Driving change: How EVs are energising the green transition

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zero carbon academy

Introduction to EVs and charging infrastructure

Driving change

As pressures around fossil fuel use and climate change increase, our world is shifting to become 'greener' (that is, less carbon intensive), with governments mindful of making changes that align with the concept of a green economy. The green economy, according to the UN, is defined as being: "low carbon, resource efficient and socially inclusive. In a green economy, growth in employment and income are driven by public and private investment into such economic activities, infrastructure and assets that allow reduced carbon emissions and pollution, enhanced energy and resource efficiency, and prevention of the loss of biodiversity and ecosystem services."[i]

One key component of the greening economy is transport, a sector which presently accounts for 20% of global carbon dioxide[ii]. In 2022, global transport CO2 emissions grew by almost 5%, with most of these emissions stemming from road vehicles, which alone produced 12% of total global greenhouse gas (GHG) emissions in 2021. The primary source of transportation emissions are light commercial vehicles (LCVs)-passenger cars, whose emissions have increased by an average of one percent per year since 2010 to more than 3.5 $GtCO_2$ (Gigaton of CO2)[iii].

Figure 1: The top 5 polluting industries

Industry	Proportion of global CO2 emissions
Built environment	40%
Energy	38%
Agriculture	22%
Manufacturing	20%
Transport & logistics	20%

Source: ZCA. Note: Figures are higher than 100% due to significant overlap between industries – largely the 'built environment' which encompasses construction and real estate.

Over the past decade, the adoption of electric vehicles, or EVs for short, has grown rapidly. So too has the argument of using EVs as a more environmentally friendly replacement for traditional ICE (Internal Combustion Engine) vehicles, where EVs are viewed as being less polluting on-road alternatives, producing fewer or no greenhouse gas emissions at point of use. Within our wider research, we study the light commercial vehicles segment (LCVs) specifically, which includes private cars, small trucks (e.g. Pick-ups) and vans.

As we move towards the next decade, numerous countries (notably EU member states, the US, UK and China) have made commitments to phase out the sale of new ICE (Internal Combustion Engine) vehicles and hybrids, instead targeting a switch to EVs.

Electricity as a fuel source for both private and commercial vehicles is becoming increasingly common. EVs can be powered using electricity from the grid, with governments and suppliers increasingly aiming to source this from renewable methods such as wind or solar energy.

Plug-in hybrid electric vehicles (PHEV) may also be known as Plug-in Electric Vehicles (PEVs) though in this research we use the former term. Vehicles which are 100% electric are termed Battery Electric Vehicles (BEVs).

Whilst BEVs can be classed as 'zero emissions' since they do not produce emissions and can also be charged by using 100% renewable energy (where available), PHEVs combine more traditional and polluting combustion engines with the capability to plug in and charge a battery to power an electric motor.

Source: Envato

Challenges and constraints

Whilst there are notable benefits to EVs, there are also a multitude of barriers and concerns around industry practices, materials in use, and the products themselves, we list a sample of these below:

a. Range anxiety & consumer opinion

Increasingly noted in discussion around consumer adoption of EVs is 'range anxiety' where concern is felt regarding the distance an EV can travel on a single charge, alongside the worry of getting stranded during the journey should battery power run out. In fact, an EY Study from May 2022 found that the top concerns inhibiting adoption included charging infrastructure and EV range anxiety. However, the study also revealed that consumers who have already purchased an EV in the past are more likely to purchase one in the future, and they have less apprehension around range distance and charging opportunities[iv].

Most recently, a survey by McKinsey discovered that 42% of hesitant EV buyers said that they will not purchase an EV until battery capacity and driving range improve[v]. The study also revealed that consumer requirements for battery range continue to rise drastically. McKinsey's survey found that for 2024, prospective EV buyers said they want to get more than 310 miles per full charge, up from 270 in 2021. Additionally, 40% stated they would prefer to see a driving range of 400 miles or more before they would consider switching to an EV. These findings suggest that an improved charging infrastructure could encourage greater EV adoption, since many people have concerns around range.

b. Energy consumption & grid pressures

Increasingly favoured and encouraged is the charging of vehicles during times of low demand, such as overnight, to reduce pressure on the

electricity grid and incentivise the use of EVs by charging when energy prices are typically lower. There is also the draw of Vehicle to Grid (V2G), where EVs can export their stored energy back to the grid, thus effectively acting as a network of batteries to store surplus energy which can then be used at peak times: "Connecting millions of EVs and coordinating their charging and discharging would minimise the costs of EV charging while allowing the grid to balance the integration of high levels of variable renewable energy sources"[vi].

When looking at the transport sector specifically, a recent UK Hydrogen Council report found that over 95% of the energy used in road transport is fossil fuel based. Further, when looking at a switch to EVs, they argue that in many regions, energy demand will be hard to cover with locally available renewable electricity: "Thus, we expect that zero-emission vehicles (ZEVs) will be powered by a mix of batteries (using electricity) and fuel cells (using hydrogen). BEVs are rapidly becoming more common and are being used in more and more situations. They are the best solution for multiple use cases, especially in passenger transportation."[vii]

Charging Infrastructure Trends

There is certainly a demand for rapid and ultra-rapid chargers because consumers are used to the quick refuelling times of ICE vehicles. However, high setup costs of level 3 charging stations might inhibit a switch to EVs due to lack of supply. At present it is estimated that cost for level 3 charging stations range from $40,000 to $175,000 per unit, a significant outlay for businesses looking to provide fast charging services[viii].

