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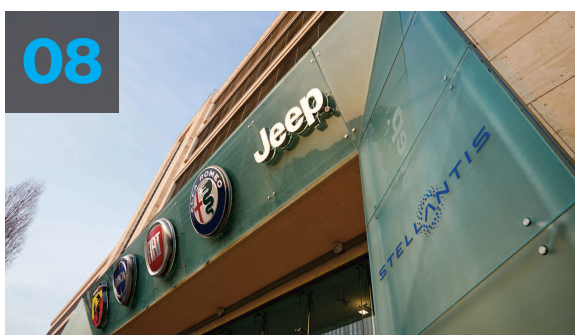
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point: Europe proposes
de facto ICE ban**

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Electric only beyond this point: Europe proposes de facto ICE ban

ACEA cautions that proposed new targets “may not be viable”, writes Megan Lampinen

The automotive industry has steadily cleaned up its tailpipe emissions over the years thanks to a combination of approaches including cleaner internal combustion engine (ICE) technologies, hydrogen fuel cell developments and battery electric advances. However, there is plenty of room for improvement. In the European Union (EU), transport contributes an estimated 21.5% of the region's 3.9 billion tons of CO₂-equivalent of greenhouse gas (GHG) emissions. In the push for its 27 member states to become carbon neutral by 2050, vehicles will play a key role.

2030 was first suggested in December 2020, so it won't come as a complete surprise to automakers or suppliers, but it still carries a punch.

"The Fit for 55 roadmap will have consequences for industry sectors and businesses across the EU and beyond, not least for automakers," says David Borland, EY UK & Ireland Automotive Leader. DIHK (Deutscher Industrie- und Handelskammertag), the German Association of German Chambers of Industry and Commerce, states that the proposal will "affect the economy across the board." The European Automobile Manufacturers' Association (ACEA) has described 'Fit

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A zero-emission tailpipe target in 2035 is a de facto ban on the internal combustion engine

Fit for 55

The European Commission has just put forward the 'Fit for 55' framework aimed at slashing GHG emissions by 55% by 2030 compared to a 1990 base level. This is a wide-ranging proposal touching on many aspects, including transport. For light-duty vehicles, the proposal is to also cut GHG by 55% between 2021 and 2030, with a 100% reduction by 2035. That represents a significantly more ambitious target compared to the Commission's current goal of a 37.5% reduction. In comparison, the US is working towards a 43% cut, while the UK is aiming for a 68% reduction. The EU's 55% target for

for 55' as a package that is "crucial for the auto sector and the millions of people it employs." IHS Markit analysts similarly warn it will have "massive implications for the electrification strategies of the major OEMs operating in the EU market."

A de facto ban

While nobody wants to be seen opposing environmental progress, one of the most commonly voiced objections to the plan has been that it effectively bans ICE models after 2035 and drives all light vehicles to battery electric propulsion. Why ban low-emission ICEs that can still contribute to environmental goals?

CLEPA, the Brussels-based European Association of Automotive Suppliers, is particularly upset that the proposal would not allow for continued use of sustainable renewable fuels. “A zero-emission tailpipe target in 2035 is a de facto ban on the internal combustion engine. This is not the most effective or efficient way to climate neutral transport in the EU; it may not even get us there,” says CLEPA Secretary General Sigrid de Vries. She points out that an ICE can be climate neutral when running on sustainable renewable fuels just as an EV is climate neutral when charged with renewable electricity. “The priority should be renewable fuels and electricity, not a ban on a technology,” de Vries emphasises.

CLEPA and others have also voiced concerns that electrification may not be the best technology fit for certain transportation use cases. Then there is the cost issue: while battery technology costs have been declining, EVs still carry a price premium over their ICE equivalents. Shifting the entire industry to EVs could put private mobility beyond the reach of many consumers.

ACEA issued similar caveats in its response to the Commission’s proposal, warning that “banning a single technology is not a rational way forward at this stage—especially when Europe is still struggling to get the right enabling conditions in place for alternatively-powered vehicles.” By ‘the right enabling conditions’ it primarily means charging infrastructure. The organisation is calling for mandatory targets around the expansion of charging points in all member states.

“The current proposal for an even bigger cut in CO₂ emissions by 2030 requires a massive further increase in market demand for electric vehicles in

a short timeframe,” points out Oliver Zipse, ACEA President and Chief Executive of BMW. “Without significantly increased efforts by all stakeholders—including member states and all involved sectors—the proposed target is simply not viable.”

Support and collaboration

In order to meet the 2030 target of a 55% reduction, IHS Markit estimates that pure EVs will need to take about 55% of the overall fleet. By its reckoning, that equates to an overall battery demand of 468 GWh by 2030. Calls are coming from many angles for various forms of industry-specific support in light of the accelerated decarbonisation roadmap.

EY’s Borland suggests that “a supportive and collaborative ecosystem at member state and cross-industry level would be required to help OEMs meet the new stringent emissions targets.” This could include something like the Alternative Fuels Infrastructure Directive proposal, which requires member states to ensure EV charging point installation every 60km on major highways and hydrogen refuelling points at every 150km. “Such supportive policy measures could help drive EU-wide electrification of the fleet and reach the net zero emissions target by 2050,” Borland tells *Automotive World*.

The Commission estimates that about six million public charging points will be needed across the EU by 2030 to achieve a 50% reduction in car CO₂ emissions. Jefferies analysts note that as the charging and fuelling targets are set at country level, in some way they “remove additional pressure on OEMs to invest in charging.” However,

there are no clear requirements around using renewable sources for hydrogen generation.

In the end, there is no escaping the impact on corporate finances or strategy. “For manufacturers, the changes will have a significant impact on supply chain structure and manufacturing costs,” predicts Borland. Some brands are considerably better positioned than others, and the tight timeline could put pressure on those already lagging.

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Without significantly increased efforts by all stakeholders—including member states and all involved sectors—the proposed target is simply not viable

“Profitability will improve as economics and pricing of EV components continue to reduce, especially batteries given they are typically 30% of the overall vehicle price,” he adds. “The significant development and engineering costs also need to be factored in to the profitability equation and it will vary by manufacturer given their progress to date. Based on the Fit for 55 proposal, the implementation of Emission Trading System (ETS) to road transport and introduction of Carbon Border Adjustment Mechanism on steel and aluminium imports might negatively impact OEMs’ cost structures and supply chain networks.”

What next

The targets will take time to be finalised with approval still needed by EU member states and the European Parliament. “We would expect lobbying from impacted sectors and stakeholders as part of the process, including automotive manufacturers and suppliers,” says Borland.

Rumblings from France suggest the country could put forward resistance to a full ICE ban. The lobby group La Plateforme Automobile (PFA) predicts that the industry would need to invest €17.5bn (US\$21bn) by mid-decade to develop sufficient batteries, charging stations, hydrogen and related services. At the same time, the end of ICE production is estimated to result in a loss of around 100,000 automotive jobs and inevitably some manufacturing plant closures in the country by 2035.

ACEA was also vocal on its concerns about the impact of the new CO₂ target on jobs. “Strong political coordination will be essential to deliver the ultimate aim of tackling climate change in the most efficient way while keeping mobility affordable for all Europeans and preserving jobs for auto workers,” states ACEA Director General Eric-Mark Huitema. Jefferies analysts suggest that, partly due to the French opposition, “writing off ICE by 2035 may be premature.” They go on to note: “Considering expected resistance from key member states to the 2035 deadline and ongoing questioning, plug-in hybrid electric vehicles could, in our view, evolve with larger batteries and efficient range extenders delivering better life-cycle emissions should battery cost-curve and capacity ramp lag expectations.”



Stellantis wants to lead the EV pack

The FCA-PSA merger has unveiled a broad set of targets for EVs which, if delivered, would make it a world leader in the space. By Xavier Boucherat

The late Sergio Marchionne, former Chief Executive of FCA, was infamous in his later years for pouring cold water on electric vehicle (EV) viability, claiming in 2017 that there was no tenable economic model for zero-emission mobility. Statements like these did little to ease investor concerns that the automaker lagged behind the efforts of rivals. In 2020, Carlos Tavares, then Chief Executive of PSA, also expressed doubts over mainstream EV demand without continued subsidies and a much-improved charging network.

Fast forward a year however, and the picture appears considerably more optimistic. Stellantis—the newly merged automaker comprised of FCA and PSA—has made commitments to electrification which, if delivered, put it on par with VW and Volvo’s goals to phase out the internal combustion engine (ICE) from their portfolios.

Speaking at the company’s 2021 EV Day event, Tavares announced that by 2030, 70% of sales in Europe and 40% of sales in the US would be low-emission vehicles (LEV), incorporating battery electric vehicles (EV), plug-in hybrid electric vehicles (PHEV) and fuel cell vehicles (FCEV). Four dedicated platforms are being developed to bring electrification to its 14 brands. Stla Small will be used for small and compact vehicles, whilst Stla Medium will be used for premium models. Stla Large will be used for performance vehicles. These three will be unibody platforms, whilst Stla Frame will be a body and frame platform for the commercial vehicle (CV) segment.



“

It would be arrogant from our side to tell you that we know everything that’s going to happen in terms of headwinds over the next years, but we have significant tailwinds from within the organisation too

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It's fair to say that this is a significant amount of work. Stellantis is developing four brand new EV platforms in parallel, along with the electric motors and transmissions that go with each, and the battery cell plants that will support these. There is an execution risk

Speaking at the event, Thierry Koskas, Stellantis Chief Sales and Marketing Officer, said the company was confident in its predictions for three reasons. First, research gathered by the automaker suggests that eco-consciousness was among the fastest growing trends in the world when it comes to buying a vehicle. Secondly, the issue of range anxiety is being effectively tackled by higher vehicle ranges and faster charging options. Thirdly, costs continue to drop, with the automaker predicting an EV could reach a similar total cost of ownership with an ICE vehicle without government incentives as early as 2026.

On range, Koskas said that anxiety had prompted “objections in the past, but improvements in batteries and charging infrastructure mean we can now satisfy most customers. By 2030, we expect that 80% of customers in the small car segment can enjoy an EV without changing their driving

FULL BEV

4 FULL BEV PLATFORMS

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STLA LARGE

STLA FRAME



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PREMIUM
VEHICLES



AWD PERFORMANCE
& AMERICAN MUSCLE



CAPABILITY &
PRACTICALITY

Ellesmere Port will be transformed into a dedicated electric van facility

habits whatsoever. In the light commercial vehicle segment, we expect that 100% of the customers should be satisfied.” The announcements come in the wake of the automaker’s reveal that its Ellesmere Port facility in England will be transformed into a dedicated electric van facility. Overall, Stellantis says it will invest €30bn (US\$35.5bn) in electrification through 2025.



Brand by brand

A number of the group’s 14 brands announced specific targets. Opel will go purely electric in Europe by 2028, with electrified versions of all models available by 2024. The brand also announced plans to enter the Chinese market. Fiat’s Olivier Francois, Brand Chief Executive, announced similarly aggressive plans. From 2024 at the latest, fully electric versions of all nameplates will be made available, and in the years ahead, the Fiat 500—the brand’s mainstay city car—will be the first model to go electric only. There will be a full switch to electrification when the cost allows, said Francois, which could come before 2030. The Arbarth range will also go 100% electric as soon as 2024.

In the US, Jeep will electrify its four best-selling models including the Cherokee, and also announced plans for solar-powered charging stations along trail routes which lack access to the grid. By 2025, the brand wants to offer a zero-emission vehicle in all of

the segments it competes in, and 70% of all sales should be electrified. Dodge too is readying up to release its own electrified model, although the brand was at pains to distance itself from the term ‘electric vehicle’. Rather, it said, electrification is as a means of giving Dodge customers what they want: more muscle “to tear up the streets, not the planet.”

Forging an advantage

Of course, Stellantis is not the first to make major commitments to EV production, with VW aiming to make 60% of European deliveries electric by 2030, and Volvo aiming for 100% by the same date. Five months after its formation, the question for the newly consolidated automaker is how to forge an advantage in an increasingly crowded field. Along with the economies of scale it hopes to leverage with the high commonality among its new dedicated platforms,

Jeep plans to install solar-powered charging stations

the company drew particular attention to a dedicated EV software division, a dual battery strategy and plans for further vertical integration of battery supply.

Part of the company's €30bn investment will open up a dedicated software division which will assist management of the battery, traction and regeneration systems, and the cockpit. Yvves Bonnefont, Chief Software Engineer, said "EVs are all about energy efficiency, charging and integration in the ecosystem. Software will help on these three fronts." A partnership with Foxconn means the automaker will be able to deliver over-the-air updates. As many as 15 million improvements and upgrades could be delivered by 2023, powered by AI-analysed data harvested from the 12 million connected vehicles Stellantis expects to have on the road.

