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**9B18M092**

should maruti suzuki invest in electric cars?[[1]](#endnote-1)

Veena Keshav Pailwar wrote this case solely to provide material for class discussion. The author does not intend to illustrate either effective or ineffective handling of a managerial situation. The author may have disguised certain names and other identifying information to protect confidentiality.

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In April 2017, the erstwhile power minister Piyush Goyal announced that by 2030, not one petrol or diesel car would be sold in India.[[2]](#endnote-2) A month later, The National Institute for Transforming India (NITI Aayog), an Indian government think tank also announced its ambitious target of achieving 100-per-cent electric cars (e-cars) in the county.[[3]](#endnote-3) On September 7, 2017, during a meeting with automobile industry representatives, transport minister Nitin Gadkari reiterated the government’s stance on clean energy vehicles and said, “Petrol and diesel vehicles need to make way for electric powertrains and engines running on other fuel variants, such as ethanol and biofuels.” He added, “I am going to do it, whether you like it or not. I will bulldoze.”[[4]](#endnote-4) Reacting to such a tough statement by the minister, chairman of the Indian automaker Maruti Suzuki India Ltd. (Maruti), R.C. Bhargava, stated, “Customers can’t be forced to buy EVs [electric vehicles].”He went further to say, “Before implementing the shift to clean technology, the government should try and build consensus among various segments of the auto industry.”[[5]](#endnote-5)

Earlier, Kenichi Ayukawa, Maruti’s managing director and chief executive officer, had expressed similar sentiments.Reacting to the Indian government’s ambitious plan of replacing all fossil fuel vehicles with e-cars in the country by 2030, he said, “It will be very difficult for the industry to change things from tomorrow. . . . I have never seen that kind of a change in the world.”Questioning the commercial viability of the plan, the affordability of e-cars, and the availability of appropriate infrastructure, he added, “There are some difficulties in expanding sales as cost is very high. How will we absorb that kind of thing[?] . . . We have to communicate to the government about [the] industry’s concerns.”[[6]](#endnote-6)

Demand and cost conditions for fully electric vehicles were not at all favourable. But the government’s announcement was requiring some rethinking by Maruti on its strategy. Apart from meeting regulatory compliances, it had to ponder how to retain its leadership position in the car market. Mahindra and Mahindra Ltd. (Mahindra), a major force in the automotive segment, had already taken the lead in manufacturing e-cars.[[7]](#endnote-7) If Maruti delayed its entry into the e-car market, it could lose its lead. However, a quick entry could subject the company to uncertainty and risk.

Maruti Suzuki: A Leader in the Passenger Car Segment

Established in 1982, Maruti was a joint venture between Maruti Udyog Limited, India, and Suzuki Motor Corporation (Suzuki), Japan.[[8]](#endnote-8) Maruti aimed to make cars available for every individual, family, need, budget, and lifestyle.[[9]](#endnote-9)  It believed in consumer satisfaction through continuous innovation in car design and services.[[10]](#endnote-10) The company was also committed to environment protection, and took pride in its corporate social responsibility in the areas of village development, road safety, and skills development.[[11]](#endnote-11)

At the time of Maruti’s establishment, India produced just 40,000 cars per year. By 2017, Maruti alone produced 1.5 million cars every year with 15 models and 150 variants.[[12]](#endnote-12) Maruti’s models were designed with superior specifications, which resulted in high resale value and less service requirement for the models. Maruti cars also provided more mileage with less fuel consumption and lower carbon dioxide emissions.

Maruti cars not only excelled in performance efficiency and environment-friendliness, they were also cost efficient.[[13]](#endnote-13) Maruti manufactured affordable cars for the vast middle-class Indian population. Economies of scale provided the cost leadership the company needed. Maruti cars ranged from ₹266,000[[14]](#endnote-14) to ₹861,000.[[15]](#endnote-15) Because of their small size and durability, Maruti cars were suitable for Indian road conditions (see Exhibit 1). Along with these advantages, good mileage and a nationwide service network that spanned over 1,500 cities and towns made these cars immensely popular.[[16]](#endnote-16) With more than 40-per-cent market share (see Exhibit 2), Maruti was a distinct market leader in India’s automotive passenger vehicle segment. In 2015, Maruti was ranked number one in customer satisfaction for the 16th time in a row in a JD Power Satisfaction Index Study.[[17]](#endnote-17)

