

The World Needs EV-Charging

26 powerful
E-mobility trends



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**Battling the
fragmented
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E-mobility is the present and future

E-mobility, or electric mobility, is about using electric-powered technology to reduce carbon emissions. Electric vehicles (EVs) are clean and efficient, offering an alternative to polluting fossil fuel vehicles. With a global appetite for more sustainable living and an awareness of the detrimental environmental impacts of using traditional vehicles, e-mobility has become a hot topic.

This eBook will outline the recent trends in e-mobility from its growth in popularity, to charging stations and payments, to vehicle design and public transport. In a nutshell, electric vehicles are gaining in popularity. This is fantastic news, but there is work to do - especially in the supporting infrastructure.



THAT'S A FACT

The electric vehicle market is growing between 40% - 60% each year.

The popularity of E-mobility

Trend 1: An increasing appetite to electrify

The electric vehicle market is growing between 40% - 60% each year, depending on the market area. In fact, it is expected to grow faster than the market for traditional fossil fuel cars.

The Guardian has reported that in August 2018, [there were more than one million electric cars in Europe](#). This popularity has been boosted by support from governments, falling battery prices, and changes in consumer tastes in favour of eco-friendly options.

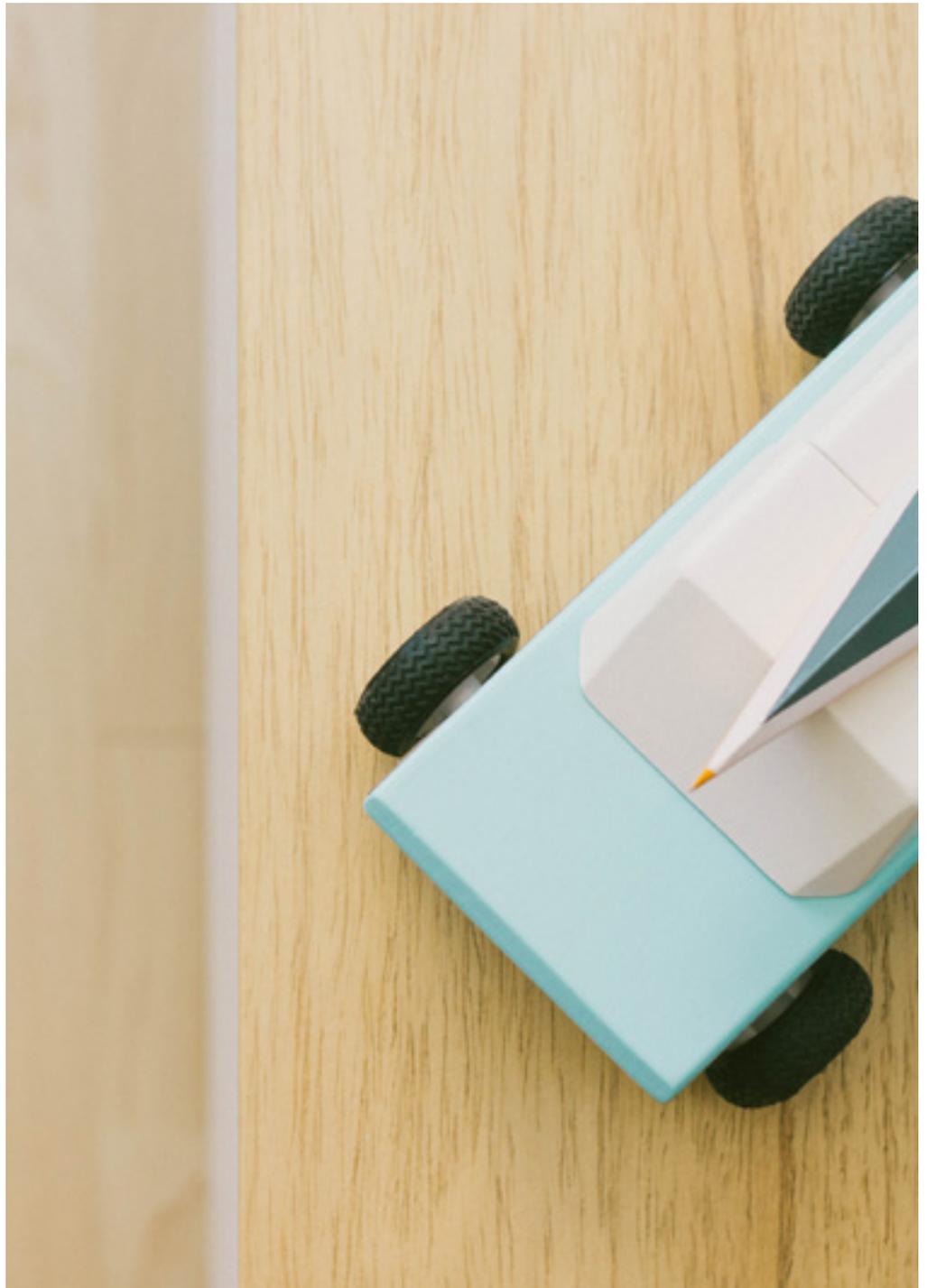
The types of EVs has also expanded. From scooters to skateboards, to bicycles and even hoverboards. It is making the commute an intriguing experience, that's for sure. Of course, it's also increasingly common to find electric cars, buses, trucks, and tractors. In 2017, [the number of electric buses and two-wheelers increased to 370,000 and 50 million respectively](#). This is mainly

