

EV outlook #1

Growth, policy and net zero

Electric vehicle (EV) growth rebounded strongly in 2020 (+43% y-o-y) and is on track for a similar rise in 2021. This growth is being driven by Europe and China, markets with a supportive policy environment. We expect policy support to spread to new markets over the next few years. Biden's American Jobs Plan overtly targets closing the gap with China on EVs and, as more countries adopt net zero climate ambitions, new targets to phase out fossil fuel car sales by 2035 are likely. We remain comfortable with our forecast of 36m annual global EV sales by 2030 (implying a 27% CAGR from 2020) but expect industry analysts' forecasts for the market to rise.

Growth confounds the critics: 43% despite COVID-19

The pandemic saw global car sales fall 14% in 2020, yet EVs rebounded: sales of 3.2m were up 43% y-o-y versus 3% in 2019. Growth was particularly rapid in Europe (137%) driven by tighter fleet-wide emissions standards and a resurgence in plug-in hybrids (PHEVs). Rapid growth here and in China has continued in 2021.

The primary role played by policy

Europe, China and California accounted for 52% of the total car market in 2020 but 87% of EV sales. A combination of consumer incentives (subsidies and lower taxes) and fleet-wide emission regulation of carmakers has encouraged adoption. In these regions the EV penetration rate of new sales (including PHEVs) is already in (or close to) double digits. Across the rest of the world it stands at just c 1%.

Policy support may strengthen

Biden's American Jobs Plan intends to allocate \$174bn to close the gap with China on EVs in the US and includes spending on consumer incentives and charging infrastructure. Re-imposing tighter fuel economy standards could also accelerate the transition. China itself is targeting 20% EV penetration of new car sales by 2025. In Europe a further tightening of fleet-wide emissions (backed by fines) in 2030 is likely to spur adoption, even as incentives reduce. The bigger picture is the shift to net zero. In H220, the UK, Japan and California (markets accounting for c 10% of global car sales) announced the intention to phase out sales of fossil fuel cars by 2035, bringing transport policy in line with their broader net zero climate objectives. We expect other countries with net zero policies to set phase out dates and, around the upcoming COP26 summit in November 2021 in particular, for more countries to set net zero ambitions.

EV market forecasts likely to rise

In 2020 EV growth rates returned to their 2011-20 average of 45%. This CAGR has remained consistent over the last decade (despite wide annual fluctuations) and is well above that implied by IEA and BNEF 2030 forecasts (20% and 23% respectively). Policy support, which has underpinned this growth so far, looks set to continue and may even strengthen. IEA and BNEF forecasts look likely to rise in our view. The key questions are about demand and whether supply can scale up as the absolute numbers rise. We are comfortable with our estimate of 36m EV sales in 2030 for now (a 27% CAGR) but will review our forecasts in more detail as we update our assessment of demand, technology and the supply chain.

Edison themes



20 April 2021

From the street

"The United States is in the midst of a fundamental transformation of our transportation sector, with consumers, businesses, fleets and automakers embracing the transition to electric vehicles. This transition will create millions of American jobs, reduce greenhouse gas emissions, create economic benefits and ensure American transportation leadership for years to come." Pasquale Romano, president and CEO of ChargePoint

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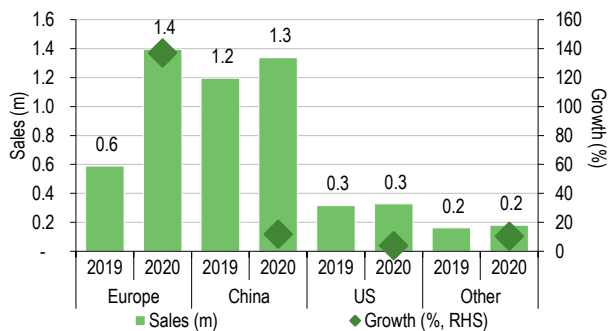
EVs, policy and net zero

In [Battery charge: The rise of lithium-ion – options and implications](#), we described the shift to EVs as one of the most, if not the most, significant industrial transitions in the next 30 years. After a strong performance in 2020, the transition is now happening in earnest in some regions. In this report, the first of a series of short notes looking at EVs, the supply chain and their effect on the energy industry, we examine the role of policy on future growth. Policy has been a major driver of growth so far and is likely to play a critical role in the future (even as the need for direct incentives diminishes). Momentum for more ambitious climate policies appears to be increasing and, as we highlighted in [The hydrogen economy: Decarbonising the final 20%](#), shifts in policy have the potential to shape and significantly accelerate the market.

