs.”

Siraj went a step further, stating that building an effective and accessible charging infrastructure is vital for encouraging more potential EV buyers to make the switch. “We found that 27% of prospective EV consumers are concerned about charging complexity and range anxiety,” she said. “Without the charging infrastructure in place that can match current and future adoption rates, growth could stall for traditional OEMs and EV start-ups.” She added that the automotive industry must collaborate closely with businesses and governments to lay



© Tesla

Tesla has achieved unprecedented success with a solely electric portfolio, but can others follow suit?

sufficient charging foundations: “While having enough EV chargers is critical, ensuring charging locations are easily available, functional and in the right place presents a much bigger hurdle to overcome.”

Back on the vehicle itself, there are hopes that battery improvements will provide cost and performance gains. Though battery costs remain high, there has been undoubted progress over the last decade. According to BloombergNEF research, since 2010 battery prices have fallen from US\$1,200 per kilowatt-hour (kWh) to US\$137kWh in 2020, making EVs more affordable for many consumers.

In addition, Brauer suggested that adopting new battery technologies, such as solid-state, could further improve the cost equation. “That’s not really a low-hanging fruit, or it would have already happened, but there’s a strong push to streamline and improve battery technology, and it will likely happen eventually,” he said. He also believes that pairing EVs with self-driving technology will also eventually create more attractive products for consumers, though he added that this also “won’t happen soon.”

There is also potential in offering in-vehicle digital services within new EVs, an approach again pioneered by Tesla. “Tesla’s success in turning profit has been driven by its ability to manufacture a vehicle that is a techie’s dream,” said Siraj. “With over-the-air software updates, streaming and subscription services and full self-driving the EV giant has built a software solution within a vehicle and created a loyal customer base that continues to grow.”

As for when EVs can become profitable consistently, the consensus is that players will start to see stable rewards towards the latter half of this decade. “As battery costs come down, economies of scale are realised in the production process, governments continue to adopt legislation to push forward the EV agenda and adoption increases, EVs will move towards price and cost parity and the tipping point becomes real,” said Siraj. “There are obvious risks associated with many of these factors that could delay or stall this tipping point. A successful and profitable transition towards an EV future relies on many more sectors and organisations coming together over the next few years.”

SOLVING THE GREATEST TECHNOLOGY CHALLENGE OF OUR TIME

New 3D interactive experience from Dell Technologies shows us what our Connected and Autonomous Future will look like, and how to get there.

Explore the 3D
interactive experience at
Dell.to/Automotive

DELLTechnologies



‘Edge as a service’ to play vital role in automotive

Where does connected vehicle data go, and how can its lifecycle be managed? Freddie Holmes speaks with Dell to find out

A single connected vehicle will produce and share a fair amount of data as it roams through a smart city. As vehicles add more features and become more autonomous, the amount of data created by each vehicle will increase significantly. Where that data goes, what it is used for and how long it persists varies by application, but one thing is clear: data lifecycle management is becoming increasingly important for the automotive industry, and how this service is consumed will be vital.

New vehicles are already highly connected today but are set to become even smarter in coming years, boosting the amount of data being created and consumed. At the same time,

cities are being outfitted with 5G cell towers, sensors inside of multi-access edge computing (MEC) units, roadside units (RSUs) and compute and storage servers to help enable the communication between a large number of disparate devices and workloads. For cars to speak with the city and vice versa, data must be shared rapidly, reliably and often in high volumes. As such, edge computing has become a hot topic for the automotive industry and those working on smart cities.

Scaling infrastructure

Edge servers allow data that is gathered from different connected devices around the city

to be processed more closely than if the server was in the cloud, for example. Upload and download speeds and latencies are greatly improved by having a local edge server, and this will become invaluable in coming years as more smart vehicles hit the road. Autonomous vehicles (AVs) will push data demands even higher.

In today’s automotive industry, edge computing is used primarily in a controlled test and development environment outside of a primary data centre. As more connected vehicles hit public roads, [the role of edge computing will skyrocket](#).

“When we start to talk about these vehicles being released into production, that’s when the edge gets very large, very

quickly,” explained James Singer, a Technologist in the Infrastructure Solutions Group at Dell Technologies.

“Edge Infrastructure is required to send data to where it needs to go; today, much of it goes to the cloud or on-premises data centres. Because of the expected volumes of data, there will be many use cases that will need to be processed on the edge.”

For example, there may not be enough time or bandwidth to send lumps of data to a data centre or to the cloud for it to be cleaned, tagged, trained and sent back to the car in the form of an over the air (OTA) update. “There will need to be some kind of edge compute where data can be sent to servers that are close to where the vehicle resides,” explains Singer. “That kind of infrastructure doesn’t exist at scale yet, but it will as the industry continues to improve vehicle functionality.”

