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NISSAN'S ELECTRIC VEHICLE STRATEGY IN 2011: LEADING THE WAY TOWARD ZERO-EMISSION

You can't ignore that zero-emission vehicles are the wave of the future.
Carlos Ghosn, president and CEO of Renault-Nissan Alliance, January 12, 2010

INTRODUCTION

It had been five months since Nissan sold its first all-electric vehicle, the Nissan LEAF, in Redwood City, California. Carlos Ghosn, president and CEO of both Nissan and its Alliance partner Renault, was betting big on zero-emission vehicles (ZEVs), to the tune of $5 billion, predicting they would be the wave of the future. The LEAF, a five-passenger compact car, could go up to 100 miles (US LA4 mode)[1] on a single charge and could be fully recharged with a home charger in about seven hours, or 80 percent recharged in 30 minutes at a quick charging station. The LEAF's retail price was $32,780, and after the $7,500 federal tax credit the price dropped to $25,280 – less than the average price of a new car in the United States.[2] Many states had

[1] Vehicles being tested under the United States' Federal Test Procedure were placed on a chassis dynamometer and were operated over a standardized driving cycle called the Urban Dynamometer Driving Schedule (UDDS), or "LA4 Cycle." This test involved duplicating a speed-time profile from an actual road route driven in the Los Angeles area in the late 1960's. This driving cycle was designed to be representative of a typical urban driving pattern. U.S. Department of Transportation. http://tmip.fhwa.dot.gov/resources/clearinghouse/docs/airquality/wtaq/wtaq.pdf, pg. 31.

[2] The National Automobile Dealers Association put the average price of a new 2010 car at about $28,400.

Debra Schifrin and Professor Robert A. Burgelman prepared this case as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

additional rebates for electric vehicles (EVs). The LEAF went on sale in Japan in December 2010, with a retail price of 2.99 million yen after government incentives (about $30,000).[3]

Ghosn believed that by 2020, electric cars would make up 10 percent of the world car market, a more bullish prediction than many analysts' forecasts. Because of his prediction, Ghosn did not see the LEAF as a niche car, and he planned a mass market effort. The Renault-Nissan Alliance was building capacity for 500,000 ZEVs. The $5 billion the Alliance had committed to the project included building assembly and battery plants, as well as designing, developing, and launching the LEAF and other ZEVs that would be released later. Nissan produced the LEAF first in Japan in 2010 and intended to expand its production to the United States and Europe starting in 2012. In 2010, the Alliance sold a total of 7.3 million vehicles – about 10 percent of total global sales.

Renault was developing its own electric cars and was a key partner for Nissan in its zero-emission projects. While Nissan built the electric car's lithium-ion batteries with Japanese joint venture partner NEC,[4] Nissan's partnership with Renault allowed for significant economies of scale. The two companies shared technical learning and experiences about electric vehicles (EVs), but Renault designed and developed EVs with some different technologies for the motor and a different battery recharging method. The two companies also had different EV business models. Ghosn wanted the Alliance to have multiple technical options and business models so it could quickly adapt to the market demands of the future. Nissan and Renault each planned to produce four EV models: a family sedan, a small city car, a light commercial vehicle, and a luxury car. Since the LEAF was already out, the Alliance's next step was for Renault to come out with its four EVs in 2011 and 2012, followed by three more EVs from Nissan.

In the United States, the LEAF was often compared to General Motors' Chevy Volt, which was a plug-in hybrid electric vehicle (PHEV) with an estimated retail price of about $41,000 ($33,500 with the federal tax incentive).[5] PHEVS such as GM's Chevy Volt used an electric motor for a certain number of miles before a small internal combustion engine (ICE) kicked in. The Volt also hit the market in December 2010. GM's engine kicked in to power the motor after an average of 25 to 50 miles, depending on the driving behavior, terrain, battery age, and temperature.[6] In the United States, 95 percent of Americans drove less than 100 miles per day, and 75 percent drove less than 40 miles per day.[7]

However, Nissan did not compare the LEAF to the Volt. Ghosn believed the two cars were fundamentally different and that customers would choose the LEAF because it was truly zero-emission. Ghosn instead saw competition coming from the all-electric vehicles manufactured by Ford, Volkswagen, and Toyota, which had not come out yet, giving Nissan a lead in the EV

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[3] Dan Strumpf and Malcolm Foster, "Nissan Will Sell Electric Car for Just Over $25,000," Associated Press, March 30, 2010.

[4] The JV was called Automotive Energy Supply Corporation (AESC).

[5] "Chevrolet Begins Taking Volt Orders: Pricing Announced," *GM News*, July 27, 2010.

[6] "GM Chevy Volt Has a Typical EV Range of 25 to 50 Miles," General Motors, September 23, 2010. http://gm-volt.com/2010/09/23/gm-chevrolet-volt-has-a-typical-ev-range-of-25-to-50-miles/

[7] Cheryl Jensen, "Pouring Over the New LEAF," *Chicago Tribune,* December 23, 2010.

market. GM countered that Americans had "range anxiety" and were afraid of getting stuck on the road after 100 miles because there was no back-up engine in an all-electric vehicle.

By March 2011, over 5,000 LEAFs had been sold, mostly in Japan, and sales were beginning in the United States and Europe. The Alliance's goal was to sell a cumulative 1.5 million EVs by 2016. Nissan wanted to make full use of its first-mover advantage to not only sell the LEAF, but to change the face of the industry by making all-electric vehicles an affordable, mass market reality.

FORCES DRIVING THE TWENTY-FIRST CENTURY AUTOMOTIVE INDUSTRY TOWARD ELECTRIFICATION[8]

Electric vehicles were invented in the 1830s, before ICE-based cars, and at the turn of the century electric vehicles outsold gas-powered vehicles. However by the 1930s, cheaper gas, longer roads, and Henry Ford's mass production techniques meant electric cars were almost entirely phased out in favor of gas-powered vehicles. Sixty years later, the world saw the next big push in the EV arena with General Motors' all-electric EV1 in 1996. Popular among its drivers, GM nevertheless leased only 800 EV1s,[9] and lost $1 billion on the car[10] by the time it stopped production in 1999. Simultaneously, Toyota introduced its Prius hybrid in Japan in 1997 and globally in 2000. By early 2011 it had sold a cumulative total of over 3 million of its 16 hybrid models.[11] While other car manufacturers such as Honda and Ford came out with their own hybrids, Toyota maintained a commanding lead in market share.

In 2010, global hybrid (HEV), PHEV, and EV sales were close to 1 million cars,[12] out of 72 million total cars and light trucks sold.[13] (See **Exhibit 1** for car sales for select countries.) In the United States, hybrid, PHEV, and EV sales hovered around 2.2 percent of overall sales.[14] (See **Exhibit 2** for hybrid sales in the United Sates.)

There was consensus among analysts that the electric car market was growing, though predictions of sales varied. J.D. Power and Associates put the number at 1.2 million EVs sold

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8 See Stanford Graduate School of Business industry note SM193, "The Growth of the Electric Vehicle Industry in 2011: Facilitating and Impeding Forces," Debra Schifrin and Robert A. Burgelman.
9 Anita Lienert, "Chevrolet Volt Takes a Giant Leap Forward," *Edmund's Inside Line,* June 3, 2008.
10 Don Sherman, "G.M. at 100: Is Its Future Electric?" *The New York Times*, September 14, 2008.
11 "Cumulative Worldwide Sales of Toyota Hybrids Top 3M," Green Car Congress, March 8, 2011.
http://www.greencarcongress.com/2010/10/worldwide-prius-cumulative-sales-top-2m-mark-toyota-reportedly-plans-two-new-prius-variants-for-the-.html#more
12 Compiled by all-electric-vehicle.com based on data from J.D. Power and Associates.
http://www.all-electric-vehicles.com/hybrid-car-statistics.html
13 "J.D. Power Sees World Auto Market Up 6% in 2011," Reuters, February 15, 2011.
http://www.msnbc.msn.com/id/41610342/ns/business-autos/
14 John O'Dell, "Three-peat: Hybrid Sales Market Third Consecutive Decline in 2010," Edmunds.com, January 7, 2011.
http://blogs.edmunds.com/greencaradvisor/2011/01/three-peat-hybrid-sales-marked-third-consecutive-decline-in-2010.html

annually by 2020, and Boston Consulting Group estimated 1.5 million by that year.[15] Pike Research said over 1 million cumulative PHEVs would be sold by 2015; IDC predicted 2.7 million cumulatively.[16] Predictions also varied for the number of global new car sales in upcoming years. Roland Berger Strategy Consultants forecast 114 million vehicles by 2025;[17] J.D. Powers predicted 90 million to 91 million by 2013 and over 100 million by 2015;[18] Datamonitor estimated 96.5 million vehicles by 2014;[19] and the Center for Automotive Research (CAR) at the University of Duisberg-Essen, in Germany, predicted 92.5 million passenger cars by 2025.[20] Passenger cars made up 80.3 percent of the auto industry.[21]

There were several forces that could push consumers toward electrified automobiles. Oil prices and availability were continuously volatile, affecting consumers at the gas pump (see **Exhibit 3** for U.S. historical gas prices), influencing political decisions and even prompting military action. During the oil price spikes in 2008, there was evidence that high gasoline prices affected drivers' habits. Many consumers began to change their buying habits, switching from sport utility vehicles (SUVs) to more fuel efficient cars and motorcycles. SUV sales dropped precipitously in 2008. As oil prices dropped in 2009 and 2010, U.S. drivers began reverting back to buying less efficient cars.

The role that auto emissions played in climate change was another factor that favored adoption of EVs. In the United States, for example, transportation accounted for one-third of the country's carbon emissions and two-thirds of total emissions from petroleum.[22] Air pollution was an enormous problem created by ICE vehicles, especially in emerging nations. China had the deadliest air pollution in the world,[23] and the speed at which China's ICE auto market was growing would only serve to exacerbate the problem. To combat climate change and pollution, governments around the world began enacting emissions regulations. One way to achieve that

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[15]"Batteries for Electric Cars: Challenges, Opportunities, and the Outlook to 2020," The Boston Consulting Group, 2010.
"Future Global Market Demand for Hybrid and Battery Electric Vehicles May be Over-Hyped; Wild Card is China," J.D. Power and Associates press release, October 10, 2010.
[16] "Pike Forecasts Annual Global Plug-in Vehicle Sales to Exceed 1M units by 2015," Green Car Congress, March 29, 2011.
http://www.greencarcongress.com/2011/03/pike-20110329.html
Joe McKendrick, "Prediction: Three Million Electric Vehicles by 2015," *Smartplanet,* October 6, 2010.
http://www.smartplanet.com/blog/business-brains/prediction-three-million-electric-vehicles-by-2015/10713
[17] "Automotive Landscape in 2025: Opportunities and Challenges Ahead," Roland Berger Strategy Consultants, February 2011.
[18]"J.D. Power Sees World Auto Market," op. cit.
[19] "Global Automobiles," Datamonitor, March 2010.
[20] "CAR Symposium: Global Car Sales to Grow 57 pc through 2025," Automotive IT International, January 27, 2011.
http://www.automotiveit.com/car-symposium-global-car-sales-to-grow-57-pc-through-2025/news/id-001492
[21] The auto industry is made up of 80.3 percent passenger cars, 6 percent motorcycles, and 13.7 percent light trucks. "Global Automobiles," Datamonitor, March 2010.
[22] Energy Information Administration.
http://www.eia.doe.gov/emeu/steo/pub/#Global_Crude_Oil_And_Liquid_Fuels
[23] World Health Organization.

goal was by regulating the allowed number of miles per gallon (mpg) for vehicles. (See **Exhibit 4** for mandated miles per gallon for select countries and regions).

Various governments offered tax incentives and rebates to EV and PHEV buyers, and some offered grants and loans to EV and PHEV manufacturers and battery manufacturers. (See **Exhibit 5** for EV incentives for select countries, and Appendix A for details). Notably, some governments began sponsoring and supporting electric vehicles early and vigorously. Israel's government planned to reduce its 78 percent car tax to 10 percent for citizens who bought electric vehicles.[24] Denmark was offering a minimum $40,000[25] tax break for electric car buyers until at least 2012, dropping the average price of a car from $60,000 to $20,000.[26]

CHALLENGES TO MASS EV ADOPTION

There were many serious challenges for mass adoption of electric vehicles. The top barriers to adoption were price, concerns about performance and range, and availability of charging stations. The price of EVs was driven up in large part by the high price of the battery, which could account for half the cost of an electric vehicle.[27] While analysts agreed that battery price would drop significantly with volume production and improved technology, the exact time trajectory for this decrease was unclear. EV makers also faced increased competition with ICE vehicles that were becoming more fuel-efficient, offering customers more choices. New federal U.S. and global mpg mandates would act to accelerate improvements in ICE vehicles. A new competitive landscape also was opening up with the push for cheap, fuel-efficient cars (for less than $3,000), especially in emerging automotive markets. In addition, tax incentives for buying electric vehicles were in place only for a few years, and Ghosn predicted a challenge for EV makers when these incentives were cut.[28]

Buyers of EVs and HEVs tended to fall into a very specific category: older, high income people who held post-graduate degrees and liked to be the first to adopt new technology.[29] HEV buyers in the United States generally lived in the Northeast or West Coast, primarily in urban centers, and were family focused.[30] Buyers also described themselves as informed consumers who were concerned about the environment. (See **Exhibit 6** for psychographics of hybrid vehicle owners). If the narrow demographic of hybrid buyers was extrapolated to EV buyers, EV manufacturers

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[24] Nicky Blackburn, "Better Place to Start Electric Car Sales This Summer," *Israel 21c,* April 26, 2011. http://www.israel21c.org/201104269017/briefs/better-place-to-start-electric-car-sales-this-summer

[25] Nelson D. Schwartz, "In Denmark, Ambitious Plan for Electric Cars," *The New York Times,* December 1, 2009.

[26] Andrew Burger, "Tax Exemption Attracts Automakers to Denmark," *TriplePundit,* November 7, 2008. http://www.triplepundit.com/2008/11/tax-exemption-attracts-automakers-to-denmark/

[27] Mike Ramsey, "High Battery Cost Curbs Electric Cars," *The Wall Street Journal,* October 17, 2010. http://online.wsj.com/article/SB10001424052748703735804575536242934528502.html

[28] Laurence Frost, "Nissan Predicts Challenge When Electric Car Incentives are Cut," *Bloomberg BusinessWeek,* May 17, 2010.
http://www.businessweek.com/news/2010-05-17/nissan-predicts-challenge-when-electric-car-incentives-are-cut.html

[29] "Future Global Market Demand," op. cit.

[30] Experian Simmons National Consumer Study, summer 2009.
SBI Energy "Electric Vehicle and Plug in Hybrid Markets Worldwide," March 2010.

might have a hard time finding mass market appeal. As a result, some analysts were skeptical about EV manufacturers' claims that large numbers of consumers would purchase EVs by 2020.