2020 and 2021 (so far): EVs confound the critics and COVID-19

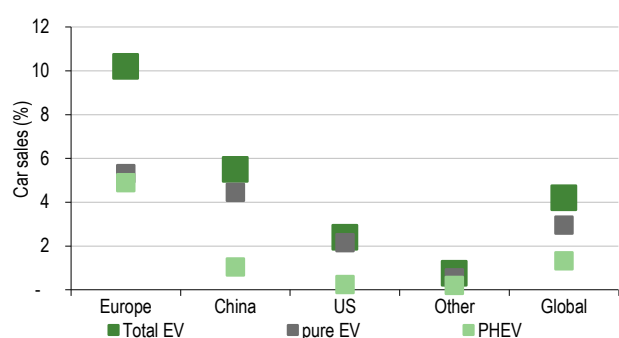
As the spread of COVID-19 began affecting car sales early last year, many analysts assumed total EVs (pure EVs plus PHEVs) would struggle to grow much (if at all) in 2020. However, trends improved steadily through the year and, fuelled by a resurgence in Europe and China in H2, ultimately 3.2m EVs were sold worldwide, 43% y-o-y growth (Exhibit 1). This impressive performance was despite negligible EV growth outside these regions and a fall in overall car market sales of 14%. The weak overall car market coupled with EV growth saw penetration rise from 2.5% to 4.2% (Exhibit 2). Growth in pure EVs was 33% but PHEV growth accelerated to 71%, driven by growth in Europe. PHEVs accounted for 31% of total EVs.

Exhibit 1: Total EV* sales by region in 2019 and 2020



Source: EV-volumes.com. Note: *Includes pure EVs + PHEVs.

Exhibit 2: EV penetration by region in 2020



Source: EV-volumes.com

The year 2021 looks to have started in a similarly strong vein. In Europe, sales are up 58% ytd (end February) y-o-y driven by strong growth in PHEVs (up 100% y-o-y), with PHEVs now accounting for 57% of total EV sales in the region. With the overall car market continuing to be affected by COVID-19, total EV penetration in Europe has risen to 14%, while internal combustion engine (ICE) vehicles sales are down 29% ytd y-o-y. EV sales are being led by Germany where y-o-y growth stands at 137% and total EV penetration has already reached 21%. In China, EV sales are up 291% ytd (end March) y-o-y, albeit against very weak months last year. EVs account for 9% of overall car sales led by pure EVs (83% of total EV sales). Reliable data on other major markets for 2021 are not yet available.

Trends highlight the primary role of policy

There is encouraging evidence for the growing consumer appetite for EVs in these numbers. The huge outperformance in a downturn across almost all markets and the rapid growth in smaller EVs in China and Germany suggests demand is spreading to new segments. This bodes well for long-term demand but it is still early days. Above all, the numbers highlight the importance of policy, and

changes in policy, on market dynamics. In Europe, the introduction of tighter fleet-wide emission targets in 2020 was the key growth driver – car companies had to increase EV sales to reduce [fines](#). At the same time carmakers increased the size of PHEV batteries to meet the tighter subsidy threshold introduced in 2019, leading to a resurgence in PHEVs. Sales in some markets (particularly France) have been boosted by subsidies and taxes on ICEs. In China the sharp recovery in growth in H2 reflected the annualising of the impact of the subsidy cuts in 2019. Arguably, the lacklustre growth (c 4% in 2020) and penetration (2%) of EVs in the US as a whole reflects the limited policy support. Approximately 45% of US EV sales are in California, where incentives and tighter pollution controls have encouraged EV adoption. Penetration of total EVs in California stood at 8.1% in 2020.

Existing policies should spur EV adoption in Europe and China

Policy is likely to remain a key growth driver in our view. Falling costs are set to reduce the need for direct demand incentives (subsidies) but policies already in place on the supply side in Europe and China (18% and 32% of the total car market respectively) look set to sustain rising adoption.