Mahindra and Mahindra to Head Electric vehicles Race

Emerging as a distinct entity in 1947 (after the partition of the country), Mahindra aspired to become one of the world’s 50 most admired global brands by 2021.[[18]](#endnote-18) It wanted to acquire leadership through products that were technologically superior, innovative, and differentiated, as well as through global expansion. Famous for its rugged and reliable automobiles, Mahindra was a federation of companies divided into 11 sectors, ranging from automobiles to real estate. It was India’s largest utility vehicle manufacturer. It also had a leadership position in the several other businesses in which it operated.[[19]](#endnote-19) Mahindra forayed into the electric vehicle business in 2010, when it bought the Bengaluru-based e-car manufacturing unit—Reva Electric Car Company.[[20]](#endnote-20) By May 2017, Mahindra had invested around ₹6 billion in the development and sale of electric vehicles. But demand was not catching up with production. Mahindra expected great potential for such vehicles, despite the low demand. It also believed that such potential in a highly price-sensitive market could be reaped only by cost-cutting measures and reducing the entry price.[[21]](#endnote-21)

Mahindra manufactured e-cars in its Nasik and Chakan factories in the state of Maharashtra.[[22]](#endnote-22) The e-cars it manufactured could reach a speed of 85 kilometres (km) per hourand run for 140 km on a fully charged battery.[[23]](#endnote-23) Batteries were essential for the production of e-cars and other vehicles. Mahindra imported battery cells and assembled them in battery packs at a facility in Bangalore, in Karnataka state. The facility had a capacity of around 400–500 units per month.[[24]](#endnote-24) Expecting a steep rise in demand and reducing costs through large production, Mahindra was stepping up its investment in electric battery packs. It planned to increase the production of battery packs at the Bangalore facility to 1,000 per month. In its eagerness to win the e-car race, Mahindra also planned to set up a new battery pack facility at Chakan, with a planned capacity of 5,000 per month. Mahindra expected that with such initiatives, the cost of batteries would decrease by two-thirds of its prevalent cost. With a reduction in the cost of batteries and other motor components, Mahindra expected the cost of car manufacturing to drop by 20 per cent. It was also simultaneously working on new technologies that would enable it to manufacture vehicles that could reach a maximum speed of 200 km per hour and cover a distance of 350–400 km on a single charge.[[25]](#endnote-25)

Besides the internal cost-cutting measures, Mahindra was relying on the government’s production subsidy for electric vehicles to original equipment manufacturers (OEMs). Although Mahindra was hopeful about the success of its cost-cutting measures and increasing demand, it was looking for consistency in government policies. Pawan Goenka, the managing director of Mahindra, emphasized the need for consistent policies: “The only plea we have is for the government to be consistent with the subsidies they are giving. The responsibility of cutting costs thereon lies on the OEMs. However, you can’t expect a return in the next two–three years; will have to look at the long-term returns.”[[26]](#endnote-26)

Like the Indian government, Mahindra saw a great future for e-cars. Therefore, Mahindra’s chairman welcomed and expressed his support of the ambitious plan of the government to shift to e-cars by 2030: “It could happen earlier too, considering the sort of disruption that is happening. . . . Sometimes it’s better not to question the practicality of it. This is a desirable and feasible goal for India. The spectre of 1.2 billion people having their own [fossil fuel powered] cars is a nightmare.”[[27]](#endnote-27)

Electric Cars: Global Scenario

Pollution control and environmental sustainability were global concerns. Replacing cars powered by fossil fuels with e-cars was one way to address this concern. Therefore, many countries had set targets to replace petrol and diesel cars with e-cars. Norway aimed to achieve a target of 100-per-cent e-cars by 2025. Germany wanted to achieve this target by 2030, and the United Kingdom aimed at achieving the target by 2040.[[28]](#endnote-28) To achieve their targets, these countries had been giving incentives in the form of tax deductions or other subsidies to consumers, producers, and supporting infrastructure providers (see Exhibit 3 and Exhibit 4).

