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Interview 09 | 2017

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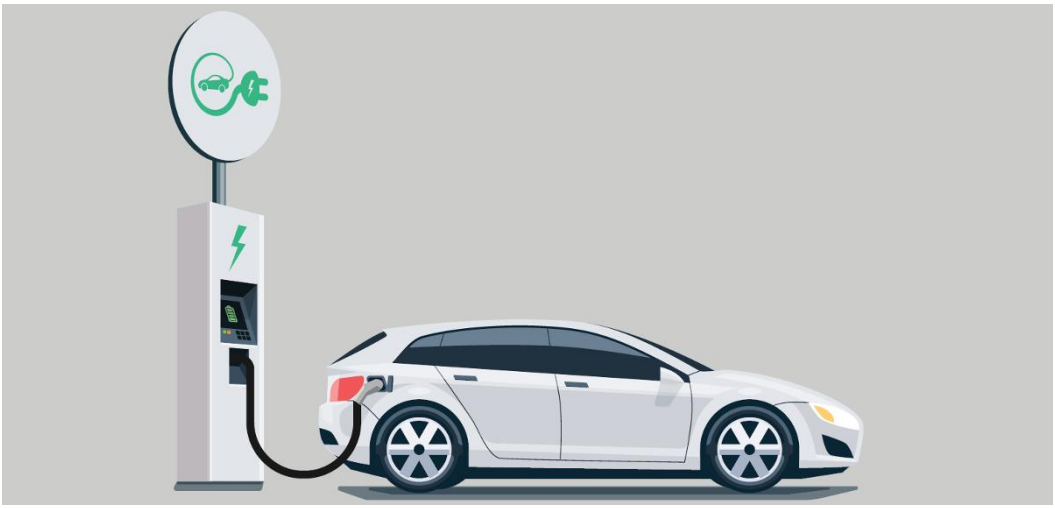
E-mobility: an electrifying future



The transformation of transportation has begun and its course is irreversible. Accelerating technological advances in energy management and materials are paving the way for E-mobility to overtake the combustion engine on the road to the future. We talked with RobecoSAM's Smart Energy Portfolio Manager, Thiemo Lang, for his views on what this means for the automotive industry and what companies are leading the transformation into the future.

What are your current estimates for the proliferation of hybrid electric vehicles vs. pure electric vehicles?

Based on current estimates, we expect about 6 million plug-in hybrid vehicles sold by 2020, as well as about 3 million purely electric vehicles on top of that. Assuming a total market of about 100 million vehicles sold, this estimate isn't aggressive by any means. In the medium to long term, purely electric vehicles will prevail because they will simply be cheaper in terms of the total cost of ownership that includes both purchasing *and* ongoing maintenance costs compared with hybrid and combustion-engine counterparts. Incidentally, due to the relatively high petrol prices, we estimate Europe to spearhead this trend from 2021-22 onward. North America and many parts of Asia will probably follow about 3-4 years later.

Will hydrogen fuel-cell technology have a role to play?

With respect to hydrogen-operated vehicles, we currently see only limited development activities. For one, fuel-cell technologies like hydrogen vehicles, are complicated to manufacture and expensive. Another hurdle is that carbon-free hydrogen is difficult to source. The way things look at the moment, hydrogen will increasingly be used as a means to store energy for stationary applications. For example, hydrogen produced through hydrolysis from solar power is well suited to seasonal storage applications

(surplus power is converted into hydrogen in summer and is then converted back into power via a fuel cell in winter).

What advantages make purely electric power drives attractive?

Electric vehicles have the advantage of a considerably higher level of overall efficiency compared to gas-powered vehicles. But even before the car hits the road, there are competitive advantages in e-vehicle production. The electric vehicle's much simpler powertrain (the transmission of power from the engine to the wheel axles) and the far lighter electric motor make the final assembly much easier and faster than is the case for conventional powertrain vehicles. It is estimated that an electric vehicle requires about 25% less assembly time (less than 30 hours compared with 40 hours for traditional cars).

"The total cost of ownership [of e-vehicles] will be cheaper compared with its hybrid and combustion-engine counterparts."

Much lower operating and maintenance costs are another huge advantage. Electric vehicles have far fewer moving parts which means there's less to break; oil changes are not necessary; and an electric motor has a very long duration. A great deal of progress has also been made with regard to battery life. Tesla reports the practically-tested range of its batteries at 90% after 250,000 kilometers (supported by a cooling system). That's an impressive figure! With more progress predicted for battery technology, electric vehicles will be especially useful for high-frequency drivers such as delivery services and car sharing platforms.

Where lies the optimism and where the obstacles for the future of e-mobility?

We are optimistic about the future of e-vehicles for many reasons. For one, we expect that battery costs – including the battery management system – will be cut in half once again (to around $100 per kilowatt-hour) by 2020. Furthermore, other significant improvements in power electronics will be achieved. This affects both the charging process as well as the control of energy flow from the battery to the motor and back again. New silicon carbide-based semiconductors reduce the conversion losses from the battery to the electric motor. Moreover, future e-vehicles will integrate the power converter into the electric motor itself thereby boosting efficiency even more.