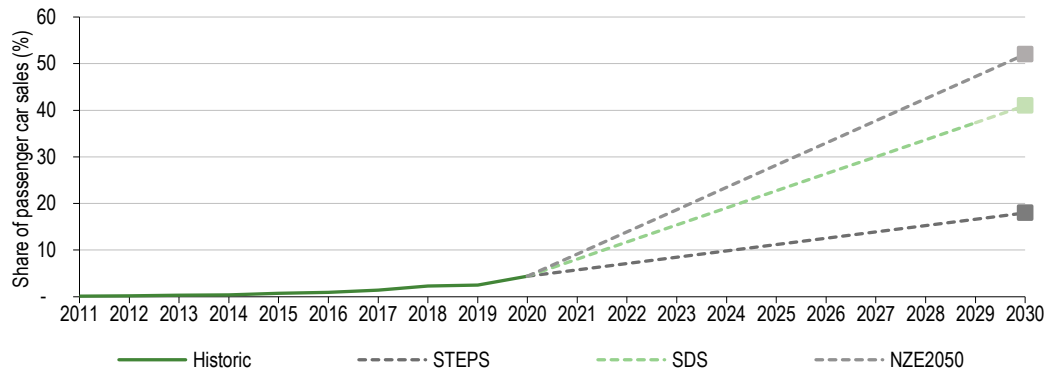
The resurgence of European EV sales in 2020 highlights the effectiveness of the EU's fleet-wide average emission regulations. The average emission intensity of new cars sold across the EU by each manufacturer is 95 gCO₂/km in 2021 (compared to the 2015 target of 130 gCO₂/km) and current regulations target that to fall 15% by 2025 and 37% by 2030. Increasing the mix of EVs is likely to be the most effective and cost-efficient way for carmakers to meet these targets.

China's fleet-wide emission standards have largely mirrored those in Europe. It is targeting fuel consumption of 4l per 100km by 2025, a 25% reduction from 2019 levels and equivalent to 93g CO₂/km. In addition it has committed to achieving a 20% penetration of EVs by 2025, implying sales of at least 5m and a 30% CAGR over the next five years.

Net zero and the automotive sector

In our view there is scope for policy support to strengthen and spread to other markets as national governments take the risks posed by climate change increasingly seriously. A growing number of countries have now adopted so-called 'net zero' targets. As specified by the IPCC (Intergovernmental Panel on Climate Change), these net zero targets require emissions to fall to zero by 2050 and are designed to restrict the rise in global temperatures to 1.5°C. According to the UN, over 110 countries have now made some form of pledge to reach carbon neutrality (net zero on CO₂) by 2050, with China aiming for net zero by 2060. Eight countries including the UK have already enshrined a 2050 net zero objective into law and the EU's Climate Law, which is likely to set deep interim (2030) emissions cuts, is expected to pass in 2021.

Exhibit 3: The IEA estimates net zero requires EVs to reach 50% of new car sales by 2030

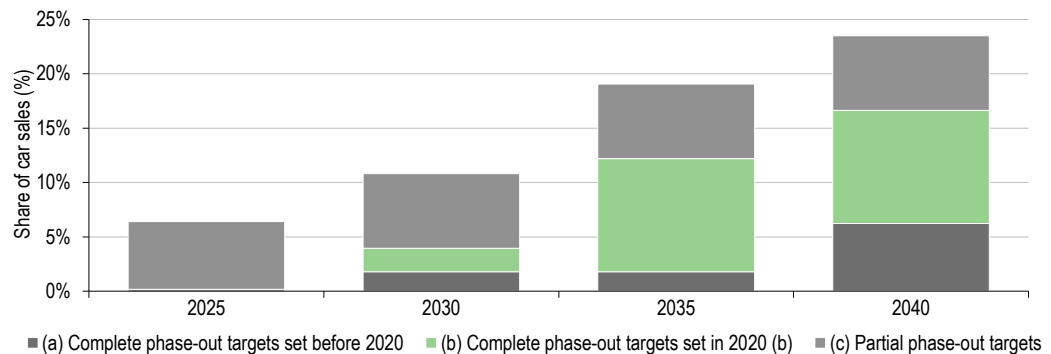


Source: IEA (2020). World Energy Outlook. <https://www.iea.org/reports/world-energy-outlook-2020/achieving-net-zero-emissions-by-2050#abstract>. All rights reserved. As modified by Edisongroup Note: The IEA's 'passenger car' segmentation may not directly equate to that used elsewhere in this report. NZE2050 is the IEA's Net Zero scenario, STEPS is the IEA's 'stated policy' scenario and Sustainable Development Scenario (SDS) reflects the goals of the Paris agreement.

These net zero targets have particular implications for the pace of decarbonisation required in the automotive sector. Given the ambition to reduce emissions to zero by 2050 and an average car lifespan of at least 12 years, it requires ICE sales to end (globally) by around 2035. Modelling by the IEA suggests that to be on track to deliver this and to ensure transport emissions remain within a net zero budget, annual new EVs sales must rise to over 50m by 2030 or 50% of new car sales globally. Meeting this target also requires some behavioural change and some adoption of fuel cell vehicles and EVs in road freight.

