EV Revolution to Bring Drastic Change to Auto Industry

PHOTO: COURTESY OF TOYOTA MOTOR

Toyota's EV concept car (TOYOTA Concept-i)
Executive Vice President Didier Leroy of Toyota Motor said, "We have no doubt that EVs will be one of the key solutions in the near future. That is why we have created a new company with Mazda and Denso to develop EV architecture with a view to mass production" at the 2017 Tokyo Motor Show.

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Electric vehicles (EVs) without engines appear to be gaining momentum as a driving force behind a drastic turning point in the 100-year history of internal combustion engine vehicles, and are beginning to cause a major paradigm shift in business for auto manufacturers around the world. This new trend in automobile technology has been given further momentum by significant developments in government policies, social values and the technological environment that were seen during the course of 2017.


Kojima Akira

In the spring of 2017, investors around the world were stunned by the news that Tesla Motors, Inc., an emerging EV manufacturer in the United States, had surpassed General Motors (GM) in terms of market capitalization. The annual vehicle production of GM is one hundred times greater than that of Tesla in terms of volume. Tesla Motors was founded in 2003 as an EV start-up in Silicon Valley, California. It has since been operating in the red with annual production of less than 100,000 EVs. Notwithstanding this performance, investors rushed to buy its stock based on the company's future potential, driving its share price to new heights. Indeed, the surge in the company's stock price may be a sign of a market bubble. But even allowing for that, the news of Tesla Motors overtaking General Motors in terms of market capitalization was quite surprising. This major news on the stock market could be interpreted as a significant event suggesting that a paradigm shift is occurring in the auto industry, which is one of the world's major business industries today.

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There are some developments that could be pointed out as reasons for the rapid growth in expectations and social attention with respect to EVs in recent years. First, there has been a change in public perception of environmental issues and government policies. Second, there has been a shift in the industrial policies and strategies adopted by China and some other countries. Third, there has been accelerated growth in the technology for automotive batteries. Meanwhile, effective applications of IT technologies have been developed for automobiles along with charging stations and other related infrastructure for EVs being established.

Following the shocking news regarding Tesla hitting a new milestone in valuation, yet another item of shocking news came out of China, which turned out to be even more significant: China's announcement of a comprehensive set of emission rules. At the end of September 2017, the Chinese government unveiled its policy requiring automakers to obtain a new-energy vehicle (NEV) score of at least 10% starting in 2019, rising to more than 12% in 2020. The Beijing government appears to have begun considering the option of completely banning the manufacture and sales of both gasoline and diesel vehicles in the future.

China's new emission rules are viewed as directly regulating manufacturing and sales activities by auto makers, given the unsuccessful subsidy program that has been in place, offering a subsidy worth one million yen per unit of NEVs.

It appears that there are two reasons why the Chinese government is taking pains to

promote electric vehicles and other NEVs. First, environmental pollution is currently an impending issue that must be urgently addressed in China. In fact, air pollution has become an extremely serious problem in large cities in China such as Beijing and Shanghai today, where it is as serious as it is in places like Mumbai, India, which ranks first on the list of cities with the highest air pollution levels in the world.

Beijing ranks as one of the cities with the highest air pollution levels, where people are exposed to air pollutants (known as PM2.5) as small as 1/50th of the diameter of a human hair, which cause extremely serious harm to health. The worsening environmental pollution in China has emerged as a social and political issue that could even test the leadership of the Communist Party, requiring its urgent attention. Environmental issues are viewed as major constraints on China's economic growth in the coming years.

Besides being promoted as part of the government measures tackling air pollution, the ongoing shift from gasoline to electric vehicles in China has been promoted as the country's industrial strategy. China has announced an ambitious plan to win a position as one of the leaders in the automobile business by 2025. Despite initiatives promoted by China to develop its auto industry with the aim of becoming a leader in the business, it has been unsuccessful in catching up with its Japanese and Western counterparts in terms of component production technologies that are necessary for gasoline and diesel vehicles, as well as the skills for fitting different manufacturing technologies together that are commonly owned by Japanese manufacturers. Given this situation, China seems to have adopted a new policy of competing in the EV market in a drastic manner, without even remaining with the existing competition.