Boosted by the research and development (R&D) efforts of many governments and private sector firms all over the world, new competitive e-car models had started appearing in the market by 2010, when Nissan Motor Co. Ltd. (Nissan) launched the world’s first 100-per-cent zero-emission e-car. Nissan’s Leaf was released for mass market distribution in Japan and the United States.[[29]](#endnote-29) With a price of US$32,780, the 2010 Nissan Leaf could travel up to160 km on a fully charged battery.[[30]](#endnote-30) Over the years, its mileage continued to improve, and in early September 2017, Nissan announced the launch of its 2018 Leaf model with a 40 kilowatt-hour (kWh) battery pack and a driving range of 240 km on a single charge for the base price of US$30,875. The next year’s model, the 2019 Nissan Leaf, was expected to have a 60-kWh capacity and a driving range of 360 km. Since the launch of the Leaf in 2010, Nissan had been able to sell around 280,000 units, making it the world’s bestselling e-car.[[31]](#endnote-31)

In the e-car segment, a close competitor of Nissan was Tesla, Inc. (Tesla). Tesla introduced the Roadster, its first electric sports car, in 2008.[[32]](#endnote-32) Although it had plenty of speed, the Roadster was expensive at US$109,000, which kept it out of the general consumer’s reach.[[33]](#endnote-33) However, in 2011, Tesla launched the 7-seater Model S sedan with a range of up to 260 km and a price of US$57,400. The intermediate model had a range of 370 km and the premium model offered a range of 480 km per charge.[[34]](#endnote-34) Although it became a commercially viable vehicle for Tesla, it was an expensive vehicle for the general consumer. Tesla further expanded its product range by introducing the Model X, a sport utility vehicle, in September 2015.[[35]](#endnote-35) In July 2017, it also added to its product range the Model 3, a lower priced, high volume e-car. The base price for the Model 3 was US$35,000, with battery pack of 50 kWh and a range of 350 km. The Model 3 was also available with a battery pack of 70 kWh and a range of 500 km, for the price of US$44,000.[[36]](#endnote-36)

Other major global auto players had also launched their own e-car variants. Some well-known models were BMW’s i3, Renault’s 20e, Volkswagen AG (Volkswagen)’s e-Golf, Hyundai Motor Company (Hyundai)’s IONIQ, and others.[[37]](#endnote-37) However, of the 1 billion cars on the world’s roads, only 2 million were electric.[[38]](#endnote-38) General awareness about e-cars was relatively low, not only in developing countries like India, but also in developed countries like the United Kingdom. Sander van der Veen, the U.K. manager of the electric charging organization NewMotion, commented on the general lack of awareness: “At the moment general consumer awareness of EVs is pretty low in the UK. . . . It’s the responsibility of governments, car manufacturers and companies like NewMotion, who support the charging infrastructure, to help raise awareness and educate the next generation of car users.”[[39]](#endnote-39)

Electric vehicles were not yet a success anywhere in the world, but growth prospects looked positive. There was impressive growth in e-car sales in 2016, when around 750,000 new e-cars were sold, raising the total number of e-cars on the road to over 2 million, compared to 1 million in 2015. With a 29-per-cent market share, Norway led in the sale of e-cars globally. It was followed by the Netherlands and Sweden, with market shares of 6.4 per cent and 3.4 per cent, respectively. Other leading countries in e-car sales were China, France, and the United Kingdom, with market shares of close to 1.5 per cent each. Until 2015, the United States had accounted for the largest market for e-car sales. However, in 2016, China surpassed the United States, accounting for more than 40 per cent of all e-cars, which was double the amount of e-cars in the United States.[[40]](#endnote-40)