The need to align transport policy with net zero targets is beginning to feed directly into national policy. Until recently most of the countries with targets to completely phase out new ICEs sales were relatively small, or had set a date beyond 2035 – incompatible with a net zero target. However, over the last year policies have strengthened, particularly in jurisdictions that have made broader commitments to being net zero. In September 2020 California announced all new car sales would be zero emissions by 2035. November saw the UK bring forward the cut-off date for ICE car sales from 2040 to 2030 (2035 for PHEVs) and in December Japan announced it would phase out ICE car sales by the mid-2030s. Together these commitments cover c 8m of annual car sales or 10% of the current market. Total national policy commitments, either to completely phase out sales of new ICE cars, or to target EVs reaching a certain proportion of new car sales, currently cover 19% of annual car sales by 2035 (Exhibit 4). There is no guarantee that countries will reach these targets of course and doing so may require additional policy support, however improvements in technology and falling costs are making these early phase-out targets appear more feasible.

Exhibit 4: Share of car sales covered by existing policy commitments to switch to EVs



Source: Edison Investment Research. Chart shows the proportion of the current annual car sales covered by current policy commitments, segmented by type of target (complete phase out (a and b) or partial target (c)). Note: (a) complete phase out target set before 2020 and year of phase out (in brackets): Norway (2025), Denmark, Iceland, Ireland, Israel, Netherlands Slovenia, Sweden (all 2030), Canada, France, Singapore, Sri Lanka (all 2040); (b) complete phase out target set in 2020 and year of phase out (in brackets): UK (2030), California and Japan (2035 and “mid 30s” respectively); and (c) Partial phase out target showing the proportion of new car sales EVs are expected to reach and the year (in brackets): China (20% by 2025), Colombia (10% by 2050), Pakistan (30% by 2030), South Korea (25% by 2030)

Where could policy strengthen?

Greater policy support looks likely in the US and could have a big impact on global EV growth. The US accounted for 18% of car sales in 2020 but EV penetration (excluding California) was just 1.6%. Biden’s recently proposed \$2trn jobs plan aims to allocate \$174bn (9%) over eight years explicitly to ‘win the EV market’. It aims to provide point of sale and tax rebates to incentivise consumers to buy US-made EVs, grants and other incentives to local government to build a network of 500,000 chargers and begin electrifying the federal fleet.

Additional policy measures could support this transition. Although it is unlikely the US will set a phase-out date, it may choose to strengthen its fuel-economy legislation. Reinstating the 54mpg (4.4 litres per 100km or c 102g CO_{2e}/km) by 2025 fuel economy standard for new vehicles, lowered to 40mpg (5.9 litres per 100km or c 137g CO_{2e}/km) by Trump, would help. While it would still be behind both the EU and China, it would imply accelerating the average annual increase in fuel economy from 2.4% currently to c.5% – a pace of efficiency gain that can only be met by increasing the mix of EV sales. As with the infrastructure plan, it is not a certainty that these proposals make it into legislation.

The EU could strengthen its fleet targets further. Existing 2025 and 2030 fleet-wide emission targets may need to be made even more stringent to comply with the pending European Climate Law. Most large EU countries (France, Germany, Italy and Spain) have yet to set phase-out targets consistent with net zero. At the same time, it is likely that the level of subsidies will continue to fall. This can have a big impact on a market in an individual year, as the flatlining of China’s EV sales in 2019 highlights. However, assuming reductions in battery costs continue, we believe that any reduction in subsidies is unlikely to have a dramatic impact on the long-term growth trajectory.

South Korea, 2% of the car market, has also made a national net zero pledge and may follow Japan by strengthening its existing (33% battery EV by 2030 target). We expect more countries to make commitments at or around COP26, scheduled for November 2021.

As the market develops, the focus of policy support is also likely to shift. With EV costs likely to reach parity with ICEs by 2025 (see [Battery charge: The rise of lithium-ion – options and implications](#)), the need to incentivise EV sales will reduce. To sustain EV growth, attention will need to shift towards providing the charging infrastructure. For households without access to off-street

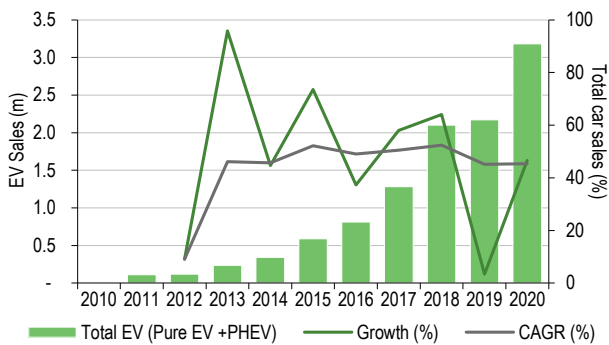
parking, charging remains a challenge. The additional demand on the grid is likely to require investment in both distribution and generation capacity.

