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Press release
Bosch compact

Bosch's electromobility strategy at a glance

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Pillar #1: Systems expertise is a USP

Bosch believes the key to leading the electromobility market lies in its comprehensive systems approach. When it comes to components, the company relies on its comprehensive systems expertise. "Our customers benefit from our expertise in intelligently linking all the components in the powertrain. This broad-based systems expertise is our USP. It is a source of huge business potential for Bosch," says Dr. Mathias Pillin, who is responsible for electromobility activities at Bosch. The Bosch portfolio includes key components of the electrical powertrain, such as the electric motor, power electronics, and battery systems. The production of a new 48-volt battery for hybrid vehicles started at the end of 2018.

Pillar #2: Energy efficiency as the prime development objective

To further increase electric vehicles' range, Bosch has been working for many years to improve the energy efficiency of individual components and the system as a whole. "Our electric motors and electric axle drive are already the benchmark for energy efficiency. In the end, affordable range is the key to helping electromobility achieve a breakthrough. Achieving this depends on smart interaction among all the components of the powertrain," Pillin says. The reasoning behind this is the less electricity the motor and other components consume, the long the battery charge will last, and the greater the range. This is an area in which the company's engineers are working on new generations of electric motors, inverters, and battery systems. Modified thermal management systems can increase electric cars' range by up to 20 percent. And special battery-management systems allow the best possible management of batteries. In this way, the efficiency of individual cells can be further increased.

Pillar #3: Standardization means speed

Bosch is certain that the electromobility market will grow rapidly in the years ahead. The company's latest forecasts assume that some 20 percent of all newly registered passenger cars and light duty vehicles will be plug-in hybrids or electric cars by 2025. By 2030, it will be more than 25 percent. About 70 percent of vehicles will then still be driven by combustion engines, some of them with

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electrical support from 48-volt systems. It is in this volatile environment that today's diverse providers of electromobility operate – from classic OEMs via auto start-ups to companies from completely different industries. Bosch is capable of meeting diverse development times and requirements. Bosch believes one main driver will be the standardization of components and systems. For the company, this is the basis for making mass-market electromobility scalable and affordable. Bosch is currently demonstrating this with its eAxle, the next-generation electrical powertrain. Bosch sells this electric axle drive to a wide range of customers – to established automakers and start-ups alike. Here, Bosch customers also benefit from the company's global research and engineering network. The latter allows the company to carry out projects flexibly and close to its customers, whether in China, Europe, or North America.

Bosch expertise relates to the entire electromobility ecosystem

In the electromobility business, no other automotive supplier is as broadly diversified as Bosch. Bosch electrical powertrain components already feature in more than one million vehicles around the world. The supplier of technology and services has carried out more than 30 production-related projects together with established automakers and start-ups around the world. It is the market leader in China, the world's biggest and fastest-growing electric-vehicle market. Bosch technology can be found in practically every class of vehicle: the supplier of technology and services develops and manufactures components for electric bicycles, scooters, passenger cars, and commercial vehicles. Bosch covers the entire electromobility ecosystem. Bosch is partnering with various automakers to give drivers of electric vehicles access to some 40,000 charge spots in eight European countries – with the help of charging apps, for example.

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Mobility Solutions is the largest Bosch Group business sector. In 2017, its sales came to 47.4 billion euros, or 61 percent of total group sales. This makes the Bosch Group one of the leading automotive suppliers. The Mobility Solutions business sector pursues a vision of mobility that is accident-free, emissions-free, and stress-free, and combines the group's expertise in the domains of automation, electrification, and connectivity. For its customers, the outcome is integrated mobility solutions. The business sector's main areas of activity are injection technology and powertrain peripherals for internal-combustion engines, diverse solutions for powertrain electrification, vehicle safety systems, driver-assistance and automated functions, technology for user-friendly infotainment as well as vehicle-to-vehicle and vehicle-to-infrastructure communication, repair-shop concepts, and technology and services for the automotive aftermarket. Bosch is synonymous with important automotive innovations, such as electronic engine management, the ESP anti-skid system, and common-rail diesel technology.

The Bosch Group is a leading global supplier of technology and services. It employs roughly 402,000 associates worldwide (as of December 31, 2017). The company generated sales of 78.1 billion euros in 2017. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT company, Bosch offers innovative solutions for smart homes, smart cities, connected mobility, and connected manufacturing. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group's strategic objective is to deliver innovations for a connected life. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is "Invented for life." The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiary and regional companies in 60 countries. Including sales and service partners, Bosch's global manufacturing, engineering, and sales network covers nearly every country in the world. The basis for the company's future growth is its innovative strength. At 125 locations across the globe, Bosch employs some 64,500 associates in research and development.

