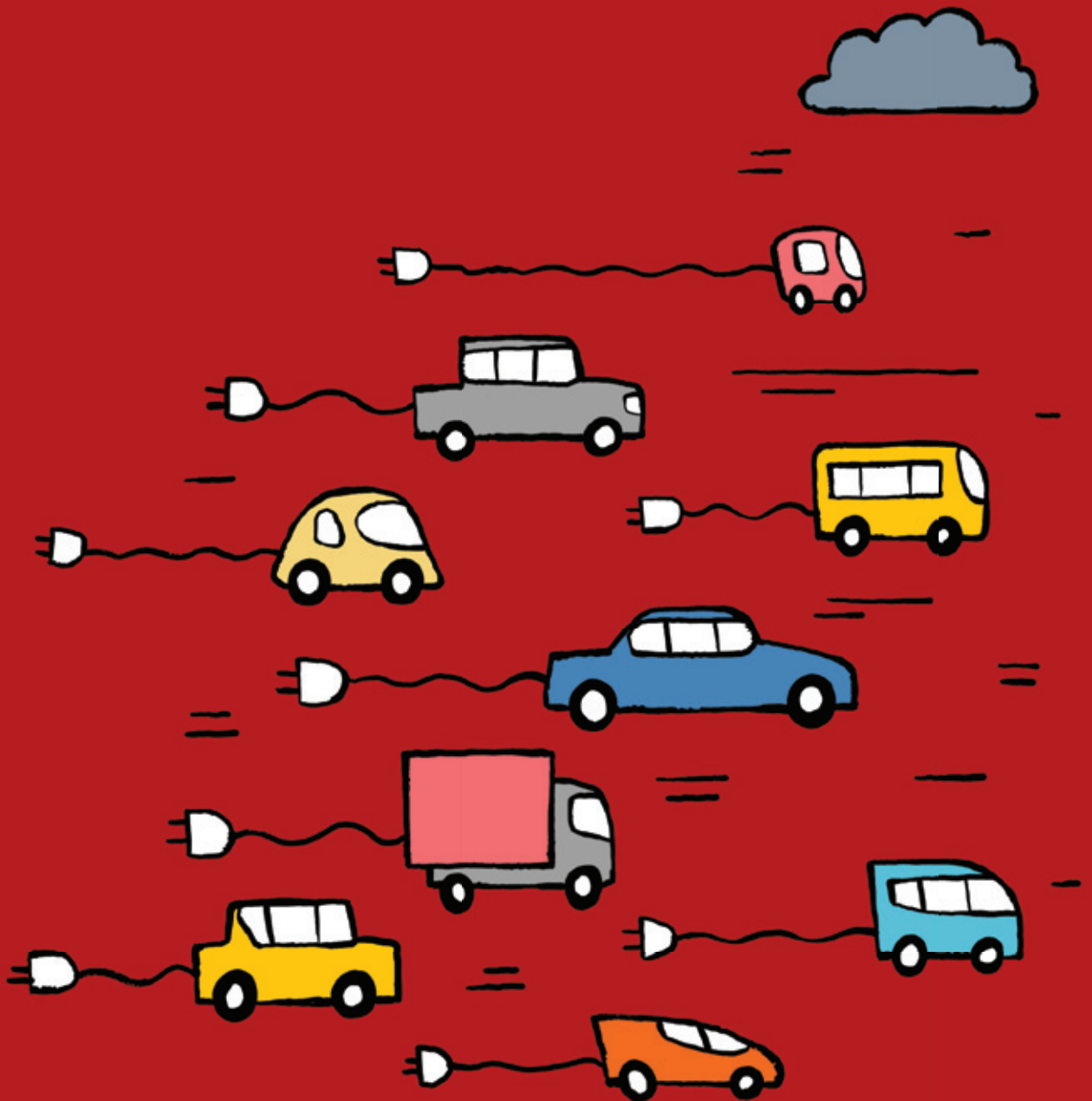


FACING THE STORM

How e-mobility is transforming the supplier industry



ROI DIALOG OVERVIEW – ISSUE 52

PAGE **The Killer App**

3

Electromobility is creating new rules for carmakers and their suppliers

With e-mobility, the automotive industry is facing the biggest paradigm shift in its more than one-hundred-year history. This change could be life-threatening, in particular for highly specialized suppliers.

PAGE **Warning Signals in the Management Cockpit**

4

How e-mobility is altering the balance of power in the automotive industry

All-electric cars are still the exception on our streets. However, the switch from the drive concept of the combustion engine to the electric powertrain is gaining momentum in the industry. We present three dimensions where particularly far-reaching changes can be expected.

PAGE **E-mobility: The Changing Automotive Life-cycle**

7

Infographic illustrating the four life stages of the electric car

The development, production, use, and recycling of an electric vehicle provide opportunities for new business models, but also require new skills.

PAGES

8-9

“The charging infrastructure is the Achilles heel of electromobility”

Interview with Christoph Stoppok, Managing Director of Electronic Components and Systems and PCB & Electronic Systems at ZVEI

Christoph Stoppok explains what effects e-mobility may have on companies, and which obstacles are currently being overcome.

PAGES

10-11

Breaking the Mold as a Factor for Success

Threat or opportunity? How established automotive industry suppliers can hold their own in the switch to e-mobility

E-mobility poses a threat to virtually every company that supplies components and systems for the traditional powertrain. We use a product-market matrix to demonstrate opportunities for survival.

PAGES

12-14

“We need to rethink the car”

Interview with Professor Matthias Busse, Chairman of Forum ElektroMobilität e.V.

Professor Matthias Busse describes how e-mobility is changing value chains in the automotive industry and what technological innovations are gaining significance.

PAGE

15

New Business Fields with Electric Vehicles

Infographics showing six new business fields and structural changes

We show what commercial areas of activity are springing up around electric vehicles and what structural change in the automotive and supply industry might look like.

THE KILLER APP

The automotive industry is having to face many changes, but it is only electromobility that can rock its very foundations.

By Hans-Georg Scheibe, Member of the Management Board, ROI Management Consulting AG

T

The contours of change are clearly drawn. In particular, electromobility, autonomous and semi-autonomous driving, the integration of motor vehicles into the global Internet of Things, and the emergence of new mobility concepts will all exert increasing pressure for change on the current business models of OEMs and suppliers in the automotive industry in the coming years. There is no doubt that the industry is experiencing the most significant paradigm shift in its over 100-year history.