Significantly, carmakers anticipating both the direction of travel of policy and technological progress are beginning to set their own voluntary targets. In January 2021 General Motors, a company with a 7% share of the global passenger car market, announced it would stop selling all fossil fuel powered 'light-duty vehicles' including hybrids by 2035. It joins a growing list of automakers promising to end ICE sales including Ford (in Europe by 2030), Volvo (2030) and Jaguar Landrover (2036).

Existing market forecasts looks too low

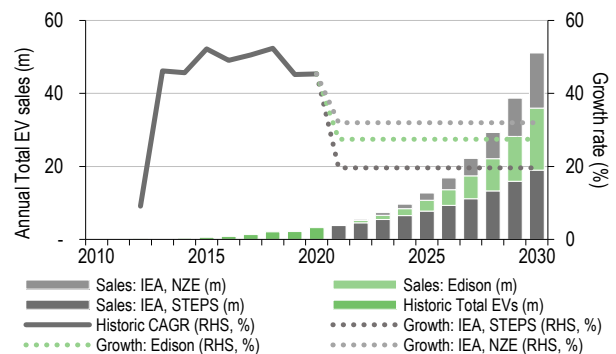
In [Battery charge: The rise of lithium-ion – options and implications](#) we highlighted that base case 2030 EV forecasts from both the IEA (in its STEPS scenario also known as a “Stated Policies” scenario) and BNEF looked too low to us. Revisions to these forecasts in 2020, made at the height of the COVID-19 pandemic, were understandably pessimistic. The [IEA now forecasts](#) 19m passenger car EVs in its STEPS scenario in 2030, while [BNEF lowered its 2030 forecast](#) to c 26m. The penetration level of EVs achieved in 2020 was closer to the BNEF’s 2022 forecast. Hence, near-term forecasts will need to rise to reflect this and we expect this will affect the longer-term trajectory. We believe both sets of 2030 forecasts now look too low and expect upward revisions in the next iterations due shortly.

Exhibit 5: Historic EV sales and growth rates



Source: EV-volumes.com and Edison Investment Research

Exhibit 6: EV forecasts in 2030 by CAGR assumption



Source: Edison Investment Research. NZE and STEPS are the IEA’s net zero and stated policy scenarios respectively

Interestingly, the resurgence in sales growth over the last nine months (June 2020 – March 2021) has seen EV growth rates return to their long-term (2011-2020) average of 45%. This CAGR has remained remarkably consistent over the last decade despite large annual fluctuations (see Exhibit 5) and is substantially above that required to meet IEA (STEPS) and BNEF forecasts (20% and 23% respectively). It is also above the 27% growth rate implied by our current forecast and the 32% growth implied by the IEA’s net zero scenario.

Extrapolating the historic CAGR from a relatively low base to forecast growth over a long time is a relatively crude way to gauge the 2030 market potential. We expect growth to slow as penetration rises. But at what point? Renewables and other (particularly commodity) technologies illustrate the potential for some markets where persistent cost declines, sustained by volume increases, can maintain long periods of rapid growth. Between 2000 and 2019 annual (net) installations of solar and wind capacity have grown at a 38% and 15% CAGR respectively. The key questions in our view are how broad is EV demand (across consumer segments and in different countries) and whether the supply chain and charging infrastructure can gear up quickly enough as the absolute numbers expand. As the preceding discussion highlights, detailed ‘bottom-up’ modelling does not necessarily produce more accurate forecasts. Tesla, 16% of total EV sales globally (23% of pure

EVs), whilst not always the most reliable forecaster of its future sales (!), expects to achieve 50% average annual growth in vehicle deliveries over a 'multi-year' horizon.

We remain comfortable with our forecast of 36m total EV sales by 2030 but will review our forecasts in more detail over the next few weeks as we update our analysis of demand and technology trends and look in more detail at potential supply chain constraints. Our analysis of policy suggests our forecast of rapid near-term growth is largely underpinned by existing commitments: China's ambition to get to annual sales of over 5m EVs by 2025 implies a 30% CAGR and strengthening fleet-wide emission standards will continue to drive adoption in Europe. Recent developments in the US and the increasing adoption of more stringent climate targets by other countries over the next 12–18 months suggest the policy environment could strengthen outside these regions.

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