Along with the growth in e-car sales, there was improvement in the charging infrastructure, but the number of e-cars in circulation was still far below the optimum scale for production. It was expected that with the achievement of economies of scale, the price of e-cars would decline substantially, making them more affordable to everyday buyers. According to a report by the Organisation for Economic Co-operation and Development and by the International Energy Agency, mass production would lead to a rapid decline in the cost of manufacturing and would increase energy density. The existing status of R&D confirmed continuous improvement in the cost of e-cars to narrow the gap between the cost competiveness of e-cars and conventional vehicles. The report forecasted that e-car stock would range between 9 and 20 million by 2020 and between 40 and 70 million by 2025. The information was based on targets set by different countries, announcements made by OEMs, and projected e-car sales. However, the report also cautioned that much would depend on government policy, the business environment, the supporting ecosystem, public procurement policies, the speed of R&D in innovative technologies, and financial incentives, among other factors.[[41]](#endnote-41) Favourable changes would facilitate early adoption of e-cars. Other studies, including one by Stanford University, were also positive about the future of e-cars. That study predicted that by 2030, the demand for fossil fuel vehicles would completely wane, which would have a major impact on their cost, the quality of service, and convenience of use.[[42]](#endnote-42)

Elecric Car Scenario in India

In 2016, three different types of cars were operating in India: conventional fossil fuel cars, hybrid cars, and fully electric vehicles (see Exhibit 5). The annual Indian car market size was around 2.5 million passenger cars, but the market for e-cars and other electric vehicles was very limited. The 5,000 e-cars on Indian roads accounted for less than 1 per cent of total car sales in the country. Mahindra was the only company in the country manufacturing e-cars: the e2o Plus and the eVerito. The price of Mahindra’s e2o Plus ranged between ₹757,000 and ₹1.127 million, whereas the price of the eVerito ranged between ₹950,000 and ₹1 million.[[43]](#endnote-43) Tata Motors Limited (Tata), another major Indian car manufacturer, was in the process of launching e-cars and had already proposed the concept of the Tiago EV and the electric Nano. Although Mahindra was the only automaker in the passenger e-car segment, there were many other companies active in the commercial vehicle market. For example, Mahindra offered two electric commercial vehicles, the e-Supro passenger and cargo van, and the e-Alfa mini rickshaw; Tata offered the e-Starbus; and Ashok Leyland, another automobile company, offered the circuit series of electric buses.[[44]](#endnote-44)

Many multinational automakers, such as Nissan and Toyota Motor Corporation (Toyota), also had advanced technology in this sphere, but their products were expensive.[[45]](#endnote-45) Mahindra had an advantage by being the first mover in the challenging Indian market.

Constrains in Boosting Demand

An average fully charged e-car battery gave impressive mileage, at approximately 140 km,[[46]](#endnote-46) but the cost was very high. Battery cost accounted for around one-third of the total manufacturing cost of e-cars,[[47]](#endnote-47) and most Indian consumers could not afford expensive cars. India was also largely dependent on imported batteries, due to its insignificant deposits of lithium, a key raw material used in most electric batteries.[[48]](#endnote-48) However, efforts were under way globally to manufacture electric batteries using alternative materials such as aluminum, which was not only cheaper but also safer than lithium,and required less charging time.[[49]](#endnote-49) India had large deposits of the aluminum ore bauxite,[[50]](#endnote-50) which implied that the cost of batteries was expected to improve in India’s future. Aluminum batteries, however, had a relatively short shelf life. Also, its advantages, which had only been proven in laboratory settings thus far, had yet to be seen in real-world settings.

Limited battery charging infrastructure was another major constraint for e-cars. Mumbai and Nagpur were two of the few cities that had battery charging stations. Otherwise, India’s infrastructure for chargers was weak. Some e-cars, such as Mahindra’s e2o Plus, could be charged at home using a 15-ampere charging socket, which took eight or nine hours, although faster charging options existed that reduced charging time to one and a half hours.[[51]](#endnote-51) To make matters worse, the country had frequent breakdowns in its electricity supply. The lack of a commercial charging network, long charging times, and an inconsistent electricity supply constrained the demand for passenger and commercial electric vehicles in the country.