Charging networks

Charging networks are the systems of EV charging station infrastructure. There are a range of charging network vendors available. Some examples are discussed in the company profile and leaderboard section of Zero Carbon Academy's full report. Different networks provide different levels of EV charging. For example, the bp pulse network provides fast 7kW chargers, 50kW rapid chargers, and 150kW ultra-rapid chargers.[ix]

Both public and home charging infrastructure are important to reduce driver fear over refuelling limitations. Past empirical studies have shown that there is a positive relationship between per capita charging infrastructure and EV adoption.[x] However, other studies have found the causality to be less clear.[xi]

Private (home & workplace) EV charging

Source: Unsplash

EV charging installation needs to keep up with EV manufacturing and ownership. Part of this process is increasing EV charger installations in

private parking areas. At the moment, EV drivers tend to rely on home charging over public and workplace charging.[xii] This is largely because home charging is currently more convenient and affordable.[xiii] Government policies and incentives can encourage more home and workplace installations.

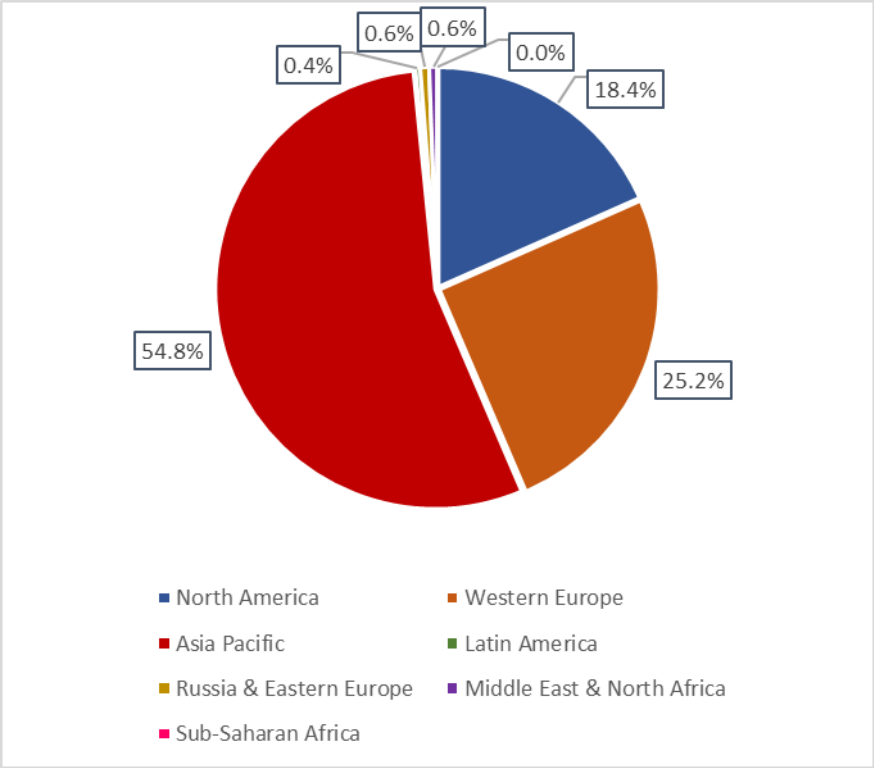
Forecast summary

Rise in BEV adoption set to continue

The segment for purely electric LCVs (BEVs) has shown strong growth over the past decade and will continue to do so with our forecasts showing a Compound Annual Growth Rate (CAGR) of 10.7% globally between 2023 and 2028, with total vehicle unit sales reaching 17.5 million annually by 2028. Other findings include:

- PHEV registrations will slow significantly towards the end of our forecast period.
- The changing mix of BEV vehicles is seeing a greater offering of more affordable models, and our study has revealed a wide variation in both sales trends and average EV pricing between regions and even neighbouring countries.
- While overall ICE numbers will decline from 2023 to 2028, several markets will continue to see growth - these include Latin America, Russia & Eastern Europe, Middle East & North Africa and Sub-Saharan Africa, as these vehicles remain the more accessible and affordable option for consumers.
- At present the market for both BEV and PHEV sales is fragmented, with manufacturers varying their approach to electrification. For example, Chinese car company BYD which traditionally sold ICE vehicles, switched in March 2022 to produce only full electric and heavily electrified plug-in hybrid cars. Other manufacturers are exploring not only electric, but alternative fuels such as hydrogen.

Total annual BEV sales globally in 2028: 17.5 million, split by region



Source: Zero Carbon Academy

For in-depth analysis, including our full suite of market forecasts, industry-specific trends and recommendations, vendor leaderboards, as well as insight into country-specific policy, ZCA's full research can be purchased here: Electric vehicles & charging infrastructure (zerocarbonacademy.com)

References

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