



The Future of Mobility:
**Connected
Autonomous
Shared
Electric**



Mobility solutions for a sustainable future

Part of



RLE INTERNATIONAL

Mobility is changing

Changing to better reflect our current economic, social and environmental priorities.

The Paris Agreement and COP26 have outlined the impact we're having on the natural world, and in return the impact our choices will come to have on us. We're just years away from irreversible climate change and the world is crying out for solutions that will allow us to progress as a species in a way that's sustainable.

A global pandemic has shown us just how much time we spend commuting and the opportunities that exist if we're able to make that time more productive, both for individuals and for businesses.

A host of trends and technological advancements will play a key role in this change throughout our society, which fall into four key areas: **Autonomy, shared mobility, electrification and connectivity.**

Within each of these areas, we'll look at what's right around the corner and what's coming next, as well as the long-term trends that could become part of our everyday lives over the next decade.

We hope you find this to be an interesting and insightful read, and welcome you to [reach out to our team](#) to learn more about our role within these emerging technologies.



Autonomous

Autonomous driving has now firmly moved out of sci-fi fantasy and onto our city streets. With applications spanning from domestic use and taxis to supporting logistics, it's no wonder so many businesses are fighting to stake their claim as the leader in this space.

Here's what's happening right now, and what we can expect in the future.

Current

Autonomous driving is no longer a stranger, and while Tesla has long led the way in this field, Mercedes beat them to the punch in 2022 to achieve Level 3 autonomy status. This important milestone allows the driver much more freedom away from the wheel: able to answer calls, check emails and even watch a movie. This marks a crucial distinction from Level 2 – where much of the industry currently remains – because Level 2 autonomy still requires the driver to be able to take the wheel if necessary.

Regardless of the technical capability, it's still a legal requirement in many countries for a human driver to have both hands on the wheel. However, we're seeing more and more tests of completely driverless vehicles, with taxis representing the biggest economic opportunity.

One such example is Waymo, backed by Google's parent company Alphabet and making waves in the industry by providing the first fully-driverless fleet of vehicles. Much like you would hail an Uber or Lyft, you can now do so without muddling through small talk with your driver. While this service is only operating from a small number of locations in the USA currently, others won't be far behind.



Coming

In the next few years, we can expect to see the industry target Level 5 autonomy, meaning that a vehicle is able to operate completely independent of human intervention in all conditions. While autonomous driving has huge potential for increasing road safety, there are still key hurdles to overcome.

Namely, the transition to self-driving technology will be a slow burn, meaning for some time these autonomous vehicles will be sharing space with human drivers. Human drivers that are unpredictable, at times irrational, and that don't always stick to programmed-in rules in the way you'd expect a computer to. The ability to operate safely in spite of this will certainly determine how quickly we see the transition to a critical mass of autonomous vehicles on the roads, and with forecasts suggesting it could be 2040 or even later before we reach this point, it's clear we have some way to go.

Logistics will also become a more prominent market for self-driving technology, as firms and whole industries look to become more efficient and address the global drought of HGV drivers. In the wake of this, autonomous trucking startup TuSimple completed its first fully-driverless journey in December 2021, shaving 10 hours off a 24-hour journey during a pilot run in Arizona.



Future

Long-term it's not unfeasible that autonomous driving technology will go off-road. We're not talking about your local dirt track here; the next autonomous revolution could be taking to the skies with Airbus and Japan Airlines just two of the firms looking for a slice of the pie.

It's not just air travel that's riding this wave either. A £200m government funding package provided to Transport for London in February 2022 included stipulations to explore the feasibility of driverless trains, though retrofitting such capabilities onto dated infrastructure like the London Underground is expected to present serious challenges in terms of cost and fire safety.



Shared

Cars lie idle for 95% of their lifetime, and when operated are typically only 25% full. With environmental goals on the agenda, it's clear that something needs to change and shared mobility represents a widespread change not just in how we get from A to B, but how our whole society functions. This trend will play a pivotal role in developing smarter cities, and it's already happening.