driven by government policy to promote the uptake of EVs in light of tightening emissions standards, and high fuel tax.

Vehicle companies are also expanding their range of electric vehicles and getting on board the electric bandwagon. [Bloomberg estimated in 2017 that in the following five years there will be 127 new models of EVs](#). This includes exciting releases from Tesla, Nissan, Jaguar Honda, BYD, Audi, Hyundai and others.

There are also startup companies creating niche and exciting EVs. For example, [Rivian](#), a Michigan-based startup, has released some innovative electric vehicle models, including a pickup truck and an affordable option for less than \$24,000. Your options are now extensive, and that is a trend that will continue.

“Rivian, a Michigan-based **startup**, has released some innovative electric vehicle models, including a **pickup truck**.”





KEY TAKEAWAY

E-mobility is the present and the future. There is an increased appetite to electrify all kind of vehicles, including skateboards, bicycles, buses, hoverboards and pickup trucks. This is mainly driven by government policy to promote the uptake of EVs in the light of tightening emission standards. While the EV industry is growing, most customers are very satisfied with their electric vehicle. However, there are some obstacles to grow, such as accessible infrastructure.



THAT'S A FACT

85% of respondents are happy they made the switch to EVs

Trend 2: Increased customer satisfaction

The major drive for owners potential buyers of EVs is the environmental benefits. The Manifesto of Electric Mobility Report also revealed data from [a 2017 survey of 850 respondents from Europe and North America that 85% are happy that they made the switch to EVs and are being more eco-conscious](#). In fact, 51% reported that concern for the environment was the main reason for their switch.

Furthermore, results from a 2018 survey by Flip the Fleet discovered that [EV owners are very satisfied with the running of their vehicle](#). Owners find their EV a great fit-for-purpose, a pleasure to drive, and they are happy with the low running and maintenance costs.

Although most of the news about customer satisfaction is very positive, there is some negative feedback and this is mostly surrounding charging stations. Data from the aforementioned Manifesto of Electric Mobility found that 55% were unhappy with the current availability of charging stations. Furthermore, 55% have never even used a public charging station before.

There is a lot of uncertainty and a genuine lack of confidence surrounding the charging situation. This must be improved to make the electric vehicle experience easier and more convenient.

Trend 3: The enduring obstacles to growth

Whilst the increasing popularity to electrify vehicles is great news, it is still not enough. Sales of plug-in electric vehicles only made up 2% of all new car and van registrations in Europe in the first half of 2018. It is evident that growth of EV adoption could and should be much higher, but there are a few obstacles to its heightened growth. These include the (in)convenience of charging, and consumer understanding about the reliability and viability of technology, or rather - customer awareness.