Although they are all debated with a similar intensity in public, the individual dimensions of change vary dramatically in their structure. Some of the foreseeable changes will be of a primarily additive nature, where intelligence in particular is paired with vehicles and the way they fit in with global data networks. One exciting development that the industry's suppliers can easily handle is the fact that an augmented reality feature will not replace the ignition coil. In contrast, new mobility concepts are having far-reaching consequences at organizational and procedural levels. It is, however, the OEMs who will need to face up to the challenges by making their marketing and branding models open and intermodal. Greater use of other means of transport and car-sharing schemes can, of course, reduce the number of ve-

hicles produced. However, they will not change the industrial structure of the market. Even autonomous driving does not yet seem to be a development that will bring huge changes in the foreseeable future: As the technology matures, we are also recognizing the many different hurdles that need to be overcome. Volvo trend researcher Aric Dromi even thinks that we are more likely to experience flying cars than autonomous, earth-bound vehicles. He claims that this is because the concept demands a complete separation of the infrastructure. Just one non-autonomous passenger vehicle or a pedestrian in the same lane as the flow of autonomous vehicles would cause the entire system to collapse.

This leaves electromobility, whose breakthrough appears more than likely in the coming years as the infrastructure for charging continues to grow, while falling prices for batteries together with their increasing efficiency ensure that electric cars come to dominate our road. The development is being boosted by the high level of public acceptance and the fact that it does not force consumers to adapt their behavior to any significant degree. Electromobility is therefore the most tangible and most probable change that we will see in the coming years, and the most dangerous one for the automotive supply industry.

Today, one thing is for certain: Replacing the combustion engine with an electric drivetrain that requires far fewer components, mechanical expertise, and the worktime investment will not only necessitate technological and procedural adjustments, but also render a significant proportion of the business models of automotive supply manufacturers obsolete.

This change may be life-threatening for many supply companies whose success is founded on extremely profound but narrow expertise if they fail to open up any alternative sources of revenue in the coming years. However, this is anything but a trivial endeavor. While the switch to electromobility certainly provides opportunities – for example in the fields of electric motors, power electronics, or thermal and battery management – the markets of the future are already a fierce battleground. Competition from outside the industry, leading global suppliers, and OEMs that also recognize the possibility of shortening the supply chain are vying to supply the mobility technology of the 21st century. Many companies – particularly SMEs – will soon have to face the question of whether to reinterpret their core competences and apply them successfully outside of the automotive industry. This is a question to which there are no simple – and above all, universal – answers.



WARNING SIGNALS IN THE MANAGEMENT COCKPIT

How e-mobility is altering the balance of power in the automotive industry

By Michael Jung, Member of the Management Board, ROI Management Consulting AG



Michael Jung, Member of the Management Board, ROI Management Consulting AG

A

As the automobile has evolved, one small detail has remained unchanged for decades: the ominous red glow of the warning cockpit light signaling possible engine damage. Although carelessly underestimated by those not in the know, the oil warning light is considered equally prophetic. Ignoring its signal sets off a disastrous chain reaction. No oil pressure means no piston lubrication, which leads to piston seizure and, in turn, serious engine damage.

But the days of this horror scenario seem numbered, provided the all-electric drive variant actually prevails in automobile production over the medium or long term. This is because an electric powertrain eliminates the highly complex constituent parts of the combustion engine. Besides the engine housing, many other system components set for redundancy include all those used for the air intake, fuel supply, ignition and lubrication. They will be replaced by an electric motor and drivetrain; alongside new components like the battery and charging system, power electronics and special air-conditioning / heating systems (see diagram pp. 5) totaling around 210 parts. This represents a huge reduction in complexity compared to the average combustion engine and its 1,400 or so parts.

This development marks a decisive watershed for the automotive industry, which to date has been able to adapt technological innovations and customer requirements within the relatively clear framework of the development cycles of their model ranges. The vehicle life cycle – from development and production to use and ultimate disposal – will be turned on its head (see diagram p. 7) and with it, the corresponding value chain structures and power relationships that have been fostered for over a century. Changes in the following three areas will hit particularly hard: the supplier structure; the manufacturer / supplier relationship; and the development of new IT- and software-driven competences in R&D.

Suppliers: Specialists under Pressure

In recent years, many automotive suppliers faced few electromobility and innovation challenges, given the sluggish market demand for all-electric vehicles as well as the willingness of their customers to make any significant change to their model preferences in favor of this drive variant. Innovations were instead applied in areas such as “downsizing”, i.e. boosting the efficiency of the traditional combustion



engine, which even resulted in sales growth for a number of engine manufacturers and engine-related suppliers. However, this focus on improving an existing product is what poses a considerable risk in the medium to long term. This is because specialist suppliers in particular will come under extreme pressure if the share of all-electric vehicles increases significantly, as industry experts predict, between 2020 and 2040. If they fail to devise alternatives to products like camshafts, turbochargers and fuel injection pumps, their business will shrink substantially or even vanish. However, forecasts setting out the concrete developments the German automotive supply industry should actually expect have fluctuated between two extremes for years. While one camp sees thousands of jobs at risk and bemoans the head start of Asian rivals in battery technology, other market studies conjure up visions new jobs opportunities emerging in the manufacture of new e-components.

“Employment prospects in car manufacturing will be impacted by a reduction in complexity.”

One thing is certain: a reduction in complexity will hit employment prospects in car manufacturing. Some of the new components could generate significant market volume, like the “electric machine” at the core of the electrified powertrain. The report “Strukturstudie BWe MOBIL 2015” forecast market volume growth for this component alone to almost 21 billion euros by 2025 and at least 38 billion euros by 2030 compared to 2013. The principal drivers here could be increasing hybridization and the growing proportion of battery-powered vehicles in global sales (cf. Strukturstudie BWe MOBIL 2015, p. 55). The example also clearly illustrates that structural change in the automotive supply industry will not happen overnight but in gradual stages.

Production and assembly plans already exist for the highly relevant parts of the value chain of the electric machine – but efficiency in implementing low-cost production still needs to be improved.

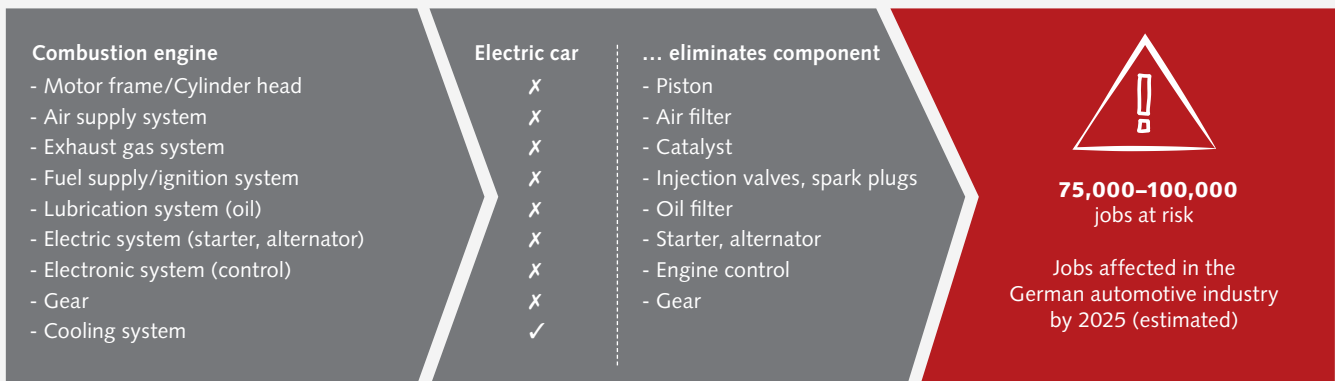
E-Cooperation: A Shift in the Value Chain

