

The Future Is Lithium
by William J. Holstein

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The advent of environmentally friendly automobiles is jump-starting a global battle over battery technology.

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L*ithium ion* may not yet be a household name, but that won't last long. The battery, which is already widely used in consumer products, is viewed by the auto industry as the next great hope to power future-generation, energy-conscious extended-range electric cars and hybrids. Automakers and their suppliers on three continents are gearing up to determine who will dominate what could be a US\$150 billion a year industry by 2030, according to AllianceBernstein. For these companies — and the countries they are in — there's a lot at stake: thousands and thousands of jobs, hundreds of millions of dollars in domestic sales and exports, and a foothold in a critical sector of the green economy.

Companies in Europe, Japan, South Korea, and China have clear leads in perfecting the battery, which can hold far more power for longer periods of time than the nickel metal hydride batteries now in use in Toyota Motor Company's Prius hybrid sedan. Whether the United States stays in the race largely depends on the future of the General Motors Corporation and its Chevrolet Volt extended-range electric vehicle. The Volt will be able to travel 40 miles solely on battery power; after that, a gasoline generator will kick in to recharge the batteries and extend the vehicle's range to 300 miles. If GM, already on life support from the federal govern-

ment, is forced into Chapter 11 bankruptcy or liquidation, U.S. prospects for securing a piece of the lithium ion industry could fall by the wayside.

The Detroit auto show in early January 2009 was in many ways a coming-out party for the lithium ion battery. GM announced that it had chosen Compact Power Inc., a subsidiary of South Korea's LG Chem Ltd., to manufacture the Volt's battery cells in Korea. GM plans to assemble the batteries into packs in a new facility in Michigan, perhaps near the Volt engine plant in Flint. That task is extremely labor intensive, and requires engineering and manufacturing skills. "That will provide a little bit of an antidote to the job erosion that's been occurring in the auto sector," says Prabhakar Patil, CEO of Compact Power, based in Troy, Mich.

Toyota, seeking to preempt its U.S. rival, disclosed at the auto show that it would launch a limited number of third-generation Priuses later this year equipped with Japanese-made lithium ion batteries. China's BYD Company Ltd., which boasts backing from Warren Buffett, showed its all-electric plug-in sedan (250-mile range with lithium ion batteries). BYD hopes to sell these cars in the U.S. market by 2011. And DaimlerChrysler AG and the BMW Group also displayed lithium ion models, including some that use batteries made in Europe by U.S. company Johnson Controls Inc.

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Toyota and GM, neck and neck for the bragging rights to being the world's largest automaker, are eyeing each other's lithium ion intentions warily. GM was stung by Toyota's success in the late 1990s with the Prius and is determined to leapfrog that generation of battery technology with a six-foot long, 400-pound lithium ion battery built to last 10 years. This will be no easy task: The lithium ion batteries found in laptops, iPods, and power tools have life expectancies of just two to three years. Because GM Chief Executive Officer Rick Wagoner would like to achieve sales of 500,000 Volts within five years, battery suppliers will have to engage in a steep ramp-up of manufacturing capability.

As recently as a year ago, Toyota argued that it was too soon to consider using lithium ion because it was an unproven technology. Some experts believe that Toyota's conclusion was in part motivated by its huge investment in three factories in Japan that made nickel batteries. "There is only one company that has a stranded cost in nickel and that's Toyota," says Alex Molinaroli, president of Johnson Controls Power Solutions. "[Toyota] would be least motivated to move to a new technology."

Toyota was also worried about the safety of lithium ion batteries. In mid-2006, the Sony Corporation had to recall about 10 million lithium ion batteries used in laptops because of a series of explosions that occurred after the batteries suffered internal metal contamination and shorted out. These Japanese-made lithium ion batteries typically contained cobalt oxide in the cathode. Newer lithium ion batteries and those still in development instead use materials like manganese and iron phosphate, considered to be somewhat safer.

But Toyota's announcement at the recent Detroit auto show that it planned to roll out 500 essentially

hand-made versions of the Prius with lithium ion batteries in late 2009 was a clear sign that the automaker had overcome its concerns about the technology. The Prius batteries will be purchased from Panasonic EV Energy Company, in which Toyota has a 60 percent stake. "Initially, [Toyota] tried to say lithium ion was too risky and that it was not ready for it," recalls Compact Power's Patil. "But GM looked at the data that we were showing them, and said, 'Yes, let's try it. It's not a slam dunk, but let's do it.' So now Toyota is joining the party." Toyota has not yet disclosed precisely what formulation will be used in these batteries.

There does not have to be a single winner in lithium. Multiple lithium ion versions can prevail for different uses. Depending on weight, safety, and energy density requirements, among other factors, some lithium ion batteries may work best for plug-in electric hybrids, which are recharged through electrical outlets, and others for gasoline-based hybrids like the Prius.

Lithium ion industry advocates say that the U.S. government could play a pivotal role in determining how much of the battery business will be domestic by allocating to lithium suppliers a chunk of the \$25 billion Congress approved for automobile alternative energy research and development. "We in the United States almost have a bias against developing a new technology in the supply base," says Johnson Controls Power Solutions President Molinaroli. "I think it's going to take encouragement from the U.S. government to make sure that at least some of the technology is developed here. We're going to need some support or leadership or guidance from the feds." His company manufactures in Europe, Molinaroli says, because that's where its customers are.

However, Patil warns that if the Obama administration spreads the \$25 billion throughout the auto industry to the dozens of companies currently involved in alternative propulsion projects, “there’s the potential for the [money] to be so diffused that it wouldn’t do that much good in any one area. As large as that sum sounds, it could become ineffective.”

Patil and others recommend the creation of a federal decision-making body, optimally within the Department of Energy, to pick the most salient and potentially useful technologies to support with the most money.

Of course, any U.S. hopes for securing a chunk of the lithium ion industry would be dashed if GM’s Volt project were to fizzle out because of the automaker’s financial problems. The work on the Volt is by far the most advanced lithium ion–based auto program of any U.S.-based manufacturer. “Because of GM’s efforts, the U.S. has a real opportunity,” says Patil. “The Volt is an opportunity to take leadership.”

But even if the Americans don’t make the train, a future with more and more powerful lithium ion batteries is inevitable; after all, the rest of the world is already on board. +

Resources

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Amy Raskin et al., “Abating Climate Change: What Will Be Done and the Consequences for Investors,” AllianceBernstein, January 2008: Explores the implications of a variety of new energy sources. (PDF) http://www.fundresearch.de/pc/partner/acm/pdf/research_blackbooks.pdf

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