From 2024, a dual battery strategy will see the company develop packs that are both nickel-free and nickel-based. Nickel-free batteries will reduce the amount of raw materials required and deliver cost reductions as high as 20% compared with nickel chemistries. The two chemistries have several points in common, including similar anode material, similar electrolytes and, by 2026, the same cell-to-pack design. Nickel chemistries will be able to deliver performance in segments where cost reduction is not the priority. Compared with 2020 levels, the company wants a 40%



reduction in nickel battery costs by 2024, and a further 20% reduction by 2030. If successful, the company is confident this will make it an EV frontrunner. In addition, the automaker wants to bring the first competitive solid-state battery to market by 2026.

To strengthen its battery supply chain, the company plans to build five gigafactories across Europe and the US. Automotive Cells Company (ACC) is the name given to Stellantis' battery manufacturing partnership with Total. Two projects are already underway in Germany and France, and a third is planned for Italy. Michelle Wen, Chief Purchasing and Supply Chain Officer, said that in the mid-term a multi-sourcing strategy would be pursued, incorporating cells from ACC and through co-operation with Asian battery partners including CATL, BYD, Volt, Samsung and LG. By 2025, it wants a minimum of 130GWh capacity. By 2030, Wen expects demand will multiply by over 20 times compared to 2021 levels, by which time the company wants 160GWh capacity through extended collaboration with ACC, bigger production blocs and a new facility in the US.

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| | NiCo FREE | Ni BASED |
|------------------------------------|--------------------------------|--------------------------|
| Cathode active material on Al foil | Fe - Mn - x | Ni - Mn - y |
| Anode active material on Cu foil | Graphite Carbon | |
| Energy Density at cell (W h/L) | 400 - 500 W h/L | 600 - 700 W h/L |
| Pack configuration 2024 | Cell-To-Pack | One unique module -based |
| Pack configuration 2026 | One unique Cell-To-Pack design | |
| Cost (€/kW h) | - 20 % | Reference |

INTRODUCTION OF 1ST COMPETITIVE SOLID STATE IN 2026 BY REUSING INDUSTRIAL ASSETS

Ploughing ahead

Speaking in a question-and-answer session, Tavares—now Chief Executive of Stellantis—said that confidence was high, in spite of the volatility seen in the global automotive market over recent years.

“What we are saying today is, we have gathered enough new initiatives, new ideas and a significant amount of synergies such that we can say with confidence that we will have a sustainable, double-digit operating margin from 2026,” he said. “It would be arrogant from our side to tell you that we know everything that’s going to happen in terms of headwinds over the next years, but we have significant tailwinds from within the organisation too.” Potential headwinds singled out by Chief Financial Officer Richard Palmer included product cost increases due to regulation of vehicle emissions, lower

government incentives for LEVs and raw material inflation for batteries.

Tavares was under no illusions as to the scale of the task ahead. “It’s fair to say that [the strategy represents] a significant amount of work,” he said. “Stellantis is developing four brand new EV platforms in parallel, along with the electric motors and transmissions that go with each, and the battery cell plants that will support these. There is an execution risk.”

However, he added, “the industry is now looking at an unprecedented transition in a very compact time window, and I do not believe the risk is any higher for Stellantis than for any other car company.”

At present, the exact mix of LEVs remains flexible. The penetration of different vehicle types will depend on market conditions, the state of each market’s charging network and the performance of Stellantis vehicles, he said.



Where has the pandemic left the autonomous revolution?

Experts from across the mobility industry share their views on the direction of driverless mobility developments. Megan Lampinen



The pandemic prompted a new wave of interest in autonomous vehicles (AVs) with the prospect of reduced contagion risks from contactless delivery and driverless taxis. In addition, the original use cases around improved road safety and greater mobility for those with disabilities and the elderly remain as relevant as ever. But still AV target dates have come and gone. Is the industry any closer to a self-driving future? At this year's Reuters Events: Car of the Future 2021, *Automotive World* sat down with a panel of experts to explore just how far the AV revolution has come, and where it might go next.

Today's state-of-the art

The end game for some players is Level 5 (L5) autonomy, which would allow a vehicle to operate in all conditions, everywhere, completely autonomously. "I don't think we are there yet," says Mary Joyce, Vice President and General Manager, Mobility, at safety science company UL (Underwriters Laboratories). "In fact, we still are quite far away. Instead, we will see more and more L4 deployments, where AVs run in a specific operational design domain (ODD), such as hospitals and university campuses."

Players like Local Motors and Voyage are pursuing exactly these use cases, running low-speed autonomous shuttles within office parks, universities and retirement communities. The restriction of operations to a controlled environment, with a limited number of variables, makes the challenge of perfecting an autonomous driving system much more manageable.

“

Fundamentally the personal ownership model may not work for AVs

Stefan Gudmundsson, Chief Innovation Officer at California automaker Karma Automotive, believes progress may run into obstacles due to the unresolved issue of how human-driven vehicles may interact with AVs in a mixed fleet. “You need to make sure that the first AVs play nicely with other vehicles out there,” he tells *Automotive World*. “It will take time to flush out the old fleet and make everything compatible with L4 or L5.”

Partly for this reason he suggests that “L5 is further away than we like to think, though certain applications will move faster than others.” These faster moving use cases include limited ODDs, like those flagged by Joyce, as well as distribution and last-mile. This is precisely what Nuro has homed in on. The company specialises in last-mile delivery for goods using fleets of electric autonomous vehicles. Earlier this year it began a pizza delivery trial with Dominos using the Nuro R2, the first fully autonomous delivery vehicle to receive regulatory approval from the US Department of Transportation to operate on public roads. Customers who opt for the driverless option will receive text alerts updating them on R2’s progress. They can retrieve their pizza with a unique PIN code.

“We see a lot of demand for this kind of low-speed, goods-only vehicle,” says Nuro’s Andrew Claire, Head of

Robots. But delivery spans much more than just pizza, and the R2 will soon begin delivering parcels for FedEx with an upcoming pilot in Houston, Texas. “We expect AVs to really take off in the whole goods delivery space,” he adds.

Ownership models

Should driverless vehicles eventually make it to the road in greater numbers, the maintenance costs could be steep. Theoretically, these vehicles need to be in perfect condition whenever they leave home, whether that ‘home’ is a depot or a private family garage, because there will be no human to address a technical problem that arises when travelling. “When a vehicle is fully autonomous, everything has to work perfectly,” emphasises Gudmundsson. “That means software is updated and every sensor is working perfectly. You cannot wait to fix something that goes wrong or ignore something that’s broken.”

Repairs may not come cheap. Today, AVs carry an abundance of expensive hardware. Replacing a GPU could put an owner out US\$1,000 easily, while a LiDAR could mean a bill of thousands of dollars. Even if costs decline over time, these vehicles will entail much more regular maintenance work than

today's passenger cars. "Fundamentally the personal ownership model may not work for AVs," predicts Claire.

Gudmundsson agrees. "We could end up with a different ownership model where you lease the car or rent it as a transportation service because the risk of investing in one would be so high," he adds. "If you get a lemon, you are in trouble."

"The expense of these vehicles and the responsibility of ownership could prove prohibitive," chimes in Joyce. She also flags some of the many questions adjacent to the issue of expense. "There are still questions of who will own these and how they will operate in society. What if only the rich can afford AVs? They may not be the ones that really need them; it is the elderly and disabled that need this transport."

Winning over consumers, and regulators

Regardless of who owns the AV, it will inevitably be called on to operate in foul weather conditions like blizzards and rainstorms. CES 2018 highlighted all too clearly the challenge that heavy rain can have on automated driving functionality, with many show exhibitors forced to cancel or amend their technology showcase plans that rainy January. "Weather has always been a challenge for AVs," concedes Claire.

The common approach is to use a variety of sensor systems which complement each other in their areas of strength, but functionality may still be limited. A good rule of thumb,

according to Gudmundsson, is if you as a human driver struggle to see in certain weather conditions, then an AV will as well. "Low-lighting is probably the exception, as AVs shine here, but in most other scenarios like fog and rain, they suffer just as we do from a perception perspective."

The bulk of today's AVs remain in the testing and development phase, but at what stage will they be deemed ready for commercial launch? An industry consensus on adequate safety testing remains out of reach and testing can only go on for so long. "You cannot physically test infinity," cautions Joyce. "You can't even simulate infinity. In order to get to 'good enough', your approach has to be a combination of proving through physical tests and simulations."

She also suggests that developers will need to provide proof that their product was developed within best practice standards of the industry. Only then will members of the public put their trust in these vehicles, she warns. "You could say that within specific ODDs we are 99% there, but the public would want us to be 99.99999%. It's a quest of how many nines we are dealing with in this problem."

"It will take time before people really trust that AVs will make the right decision for the greater good in any situation," says Gudmundsson. "There are still a fair number of accidents with these systems, even though there are not many out there yet. That erodes public trust. Today's statistics say an AV is as good as the average driver. With all the costs associated with it, that's not good enough. We need to be as good as the best driver in all situations. When we get there, people will trust the system."

Could Hyvia catalyse the hydrogen LCV segment?

The new JV is offering not just fuel cell vans but also the fuel, the stations and the fleet management services.

By Megan Lampinen



A new player has emerged in the hydrogen mobility ecosystem, making bold promises for the European market. Renault Group and US hydrogen specialist Plug Power have formed the 50-50 joint venture Hyvia to tap an anticipated hydrogen fuel cell boom. Renault likes to refer to itself as a 'hydrogen pioneer' but so far it has primarily used the technology as a range extender for battery electric LCVs.

If all goes to plan, Hyvia expects to be the first company to offer not only hydrogen fuel cell vehicles but also the hydrogen on which they run, the fuelling stations and even fleet maintenance and management. The venture is based in Renault's home market of France. The head office and R&D teams are located in Villiers-Saint-Frédéric, the home of Renault's LCV engineering and development centre, with the aim of maximising synergies across the two teams. Process, manufacturing and logistics teams are based in Flins, as part of the Re-Factory project, and plan to begin the assembly of fuel cells and refuelling stations by the end of 2021. The first vehicles will be assembled at the Batilly plant, while Renault's subsidiary PVI will carry out fuel cell integration in Gretz-Armainvilliers.

While it's still early days for hydrogen mobility, President David Holderbach believes Hyvia should be able to quickly carve out a dominant position: 30% of the European market for hydrogen LCVs by 2030. There is plenty of work ahead, but as Holderbach tells *Automotive World*, backing from such experts as Renault Group and Plug Power should arm it with the necessary capabilities to become a pioneer in the segment.



David Holderbach
President, Hyvia

What is Hyvia's role in the evolution of hydrogen?

Hyvia will offer a complete ecosystem of turnkey hydrogen mobility solutions: LCVs with fuel cells, hydrogen stations, supply of carbon-free hydrogen, maintenance and fleet management. This is unique, as it covers the whole ecosystem, and is made possible because we can draw on strengths and skills from Renault Group and Plug Power. We will operate across four sites in France and will sell across Europe.

Why are you backing hydrogen as opposed to another clean technology?

The main advantage of hydrogen fuel cell vehicles is greater freedom: Hyvia's hydrogen technology offers ranges up to 500km. Hydrogen generates no local pollutants or emission in use. It offers a quick refill

**Renault
Group**

**PLUG
POWER**

HYVIA

time of just three minutes. On top of that, certain countries and regions are offering incentives to support uptake of zero-emission vehicles.

What are the current pain points for hydrogen fuel cell commercial vehicles, and how do you plan to address those?

The hydrogen fuelling network has yet to be developed. We will offer the

vehicle, the hydrogen stations and customer support with a tailored hydrogen solution. Admittedly, the price of the fuel cell needs to be reduced, as was the case for the first battery electric solutions. Costs are still high, but significant reductions can be anticipated as volume grows and customers' needs change. Here, Hyvia draws on the expertise of Plug Power, which has already deployed more than 40,000 fuel cells.