Current

You've probably been a consumer of a shared mobility solution without even giving it a second thought. Ride-hailing providers like Uber, Lyft and Curb have been ferrying us around towns and cities for years, requiring a much smaller fleet of vehicles to get us where we need to go 'on-demand'.

This is just scratching the surface though, with many of the major players in this space now rolling out ride-sharing options, like UberX Share, where customers now opt to allow the driver to pick-up extra passengers en-route to share the overall cost.

While the global pandemic will certainly impact the short-term demand for services like this, increasing awareness and compassion towards environmental concerns coupled with the friendlier pricing will only make it a more attractive offering as time goes on.

Also taking off in the shared mobility space is the growing uptake of micromobility: the collection of small, lightweight vehicles typically operating at speeds below 15mph. While the pandemic halted the growth of this sector, it's demonstrated strong post-pandemic recovery. Few points of physical contact and ease of maintaining distance from others make this a less risky option than other forms of shared mobility (McKinsey).



Coming

Next steps within shared mobility will take on-demand ride hailing further, with Mobility-as-a-Service (MaaS) becoming an increasingly popular solution over vehicle purchase. MaaS will see automotive manufacturers and startup firms offer vehicles on a subscription basis. In much the way subscription services have revolutionised TV, music, and software, as mobility becomes more and digitalised, we can expect to see this industry go the same way. In fact, startups are already emerging to take advantage of the opportunity. London-based Breathe offer subscription pricing for Tesla Model 3s, including insurance, service, maintenance and repairs.

We know that Uber is investing heavily in emerging shared mobility trends, and one such trend it had hoped to capitalise on was driverless rides. Through their Advanced Technologies Group, they have spent several years developing a solution that would allow them to remove the most significant cost associated with ride-hailing: the driver. However, in late 2020 they sold this division to Aurora, a self-driving startup based in San Francisco. They haven't pulled out completely though. Their following \$400m investment in Aurora gives them a sizeable 26% share of the Amazon-backed company.

Amongst the ever-growing variety of mobility options we'll continue to see, perhaps the most significant trend on the horizon is the one that connects them all: a shared interface. We see elements of this within current apps like Google Maps, and Rome2Rio where you can choose between different transport modes and their estimated journey times. Shared interfaces coming next will take this concept further, incorporating many more modes of transport, including shared ride-hailing and micromobility vehicles. Rich data will allow you to efficiently string together many forms of transport into one journey plan whether it's price, journey time, or environmental impact that is the focus. You'll also be seamlessly connected to the relevant booking systems and have the necessary information at your fingertips from a single source.



Future

One possibility for the shared mobility space in the future is the opportunity for self-driving vehicle owners to be able to lease their vehicles out while they're not using them. This could take a similar form to Waymo's RoboTaxi service, providing additional income to the owner and reducing the need for more vehicles to be produced in order to service the same number of people.

Tesla's Elon Musk has already gestured at making this a reality for the host of Tesla owners, and with living costs rising and environmental issues taking up more of our newsfeeds, this could prove to be a popular option for the future. Mass market uptake, though, depends heavily on consistently strong growth of driverless vehicles and solving the logistical challenges involved with organising such an enterprise.