Prior to the new regulations on automobile production, China unveiled a plan in 2012 to promote new energy vehicles with the exception of hybrid vehicles (HVs), for which Japanese manufacturers have the advantage. This policy excluding HVs from the promotion list suggests that China has an audacious strategy to win the competition against Japanese and Western car manufacturers by achieving growth in the field of EVs and plug-in hybrid vehicles (PHVs), which are generally believed to involve fewer barriers for new entrants in terms of the existing patent restrictions, etc.

China unveiled a national plan in 2015, dubbed "Made in China 2025," and this was followed by "Strategic Industries Set to Gain from the 13th Five-Year Plan" announced in 2016. Both of these plans call for the need to develop industries related to NEVs including EVs, with the aim of selling 2 million units of NEVs in 2020 with 5 million NEVs on the roads by that year. Furthermore, the Beijing government aims to have NEVs represent 20% (or 7 million units) of the new car market for NEVs by the year 2025. Given that the actual

number of NEVs sold in 2016 was 500,000 units, those targets announced in recent years sound quite ambitious.

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Meanwhile, eco-friendly policies have been increasingly adopted among industrialized countries in the West. Among others, Norway has announced a target of completely banning petrol-powered cars, which will be replaced by EVs by 2025. Norway's EV policy, in particular, seems to represent a sense of urgency regarding global warming that is shared extensively by people in society, with an exemption from the 25% VAT on their purchase and no purchase/import taxes (worth 1 million yen). The EV incentive program also includes no charges on toll roads and access to bus lanes. The number of charging stations designated for EVs exceeds 10,000 to date, and sales of EVs comprise 20% of new car sales.

In July 2017, the United Kingdom and France announced policies to completely end the production and sale of gasoline and diesel cars by 2040. India, which is plagued by serious air pollution, has also announced that it will ban the sale of gasoline and diesel cars, completely replacing them with EVs by the year 2030.

Given the trend that is already underway toward EVs in these countries, leading automakers around the world have embarked on initiatives to promote a shift toward EVs. Volvo Cars of Sweden announced in July 2007 that it would build only EVs from 2019. In an interview with Nikkei Business, Volvo's CEO Hakan Samuelsson said, "It is true that we have been inspired by the move made by Tesla Motor of the U.S. We will launch our first EV soon, which will be positioned as a high-end model in response to the competition provided by Tesla."

The shift toward EVs that is underway in Europe is based on the strong concerns about global warming shared by the individual countries there. It also appears that the new trend has been instigated by a shared approach among the leading car manufacturers in the West about the enormous market potential of China.

China's automobile market is certainly enormous. During 2016, 28 million units of new cars were sold in China, which is 1.6 times more than in the U.S. and 5.6 times higher than the market size in Japan. The Chinese government expects that the amount of new car sales alone will reach 35 million units in 2025, of which 20% (or 7 million units) will be represented by NEVs. Every car manufacturer in the West must move toward EVs as long as they place high expectations on the strong market potential of China.

It is worthwhile paying attention to the recent move made by Volkswagen of Germany,

among other manufacturers in the West. Volkswagen has recently suffered from a tarnished reputation in the wake of the scandal over its cheating on emissions tests. It appears that the German car manufacturer is promoting an aggressive shift toward EVs in order to recover quickly from the tainted image associated with this scandal. Volkswagen's aggressive stance could also be explained by its sales performance, which remained strong in China even after the scandal broke out.

In September 2017, Volkswagen announced a plan to sell 1.5 million units of EVs in China in 2025, representing half of the 3 million units of EVs to be marketed by the company worldwide. Volkswagen's worldwide car sales amounted to 10,310,000 units in 2016, of which approximately 4 million units were sold in China. The company ranks first among leading car manufacturers around the world in terms of both worldwide sales and sales in China.

U.S. counterparts are also taking steps to move toward EVs. General Motors will launch at least twenty new models of EVs or fuel-cell cars in the coming years until 2023. The company will launch two new electric vehicles within 18 months. A large-sized truck powered by a fuel cell is currently under development. It goes without saying that General Motors remains very keen on the car market in China because of its enormous size surpassing that of the United States, with nearly 40% of the company's total sales dependent on the Chinese market.