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The go-to partner for electric driving:

Bosch's electromobility strategy

Statement by Dr. Rolf Bulander,

member of the board of management

of Robert Bosch GmbH and chairman

of the Mobility Solutions business sector,

February 28, 2018

Check against delivery.

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Ladies and gentlemen,

I would like to start by taking a look into the not-too-distant future, and the year 2020. By then, Bosch wants to lead the emerging mass market for electromobility. That is our objective. In this endeavor, we are relying on our systems expertise and the development and manufacture of key components, such as the electric motor, power electronics, and battery systems. In this way, we want to become the go-to partner for electric driving.

Our electromobility strategy goes far beyond the powertrain, for Bosch's expertise covers the entire electromobility ecosystem – from proven components for electrified applications to digital connection with the charging infrastructure. We are drawing on old and new core competencies to secure and gain market share. Later, I will explain the three core elements of our strategy – systems expertise, energy efficiency, and standardization – in more detail.

Battery cells: outsourcing instead of in-house manufacturing

Let me start by announcing a decision on a matter that has been the subject of a lot of speculation in recent months. Is Bosch going to start manufacturing its own battery cells? The answer is "no." Bosch will continue to buy in the cells needed to make batteries. We are convinced that battery cells will be a standardized commodity in the long run. We have to understand cells technically, we don't have to make them ourselves. We now know that we will be electromobility leaders even without cell-manufacturing operations of our own. Cell production is not decisive for our success. When it comes to cells, it also holds true that they are just one component of a complete system. It is systems expertise that will be decisive. In other words, we will stick to our successful recipe of drawing up specifications for cells with our suppliers, buying these cells from them, and using our electronics expertise to combine and refine them in battery systems.

Let me go into the reasons behind our decision in more detail:

Technically speaking, we have made excellent progress in cell development. In our development joint venture with GS Yuasa and Mitsubishi, we have concluded our research into lithium-ion technology. In concrete terms, this means that the next-generation lithium-ion cells we have developed are on a par with those of Asian competitors. The end of our research work also means the end of the joint venture. We want to continue working with our two former partners in the future.

The research done by our Seeo start-up goes one step further, into solid-state technology or post-lithium-ion technology. Here too, we have made significant technological progress. Solid-state technology is the way forward for the manufacture of mass-marketable batteries from the middle of the next decade. Solid-state technology offers the possibility of doubling batteries' energy density and more than halving their costs. However, this calls for even more R&D expenditure. We are currently in talks with interested parties that will continue Seeo's research work.

Regardless of development progress, cell manufacturing is not just a question of technology: entering into cell production is above all a commercial undertaking that has to make economic sense. Our aim is to lead the fields in which we operate. In the case of cell manufacturing, what would that mean in concrete terms? By 2030, some 1,000 gigawatt hours of battery capacity will be required worldwide. In order to secure a market share of 20 percent and, with it, a leading position, an investment of some 20 billion euros would be necessary for a manufacturing capacity of 200 gigawatt hours. Given dynamic external market factors that can only be predicted with difficulty, it is unclear whether such an investment would pay off for Bosch, and when.

Why is that? For new entrants, the market conditions are more than challenging. Five Asian manufacturers currently dominate the market. They already produce huge volumes of cells, and thus have significant competitive advantages.

Even if we had a large market share, the business risk would be high for us. Since the cost of materials – including raw materials – accounts for three-quarters of cells' manufacturing cost, there only remains a narrow scope for creating and exploiting competitive advantages.

Following an assessment of the economic factors relating to the establishment of cell manufacturing operations, we concluded that investing in future cell technologies – whether improved existing technologies or future ones – is too risky. In the interest of the company as a whole, such an investment cannot be justified.