Connected

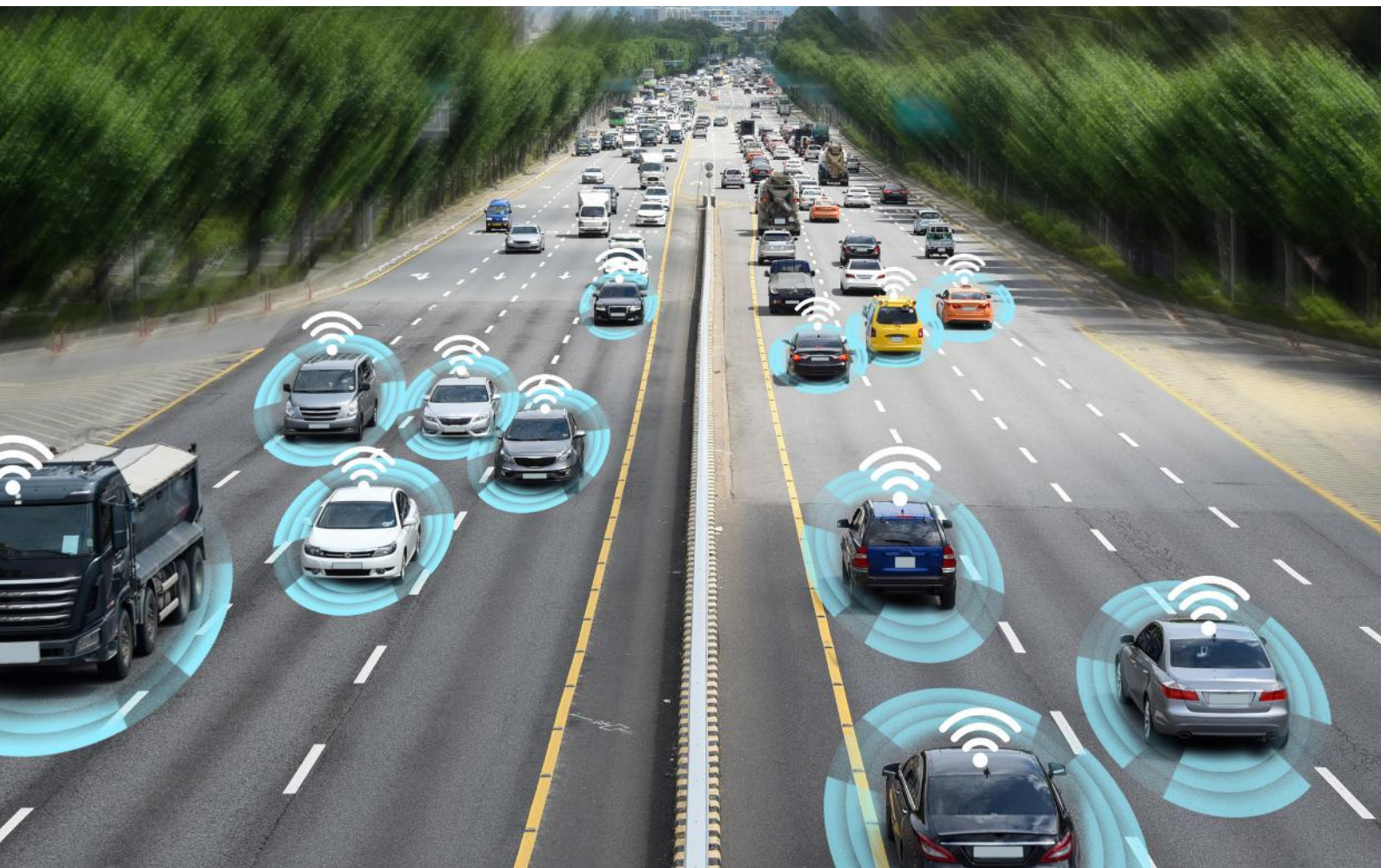
Just as the world is becoming increasingly connected, the same is happening in the mobility space. These changes could be as simple as built-in infotainment systems, or as complex as connecting individual vehicles to the network of road safety systems. What is clear is that this increasing connectivity will play an instrumental role in our changing relationship with mobility and the future technologies that will drive this.

Current

Vehicles of today are already far more connected than ever before, many now coming with an in-built navigation system as standard, allowing you to plug in your destination with a couple of taps. Bluetooth has replaced the trusty aux cable as the go-to for connecting up our smartphones, effortlessly switching between in-bound calls and your favourite Spotify playlist. In one way or another, all of these are connecting your vehicle to the world outside.