It is evident that consumer interest is there, but the momentum for growth needs to be accelerated and captured by providing low-cost, well-located charging systems. It's great to have the vehicles on the road, but accessible infrastructure will entice more customers and remove confusion about EV charging. This is something that needs to be, and can be, improved to make EVs more accessible to wider audiences.

Consumer awareness is also key to leveraging greater adoption of EVs.

[The International Council on Clean Transportation \(ICCT\) reports that in many regions, consumers are unfamiliar with EV technology](#). Markets with more awareness campaigns and marketing tend to have greater adoption of EVs. The ICCT reports that sustaining a broad range of outreach programmes that are suitable to each national context can capture a wider audience and increase consumer awareness.

Charging stations

Trend 4: Wireless charging

A new trend in EV charging is the proliferation of wireless EV charging stations and systems. Currently, there are only a few major players developing this technology. One example is [Qualcomm Halo, a company that has developed Formula E charging stations that can transfer up to 22kW of power](#). And one of the most advanced mainstream wireless providers in the USA is [Plugless](#). A wireless adaptor must be installed to the underside of a car, and this

can receive power from a pad. Wireless charging works via inductive charging. Electricity is transferred between two magnetic coils. There is one magnetic pad on the ground and one on the underside of the EV. The vehicle just has to be close to the charging system for it to work seamlessly.

There is potential for charging stations to be located strategically underneath certain parking areas, or even along the roads. This would mean that EVs can be charged

whilst on-the-go. Very convenient, and means that the driver never needs to think about stopping to charge a battery. This would present a huge disruption to the current business models for EV charging stations.

Trend 5: Meeting the challenge of accessibility

The number of accessible public charging stations available is key. [The US and Canada has 22,000 public charging stations as of 2018](#) that are classified as alternate current (AC) and direct current (DC) fast-charging. However, there are 168,000 petrol stations in the US and Canada. That is about seven times more. For drivers considering an electric car, this can be frustrating. If EVs are to be successful, consumers need to know they can

charge whenever they want. Speedy charging is key, but the technology of a fast charge is more challenging than it seems. At the moment, there are few charging stations globally that are capable of charging quickly and safely, and it could take years for the technology to become a mainstream norm for all charging points.

As we'll see in the next section, there are sparse and diverse networks of charging stations. Until now, EV owners have needed

to sign up to multiple services to get access. The infrastructure has also been limited to densely-populated areas, restricting owners to charge in these locations. This is changing, with [some experts estimating that there will be 40 million EV charging points worldwide by 2030](#). current business models for EV charging stations.

Trend 6: Big brands are acquiring startups

The big brands are moving into the e-mobility space, and EV charging is one area where they are making a mark. For example, BP have purchased [ChargeMaster](#) and Shell have purchased [NewMotion](#) and [Greenlots](#). Total have purchased [G2Mobility in France](#). There are many more examples, and this is a trend that will continue for the foreseeable future as they gain a foothold in the industry.



“Speedy charging is **key**, but the technology of a **fast charge** is more challenging than it seems.”



EV charging payments

EVs will eventually become adopted around the world. Such colossal shifts in the market require a set of standardised methods to be developed and integrated, to accommodate the transition from traditional to electric vehicles on a global scale. At the moment, the payment infrastructure is fragmented. But this will not be the case forever.

Trend 7: Battling the fragmented infrastructure

The growth in the number of EVs has [outpaced the investment in charging infrastructure](#). Because of this, the installation of charging stations and associated payment methods has been done in a variety of different ways, by a variety of different industry stakeholders. Some operators and public stations offer free charges. In these cases, there was no interest in payment solutions whatsoever!

For operators and automakers who are taking payments, many have provided custom solutions for their proprietary systems, which rely on closed digital memberships and / or operator-specific cards. These methods are somewhat limiting, and do not deliver on the broader market needs.

In order to ensure a good experience for all EV owners, payment methods must meet some mandatory requirements such as security, convenience, and universality.