Lastly, although electric vehicles were emissions-free, there was still the question of carbon footprint. A large percentage of global electricity generation came from coal. Coal-powered plants were environmentally unfriendly, and coal was the largest source of global carbon emissions. Therefore for EVs to reduce the world's carbon footprint, electricity generation from renewable resources would have to keep pace with the production of EVs. In the United States in 2009, renewable energy (conventional hydroelectric power, geothermal, solar/PV, wind, and biomass) accounted for less than 9 percent of energy production.[31]

NISSAN'S EARLY ELECTRIC VEHICLE TECHNOLOGIES

Development of the LEAF started in October 2007, but development of the battery began much earlier, in 1992. At that point, Nissan made the important technological decision to develop lithium-ion batteries. At the time they were still dangerous and difficult to handle, but they also were very promising because the energy density[32] was so high. Nissan's development of electric vehicle batteries was spurred on by new California regulations that required automakers to have a very small percentage of electric vehicles in the market, which for Nissan translated to about 100 or 200 EVs. Given the size of the California market, Nissan wanted to continue selling cars there and therefore built a few different basic electric vehicles. However, California soon reversed its regulation, and experimentation with EV batteries slowed down.

Various other EV pilots were tried in the following years. In Japan in 1999, Nissan produced a few hundred all-electric two-seater EVs called the hyper-mini. Executive Vice President Mitsuhiko Yamashita, head of R&D for Nissan, described it as a relatively expensive "super golf cart,"[33] with a very limited driving range. (See **Exhibit 7** for Nissan executive bios). Around that time Nissan was facing bankruptcy, so it invested very little in EVs or battery production. However, the company kept the very small EV program alive.

In 2005 Yamashita ordered his team to create a prototype of the EV with the current leading-edge technology. In 2006, Ghosn drove the car and became excited about its possibilities, but he was not yet completely satisfied that the technology was ready. Over the next year, Yamashita reported to Ghosn about the progress of the EV and the battery technology. In 2007, Ghosn decided that battery technology had reached a cost and efficiency level such that it was viable to begin developing an electric car.

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[31] Energy Information Administration.
http://www.eia.doe.gov/emeu/aer/pecss_diagram.html

[32] Energy density refers to the amount of energy stored per unit space or volume. A typical lithium-ion battery has an energy density of 100-200 watt-hours per kilogram (wh/kg).

[33] All quotations are from interviews with case authors.

LAUNCHING AND MARKETING THE LEAF

Inception of the LEAF

In 2006 Nissan saw that competitors such as Toyota, Honda, and Ford were charging ahead and finding success with the hybrid. Nissan had not invested in hybrid technology when its competitors were doing so because it was facing bankruptcy at the time (1999-2000) and did not have the necessary financial resources. According to Andy Palmer, Nissan executive vice president for global planning and program management, "We looked out the window in 2006 and saw that 12 percent of new car sales were hybrids, and we said 'So what do we do?' There was very heavy pressure within Nissan to do a 'me-too' hybrid." However, said Palmer, others in the company felt that building a 'me-too' hybrid would make Nissan a 'me-too' brand. "That is not where we wanted to be or how we wanted to position Nissan as a brand. So there was a discussion about what else we could be." Various ideas were discussed, including fuel cell cars, but Nissan decided to start experimenting with electric vehicles. At this point, Ghosn became more involved with the EV venture. He believed that EVs could be a significant breakthrough for Nissan, and he pushed the company to think big – in terms of tens of thousands or hundreds of thousands of EVs in the medium-term.

Development of the LEAF started in October 2007, but there was a significant amount of internal cynicism. One major concern was whether Nissan had the power to persuade governments to invest in the necessary infrastructure. Other concerns included the high cost of the battery (discussed later in this case) and the ultimate sticker price of the car.

Development cycle, launching, and ramping up production

The LEAF's three-year development cycle was exceptional for Nissan. Fundamentally, Nissan followed the four-year development steps it used for an ICE. The main difference was the weight proportion; the crash mode was different because the battery was distinct from a fuel tank, and the motor was much smaller than an ICE engine. Nissan was using the same talents and analytical skills that it employed with the ICE to test crash modes and safety.

In December 2010, three years after development of the LEAF began, the car was launched. In 2010 and 2011 the LEAF was assembled in Japan at its Oppama plant, in Yokosuka. Nissan expected the Oppama plant to have a capacity of 50,000. Beginning in 2012, Nissan would begin building LEAFs and batteries in its new plant in Smyrna, Tennessee, which had the capacity for 150,000 EVs and 200,000 batteries. Nissan was investing about $2 billion in this plant.[34] Plants were planned for the United Kingdom and Portugal by 2012, mainly to serve the European market. Ghosn noted that the bottleneck for the EV was the battery supply, so in the beginning of 2011, Nissan was spending a lot of time doing arbitrage between regions about how many cars to deliver to the United States versus Europe versus Japan.

[34] Alex Taylor III, "Here Comes the Electric Nissan LEAF," *CNN Money,* February 17, 2010.

Ghosn said that if the Alliance sold the 500,000 electric cars and batteries a year it planned by 2015, it would have the minimum needed to establish a solid financial return on the $5 billion investment it would be making.

> The profitability is the thing which preoccupies me the least. Most governments have accepted incentives for the zero-emissions cars. Most of the competitors are not jumping into it, which means I am not going to be facing strong competition. Also, even if the price of gas is at a very reasonable level, the price of the LEAF allows us to justify the case to the consumer. On top of that, let's not forget the work we are doing on the battery will be useful not just for the electric cars, but for the hybrids and fuel cells. We'll be able to use part of it for other technologies.

Ghosn was not advocating asking for a premium on the LEAF initially, but he believed there would be one – from the dealers if not from Nissan. If there were not enough cars, there would be a premium: "Suddenly there will be 3 percent up, 5 percent up, or 6 percent up, because that would be normal competition. But I'm not factoring this into my profitability calculations." (See **Exhibit 8** for Nissan and Renault financial information).

The Alliance did not view its ZEVs as a niche product, like sports cars, but rather as regular cars that were also zero-emission. As such, Ghosn did not see companies like Tesla, which made $109,000 sports cars, as competition. He felt that requests for electric cars quickly would add up to 300,000 to 500,000 cars a year ─ with more precise numbers being apparent later in 2011. He pointed to customers who already were committed to EVs: energy companies, some of the large transporters like FedEx, and officials in the Obama administration who wanted a percentage of government vehicles to be electric.

Leading up to the LEAF's launch in 2010, Nissan had received 20,000[35] reservations in the United States and Japan for the LEAF, exceeding its capacity.[36] (Americans paid $99 to make reservations for the LEAF.)[37] In addition, about 260,000 customers were "hand raisers," expressing an interest in purchasing the car.[38]

Ghosn believed the LEAF would be a beachhead to establish Nissan's name, technology, and reputation.

> In terms of reputation, it's all win. You do something for the environment, something good for the public – you are being bold and developing new technology. Nobody is going to say, "these guys are crazy for developing the

[35] Molly Peterson, "Electric Car Advocates Offer Ideas About Where All Those Future Plugs Should Go," *Southern California Public Radio,* December 14, 2010.
http://www.scpr.org/news/2010/12/14/Plug-in-coalition

[36] "Nissan: Electric Car Orders Above Capacity," Associated Press, May 13, 2010.

[37] Jim Motavalli, "The Chevy Volt Launches, With Dealers in the Driver's Seat," *CBS Interactive Business Network,* December 14, 2010.
http://www.bnet.com/blog/electric-cars/the-chevy-volt-launches-with-dealers-in-the-driver-8217s-seat/2824

[38] Ibid.

> electric car." They may say "the battery is too big," but everybody is saying you are doing the right thing.

Palmer noted that when people stopped calling the LEAF a niche vehicle and started calling it a viable alternative to a hybrid, there was a positive shift of thinking inside the Alliance about the potential for success of the EV venture. Nissan's goal then became to explain to the mass market that the LEAF was also an exciting and lifestyle-changing car; it was quiet, had exceptional handling, and had advanced IT connections such as smart charging. Each car was monitored through IT support at Nissan's data center, which connected to its service center and service provider. Drivers also could check the status of the car's charge via the Internet. They could turn on the car's heat or air conditioning from their house or mobile phone before getting into the car without draining the battery. (See **Exhibit 9** for LEAF IT services).

The LEAF also had on-demand driving support, which showed drivers where the nearest charging stations were or how to maximize their driving range. In the near future, for on-demand taxis, the system would be able to calculate which taxi had the battery capacity to pick up which customer, depending on the distance a customer wanted to travel. The LEAF would have functions such as the ability to download multimedia content like movies or newspapers, which the car would be able to read out loud to the driver. Nissan said that in essence it was selling a car plus its services.

The company's research showed that LEAF sales would come predominantly from the United States and maybe Europe. Although China's auto market was growing incredibly quickly (China had 90 million cars in early 2011, up 19 percent from a year earlier),[39] Ghosn did not plan to sell cars there because the government did not give incentives to consumers for foreign brands of EVs.

> The Chinese probably want to make sure that BYD and other Chinese EV automakers are ready before giving incentives. They don't want to give us too much of a head start. However, I think the pressure will be very strong, because when people start to see the LEAF in New York and California and Japan, they are going to start asking questions – why don't we have these cars here?

However, while Nissan was not pursuing a full launch in China, it was doing pilot tests in China's Wuhan province to be ready to take a leadership position when the government outlined a clear direction for EVs.

Even so, Ghosn acknowledged that overall LEAF sales would be steady, and Nissan EVs would not take the market by storm. It would be a process of building capacity, going market after market, going after the natural user and doing it progressively. He explained that both the technology and the customer would evolve over time, and the cost of the battery would go down. "It is something that you cannot avoid. You cannot ignore that EVs will be part of the future."

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[39] "Update: How Many Cars are There in China?" *China AutoWeb*, March 2, 2011.

Ghosn was content with steady sales at first because Nissan was still building capacity. "We have to be careful not to create too much expectation in the market. We have to do two things at the same time, create hype around the electric car, but not too much, because people will come ask for the electric car, but the car is not yet available." In addition, Ghosn did not want to ramp up production too quickly; rather, he wanted to focus on quality.

Ghosn emphasized that Nissan was not targeting everybody in the market, but just what the company estimated as the 20 percent of customers for whom the electric car made a lot of sense: customers who drove short distances, lived in cities or areas with high pollution, and paid high gasoline prices but low electricity prices.

Ghosn said Nissan's strategy for the LEAF would clarify and become more precise over time.

> There are a lot of factors that we can't control such as oil price and lithium price, which has dramatically increased in the last three years. In addition, it's very difficult to assert certain things in such a moving game: price, technology, development of the battery, development of the devices for charging, governments stepping in and putting incentives in, etc.

Marketing

Nissan did not conduct an initial media blitz, but rather, Ghosn explained, was letting "influencers" do the marketing for the company. He used the Toyota hybrid as a model:

> The Toyota hybrid's reputation was not done by Toyota; it was done by the media. It was done by the influencers, by the political people, by the CEOs, the artists, the Hollywood stars – and that's the way we want to do it for the EV. I don't want to spend money and time on this. Let other people talk about the car; this is the first wave. It may not be sufficient, but we are keeping the infantry behind. The advertising is the infantry, and we use it at the end after we have bombed the land. But at the beginning, PR can be very powerful.

Ghosn said that every time he sat down with the media, 80 percent of the time they asked him about the EV. Politicians and world leaders were asking him to meet with them and explain what Nissan was going to do, what the potential was for the EV, and how they could launch EVs in their own countries.

Palmer noted that one of the reasons the LEAF became such a big part of Nissan's strategy was the world financial crisis that began in 2008. Nissan would not have gotten loans from the U.S. Department of Energy or the governments of the United Kingdom and Portugal if there had not been a need for stimulus, he said. "So it was an accelerator rather than a brake."

COMPETITORS

The best known all-electric vehicle on the road was the Tesla Roadster, a sports car that cost $109,000. (See **Exhibit 10** for EV release dates, prices, and ranges). Tesla also was in production for its Model S sedan, which it would sell for a base price of $57,000. In addition, there were

EVs on the road from Mitsubishi, Daimler, and Think, but they were designed primarily for city driving. There was competition from the Chinese brands BYD and Chery, which were running some test programs in Europe. BYD's electric car, the e6, was set to go on sale in the United States at the end of 2011 or in 2012 for about $35,000.[40] There was enormous political support in China for these companies. The country's Ministry of Industry and Information Technology set a goal for China to build and sell over 1 million EVs a year by 2015.[41] However, Ghosn did not view China's EV carmakers as a threat in the near term because he believed their battery technology was still developing.

Therefore, Nissan said it had a first mover advantage in launching a global, mass market, affordable EV that had the same capabilities as an ICE car. However, Ghosn acknowledged that in a few years Nissan would face real competition in the EV space from Toyota, Volkswagen, Ford, and possibly Honda. These companies would be releasing EVs between late 2011 and 2014. Because of this, Ghosn said, competition would then be on other features: external and internal design, acceleration, comfort, range reliability, charging, and IT interconnectivity.

The only mass marketed PHEV was the Chevy Volt. Toyota had plans to offer a PHEV by 2012, but with a limited range of about 13 all-electric miles per charge. (See **Exhibit 11** for PHEV release dates, prices, and ranges.) Ford, Honda, Mitsubishi, and Volvo, among others, would also offer PHEVs in 2012 or beyond.

In the media there was constant comparison between the LEAF and GM's Chevy Volt. From its launch in December 2010 through February 2011, GM sold about 925 Volts (compared to about 175 North American-only sales for the LEAF.[42]) GM said it was ramping up production and was on schedule to build and sell 10,000 Volts by the end of 2011,[43] and 60,000 Volts by 2012. Of those, 45,000 were for the U.S. domestic market.[44] Chevy originally maintained that the Volt could go about 40 miles per charge, but in late 2010 GM had to change that range expectation to 25 to 50 miles per charge.[45] GM had invested over $750 million on the Volt.[46]

"Range anxiety" – the fear that the battery would run out and EV owners would be stranded on the road — had come into the lexicon of the debate pitting the EV against PHEV and ICE. A Consumer Electronics Association survey showed that 71 percent of consumers thought "running out of battery power" was a disadvantage, and 66 percent were concerned about the lack of

[40] "2011 NAIS: BYD e6 Electric," *All about Auto,* January 2010. http://www.allaboutauto.us/2011/01/10/2011-naias-byd-e6-electric-live-photos.html

[41] "China Plans to Make a Million Electric Vehicles a Year by 2015," *The Guardian,* February 22, 2011.

[42] Megan McArdle, "Chevy Volt, Nissan LEAF Show Lackluster Sales in February," *The Atlantic,* March 3, 2011.