HYVIA
A JOINT VENTURE
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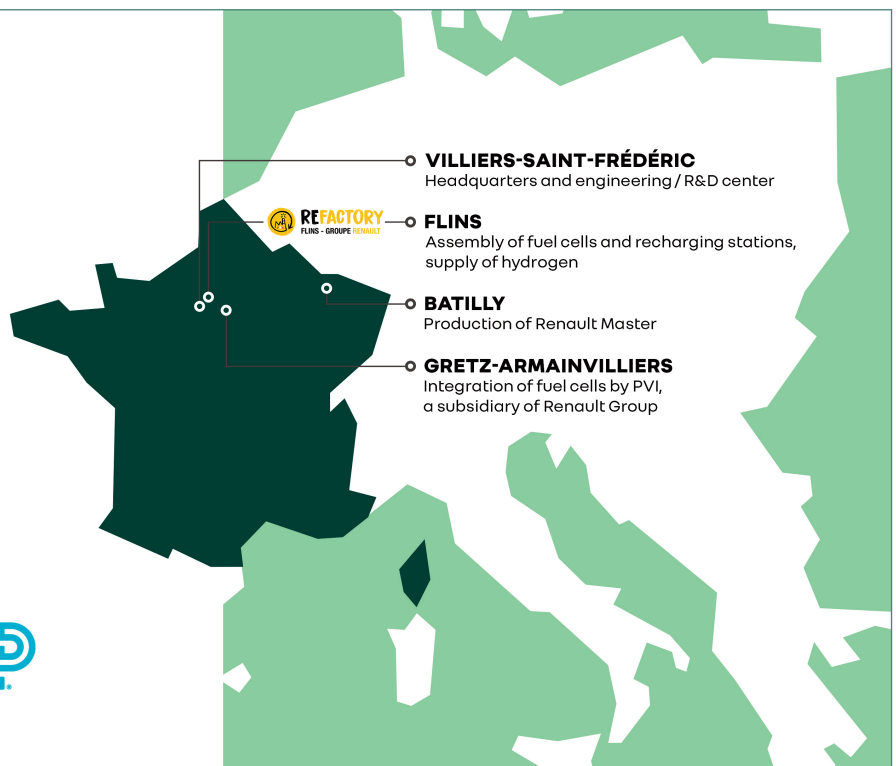
A complete ecosystem
of innovative technologies
and services for hydrogen mobility

Activities that generate employment
and value in France

A target for 2030: 30% market share
of hydrogen light commercial
vehicles in Europe

**Renault
Group**

**PLUG
POWER**



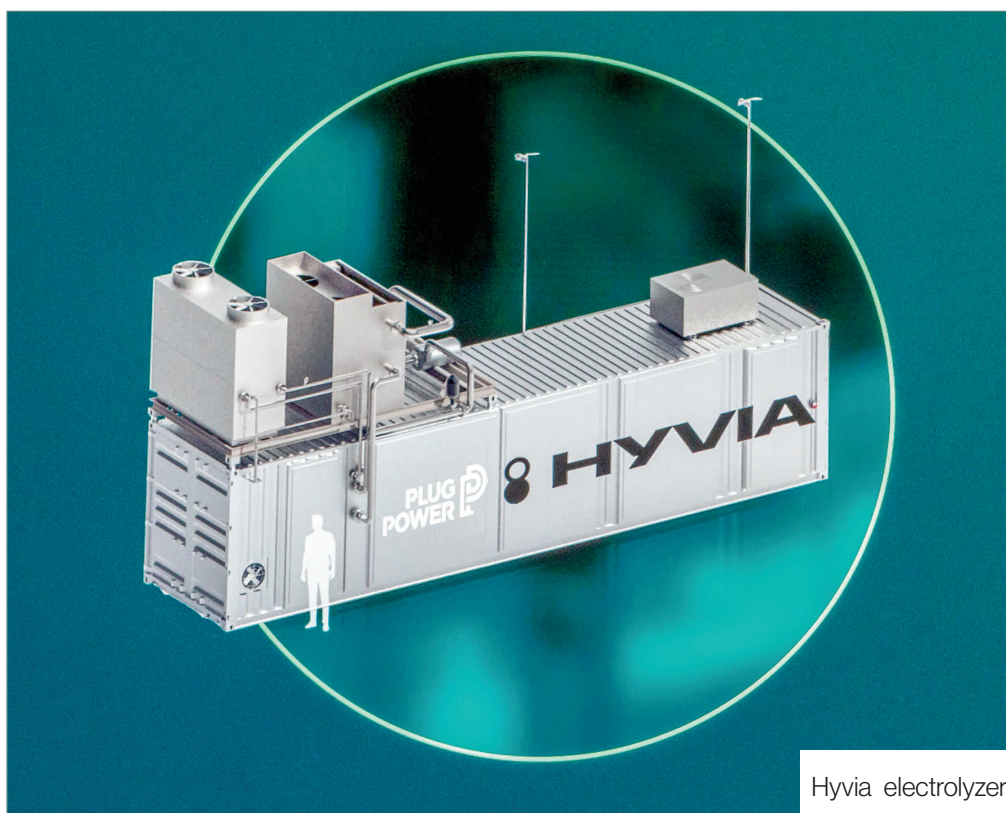
How important is green hydrogen and how quickly could it become the norm?

Plug Power is a technology leader in green hydrogen solutions via electrolysis. Europe is also engaged in promoting green hydrogen projects. The region's energy policy aims for carbon neutrality by 2050 under the Green Deal. The transformation is based on the massive development of renewable energies, in particular wind and solar power. These energies have the disadvantage of being intermittent and not necessarily producing electricity when it is needed by the grid. One of the solutions being considered for storing electricity is to convert it into hydrogen by electrolysis of water. This green hydrogen does not generate any pollutants and can in turn be used as clean energy for various applications. Also, recent announcements demonstrate significant financial support for the development of the

hydrogen industry and a favourable environment for the development of its applications.

With regard to mobility, how do you see the energy transformation developing?

There are tighter environmental constraints on transport along a couple of main lines. One is pollution reduction with the gradual tightening of emission standards and the emergence of access restrictions to the most critical areas, such as dense or highly industrialised regions. Then you have the reduction of greenhouse gas emissions. These CO2 targets for manufacturers on the average emissions of their fleets (CAFE) require an increasing proportion of carbon-free vehicles. The access restrictions I mentioned lead to a significant limitation of individual private vehicles in dense areas. The more individual mobility is constrained, the greater will be the



Hyvia electrolyzer



Hyvia aims to capture 30% of the European market for hydrogen LCVs by 2030

use of local services and home delivery. These two elements reinforce the role of zero emission LCVs, whether for supplying local shops or home delivery.

What is the near-term vision for Hyvia?

We see hydrogen as a cornerstone of the energy transition and a solution for zero-emission mobility, starting with LCVs. The name Hyvia is a contraction of 'Hy' for hydrogen and the Latin word 'via' for road. This name embodies this ambition to open a new path towards low-carbon mobility. The near-term objective is to bring the Renault Master hydrogen version to production by the end of 2021.

Will the fuel cell vehicles wear the Hyvia or Renault brand? And what is the thinking behind that choice?

The first three fuel cell vehicles we bring to market will be based on the Renault Master platform. They will carry Renault brand in order to capitalise on the awareness of Renault, a major player in automotive industry. A Hyvia sales channel is also planned.

Initially you are targeting the van segment. Might this be expanded down the line?

We are initially concentrating our offer on LCVs, where hydrogen is most relevant. Fuel cells allow greater range and faster refuelling time, ideal for intensive usage. As part of the

implementation of urban access restrictions, the demand for zero-emission solutions will increase and promises to be all the more difficult to satisfy for larger vehicles, where the balance between payload, range and availability over long time slots is tricky.

What role do you see for hydrogen alongside other low- and zero-emission technology?

Hydrogen complements electric LCVs for critical pure electric use cases. In heavy duty applications running more than 200km, thanks to fast fuelling, hydrogen can extend the range of zero-emission vehicles. On intensive-use road vehicles operating 24 hours a day, the fuel cell can refuel in a few minutes, greatly improving the use efficiency. For zero-emission vehicles requiring an occasional extra range without the availability of an appropriate charging solution, whether in terms of location or time, the fuel cell can considerably extend

daily mileage limits. We are not ruling out expansion down the line.

How do you see fuel cell uptake developing over the course of the decade?

Uptake will grow significantly over the course of the 2020s, thanks to cost reductions and the context I mentioned earlier. Hyvia is planning to localise fuel cell components as the supplier know-how and production capacities increase.

What would constitute a successful first year for Hyvia?

The first three fuel cell vehicles brought to market by Hyvia should be available in Europe by the end of 2021, accompanied by the deployment of charging stations and the supply of green hydrogen. Beyond that, having customers become advocates of hydrogen LCV mobility will be a clear sign of success.



Renault Master Van H2-TECH



In the shared mobility space, failure is good

Trial and error is pivotal for shared mobility development, and much-needed political supporters shouldn't be deterred by this, argue experts. By Xavier Boucherat

Shared mobility has the potential to transform city streets. Car-sharing, car-pooling, last-mile connections to public transport and innovative services like on-demand micro-shuttles could take large numbers of private vehicles off the road, tackling congestion and reducing emissions. At the same time, these services could democratise mobility, offering many the same flexibility and freedom associated with private vehicle ownership.

Yet among the CASE mobility megatrends—connected, autonomous, shared and electrified—shared mobility also represents the biggest question mark. In many markets, cultural attachment to the private vehicle remains strong, and sustainable models for services remain elusive, even for automakers with plenty of financial clout.

The shuttering of Ford's Chariot—an on-demand minibus service—and GM's Maven—a peer-to-peer car-sharing service—exemplifies the scale of the challenge. Even once-popular services like Autolib, the all-electric Parisian car-sharing service, have been unable to secure profits, dogged by maintenance issues and poor customer experiences. Yet for all the missed opportunities, there is value in failure, with early adopters shedding light on what is possible, and what hurdles remain. To ensure ongoing development, the support of local authorities is vital.

Local backing

That's according to Maximilian Mader, founder and Chief Executive of New Mobility Enterprise (NME), an



Ford's Chariot was shuttered by the company, but failed projects are useful for highlighting the limits and possibilities of shared mobility

Austrian e-mobility company which along with selling an electric van has developed a mobility platform which facilitates vehicle-sharing. There can be no doubt, he said, that shared mobility platforms—across both passenger transport and goods delivery—are the answer to many cities' problems.

“One of the things that NME has found helpful over its time as a business is the help of municipal authorities and local politicians,” he said during Future Mobility Europe, a two-day virtual conference on the subject of urban shared mobility. Without political support, new companies in the shared mobility space face a credibility problem: when shared mobility platforms take new ideas directly to potential customers, he said, there are often concerns around profitability, and whether that company will still be around one year from now.

Car2go withdrew from several unsuccessful markets in the past

“However,” he said, “if a politician is lending support, things are easier. It reassures citizens that the expertise is in place and that long-term solutions are needed.” The figures back this up, he added, with both urban populations and e-retail deliveries expected to soar over the coming years.

The problem, he said, is that for politicians, deep engagement with these new concepts can be risky business. To some extent, shared mobility development is already proving a case of trial and error, and for a safety-focused sector like mobility, the fallout when things do go wrong can be damaging. But without trial and error, and support for new initiatives from the private sector, he added, cities can’t expect change, and new companies can’t expect to survive.

“If we look at cities like Paris,” he said, “where the local government has announced it will push cars away from some major roads, such a decision is going to encourage a lot of innovation. There is a political will to set goals and turn cities into livelier places. There will of course be failures along the way, but there will also be new approaches and new concepts.”

Culture wars

The question for city governments and shared mobility service providers is, what is it going to take



to get people to give up their | private vehicles in favour of car-sharing, car-pooling and other solutions? Total cost of ownership (TCO) is one consideration: if notably lower than the price of car ownership, it is easy to see how some may make the jump.

But cost isn’t everything. Speaking on the panel, Michael Munter, Head of Strategic Planning and Sustainable Mobility for the City of Stuttgart, said the challenge was cultural. “If we think about Germany, for many people, the car is a second living room,” he said, and such attitudes have only galvanised over the course of the pandemic with many people returning to regular private vehicle use due to health and safety concerns.

Mader agreed, adding that to tackle this, legislators must be positive. “Citizens must be encouraged, and not punished,” he said.

“Stakeholders must be incentivised to work on giving people their cities back, reclaiming roads and parking lots which could have alternative uses. People are going to respond more positively to the promise of greener, livelier cities than the threat of rising TCO of vehicle ownership and vehicle bans.”