Trend 8: Contactless technology

Recognising the current inefficiencies, operators are now implementing payment solutions based on tried-and-tested methods. As of 2019, new [Allego charging stations in the UK will be equipped with Near Field Communication \(NFC\) payment technology](#); enabling users to initiate a charging session and pay for it by tapping their contactless card, digital wallet, or smart wearable device.

Indeed, we implemented a similar ad-hoc payment solution in Germany for Autobahn Tank & Rast, whereby a CCV terminal was integrated with their charging points. These terminals accept

ad-hoc (non-member) payments through contactless cards, and we're exploring further payments innovation.

Contactless technology has been widely adopted across the retail market over the past decade, proving very successful. The solution is familiar to customers, and it checks the boxes in terms of convenience. However, there is arguably more to charging a car than to buying a cup of coffee. Therefore, we must look at implementing payment methods that suit the needs of EV users specifically.

Trend 9: App-based front-end solutions

Mobile applications are certainly the go-to technology for providing a familiar and user-friendly interface, as well as offering a powerful platform for additional features. The flexibility and security aspects of mobile applications provide the perfect foundation for recurring payments.

From the user's perspective, the setup is simple:

1. Download mobile application
2. Register an account
3. Provide payment details
4. Plug-in and charge

By completing these steps, users will be able to access any EV charging station owned by the operator. To start a charging session, drivers would scan a QR code, identify themselves using RFID or NFC, or even use the geolocation service of the phone. Using an application-based interface can enable seamless and secure payments, allowing customers to drive in, charge their vehicle and drive away.



THAT'S A FACT

The growth in the number of EVs has outpaced the investment in charging infrastructure.

All the heavy lifting will be done in the back-end by using tokenisation.

Tokenisation is the process of securely encrypting payment details in return for a token, which can be used by the merchant to authorise payments.

In addition, harnessing the power of a smart device offers a huge range of features such as:

- Using geolocation on a device which automatically starts a session based on location
- Better security through tokenisation
- Calculating and displaying estimates for charging sessions
- Tracking the charging and spending over time
- Monitoring location availability and pricing levels

Trend 10: Mobile website front-end solutions

For ad-hoc payments, using a website to provide the user interface would work just as well. The process would usually involve a one-time eCommerce payment, although recurring customers could also benefit.

Customers would need to start a session by accessing a website; by either scanning a QR code, entering a limited-access WiFi network, or manually navigating to the operator's webpage URL. Once accessed, the customer would provide their payment details or complete an eCommerce transaction (via iDEAL or similar) and start the charging session.

Users can also register an account with the operator, and can save the payment details or other key information. As with the application, websites are powerful and can deliver added-value features.

Trend 11: The connected car

Looking at the recent advancements in IoT technologies, we can easily imagine a smart car equipped with features that removes our current reliance on external devices such as mobile phones or physical bank cards. The car becomes the identifier and the trigger for payments to be made.

Even with non-smart cars, we can implement something more rudimentary such as identifying a vehicle by its number plate and tracking the amount charged against this identifier. However, that would not really capitalise on the vast possibilities offered by more advanced technology. Solutions such as these become feasible via a connected car:

- Linking the car to an account which is set up for recurring payments
- The car becomes a smart device, able to pay without the need for a smartphone or card
- The car can be connected to an operator network where all its activity is tracked and payments are completed in the background

Theoretically, tokenised payments through a connected car can provide seamless experience; automatic payment for tolls, payment for drive-thru refreshment, and more. This would rely on open networks.

Trend 12: Lease company partnerships

For those leasing a car, payments for charging can become part of the lease agreement. Lease companies can work with the charging station operators, and either include the payments within the monthly installments, or send an invoice separately to the EV owner. Both options would be feasible.

Trend 13: Visionary payment ideas

So far, the payment methods we've discussed have made the assumption that charging stations are going to be the standard charging system for the future. What if they're not?

There is plenty of talk about renewables, including solar-powered charging that provides free sustainable power for EVs. However, [the implementation with current solar technology is insufficient](#) from multiple points of view: capacity, size, weight, cost, aerodynamics, and also... weather.