[43] Sebastian Blanco, "GM Says Chevy Volt Sales Numbers Will Rise in May; 10,000 Deliveries Scheduled for 2011," *Autoblog green,* March 7, 2011. http://green.autoblog.com/2011/03/07/gm-chevy-volt-sales-numbers-rise-may/

[44] Nikki Gordon-Bloomfield, "Chevy Prepares for Volt Production Increase, 60,000 by 2012," *All Cars Electric,* May 19, 2011.

[45] Richard Posluszny, "Chevrolet Volt's Electric Range Now 25-50 Miles," *USA Today,* September 24, 2010.

[46] Claes Bell, "Chevy Announces Pricing of Volt," *Bankrate.com,* July 27, 2010.

charging stations.[47] A separate survey from cars.com showed that 54 percent had range anxiety.[48] GM tried to trademark the term range anxiety to "promote public awareness of electric vehicle capabilities,"[49] in other words, to use the term in its marketing to differentiate itself from all-electric vehicles like the LEAF. Hideaki Watanabe, corporate vice president and Alliance managing director of Nissan's Zero Emissions Business Unit, said that to combat the fear of range anxiety Nissan would have to emphasize education about the EV:

> The people do not yet understand the electric car and the potential of the electric car. Some people are very scared about the autonomy of the battery, but they don't have to be so scared about that. Most people don't drive more than 100 miles a day in Japan and even in other countries in Europe. So, the LEAF's ability to go 100 miles is good enough for everyday use.

(See **Exhibit 12** for trip lengths and share of trips by purpose in the United States).

After a few months of LEAF sales, Watanabe found that range anxiety was not at the top of the list of feedback he was getting from potential customers. Questions and concerns about the LEAF were mostly centered on the availability of charging stations, dealer locations, and price.

BATTERIES

One of the main objectives for Nissan, and all EV makers, was reducing the cost and complexity of the battery as quickly as possible; the battery was by far the most expensive component of the car. The 2010 cost of an automotive lithium-ion battery pack as sold to an original equipment manufacturer (OEM) was estimated at $16,000 (between $1,000 and $1,200 per kWh.)[50] (Nissan did not disclose the cost of its battery.) The United States Advanced Consortium set a cost target of $250 per kWh, and battery costs were expected to decline quickly with higher volume production. The Boston Consulting Group estimated that battery pack costs to OEMs would drop by 60 to 65 percent ($360 to $440 per kWh) by 2020 ($6,000 for a 15-kWh NCA[51] battery pack).[52]

However, costs of raw materials and commoditized parts were expected to remain relatively fixed over time. These costs equaled about 25 percent of 2009 battery costs.[53] Therefore, there were challenges for battery makers to reach the consortium's 2020 prediction.

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[47] "Americans Want to Give Electric Vehicles a Test Drive, New CEA Study Reports," *BusinessWire*, August 23, 2010.
http://www.businesswire.com/news/home/20100823006181/en/Americans-Give-Electric-Vehicles-Test-Drive-CEA

[48] "Cars.com Survey: Most Buyers Still Wary of Electric Vehicles," *cars.com,* May 4, 2010.
http://blogs.cars.com/kickingtires/2010/05/carscom-survey-most-buyers-still-wary-of-electric-vehicles.html

[49] Chuck Squatriglia, "GM Wants to Trademark 'Range Anxiety,'" *Wired,* August 31, 2010.
http://www.wired.com/autopia/2010/08/gm-wants-to-trademark-range-anxiety/

[50] "Batteries for Electric Cars: Challenges, Opportunities, and the Outlook to 2020," The Boston Consulting Group, 2010.

[51] NCA stands for nickel-cobalt-aluminum.

[52] "Batteries for Electric Cars," op. cit.

[53] Ibid.

Nissan/ NEC Joint Venture

In 2007 Nissan decided to make battery production a separate business in Japan and set up a joint venture with Japanese battery maker NEC called Automotive Energy Supply Corporation (AESC). Nissan owned 51 percent of the JV, and NEC owned 49 percent. The LEAF's motor was made in the Yokohama plant, and the AESC battery plant was in Zama. NEC's battery business was relatively small, but they knew how to make specialty electrodes that were critical for the EV battery. Nissan's battery business unit itself employed about 50 people.

Ghosn said the close collaboration of Nissan and NEC had multiple advantages. For one, having AESC as a supplier meant Nissan could control the number of batteries produced to ensure it would have sufficient supply for its EV line. AESC combined the mechanical engineering talents of Nissan's engineers with NEC's chemical and electrical engineers, and together the two companies could come up with more innovation choices. Through simultaneous engineering, they were able to coordinate and organize new ideas, which led to a quicker time to market and lower costs. With Nissan and NEC engineers working together, there were daily discussions about what Nissan needed for the LEAF, which eliminated bureaucratic layers and delays.

The collaboration also meant that at any moment Nissan could incorporate the newest battery technology into its cars. In addition, Nissan and Renault could start with the car design and specify how the battery must be, as opposed to the other way around. There also were advantages for NEC. The company got the perspective of the automotive world, which it could translate to its industrial applications. It also could scale up significantly, as the number and size of the batteries produced for electric vehicles was much larger than for NEC's other products.

It was estimated that the battery market would reach $25 billion by 2020. However a sensitivity analysis showed that the market for electric car batteries would range from $5 billion to $60 billion by 2020.[54] The Renault-Nissan Alliance wanted to tap into that market so that in addition to self-supplying batteries, it could sell batteries to other companies. That decision was made because in 2007 the volume of batteries Nissan and Renault needed was very limited. But by 2015, the number of batteries they would require would be much, much larger – reaching about 500,000 units. Toshiaki Otani, corporate vice president of Nissan and Alliance managing director for Global Battery Business, said the increased number of units brought costs to a very competitive level. Yamashita noted that overall, "the volume effect is probably endless. If we look at the very small components, 500,000 is good enough. But if we look at raw materials or chemistry, if our volume reached 1 or 2 million, we can get significantly more benefit to purchasing raw materials like lithium and magnesium."

Selling to companies outside the Alliance meant AESC and Nissan could sell the best battery technology to competitors in the EV space, but it forced AESC to stay competitive with other battery suppliers. It also forced the Alliance to make the best, most competitive and attractive vehicles, so AESC would be motivated to bring the best technology to them. On the flip side, the Alliance was sourcing batteries outside AESC. Renault planned to buy some batteries from South Korea-based LG Chem.

[54] "Batteries for Electric Cars," op. cit.

Ghosn wanted Nissan to ramp up battery production quickly so that its batteries became the de facto global standard. By the end of 2011, AESC would have capacity for 90,000 batteries, which were dispatched to Nissan's Oppama plant for LEAF and Renault's EV assembly. The Alliance planned to quickly expand battery production globally through its production sites, using AESC know-how. In addition to Japan, it would build capacity for 50,000 batteries per year in the United Kingdom, 200,000 in the United States, 50,000 in Portugal, and 100,000 in France, for a total of 500,000. The Alliance expected to produce that many EVs annually by 2015, half by Renault and half by Nissan. These would all use manganese lithium-ion batteries, which were high in durability.

AESC's biggest competitors were LG Chem, which used similar technology, and the Samsung-Bosch joint venture. LG Chem was building batteries for the Chevy Volt and was investing $303 million to build a Volt battery plant in Michigan.[55] LG Chem had many contracts with other automotive OEMs as well. Ghosn was not concerned about China's BYD, a huge battery maker that was moving into electric cars, even though it was considered by many to be an up and coming powerhouse. Supporters of BYD included Warren Buffet's Berkshire Hathaway, which acquired a 10 percent stake in the company. Although Nissan could not benchmark BYD's batteries, Ghosn believed that technologically they were notably inferior to the batteries being developed in Japan and South Korea. (See **Exhibit 13** for list of global automotive battery companies).

Battery Business Models

The Alliance had two distinct business models for their EVs. The first was to sell the car and the battery as one unit, so the buyer would own both. A second model involved selling the electric car but leasing the battery. Customers would pay a monthly lease fee of varying cost, depending on the region, with the ability to change the battery if there were problems. In some regions, most notably Israel, customers also could take advantage of Renault's quick drop system; they could go to a special station and in less than five minutes have a battery that was running out of charge replaced with a charged battery. Thus Renault took on the uncertainty about the life of the battery so customers did not have to worry about it. Ghosn outlined two advantages of this model for Renault:

> First, if we change the technology of the battery, we can change it, and the consumer cannot say, "I bought this battery, I want to keep it." Number two; it helps compare the cost of the lease of the battery to the cost of gasoline. Because if you buy the battery, it is folded into the cost of the car and is not comparable - there is a huge difference between the cost of electricity and gasoline. The leasing model allows you to say that the cost of the car is the same, but then you pay the lease of the battery and the cost of the charge.

At a lease price of $100 per month, for example, if a consumer drove 1,000 miles per month (about the U.S. average),[56] it came out to 10 cents per mile. Ghosn compared that to 12.5 cents a

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[55] "LG Chem Announces $303 Million Investment to Build Volt Battery Plant in Michigan," GM Volt Website, March 12, 2010.
[56] IBIS World, http://www.ibisworld.com/bed/default.aspx?bedid=1580

mile if oil were $70-$75 a barrel.[57] "So we took the worst case in gasoline and the worst case in the EV, and even in the worst case, we are OK."

Battery "Second-Life" Use

In September 2010, Nissan and Sumitomo Corporation established a joint venture called 4R Energy Corporation to conduct research on second-life use of lithium-ion batteries previously used in electric cars.[58] After the life of the vehicle, a battery typically had 70 to 80 percent capacity left. Nissan had a 51 percent stake in the new JV, and Sumitomo had 49 percent. 4R stood for Reuse, Resell, Refabricate, and Recycle, and the JV's markets were Japan and the United States. (See **Exhibit 14** for details on each of the four Rs). From an environmental point of view, Nissan said it needed to fully utilize the batteries. Watanabe explained that the JV was also critical from a business perspective; it would reduce the initial cost of the battery and help society accept the electric vehicle.

4R Energy President Takashi Sakagami outlined the JV's two main missions: 1) to promote zero-emission mobility to realize a zero-emission society, and 2) to promote renewable energy by creating products that store renewable energy such as solar or wind. These products could help manage the smart grid and store night electricity for use in the daytime for cost savings. In Japan, daytime energy use cost three times more than nighttime energy use.

4R Energy had two business categories: reusing batteries for non-EV applications and recycling or safely disposing of batteries. Its goal was to use materials from existing batteries for future batteries. Sakagami said it was technically possible, but not yet economically feasible.

The company first collected the battery pack, disassembled it, and checked for secondary use for each module. Then it added a battery management system to operate or control the battery. To add more value for customers, 4R was thinking of making it an energy storage system by adding a power conditioner, a device that could convert energy such as solar power from direct current (DC) to alternating current (AC), allowing it to operate as a storage battery for the home.

Watanabe knew it would take from four to six years for the JV to be ready to provide products in any real volume. "But what we're doing is utilizing some test samples in order to build up those business cases. We don't want to wait until the batteries are done." In early 2011, the company still had very low revenue, or zero revenue in some cases. Sakagami acknowledged, "At this moment, actually, we don't know exactly about used battery performance, because we don't have a used battery as of today." So 4R Energy was focused on technical and business feasibility studies and was approaching potential partners and clients.

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[57] On March 24, 2011 the price of a barrel of West Texas Intermediate (WTI) crude oil, the U.S. benchmark, was $105 on the New York market.
http://forex.negocio-internacional.net/tag/oil-prices-today-march-24-2011/

[58] "Nissan and Sumitomo Establish Joint Research Company for Promotion of '4R Energy' Business," Nissan press release, September 15, 2010.
http://www.nissan-global.com/EN/NEWS/2010/_STORY/100915-02-e.html

Sakagami said the customer pool was small, and would be so for the next few years. For example, Sakagami was working with several housing builders in Japan, many of whom were struggling and looking to differentiate themselves with some kind of ecologically sustainable house. 4R would be delivering a limited number of products to those customers at the end of 2011 to monitor customer usage and technical performance. With the recent earthquake in Japan and the electricity supply unstable, the demand was likely to increase faster than originally anticipated, and the plan was to accelerate market introductions. 4R also was working with solar power and windmill manufacturers.

Infrastructure of Charging Stations

Nissan was developing both normal and quick charge systems and was working to standardize as much as possible in order to reduce the cost. The company had begun installing both regular and quick charging units around the world. For example, in Japan, Nissan had installed two normal charging units in each of its 2,000 dealerships. It also had quick charging systems in 200 dealerships. Nissan had an in-house quick charging system, which it was continually developing, and it built the chargers for its Japanese dealers there.

Nissan also partnered with third parties all over the world to build the EV infrastructure. To build quick charge public plug-in stations, Nissan had partnerships with almost 100 states, countries, municipalities, and utilities.[59] However, Watanabe explained, Nissan did not want to over-invest in infrastructure:

> Some people are saying a quick charge system is mandatory and key to the marketing of the EV, which is not really true. If you know you won't drive 100 miles a day, you would charge at home, not go to an electrical station.

Nissan's partner AeroVironment built and installed home chargers for EVs in the United States for $2,200, or about $1,100 with a federal tax credit.[60]

One company taking the global lead in building charging station infrastructure was Silicon Valley start-up Better Place, founded by former SAP executive Shai Agassi. Renault and Nissan were working closely with Better Place and the governments of Israel and Denmark, among other countries, to build charging spots across those countries. Better Place ordered 100,000 units of Renault's Fluence Z.E. electric cars for its operations in Israel and Denmark.[61]

Renault EVs would arrive in Israel in October 2011, and the LEAF would arrive in summer 2012. Renault-Nissan and Better Place felt Israel was an ideal place to mass-market the electric car, since the country was only 8,500[62] square miles, about the size of New Jersey. Ninety percent of Israeli car owners drove less than 40 miles per day, and all major cities were less than

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[59] Taylor, "Here Comes the Electric Nissan LEAF," op. cit.

[60] The home charger also could be leased for $30 a month.
Jim Motavalli, "Nissan LEAF Electric Car Priced at $32,780," *The New York Times,* March 30, 2010.

[61] Jim Motavalli, "More Implausible than Le Carré: Renault's Electric-Car Espionage Case," The CBS Interactive Business Network, March 16, 2011.

[62] Israel Central Bureau of Statistics.

90 miles apart.[63] In Israel, Better Place had raised $200 million[64] by 2008 from holding company Israel Corp., investment bank Morgan Stanley, venture capital firm Vantage Point, and a group of private investors.[65] Better Place's goal was to raise $1 billion for the Israeli project.[66] In early 2010, Better Place raised $350 million[67] in a second round of equity, bringing the total to over $750 million. It was the largest venture deal of 2010.[68]

Like Israel, Denmark was considered an excellent country for mass-marketing electric cars. It was about 16,000 square miles[69] and needed only 750 wind turbines to power every car in the country.[70] The average commute in Denmark was 12.4 miles per day.[71] Renault EVs would arrive in Denmark in October 2011, and the LEAF would arrive in late 2011 or early 2012.