From the car-buyer’s perspective, e-models may still have something exotic about them – but attitudes within the automotive industry towards

the electric powertrain have already transformed since batteries have become ever more economical and better-performing. The example of Tesla in particular shows how all-electric cars can be developed, manufactured and sold for a mass market. The electrification of the powertrain thus looks set to shift the goalposts considerably in the value chain between car manufacturers and suppliers. While the relationship between OEM and supplier for the combustion engine was on a clear “buyer-seller” basis, car manufacturers can now choose between two strategies: a) consolidate development competence in electric drive systems in house, or b) buy in all the components from suppliers and focus on system integration.

From the combustor to the electric car:

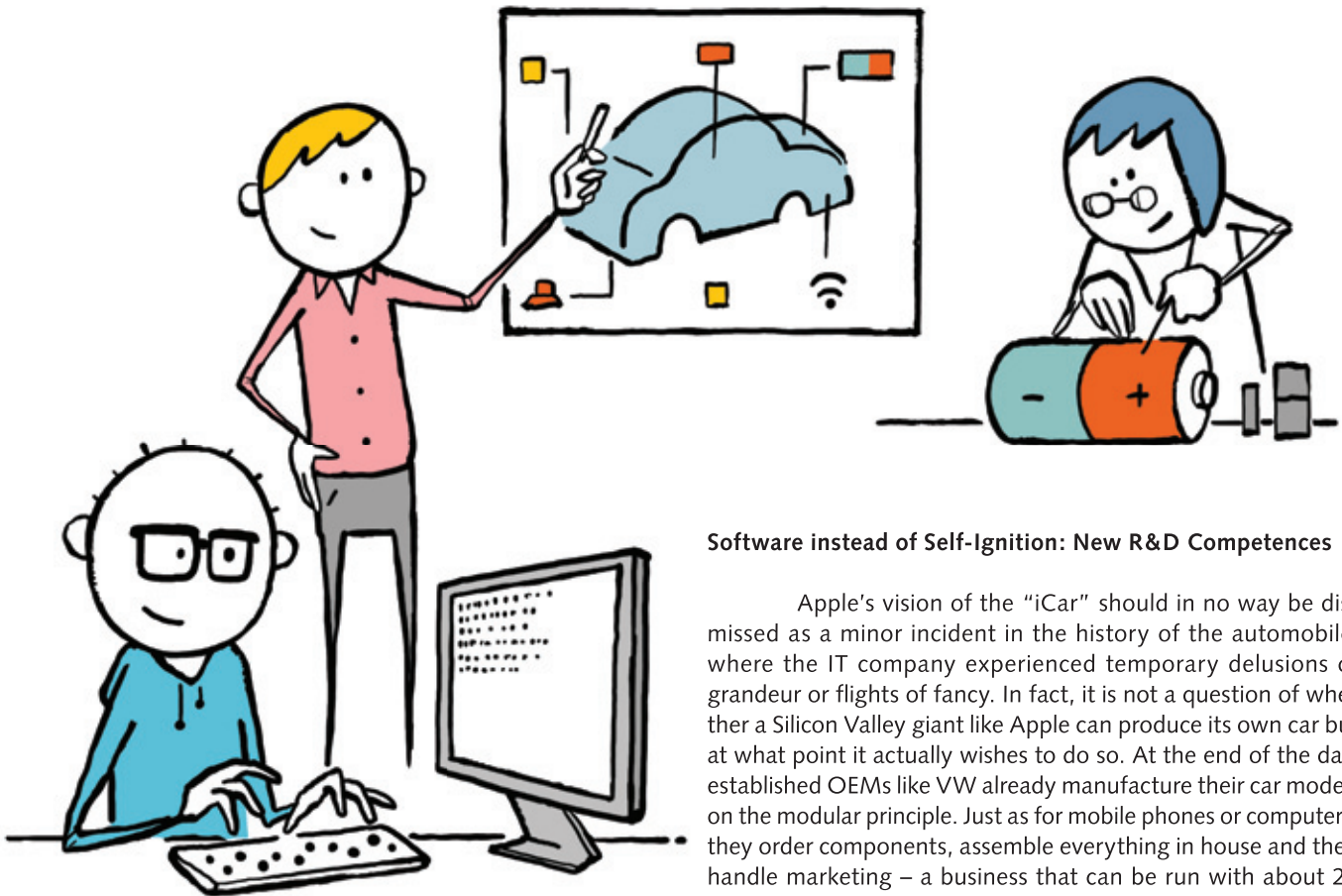
Elimination of basic systems and components



Added new components/systems:

Power electronics, DCDC converters, battery and charging system, hydrogen cell and tank, systems for air-condition and heating

X = System is eliminated



Software instead of Self-Ignition: New R&D Competences

Apple's vision of the "iCar" should in no way be dismissed as a minor incident in the history of the automobile, where the IT company experienced temporary delusions of grandeur or flights of fancy. In fact, it is not a question of whether a Silicon Valley giant like Apple can produce its own car but at what point it actually wishes to do so. At the end of the day, established OEMs like VW already manufacture their car models on the modular principle. Just as for mobile phones or computers, they order components, assemble everything in house and then handle marketing – a business that can be run with about 25 percent of in-house value added. Enhancing the combustion engine with hybrid technologies or replacing it long term with an electrified powertrain will make it easier for new entrants from outside the industry to take up car manufacturing.

Furthermore, the automotive industry is already competing with the IT sector for the best candidates, especially IT and electrical engineering specialists. A situation which will further intensify for OEM and supplier R&D departments over the next few years given that electronics and software are continuing to merge, for example for (semi-)autonomous cars, which require sensor technology from the electronics field and software to process the captured data. This is why the all-electric vehicle in particular has more in common – at least in development engineering terms – with a smartphone than a conventional car. The software-controlled management of power consumption in elements ranging from infotainment and driver assistance systems to heating, lighting, etc, in combination with progress in battery technologies, is what will underpin success in range and performance and thus boost the appeal of the vehicle for end customers.

The automotive industry must quickly realize that it is in competition with the IT sector when it comes to recruitment – and must now launch and fund university and training initiatives to meet the demand for technical specialists. Anyone ignoring these developments is in danger of seeing their business model come to a clunking halt.