We estimate that pending improvements in power electronics will increase the distance range of a vehicle by up to 20% (particularly in city traffic), given the existing battery capacity. Or expressed the other way around: Less battery capacity to achieve the same distance range. Typical battery capacities of a purely electric mid-range car sold from 2020 onward will be in the range of 60-80 kilowatt-hours, which would mean battery costs of about $6,000 to $8,000 per vehicle. This would then be equivalent to about 20-25% of a vehicle's total costs—a significant reduction compared to today's overall cost of 40%. And even that is nowhere near the end of the story because cost reductions in battery production will continue to occur well into the next decade.

A potential obstacle could be the lack of electric charging / re-charging infrastructure. For the ongoing success of electric mobility, it will be very important to expand the network of charging stations. For example, China has a program to install about 5 million charging stations by 2020 – a very ambitious target. Europe – and particularly Germany – is limping along in comparison. We also see innovation in fast-charging stations. Already today, 10-15 minutes is a feasible time to fully charge a battery.

Will newcomer Tesla dominate or do long-established automotive giants still have a chance to succeed in the e-mobility market?

Tesla has an outstanding brand image thanks to its charismatic CEO, Elon Musk. He perfectly embodies the values of innovative strength, technological leadership, and just downright coolness. Tesla has

incurred virtually no marketing expense and has no need to appear at the international automotive show (IAA) in Frankfurt.

We also wouldn't underestimate the extent to which Tesla has invested huge sums in infrastructure in recent years, such as charging stations and customer service centers. Ninety percent of the vehicle problems that occur can be identified by Tesla via radio transmission from a remote location. This reduces the headache of repair work by feeding valuable information to mechanics even before the vehicle even pulls into the garage, and creates significant savings in terms of time and money. Tesla is also a market leader in supply-chain management and sourcing of basic raw materials for its batteries.

Furthermore, the unveiling of the Model 3 will further shake up the automobile industry with its aim to outclass gas-powered sedans even before accounting for the economic and environmental advantages of e-vehicles. Of course, the German automobile industry has finally wakened to the threat of electric mobility. Automakers have announced their intent to produce a whole series of new, purely electric vehicles by 2019/2020.

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You've just alluded to the reality hitting European automakers, how does the situation look in the all-important Chinese car market? Several German manufacturers have joint ventures with Chinese production companies. At present, which ones do you consider to be worthy of attention?

The Chinese government has an aspiring agenda for electric mobility and is currently working on a timetable to end production and sales of combustion engine vehicles. Details will be announced soon; so far we only know their short-term targets – about 3 million electric vehicles (hybrid plug-ins and purely electric) to be newly registered by 2020.

What we've seen up until now is that the Chinese market has been very fragmented and will continue to be dominated by Chinese participants. Moreover, in an effort to boost its own industrial and intellectual capacity, China has limited foreign access to its automotive markets. Instead, the government favors partnerships between Chinese-run companies and foreign exporters of vehicles and automotive parts suppliers. Given the sheer size of the Chinese market, Western suppliers, still stand to benefit. An illustrative example would be semiconductor manufacturers like Germany's Infineon, which supplies China with the power semiconductors needed for electric vehicles and charging stations.

Could you also comment on the battery manufacturers?

Balancing battery supply with expected demand will clearly be a challenge. It will be particularly interesting to see the extent to which the expected increase in demand for the basic raw materials like lithium, cobalt and graphite—needed for efficient battery storage—can be matched by corresponding supplies. The supply of cobalt, in particular, could cause some difficulties. We expect that the battery industry will therefore try to reduce the share of cobalt in the cathode of batteries.

What opportunities/risks are in store for automotive suppliers?

Vehicle manufacturing will change significantly—as reliance shifts from mechanical and hydraulic components towards electronic parts as electrification, autonomous driving and "connected" vehicles proliferate. The vehicle of the future could resemble a mobile computer where cars are able to self-drive thereby giving passengers the ability to be productive while commuting.

Automotive suppliers are trying to adapt to this changing competitive landscape. In this context, it is also interesting that the German automotive group, Continental, publicly predicted that 2023 would mark the end of European production launches for conventional powertrain platforms.

Since electric mobility demands efficient electric power control and conversion systems, the share of (power) semiconductors per vehicle will continue to rise strongly. Companies, such as Infineon, ON Semiconductor, Power Integrations, Monolithic Power and Cree appear well positioned in the present competitive environment.

"E-mobility is already forcing significant change in the automotive industry but as old acts fade, new players emerge on the scene bringing positive impacts not only for the transportation sector but also for society and the real economy."

Thiemo Lang, PhD
Senior Portfolio Manager, RobecoSAM Smart Energy Strategy

About RobecoSAM
Founded in 1995, RobecoSAM is an investment specialist focused exclusively on Sustainability Investing. It offers asset management, indices, impact analysis and investment, sustainability assessments, and benchmarking services. Together with S&P Dow Jones Indices, RobecoSAM publishes the globally recognized Dow Jones Sustainability Indices (DJSI) as well as the S&P ESG Factor Weighted Index Series, the first index family to treat ESG as a standalone performance factor using the RobecoSAM Smart ESG methodology. As of June 30, 2017, RobecoSAM had client assets under management, advice and/or license of approximately USD 19.3 billion.

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