

Behind Toyota's hybrid revolution Automaker's successful gamble with Prius fuels its image as a trendsetter

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Toyota City, Japan -- Satoshi Ogiso doesn't look or act like a brash automobile executive. With an ill-fitting suit and spiky hairdo, his hands flutter bashfully across his face as he talks of "difficulties," "challenges" and "problems."

The 45-year-old engineer refuses to brag about his accomplishments. But as chief engineer of the hybrid Prius, Ogiso has helped Toyota revolutionize the auto industry.

By making huge long-term investments in gas-saving technologies that U.S. automakers poohpooed, Toyota has proved that corporate environmental consciousness can be wildly profitable.

"What has made this revolution possible is that Toyota is a company with a focus on technology, because we think innovation is the future of our company," Ogiso said in an interview. "So we cannot fall behind. We are trying very hard, and it is very difficult."

Ogiso's humility is typical of Toyota. Its world headquarters in Toyota City, a quiet industrial city 150 miles southwest of Tokyo, has a deceptively modest demeanor: The nondescript, 13-story building looks like it might house a midsize insurance firm in any American suburb.

But Toyota is expected to overtake the nearly bankrupt General Motors this year as the world's largest automaker. While GM and Ford are closing factories and losing billions of dollars annually, Toyota is expanding at a red-hot pace around the world.

For years, Toyota recorded solid growth because of its dependable, fuel-efficient cars such as the Camry. Then, in the 1990s, while U.S. automakers were building bigger and bigger SUVs and trucks, Toyota threw itself into hybrid gasoline-electric research, investing more than \$1 billion in the then-little-known field.

Executives at GM, Ford and Daimler-Chrysler derided the hybrids as money-losers and lagged in producing their own models. Toyota pressed ahead, and its resulting hybrids -- the Prius, the Highlander SUV and Lexus RX400h, as well as a half-dozen other hybrid models sold only in Japan -- now dominate the market, accounting for about 80 percent of U.S. hybrid sales.

Hybrids make up only 3 percent of Toyota's overall world sales, but the buzz resulting from their success has added to Toyota's public image as a trend leader.

"Toyota is willing to make investments to gain technological capability, not just for guaranteed returns on investment, like the Big Three," said Jeffrey Liker, the author of a recent book, "The Toyota Way."

"Toyota believes that 10 years from now, its hybrid technology will be like the Windows platform is now -- most cars will be a version of hybrid," said Liker, a professor of industrial and operations engineering at the University of Michigan. That gamble is "probably correct," he added.

In many ways, the Prius project appears to be a textbook example of Toyota's much-vaunted, much-imitated internal management system and its mantra of kaizen, or continuous improvement, in which top executives steadily ratchet up performance standards for their employees, while also listening closely to suggestions and emphasizing consensus.

The project was the brainchild of Toyota's chairman at the time, Eiji Toyoda, a member of the company's controlling family, who had an unusual obsession with energy saving. The secretive project, known internally only as G21, was at first not meant to be a hybrid.

Ogiso was one of the original team of about 100 engineers selected by Toyota chiefs in late 1993. "We didn't know much about the idea," he said. "Our only instruction was that it should achieve a fuel-efficiency improvement of 50 percent, and it somehow should be the 'car of the 21st century.'"

The insistence on fuel efficiency was highly unusual. At the time, the price of oil averaged below \$15 per barrel, Americans were snapping up ever-bigger SUVs, and saving gasoline seemed like a politically correct anachronism.

But Toyota's chairman convinced his top executives that environmental issues were a long-term threat, said Takehisa Yaegashi, a chief of the Prius project in the mid- and late 1990s who later became chief of all Toyota alternative power-train projects.

"In those years, discussions were going on about the hybrid program, but we thought it was quite clear that global warming was a challenge we would have to take up," said Yaegashi, who now is a semi-retired consultant for the firm.

In September 1994, the G21 team first heard hints from top executives that it should consider hybrid technology, which had been tainted by its association with an earlier, failed project to build an electric car. That December, management came with a thunderbolt -- instead of a 50 percent improvement in fuel efficiency, the new car would need a 100 percent improvement.

The team protested that this would be impossible with a normal internal combustion gasoline engine. Fine, the response came. So you'll have to make it a hybrid.

In August 1995, Toyota's new chairman, Hiroshi Okuda, came with another thunderbolt -- instead of the previous target date of December 1998, the project would have to be completed by December 1997.

The team worked feverishly, canceling all vacations and working through most weekends, and divided into two 12-hour shifts, working around the clock.

They had several crises. At first, the electric motor's battery was very sensitive to high temperatures, and it would malfunction when heated up by the gasoline engine next to it. "For a long time, we couldn't solve that," Ogiso said. "It was very difficult."

After that was fixed, a full-scale prototype vehicle was plagued by malfunctions. "It would hardly go 100 meters," Ogiso recalled.

The tight-knit team of Yaegashi, Ogiso and the others finally succeeded in beating the deadline by two months. The Prius was launched on the Japanese domestic market in October 1997. Three years later, it came to the United States.

Last year, Toyota sold 110,400 Priuses in the United States and Canada and 43,600 in Japan. U.S. and Canadian sales of other Toyota hybrid models totaled 40,300 and Japanese sales were 14,500.

Yaegashi calls hybrid technology "the key to two issues -- the global environment and the development of world energy resources. I do not understand why U.S. manufacturers are not so keenly working on hybrid technology. Are they more optimistic about global warming or the supplies of oil?"