Automobile Policy in India

The automotive industry accounted for 7.1 per cent of India’s gross domestic product and employed around 32 million people, directly and indirectly.[[52]](#endnote-52) This industry was a major consumer of crude oil, but with its poor oil reserves, India depended mainly on imported oil. Its high import bill was one reason for the country’s bourgeoning trade deficit.[[53]](#endnote-53) A significant movement toward e-cars, along with a shift toward green energy sources, would not only help the country control pollution levels but also generate significant savings in oil import (see Exhibit 6). An additional benefit of electric vehicles was that they were more energy efficient. Emphasizing India’s reasons for leading the e-car revolution, Ashok Jhunjhunwala, the principal advisor to the Ministry of Power and the Ministry of New and Renewable Energy, noted that with battery prices falling, electric vehicles would be most sought after in the next five to six years. He then warned that if India waited until that time, it would end up importing electric vehicles instead of oil.[[54]](#endnote-54)

To lead the electric vehicle revolution, the government came up with several initiatives. In 2013, the Government of India launched the National Electric Mobility Plan 2020, with the objective of achieving national fuel security by promoting hybrid and electric vehicles.[[55]](#endnote-55) To achieve its objective, the government launched another program in 2015—the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles, commonly referred to as the FAME scheme[[56]](#endnote-56) (see Exhibit 7). Also in 2015, to further promote the adoption of electric vehicles, the National Green Tribunal banned the registration of new diesel vehicles in India’s capital city, Delhi.[[57]](#endnote-57)

The roll out of a new indirect tax reform, in the form of the Goods and Services Tax in July 2017, was expected to reduce the tax burden on passenger vehicles, although the government nullified this benefit by raising taxes on premium cars.[[58]](#endnote-58) Political leaders belonging to the incumbent government passed on any anti-fossil-fuel declaration.[[59]](#endnote-59) The government was providing consumer subsidies for e-cars, but fiscal imbalance was casting doubts on their sustainability. Besides, the country did not yet have an electric vehicle policy, so car manufacturers were not sure whether the benefits would continue for e-cars.[[60]](#endnote-60) Unlike the governments of many other countries, which promoted electric vehicles, the Indian government had no provision for a tax incentives for electric car owners. India had also made substantial investments in oil refineries. Therefore, car manufactures, the public, and analysts all feared that the government could succumb to its large fiscal deficit and pressure from oil companies and fail to reach its self-imposed deadlines. Given the uncertain environment, many well-known global car brands in India, including Hyundai, Honda Motor Company Inc., Toyota, and Mercedes-Benz, were finding it difficult to convince their parent companies to direct investments toward the Indian market.[[61]](#endnote-61)

Investment in E-Cars and Components in India by Multinational Companies

Suzuki indicated its intention to set up a joint venture with Toshiba Corporation and Denso Corporation with an investment of ₹12 billion million in lithium-ion battery manufacturing. It aimed to use these locally manufactured batteries in domestically-developed hybrid and fully electric vehicles by 2020. Nissan was also exploring the demand for its e-car, the Nissan Leaf, within the government and in private-sector firms. It was also interested to learn if the car could be assembled in India to meet local conditions, and whether parts could be manufactured in the country itself.[[62]](#endnote-62) Tata had signed an agreement with Volkswagen, Europe’s largest automaker, to develop components and new vehicles.[[63]](#endnote-63) Tesla, the U.S. electric vehicle maker, was planning to set up a factory in India to cater to local demand for e-cars, but it was looking for a waiver on restrictions to import its high end e-cars until its factory was built in the country.[[64]](#endnote-64) Although many foreign companies had shown interest in investing in the production of e-cars and components in India, they appeared to be waiting for more clarity on the evolving economic environment before venturing into the country.

Shifting from Fossil Fuel Cars to E-Cars

Mahindra, which had already launched two models of e-cars, was intending to electrify its range of vehicles. Analysts were expecting that it would come up with a series of fully electric extra utility vehicles (so-called XUVs).[[65]](#endnote-65) Other car manufacturers were also preparing their e-car platforms. These manufacturers had already indicated their intention to launch e-cars by 2020. Audi India, for example, was ready to launch e-cars by 2020, while Hyundai, which had originally planned to launch a hybrid car, had shelved its hybrid plans and was shifting its focus to an e-car.[[66]](#endnote-66)

Maruti wondered if it should wait for the uncertainty to clear and watch other car manufacturers experiment with their e-car models, thus taking a second-mover advantage. Or maybe it should expedite the process of building e-cars and keep its leadership position intact. What was at stake for Maruti if it delayed its move to e-cars for few years? Investment costs were very high, but leadership was also important. If it opted for entry in the e-car segment, what would be its best entry mode to effectively manage the competition in the crowded market? The stakes were very high and depended greatly on the consistency of government policies.