An important question the automotive industry may ask or is already asking, says Singer, is how the data gets from the vehicle to the cloud or to a hosted data centre. The industry is also trying to flesh out who will guarantee that the data makes it to its final destination securely, as well as who gets to see the data once it leaves the car. Then there is the question of whether the data persists on an edge server or if all data must be sent to one location. “Since the data is mobile and disaggregated, how will the data be gathered and find its way home?” asks Singer. “Will automakers or Tier 1/Tier 2 suppliers be required to build out their own edge compute, networking and storage? These are all valid questions.”

Edge as a Service

Questions such as these centre around one key consideration: how will the automotive industry consume edge computing? Dell believes that Edge as a Service (EaaS) is the answer and is

currently investigating what is required to make this vision a reality.

The idea is that EaaS will allow automakers to leverage the skills and resources of end-to-end edge infrastructure providers. In effect, it will provide a turnkey edge solution for automakers as they look to bring new connected and autonomous features to the mass market. It follows similar trends around Software as a Service (SaaS) and Platform as a Service (PaaS), which have both accelerated the industry’s move toward digitalisation.

Dell’s technologists and engineers are investigating numerous variables that will influence how EaaS is offered. These include everything from environmental factors such as power and cooling requirements to physical and data security, how the compute and storage will be serviced, and whether certain data will persist at one particular location or eventually make it back to the cloud. “There are many unknowns about how data will flow in the automotive pipeline,” Singer emphasises. “But one thing is for certain, the automotive industry will consume compute and storage functionality as a service.”

Car, edge, cloud

In theory, this mobility sensor data will be put to good use, but as Singer explains, it is about prioritising what data leaves the car, what data is stored and perhaps even what data is no longer needed. “In a fully-fledged production environment, we will need to be more judicious about what data leaves the car, what is deleted, what is stored and what can be processed locally in the vehicle,” he says.

[Recent advances around cellular vehicle-to-everything \(C-V2X\)](#) will make things slightly more complex on the data management front. “With C-V2X, there will be a huge

amount of chatter between RSUs, cell towers, local and cloud infrastructure and other vehicles. This is where the volume of data starts to become a real challenge, and surrounding resources that are ‘aware’ will not only be the creators but also the consumers of data,” he adds.

A vehicle’s on-board sensors are constantly gathering information. A vehicle might spot that a crash has caused a road block, for example, or that a group of nearby school children could be at risk as they approach a pedestrian crossing. A section of road might be icy or damaged, and the safety driver or passengers (if fully autonomous) could send a distress signal to emergency services. When video data starts being shared in high volumes—and in higher quality—this is when the edge will become invaluable.

“Basic data being transferred from vehicle to vehicle and vehicle to infrastructure might be in the realm of kilobytes,” explains Singer. “But when we’re talking about data streaming from the video cameras on these fleets of AVs, that will accumulate a huge amount of data. Even if it is only 10% of what is being created by the AV’s various sensors, that is then multiplied by thousands of cars. The scale becomes tremendous.” While LiDAR generates more data than RADAR, GPS, Ultrasonic and IMU, he explains, it does not come close to the amount of data coming from a video camera. Many vehicles already use 1K cameras, but that will transition to 4K and in the future maybe even 8K, Singer observes.

Pushing data back to a core data centre would be “a long journey” emphasises Singer, and thus the general trend over the next few years will be to locate compute power and storage closer to where data is being created. As edge servers will be in a different environment compared to that of a secure core data centre, the next challenge will be ensuring this infrastructure does not fall prey to cyber

attacks. “There are many potential attack vectors, and in this environment the idea of a firewall is no longer going to be good enough,” Singer warns.

“

It will require a robust partnership between many different companies to make this happen

EaaS will handle the data avalanche

As the megatrends of 5G, autonomous driving and smart cities converge, an end-to-end edge infrastructure—provided to automakers through EaaS—will prove invaluable. This ecosystem will extend from the edge, to core data centres, and to the cloud, helping to manage the increasingly complex data lifecycle of next-generation mobility.

The benefits of edge computing to the automotive industry and smart city developers are clear, but individual players cannot approach all this on their own. Singer urges that stakeholders across the ecosystem work together if this application of the edge is to become a reality. “Dell will not be able to build out all of this edge infrastructure on its own,” he concludes. “It will require a robust partnership between many different companies to make this happen.”

New electric SUV leads brand transformation for Lotus Cars

Freddie Holmes speaks with Matt Windle, Managing Director of Lotus Cars, following the launch of its first ever fully electric SUV



© Lotus Cars

Electric powertrains and converging vehicle segments continue to lead automakers down unfamiliar paths.

Following similar moves from the likes of Aston Martin, Lamborghini and Porsche, Lotus Cars is the latest to branch out into new segments and new powertrains.

On 29 March 2022, the Geely-owned automaker lifted the covers on its first electric SUV, the Eletre, as it undergoes the biggest transformation in the brand's history. The reveal took place at a glitzy event in London, UK, complete with a one-take choreographed dance and the Eletre driven on stage by Formula 1 legend Jensen Button.

