Rising currents lifting EVs to new heights

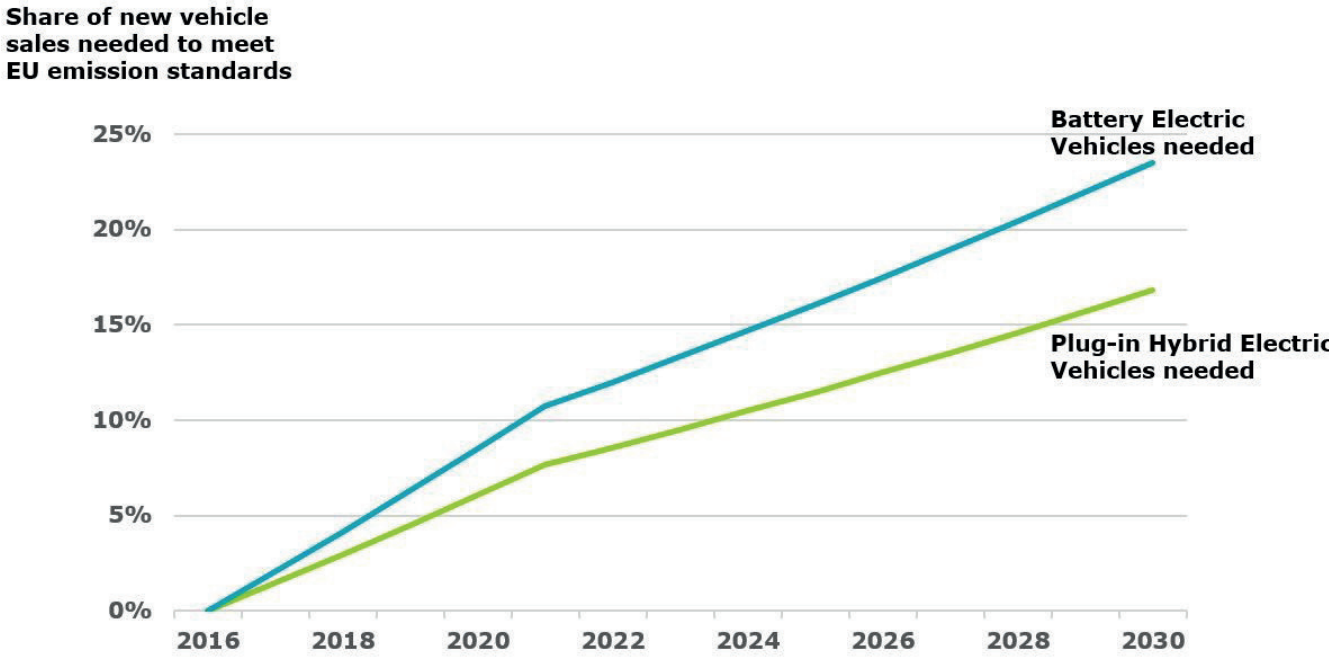
Topic of the month July/August 2018

Bogged in smog

Air pollution is a distressing global topic that has unleashed outrage and action from not only environmentalists but also governments and corporations. Transportation is responsible for about a quarter of global greenhouse gas emissions, with passenger cars and other light vehicles accounting for 17% of the total.[1] In China, one-third of pollution comes from gas and diesel-burning engines and deaths due to air pollution in India and China have already reached a million and continue to rise. Developed and emerging economies face similar crises.[2] The European Environment Agency reported that dirty air resulted in the premature death of nearly half a million citizens.

As air quality declines, total economic and welfare costs are rising. Population growth and city density are also increasing, exacerbating a problem that is already out of control. By 2060, the total cost of air pollution will account for 1% of global GDP (up from 0.3% in 2015).[3] Combatting air pollution by targeting automotive transport is gaining momentum among governments worldwide. China is aggressively supporting the Electric Vehicles (EV) market through subsidies and restrictions on petroleum-powered vehicles in smog-choked cities. Similar measures have been introduced in urban settings around the world and are hastening the demise of the conventional cars (Figure 1).