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Exhibit 1: Indian Road Condition and Driving Habits

Most Indian roads are narrow and congested. Potholes are common sights on these roads. Encroachments on footpaths force pedestrians to walk on roads. Either Indian laws do not meet global safety standards pertaining to drink driving, helmets, and child restraints, or there is lack of enforcement of these laws. These conditions lead to chaos on Indian roads.

A survey conducted by the Ford Motor Company indicated that 49 per cent of respondents in India spend more than 100 minutes every day driving their cars. More than one-fourth of the respondents also admitted to excessive use of mobile devices while driving for taking selfies, text messaging, or accessing emails and various social media sites. About 56 per cent of them admitted to speaking over their mobile devices while driving. Around 55 per cent also changed controls on the music system while driving.

Source: Prepared by the author with information from Dinu Hazrat, “70% of Indian Drivers Have Unsafe Driving Habits, Says Ford Survey,” DNA, accessed March 25, 2018, www.dnaindia.com/business/report-70-of-indian-drivers-have-unsafe-driving-habits-says-ford-survey-1908875; Dipak K. Dashi, “Indians Spend More Time behind the Wheel than Chinese, Aussies: Survey,” *Times of India*, February 23, 2015, accessed March 25, https://timesofindia.indiatimes.com/india/Indians-spend-more-time-behind-the-wheel-than-Chinese-Aussies-Survey/articleshow/46337734.cms.

EXHIBIT 2: Market Share of Automobile Companies in 2015–16

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Passenger Cars and Vans** | | | **Medium and Heavy Commercial Vehicles** | | |
| **Rank** | **Company** | **Share** | **Rank** | **Company** | **Share** |
| 1 | Maruti Suzuki India Ltd. | 40.48 | 1 | Tata Motors Ltd. | 51.85 |
| 2 | Hyundai Motor India Ltd. | 23.70 | 2 | Ashok Leyland Ltd. | 21.60 |
| 3 | Honda Cars India Ltd. | 10.20 | 3 | Renault Nissan Automotive India Pvt. Ltd. | 12.33 |
| 4 | Ford India Pvt. Ltd. | 7.89 | 4 | VE Commercial Vehicles Ltd. | 6.36 |
| 5 | Volkswagen India Pvt. Ltd. | 5.16 | 5 | Daimler India Commercial Vehicles Pvt. Ltd. | 4.23 |
| 6 | Skoda Auto India Pvt. Ltd. | 3.50 | 6 | Mahindra Vehicle Mfrs. Ltd. | 1.29 |
| 7 | Mercedes-Benz India Pvt. Ltd. | 3.22 | 7 | Man Trucks India Pvt. Ltd. | 0.77 |
| 8 | Fiat India Automobiles Pvt. Ltd. | 2.10 | 8 | Komatsu India Pvt. Ltd. | 0.48 |
| 9 | BMW India Pvt. Ltd. | 1.60 | 9 | Scania Commercial Vehicles India Pvt. Ltd. | 0.44 |
| 10 | General Motors India Pvt. Ltd. | 1.54 | 10 | A M W Motors Ltd. | 0.15 |

Source: “Industry Outlook,” Centre for Monitoring Indian Economy Pvt. Ltd. (CMIE), accessed December 13, 2017, <https://industryoutlook.cmie.com/kommon/bin/sr.php?kall=wshreport&repcode=905005000000000000000000000000000000000000000&repnum=54206&frequency=A&icode=0101014502010500>.