In March 2011, Renault and Better Place opened the first European Better Place center in Copenhagen, where customers could test drive and order a Renault Fluence "Prime Time" ZEV sedan. The price of the car was 205,000 DKK ($38,450.)[72] It had a range of 114 miles and a swappable battery. A battery subscription service was $277 to $556 per month, and a home charging station was $1,879. While these prices seemed high to American drivers, they added up to a cheaper investment for Danish drivers, given the price of a comparable gas or diesel car and the high price of gas in the country.[73] Charging networks had been built in more than 260 points in Denmark, and more than 1,000 were planned for the beginning of 2012.

Nissan also joined forces with U.S. company ECOtality North America (formerly known as eTec) to build 12,750 charging stations and deploy 5,000 LEAFs in five U.S. markets: the states of Tennessee and Oregon, the cities of San Diego and Seattle, and the Phoenix/Tucson region. By March 2011, ECOtality North America had installed 400 charging stations for on-road electric vehicles.[74] California-based Coulomb Technologies also was building charging stations, and in January 2011 GM announced that Coulomb's charging stations would be installed at its Chevy dealerships to support the Volt.[75]

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[63] Nissan press release, January 21, 2008.
http://www.nissan-global.com/EN/NEWS/2008/_STORY/080121-02-e.html.

[64] Bradford Plumer, "The Future of the Electric Car," *The New Republic*, August 25, 2008.

[65] Steven Scheer, "Renault to Develop Electric Cars for Israel," Reuters, January 22, 2008.

[66] Katie Fehrenbacher, "Better Place Fuels Up with $350M, Focuses on 2011," Gigaom, January 25, 2010.

[67] Camille Ricketts, "Better Place Draws a Massive $350M to Charge Electric Cars," *GreenBeat,* January 24, 2010.
http://venturebeat.com/2010/01/24/better-place-draws-massive-350m-to-charge-electric-cars

[68] "Venture Deal Flow Increased in 2010," TechJournal South, February 21, 2011.

[69] VisitDenmark.com, the official tourist Website of Denmark.

[70] Tamar Snyder, "Who Revived the Electric Car?" *The Jewish Week,* August 6, 2008.

[71] Melissa Valadon and Nicolaj Stenkjaer, "Do Electric Cars Make Sense in Denmark?" Nordic Folkecenter for Renewable Energy, January 2008.

[72] "Better Place and Renault Launch Fluence Z.E., the First 'Unlimited Mileage' Electric Car Together with Innovative eMobility Packages, in Europe's First Better Place Center," Better Place press release, March 3, 2011.

[73] Keith Berry, "Better Place Announces First EV Battery Prices," *Wired,* March 3, 2011.

[74] ECOtality North America.
http://www.ecotalityna.com/

[75] "Chevrolet to Provide Coulomb Electric Vehicle Charging Stations to Chevrolet Dealerships," *Entertainment Closeup,* January 24, 2011.

THE CREATION OF THE GLOBAL ZERO-EMISSION BUSINESS UNIT

In 2002 Nissan and Renault created Renault Nissan BV (RNBV), an Alliance-level body to help find synergies between Nissan and Renault.[76] During the economic downturn in 2009, RNBV was given real teeth and had the mission to accelerate and find an additional €1.5 billion of synergies. Thirteen units were created; one was for EVs, run by Watanabe. The position gave him visibility into the EV programs of both Nissan and Renault and the authority to make Alliance-level decisions. Watanabe also ran the EV business unit within Nissan. (RNBV managing directors doubled up, keeping their positions within Nissan and Renault.)

In setting up the EV business unit, Ghosn very consciously protected it to make sure it did not get cut or lose resources. This was especially important given that the auto industry was going through a serious downturn due to the world financial crisis. The business unit had what Watanabe called a special shield.

However, he said, at the same time Ghosn also told him not to build boundaries or silos because it was a cross-functional team and should do whatever was necessary to create zero-emission mobility. Watanabe added that although it sounded counterintuitive, Ghosn told him to build the business unit with an eye toward dismantling it eventually. "Mr. Ghosn told me: once all the supporting functions and infrastructure for the EV are set up and it is no longer special, we will not need a business unit or a protection shield – it will just be normal procedure."

Watanabe encouraged the team to take risks and not be scared to try new things. "We don't want to bet everything on the project, but trial and error is a learning process. It is training for us, so as we go along we make the organization stronger."

THE HOLISTIC APPROACH WITH ZERO-EMISSION BUSINESS AND ICE

The Nissan plant in Oppama modified its assembly line to produce normal internal combustion engine vehicles and EVs, making manufacturing capability quite flexible. Given Nissan's capability to allow various type of vehicles to be produced in the same production line, Watanabe said, there was no need to create a dedicated line for EVs, allowing the company to reduce investment costs significantly.

Ghosn did not believe the EV would be competing with other Nissan cars, at least initially:

> The guy who comes in to buy an EV in the beginning is completely different than the guy who buys a normal gasoline vehicle. However, once we get to 1 million or 1.5 million EVs, this is where we will stop some gasoline engine cars from the development and extend the EV product line.

But Ghosn didn't foresee those tradeoffs being made in the first steps. In addition, even if Ghosn's optimistic forecast of 10 percent market share for EVs by 2020 came true, that meant that 90 percent of the world's vehicles would still be ICE vehicles. So Nissan was pushing hard

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[76] See Stanford Graduate School of Business case SM166, "The Renault-Nissan Alliance in 2008: Exploring the Potential of a Novel Organizational Form," Robert A. Burgelman and Sara Gaviser Leslie.

to improve the efficiency of its ICE, which included the technology of the hybrid. According to Watanabe, "Nissan is not trying to convince the world that everything will be EV one day, but we are a company that is trying to propose various solutions which fit various needs. And that, of course, includes the ICE vehicle improvement."

Ghosn also emphasized that different people were in charge of Nissan's different products: zero-emission vehicles, entry level products, the V platform (the new small cars), and cars for emerging markets. "I don't think it's a systematic arbitrage, EV versus small car. I think they complement each other. Nissan employees feel good that on top of the EV we are paying attention to the entry level cars, the small cars, and the Infiniti. This gives them a sense that they can be bold in their strategy because the house does not depend only on them."

NISSAN'S ELECTRIC CAR STRATEGY IN THE CONTEXT OF THE RENAULT-NISSAN ALLIANCE

Ghosn explained that it would have been extremely difficult for Nissan or Renault to build and mass market the electric car without each other.

> The Alliance makes it happen; you need scale, you need financial power, and, frankly, the amount of investment necessary to develop the electric car is the same no matter if you have one company or two or three companies. So the more companies you have, the more you have a relatively light weight on your finances for the development of this effort.

Ghosn noted that the Alliance had to make sure high investment components, in particular the battery, were common from the start, in order to optimize costs. "Everything the consumer doesn't care about and doesn't see should be commonized. But then you have different designs, different concepts, and different functionalities."

However, Ghosn and Watanabe did not want Renault and Nissan duplicating development. According to Watanabe, Renault and Nissan could not predict all the customer needs and technical solutions that might come up in the future. "So, the best thing for us is to allocate work force efficiently between Renault and Nissan so we have various options in our pipeline to be able to adapt to whatever the customer needs or the market requires in the future."

For example, Renault was leading the technology on the quick drop system for replacing batteries, mainly to be used in Israel. However, if that was going to become the major technology in other regions, Nissan could quickly adopt it, because the technical knowledge was in the Alliance. Another example was Renault's work on the system for the motor, which was different from Nissan's.

The Alliance had a structure called EVCCT (Electric Vehicle Cross Company Team), and a subcommittee that exchanged information between Renault and Nissan. So from a technical point of view, the two companies shared new findings and experiences throughout the development phase. Across the Alliance, there were 2,000 people working on the EV, including

5 percent of the Alliance's engineers. That was still a fairly small number, but Ghosn felt it was appropriate for the size of the EV program.

In addition to sharing technological information, Renault and Nissan could communicate about distinct business models for each region, which translated to significant synergies. The companies also could share investments for battery plants. For example, land owned by Renault in Portugal would be used to build Nissan's battery plant in order to take advantage of substantial incentives offered by the Portuguese government. This would allow Renault and Nissan to maximize synergies as well as share back offices. Overall, the Alliance allowed the two companies to more efficiently negotiate with authorities, governments, or third parties. Renault dealt with the French government and Nissan dealt with the Japanese and U.S. governments. According to Palmer, this collaboration was critical:

> If either company had tried to go it alone, I don't think we would have sold the electric car any further than the shores of Japan because we did not have the ability to go in and have credibility in front of governments. The combination of Renault and Nissan allowed us to go to every government around the world and say, "We as the Alliance, as the [combined] No. 3 manufacturer of motor cars in the world, believe in this technology." That is why the Alliance is important beyond the sharing of parts.

Nissan's LEAF would be present in the United States, Japan, and Europe, and the idea was to have a global car that could comply with all the regulations and customer needs in those regions. That led Nissan to be in the C-segment (mid-sized cars) area, with the 5-door hatchback. Renault would concentrate more exclusively on the European region and would focus its mass market effort on smaller cars like B-segment (compact) cars. But the strategy for both companies was common – jumping into the volume zone.

As chairman, Ghosn said, it was his job to make decisions in areas such as allocating the capacity of batteries between the two companies. He also decided how much each company would invest in establishing a new plant. One tricky area to negotiate was the price AESC charged Renault for batteries. Otani noted that Renault wanted to buy the batteries as cheaply as possible, but Nissan wanted to sell the batteries at a high price. However, Renault planned to buy part of its batteries from LG Chem, which kept AESC's prices competitive. Ghosn was a firm believer in the win-win philosophy he had established for the Alliance, the idea that decisions would benefit both companies.

Ghosn said the skills necessary for the electric car were so specific that he didn't think he would be able to draw too many engineers and executives from inside the organization, and therefore he would be hiring from the outside. "Technically, the top executives do not have competencies in this area, because they are more from the past. But we are having a new generation of engineers who are participating in this new adventure of the electric car, and they are going to come to the front very quickly." For battery development, Nissan was snatching up as many chemical engineers as possible. Chemical engineering had not been very popular among young Japanese, who saw a career path only to chemical factories. Ghosn hoped these new opportunities would spur more students to go into the field.

Ghosn said his role remained to push the idea of the EV inside the Alliance, especially because the EV was such new territory. "You still have people inside the Alliance saying, 'Why are we doing all of this? Why are we wasting all this money? We can do ICE. We can do a hybrid.' So we need to push it to make sure that EV is a priority."

CONCLUSION

Ghosn had seen many people drive the LEAF and come out with a smile, and Nissan called this phenomenon the LEAF smile. Ghosn hoped that before too long, millions of people across the globe would experience the LEAF smile and become converts to this breakthrough technology. He wanted the Alliance to have a 20 percent share of the EV market by 2020. But Nissan had to carefully consider its strategy decisions over the next one to two years if it wanted to achieve its goals. Now that the Nissan LEAF was in the market and the company was on track to sell tens of thousands by the end of 2011, Ghosn said he had to move to the next level.

> Now that we have taken the leadership in zero-emission affordable cars, the challenge is to figure out how we can transform this leadership into a massive market advantage; a massive brand strength; and a massive, significant factor of transformation of the entire car industry. We want to be the company that makes the car friendlier, more environmentally sound, and turns it into a modern object for the twenty-first century.

Exhibit 1
New Car Sales for Select Countries and Regions in 2010 (in millions)

	2010	growth from 2009
U.S.	11.5	10.5%
China	18	32%
Japan	5	7.5%
European Union	13.4	-5.5%
India	2	30%
Russia	13	30%

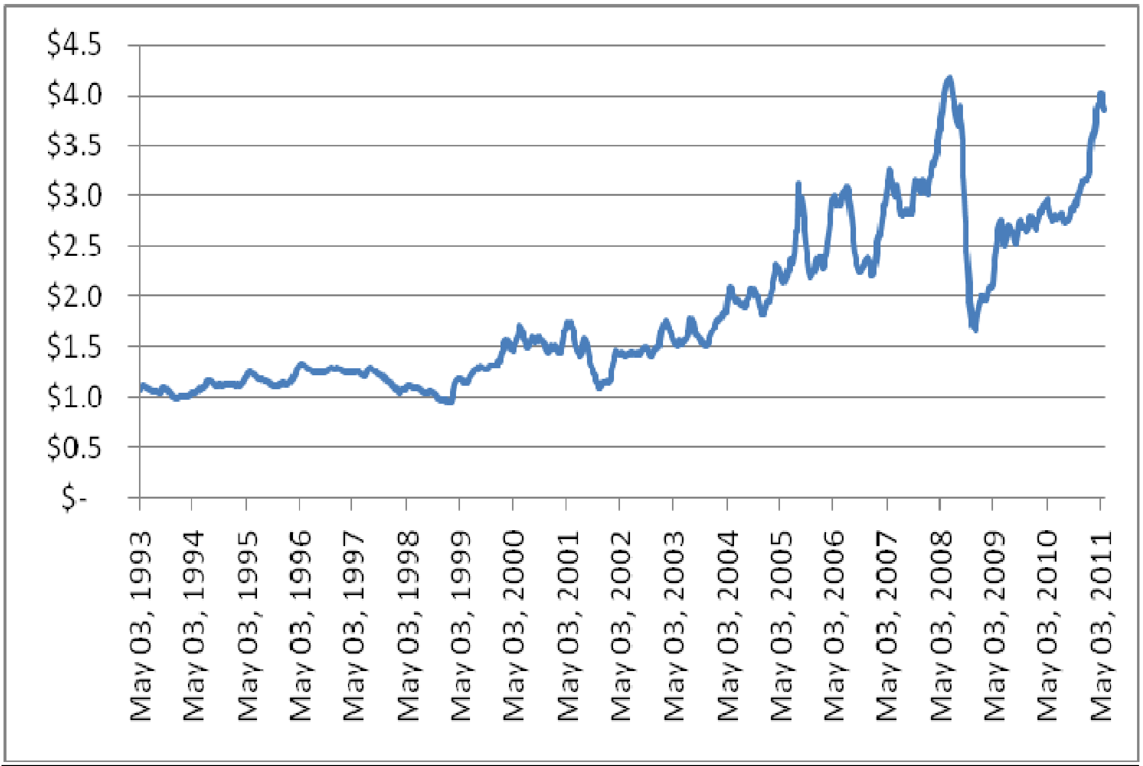
Source: Compiled by case author.