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Given the worldwide shift toward EVs, what is the latest situation for Japanese auto manufacturers in comparison with their counterparts in the United States and Germany?

History tells us that the first car invented was an electric vehicle. Karl Benz of Germany invented a gasoline vehicle in 1886. Thirteen years before that, however, an electric drive truck had been invented in the United Kingdom. Despite this long history, electric vehicles received little attention in the auto industry until recently because of technical and commercial constraints including their speed capability (no faster than 100 km/h), driving range, and price.

Another interesting historical fact is that Japan has had some experience with electric vehicles in the past. Electric vehicles have been spotlighted three times in Japan to date. The popularity of electric vehicles has now made a comeback among auto manufacturers in Japan for the fourth time.

EVs attracted attention in the Japanese industrial community for the first time in the 1970s in the wake of the oil crisis and air pollution. The Ministry of International Trade

and Industry in those days (now the Ministry of Economy, Trade and Industry) launched a development project for EVs. Companies like Toyota Motor and Nissan Motor participated in the project, which was successful in exploring a new frontier for EV development in Japan. The second wave of industrial attention occurred in the 1990s, when the Zero Emission Vehicle (ZEV) Program was adopted by the State of California in the United States. With the enactment of the program, Toyota and Honda went on to produce and market EVs in view of the significant importance of the U.S. market to them. Despite their efforts, the EVs' popularity did not last long.

The third wave came around after 2006, when Mitsubishi Motors launched the i-MiEV, a production model EV, and its competitors followed suit. But the booming attention in the industrial community soon fizzled out because of (1) inadequate fuel cell capabilities, (2) the improvement of an emission control system for gasoline vehicles, and (3) the advent of eco-friendly hybrid cars with greater fuel efficiency.

And now, the fourth wave of the EV boom has arrived in Japan. During the last three periods visited by the waves of industrial attention regarding EVs, Japanese automakers spearheaded technological development activities for EVs. As a result, they have accumulated related knowhow and expertise. Notwithstanding this, Japanese automakers appear to be less aggressive in their approach toward EVs as compared with their competitors in the West, particularly in Europe.

It appears that Japanese automakers are remaining less active in promoting EVs because I believe they are facing the paradox of success. According to my observations, Japanese automakers tend to find it uncomfortable to push EVs that might challenge their success and achievements with gasoline and diesel cars, including hybrid models that have won the leading position among automakers around the world in terms of high fuel efficiency and a smaller environmental impact. It is no wonder that established automakers in Japan may persistently be tempted to maintain the pyramid of suppliers consisting of a number of related manufacturers, including those making components that ensure excellent car quality.

Be that as it may, the worldwide trend moving toward EVs is not just a temporary phenomenon, but it will potentially create a new wave of change in the twenty-first century. Until recently, it had been a general consensus among industry experts and automaker executives that it would take 10 to 20 more years for EVs to take off as production models while they are poised to take the world by storm. It appears, however, that the new era of electric vehicles is approaching us even more rapidly than the experts had previously predicted.

Given the worldwide trend gathering momentum toward EVs, Japanese automakers are set to follow the move. Nissan is another story in this situation because it is the only Japanese manufacturer that has been marketing EVs in China to date. We should perhaps see Nissan as a French automaker, because Nissan is owned by Renault of France. In September 2017, the Nissan-Renault Alliance announced a mid-term management plan covering the next six years through 2022. According to the plan, they are aiming to commercialize autonomous drive vehicles and raise the EV ratio to 30% of total sales. Ambitious initiatives announced by the Nissan-Renault Alliance and Volkswagen (as mentioned earlier) are likely to boost the worldwide trend even further. Again, it appears that the new era of electric vehicles will be upon us much sooner than we previously anticipated.

How much sooner will the EV era be upon us? It will largely depend on the degree of acceleration in the related technological developments, aside from the industrial policies, environmental regulations and national policies that are adopted by the members of the global community.

Technological developments have been accelerating in many related fields, giving native EVs a driving range of up to 400 kilometers or more per charge. There are some models on the market with a range of close to 600 kilometers. Long charging times currently remain a bottleneck for the full-scale rollout, however remarkable technological developments are being achieved in this field.