This has several implications for automotive suppliers. They can share in this development of competence, for example, by developing partnerships and commit themselves to their previous customers on the manufacturer side in the process. Long term, however, carmakers may follow the General Motors example and build up their own inhouse competences for batteries and electric motors to enhance their independence. GM has been investing considerable sums in inhouse battery and electric motor production for seven years, the fruit of which has been between 58 and 158 electric vehicles a day produced in Detroit, depending on demand, some of which already have a range of up to 500 kilometers.

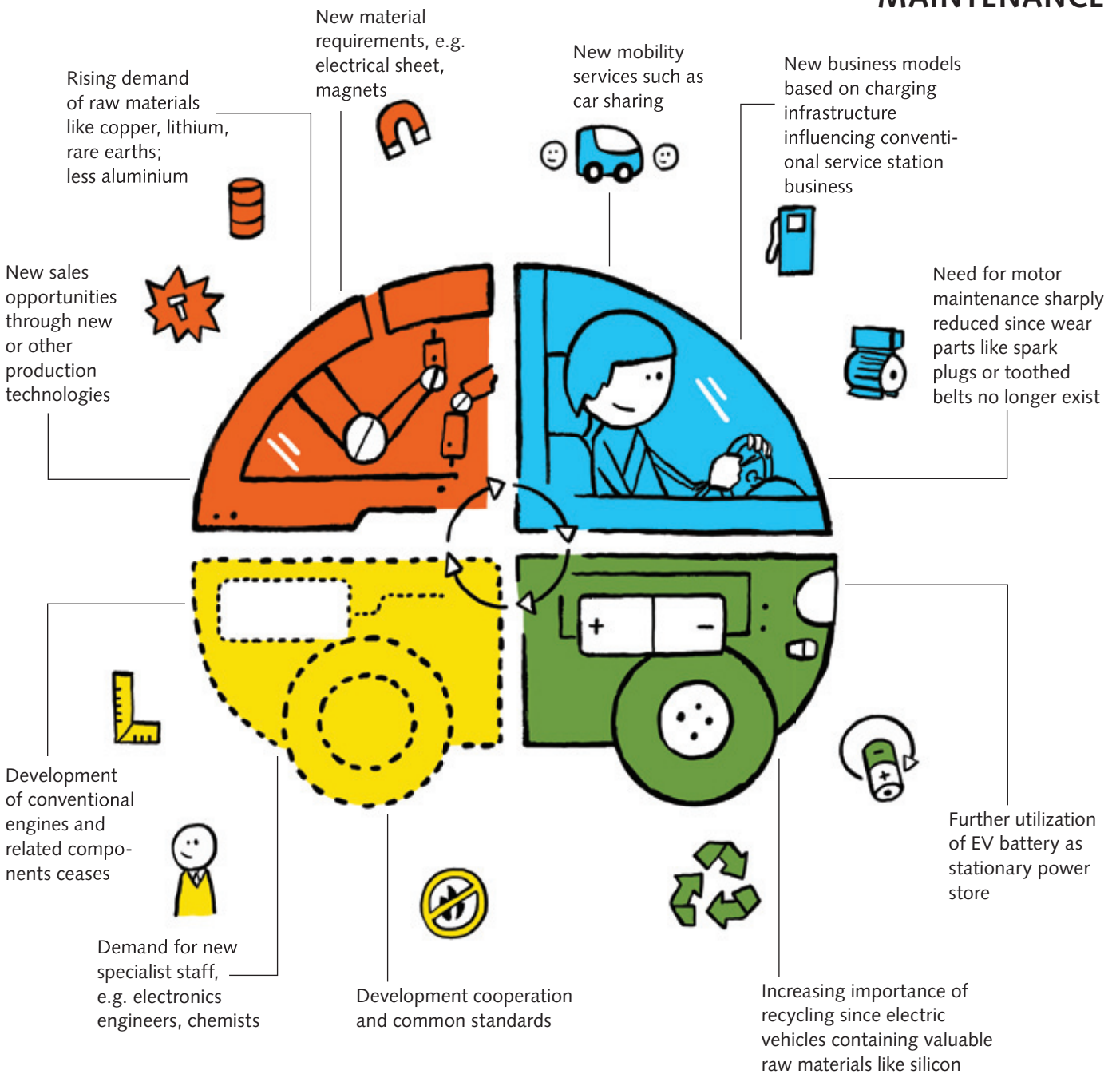
Whatever happens, automotive suppliers need a "plan B" to avoid becoming over-dependent on the electromobility strategy of their OEM customers, i.e. cooperative partnerships with battery producers and mechanical and plant engineering companies. Targeting not only reciprocal knowledge transfer but also the development of common products and services relating to the electric powertrain, with a special USP enhancing their appeal as a long-term partner for OEMs based on this "e-competence".

"The all-electric vehicle has more in common with a smartphone than a conventional car."

E-MOBILITY: THE CHANGING AUTOMOTIVE LIFE-CYCLE

MANUFACTURING

OPERATION & MAINTENANCE

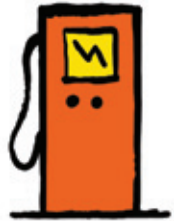


RESEARCH & DEVELOPMENT

DISPOSAL

“THE CHARGING INFRASTRUCTURE IS THE ACHILLES HEEL OF ELECTROMOBILITY”

Interview with Christoph Stoppok, Managing Director Electronic Components and Systems and PCB & Electronic Systems at ZVEI



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DIALOG: Mr. Stoppok, at what points in the automotive life cycle do you see the biggest changes coming in electromobility?

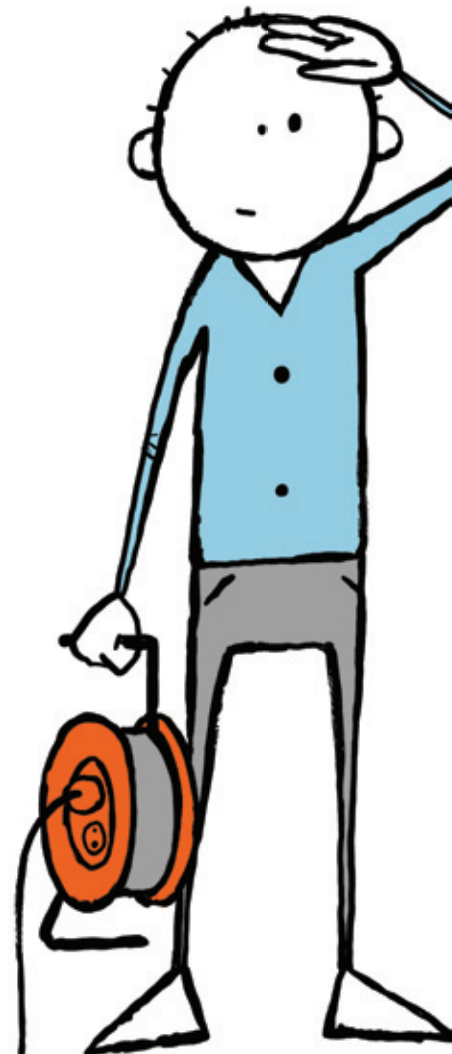
CS: Overall, I think we can expect the whole system to change, not just the car. With the car it is clear – certain components will simply become obsolete. The tank, gearbox and exhaust system for example. And though new components will, of course, be added, they will be less complex. This will considerably simplify the entire peripheral environment, whether for maintenance or diagnosis. However, the infrastructure is also set to change. The charging points won't come from traditional oil companies, but companies in electrical automation sectors instead – as already exemplified by factory equipment suppliers on a large scale. Similar developments are unfolding on a smaller scale, for example, among installation contractors who have to equip or retrofit residential buildings, as it is sometimes totally impossible to charge several cars in parallel with the current domestic set-up. Accordingly, these small firms will develop new business models.