The trouble, he said, is that convenience must take both physical and digital aspects into account. In today’s major cities, it is common to see up to 20 different mobility services in operation. For a user, this is a nightmare necessitating multiple apps depending on the mode of transport. What’s more, studies prove that very

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What is required is a supply of convenient, seamless mobility modes. Step-by-step, the people will come to view this as an alternative to their private cars, even if just once or twice a week

Munter added that a purely punitive means of transition could disproportionately affect poorer communities: if a city imposes a US\$50 charge on driving into town, richer communities could simply pay the fee. “What is required is a supply of convenient, seamless mobility modes,” he said. “Step-by-step, the people will come to view this as an alternative to their private cars, even if just once or twice a week.” In Stuttgart, he adds, the benefits of many workers staying home one or two days a week were measurable, with less congestion and lessened demand on parking.

few customers will willingly embark on a multimodal journey unless there is no choice. “These options can be painful,” agreed Mader, “and were it not for my curiosity to try them out and experience where the challenges and difficulties lie, I would not use them.”

Aggregation of services will therefore be key, as will easily accessible ticketing systems and a means of quickly looking up how to get from A to B. Importantly, he concluded, these are aspects which are not likely to be solved by a city administration, but by the mobility community itself. This will depend on the further integration of public and private initiatives in transport.



Will battery swapping dominate 'traditional' EV charging?

Proponents argue that swapping in and out batteries is a more cost-, energy- and time-efficient solution to EV charging. By Jack Hunsley

When it comes to electric vehicle (EV) charging, most vehicles are plugged into mains-connected stations in a manner not dissimilar to using a fuel pump. However, might there be a more practical approach? Those in the battery swapping business argue that completely removing and replacing an EV's battery not only unlocks vital time and costs savings but also enacts efficiency gains throughout the electric mobility ecosystem.

One such proponent is Ample, [a start-up that emerged from stealth in January 2021 by announcing a tie-up with Uber](#). The ride-hailing giant stated at the time that it sees Ample as a vital contributor in its ambition to electrify all its rides in the US, Canada and Europe by 2030, pumping in US\$70m in funding. Six months after deployment, Ample's John de Souza, Co-Founder and President, says his company's newly gained real-world experience has only further underlined the flaws in conventional EV charging.

Charging drawbacks

Starting with utilisation rates, de Souza says that queues for chargers at public depots and forecourts will only worsen if the industry refuses to think differently. "The problem with public charging is that as soon as you get to utilisation rates that are around 20 to 25%, it's effectively unusable," he told *Automotive World*. "If you get stuck behind one or two cars you could have to wait an hour before you start charging. Public charging only works with low utilisation, ideally less than

10%, which right now is where they are at but as soon as it goes higher it falls apart."

These wait times could be reduced with faster charging technology, or by customers opting to not fully top up their EV's battery. However, both solutions undermine an EV's overall efficiency. "Normally when a customer uses a charger, they only charge up to around 80%," said de Souza. "If they arrive with, for example, 30% charge then they are only adding 50%. You might have a big battery but if you're not using the entire capacity, you're carrying extra weight but not getting all the range." In contrast, Ample's stations can swap in a fully charged battery in ten minutes, with the aim to cut this to five minutes in the future.

Upping charging rates also has its drawbacks. Fast charging can lead to short periods of high energy demand on the grid that may force the use of non-renewable energy to ensure a consistent flow. A swap station can instead recharge batteries around the clock, allowing companies like Ample to make the best use of renewable energy by spreading demand out. This also improves the efficiency of the charging process itself, with de Souza stating that when using a fast charger at least a third of the energy drawn from the station is not added to the battery itself but is instead wasted during the charging process, mostly as heat. "That is the equivalent of pouring a third of the gas you add at a fuel pump on the floor," he added.

Rapid charging cycles also risk damaging an EV battery, reducing its overall capacity and lifetime power

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The government is thinking about offering US\$50bn for chargers. If you gave us US\$5bn we could replace every gas station in the country with a swapping station, yet with their method, they will not even scratch the surface in terms of the number of chargers we need

output. Given the battery is also the most expensive EV component currently, compromising its integrity could put a significant dent in an EV's resale value. “In contrast,” said de Souza, “with a swappable system you can access the latest battery technology and extend the vehicle's lifecycle to as much as 20 years or more.”

OEM interest

Despite these theoretical benefits, battery swapping has failed to grab headlines in the same way that plug-in charging has. This is partially due to the demise of Better Place in 2013, a company that had generated more than US\$1bn in funding for its battery swapping technology before falling foul of financial mismanagement and lower than expected market penetration. It succumbed to bankruptcy in November 2013, selling its

remaining assets for just US\$450,000. However, increasing automaker interest in battery swapping may change this.

To date, Tesla and China's Nio are the two most public proponents, with the latter announcing in May 2021 that its battery swapping stations will soon make their European debut in Norway after good success in China. Vice President of Nio Europe, Hui Zhang, told *Automotive World* that battery swapping is an “integral part” of Nio's business strategy, adding that “the technology has the potential to address several pain points regarding the adoption of EVs.” Ample has also seen good OEM interest in its technology, with de Souza noting that since January it has been contacted by a further three automakers with which it had had no prior relationship and that Ample is now working with several “top ten OEMs.”

Current technical challenges

Technical challenges do remain. According to Nio's Zhang, one key hurdle is ensuring that swappable batteries do not compromise the vehicle's general structural integrity. He added that tackling this specific issue has led Nio to generating more than 1,200 patents and undergoing “multiple rounds of intense simulation and testing” to reach its current setup. “The car and the battery are linked with ten ‘bayobolts’ which guarantee safe and reliable connection,” said Zhang. “This mechanical connection has boosted the overall torsional stiffness of the car by more than 25%.” Other on-vehicle considerations include ensuring batteries can communicate with onboard software management systems, and guaranteeing satisfactory electrical and mechanical connections.

The swapping stations themselves must also be quickly deployable, easily scaled and a manageable size. For instance, Nio's first-generation solution occupied an area roughly the size of three parking spaces, with its second-generation station occupying four. "This will allow us to store more batteries, quadruple the daily service capacity and decrease the cost," said Zhang. Specifically, the extra space will allow more room for batteries to be safely recharged as quickly as possible and to manage monitoring and diagnostic tools to help identify any potential problems. Ample also measures its station's size in parking spaces; its setup occupies two slots and is designed for "rapid deployment" given it requires "no construction."

Too late to change?

Is it too late to convince governments to swap out traditional charging? De Souza fears so, pointing out that, at least in the US, regulators are rapidly accelerating infrastructure subsidies for companies building traditional charging points. "We are in a legislative environment right now where we have to be very careful and we do not have many people on our side," he said. "The government is thinking about offering US\$50bn for chargers. If you gave us US\$5bn we could replace every gas station in the country with a swapping station, yet with their method, they will not even scratch the surface in terms of the number of chargers we need."

Other markets do show more promise, such as China. Ample is particularly enthused by China's regulatory approach to battery swapping. As de Souza outlined, the

country has capped the maximum subsidy available for vehicles that can only use conventional chargers. "What they're essentially saying is that charging works for cheap vehicles but if you want something expensive and above that cap, it has to be swappable," he said. "It's clear that that subsidy is favouring swapping and they now have started to put battery swapping standards in place that go into effect in November." By 2025, China aims to be swapping 45 million EV batteries a week.

More cities around the world are also considering the technology, which de Souza says comes from a desire to electrify as quickly as possible. "Internationally we are inundated by so many stakeholders contacting us saying they want to go straight to swapping," he added.

New business

For automakers, opting for battery swapping may also unlock fresh revenue streams. Nio, for instance, has packaged its swapping technology with its Battery-as-a-Service (BaaS) programme. This scheme allows customers to purchase their EV separately from the battery, cutting initial entry costs but also giving buyers scope to change their battery to meet their current driving needs. "If you want a bigger battery for a month in summer whilst you go on longer trips, you can just upgrade and only pay accordingly," said Zhang.

Battery swapping on paper offers undeniable flexibility, but it is a technology that has been burnt before. It is too early to say whether this latest revival will last but current enthusiasm is higher than at any point since 2013.

What does fleet futureproofing look like post-COVID?

Research from Shell and F&S highlights the technologies that will steer trucking decarbonisation and digitalisation.

By Megan Lampinen

The global response to COVID-19 has impacted the road freight industry from the start and will leave a lasting legacy. As players begin looking to the new normal, how are they adjusting their strategies in terms fleet management digitalisation, sustainability practices and decarbonisation efforts? Recent research from Shell and Frost & Sullivan (F&S) sheds light on some of the most important developments within the industry as it looks to futureproof in an increasingly uncertain world.

Telematics to the rescue

The good news is that global road freight revenues are poised to grow 4.3% on average every year between 2020 and 2025, according to the whitepaper [*Navigating Roadblocks in the Long-Haul Road Freight Industry*](#). However, companies face significant headwinds in the form of continued driver shortages, rising costs, decarbonisation, security and a heightened regulatory environment. In many cases, smart technology can help. The driver shortage is a case in point.

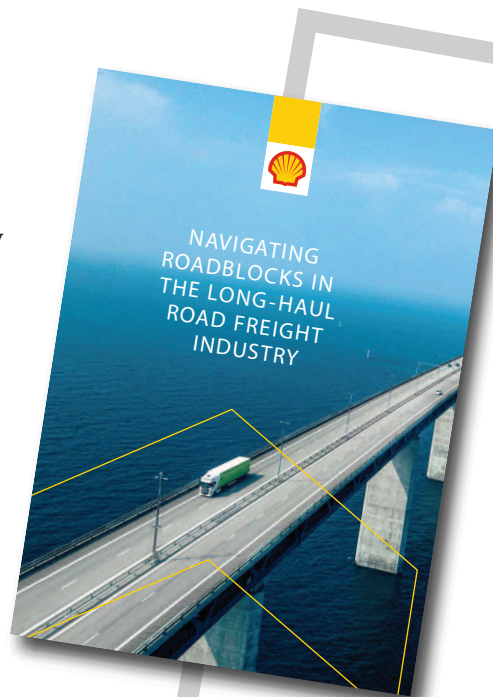
Almost regardless of geography, fleets are concerned about securing skilled drivers to put behind the wheel. “The job of a driver is very demanding and requires a clear skillset,” comments Patrick Carre, Vice President of Commercial Road Transport at Shell. “Trucks are expensive and complex pieces of

kit. We found that concerns around a shortage of trained drivers exists in many geographies.”

Driver skill plays out in many areas, including safety, fuel economy and overall fleet efficiency. This is an area where telematics can make a big difference, with a range of solutions on offer that connect real-time vehicle driving data to fleet management platforms, allowing managers to monitor and train drivers. The data from these fleet management tools is also being harnessed to improve decision making in areas like routing.

Because trucks are high-value assets, and often loaded with high-value goods, fleets are understandably concerned about security. This touches on everything from fuel theft and fuel fraud to the threat of a load being carried off. Shell and F&S research found that 65% of fleet managers consider fraud a problem for their business. To limit the threat to profitability, the recommendation is to embrace digital solutions. Payment monitoring and management tools offer insight into driver expenditures, with real-time fraud detection and alerts. Managers can also set location limitations that require drivers to visit only certain pre-selected sites.

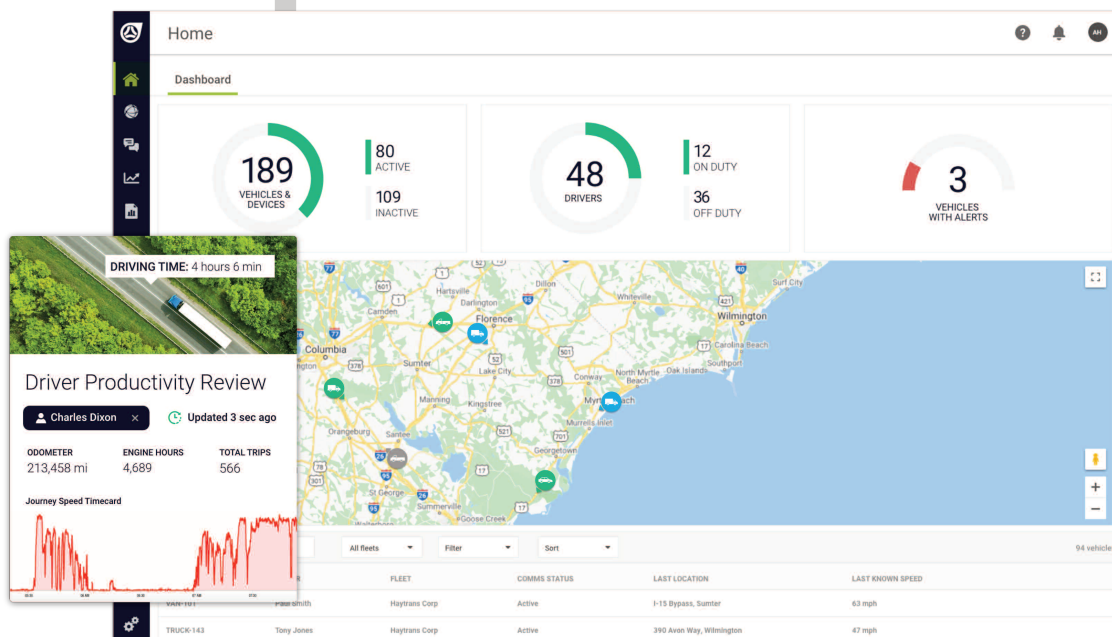
While the whitepaper examined the impact of digital and connected technology, it did not go into autonomous driving or



platooning. “We did touch on it in the interviews that we had, and autonomous driving in particular is on people’s minds, but it appears to be a bit further out,” says Carre. “The industry sees it as a technical possibility and something that will eventually arrive, but later on.” When it does, he sees particular scope in the US, where drivers may have to cover vast geographies.