Another option is to invest in roads with [built-in charging systems](#). Sweden has already made a first step in implementing this technique on sections of a road outside Stockholm, which has an embedded rail with a movable arm that attaches itself to the bottom of the vehicle to provide charge. Needless to say, mainstream adoption of this technology would require a great deal of investment, optimisation, and a set of standards to apply across manufacturers and geographies.

Wireless charging is also of huge interest. As Anke Vandenbussche mentioned in her CCV article, wireless could actually be a game-changer in the drive for better EV charging infrastructure:

Who would own this infrastructure? Would this be provided for free, or would it be included within a regular car tax? These questions don't need to be answered immediately, but we must leave no stone unturned before we plan the certain future of EV charging payments.





Vehicle design

E-mobility for the masses is not just about good functionality. The basics are essential, but not enough.

Encouraging global uptake presents a whole host of other challenges. Today's consumer is demanding. They don't just expect the most innovative technology. They also expect impeccable design, smart use of space, a wealth of choice, and excellent safety standards - all under one hood.

Trend 14: Native EVs

One big change is that we're now commonly seeing "native" EVs. These are cars built on custom electric platforms, rather than being adapted from their fossil-fuel counterparts. These native EVs have more interior space and can travel further per charge. Designing the vehicles entirely around the electric concept results in fewer compromises, greater flexibility, and a stronger all-round design.

These native EVs can be designed around the battery pack, allowing for higher ranges, speedier cars, and more power. The increased performance of native electric vehicle designs makes them better value for money. A big improvement when compared to non-native equivalents.

Trend 15: Range improvements

The electric car range is much improved, now travelling between 200-400 km on just one charge. This is much better than earlier EVs that could typically only travel up to 130 km - although this of course depends on the make and model of the vehicle in question. This will continue to be a constant area for improvement.

Trend 16: Bigger, better, and cooler

Electric vehicles are getting bigger, better, and certainly cooler. There are many more options on the market than just a few years ago, and we anticipate plenty of exciting releases over the next decade. This includes chopper motorbikes, futuristic cars, and trucks that look like spaceships.

Trend 17: Battery technology consensus

Currently [there's no proven industry consensus on the best EV powertrain design](#). At the moment, there are three main battery-cell designs: pouch, cylindrical, and prismatic. Each has pros and cons, but experts say there is no clear winner on performance at the moment. Industry stakeholders must invest in these technical areas to determine standards and optimise battery performance for the mainstream.