John Cleveland, vice president of IRN Inc., an auto industry consulting firm in Grand Rapids, Mich., said Toyota views environmental concern as simple business logic, not "do-gooderism."

Toyota has been the most explicit automaker "about the environmental challenge facing the auto industry because it has always had such a long-term perspective, ever since the days of Mr. Toyoda, when he started the company with a 50-year business plan," Cleveland said, referring to Kiichiro Toyoda, who founded the company in 1938 as an offshoot of his family's textile loom business.

"Now, they're starting to realize they have an almost \$200 billion market (capitalization) based on a carbon energy source that's diminishing, and they're wondering, 'What's our company going to be worth 50 years from now, when oil may be much more scarce?' " said Cleveland, whose company's client list includes several Toyota parts suppliers. "So they're the most aggressive about developing alternate technologies."

By Wall Street's main yardstick -- the company's share price levels -- Toyota is the world's ninth most valuable company, and is now worth more than double the combined value of GM, Ford and DaimlerChrysler.

Japanese analysts agree that even by Japan's standards, Toyota is unique.

"Toyota is a model company in the field of environmental management and resource productivity," said Ryoichi Yamamoto, a professor of environmental materials design at the Institute of Industrial Science of the University of Tokyo.

Yamamoto cited Toyota's steps to improve the recyclability of its cars, its reduction of waste and pollution in its manufacturing plants, and its focus on fuel efficiency. "Other companies are trying to imitate it, but they have not yet reached the same level," he said.

Some environmentalists disagree.

"Toyota is two-faced," said Yurika Ayukawa, director of the climate change program at the World Wildlife Fund of Japan. "It wants to be seen as an eco-company, as environmentally committed, but it's really just business as usual."

Ayukawa noted that Toyota has joined with U.S. automakers in filing lawsuits in state and federal court seeking to block California's landmark 2004 rule ordering all automakers to reduce the greenhouse gas emissions of the cars they sell.

Masayuki Sasanouchi, general manager of Toyota's environmental affairs division, defended the company's attack on the California rules.

"We understand climate change is a federal issue, so we don't think California has a right to legislate it," he said. "We don't believe carbon dioxide is the same as a pollutant, and for this

reason it's not covered under the Clean Air Act," he said, referring to the 1977 law, amended in 1990, that gives California the right to set air-quality standards different from the federal government's rules.

In fact, Toyota probably would benefit if the new California rule goes into effect in 2009 as scheduled, because its cars produce less emissions than its competitors' cars. But some analysts said Toyota seems to have bowed to larger political concerns, calculating that by allying with the politically powerful Detroit automakers on the anti-environment lawsuits, it could defuse pressure in Congress for anti-Japanese tariffs.

"Toyota is hypersensitive to the potential for protectionist backlash," Jeffrey Liker said, pointing out that Toyota's exports from Japan to North America are growing fast, reaching 940,000 cars in 2005, up 16 percent from 2004.

Environmentalists also have criticized Toyota for using hybrid technology to boost the horsepower and acceleration, rather than fuel efficiency, of its new Lexus RX 400h and Highlander hybrid models.

And under U.S. fuel-efficiency rules, the high mileage of the Prius helps Toyota comply with fleet averages even as it launches gas guzzlers like a larger, beefed-up version of the Tundra, its big pickup.

For Toyota, whose U.S. sales are soaring while American automakers' sales are slumping, there is never time for bragging.

A hybrid version of the best-selling Camry will be released this autumn. Ogiso said his team of engineers is working on a new version of the Prius and other hybrid projects.

"We need to continue working hard," Ogiso said. "We need to be making drastic improvements."

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Toyota's hybrid technology and economic applications

As this article presents, Toyota has been able to make much profit in a global market comparing to other auto companies such as GM or Ford. Moreover, they see the future positively and they will make gradually more and more based on new hybrid technology. "Hybrids make up only 3 percent of Toyota's overall world sales, but the buzz resulting from their success has added to Toyota's public image as a trend leader." And "Toyota believes that 10 years from now, its hybrid technology will be like the Windows platform is now -- most cars will be a version of hybrid."

Considering the facts that there are clearly barriers to entry in auto industry and that there are actually few companies producing cars, the auto industry seems to be

defined as 'oligopoly.' Particularly, economies of scale suggest that there should be only a few firms in market to enjoy profit. The technologies that incumbent firms have accumulated to produce cars are not easily accessible to those who want to start from the bottom. Moreover, incumbent firms may protect their market share by using strategic actions to block others to enter the market. However, Toyota actually acts as a monopoly based on their hybrid technology. "By making huge long-term investments in gas-saving technologies that U.S. automakers pooh-poohed, Toyota has proved that corporate environmental consciousness can be wildly profitable."

As a monopolist, Toyota can charge the price that exceeds marginal cost and produce less than competitive market equilibrium quantity. Then dead weight loss will occur which would be an inefficiency because output will be lower than perfect competition. But given the fact that Toyota does not have a patent on the technology, other auto firms will enter, meaning that price will be equal to marginal cost in the long run as long as there is a market demand.

In addition, Toyota's effort to be an eco-company can be seen as a positive externality because hybrid cars pollute less than conventional cars. Therefore, relative to baseline of buying a conventional car, buying a hybrid car is beneficial for society. Buying a hybrid car reduces pollution, and so people who are not the buyers or the sellers receive some benefits in the form of cleaner air and less-pollution related illnesses. Also, by purchasing a hybrid car, a consumer may encourage producers to refine hybrid technology and continue developing low-polluting technologies. So, there may be a benefit to society in the form of greater technological change.