Decarbonisation driving change

Perhaps even more pressing than drivers and security is the need to decarbonise, which goes hand in hand with changes in the regulatory environment. More than 70% of industry respondents said this was their organisations’ leading priority or one of their top three priorities. “Decarbonisation is the name of the game,” Carre tells *Automotive*



TN360 software from Teletrac Navman helps managers monitor business efficiency in real-time

World. “In many regions, including Europe and the US, we see sectoral targets being set and that will undoubtedly drive change over the next five to ten years.”

Fleets can tackle decarbonisation on many fronts but when it comes to how the truck is powered, the main zero-emission contenders are battery electric setups and hydrogen in the form of fuel cells or possibly an internal combustion engine (ICE). “There are variations of the theme, but there’s almost a consensus emerging with automakers and shippers that hydrogen and electric are the long-term sustainable plays,” he adds.

Even with truckmakers offering new models and fleets interested in buying them, it will take time to convert the vehicle parc. Europe alone is home to about six million trucks, each with an average lifetime of ten years. In the

meantime, a near-term benefit could be found in the form of bio-LNG.

“With LNG we have a technology that builds on an existing gas engine and fuelling infrastructure that is being enlarged as we speak,” Carre points out. “It can offer an immediate opportunity to decarbonise part of the transport system if we feed the gas grid with biomethane and other biogas components. This is not a silver bullet for everything, nor is it an infinitely scalable solution, but we need to have something for the short-to medium-term, and it could very well be bio-LNG.”

Decarbonisation also comes in the form of aerodynamic design. Shell has worked on this area in the US through project Starship. In collaboration with an engineering design company, Shell researchers explored the effect of materials and design on energy demand in a Class 8 truck travelling

Shell's next-generation Starship truck features a custom aerodynamic design and aims to demonstrate improvements in fuel economy for Class 8 trucks while lowering CO2 emissions



from San Diego, California to Jacksonville, Florida. Like LNG, Carre sees aerodynamics as a near-term lever to pull but not a cure-all for the decarbonisation challenge. “This is something that can be done today, with today’s technology,” he emphasises.

The same can be said for highly efficient lubricants, telematics and digital freight brokerage. “Technology is our friend in this space and can help us increase the carbon efficiency of the existing diesel truck fleet that’s out there,” he adds.

Working in concert

Decarbonisation efforts are clearly underway, along with the adoption of telematics solutions, but where will that position the industry by the end of the decade?

“Many people genuinely believe that the road transport industry can be decarbonised over the next couple of years. Exactly what the road will look

like, though, is something on which we have to work together,” says Carre. Among other things, he believes that automakers, infrastructure companies, shippers and hauliers need to form coalitions to engage with regulators. “No player or no single link in this value chain can do it on their own. We have to work in concert together.”

Importantly, Carre believes there has been a real shift in the mindset of transport players, many of whom are putting sustainability at the core of their roadmaps. Prioritising this target will ultimately drive the uptake of digital technologies and alternative fuels. “As I’ve mentioned, technology really is our friend in this space,” he reiterates. “We need it here and now. With economic growth, the need for transport will only increase, so in a way, the demand for this industry is assured. However, it comes with a clear obligation for everyone to play their part in decarbonising it and making it sustainable.”



New mobility must focus on maximising societal benefits

More data is needed to determine whether a transportation innovation should be mandated, encouraged, restricted or even forbidden. By Megan Lampinen

The mobility industry is experiencing a wave of innovation, with numerous developments around public transport, shared mobility and autonomous vehicles (AVs). Traditional automakers, start-ups and even the tech giants are all promising significant advances in terms of comfort, convenience and accessibility, but there's a serious risk associated with some of these developments as well.

Transit expert Todd Litman, Founder and Executive Director of independent research organisation Victoria Transport Policy Institute, warns that in certain situations, apparently congestion-reducing and time-saving innovations may in fact exacerbate existing urban problems. Before governments and transport agencies set out policies, they need to consider the full impact of emerging mobility options.

Litman sat down with *Automotive World* to discuss some of the key messages from his book, [*New Mobilities: Smart Planning for Emerging Transportation Technologies*](#), which can help determine whether a transportation innovation should be mandated, encouraged, regulated, restricted, or even forbidden. The ultimate aim, he explains, is to facilitate a balanced array of transport options so that each modality is used in the most efficient and equitable way.

What prompted you to write this book?

Five or six years ago I started examining how we should think about AVs. At that time, a number of industry optimists were predicting that by 2020, most people would rely entirely on AVs and move away from

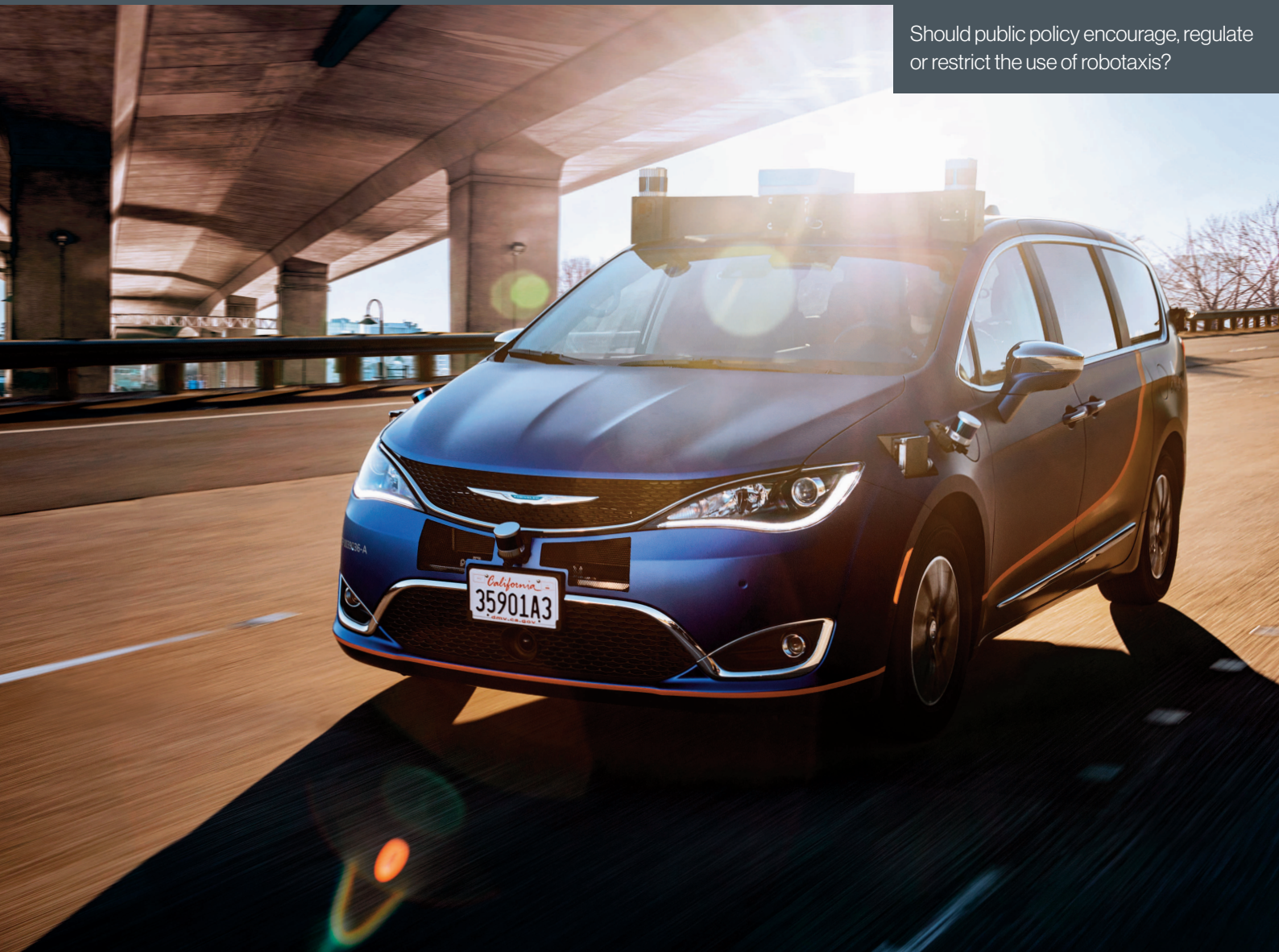
car ownership. In theory, this could solve many problems, everything from providing basic mobility for non-drivers and reducing congestion to eliminating parking problems and accidents. It's a techno-optimistic utopian vision of the future.

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I want to determine what we should fear, what we should be excited about and how we can ensure that these new technologies and services maximise benefit both to individuals and communities

And you had concerns about this vision?

Most of these predictions came from people with a financial interest in the industry. Many came from the telecommunications segment, which saw transformational change over the past few decades with the smartphone. They were predicting that the automotive industry would change in the same way. As a curious guy, I looked critically at some of the assumptions.



Should public policy encourage, regulate or restrict the use of robotaxis?

What conclusion did you come to?

The optimistic predictions were probably not realistic. I began to look beyond AVs at some other transportation innovations that may very well affect society in the future. I broadened the discussion to include flying taxis, the hyperloop and the whole movement toward mobility as a service (MaaS). Even though there is a lot of information on these new modes of transport individually, few people are looking at how the overall integration of these new technologies will work.

As a policy analyst, what sort of questions are you asking about each of these mobility modes?

I want to determine what we should fear, what we should be excited about and how we can ensure that these new technologies and services maximise benefit both to individuals and communities. Some of these ideas are fine if they are used where they are really worthwhile. The risk is they create more traffic congestion or generate more collisions and emissions, making poor people worse off. For planners and policymakers,

that's where the discussion needs to be. If you talk about technologies like AVs, flying cars, and drones, the first people that you talk with are inevitably engineers and investors who are excited about this technology. They are interested in how soon you'll have a prototype ready, but there's a great need for naming these fundamental questions at the same time.

then policy should be designed differently.

In your book you single out public transit and mobility prioritisation strategies as those that provide the best social benefit overall. What's the thinking behind that?

Everybody would benefit if buses were not stuck in traffic congestion

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If you talk about technologies like AVs, flying cars, and drones, the first people that you talk with are inevitably engineers and investors who are excited about this technology

How can you predict the full impact of these technologies?

Part of the challenge is that we can't predict some of the details. We don't know exactly when or how AVs and hyperloops will be commercially available and used. It is all contingency planning and we have to frame it as an 'if then' statement. If AVs are affordable, commercially available and perform as predicted, and if they achieve their targets like reducing accidents, then policy maker should do x, y or z. But if they prove more expensive or more dangerous or they're less flexible,

along with general traffic, because that would motivate some people to get out of their cars and use public transit. Where roads are congested, everybody's better off if policy favours space efficient modes. Somebody driving alone in a car is taking up one or two orders of magnitude more space than somebody who is a passenger in a bus. We want to motivate the typical commuter to choose public transportation, and to do that it has to be the faster option. That means the road must be managed to favour buses, giving them priority over a private car.



What sort of cleaning regulations will be required for autonomous shared vehicles?

And the mobility prioritisation aspect?

Imagine that Uber comes out with a van that can carry up to eight passengers, travelling from a suburb to central London. You could either drive yourself to work and pay a fee to use the priority lane or you could take this cheaper van option. That's the mobility prioritisation strategy.

Your research also warns that AVs could prove less comfortable and convenient than personal vehicles or today's taxis. What sort of questions need to be asked on this front?