Trend 18: Strong performance

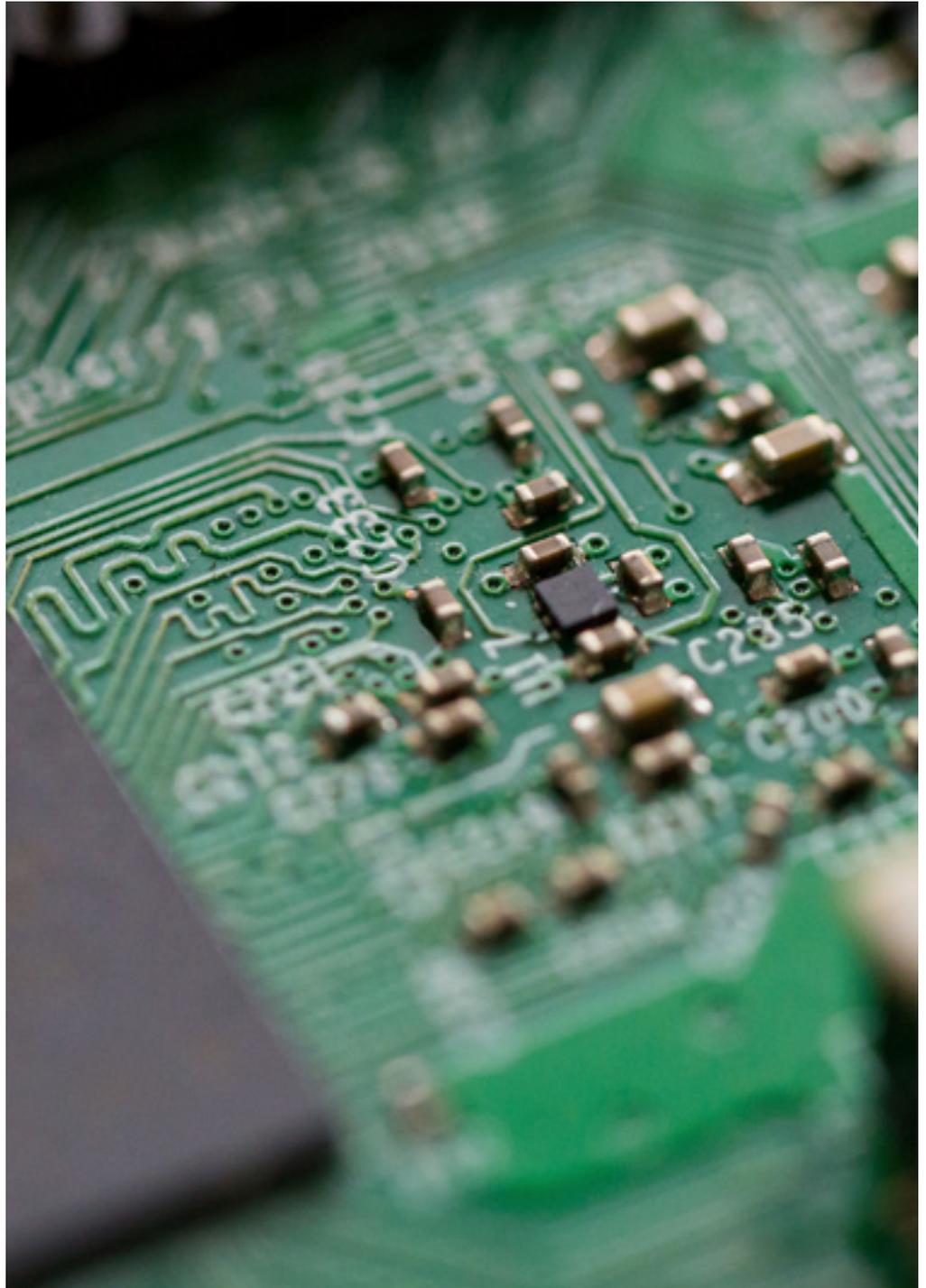
EVs now offer strong performance. For example, acceleration capacity is close to high-specification fossil fuel-run cars. EVs now do not require extensive or regular upgrading or maintenance. Therefore, they cost far less than to operate than they used to.



THAT'S A FACT

Designing the vehicles entirely around the electric concept results in fewer compromises, greater flexibility, and a stronger all-round design.

“The increased **performance** of native electric vehicle designs makes them **better value** for money.”



Trend 19: Cost-effective design processes

Companies are making their designs more cost-effective. The focus is on component integration in the powertrain and smarter application of lightweight materials in structural parts. More recent EVs use aluminium that is only 5-10% of total vehicle weight. [Regular cars also contain more than 2000 parts, but EVs often contain only 20](#), making them extremely reliable and easy to maintain.

Trend 20: Better safety standards

EVs are safer than ever. In general, EVs are known to be safer than petrol or diesel vehicles because they're less flammable, easier to maintain, and also less likely to roll over due to a lower sense of gravity on many models. The EV industry is constantly striving for optimal safety, and technology such as sensors and early warning will help in this regard. Battery technology is also improving, allaying lingering doubts about the **safety of lithium-ion batteries (LIBs)**.

Trend 21: High-tech features

Brands are implementing amazing high-tech features into their EVs. Vehicles are being equipped with advanced-driver-assistance-systems, connectivity and “smartphone-like” interfaces to enhance the driver’s electric car experience, increase security and safety, and add value to the product.

Although there has been some fantastic progress in EV design, there is definitely room for improvement. Some experts argue that mainstream EV car designers are on the conservative side, playing it safe. Indeed, it is true that EVs look like their fuel-run counterparts because it offers familiarity. Whilst the designs may not be mind-blowing or thrilling right now, as we’ve already mentioned there is anticipation that [electric-first design innovation will push the boundaries in upcoming years](#).