Exhibit 2
U.S. Hybrid Sales by Brand in 2009

Toyota	174,046
Honda	35,651
Ford	33,927
Lexus	21,499
GM	17,656
Nissan	9,423
Total	292,202

Source: EVs Roll.
http://evsroll.com/Hybrid_Car_Statistics.html

Exhibit 3
U.S. Gasoline Prices Historical Chart
(Dollars per Gallon)



Source: U.S. Energy Information Administration.
http://www.eia.gov/dnav/pet/hist/LEAFHandler.ashx?n=PET&s=EMM_EPM0_PTE_NUS_DPG&f=M

Exhibit 4
Mandated Miles Per Gallon (mpg) for Select Countries or Regions

	2011	2012	2015	2016	2020	2025
U.S.	27.5 mpg for passenger cars; 20.7 mpg for light trucks			39 mpg for passenger cars; 30 mpg for light trucks*		Obama administration proposal: 62 mpg
European Union	40 mpg	47 mpg, 52 mpg diesel			57.6 mpg	
China	43 mpg for lighter cars 21 mpg for heavier cars		42.2 mpg			
Japan	35 mpg		47 mpg			

* The Obama administration estimated that to meet these new regulations, car manufacturers would have an added cost of more than $1,300 per vehicle.
Sources: Clean Technica, BBC News, USA Today, The New York Times, The Global Fuel Economy Initiative, The Encyclopedia of Earth, J.D. Power and Associates, Environment for Europeans, Brookings.

Exhibit 5
Government Programs to Promote Electric Vehicles (Select Countries)

	Tax Incentives	Rebates/ Subsidies	Funding to Manufacturers
United States federal government	$7,500		$2.4 billion grants $25 billion direct DOE loans
U.S. individual states	Varied	Varied	
Israel	Reducing 78% tax to 10% for EVs		
Denmark	$40,000		
China		$7,300 - $8,900 for fleets and taxis. In five major cities $7,300 to $8,900. Nationwide $4,400 for qualified fuel efficient vehicles	$100 billion yuan ($15 billion) through 2021
U.K. and Republic of Ireland		$7,800	
France		€5,000 ($7,100)	$550 million
Germany			€2 billion ($2.8 billion)
Belgium		$11,700	
Japan		780,000 yen	R&D support (amount unclear)

Note: Exchange rates are from March 22, 2011.
Sources: Compiled by case author.

Exhibit 6
Psychographics of Hybrid Vehicle Owners
2009

	Smart Greens	Informed Consumer	Early Adopter	Active Lifestyle	Family Centered
Hybrid Vehicle Owners	45%	52%	44%	55%	52%
U.S. National Average	37%	42%	33%	42%	41%

Note: Values are the percentage of responders who answered "above average" or "far above average" to each of the questions.
Sources: Experian Simmons National Consumer Study, Summer 2009.
SBI Energy "Electric Vehicle and Plug in Hybrid Markets Worldwide," March 2010.

Exhibit 7
Nissan Executive Bios

Carlos Ghosn

President and chief executive officer, Nissan Motor Co.
President and chief executive officer, Renault SA

Carlos Ghosn is the president and chief executive officer of Nissan Motor Co., Ltd. Ghosn joined the company as its chief operating officer in June 1999, became its president in June 2000, and was named chief executive officer in June 2001. Ghosn was named president and chief executive officer of Renault SA in May 2005, in addition to his responsibilities at Nissan. In May 2009 he was appointed chairman and chief executive officer of Renault. Prior to joining Nissan, Mr. Ghosn served as executive vice president of the Renault Group, a position he had held since December 1996.

Before he joined Renault, Ghosn worked with Michelin for 18 years. As chairman and chief executive officer of Michelin North America, Ghosn presided over the restructuring of the company after its acquisition of the Uniroyal Goodrich Tire Company in 1990. Previously, Mr. Ghosn had worked as the chief operating officer of Michelin's South American activities based in Brazil; as head of research and development for industrial tires in Ladoux, France; and as plant manager in Le Puy, France.

Ghosn was born in Brazil and graduated with engineering degrees from the Ecole Polytechnique in 1974 and from the Ecole des Mines de Paris in 1978.

Mitsuhiko Yamashita

Member of the board of directors and executive vice president of Nissan Motor Co.

Mitsuhiko Yamashita joined Nissan Motor Co., Ltd. in 1979. He worked in Nissan's Research and Development group, becoming senior manager and then general manager of Vehicle Design Engineering Department No. 1 in 2001. In 2002 Yamashita transferred to the Nissan Technical Center in North America, and in 2004 he became senior vice president in charge of the Environmental and Safety Engineering Department, the Technology Planning Department, the Materials Engineering Department, the Measurement Engineering Department, the Advanced Vehicle Engineering Division, and the Electronics Division. In 2005, he became the executive vice president supervising Research, Technology and Engineering and also became a member of the board of directors. The following year he became executive vice president supervising Research and Development. Since 2007 he has served as executive vice president supervising Research and Development, Total Customer Satisfaction Function (TCSX).

Yamashita graduated from Kyoto University with a master's degree in aeronautical engineering, and he conducted advanced research at MIT.

Andy Palmer

Executive vice president, Nissan Motor Co.
Global Corporate Planning, Product Planning & Program Management Division

Andy Palmer is executive vice present of Nissan Motor Co., Ltd., in charge of Global Product Planning, Global Program Management, Global Marketing Intelligence, Global IS, Global Infinity Business Unit, Global Marketing Communications, and Global Corporate Planning (including OEM business). Palmer joined Nissan in 1991 as business administration manager at the Nissan Technical Centre Europe (NTCE), becoming deputy managing director of NTCE in 2001. In 2002, he transferred to Japan as program director for light commercial vehicles (LCVs). In 2003, Palmer was appointed president of Nissan Motor Light Trucks Co., Ltd, while retaining his duties as program director.

In 2004, Palmer established the LCV business unit within Nissan, and in 2005 he was promoted to corporate vice president in charge of the unit. In 2009, Palmer was appointed senior vice president and a member of Nissan's executive committee. In 2010, his scope of responsibilities was extended to include Global Marketing and Brand and Communications. Prior to joining Nissan, Palmer worked at Rover Group and Automotive Products, Ltd.

Palmer graduated from Warwick University with a master's degree in product engineering and from Cranfield University with a doctorate in management.

Hideaki Watanabe

Corporate vice president of Nissan Motor Co.
Alliance Managing Director of the Zero-emissions Business

Hideaki Watanabe joined Nissan Motor Co., Ltd, in 1989. In 1998 he was assigned to Nissan North America's Purchasing Department. In 2002 he became the manager of Renault Nissan Purchasing Powertrain, and in 2003 became manager of the Purchasing Strategy Department. In 2006 he was manager of Product Purchasing Department No. 2, becoming program director of the Program Director Office a year later. In 2009 he became divisional general manager of the Global Zero Emissions Business Unit, and in 2010 he moved to his current position as Alliance managing director of the Zero-Emissions Business Unit.

Watanabe graduated from the faculty of law at Keio University.

Toshiaki Otani

Corporate vice president of Nissan Motor Co.
Alliance managing director of the Global Battery Business

Toshiaki Otani joined Nissan Motor Co., Ltd. in 1980, and served at Nissan Motor Iberica S.A. from 1995 to 2000. He then became group general manager and deputy general manager of Parts Purchasing Department No.1. After serving as senior manager of the purchasing strategy department, he became vice president of Nissan North America Inc. From 2005 to 2010 he was vice president and managing director at Dongfeng Motor Co., Ltd. and Dongfeng Nissan Passenger Vehicle Company, respectively. In 2010 he became corporate vice president in charge of the Global Battery Business. Otani graduated from the Faculty of Economics at Kyoto University.

Takashi Sakagami
President of 4R Energy Corporation

Takashi Sakagami began his career at Nissan Motor Co., Ltd. in 1986 at the Africa Department, moving the next year to Dealer Sales at Nissan Sunny Tokyo. In 1989 he moved to the Middle East and Africa Department, where he was in charge of the African market and then the Saudi Arabian market. After serving as sales manager at the Jeddah office, Saudi Arabia, he worked in the Marketing and Sales Department in charge of South African business, becoming manager of the department in 2000. From 2004 to 2009, he worked at the Corporate Planning Department for mid-term planning as manager, senior manager, and then general manager. In 2010 he moved to the Zero-Emissions Vehicle Strategy Group at Nissan before becoming general manager and then president of 4R Energy Corporation. Sakagami graduated from Keio University with a BA in law.

Exhibit 8
Renault-Nissan Alliance Financial Information
Nissan Motor Company Income Statement

Chart Selected Items For the Fiscal Period Ending *Currency*	Reclassified 12 months Mar-31-2006 *JPY*	12 months Mar-31-2007 *JPY*	Reclassified 12 months Mar-31-2008 *JPY*	12 months Mar-31-2009 *JPY*	12 months Mar-31-2010 *JPY*	LTM 12 months Dec-31-2010 *JPY*
Revenue	8,880,349.0	9,773,871.0	10,070,983.0	7,771,925.0	6,967,373.0	8,055,758.0
Finance Div. Revenue	547,943.0	694,712.0	753,255.0	665,049.0	549,904.0	503,775.0
Other Revenue	-	-	-	-	-	-
Total Revenue	**9,428,292.0**	**10,468,583.0**	**10,824,238.0**	**8,436,974.0**	**7,517,277.0**	**8,559,533.0**
Cost Of Goods Sold	6,649,937.0	7,498,350.0	7,820,372.0	6,613,295.0	5,749,802.0	6,612,808.0
Finance Div. Operating Exp.	391,050.0	528,836.0	587,026.0	505,567.0	396,417.0	350,723.0
Gross Profit	**2,387,305.0**	**2,441,397.0**	**2,416,840.0**	**1,318,112.0**	**1,371,058.0**	**1,596,002.0**
Selling General & Admin Exp.	1,402,788.0	1,546,794.0	1,509,936.0	1,287,601.0	952,860.0	977,173.0
Provision for Bad Debts	35,005.0	38,282.0	43,776.0	94,941.0	45,984.0	26,703.0
R & D Exp.	-	-	-	-	-	-
Depreciation & Amort.	72,888.0	73,045.0	75,742.0	78,020.0	65,289.0	65,289.0
Amort. of Goodwill and Intangibles	4,783.0	6,337.0	7,565.0	6,494.0	6,221.0	6,221.0
Other Operating Expense/(Income)	-	-	-	-	-	-
Other Operating Exp., Total	**1,515,464.0**	**1,664,458.0**	**1,637,019.0**	**1,467,056.0**	**1,070,354.0**	**1,075,386.0**
Operating Income	**871,841.0**	**776,939.0**	**779,821.0**	**(148,944.0)**	**300,704.0**	**520,616.0**
Interest Expense	(25,646.0)	(30,664.0)	(36,118.0)	(33,798.0)	(28,995.0)	(28,100.0)
Interest and Invest. Income	21,080.0	25,546.0	28,205.0	22,711.0	15,768.0	16,806.0
Net Interest Exp.	**(4,566.0)**	**(5,118.0)**	**(7,913.0)**	**(11,087.0)**	**(13,227.0)**	**(11,294.0)**
Income/(Loss) from Affiliates	37,049.0	20,187.0	37,217.0	(1,369.0)	(50,587.0)	29,653.0
Currency Exchange Gains (Loss)	(34,836.0)	5,796.0	(28,991.0)	5,012.0	(10,554.0)	(29,672.0)
Other Non-Operating Inc. (Exp.)	(5,986.0)	(25,825.0)	(6,832.0)	(16,352.0)	(18,589.0)	8,789.0
EBT Excl. Unusual Items	**863,502.0**	**771,979.0**	**773,302.0**	**(172,740.0)**	**207,747.0**	**518,092.0**
Restructuring Charges	(9,404.0)	(20,565.0)	(7,309.0)	(4,150.0)	3,921.0	0.0
Impairment of Goodwill	-	-	-	-	-	-
Gain (Loss) On Sale Of Invest.	38,331.0	7,228.0	541.0	(3,009.0)	(2,703.0)	(3,210.0)
Gain (Loss) On Sale Of Assets	(5,471.0)	3,096.0	56,797.0	33,868.0	(11,435.0)	(5,549.0)
Asset Writedown	(26,827.0)	(22,673.0)	(8,878.0)	(19,649.0)	(35,682.0)	(19,395.0)
Other Unusual Items	(51,090.0)	(41,633.0)	(46,495.0)	(53,091.0)	(20,228.0)	(8,632.0)
EBT Incl. Unusual Items	**809,041.0**	**697,432.0**	**767,958.0**	**(218,771.0)**	**141,620.0**	**481,306.0**
Income Tax Expense	254,408.0	212,162.0	262,708.0	36,938.0	91,540.0	179,078.0
Earnings from Cont. Ops.	**554,633.0**	**485,270.0**	**505,250.0**	**(255,709.0)**	**50,080.0**	**302,228.0**
Earnings of Discontinued Ops.	-	-	-	-	-	-
Extraord. Item & Account. Change	-	-	-	-	-	-
Net Income to Company	**554,633.0**	**485,270.0**	**505,250.0**	**(255,709.0)**	**50,080.0**	**302,228.0**
Minority Int. in Earnings	(36,583.0)	(24,474.0)	(22,989.0)	22,000.0	(7,690.0)	(25,361.0)
Net Income	**518,050.0**	**460,796.0**	**482,261.0**	**(233,709.0)**	**42,390.0**	**276,867.0**
Pref. Dividends and Other Adj.	573.0	-	-	-	-	-
NI to Common Incl Extra Items	**517,477.0**	**460,796.0**	**482,261.0**	**(233,709.0)**	**42,390.0**	**276,867.0**
NI to Common Excl. Extra Items	**517,477.0**	**460,796.0**	**482,261.0**	**(233,709.0)**	**42,390.0**	**276,867.0**
Per Share Items						
Basic EPS	¥ 126.940	¥ 112.331	¥ 117.757	¥ (57.377)	¥ 10.401	¥ 66.720
Basic EPS Excl. Extra Items	126.940	112.331	117.757	(57.377)	10.401	66.720
Weighted Avg. Basic Shares Out.	4,076.6	4,102.1	4,095.4	4,073.2	4,075.5	4,149.7
Diluted EPS	¥ 125.960	¥ 111.710	¥ 117.560	¥ (57.377)	¥ 10.401	¥ 66.720
Diluted EPS Excl. Extra Items	125.960	111.710	117.560	(57.377)	10.401	66.720
Weighted Avg. Diluted Shares Out.	4,108.2	4,124.9	4,102.3	4,073.2	4,075.5	4,149.7
Normalized Basic EPS	¥ 132.389	¥ 117.619	¥ 118.014	¥ (26.505)	¥ 31.859	¥ 78.031
Normalized Diluted EPS	131.370	116.971	117.815	(26.505)	31.859	78.031
Dividends per Share	¥ 29.00	¥ 34.00	¥ 40.00	¥ 11.00	NA	¥ 5.00
Payout Ratio %	20.4%	28.4%	31.5%	NM	NA	7.6%
Shares per Depository Receipt	2.000	2.000	2.000	2.000	2.000	2.000

Source: Capital IQ.