Exhibit 3: Three Most Important Fiscal incentives for Electric Cars in Western Europe in 2017

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | **Purchase Grant**  **(One Time)** | **Ownership Tax**  **(Annual)** | **Company Car Tax**  **(Annual)** |
| Belgium | €4,000 (US$4,949) Grant | No Tax  at All | 120%  Deductible |
| France | Up to €10,000 (US$12,372)  Grant | 50% or 100%  Discount | No Tax  at All |
| United Kingdom | £4,500 ($11,345)  Grant | No Tax  at All | 9% |
| Germany | €4,000 (US$4,949)  Grant | No tax  at All | Up to €8,000 (US$9,897)  Discount |
| Norway | No Value Added Tax | NOK 455  Instead of NOK 2.820\* | 50%  Discount |
| The Netherlands | No Purchase | No Tax at All | 4% |

Note: \*NOK 455 was the road tax on electric vehicles; NOK 2.820 was the road tax on petrol cars; € = EUR = euro; US$1 = €0.92 on April 30, 2017; £ = GBP = British pound; US$1 = £0.77 on April 30, 2017.

Source: Compiled by the author with information from Vivian Zhou, “3 Electric Car Incentives You Need to Know in Europe,” rEVolution, July 4, 2017, accessed March 22, 2018, <http://blog.ev-box.com/electric-car-incentives/>.

Exhibit 4: Overview of National Non-Fiscal Incentives for Electric Vehicles in Five European Countries

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Type** | **Incentive** | **Germany** | **United Kingdom** | **France** | **The Netherlands** | **Norway** |
| Regulatory Incentive | * Sales target | * 1 million by 2020 * 6 million by 2030 |  | * 2 million by 2020 | * 200,000 EVs by 2020 * 1,000,000 EVs by 2025 |  |
| Indirect Incentive | * Preferential access |  |  |  |  | * Free access to toll roads for EVs * Reduced ferry rates for EVs * Free parking |
| Charging Infrastructure | * Funding for charging infrastructure | * Showcase and model regions; Schnelllade-netz für Achsen und Metropolen | * Plugged-in places * €40 (US$50) million for 2015 to 2020 | * €50 (US$62) million funding for charging infrastructure * Public–private partnership | * E-laad foundation: 3,000 charging stations with €25 (US$31) million * Green Deal: €33 (US$41) million | * Funding for charging stations 2009–2010: €12 (US$15) million * Ongoing funding for fast chargers |
| Complementary Policies | * R&D support | * Showcase and model regions | * Advanced propulsion centre | * Funding available for battery and EV research | * Various R&D programs | * Support for research activities |
|  | * Public procurement preference | * Increased allowable spending and EV target |  | * EV target for government |  | * Limit of 120–140 grams of carbon dioxide per kilometre |
|  | * Outreach and education | * Showcase and model regions | * Office for low emission vehicles | * Various outreach activities | * Education and promotion events * Web portals | * Gronn Bil Web portal * Special EV license plates |
|  | * Fleet purchasing * Incentive |  | * Favourable asset depreciation rates for EVs * EV taxi scheme | * EV target for business fleets * Subsidy for car rental | * Subsidy for vans and taxis * Environmental Investment Rebate |  |

Note: € = EUR = euro; US$1 = €0.92 on April 30, 2017; EV = electric vehicle; R&D = research and development

Source: Compiled by the author with information from Uwe Tietge, Peter Mock, Nic Lutsey, and Alex Campestrini, “Comparison of Leading Electric Vehicle Policy and Development in Europe,” The International Council on Clean Transportation, white paper, May 2016, accessed March 23, 2018, https://www.theicct.org/sites/default/files/publications/ICCT\_EVpolicies-Europe-201605.pdf.

EXHIBIT 5: Comparison of Conventional Cars, Electric Cars, and Hybrid Cars

Conventional Cars

Conventional cars had internal combustion engines, which ran on fossil fuels such as gasoline or diesel. The engines were operated by burning the fuel. The heat generated from combustion caused expansion of gases, which pushed the pistons that turned the wheels. However, the combustion or burning of fuel emitted carbon dioxide and other harmful gases, which contributed to air pollution and global warming.

**Electric Cars**

Electric cars did not have internal combustion engines. These vehicles had electric motors, which were run using the energy stored in batteries. The energy stored in batteries was released electrochemically. In such a process, there was no burning of fuel, and hence, no emission of any kind, making such cars pollution-free.

There were other important differences between the two types of cars. Around 70 per cent of components of e-cars were different from conventional cars. The two types of cars also differed in terms of number of moving parts. Electric motors had just one moving part, whereas conventional cars had more than 100 moving parts. Because of their having fewer moving parts, electric cars required less maintenance, which lowered maintenance costs. Less maintenance also made these cars more reliable.