The proponents are exaggerating the benefits. Every time you see a picture of a robotaxi, the passengers are

clean and well dressed, and the vehicle is in perfect condition. What is that taxi going to look like after a year of use when some of the passengers have been travelling home after a night of drinking, maybe a few people have used it as a private space? What happens if you get into this taxi and there's a stain on the seat? There are big questions around how frequently those vehicles will need to go to a cleaning station and what the cleaning station industry will look like. How far will an average robotaxi have to drive itself in order to reach the cleaning station? How much time will that take out of its operating schedule, and what symptoms will it use to determine how frequently it has to go? These are just some of the things we need to be thinking about.

So is the big question whether every mobility modality makes people better off?

Let me give you an example. Between the years 1900 and 2000, motorisation allowed the average person to travel about ten times faster and further. But then look at how people spend their money. A survey of how working-class families spent their money in 1900 had no category for transportation expenses, as most people walked everywhere. Today, the average motorist spends 20% of their household budget on the car. That means 20% of your work hours are devoted to earning money for your car. If you use effective speed, which is your travel speed measured as your travel distance, divided by the time you spend traveling and the time you spend earning money to pay your travel expenses, the average person is not going much faster than our great-grandparents. To put it another way, many people are spending a lot of money on cars that would be better off not owning a car and relying more on walking, bicycling and public transit.

Is there a threat to the traditional automaker business model in these conclusions?

You could see it as similar to the petroleum industry and how they were threatened by vehicle electrification. A smart investor will invest less in oil wells and more in solar panels or wind farms. You can still make a profit, it just changes where you put your effort. Anybody who says that this is a threat to industry lacks imagination.

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Anybody who says that this is a threat to industry lacks imagination

How would you sum up your advice on transport policy planning around these new mobility options?

Remember the myth about Icarus, who took this wonderful new technology in the shape of wax wings that his father made. Despite the warnings, he flew too close to the sun and died. That's an extreme example, admittedly. If we are clever, we simply use new technologies. If we are wise, we use new technologies to maximise our benefits. The question we have to ask ourselves is whether our plan is going to be clever or wise? Should we be focusing on the technology or should we focus on maximising benefits?

A close-up photograph of a hand using a yellow microfiber cloth to polish a bright red car body panel. The car's surface is highly reflective, showing clear highlights and reflections. The hand is positioned on the right side of the frame, moving the cloth across the red surface. The background is dark and out of focus.

Self-healing materials to shape the cars of the future

Ben Smye explores the current trends in self-healing materials research, and where they might take the automotive industry in the coming years

It sounds like something out of a science fiction film, but the idea of a self-healing car might not be as wild and futuristic as it seems. Though machines that can fix themselves remain a long way off, materials engineers have been developing technology that could soon make this fiction a reality.

How do self-healing materials work?

The most well-known means for creating a material that can heal itself is to embed small capsules of healing agent inside the material itself. When the material is damaged, the capsules break and release the repair substance. However, the capsule size is crucial in this design, since if they are too big, the material will be weakened. They can also only be used once, which is not ideal if a material is likely to suffer repeated damage.

However, engineers have created self-healing materials that work through vascular networks, similar to veins on a leaf. In these microvascular materials, when there is a crack, healing agent flows through the vascular network and heals the break. This has proven to be effective, but it is also a slower method of repairing a material.

One challenge when creating self-healing materials that can be used in the automotive sector is that it's much harder to create metals with these properties. Many vehicular parts are made of metal, but because of the chemical construction of metals and the way their atoms bond together, it's difficult to create a self-healing metal. As a result, design engineers often concentrate their research on polymers.

Research into self-healing polymers has yielded ground-breaking results. It's now possible to have a smart polymer that can regain its previous characteristics even after being damaged. Even more exciting is that materials scientists have been able to develop smart polymers called intrinsic polymers that can repair themselves without external stimuli. These intrinsic polymers have specific reversible chemical bonds, which means that they can recover their original properties.

Practical applications

All these developments are promising, but the question remains as to how these early steps in self-healing materials can be more than just curiosities from a laboratory. Many researchers are therefore exploring practical applications of their developments. For example, [researchers are looking at the potential for self-healing polymeric coatings in a space exploration and deep-sea context](#). In these situations, a coating would reduce maintenance costs dramatically, as these are difficult places for repair work to take place.

These coatings are being designed for extreme environments, but should there be success in these sectors, the products will likely be made available in other areas. Some of the coatings being designed are anti-corrosive, while others are scratch resistant. These features are obviously useful for travelling to outer space and under the sea, but they would also be beneficial to vehicles that operate in less extreme conditions.

Painting cars is one of the major reasons for costs increasing during automotive maintenance. If the



developments in self-healing polymeric coatings can create paint that can withstand minor scratches and resist corrosion, this could impact how much automotive operators have to spend on repairs. Even something this simple has the potential to extend the use life of vehicles, which would be good news for users.

Reversible chemical bonds are also at the heart of another technological advancement. Researchers at [Harvard University have developed a tough, self-healing rubber](#). To do so, they combined covalent and reversible bonds together by creating a molecular rope. The result is a transparent rubber that heals itself by distributing stress around the material.

When rubber cracks, it is usually because stress has become localised at one point. The molecular composition of the self-healing rubber prevents this from happening, as the material spreads the stress around through a network

of crazes, which are essentially cracks that are connected by fibrous strands. By allowing the stress to be dispersed more evenly through the substance, the self-healing rubber is far more able to cope with force being applied to it.

Self-healing rubber has many potential practical applications. It could be used to make rubber bands that never snap, but the main use that the researchers have pointed out is tyres. Tyres made of this kind of rubber would be able to withstand more stress than the ones currently available, and would likely last longer, even in extreme environments. It's even been suggested that should a tyre happen to be cut, if it was made of self-healing rubber, it wouldn't need to be replaced immediately.

But perhaps we need to look beyond just cars themselves for the uses of self-healing materials. Road surfaces are easy to overlook when thinking about improvements in materials science. However, recent

developments mean that as well as cars with self-healing properties, roads could also display these characteristics in the future.

and compare various materials to choose whatever works best, and materials databases such as Matmatch can help.

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It sounds like something out of a science fiction film, but the idea of a self-healing car might not be as wild and futuristic as it seems

In a promising development scientists have patented a self-healing concrete. [Hendrik Marius Jonkers's concrete includes bacteria that produce limestone](#), allowing the road surface to mend itself. Roads of the future thus have the potential to fill their own potholes. Pothole repair cost an estimated £1.3bn (US\$1.84bn) in the UK in 2020, so developing a self-healing road could do more than just make for a smoother driving experience; it could reduce repair costs and potentially extend the driving lives of vehicles.

In the area of self-healing materials, it would seem that science is doing its best to catch up with fiction. However, it's not there yet. Until then, design engineers should work on selecting materials that are best suited to the demands of their project. Design engineers need easy ways to research

For example, [a polyamide material such as ForTii 11](#) provides optimal toughness for automotive electrical components. This high temperature polyamide contains halogen-free and halogen-containing flame retardants and performs well in harsh environments. It minimises the risks of cracking, and improves product reliability in terms of thermal shock ageing.

Futuristic cars that can mend themselves might not be available for purchase just yet, but research into self-healing materials is gaining ground every year. Cars that never get scratched or can repair their own damages might be driving on the roads in the next few decades. Though the technology is still being developed, materials scientists and engineers are turning the stuff of science fiction into science fact.

About the author: Ben Smye is head of growth at [materials search engine Matmatch](#)



Traton plays the long game with electric delivery in Brazil

The e-Delivery launch validates Volkswagen Caminhões e Ônibus' EV capabilities and steers the Brazilian market in a new direction. By Megan Lampinen

Brazil's commercial vehicle market has officially begun its electrification journey with the market launch of the [e-Delivery](#) from Volkswagen Caminhões e Ônibus (VWCO). Four years after the first prototype was shown, Traton's Brazilian division officially handed over the first electric model to beverage delivery company Ambev on 12 July. This debut model marks the first of a batch of 100 e-Deliveries that will enter operation before the end of the year, potentially growing to 1,600 by 2025. The truckmaker also has contracts in place with Coca-Cola FEMSA Brasil and JBS, with interest expressed by a total of 58 additional local businesses.

For VWCO this milestone serves as validation of its development capabilities and technological innovation. For Brazil as a whole, it marks a new direction in commercial transport. "When we showed the e-Delivery prototype back in 2017 we knew we were changing the course of the industry," VWCO President and Chief Executive Roberto Cortes told media at the launch event. "Soon, along with other VW and Traton Group initiatives, we will change the history of world transportation."

Landmark offering

That's a bold claim, but for Cortes, it's all about offering fleets "the option to make better choices." In Brazil, that choice currently comes in two forms: an 11- and a 14-ton version both aimed at delivery in urban regions. This segment is a particularly good match for electrification in light of tightening emissions requirements and low-emission zones in city centres. The

vehicles' quiet operation makes them a logical choice for routes where noise is an issue, such as late night or early morning neighbourhood operation or within hospital grounds. The return-to-base model of fleets in this segment, as well as their shorter daily mileage, avoids the many challenges of relying on public charging infrastructure.

Notably, VWCO isn't just providing the electric trucks; it is also providing technical consulting on charging infrastructure and the chargers. Its e-Consortium business model brings together a range of ecosystem partners across manufacturing, assembly, charging infrastructure and battery lifecycle management: CATL for battery packs, WEG for motors, Bosch for electronic control modules, Meritor for axles, Siemens for EV chargers, etc.

Profit desert

Developing the e-Delivery was no easy feat. A team of 150 professionals worked on the project over a number of years, overseeing more than 400,000km of testing. At its manufacturing facility the automaker built an entirely new production area, known as the e-Shop, dedicated to electrification. In total, VWCO estimates that it spent Real 150m (US\$29m) on the e-Delivery, and it may not make that back quickly.

In fact, most automakers are not making a profit from the sale of EVs today. Analysts have warned that the shift to electrification will likely bring a 'profit desert' period that most automakers will simply have to survive. In the passenger car segment,



Volkswagen Caminhões e Ônibus has begun handing over e-Delivery models to its first customer, Ambev

McKinsey estimates EVs cost up to US\$12,000 more to produce than a comparable internal combustion engine version. It's a similar situation for electric trucks. "For the time being, nobody is making profit on EVs, either on passenger cars or commercial vehicles," says Axel Schmidt, Automotive Global Lead at Accenture. He points out that the technology is still new and production volumes low. As output ramps up, there's a good chance profits will become possible.

Despite the challenge, Cortes is sanguine. "All innovation entails initial product development costs," he tells *Automotive World*. "We understand that it will take time to see financial results." The company intends to build on the e-propulsion technology used with the e-Delivery and apply it to other segments down the line. "An electric bus will probably be the next product," he teases. "We are studying the viability of electrification across our product line."

For fleet operators, the payback will also take time. The e-Delivery costs about 2.5-times as much as its diesel equivalent but the promise of a lower total cost of ownership (TCO) is expected to sway buyers. The company estimates that operators can make back the difference in three to four years. VWCO's Ricardo Alouche, Sales, Marketing and After Sales Vice President, pointed not only to the fuel savings but also the lower maintenance costs associated with EVs. "Ownership costs are so much lower than a traditional vehicle, so it will help our clients increase profitability," he explains. "It will also help their image and branding."

Outlook

Local production and sale of electric trucks may be new for Brazil, but parent company Traton has been building up experience in the segment for some time. Its performance so far, however, points to headwinds for VWCO. "The first commercially



available battery-electric truck, Fuso's eCanter, has performed pretty weakly," says Jonathan Storey of Automotive Reports. The eCanter made its world premiere in September 2017 and it entered series production the following month. "The market reception for the eCanter has been lacklustre, and cumulative global deliveries reached just 150 units by March 2020 and over 200 units by March 2021," he adds.

However, the long-term outlook for electric urban delivery applications is promising and the segment is attracting a growing number of players. Establishing itself as a serious contender in the field now could prove a logical move for VWCO and give it a first-mover advantage in its home market. A promotional video played during the e-Delivery launch event

stated, 'Doing it first means making history. Following trends was never our style. We prefer to create them.'

Offering the first locally developed and built electric truck for Brazil indeed breaks new ground, but just how fertile it proves may hinge on factors outside of VWCO's control, such as government incentives, grid issues, fuel pricing, etc. "The climate is changing more in favour of e-trucks so the e-Delivery should perform better [than the eCanter], but all supportive measures should be considered," adds Storey.

The focus now is on rolling out deliveries across Brazil and to other markets, even possibly Europe, in the future. "We are absolutely going international with this product," said Cortes.