Figure 1: Emissions standards—spurring EV uptake



Source: RobecoSAM, ICCT, 2018

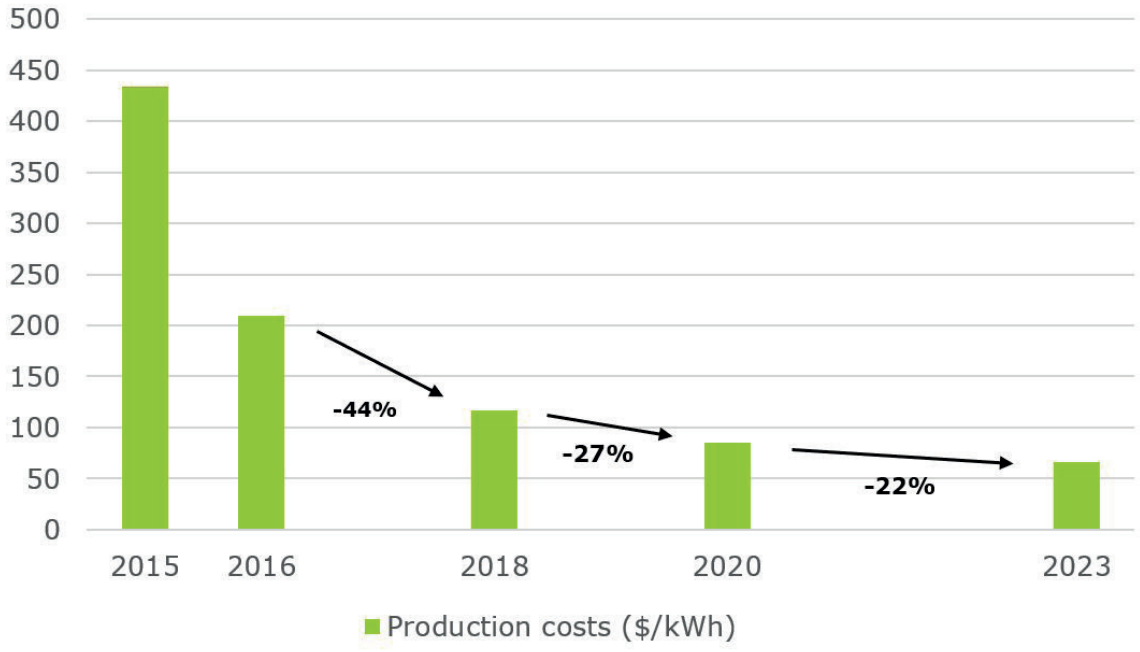
Estimates assume fuel car efficiency to improve 1% p.a. and a rate of 47g/CO2 per 100km for Plug-in hybrid EVs

Although incremental improvements in fuel efficiency and exhaust technologies of traditional cars are advancing, the overall costs of emission compliance are rising. As restrictions on ICEs (internal combustion engines) intensify and public awareness on climate change strengthens, EVs are in the crosshairs as a solution for pollution.

The role of lithium and lightweights

EV ascendency can't be achieved without battery power and mass production of lower-cost, lighter-weight and denser lithium-ion batteries are essential for charging the EV revolution. Driven by EV sales, RobecoSAM estimates the auto industry will consume 50% of total lithium output by 2020, up from around 18% in 2016. Batteries contribute, on average, to around a third of an EV's total cost and account for the EVs higher price tag. Based on pure economics, prices need to fall for EVs to overtake sales volumes of traditional vehicles. Innovation and economies of scale have already driven down the average battery cost to a fifth of 2010 prices and analysts are optimistic that figures will continue to fall rapidly.[4] In fact, EVs early movers are poised to halve costs again (to $100 per kWh) by 2020 (Figure 2). Cost parity with traditional cars is expected when battery pack prices fall in the $125-150/kWh range, so a tipping point is fast approaching.[5]