DIALOG: At the same time, the disappearance of components is putting the very existence of various suppliers at risk. What consequences will this have for electrical industry companies?

CS: There will be winners and losers. Companies that only manufacture individual components are certain to experience difficulties if that part disappears. Companies that can hold their own in the market but



“New business models will emerge and persist in areas of market growth.”





**Christoph Stoppok, Managing Director
Electronic Components and Systems and
PCB & Electronic Systems at ZVEI**

will still struggle are the large tier-1 suppliers – currently system suppliers. From a certain scale onwards, however, they will simply be able to restructure their portfolio, given their very wide product range. Specialists offering individual products may be able to survive in their niche for a while – but not indefinitely. Of course, it goes without saying that the traditional car will not disappear overnight. It may take up to 20 or 30 years. Even so, maintaining a long-term business model in a shrinking market will prove increasingly difficult, because new business models will emerge and persist in areas of market growth.

DIALOG: *One way of responding to market changes is by forging collaborative partnerships, for example between mechanical engineering firms and car manufacturers. How do such partnerships prosper?*

About the ZVEI – German Electrical and Electronic Manufacturers’ Association

The ZVEI is committed to the common interests of the electrical industry in Germany and on an international level. This commitment is supported by the involvement of around 160 employees in the main office and about 5,000 employees of member companies in an honorary capacity. With its 22 specialist associations and four corporate members, the ZVEI represents a sector with sales of EUR 178.3 billion in 2015 and around 850,000 employees. With a further 704,000 employees outside Germany, the value chain of the electrical industry represents the largest global network of any sector.

www.zvei.org

CS: Establishing such partnerships is contingent on a win-win set-up. What you often find is one partner that knows the market and the other with a good product that is not yet established on the market. Both parties stand to gain on this basis. Good opportunities also exist for a number of electrical companies, as well as software businesses that have had no previous contact with the automotive market. There is great potential for software and electrical engineering companies in particular, if they partner with traditional automotive suppliers. Nevertheless, there is no guarantee of success and this does not apply across the board. Mechanical engineering businesses are set to lose out, for example, because the mechanics field will shrink. Although car bodies and brake pads will certainly still be needed in future, many mechanical components will disappear.

DIALOG: *What still hinders electromobility?*

CS: Electromobility is a new system technology. First and foremost, the cars need to become more innovative, i.e. more attractive. In other words, they have to be able to do everything a present-day car can do, plus a little bit more, perhaps. On top of that, a charging infrastructure is needed - and this is currently the biggest stumbling block. You cannot operate an electric vehicle on an everyday basis in Germany today because in 90-95 percent of cases, it is practically impossible to charge it. There is simply no plausible business model for a charging infrastructure today. So unfortunately, this is where politicians will have to step in with by continuing to provide funding until a viable business model emerges, because the charging infrastructure is currently the Achilles heel of electromobility in Germany. This is also something that industry cannot handle unaided – neither energy suppliers, who have to provide electricity at a profit, nor car manufacturers, who need to form a consortium to set up charging stations along the main highways to cover basic needs. There is currently no financially viable modus operandi.

“You cannot operate an electric vehicle on an everyday basis in Germany today.”

DIALOG: *How must electric cars change to match the appeal as of conventional vehicles?*

CS: The electric car of the future will be a world away from a mere replacement of the traditional combustion-engined car. That’s also the main reason why electric cars have seen no appreciable breakthrough. Current models lack the innovations that demanding users expect – offering even fewer than conventional vehicles: less range, higher costs, longer charge-times – all of which are constraints.

BREAKING THE MOLD AS A FACTOR FOR SUCCESS

Threat or opportunity? How established automotive industry suppliers can hold their own in the switch to e-mobility

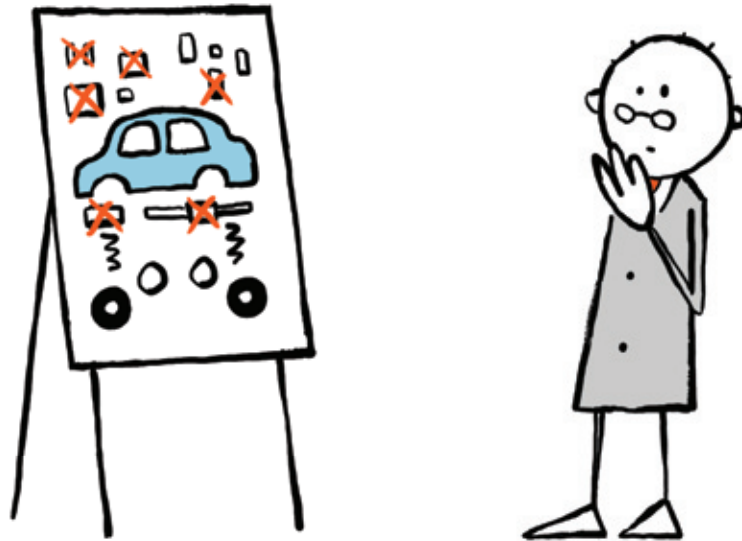
By Marconi Libório, Senior Consultant, ROI Management Consulting AG



Is the switch to e-mobility following in the footsteps of previous technological automobile innovations? If so, expect combustion-engined vehicles to be outnumbered by their hybrid and electric peers on our roads before long. The example of ESP (electronic stability program) perfectly illustrates the “establishment phases” of new technologies that are first rolled out in premium vehicles for wealthy and tech-savvy customers and then deployed across all model classes when the technology is tried and tested. Rolled out in the Mercedes S-Class Coupé in 1995, ESP is now a standard fixture in all new cars in Europe, but has failed to dominate in many places. By comparison, initial signs of this development have already emerged in e-mobility. The Tesla Model S, for example, was not only the best-selling premium-class automobile in the USA in the third quarter of 2016, its sales even outperformed the second- and third placed Mercedes S-Class and BMW 7-series combined! However, in the case of e-mobility, new competitors from the Chinese automotive industry may prove the real “mold-breakers”, given an increasing focus on e-mobility, and look set to make their market presence felt.