Exhibit 8 (continued)
Renault-Nissan Alliance Financial Information
Nissan Motor Company Balance Sheet

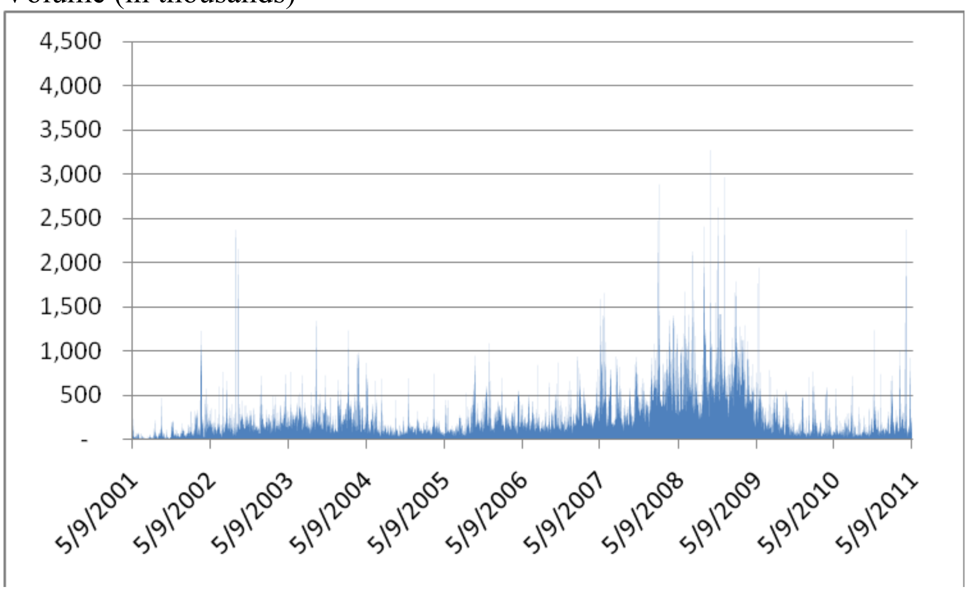
Balance Sheet as of:	Mar-31-2006	Mar-31-2007	Mar-31-2008	Mar-31-2009	Mar-31-2010	Dec-31-2010
Currency	*JPY*	*JPY*	*JPY*	*JPY*	*JPY*	*JPY*
ASSETS						
Cash And Equivalents	402,968.0	450,916.0	561,900.0	621,783.0	795,435.0	676,782.0
Short Term Investments	11,589.0	28,255.0	24,643.0	126,968.0	50,641.0	78,568.0
Total Cash & ST Investments	**414,557.0**	**479,171.0**	**586,543.0**	**748,751.0**	**846,076.0**	**755,350.0**
Accounts Receivable	400,592.0	583,004.0	608,195.0	330,182.0	549,377.0	540,915.0
Total Receivables	**400,592.0**	**583,004.0**	**608,195.0**	**330,182.0**	**549,377.0**	**540,915.0**
Inventory	856,499.0	1,004,671.0	1,005,165.0	760,070.0	802,278.0	1,043,502.0
Finance Div. Loans and Leases, ST	3,589,156.0	3,557,255.0	3,234,629.0	2,710,472.0	2,646,177.0	2,599,287.0
Finance Div. Other Curr. Assets	11,804.0	7,009.0	8,325.0	10,931.0	6,975.0	12,891.0
Deferred Tax Assets, Curr.	314,859.0	324,979.0	299,306.0	226,516.0	229,093.0	-
Other Current Assets	434,787.0	536,797.0	552,061.0	492,460.0	500,434.0	784,192.0
Total Current Assets	**6,022,254.0**	**6,492,886.0**	**6,294,224.0**	**5,279,382.0**	**5,580,410.0**	**5,736,137.0**
Gross Property, Plant & Equipment	8,516,356.0	9,226,537.0	8,982,492.0	8,292,067.0	8,130,752.0	7,749,011.0
Accumulated Depreciation	(4,077,548.0)	(4,349,349.0)	(4,355,940.0)	(4,182,020.0)	(4,272,623.0)	(4,164,745.0)
Net Property, Plant & Equipment	**4,438,808.0**	**4,877,188.0**	**4,626,552.0**	**4,110,047.0**	**3,858,129.0**	**3,584,266.0**
Long-term Investments	401,520.0	384,337.0	450,776.0	299,208.0	265,710.0	375,052.0
Goodwill	86,719.0	83,705.0	83,466.0	76,190.0	64,454.0	-
Other Intangibles	100,230.0	101,608.0	102,880.0	91,028.0	79,457.0	131,364.0
Finance Div. Other LT Assets	1,866.0	1,875.0	1,393.0	1,369.0	3,045.0	3,539.0
Loans Receivable Long-Term	18,520.0	26,322.0	24,555.0	23,045.0	11,125.0	-
Deferred Tax Assets, LT	163,550.0	157,495.0	94,420.0	113,320.0	133,666.0	-
Deferred Charges, LT	508.0	-	-	-	-	-
Other Long-Term Assets	247,451.0	276,792.0	261,216.0	245,951.0	218,824.0	287,942.0
Total Assets	**11,481,426.0**	**12,402,208.0**	**11,939,482.0**	**10,239,540.0**	**10,214,820.0**	**10,118,300.0**
LIABILITIES						
Accounts Payable	957,055.0	1,076,607.0	1,083,524.0	596,998.0	974,862.0	1,071,275.0
Accrued Exp.	629,838.0	589,337.0	563,672.0	452,065.0	523,444.0	478,442.0
Curr. Port. of Cap. Leases	57,804.0	49,819.0	74,827.0	71,177.0	64,780.0	80,571.0
Finance Div. Debt Current	2,534,485.0	3,098,013.0	2,757,754.0	2,291,688.0	1,626,809.0	1,581,398.0
Finance Div. Other Curr. Liab.	26,539.0	26,579.0	35,906.0	24,906.0	26,425.0	16,812.0
Def. Tax Liability, Curr.	8,063.0	9,064.0	1,501.0	198.0	114.0	-
Other Current Liabilities	637,925.0	725,900.0	725,432.0	551,662.0	640,424.0	609,160.0
Total Current Liabilities	**4,851,709.0**	**5,575,319.0**	**5,242,616.0**	**3,988,694.0**	**3,856,858.0**	**3,837,658.0**
Long-Term Debt	556,080.0	389,552.0	403,111.0	805,885.0	857,433.0	652,967.0
Capital Leases	71,708.0	59,140.0	85,203.0	105,278.0	86,206.0	78,593.0
Finance Div. Debt Non-Curr.	1,597,815.0	1,507,969.0	1,420,689.0	1,489,700.0	1,442,038.0	1,426,064.0
Pension & Other Post-Retire. Benefits	267,695.0	194,494.0	181,368.0	186,983.0	176,941.0	174,736.0
Def. Tax Liability, Non-Curr.	502,091.0	507,600.0	461,792.0	447,140.0	445,299.0	-
Other Non-Current Liabilities	260,452.0	291,140.0	295,260.0	289,807.0	334,940.0	767,678.0
Total Liabilities	**8,107,550.0**	**8,525,214.0**	**8,090,039.0**	**7,313,487.0**	**7,199,715.0**	**6,937,696.0**
Common Stock	605,814.0	605,814.0	605,814.0	605,814.0	605,814.0	605,814.0
Additional Paid In Capital	804,470.0	804,470.0	804,470.0	804,470.0	804,470.0	804,470.0
Retained Earnings	2,116,825.0	2,402,726.0	2,726,859.0	2,415,735.0	2,456,523.0	2,702,479.0
Treasury Stock	(249,153.0)	(226,394.0)	(269,003.0)	(269,540.0)	(267,841.0)	(161,549.0)
Comprehensive Inc. and Other	(189,973.0)	(38,668.0)	(361,462.0)	(928,757.0)	(889,228.0)	(1,093,351.0)
Total Common Equity	**3,087,983.0**	**3,547,948.0**	**3,506,678.0**	**2,627,722.0**	**2,709,738.0**	**2,857,863.0**
Minority Interest	285,893.0	329,046.0	342,765.0	298,331.0	305,367.0	322,741.0
Total Equity	**3,373,876.0**	**3,876,994.0**	**3,849,443.0**	**2,926,053.0**	**3,015,105.0**	**3,180,604.0**
Total Liabilities And Equity	**11,481,426.0**	**12,402,208.0**	**11,939,482.0**	**10,239,540.0**	**10,214,820.0**	**10,118,300.0**

Source: Capital IQ.

Exhibit 8 (continued)
Renault-Nissan Alliance Financial Information
Nissan Motor Company Share Price and Volume

Adjusted Closing Price in USD

Volume (in thousands)



Source: Yahoo Finance.

Exhibit 8 (continued)
Renault-Nissan Alliance Financial Information
Renault SA Income Statement

For the Fiscal Period Ending	12 months Dec-31-2005	12 months Dec-31-2006	12 months Dec-31-2007	12 months Dec-31-2008	12 months Dec-31-2009	12 months Dec-31-2010
Currency	*EUR*	*EUR*	*EUR*	*EUR*	*EUR*	*EUR*
Revenue	38,366.0	38,409.0	38,679.0	35,757.0	31,951.0	37,172.0
Finance Div. Revenue	1,880.0	1,923.0	2,003.0	2,034.0	1,761.0	1,799.0
Other Revenue	-	-	-	-	-	-
Total Revenue	**40,246.0**	**40,332.0**	**40,682.0**	**37,791.0**	**33,712.0**	**38,971.0**
Cost Of Goods Sold	31,080.0	31,343.0	31,408.0	29,659.0	26,978.0	30,620.0
Finance Div. Operating Exp.	926.0	985.0	1,121.0	1,292.0	953.0	813.0
Gross Profit	**8,240.0**	**8,004.0**	**8,153.0**	**6,840.0**	**5,781.0**	**7,538.0**
Selling General & Admin Exp.	4,883.0	4,978.0	4,949.0	4,770.0	4,382.0	4,605.0
R & D Exp.	2,034.0	1,963.0	1,850.0	1,744.0	1,795.0	1,834.0
Depreciation & Amort.	-	-	-	-	-	-
Other Operating Expense/(Income)	(267.0)	(50.0)	0.0	0.0	0.0	0.0
Other Operating Exp., Total	**6,650.0**	**6,891.0**	**6,799.0**	**6,514.0**	**6,177.0**	**6,439.0**
Operating Income	**1,590.0**	**1,113.0**	**1,354.0**	**326.0**	**(396.0)**	**1,099.0**
Interest Expense	(248.0)	(333.0)	(375.0)	(373.0)	(471.0)	(500.0)
Interest and Invest. Income	153.0	223.0	274.0	157.0	118.0	146.0
Net Interest Exp.	**(95.0)**	**(110.0)**	**(101.0)**	**(216.0)**	**(353.0)**	**(354.0)**
Income/(Loss) from Affiliates	2,606.0	2,277.0	1,675.0	437.0	(1,561.0)	1,289.0
Currency Exchange Gains (Loss)	(8.0)	18.0	(4.0)	14.0	1.0	5.0
Other Non-Operating Inc. (Exp.)	47.0	49.0	128.0	134.0	(9.0)	4.0
EBT Excl. Unusual Items	**4,140.0**	**3,347.0**	**3,052.0**	**695.0**	**(2,318.0)**	**2,043.0**
Restructuring Charges	(109.0)	(241.0)	(143.0)	(489.0)	(218.0)	(449.0)
Impairment of Goodwill	-	-	-	-	-	-
Gain (Loss) On Sale Of Invest.	(271.0)	135.0	53.0	509.0	(43.0)	1,969.0
Gain (Loss) On Sale Of Assets	-	-	23.0	158.0	(16.0)	151.0
Asset Writedown	-	-	-	(114.0)	(297.0)	(159.0)
Other Unusual Items	33.0	(26.0)	4.0	2.0	(28.0)	(7.0)
EBT Incl. Unusual Items	**3,793.0**	**3,215.0**	**2,989.0**	**761.0**	**(2,920.0)**	**3,548.0**
Income Tax Expense	331.0	255.0	255.0	162.0	148.0	58.0
Earnings from Cont. Ops.	**3,462.0**	**2,960.0**	**2,734.0**	**599.0**	**(3,068.0)**	**3,490.0**
Earnings of Discontinued Ops.	-	-	-	-	-	-
Extraord. Item & Account. Change	-	-	-	-	-	-
Net Income to Company	**3,462.0**	**2,960.0**	**2,734.0**	**599.0**	**(3,068.0)**	**3,490.0**
Minority Int. in Earnings	(86.0)	(74.0)	(65.0)	(28.0)	(57.0)	(70.0)
Net Income	**3,376.0**	**2,886.0**	**2,669.0**	**571.0**	**(3,125.0)**	**3,420.0**
Pref. Dividends and Other Adj.	-	-	-	-	-	-
NI to Common Incl Extra Items	**3,376.0**	**2,886.0**	**2,669.0**	**571.0**	**(3,125.0)**	**3,420.0**
NI to Common Excl. Extra Items	**3,376.0**	**2,886.0**	**2,669.0**	**571.0**	**(3,125.0)**	**3,420.0**
Per Share Items						
Basic EPS	€ 13.230	€ 11.230	€ 10.320	€ 2.226	€ (12.135)	€ 12.700
Basic EPS Excl. Extra Items	13.230	11.230	10.320	2.226	(12.135)	12.700
Weighted Avg. Basic Shares Out.	255.2	257.0	258.6	256.6	257.5	269.3
Diluted EPS	€ 13.120	€ 11.100	€ 10.170	€ 2.220	€ (12.130)	€ 12.700
Diluted EPS Excl. Extra Items	13.120	11.100	10.170	2.220	(12.130)	12.700
Weighted Avg. Diluted Shares Out.	257.3	260.1	262.4	256.8	257.5	269.3
Normalized Basic EPS	€ 10.140	€ 8.140	€ 7.376	€ 1.693	€ (5.626)	€ 4.742
Normalized Diluted EPS	10.055	8.043	7.270	1.691	(5.626)	4.742
Dividends per Share	€ 2.40	€ 3.10	€ 3.80	NA	NA	€ 0.30
Payout Ratio %	14.6%	23.0%	32.3%	183.7%	NA	NA
Shares per Depository Receipt	1.000	1.000	1.000	1.000	1.000	1.000

Source: Capital IQ.