Shared EV chargers provide a home away from home

Co-Charger believes that community charging can make electric vehicle ownership more convenient for those without a private wallbox. Freddie Holmes finds out more



For the first time, drivers have the opportunity to fill up their cars at home. Electric vehicles (EVs) mean that dedicated trips to the fuel station are no longer necessary, and all it takes is the installation of a domestic wallbox. As such, EVs can be charged when they would already be stationary. For most drivers, this means that very little public charging is needed.

The challenge is that not everyone can have a domestic wallbox installed at their home. This might be due to physical constraints: perhaps there is no private drive, as the user lives on a terraced street or in an apartment block. The property might be rented, in which case a wallbox is at the discretion of the landlord. For some, the lump sum needed to purchase a home charging station may be off-putting—another expense for a vehicle that is already more expensive to buy up front than a conventional car.

One company believes there is an opportunity for domestic chargers to be shared by other drivers, and not just for the occasional top up: UK-based Co-Charge says EV drivers can rely on other peoples' home wallboxes as their primary charging station. The company even hopes that community charging becomes part of the conversation at a dealership: if buyers cannot have their own charging station at home, sales executives can suggest shared chargers as an alternative.

Speaking to *Automotive World*, Joel Teague, Chief Executive of Co-Charger, explained that this would have the same impact as installing thousands of new chargers across the country, but without a drop of additional investment required: these are chargers that are already in place, just with better utilisation. Co-Charger is a UK

operation for now, but its strategy could be easily adopted in any market where domestic chargers are common.

The business model has been described as Airbnb but for EV charging. Is this accurate?

Only if everyone went on holiday every week and did it in their own street. There are already companies that offer an 'Airbnb for charging' experience, where you can use an app to find a charger when you are away from home. But that is not us: we are focussed on base charging, which is primarily while you are at home or at work.

Your base charging strategy is usually sorted out before you buy an EV; only around 9% of drivers today will buy an EV without knowing exactly where their vehicle will be charged. We provide a solution for people who cannot charge at work or home. If Airbnb is a holiday lettings company, think of us as a residential lettings company.

How does Co-Charger work in practice?

It is a neighbourhood model that is based on the idea of 'community charging'. The person with the charger makes it available to a handful of neighbours so that they can go and buy an EV as well. Let's say Sue has spent £700 (US\$950) to have a charger installed on her driveway but it is only used one night a week on average. Sue can download our app, set up a host account that says where she lives, what type of charger she has, and how much she wants to charge per hour for others to use it. Someone who lives nearby and cannot charge at home or work can sign up as a chargee. They can then be paired up with Sue through the app.



A home charger means the car can be charged just like a smartphone—but not everyone has the luxury



How can the owner of the charger ensure it is not in use when they need it?

The person looking to use the charger can message the owner directly and make scheduled bookings. For example: every Tuesday night from 6pm until Wednesday morning at 8am before leaving for work in the morning. All communication is handled through the app, which sorts the matchmaking, the formal booking process, reminders and payment.

The idea is that chargees can book for an extended period of time, meaning they can just walk home rather than having to hang around waiting—like you do with a public charger. And importantly, you only pay for the time the vehicle is charging, which is validated through the app. We take a small fee, but the rest of the profit goes to the owner of the charging station.

In effect, you are increasing the utilisation of existing stations. Does this mean fewer public stations are needed?

This increased utilisation is the key. If you step away from the bubble of EV enthusiasts and consider the average driver, they are not going to ditch their trusty diesel until they know they have a solution that is convenient, dependable and affordable. By reusing the expensive part of charging—the charger—everybody saves money. In some cases, the chargee will pay less than the owner of the charger because they have not had to pay for the installation of the wallbox. Ultimately, this will help to create new EV drivers and not just support existing EV owners. It is a convenient way of charging, with only a slightly longer walk to your front door.

Who is most likely to use community charging as a primary solution?

We have not run a full analysis on this yet, but roughly 40% of the UK population does not have a driveway. On top of that, many live in rented accommodation or have a home where the wiring or sub-station will not support a charger. If you put together all the different reasons why people cannot have a charger at home, that accounts for roughly half of the motorists in the

How can awareness of community charging be increased among prospective EV buyers. Are dealerships recommending this yet?

We are trying to weave it into the way things are done. We will soon announce a deal with one of the UK's major leasing companies which will mean we are part of their sales process, and we also have a deal with a company that offers EV packages for

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Ultimately, the aim is to stitch ourselves into the fabric of EV ownership

UK. It is a pretty huge number. Crucially, research has shown that if you have a driveway you are four times more likely to own an EV.

How many EV drivers are currently sharing chargers through your app?

We currently have around 3,700 registered users, but at the moment, the usage level is fairly low. Fewer people are driving their cars at the moment in general, and interestingly, many who have registered with us have not even bought an EV yet. But as the system builds, more users will be within walking distance of a host and usage will increase naturally. The app notifies users when there is a new opportunity nearby, and that is helping to quickly build up a critical density of those with chargers and those who need to charge. We are currently growing our user base at around 40% month-on-month.

prospective buyers. We are in conversation with some of the major automakers, which are also keen on the idea of community charging. In addition, Co Charger sits on the EV forum of the UK's Society of Motor Manufacturers and Traders (SMMT). All of this is part of a push to integrate ourselves within the car sales process.

Can this help the UK in its bid to go all electric?

Studies have shown there is a massive shortfall in the number of chargers planned in the UK, and that if just one in 25 home and workplace chargers is shared, this would plug the gap. Every time an EV is sold to someone with a home charger, they then become another host—the system self-scales. Ultimately, the aim is to stitch ourselves into the fabric of EV ownership.



The automotive industry needs a telecoms mindset

Telecoms companies are making strides into all areas of the car, and are hoping to impart some of their own thinking as the 5G rollout beckons. By Xavier Boucherat

Recent years have seen the world's telecoms giants take progressively bigger steps into the mobility ecosystem, with connected services, autonomous vehicle (AV) development and smart city applications all dependent on their networks. The gradual onset of 5G connectivity will further enshrine the role of these companies in the sector: with connected, autonomous, shared and electric (CASE) megatrends transforming the automotive business, automakers will be acutely aware that one day, fast and reliable connection speeds will be just as important as a vehicle's driving performance on the road.

AT&T—the largest telecom company by total revenue—now has more than 40 million cars across 30 brands on its network. A May 2021 announcement in partnership with Honda underlined how players in the space are building ever-closer links with automakers to create attractive digital packages for potential customers: the automaker now offers AT&T's Unlimited In-Car Wi-Fi service with WarnerMedia's Ride app included for free, making more than 1,000 hours of live and on-demand video available to passengers.

can provide, as opposed to protocols such as Direct Short-Range Communications (DSRC).

In May 2021, Volvo and Ericsson undertook a joint project aimed at solving a different challenge: the successful handover of connected cars between cross-border 5G networks. Such situations are common in regions such as Europe and are often part of long trips when connected services such as maps are particularly appreciated.

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Successful, widespread delivery of connected services and features will depend on the automotive industry's ability to pivot to a model not unlike the telecoms industry

Meanwhile in the realm of safety, Verizon also announced a partnership with Honda at the University of Michigan's Mcity, an AV proving ground. The pair are exploring how 5G Ultra Wideband and 5G Mobile Edge compute can ensure fast and reliable communication between road infrastructure, vehicles and pedestrians. Tests included messages and alerts to emergency vehicles, pedestrian crossings and red-light runners. It is increasingly likely that vehicle-to-everything (V2X) communication will lean on cellular networks for the richness of data they

Tests at Sweden's 'AstaZero' track demonstrated that smooth handovers were possible, ensuring not only the uninterrupted delivery of fully up-to-date maps, but that vehicles could also update maps themselves where necessary via the Mobile Edge Cloud and deliver this valuable data to other vehicles in the area. In effect, the 'Cooperative, Connected and Automated Mobility (CCAM) Ecosystem' allows autonomous and connected cars to behave like smart clusters, rather than individual units.



In a statement, Mikael Prytz, Research Director, Ericsson Area Networks, stressed the data-intensive nature of this functionality. “Sharing an update map with other cars is a latency-sensitive task and requires high network performance within and across multiple networks. During the test at the AstaZero track, we could tackle this challenge with promising results.” The test encompasses a large scale-scale connected car trial along a 5G corridor between Metz in France, Merzig in Germany, and Luxembourg.

An evolving relationship

Speaking to *Automotive World*, Magnus Gunnarsson, Head of Connected Vehicle Business

Development & Portfolio, Ericsson, said that successful, widespread delivery of connected services and features will depend on the automotive industry’s ability to pivot to a model not unlike the telecoms industry. For this to work, he explained, automakers must move from inward-looking stovepipe development to an outward approach that embraces interoperability and collaboration.

“This is what the telecoms and telecoms equipment industry has been doing for the last 20 or 30 years,” he said. “Modern handsets will work regardless of whether you are in Europe or the US. This is thanks to standardisation. What we are trying to do, hypothetically, is to install some of that thinking into the mobility space.”

This is an immense task, he added, but Gunnarsson believes there is a strong will to succeed. 5GAA, the global association of 130 companies including major automakers, continues to go from strength to strength in defining worldwide standards for automotive 5G. Recently it announced a new programme with the Global Certification Forum to support the drive for interoperability, reliability and safety of cellular-V2X networks.

mobility comes to life, said Gunnarsson, companies like Ericsson are bringing 5G to market. What's important to understand, he says, is that the next generation of cellular technology brings more than simply faster speeds and greater bandwidths: 5G has been built from the ground-up with devices in mind, meaning that unlike 4G—which largely connects people with people,

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The connected vehicle is the defining IoT case and that's why today you will find a dedicated automotive unit in all telecom companies

The telecoms giants are responding in kind to help automakers meet their CASE goals. Even electrification, which Gunnarsson suggests might be the biggest megatrend of them all, is having an impact: connectivity is not a requirement of going electric, he said, “but all the major automakers worldwide are now taking the opportunity to start with a white sheet of paper when it comes to vehicle architecture design. New electrical architectures are far more server-based, bringing benefits including over-the-air updates, new sensors, high performance computing and more.”

This opens further opportunities for connectivity and collaboration with the telecoms sector. As CASE

and people to the internet—5G is designed to connect everything.

“The connected vehicle is the defining IoT case,” he concludes, “and that's why today you will find a dedicated automotive unit in all telecom companies. It is a hugely interesting space to work in, and we're well past the hype phase.” Automated or not, connected vehicles are quickly becoming a reality, and the role of telecoms companies is clear: to help automakers extract the most value from opportunities, and to foster and interoperable, collaboration-based ecosystem, much like players such as Ericsson, Nokia and more have done in years past.



Out with the old, in with the new at VW AGM

The world's largest car company unveiled its strategy to take the lead on EVs, whilst also drawing a line under Dieselgate. By Xavier Boucherat

Following the start of ID.3 and ID.4 deliveries in late 2020, and the unveiling of the China-only ID.6 SUV, the dominant theme of VW's AGM 2021 was always going to be electrification and—in the words of Hans Dieter Poetsch, Chairman of the Supervisory Board—VW's transformation into a tech company. Despite continued COVID-19 disruption, things are reportedly on schedule, with 170,939 electric vehicles (EV) sold over the first half of 2021, a figure twice that over the same period in 2020.

The time is now!

The event came in the aftermath of devastating floods in VW's home market of Germany, which have so far taken 180 lives with more than 150 still missing. Chief Executive Herbert Diess left little room for interpretation on what he felt was behind the flooding. "Climatologists have long predicted that climate change is

leading to more extreme weather events," he said. "For every degree of global warming, the air can absorb 7% more water vapour, with overnight rains turning into raging torrents that can sweep away entire streets."

Along with the floods, the AGM followed the European Commission's unveiling of the 'Fit for 55' climate package, under which it aims to cut greenhouse gas (GHG) emissions by at least 55% by 2030. By that point, said Diess, EVs could account for as much as 66% of the new vehicle fleet. Electric mobility, he added, is the only technology that can significantly reduce vehicle CO2 emissions over the next ten years, and now the company has its sights set firmly on becoming the EV world leader.

Hence, the automaker has unveiled its 'NEW AUTO' strategy which, if all goes to plan, will spell a complete transformation of the company by 2030, said Diess. Things are going well: a 26% market share in Europe



Herbert Diess presented the NEW AUTO' corporate strategy at the recent AGM



Herbert Diess, says one analyst, has recognised the need to personally involve himself in electrification and sustainability, much like Elon Musk

puts it ahead of all competitors, and with its own production under way in the US and China, the group feels it is well positioned to repeat this success elsewhere.