In any case, as a car nation, Germany will be one of the first to notice what a switch to e-mobility will entail, because Germany itself is a key producer of automobiles as well as being one of the pioneer markets, where new models and vehicle concepts achieve large market shares from an early stage. The consequences of e-mobility on the automotive industry here and the associated service sector will therefore be very far-reaching (see diagram on p. 7). Virtually every company that supplies components and systems for the traditional powertrain faces a serious threat, given that their market in Germany is shrinking and will disappear in the foreseeable future. For these companies, e-mobility becomes an existential question, which can only be met with new strategies. The chances of survival can be shown in very simplified form using a product-market matrix (also known as an Ansoff matrix):

| | | |
|-----------------|--|--------------------------------|
| NEW MARKET | (2) Market development/ New regions & target groups | (4) Diversification |
| EXISTING MARKET | (1) Market penetration: Increased market share | (3) Innovation |
| | EXISTING PRODUCTS / TECHNOLOGIES | NEW PRODUCTS / TECHNOLOGIES |



Affected companies should now decide on which quadrants they wish to focus their activities. This spawns specific strategies and different areas of focus:

(1) Market penetration/(2) Market development: If a company decides to continue working with its existing products and technologies, it should focus its activities on sales/marketing and production footprint. A sensible production footprint (which products are produced in which locations) coupled with a high OEE (overall equipment effectiveness) is the prerequisite for ensuring competitive production costs. Traditional lean manufacturing tools provide important assistance to continuously optimize OEE. However, the chances of increasing your own market share or even opening up new markets tend to be limited, because the market for all automotive manufacturers and suppliers is usually saturated. Gaining ground here means to be better than the competitors, who can also produce good products favorably. Moreover, this approach depends on the combustion engine retaining an appreciable share of overall global car production. Until then the company wins time and money, in order to prepare the bigger step into one of the other two quadrants.

(3) Innovation/(4) Diversification: If a company instead sets itself the goal of working with new products or technologies, its focus should be on managing innovation and developing products. The crucial question concerning the available expertise in the company should be considered in the case of innovation management – because this is what paves the way for product development. It is also important to take into account whether demand for an existing product will be sustained if the product has to be revised. Air-conditioning units and parking heaters, for example, will continue to exist, even if the drive or energy source is different. In contrast, eliminating the combustion engine will also end demand for components like spark plugs or oil filters.

Product development and diversification may open up greater growth opportunities, but may also bring greater risk. The company must invest significantly and may have to work with new, unfamiliar markets. The success factor here is clearly speed. New ways of finding ideas have to be created which are strongly customer-oriented perspective. Furthermore, new business models have to be revealed.

In addition, the potentials of products and services must be considered. The example Car Sharing shows how OEMs are currently changing into service providers. To master innovations and new technologies quickly, for example through a lean PEP (product development process), is becoming increasingly important. Who could imagine some years ago, that Google is able to produce a own car so quickly? Therefore, cooperations with companies that complement the lack of competencies and build strengths are gaining in importance. And ultimately, it's tremendously important to convince and inspire one's own team to take new paths to innovation quickly and openly.

In this sense the pattern break becomes the success factor. In addition, it is more than ever important to gain speed - whether by developing completely new approaches, a clear strategy and the courage to "cut off old braids". New market players such as Tesla, Google and Co. do not have these strains. Whether companies perceive electromobility as a threat or take it as an opportunity depends entirely on them.



“WE NEED TO RETHINK THE CAR”

An interview with Professor Matthias Busse,
Chairman of Forum ElektroMobilität e.V.

D



DIALOG: Professor Busse, electromobility is tied to a complex process of change. At which critical points in the value chains of the automotive industry will we see the greatest change in future?

MB: Looking ahead to the medium- to long-term from today's cars, I think we can expect far more than mere powertrain changes alone. We need to rethink the car from scratch, particularly given the further caesuras in mobility, such as driverless vehicles and the integration of networked vehicles with the infrastructure waiting in the wings. I'm convinced that electromobility can only elicit the desired success and improvements sought if these subjects are considered together. So simply removing the combustion engine and replacing it with an electric motor and battery is not enough. The car has to be rethought within the context of its environment.

DIALOG: What will that mean in concrete terms for the vehicle structure? Which components will become redundant and which will continue to play a role in an electric vehicle?

MB: From a technical perspective, certain components of conventional vehicles will undeniably no longer exist in their present form in time to come. This applies, for example, to the engine itself, the gearbox, the entire fuel supply system and exhaust aftertreatment – provided, of course, that the all-electric vehicle actually arrives. We assume that numerous hybrids will hit the market a decade from now. So we have, in a sense, combined two cars in one; combining the complete powertrain of a combustion engine with an electric powertrain – basically the most expensive, technologically sophisticated and heaviest car you can imagine. Even so, the demand will still come from the German, or European market, in particular, given the very high technological automotive standard here and the fact that no-one will compromise on range or similar right from the outset.

Conversely, if you consider the all-electric car, vehicles will become far simpler. An electric powertrain has considerably fewer components. What we have developed over the last 120 years with the combustion engine is nothing short of a tech-

nical miracle, and it is only because we produce combustion engines in such high numbers and in such an intensely competitive environment that we can offer them at all at prices the market can bear. Over time, electric vehicles will be cheaper option because of the far simpler structural design. If we had taken a different path 120 years ago by choosing to optimize the electric powertrain and were only starting to develop the combustion engine now on a small scale, it would be out of range for all but the rich. Since so much of what a vehicle now contains in terms of highly complex transmission technology or exhaust aftertreatment will disappear, supplier value chains will also doubtless change.

DIALOG: The disappearance of combustion engines, gearboxes and exhaust technology places the very existence of many suppliers into question. Can they hope to survive?

MB: There are certainly a number of companies that, with their technological portfolio, can restructure without necessarily having to reinvent themselves from scratch. Take the casting industry for example – engine blocks, cylinder heads,

wheel rims – all of which cast components. With the exception of the wheel rim, all these parts will doubtlessly no longer be needed in their current volumes. A foundry, and the entire industry, will have to adapt accordingly and devise new offerings, which may also include alternative products. For example, thanks to a special process developed by Fraunhofer IFAM, coils used in electric motors can be cast and no longer need to be wound. Transforming the wound coil into a cast coil with new technical attributes – with this type of approach, a supplier can once again play a part in producing electric motors.