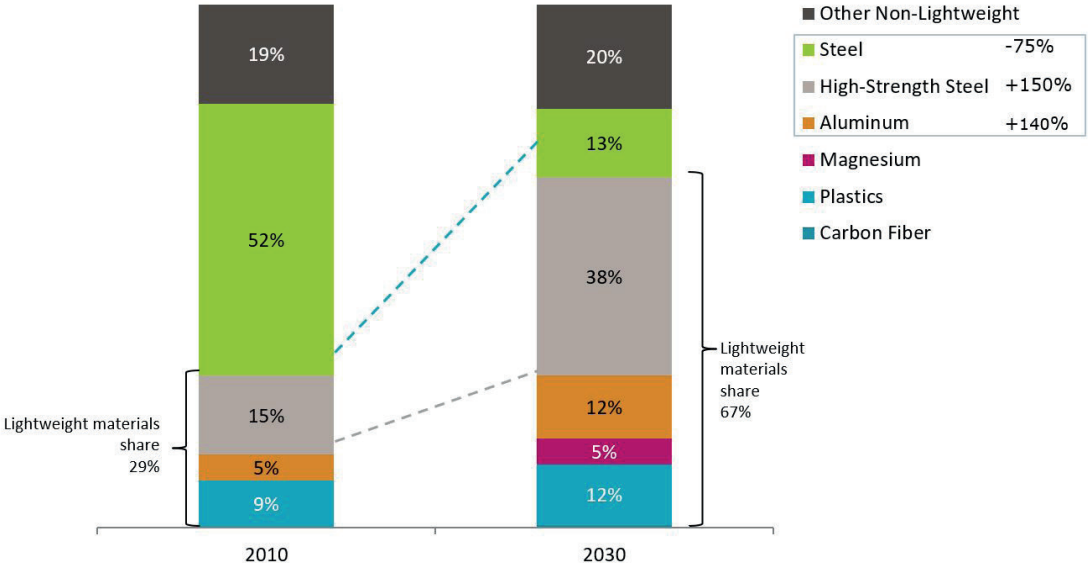
Figure 2: Battery production costs continue to decline



Source: Samsung SDI, BNP Paribas, 2016

Lithium isn't the only commodity needed to fuel the EV evolution. To maximize fuel efficiency, steel-heavy components of today's cars must be replaced with lighter weight materials like aluminum and polymer composites. Lost weight means distance gained on less fuel and helps make room for the other essentials like bigger batteries, electronic motors, safety devices and onboard control systems which interface with external networks.

Figure 3: Shedding weight to gain distance—the share of lightweight materials in vehicles is rising

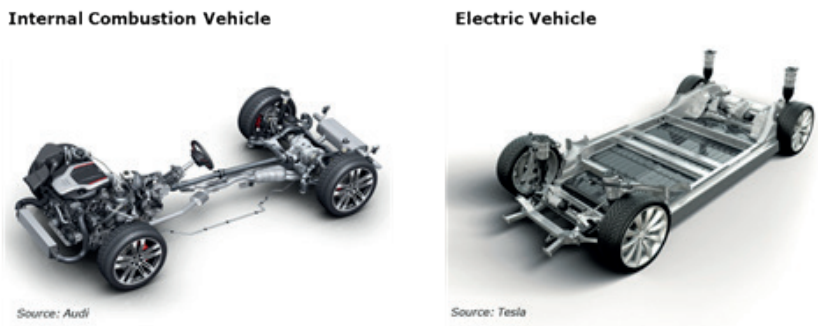


Source: McKinsey, RobecoSAM

Vehicle Electrification Part 1— overhauling the powertrain

EVs are considerably cleaner and more energy-efficient compared to petro-powered vehicles—compelling features that will continue to improve with time and technology. But the benefits to consumers extend beyond fuel costs and low emissions. Production and maintenance costs are also sinking thanks to a radically re-engineered powertrain system. The powertrain is the EV's life force that converts battery power into horsepower. The EV powertrain is structurally simpler and lighter compared to traditional cars resulting in more efficient assembly and lower production costs (See Figure 4). And as production scales up, costs come down. Structural simplicity means fewer breakable parts to service and lower maintenance costs over the life of the car.