We will therefore continue to buy in cells in the future, and not manufacture them ourselves. I want to emphasize that this is a "no" to cell manufacturing operations of our own, but a "yes" to batteries at Bosch. After all, we have built up considerable cell-technology expertise over the years. In a center of competence, Bosch will continue to add to the comprehensive battery-cell expertise it has built up over recent years. As was occasionally the case in the past, moreover, several hundred associates will continue to work on battery systems. They will develop battery-management systems and 48-volt battery systems, and draw up the specifications for cells. We see huge potential for 48-volt battery systems. By 2030, a 48-volt system will support the combustion engine in 20 percent of new vehicles. This year will see the start of production of a new generation of 48-volt batteries that are also suitable for compact and sub-compact cars. Our USP here is our systems expertise and our ability to draw up specifications for cells together with suppliers. Our customers also benefit from our expertise in product design and materials research.

We will use the technology development work at the center of competence not only for mobility applications but also products from other parts of Bosch, such as household appliances and power tools. So much for battery-cell manufacturing.

The go-to partner for electric driving

Ladies and gentlemen, we want to be the go-to partner for electric driving. We are already a leader in the powertrain field – and we will be in the future as well. Our strategy takes account of the currently dynamic developments in the electromobility market. We are currently seeing the emergence of a market in which the deck is being reshuffled and the first orders are being placed, worth billions of euros. Last year, we won 20 new orders relating to electromobility. We want to build on this, and gain market share and extend our position in a rapidly growing environment. Our strategy rests on three pillars, which I would like to explain to you in detail: systems expertise, energy efficiency, and standardization.

Pillar #1: Systems expertise

Our first core competency is systems expertise. This has always been the key to Bosch's success. And we are relying on it in electromobility as well. Our customers benefit from our expertise in intelligently linking all the components in the powertrain. This broad-based systems expertise is our USP. The Bosch portfolio includes key components of the electrical powertrain, such as the electric motor, power electronics, and battery systems.

Our systems expertise goes beyond the electric car's hood. Our "system!e" which we recently premiered connects the electrical powertrain with the Bosch Automotive Cloud Suite. This gives rise to web-based services that enhance the everyday benefits of electromobility. The charging assistant is one example. Let's say someone is driving from Munich to Hamburg. The

assistant knows where all the charge spots along the route are, plans recharging stops in advance, and deals with all payment transactions. And with additional information about restaurants, cafés, and places to shop, drivers can make better, more relaxed use of the recharging break.

Pillar #2: energy efficiency

Our second core competency is energy efficiency. Our electric motors and eAxle already lead the way here. The less electricity the motor and other components consume, the long the battery charge will last, and the greater the range. This is an area in which our engineers are working on new generations of electric motors, inverters, and battery systems. Modified thermal management systems can also increase electric cars' range by up to 20 percent.

Pillar #3: Standardization

Our third core competency is standardization. For us, this is the basis for making mass-market electromobility scalable and affordable. The eAxle, our latest electric drive, is evidence of this. We sell this electric axle drive to a wide range of customers – to established automakers and start-ups alike. As Bosch can quickly and flexibly adapt the drive to the automakers' requirements, customers have no need for time-consuming new designs, which speeds up their development times.

There's a saying in our company that there's no car on the planet without a bit of Bosch in it. In the future, this will have to be extended to include electric cars. Wherever you look under the hood – be it in Asia, Europe, or North America – you'll always find the Bosch armature in a circle. Our electromobility unit will play a leading part in shaping the dynamic transition to electric driving. In this transformation process, we will be there to support our customers with knowledge and technology. Even now, Bosch technology can be found in more than 800,000 electric vehicles and hybrids worldwide.

And it’s not just the car we are electrifying. Our technology can be found in practically every class of vehicle: we develop and manufacture components for electric bicycles, scooters, passenger cars, and commercial vehicles. In the electromobility business, no other automotive supplier is as broadly diversified as Bosch. What’s more, we are at home in the entire electromobility ecosystem – from proven components for electrified applications to digital connection with the charging infrastructure. Our customers benefit just as much from this market experience as from our global research and development network. The latter allows Bosch to carry out projects flexibly and close to its customers, whether in Asia, Europe, or North America.

Thank you.

Press release

Battery cells: Bosch opts for outsourcing over in-house manufacturing

February 28, 2018
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- Aim is to lead electromobility mass market from 2020
- Bosch strategy: systems expertise, energy efficiency, and standardization
- In-house cell manufacturing is not decisive for success in electromobility
- Center of competence secures cell expertise
- Bosch supplies electrical powertrains in all vehicle segments, from bicycles to trucks

Stuttgart, Germany – Bosch aims to lead the mass market for electromobility that will emerge after 2020. In this endeavor, it is relying on its systems expertise and the development and manufacture of key components of the electrical powertrain, such as the electric motor, power electronics, and battery systems. The company will continue to buy in the cells needed to make these battery systems. For economic reasons, Bosch has decided not to set up cell manufacturing operations of its own. “For Bosch, it’s important to have a technical understanding of cells. We don’t have to make them ourselves,” says Dr. Rolf Bulander, member of the board of management of Robert Bosch GmbH and chairman of the Mobility Solutions business sector.