Most EVs are currently equipped with lithium ion batteries, which require a long charging time. For example, Nissan's LEAF model takes 8 hours to be fully charged from a 200V outlet in the garage, and it takes 30 minutes to achieve an 80% charge using a rapid charging unit. All-solid-state batteries have greater energy storage capacity than lithium-ion batteries. If all-solid-state batteries were used for electric vehicles, the time taken for a full charge may potentially be reduced to just 3 minutes.

Given this situation, Toyota has started accelerating the shift in business toward EVs without resting on its laurels due to the success of its hybrid models. Toyota's new approach has been represented by the establishment of EV C.A. Spirit, a company for developing core electric car technologies and control systems along with common architecture that can be used regardless of the vehicle's size or shape. EV C.A. Spirit was jointly established by Toyota, Mazda and Denso in September 2017. Suzuki is looking to join the new company specializing in the development of EVs.

It has often been pointed out, however, that auto-related companies in the Japanese camp remain rather defensive about the new worldwide trend toward EVs because they

are tempted to protect their successful achievements with the existing engine-powered vehicles.

Harvard Business School Professor Clayton M. Christensen, who is known as one of the world's top experts on innovation, points out that Japan has been plagued by a protracted economic downturn since 1990 because it has been trapped by the Innovator's Dilemma, which makes it hard for the country to become open to Disruptive Innovation. Disruptive Innovation refers to an innovation process with a sophisticated new technology, displacing existing technologies or products.

As a forerunner in the hybrid car business, it is no wonder that Toyota would be tempted to sidestep innovative attempts to develop a new technology that could destroy its successful achievements with hybrid models. Electric vehicles could turn out to be a disruptive tool or a product for Toyota. Sidestepping the EV shift could cause fatal damage to Toyota in the long run. Indeed, that is the inherent nature of EVs.

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One of the characteristics of an electric vehicle is that it uses 40–50% fewer components than a regular engine-powered vehicle. This makes new entries into the EV market relatively straightforward for companies with little experience in car manufacturing. Tesla is certainly a case in point. Google has also announced its entry into the autonomous driving vehicle business.

Quite a few EV manufacturers have been established recently in China. BYD is one of these. BYD was originally established in 1995 as a small start-up with twenty employees specializing in the production of cell phone batteries. It has grown to employ 220,000 people, producing EV models ranging from passenger cars to buses. Most of the buses driving on the roads in Shenzhen are EV models manufactured by BYD. The buses are able to drive up to 400 kilometers per charge. BYD has built and owns a charging tower capable of charging 400 buses at a time. The company is taking active steps to build the infrastructure necessary for EVs.

With the progress in the EV shift, the auto industry will undergo a significant change in structure. A significant change must occur to the pyramid-shaped supply chain consisting of subcontractors supplying components and the like to huge car manufacturers positioned at the top. It is estimated that 5.34 million people work in the Japanese auto industry: 188,000 in the car production sector, 626,000 in the component sector, 456,000 in the materials sector, and 4,074,000 in the related service sector. Manufacturing shipments of the automotive industry in Japan currently amount to 53.3 trillion yen per year,

accounting for 17.5% of that for the manufacturing sector as a whole.

An EV does not require many of the components that are necessary for a conventional vehicle with an engine, which means that there will be fewer jobs for the EV production. But there is no need for us to become pessimistic about the future. Japan has remarkable strength in technological competitiveness in the field of components and resource materials. Stock markets in Japan have discounted the growth potential of material suppliers and others, boosting their share prices amid the EV shift that is happening around the world.

The EV shift will boost the popularity of autonomous driving vehicles in the future. Automotive industries around the world will undergo a significant structural change. It is often pointed out that there are four waves involved in a structural change, known as "CASE," i.e. Connectivity, Autonomous, Sharing, and Electricity. Growth will be achievable only for those companies that address the challenge. No car manufacturer can afford to rest on its success in its existing business. The automotive industry will undergo a significant change in structure with new entrants from unrelated areas. Automakers must respond to the changing business environment.

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