KEY TAKEAWAY

Today's consumer is demanding. They don't just expect the most innovative technology. They also expect outstanding design, smart use of space, a wealth of choice, and excellent safety standards. Companies need to meet these demands in order to be successful.

Electric public transport

To reduce greenhouse gases and in a bid to remove nasty exhaust fumes, private companies, governments, and organisations have introduced electrified transport. We've witnessed a more rapid electrification of public transport than of private vehicles, with regions and cities implementing electric rail and buses. Even aviation is getting in on the action!

This is great news to show the masses how effective, efficient, and reliable electrifying their vehicles can be. Yet, more can be done as [86% of energy consumed by transport systems is driven by fossil fuels](#). We hope to see greater implementation of EVs across the globe over the next few years.

Trend 22: Electric buses

A bus is the perfect use case for an electric drivetrain. Electric motors have a very high torque. Buses are heavy and require this high torque. What is great about electric motors is that they can give these big vehicles the push, even at low speeds. Furthermore, buses stop regularly along their route. This provides an opportunity for the battery to recover energy. Statistics revealed that [electric buses only use 20% of the raw energy of a diesel bus that travels the same distance](#).

The result of this electric goodness is that electric buses are cheaper to run; 35% cheaper in fact. As the cost of batteries continues to decrease, electric buses will become cheaper to operate. These vehicles are great for urban environments, producing 4-6 times less

greenhouse gases than diesel-run buses. There are some great examples of areas electrifying their buses. [Shenzhen, China, has managed to electrify 100% of their buses](#), with around 16,000 electric shuttles and operating the world's largest electric bus fleet. By doing this, they have managed to drastically decrease air pollution. This trend is not only limited to Shenzhen; China itself contains 99% of the world's electric buses.

Kuala Lumpur has also been running their fully electric Bus Rapid Transit (BRT) for a couple of years, and are introducing ten more routes in the near future. India also has goals to fully electrify their buses by 2030. Eleven of the world's major cities have pledged to have completely electric bus routes by 2025.

Whilst increased numbers of electric buses

is great news, it is important to also have the right infrastructure in place to support them. There needs to be the appropriate number of charging stations with uniform standards. Furthermore, a strong integration between charging stations and provider is incredibly important. It is no use having charging stations if the energy provided is insufficient.

Shenzhen maintains strong partnerships between charging stations and providers. Stations are positioned along bus routes and charging times are coordinated for buses to recharge overnight when electricity demand and prices are lower. Whilst it works in this case, each location is different.



“Electric aviation could dramatically **reduce emissions** and make carbon-cutting emissions goals more **feasible.**”

Trend 23: Electric trains

Trains play an important role in moving people and freight. With large distances required for commercial freight, and people travelling all over the globe, rail operators worldwide are also seeking to reduce their carbon emissions. There is now an exploration of different fuel sources, including electricity, hydrogen fuel cells, and liquid natural gas.

Hydrogen fuel cells is proving a popular alternative method of powering trains. France is a leading example of using hydrogen to power trains. Their train's fuel cells power its electric motor, and [Alstom claims this creates a 100% emission-free train unit.](#)

Electric trains are a fantastic and viable option for transportation. Their range will increase as battery capacity increases, and they will too become cheaper with plummeting battery prices. Back in 2012, The [Guardian reported that a high speed electric train travelling 300 km per hour produces less Co2 per passenger than a diesel-fuelled train travelling its top speed at 220 km per hour.](#)

A good example and forerunner on the electric train ride is Germany. The German Federal Government provided a whopping four million euro subsidy as part of an innovation programme for e-mobility. They implemented a

new battery-powered train through Bombardier; the first of its kind in Europe. These trains create absolutely no exhaust fumes, and set standards for 90% efficiency and recyclability. They are also said to be 50% quieter than normal trains - great for cutting down that noise pollution too.