Figure 4: Complex and clunky vs. simplified and sleek

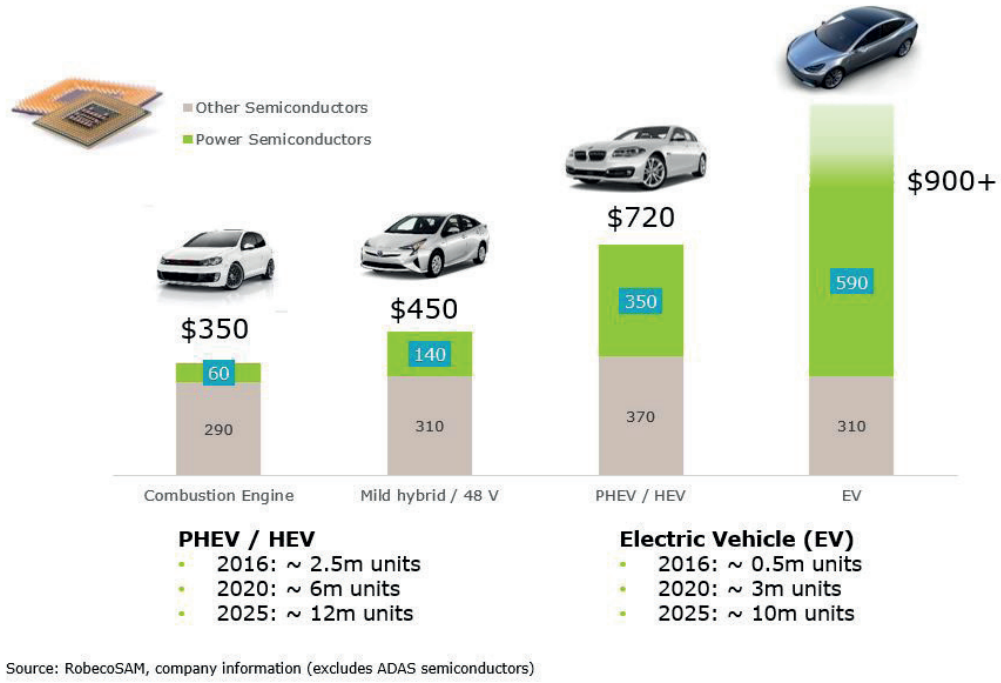


Advantages like these are making EVs price-competitive and increasing their mass appeal. Unsurprisingly, automakers have announced ambitious targets for EV models across product line-ups. As these positive forces converge, an inflection point in EV sales is expected early in the next decade.[6]

Vehicle Electrification Part 2—powering more than mobility

Electrification will revolutionize mobility quite literally from the inside out, starting with the car's internal design and then shifting to its external interactions within a larger transportation system. Critical to this second stage of development are the IT technologies that enable cars to communicate information to centralized data hubs to prevent problems and optimize performance. In future, vehicle-to-vehicle (V2V) communication will improve passenger safety and reduce traffic congestion while vehicle-to-grid (V2G) applications will allow EV owners to optimize charging tariffs and help stabilize the energy grid. Software, sensors and semiconductors are at the heart of this transition. Electric vehicles already have 10x more semiconductor content than traditional vehicles (Figure 5).

Figure 5: Circuits and semiconductors increasing in content



Source: RobecoSAM, company information (excludes ADAS semiconductors)

The demand and sophistication of vehicle electrification will intensify with the acceptance and expansion of autonomous driving. Ultimately, vehicle architecture, manufacturing, and engineering will undergo a complete overhaul. The car of the future will transform from one dominated by pure mechanics, hydraulics and hydrocarbons to one of circuits, silicon and software – a "computer on wheels" with the power to reduce pollution and improve urban life and infrastructure.

[1] Credit Suisse Connection Series, «Drive Train to Supply Chain," April 14, 2016, p. 40
[2] OECD Policy Highlights, Economic Consequences of Outdoor Air Pollution, 2018
[3] Ibid
[4] Bloomberg, "Electric cars may be cheaper than gas guzzlers in 7 years," 22 March 2018
[5] Howell D. et all, 2016, Overview of the US Dept of Energy VTO Advanced Battery R&D program. Online at https://www.energy.gov/sites/prod/files/2016/06/f32/es000_howell_2016_o_web.pdf
[6] Bloomberg New Energy Finance, Electric Vehicle Outlook 2017

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