What we're seeing now is more advanced uses of connectivity. While certainly not the only player making waves in this area of mobility, Tesla are certainly one of the first to do it at scale with the release of their over-the-air updates. With Teslas representing the new era of vehicles that operate more like a MacBook on wheels than the combustion engine-powered cars we've become used to, providing updates is key. They use this function to add new features and enhance existing ones, using your home Wi-Fi to deliver this data.

They also pool data from the cameras on each vehicle to continuously improve the driving experience and bring fully autonomous driving closer to reality. Because Tesla vehicles rely on cameras for this autonomous driving capability, they're able to expand far quicker than other firms in this sector that need to pre-map new locations to guarantee a safe and hassle-free experience.



Coming

Considering the rise of Amazon's 1-day 'Prime' delivery service, contactless payments surpassing chip-and-pin, and the increasing number of self-service terminals at fast food restaurants, it's fair to say that convenience has dominated many of the technological changes taking place in our lives.

In the same spirit, mobility is elevating from simply a solution to get from A to B, to precious time in our day that can be recaptured. Underlying the trend towards a greater volume of autonomous vehicles is what that time away from the wheel offers us. Freedom. Freedom to work, relax, or catch up on a new TV series. While this represents a much larger trend in the mobility sector, the connectivity will be fundamental in giving passengers a wider choice in how to use this time.

Something else expected to have a serious impact is multi-modal transportation systems. The series of interconnected transport modes including traditional options like cars, buses, trains, taxis, and emerging micro-mobility solutions like electric scooters. The reliance on multiple forms of transport will become an increasingly attractive prospect, especially in urban areas, as it becomes more convenient, more affordable, and easier to use. The connection between different transport systems, schedules, and availability will be perhaps the most significant factor in driving this popularity.



Future

While the advancements occurring in mobility are incredibly exciting, they don't come without added risks. As we move into this new era, where computer codes are replacing the nuts and bolts that move us all forward, it's important to note that these codes are vulnerable to hacking. Especially when you consider the increasing number of updates devoted to autonomous driving. Were those codes hacked, it's possible we could see the kind of ransomware attacks that have become so common on PCs shift to vehicles.

Researchers like David Colombo have already picked up on coding flaws within Teslas to access systems like opening and closing the windows as well as starting keyless driving and lighting systems. While these methods don't allow access to acceleration or steering controls, they still pose considerable threat to the owners of these vehicles and other road users. While this particular instance happens to be down to driver fault, rather than the code being used, it still needs to be monitored carefully as more and more of us opt to drive these increasingly connected vehicles.



Electric

The environmental impact of mobility as it stands cannot be understated. In 2019, the UN General Assembly was warned that under current circumstances, we were likely to face irreversible climate change in just 11 years. Countless demonstrations, protests and rallies show significant public support to take climate change more seriously, which has prompted governments to commit to achieving net carbon neutral by 2050. While that feels a way off yet, achieving it means a massive shift in culture and practises across all industries.

Mobility is making headway in this sense, with many nations now banning the sale of fossil fuel-powered vehicles as early as 2025, prompting a sweeping move across the sector to focus on clean, renewable-powered concepts.

Current

Electric vehicles are not new, and certainly not because of these fresh environmental regulations. There's been a mass market for electric cars going back as far as 2010 with the Nissan Leaf. But there's certainly a refuelled sense of importance; a change in perception around electric cars due mainly to new players entering the market with high-end concepts like the Tesla Model S and Rimac Nevera, along with OEMs including Jaguar, Porsche, and Audi releasing their own all-electric models too.