Exhibit 8 (continued)
Renault-Nissan Alliance Financial Information
Renault SA Balance Sheet

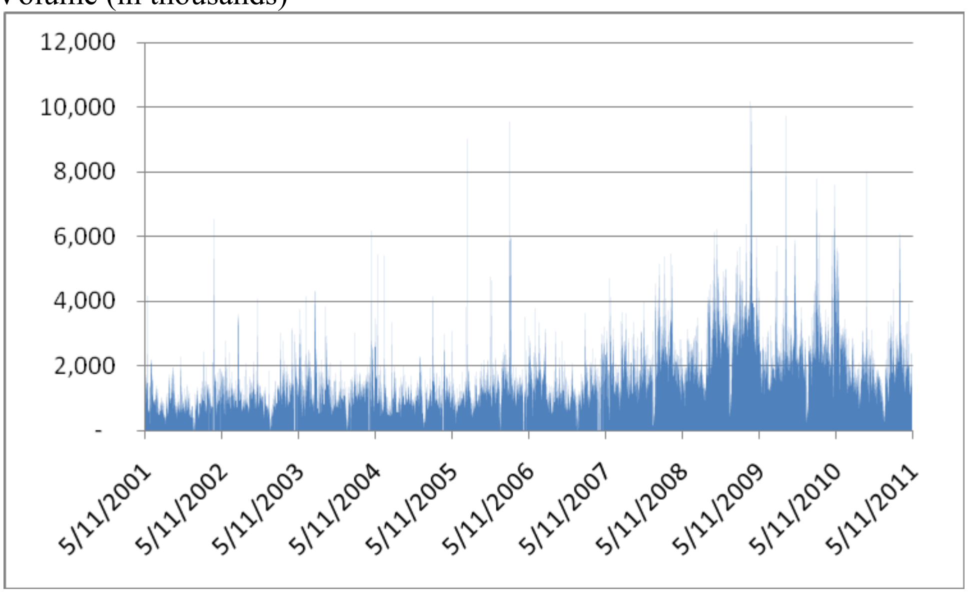
Balance Sheet as of:	Restated Dec-31-2005	Restated Dec-31-2006	Dec-31-2007	Dec-31-2008	Dec-31-2009	Dec-31-2010
Currency	*EUR*	*EUR*	*EUR*	*EUR*	*EUR*	*EUR*
ASSETS						
Cash And Equivalents	6,151.0	6,010.0	4,721.0	2,058.0	8,023.0	10,025.0
Short Term Investments	469.0	312.0	204.0	122.0	68.0	56.0
Total Cash & ST Investments	**6,620.0**	**6,322.0**	**4,925.0**	**2,180.0**	**8,091.0**	**10,081.0**
Accounts Receivable	2,055.0	2,102.0	2,083.0	1,752.0	1,097.0	1,329.0
Other Receivables	2,034.0	1,627.0	1,792.0	2,095.0	1,518.0	1,591.0
Notes Receivable	1,141.0	1,575.0	669.0	437.0	327.0	485.0
Total Receivables	**5,230.0**	**5,304.0**	**4,544.0**	**4,284.0**	**2,942.0**	**3,405.0**
Inventory	5,857.0	5,309.0	5,932.0	5,266.0	3,932.0	4,567.0
Prepaid Exp.	120.0	148.0	259.0	184.0	218.0	183.0
Finance Div. Loans and Leases, ST	20,700.0	20,360.0	20,430.0	18,318.0	18,243.0	19,276.0
Finance Div. Other Curr. Assets	-	-	176.0	498.0	-	-
Other Current Assets	520.0	610.0	514.0	548.0	487.0	347.0
Total Current Assets	**39,047.0**	**38,053.0**	**36,780.0**	**31,278.0**	**33,913.0**	**37,859.0**
Gross Property, Plant & Equipment	28,971.0	30,203.0	30,461.0	30,591.0	31,308.0	32,092.0
Accumulated Depreciation	(16,280.0)	(17,037.0)	(17,406.0)	(17,773.0)	(19,014.0)	(20,588.0)
Net Property, Plant & Equipment	**12,691.0**	**13,166.0**	**13,055.0**	**12,818.0**	**12,294.0**	**11,504.0**
Long-term Investments	12,460.0	12,980.0	13,221.0	13,972.0	12,332.0	15,199.0
Goodwill	247.0	278.0	300.0	274.0	232.0	250.0
Other Intangibles	108.0	82.0	96.0	97.0	156.0	149.0
Finance Div. Other LT Assets	13.0	15.0	21.0	23.0	26.0	34.0
Loans Receivable Long-Term	87.0	78.0	72.0	68.0	68.0	89.0
Deferred Tax Assets, LT	355.0	313.0	220.0	252.0	279.0	705.0
Deferred Charges, LT	2,617.0	3,062.0	3,660.0	3,942.0	3,505.0	3,278.0
Other Long-Term Assets	747.0	824.0	773.0	1,107.0	1,173.0	1,040.0
Total Assets	**68,372.0**	**68,851.0**	**68,198.0**	**63,831.0**	**63,978.0**	**70,107.0**
LIABILITIES						
Accounts Payable	7,788.0	7,384.0	8,224.0	5,420.0	5,911.0	6,348.0
Accrued Exp.	1,834.0	2,001.0	2,071.0	1,542.0	1,853.0	2,213.0
Short-term Borrowings	46.0	-	-	1,018.0	617.0	416.0
Curr. Port. of LT Debt	2,501.0	3,715.0	1,517.0	4,201.0	3,208.0	4,130.0
Finance Div. Debt Current	22,427.0	21,212.0	21,196.0	18,950.0	19,912.0	19,366.0
Finance Div. Other Curr. Liab.	73.0	59.0	52.0	43.0	49.0	44.0
Curr. Income Taxes Payable	215.0	121.0	166.0	55.0	54.0	106.0
Unearned Revenue, Current	276.0	414.0	446.0	433.0	411.0	436.0
Other Current Liabilities	5,188.0	4,918.0	4,638.0	4,757.0	3,780.0	4,093.0
Total Current Liabilities	**40,348.0**	**39,824.0**	**38,310.0**	**36,419.0**	**35,795.0**	**37,152.0**
Long-Term Debt	5,634.0	5,159.0	5,141.0	5,511.0	8,787.0	6,834.0
Finance Div. Debt Non-Curr.	267.0	271.0	272.0	262.0	261.0	262.0
Finance Div. Other Non-Curr. Liab.	50.0	57.0	64.0	111.0	151.0	190.0
Def. Tax Liability, Non-Curr.	231.0	251.0	118.0	132.0	114.0	125.0
Other Non-Current Liabilities	2,350.0	2,218.0	2,224.0	1,980.0	2,398.0	2,787.0
Total Liabilities	**48,880.0**	**47,780.0**	**46,129.0**	**44,415.0**	**47,506.0**	**47,350.0**
Common Stock	1,086.0	1,086.0	1,086.0	1,086.0	1,086.0	1,127.0
Additional Paid In Capital	3,453.0	3,453.0	3,453.0	3,453.0	3,453.0	3,785.0
Retained Earnings	3,376.0	2,886.0	2,669.0	571.0	(3,125.0)	3,420.0
Treasury Stock	(456.0)	(373.0)	(499.0)	(612.0)	(229.0)	(145.0)
Comprehensive Inc. and Other	11,570.0	13,536.0	14,868.0	14,461.0	14,797.0	14,048.0
Total Common Equity	**19,029.0**	**20,588.0**	**21,577.0**	**18,959.0**	**15,982.0**	**22,235.0**
Minority Interest	463.0	483.0	492.0	457.0	490.0	522.0
Total Equity	**19,492.0**	**21,071.0**	**22,069.0**	**19,416.0**	**16,472.0**	**22,757.0**
Total Liabilities And Equity	**68,372.0**	**68,851.0**	**68,198.0**	**63,831.0**	**63,978.0**	**70,107.0**

Source: Capital IQ.

Exhibit 8 (continued)
Renault-Nissan Alliance Financial Information
Renault SA Share Price and Volume

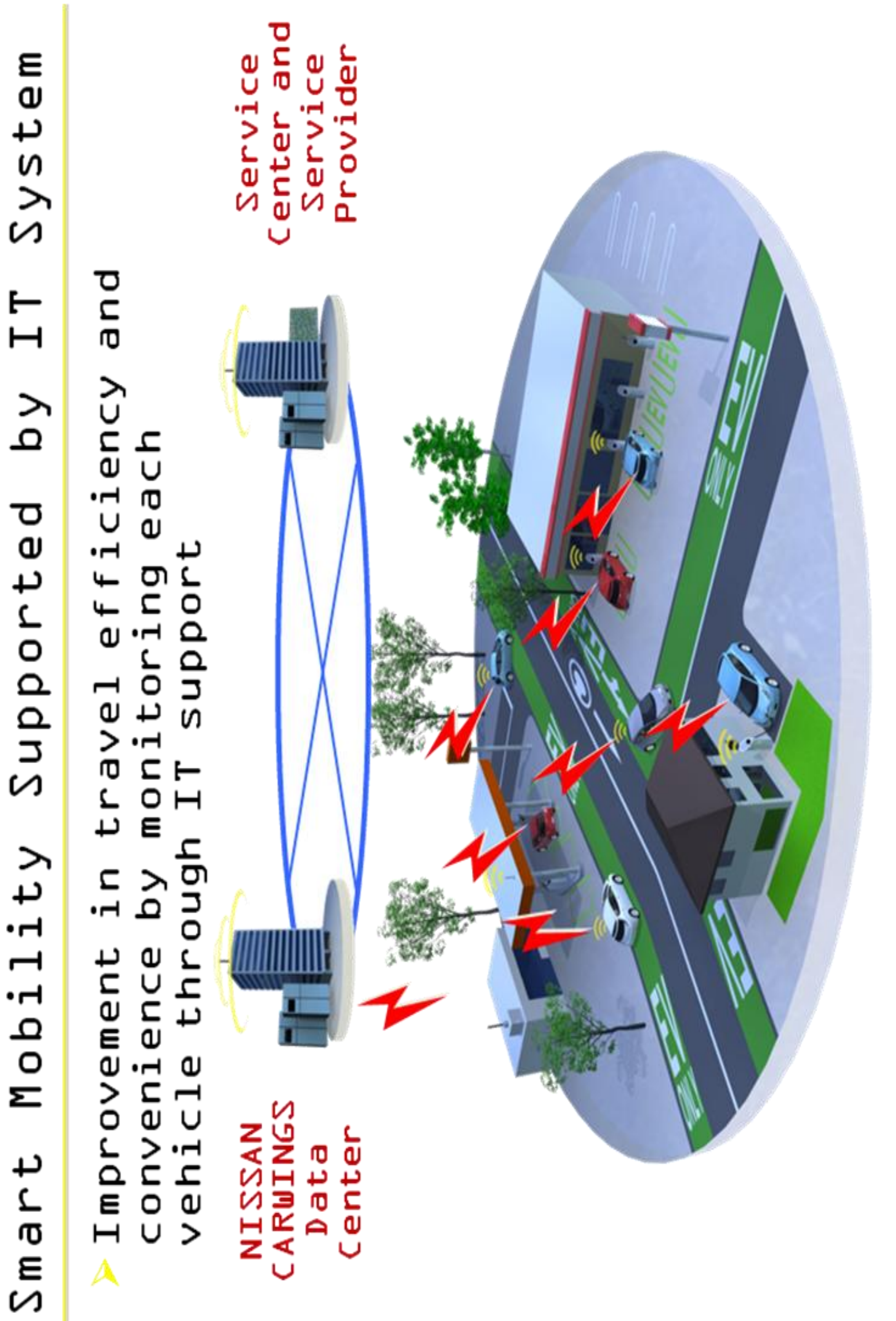
Share price in euros

Volume (in thousands)



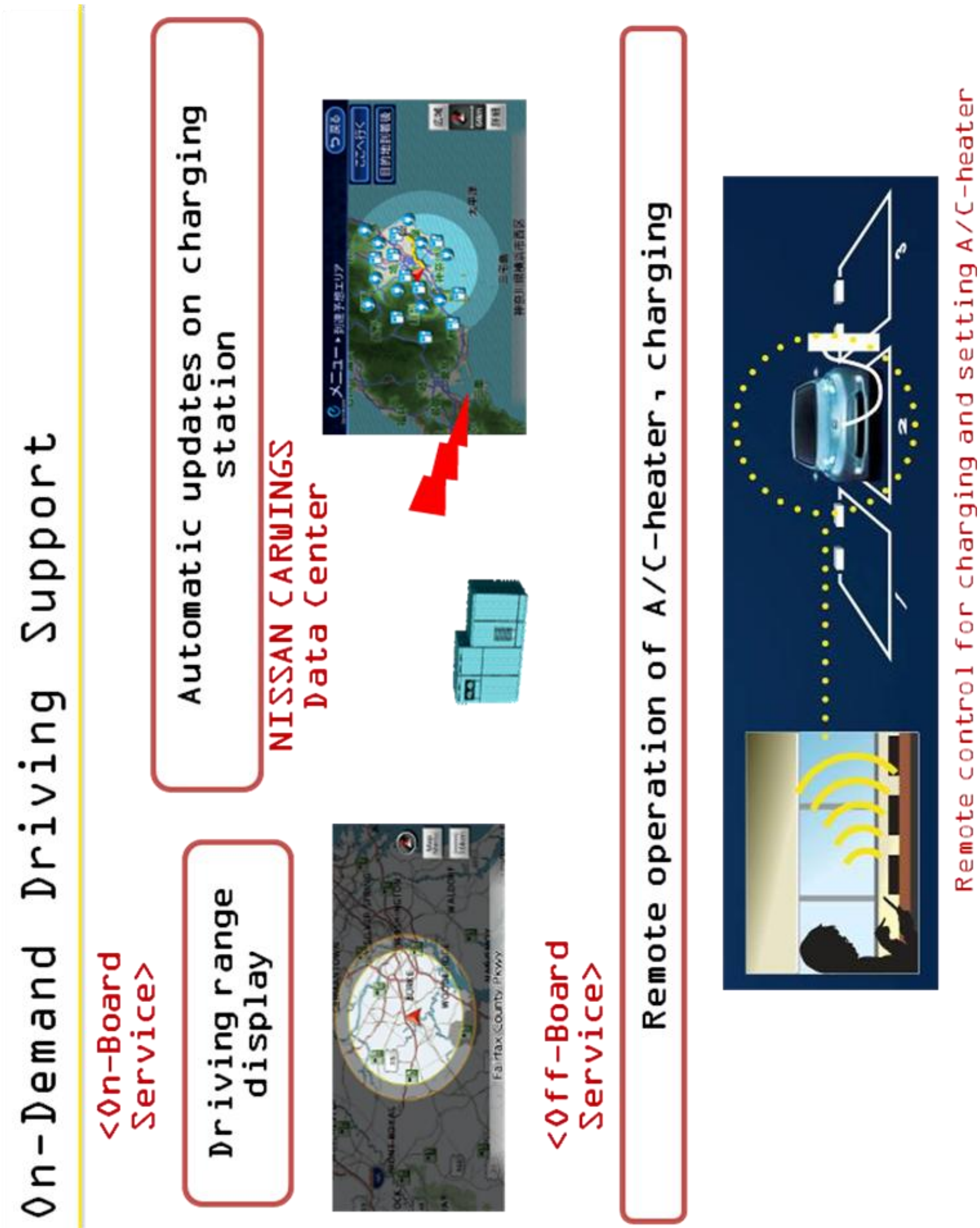
Source: Capital IQ.