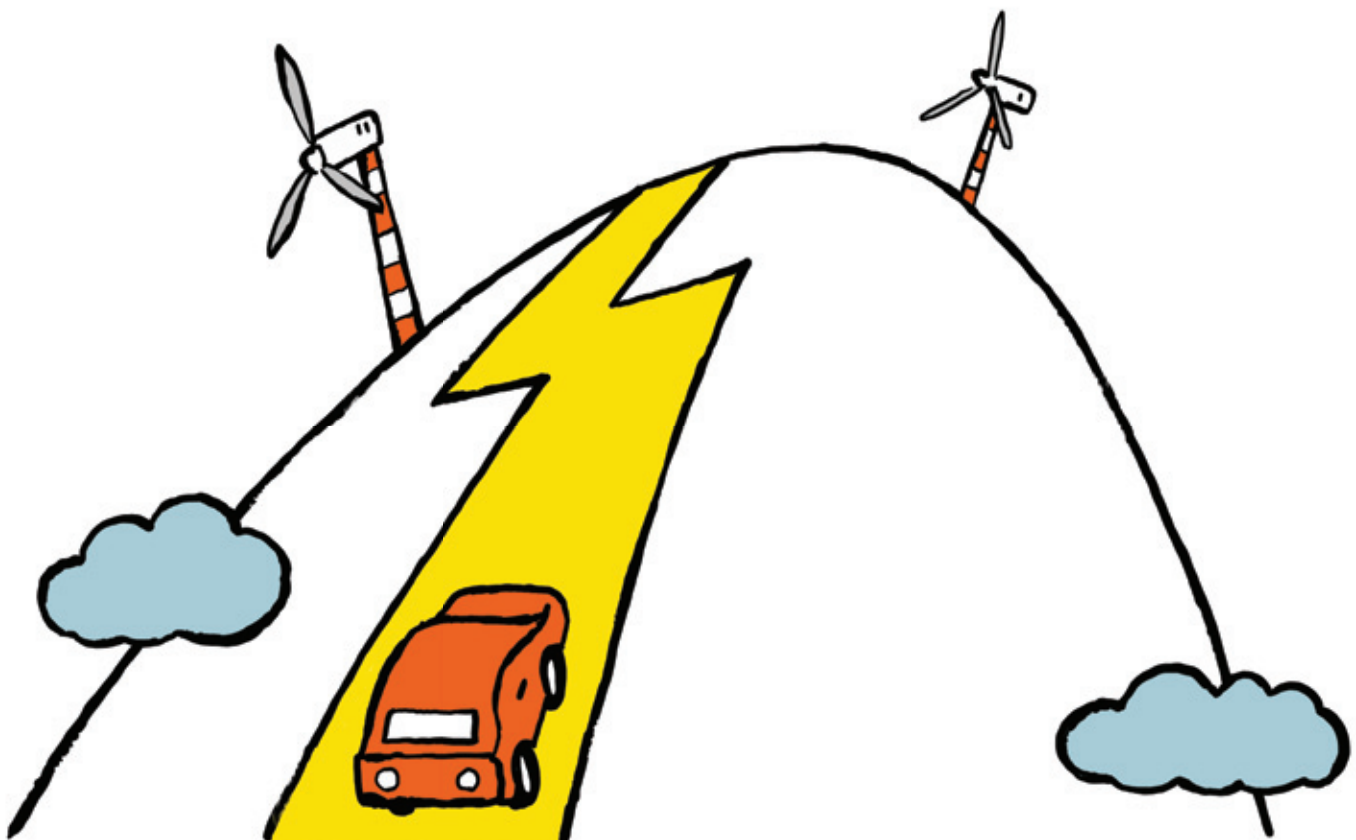
DIALOG: *What actually needs to happen in the coming years for Germany to establish itself as the leading electric mobility supplier in a globally competitive environment?*

MB: In the car industry it will all boil down to exploiting wide-ranging new technologies and mastering growing complexity in several areas of activity. Software and digital issues, for example, will become increasingly crucial. Vehicles already contain innumerable control devices, electronics and software. This trend is set to continue. Which is why links to the software industry and electronics manufacturers should be strengthened. Moreover, industries that previously went it alone will have to join forces far more. The key, however, is that we apply everything that is being discussed in other contexts under the

heading of energy transition to the car. We shouldn't separate these discussions – quite the opposite. The automotive industry and power suppliers must collaborate much more closely and coordinate their objectives. Electromobility will only make sense if we can one day obtain driving power entirely from renewable sources, which is definitely possible. The various industries all stand on their own when it comes to these topics – i.e. digital vehicle internetworking and connecting vehicles to the charging

infrastructure – and operate independently from each other. Politicians also have to respond here, by promoting such networking and supporting efforts to rethink the entire car infrastructure. →

“The automotive industry and power suppliers must collaborate much more closely and coordinate their objectives.”





Professor Matthias Busse,
Chairman of Forum
ElektroMobilität e.V.

About Forum ElektroMobilität e.V.

From a holistic systems perspective, Forum ElektroMobilität e.V. bundles relevant experts from industry, SMEs, research and politics together in the subject area of electromobility. The association brings together players at the operational level in a cross-industry dialog, placing special emphasis on SMEs. The services provided by the association, which is member-funded, include networking & contacts, information & knowledge management, marketing & communications, as well as project initiation & funding management. The influential network spawns new partnerships and innovation that pave the way to form new business models.

www.forum-elektromobilitaet.de

DIALOG: *What examples of cross-sectoral cooperation can you envisage?*

MB: Let's take the photovoltaic industry as an example. It's a fascinating idea for all private electric vehicle owners to generate electricity on their own roof, store the power at home and use that home-produced power in the evening to recharge their electric car. The key question is, "Where do we get the electricity?" And the answer has to be, "From renewable energy." As an industrialised nation, we in Germany must and can do this.

In fact, we don't even need that much additional electricity if we wish to power all our cars that way. Experts quote just 8-10 per cent of additional electricity compared to now. If we managed our power grid intelligently, we could achieve this using renewables, i.e. wind and solar power. Nevertheless, energy storage solutions must also be found. This brings us back to the industries of interest for the car, namely in connection with the electric storage topic, i.e. the battery. Not just in the car but also for storing electricity at home or in the local municipality. It makes little difference whether the storage is integrated at home or in the car.

DIALOG: *What technological innovations can we expect in the near future with electromobility?*

MB: One fascinating question is whether electricity actually has to pass through a cable to reach the car. To which I would argue: No. Why shouldn't we work on feeding electricity into a car inductively while underway? We are familiar with this principle from the electric toothbrush. One coil can be integrated into a parking space and the receiver coil in the car. High-frequency alternating voltage can be

used to feed the car with electricity remotely. This is no problem for parked cars as the technology is basically in place. However, it can also be made to work during the journey, namely through inductive transmission. We call this process *dynamic inductive charging*. What was needed is a coil structure laid into the road and a corresponding receiver coil in the vehicle. Just imagine if we equipped all our highways with such a coil system – we would then have overcome the issue of range in a single swoop. We would have a technology where we could assume technological leadership. However, politicians need to take the right decisions to implement it, since it is just as fundamental a question as the switch from diesel to electric locomotives and the construction of overhead power lines for the rail network.