“We assume that our margins in the electric mobility and internal combustion engine (ICE) business will reach the same level in two to three years,” he claimed. “By 2030, the global EV market will be on a par with internal combustion engine (ICE) vehicles.” With the catch-up complete, he says, EVs will be much cheaper than their standard combustion counterparts.

At the core of these efforts will be the development of a standardised battery cell format, the ‘unified cell’, which VW hopes to install in 80% of

vehicles by 2030. Together with partners including LG Chem, SKI, CATL and Guoxuan High-tech, VW will become one of the world’s largest battery cell producers, with six gigafactories established in Europe alone by 2030.

Jose Pereira, Director, Automotive & Transportation at Frost & Sullivan, agrees that VW is now in a good position to lead the EV market worldwide, having moved quickly after the Dieselgate scandal to develop a dedicated platform that can be leveraged across its different brands. “They are also investing in battery manufacturing and working to standardise key components like cells to enable further cost reductions over the next five to ten years, with the objective of lowering vehicle prices and making the EV accessible to a wider mass market audience beyond EV enthusiasts.” Other automakers such as GM and Hyundai have followed similar approaches, he says, but are later to market, meaning their respective strategies for the next five years lack the same clarity and focus.

“It is clear that VW is doing a great job of portraying itself as one of the most pro-EV companies among established automakers,” says Pedro Pacheco, Senior Research Director, Gartner. “Events like Battery Day, clearly inspired by Tesla, contribute to this... In a sense, Dieselgate may have come



VW is in a good position to lead the global EV market

at the right time for VW, as it allowed its leadership to see they needed a fresh start, and that meant EVs.” Pacheco also suspects Diess has recognised the need to become more personally involved in advocacy for EVs and sustainability in general. “Again, this draws inspiration from Tesla and Elon Musk’s posture as an EV evangelizer who speaks directly to the public. But in any case, it’s producing great results.”

Brand new

Diess also took time to outline what the advent of the electric, connected vehicles would mean for the organisation of individual brands within the VW family, drawing attention to volume, premium and sport segments. These distinct brands have been a strength of the automaker through the years, he argued, and this will remain the case, but by 2032 the way in which these will be differentiated will be very different. Software and tailored customer solutions, said Diess, will become the main tools by which brand identity is forged.

In the volume segment, the focus is electrification and the new MEB platform. VW has grown its share of the market in Germany by 20% over the first half of 2021 with brands including its namesake marque, Seat and Skoda leading the drive. With the ID.3, ID.4, ID.5 and ID.6, the group is aiming to lead the global EV market by 2025. The ID.Buzz will also play an important role: a spiritual successor to the Bus camper van, VW plans to equip it with Level 4 self-driving technology, suitable for ride-sharing and logistics applications.

Audi will lead the group’s premium offerings. The Q4 e-tron is the first premium vehicle built on the group’s new MEB EV architecture, whilst ‘Project Artemis’—a hi-tech flagship Audi EV—will be the first to use the VW.OS operating system. These technologies will also be rolled out across the Bentley and Lamborghini ranges, helping the group to benefit from greater economies of scale and leverage synergies across the premium segment. Long term, VW.OS will be rolled out group-wide, with 40 million vehicles running it by 2030.



In the sports segment, Porsche remains an extremely valuable proposition with profit margins of over 50%. But here too the automaker wants to go green, with the all-electric Taycan already having amassed an order backlog of five months. The brand is aiming for 80% all-electric models by 2030, as well as net-carbon neutral. Porsche is also lending electrification expertise to Bugatti and hyper-car development.

VW is doing a great job of portraying itself as one of the most pro-EV companies among established automakers

Putting the matter to bed?

Updates on the company's investigation into the Dieselgate scandal have been a feature of VW AGMs since 2016. 2021 may prove the last: Jorg Hofmann, Deputy Chairman of the Supervisory Board, said that "the most comprehensive and complex investigation carried out by a company in German economic history" was now complete.

Findings from Gleiss Lutz, the law firm tasked with the investigation, led the VW Supervisory Board to conclude that former Chairman of the Board Martin Winterkorn and former Audi Chairman Rupert Stadler breached their duties of care. In particular, said Hoffmann, Winterkorn received specific indications of unlawful engine software functions as early as 2015, but failed to prioritise the matter. Winterkorn and Stadler remain adamant that they acted within their duties at all times.

Both will pay settlements to VW for damages, as will insurers. These will do little to cover total estimated damages of €32bn (US\$37bn), said Hofmann, but the company is adamant that this is the best way forward. A push for further damages

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In a sense, Dieselgate may have come at the right time for VW, as it allowed its leadership to see they needed a fresh start, and that meant EVs

would likely result in enormous legal fees, and in any case, said Hofmann, Winterkorn, Stadler and the relevant insurance companies are in no position to cover all damages. The company will hope that this proves Dieselgate was an isolated incident of executives acting in bad faith, and not a company culture issue, says Pereira.

The investigation found no wrongdoing on the part of Diess and Poetsch, and criminal charges made against the pair were dropped in 2020 in exchange for payment of fines. Hofmann was keen to stress that Poetsch—who became chairman of the Supervisory Board just weeks after the scandal broke—did not attend meetings where the issue of board members breaching duty of care was discussed. Poetsch is seeking re-election for the chairman position.

The company's investigation may have concluded, but only time will tell whether Dieselgate now disappears for good. What is important, says Pacheco, is that VW stays consistent: “It really needs to

walk the talk, and some work remains to be done on that front. VW has used its EV offensive to build a strong image of sustainability advocacy, but at the same time it failed to achieve the EU's CO2 targets last year, putting in a worse performance than several large carmakers.” In an interview with German newspaper Handelsblatt, Diess also said he was against a speed limit on the autobahn, a move which the country's green party has pushed as a quick and simple way to achieve emissions reductions.

Moving forward, says Pereira, it is likely that some law firms will make further attempts to recover damage. Leigh Day, a UK-based firm, is the most recent example, bringing a case against the VW Group in Europe in June 2021. “This will continue to be a thorn in the side of VW that it would like to be rid of once and for all,” says Pereira. “It will have to navigate the headlines every so often and repeat the line that as far as it is concerned, the topic is in the history books while it is focussed on the future.”



Magna jockeys for ADAS leadership with Veoneer acquisition

Megan Lampinen offers an inside look at one of the most significant automotive M&A transactions of the year

The advanced driver assistance systems (ADAS) market is projected to grow rapidly as vehicles edge ever closer to an automated future. For suppliers with the right in-house capabilities, scale and financial backing, the segment could prove a major revenue driver.

The global ADAS market in 2020 was estimated at US\$13bn but that should triple over the coming ten years, expanding at a compound annual growth rate (CAGR) of about 14%, according to Magna. The Canadian supplier, which is already a key player in this segment, recently announced a deal to acquire Swedish rival Veoneer. The acquisition will give it immediate access to Veoneer's portfolio of automotive sensing technology including camera vision systems, surround-view cameras, radars, the perception stack and LiDAR. Magna believes the move will position it as one of the largest global ADAS players while simultaneously bolstering the Canadian giant's underlying aim to provide full vehicle competencies for the car of the future.

Complementary versus redundant

Once the deal is completed and approved, Veoneer will be combined with Magna's existing ADAS business and integrated into the electronics operating unit. Camera and radar technologies represent the largest components within the ADAS market, and Magna expects them to remain so over next decade. Domain controllers are another fast-growing segment and

are on track to become the third largest element of the addressable market by 2030. Magna and Veoneer both play to these promising segments, and the idea is that the two will be even more effective when working together.

The combined business are expected to see a CAGR of about 30% out to 2023, twice the pace of the ADAS market. That also compares to an expected 20% growth rate for Magna's standalone ADAS business over the same timeline. "Veoneer's complementary technology offerings, customer base, and geographic footprint make it an excellent fit with our ADAS business, and the acquisition strengthens our global engineering and software development talent base," asserts Magna Chief Executive Swamy Kotagiri.

However, there is a big difference between technologies that complement each other and those that are redundant. Peter Sklyar, Equity Research Analyst at BMO Capital Markets, points out that in terms of camera systems and domain controllers, "Magna had already progressed well down the road." However, Kotagiri insists that product overlap is not a concern, pointing to radar as an example of how the two line-ups fit together. He notes that Veoneer has had corner and short-range radar in production for a long time, with millions of units in production and on the road, while Magna has been looking more to digital imaging radar.

But complementary benefits are not limited to product, as Kotagiri also points to the geographical diversity, particularly customers in Asia.

Berenberg flags the “meaningful increase in exposure to Daimler and Ford” along with the potential to “establish sales pipelines with OEMs in Asia such as Honda and Hyundai-Kia and some domestic Chinese automakers.”

Competitive edge

Kotagiri is optimistic that this acquisition will position Magna within the world’s top five ADAS players. “And there will not be a very big gap between these top players,” he emphasises. Berenberg points out that it “would put Magna on par with Aptiv in terms of its ADAS revenue contribution,” which is estimated at US\$1.2bn pro-forma for 2020, compared to Aptiv’s US\$1.3bn.

Veoneer brings years of experience in key ADAS areas and an additional 3,800 engineers, 1,700 of which specialise in software, but does this make it more likely that Magna’s bids will be successful over rivals moving forward? The argument is that elevating the combined company’s status to that of a full-systems ADAS supplier makes it more attractive to customers. Kotagiri specifically flagged the importance of a wider system understanding: “We can supply pieces of the entire system, but more importantly we have a whole system understanding. That will bring us to the table at a different level. As we talk to new entrants and customers, it is important to show we understand not just the pieces of ADAS but also how it fits into overall evolving architecture of the vehicle going forward.”

“Magna is clearly aiming to be the complete vehicle provider for the car of tomorrow,” writes Berenberg Analyst Michael Filatov in an investor note. Veoneer and ADAS are just the latest strategic focus areas in a corporate strategy that covers vast swathes of the wider vehicle ecosystem. “Between its vehicle contract manufacturing capability, established base ADAS business, strategic collaboration with EV platform start-up REE Automotive, its LiDAR relationship with Innoviz, and now its acquisition of Veoneer, Magna is apparently aiming to offer a complete vehicle package from seating, structures, and mirrors to ECUs, sensors, and the perception/policy stack.”

Something added, something lost

Magna promises that the Veoneer addition will build upon existing relationships with both companies’ automotive customers and technology partners. However, the analyst community voiced concerns that not all of these will remain intact. Analysts at Wolf Research point specifically to Magna’s work with Mobileye. The two have partnered on camera-based ADAS since 2007, and programmes in the pipeline will incorporate Mobileye vision systems. But Veoneer specialises in vision systems as well. “In the past, we have seen Mobileye refuse to work with companies that produce their own vision systems, which Veoneer is doing,” observes one Wolf Research analyst. Kotagiri would only state that Magna intends

to “continue the strong relationship we have with Mobileye.”

Chris McNally of Evercore ISI suggests that “the main question is not around Magna’s relationship with Mobileye but how vision technology for existing programmes at Veoneer will get migrated going forward. It is clear that radar, thermal, and DMS (driver monitoring systems) will bring scale but how do we migrate existing customers over to Mobileye vision over time?” There was no clear answer at this stage.

A compelling opportunity

With expected annual run-rate synergies of about US\$100m by 2024 and a top five position in the ADAS

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The combined business are expected to see a CAGR of about 30% out to 2023, twice the pace of the ADAS market

market, the logic for the acquisition is clear. John Murphy with Bank of America observes that it “seems like it makes a lot of sense”, but Veoneer didn’t necessarily come cheap. Magna is spending US\$31.25 per share in cash, representing an equity value of US\$3.8bn and an enterprise value of US\$3.3bn. “While we believe the acquisition makes sense from a growth as well as portfolio, customer, and geographic expansion perspective, we are somewhat surprised by the premium paid for a business that has yet to be profitable and continues to burn cash,” observes Filatov.

Kotagiri pointed out several times during the analyst call that the reaction from customers has been positive. Now it’s down to shareholders and regulators. Veoneer stockholders collectively representing 40% of the outstanding shares of common stock have either entered into support agreements with Magna or provided indications of support. Jan Carlson, Veoneer’s Chairman, President and Chief Executive, has described it as “a compelling transaction for all stakeholders.”

As for regulatory approval, Kotagiri doesn’t expect to run into any obstacles or to be forced to dispose of certain parts of the business. The transaction is anticipated to close near the end of 2021, and if all goes to plan, Veoneer should be accretive to Magna’s earnings by 2024. Chief Financial Officer Vince Galifi concludes, “From a financial perspective, I am confident that this will create value for our shareholders and will give us more opportunity as a full system supplier.”