Established automakers are currently extending their vehicle ranges to include many electrified models. At the same time, start-ups are entering the market with new electromobility concepts. Bosch’s electromobility strategy takes account of these dynamic market developments. Its objective is to make electric driving more viable and mass-marketable. The strategy Bosch is pursuing involves increasing electric vehicles’ energy efficiency, using systems expertise to intelligently link all the components of the powertrain, and using standardized components to make electromobility scalable and affordable. Beyond the vehicles themselves, Bosch is developing solutions for the recharging infrastructure. Using web-based services, the recently premiered “system!e” will considerably enhance the viability of electric driving.

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Expansion of battery business – a center of competence for technology development

Bosch will continue to work with cell suppliers to design cells for hybrid- and electric-vehicle batteries, and buy these cells from them. For this reason, the company is disbanding its research into current and future cell technologies, whose brief was to assess the feasibility of in-house cell production. The Lithium Energy and Power GmbH & Co. KG (LEAP) joint venture for lithium-ion technology will be dissolved. The subsidiary Seeo, which researches into solid-state technology, is to be sold. In a center of competence, Bosch will continue to add to the comprehensive battery-cell expertise it has built up over recent years. As was occasionally the case in the past, several hundred associates will continue to work on battery systems. They will develop battery-management systems and 48-volt battery systems, and draw up the specifications for cells. "Even now, Bosch is capable of integrating individual components into complete systems. We make highly efficient 48-volt battery systems and develop attractive battery-management systems," says Dr. Mathias Pillin, who is responsible for electromobility activities at Bosch. The technology development work at the center of competence will benefit not only automotive applications but also products from other parts of Bosch, such as household appliances and power tools.

Technological potential exists, but economic risks are high

Regardless of the decision that has now been made, Bosch sees huge potential in solid-state technology. "Technically speaking, we've made excellent progress in our development work. Solid-state technology is the way forward," Pillin adds. The decision to continue buying in cells in the future is the result of a lengthy economic assessment, in which it became clear that investing in the commercialization of cell technologies – whether improved existing technologies and future ones – is too risky. For a competitive, market-relevant cell manufacturing operation, calculations showed that the initial investment alone would be some 20 billion euros. This sum would allow the company to set up manufacturing capacity of approximately 200 gigawatt-hours, equivalent to a 20 percent market share, and thus a leading position in the market.

In addition to this initial investment, there would be operating costs running into billions, and three-quarters of the manufacturing cost would be cost of materials. This would therefore leave only a narrow scope for creating and exploiting competitive advantages. Given dynamic external market factors that can only be predicted with difficulty, it is unclear whether this investment would pay off for Bosch, and when. In the interest of the company as a whole, therefore, such a risky investment cannot be justified.

Bosch expertise relates to the entire electromobility ecosystem

It is equally clear that is above all understanding of battery cells, not in-house manufacturing of the cells themselves, that is decisive for business success in electromobility. Even without cell manufacturing operations, Bosch is well positioned in electromobility. “We want to be the go-to partner for electric driving. We are already a leader in the powertrain field – and we will be in the future as well,” Bulander says. Bosch electrical powertrain components already feature in more than 800,000 vehicles around the world. The supplier of technology and services has carried out more than 30 production-related projects together with established automakers and start-ups around the world. It is the market leader in China, the world’s biggest and fastest-growing electric-vehicle market. The company’s portfolio stretches from power electronics, to 48-volt mild hybrid batteries and battery-management systems, to electric motors and electric axle systems. Bosch technology can be found in practically every class of vehicle: it develops and manufactures components for electric bicycles, scooters, passenger cars, and commercial vehicles. Bulander adds: “In the electromobility business, no other automotive supplier is as broadly diversified as Bosch.” Bosch is partnering with various automakers to give drivers of electric vehicles access to some 17,400 charge spots in five European countries – with the help of charging apps, for example. “Bosch’s expertise covers the entire electromobility ecosystem – from proven components for electrified applications to digital connection with the charging infrastructure,” Bulander says.

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