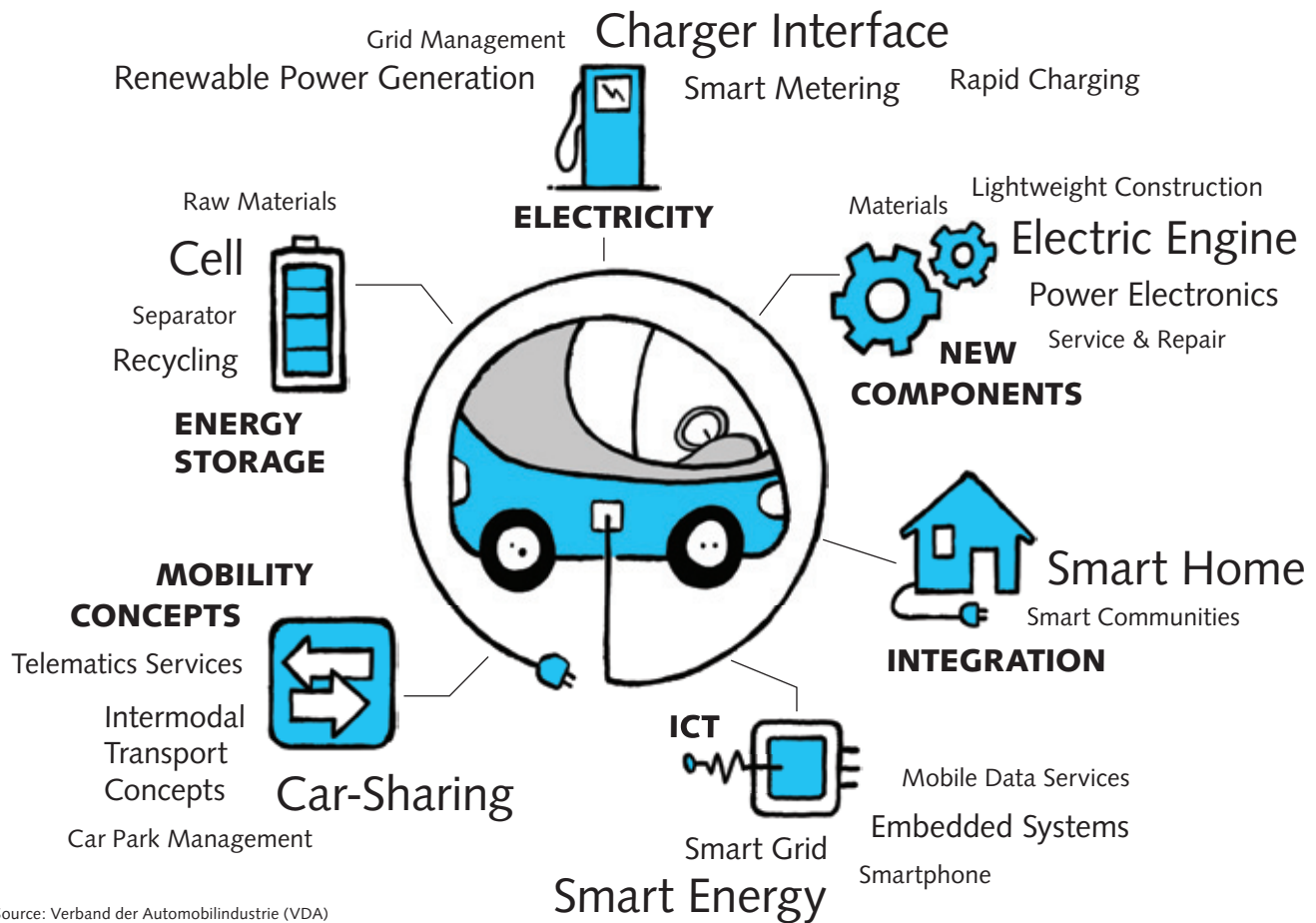
DIALOG: *What will further spur the transition to e-mobility – in Germany and overseas?*

MB: There are numerous ideas and approaches that can inspire German companies to gain a unique competitive advantage against global competition. It may all center on electromobility - but many other adjacent areas also need to be considered. If we fail to focus on them, we may end up overtaken by other countries like China or the USA. The fact that our market is filled with the best and most exciting cars around is unfortuna-

“Why should we not work on feeding electricity into a car inductively while underway?”

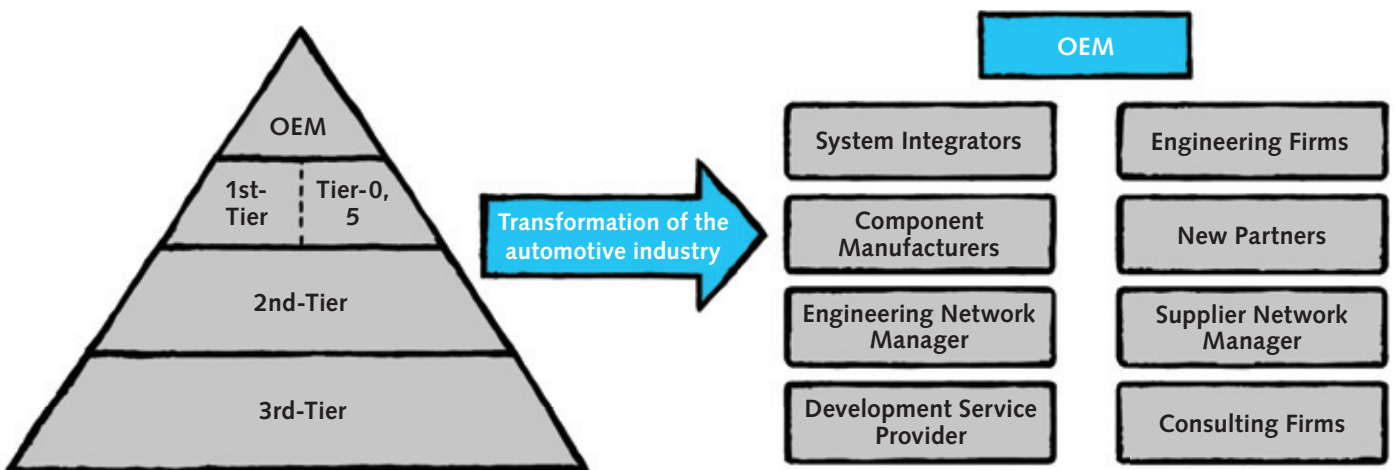
tely a downside, since it leaves customers less than keen on buying an electric car. The situation is totally different elsewhere in the world, given the huge need for mobility.

NEW BUSINESS FIELDS WITH ELECTRIC VEHICLES ...



Source: Verband der Automobilindustrie (VDA)

... and structural changes in the automotive and supplier industry



Source: Schneider: Modernes Sourcing in der Automobilindustrie. Gabler (2011)

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