Best known for producing super-light sports cars with throaty gasoline engines, the move to not only an electric powertrain but also the bulky SUV segment is a seismic shift for Lotus. On paper, it is a vehicle that few would have ever expected to materialise. But in the flesh, it is not immediately obvious that the Eletre is an SUV. Lotus' design team has placed an emphasis on aerodynamics and the concept of being 'carved by air.'

There are various design tricks in play—an elongated wheelbase, short overhangs at the front and rear, and a raking front windscreen—which all create the illusion of being low to the ground, and being long as opposed to tall. While it sits in a similar mould to the Lamborghini Urus, a V8-powered 'super sport utility vehicle', there is

no engine at the front of the Eletre. Lotus' Head of Design, Peter Horbury, says that this has paved the way for a "design revolution."

The move into new segments and new powertrains is being led by Matt Windle, Managing Director of Lotus Cars, who took the reins in January 2021 from his prior role of Executive Director of Engineering. At the global launch in London, Windle described Lotus as a "rebellious brand" that "does things people don't expect." Creating an electric 'hyper-SUV' certainly falls into that bracket. Speaking with *Automotive World*, Windle discussed how the focus remains very much on drivability and that Lotus is sticking to its roots despite the shift into new territory.

Is this the most significant launch in the Lotus brand's history?

It is certainly a momentous moment in our history, and the most significant milestone yet in the ongoing transformation of Lotus from a UK sports car company into a truly global performance car business and brand.



“

We've learned a massive amount from the Evija programme

- Matt Windle

Managing Director, Lotus Cars



© Lotus Cars

How do you ensure an SUV still feels like a Lotus?

With the Eletre we've taken the core principles and Lotus DNA from more than 70 years of sports car design and engineering, and evolved them into a desirable all-new lifestyle car for the next generation of Lotus customers. We've taken Lotus' renowned expertise in the fields of ride and handling, steering and optimised aerodynamics, and have carefully and respectfully evolved them. Eletre takes the heart and soul of the latest Lotus sports car—the Emira—and the revolutionary aero performance of the all-electric Evija hypercar and reinterprets them as an SUV.

What separates a “hyper-SUV” from the other “very quick SUVs” in the market?

There are three clear reasons why we're calling it a hyper-SUV. Hyper-

performance: at 2.9 seconds for 0-60mph, it is one of the fastest-accelerating SUVs in the world. Hyper-design: Eletre has the hypercar design language from the Lotus Evija. And hyper-tech: with 800v capability built into the architecture, it is also a hyper-charger.

Who is the Eletre driver, and do you see any obvious competitors to the Eletre?

We expect Eletre customers to be those who need the practicality of a larger SUV—perhaps because they have children—yet still want something that's beautifully designed and from a globally recognised premium brand. They will also value the dynamic experience and sporting image that comes from owning a Lotus. They will also be environmentally aware and want to play their part by owning an EV. In terms of competitors, you can make your own mind up.

The Eletre aims to attract
eco-conscious drivers
that will not compromise
on performance



© Lotus Cars



What did you learn about EVs from the Evija hypercar?

We've learned a massive amount from the Evija programme, and the benefit of porosity is a great example. This is the principle of air flowing through the car as well as all around it. For the driver, there are clear benefits to porosity, such as less resistance in cutting through the air, and so a more efficient journey in terms of improved vehicle range, speed and performance.

“

The Eletre delivers a significant number of firsts for Lotus

It's a signature theme that is running through all the latest cars from Lotus—the Evija, Emira and now the Eletre. It is most obvious where air is channelled under the leading edge of the Eletre, emerging through two exit vents integrated in the bonnet above. There are other examples of porosity ahead of and behind the front wheel arches, behind the rear wheels, and at the top of the D-pillar.

What design elements of Evija carried over into the Eletre?

There are many elements inspired by the Evija and Emira, including the cab-forward design. At the front, the very sharp and crisp leading edge reveals a clear lineage from both. It draws a distinct line across the car, separating

the bonnet from the very striking and contemporary design treatment below. There are further echoes of Evija in the layering in surfaces, the creation of space and the optimised aerodynamic performance. At the rear, the air vents at the extremities of the car are similar to what's on Evija and Emira.

As an electric SUV—two of the biggest industry trends combined—might the Eletre be something of a cash cow for Lotus?

The order books are open and we've been delighted by the worldwide customer response since we revealed the Eletre. Like all current and future Lotus cars, it is designed and engineered to be sold in all major international markets. We're not going to commit to sales figures, though we're confident it will prove very popular.

Is this a sign that Lotus will be expanding into more new segments?

The Eletre delivers a significant number of firsts for Lotus—the first five-door production car, the first model outside sports car segments, the first lifestyle car, the first mainstream EV, the most 'connected' Lotus ever. There is much more to come from Lotus, and a good example is Lotus Advanced Performance, which we launched in February. It's a new division of the business dedicated to delivering thrilling bespoke vehicles and world-class customer experiences.

You say you're already focusing on the next launch. When is that and what should we expect?

We said last year that we would be launching the Lotus Type 133, a four-door EV sports coupe, in 2023. That remains on track.