Exhibit 9
Nissan LEAF IT services



Source: Nissan.

Exhibit 9 (continued)
Nissan LEAF IT services



Source: Nissan.

Exhibit 10
All-Electric Cars Release Date, Price, and Range

	Release date	Price*	Range (miles per charge)
Nissan LEAF	2010	$32,780 in the U.S., $40,000 Japan	100
Renault Fluence, Twizy, Kangoo	2011	€20,000 ($28,600), €6,990**($10,000), €20,000 ($28,600)	100, 60, 100
Ford Focus	late 2011(e)	TBA	80-100
Toyota FT-EV II	2012(e)	TBA	50
Toyota RAV4 (Tesla battery pack)	2012(e)	TBA	100
Volkswagen	2014(e)	TBA	TBA
Honda Fit	2012(e)	TBA	100
BYD e6	China 2010, U.S.A 2012(e), Europe 2012e	$35,000 in the U.S.	180
Chery M1	2010	5 versions 149,800 - 229,800 yuan ($26,000 - $34,000)	75-93
Tesla Roadster	2008	$109,000	244
Tesla Model S	2012(e)	$57,400, $67,500, $77,400	160, 230, 300
Mitsubishi iMiEV	Japan 2009, U.S. 2012(e)	Japan $42,000, U.S. $30,000(e)	Japanese version 80-100, U.S. version 50-80(e)
Daimler Smartcar	Europe 2007, U.S. 2010	For lease only $600/month	72
Daimler E-Cell	TBA	TBA	124
Think	Europe 2008, U.S. mid-2011	$34,000	75-100

(e) = expected.
*prices do not factor in government subsidies.
**not including battery lease cost.

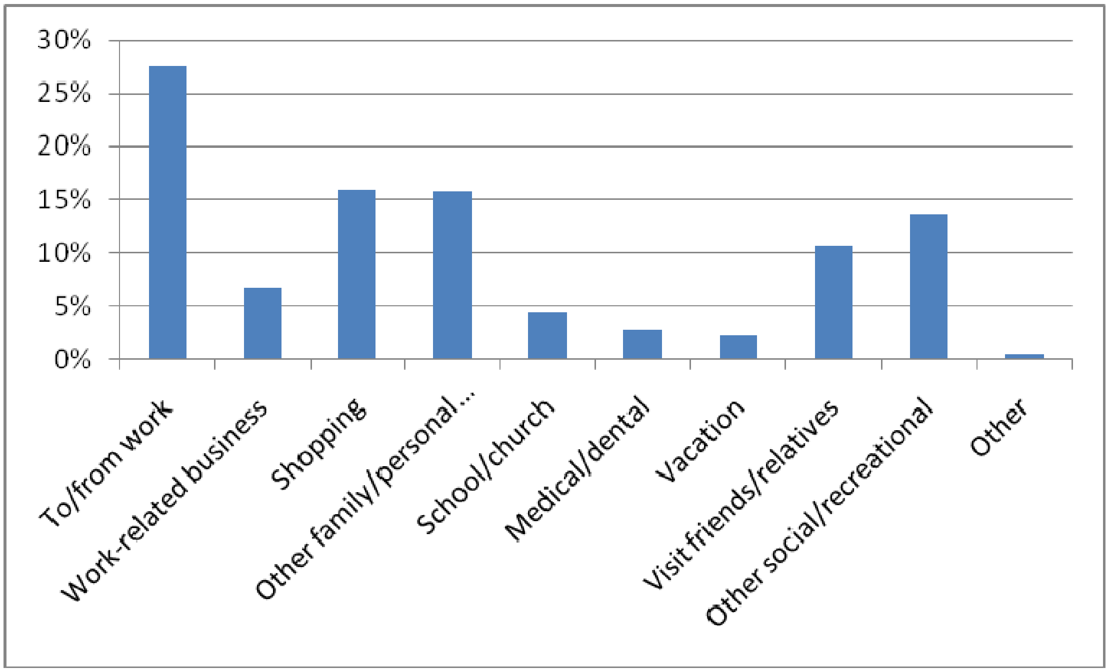
Sources: Nissan, Renault, Ford, Los Angeles Business Journal, Plug-In Cars, Wall Street Journal, Tesla Motors, Fast Company, China Autoweb, Motornature, Greentech Media, Green Car Congress, CNet, CNN, Plug-in America, Toyota, Clean Fleet Report, Road and Track, Green Cars.

Exhibit 11
Plug-In Hybrids Release Date, Price, and Range

	Release date	Price	Range (miles per charge)
GM Chevy Volt	2010	$41,000	25-50 all-electric miles
Ford C-MAX Energy PHEV	2012(e)	TBA	TBA
Ford Escape PHEV	2012(e)	$38,000	30-35 all-electric miles
Volvo V70 PHEV	2012(e)	TBA	30 all-electric miles
BYD F6DM	2009	$22,000	40-60 all-electric miles
Toyota Prius PHEV	2012(e)	$28,000 in the U.S.	14 all-electric miles
Fisker luxury sport PHEV	2010	$95,000	50 all-electric miles
Honda plug-in hybrid	2012(e)	TBA	TBA
Mitsubishi PX-MiEV	concept car	TBA	30 all-electric miles

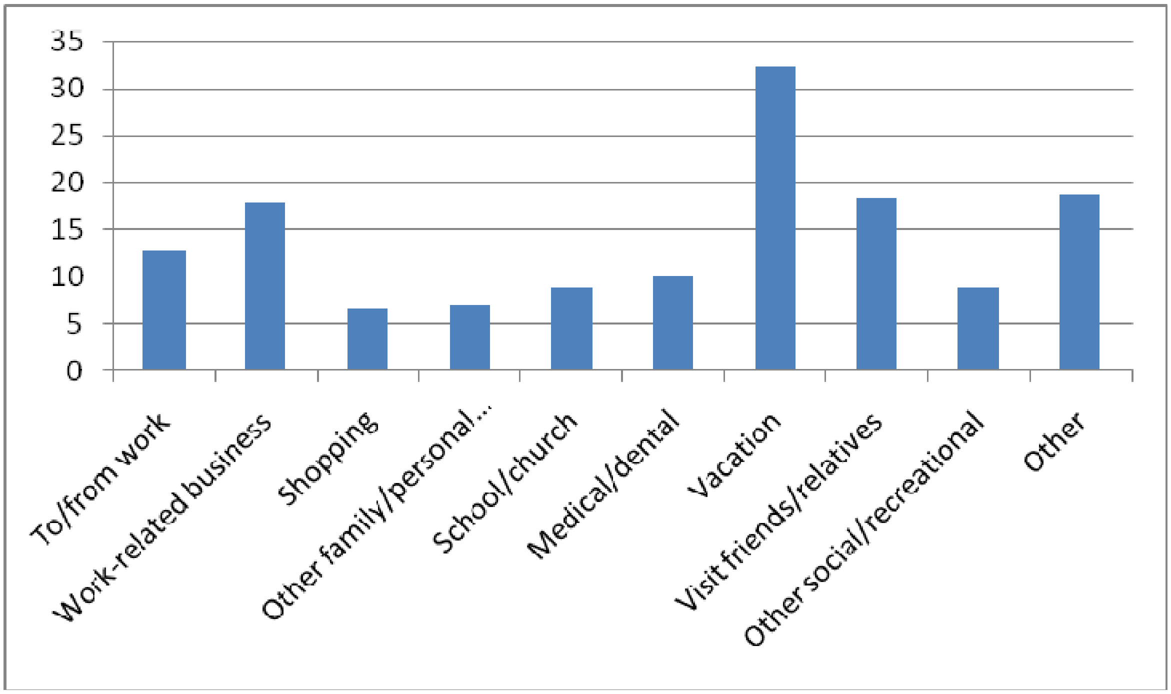
(e) = expected.
Sources: General Motors, Ford, Los Angeles Business Journal, Plug-In Cars, Wall Street Journal, Fast Company, Motornature, Greentech Media, Green Car Congress, CNet, CNN, Plug-in America, Toyota, Clean Fleet Report, Road and Track, Green Cars, Endgadget.

Exhibit 12
Share of Trips by Purpose in the United States in 2009



Source: National Household Travel Survey.
http://cta.ornl.gov/data/chapter8.shtml

Exhibit 12 (continued)
Trip Length by Purpose in the United States in 2009
(in miles)



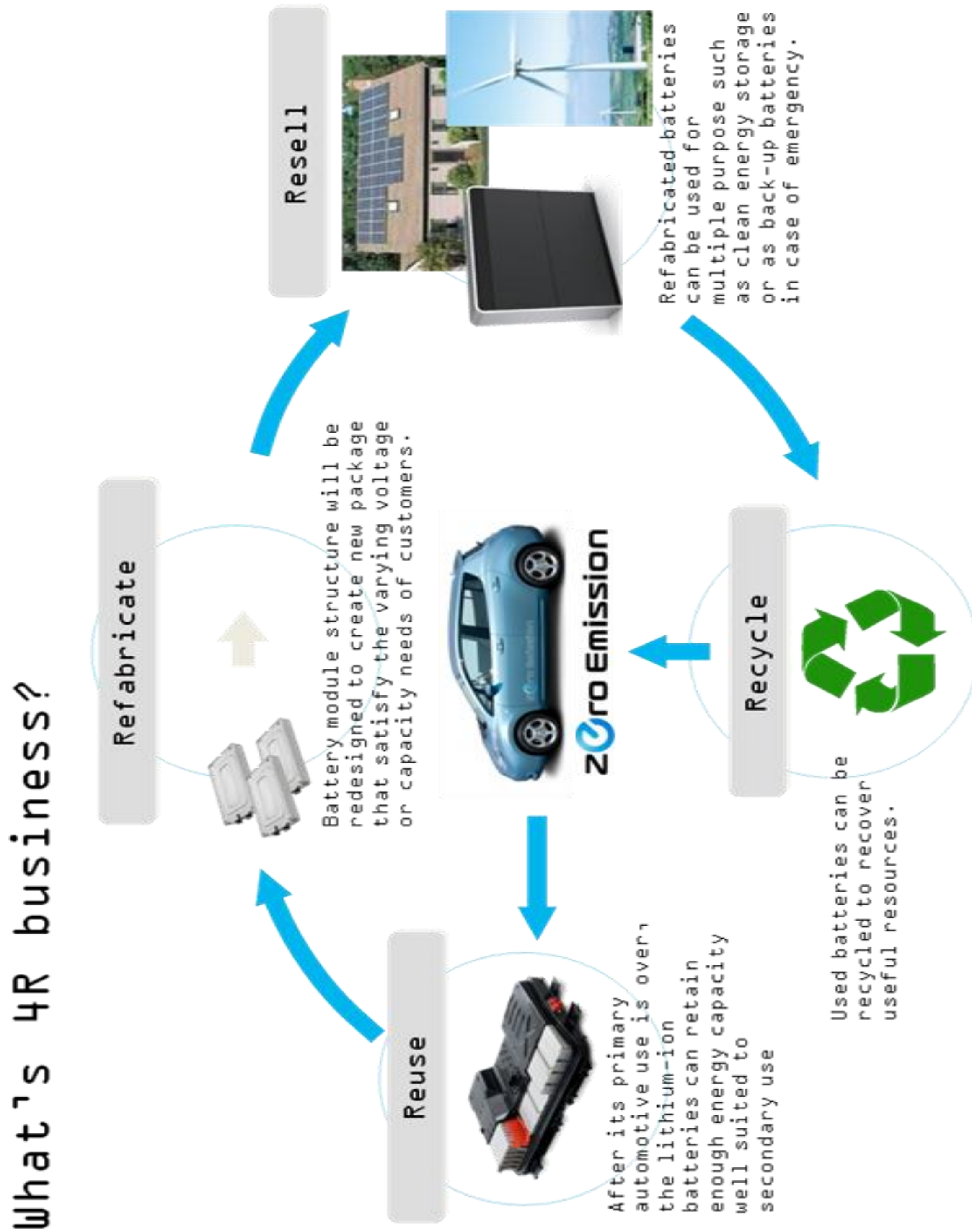
Source: National Household Travel Survey.
http://cta.ornl.gov/data/chapter8.shtml

Exhibit 13
Electric Car Battery Makers by Country

Company	**Country**
A123	U.S.
Johnson Controls	U.S.
Ener1	U.S.
BYD	China
BAK	China
Mitsubishi	Japan
Toyota and Matsushita	Japan
Nissan and NEC	Japan
Hitachi	Japan
Sanyo Electric and Volkswagen	Japan, Germany
Samsung SDI and Bosch	Japan, Germany
LG Chem	South Korea
Saft	France

Note: Johnson Controls and Saft are in partnership.
Source: Compiled by case author.

Exhibit 14
4R Energy Corporation



Source: Nissan.

Appendix A
U.S. and European Government EV Incentives

In the United States, as part of the American Recovery and Reinvestment Act of 2009, the government enacted a $7,500 consumer tax credit for the purchase of an all-electric vehicle or plug-in hybrid. Individual states offered additional rebates or tax incentives. The Recovery Act distributed $2.4 billion in grants: $1.5 billion to U.S.-based manufacturers to produce batteries and components, $500 million to produce electric drive components, and $400 million for building charging infrastructure and buying test fleets. Big recipients included GM, LG Chem, Ford, and Chrysler.

Started in 2008, the Advanced Technology Vehicle Manufacturing Loans Program authorized $25 billion in direct Department of Energy loans for up to 30 percent of the cost of re-equipping and expanding manufacturing facilities in the United States used to produce advanced technology vehicles (ATVs), which included light-duty vehicles or ultra efficiency vehicles such as hybrid electric vehicles and all-electric vehicles.[77] Big recipients included Ford ($5.9 billion), Nissan ($1.4 billion), Fisker ($529 million), and Tesla ($465 million).[78] As of March 2011, the DOE had provided only $9 billion in loans.[79]

European countries were offering tax incentives similar to those of the United States: The United Kingdom and the Republic of Ireland offered $7,800, France $6,500, and Belgium $11,700. The German government funded technology research and development rather than providing consumers subsidies or incentives.[80]

[77] U.S. Department of Energy, http://www.afdc.energy.gov/afdc/laws/law/US/411

[78] Sebastian Blanco, "Most Advanced Technology Vehicles Manufacturing Loan Program Money Delayed," *Autobloggreen*, January 24, 2011.

[79] Leslie Earnest, "Mobility Van Maker Gets $50 Million Advanced Tech Vehicle Loan," Edmunds.com, March 11, 2011.

[80] Anthony Ingram, "Electric Vehicle Incentives Guide: Country By Country," Venturebeat.com, July 30, 2010.