While the market for electric vehicles is still in its early stages in many countries, there are others where it's far more developed. Norway really is leading the way when it comes to adopting this global trend, with over 65% of new passenger cars sold in the country during 2021 powered by electric motors (Time). The USA have made strides in catching up, with President Biden's January 2022 infrastructure bill including \$7.5 billion for a nationwide charging network. What's crucial to Norway's policy success around EV adoption, though, is that they have embraced it from a demand side too.

While combustion engine vehicles are heavily taxed in the country, EVs face no tax at all. This 25% saving puts them into an affordability bracket with typical vehicles which, combined with the growing range of choices, is fuelling their popularity amongst Norwegians.

Government policy isn't the only factor affecting prices though. Bloomberg stats show a 90% drop in battery costs between 2010 and 2021. A trend that, while slowing now, supports the economic case for people switching over. Many reports expect that by 2025, the 'sticker price' of an electric car will actually be considerably lower in like-for-like comparisons, all while oil prices continue to head in the opposite direction.



Coming

As the electrification trend is in full swing, finding convenient charging solutions is becoming an incredibly lucrative opportunity, and some believe that removing the physical cables completely is the answer. With vehicles lying idle for around 90% of their lifespan, they could be right.

Wireless charging hasn't quite been fully embraced with mobile phones yet, but evidence suggests the mobility sector could be far more receptive to this technology with trials already taking place across the globe.

One such test involves a fleet of Volvo's all-electric XC40s and a taxi firm in Gothenburg, Sweden. This 3-year pilot run will be to iron out technical details and review the feasibility of this technology in-context. Each vehicle has been fitted with a wireless charging system from Momentum Dynamics, while wireless charging pads have been built into two taxi ranks, with 360-degree cameras aiding the drivers in aligning the two components correctly. Momentum Dynamics is also supporting a similar project with Jaguar Land Rover in Norway.

Trials for longer distance wireless charging have also occurred in Paris, supported by vehicle manufacturer Renault, Qualcomm and thinktank Vedecom Institute. This could be a revolutionary answer to the most common electric vehicle hurdle – range anxiety. Renault's solution comes under the umbrella of dynamic charging infrastructure, with similar wireless charging pads to the Volvo test being placed along the road infrastructure to maintain continuous charging throughout a journey, making the range limited only by the infrastructure itself. While plans for these electric roads are already in place across Europe, with Germany and Sweden leading the way, the cost factor relative to traditional roads is still slowing uptake.



Future

Much of the current solutions around the electrification of mobility are focused on reducing carbon emissions within the vehicle itself, but this electricity is still connected to a wider power grid, powered itself from a variety of sources – not all of these being renewable.

Kinetic energy recovery systems could be one of the future technologies that help tackle this larger challenge. Kinetic energy recovery in the mobility sector is actually an existing technology, most prominently featuring in Formula 1 motor racing. The technology centres around the concept that energy cannot be destroyed, only converted. In this case, the energy typically lost during the braking process is captured and converted into electricity to give the vehicle a power boost when needed.

Bringing this back to the practical use of kinetic recovery within our transport network, it could take the form of piezoelectric materials being implemented into motorway networks, though it's more likely that a hybrid of energy capture solutions would be used, including sound, heat and solar power.



Get in touch

About FutureMotiv

FutureMotiv Ltd. specialises in electric and hybrid vehicle systems and integration, providing engineering services and components to support both prototype and production vehicle programmes at all stages of development.

We create rapid solutions for prototyping electrical systems in new future vehicle concepts, demonstrators, show vehicles and road vehicles, as well as providing technical support for integrating electric, hybrid and fuel cell technologies.

Helping you realise your vision

Since the company launched in 2018, our collaborative team has continued to grow, and we now have employees from all around the world speaking over 20 languages amongst them.

We are part of RLE International, one of the world's leading engineering groups, and our passion for EVs and hybrid technologies is reflected in everything we do. FutureMotiv's innovative team bring together the best in skills and experience to help you bring your project to life.

If you are looking for a partner for an upcoming project, please do [get in touch](#).

We look forward to hearing from you.





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