Trend 24: Electric planes

The electric aircraft movement is taking off. Electrifying our planes presents great progress towards a more eco-friendly world, because [aviation accounts for 4% of world greenhouse gas emissions, according to the European Commission.](#) Electric aviation could dramatically reduce emissions and make these carbon-cutting emissions goals more feasible.

Electric planes are certainly not the most common form of electric mobility, to say the least. But progress is being made. In 2016, the Solar Impulse 2 was the first electric aircraft to complete a trip around the world emitting no emissions and burning no fuel over its 16-month journey. An amazing achievement.

For the passenger, electric planes would

be extremely beneficial. They could result in cheaper flights, decreased noise and also a higher rate of climb. Electric engine planes will be capable of maintaining their performance at higher altitudes where air resistance is lower, so the aircraft will have to be less powerful to reach equivalent speed of traditional planes.

Whilst this sounds super exciting, there is a very long way to go before commercial flights are powered electrically. With the current pace of battery and electrical engine developments, it may not be until 2030 that we see commercial electric aircrafts. Nonetheless, it is exciting to see the potential for flying electric in the future.



THAT'S A FACT

China contains 99% of the world's electric buses.



Batteries

Without high-performance batteries, we wouldn't have the growth of electric vehicles. This is a key area for innovation, and will shape the evolution of the EV industry.

Trend 25: Falling battery prices

EVs are currently more expensive than fuel-run vehicles. However, this is expected to change within the next ten years, and this is mainly due to the batteries. The battery is the heart and soul of the EV. Therefore, prices, EV reliability and accessibility all depend on battery trends. There have been changes to battery technology over the past decade that have boosted momentum in the EV movement.

One of the reasons why EVs are increasing in popularity and becoming more accessible is the falling prices of batteries. [In 2010, lithium-ion batteries cost \\$1000 per kwh](#). In 2017, the cost

fell to drastically to \$200 per kwh, and this number keeps on falling.

In fact, [in 2018 Tesla stated that they are expected to be at \\$100 per kwh in the next two years](#). This means that by 2020 the cost of batteries will have plummeted by 90%. These cost developments are cheaper and faster than many expected. [As batteries currently make up half the price of an EV](#), the decreasing costs of batteries are bringing the cost of EVs closer to our traditional vehicles. [Analysts say that general price parity will be achieved between fuelled vehicles and EVs by 2020](#).

Trend 26: Increasing battery performance

Not only are costs of batteries falling, but they can now handle a lot more as they now have greater capacity. Therefore EV owners do not have to worry about their vehicle running out of charge so quickly. It is said that lithium-ion batteries are increasing 5-8% in capacity every year.

[Over the last six years, EV median range has extended by 56% , and some models can drive 300 miles just in one charge](#). This can put regular fuel-run cars to shame, and any range anxiety consumers have about the convenience of EVs is mitigated.

EV battery packs now have longer lives, making them more reliable and efficient. What is even better is that batteries don't tend to degrade over time, or with more

distance driven. [In fact, batteries only lose 1% capacity every 30,000 km \(18,750 miles\) driven](#). Therefore, the upfront cost of an EV depreciates a lot slower over time, which makes the investment more worthwhile.



THAT'S A FACT

by 2020, the cost of batteries will have plummeted by 90%



KEY TAKEAWAY

Car batteries get better and cheaper: it is a key trend that drives the EV industry forward. And the future looks bright and green, since 99% of vehicle batteries can be repurposed, saving energy and greenhouse gas emission.

The road to EV ubiquity

These trends drive us forward into a better future. Acknowledging the challenges in e-mobility allows us to face them directly, and overcome them. Whilst this is a fiercely competitive commercial environment, we believe that a culture of collaboration will bring together the fragmented groups of stakeholders to deliver value to the mass market. This is an exciting time of technological advancement, and we aim to provide the e-mobility market with innovative payment solutions for a seamless customer experience.

**READY
TO KNOW
MORE ?**



Are you ready to explore your opportunities in EV charging?

Please contact our support team at supportme@ccv.eu or **+31 88 228 9965**

and we will organise a workshop or round-table to clarify your business challenge and uncover solutions that fit your needs.

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