In addition to lower maintenance costs, these cars were also more fuel cost efficient. According to one estimate, electric cars could travel approximately 70 kilometres for US$1, which was more than twice the efficiency of a conventional or gasoline car.

However, despite their low running and maintenance costs, electric cars had not yet gained popularity. They were expensive, with the major cost being the battery, which accounted for approximately one-third of the total manufacturing cost. Another constraint was the limited range per single charge of the battery. Most batteries had a range of 160–240 kilometres. Besides the batteries having a limited battery life, which necessitated periodic replacement, there was also a need for widespread recharging infrastructure with 24-hour electric power and stable voltage and current. Skilled technicians were also required for the servicing and maintenance of electric cars.

Hybrid Cars

Hybrid cars were a combination of traditional fossil fuel powered cars and electric cars that comprised two engines—a combustion engine and an electric motor. Combustion engines in these cars were run by burning petrol or other fossil fuels, whereas their electric motors used stored energy from an electric battery that could be charged when the car was run on fossil fuel. Hybrid cars had low emissions compared to conventional cars, and they could provide a smooth ride.

Source: Created by authors with information from “How Do Gasoline & Electric Vehicles Compare,” Idaho National Laboratory, accessed October 2, 2017, <https://avt.inl.gov/sites/default/files/pdf/fsev/compare.pdf>; John Farrell, Electric Vehicles Report: Part 1 — Electric Vehicles Are Going Mainstream, Clean Technica, October 2, 2017, accessed December 13, 2017, <https://cleantechnica.com/2017/10/02/electric-vehicles-report-part-1-electric-vehicles-going-mainstream/>; Adam Vaughan, “Electric Cars: Everything You Need to Know,” *The Guardian*, July 26 2017, accessed November 6, 2017, https://www.theguardian.com/environment/2017/jul/26/electric-cars-everything-you-need-to-know.

Exhibit 6: India’s Targeted Energy Capacity Mix (in Gigawatts)

|  |  |  |  |
| --- | --- | --- | --- |
| **Energy Source** | **2017** | **2022** | **2027** |
| Coal | 199 (58%) | 249.3 (47%) | 249.3 (38%) |
| Gas | 25 (7%) | 29 (5%) | 29 (5%) |
| Other Zero Emissions | 57 (17%) | 80 (15%) | 96.8 (15%) |
| Renewals | 60 (18%) | 175 (33%) | 275 (42%) |

Source: Compiled by the authors with information from “In 10 Years, Renewal Sources Will Dominate Half of India’s Energy Capacity,” *Business Standard*, April 19, 2017, accessed March 23, 2018, www.business-standard.com/article/economy-policy/in-10-yrs-renewable-sources-will-dominate-half-of-india-s-energy-capacity-117041900200\_1.html.

Exhibit 7: FAME India Scheme 2015

|  |  |  |
| --- | --- | --- |
| **Component of the Scheme** | **2015–16** | **2016–17** |
| Technology Platform (including testing infrastructure) | ₹700 million (US$10.77 million) | ₹1,200 million (US$18.46 million) |
| Demand Incentives | ₹1,550 million (US$23.07 million) | ₹3,400 million (US$52.29 million) |
| Charging Infrastructure | ₹100 million (US$1.54 million) | ₹200 million (US$3.08 million) |
| Pilot Projects | ₹200 million (US$3.08 million) | ₹500 million (US$7.69 million) |
| IEC/Operations | ₹50 million (US$0.77 million) | ₹50 million (US$0.77 million) |
| Total | ₹2,600 million (US$39.99 million) | ₹5,350 million (US$82.28 million) |
| **Grand Total** | **₹7,950 million (US$122.27)** | |

Note: ₹ = INR = Indian rupee; US$1 = ₹64.8 on April 30, 2017; IEC =

Source: National Automotive Board, *FAME—India [Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India]*, Government of India, Ministry of Heavy Industry & Public Enterprises, April 27, 2015, accessed March 22, 2018, http://dhi.nic.in/writereaddata/UploadFile/Fame\_India\_Revised\_270415.pdf.

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