

The Electric Car Battery War

U.S. and Asian rivals are rushing to hone lithium-ion technology. Should the feds get involved?

By [Pete Engardio](#)

There is little in its spare Manhattan headquarters to suggest that Ener1 ([HEV](#)) could someday be an industrial power. The office of Charles A. Gassenheimer, a former hedge fund manager installed as CEO in August to shake up Ener1's management, has few props. They include a framed photo of Senator Richard Lugar (R-Ind.) visiting the company's Indianapolis factory, a poster from a charity event called Ball of the Wild, and a white metallic device the size of a book.

Ener1's future rests on that device, a prototype of a lithium-ion cell that, Gassenheimer hopes, will power fleets of eco-friendly cars. President Barack Obama has set a target of 1 million electric cars on U.S. roads by 2012. "If we are going to meet that goal," Gassenheimer says, "it will require about \$40 billion worth of domestically produced batteries." Most experts agree that lithium ion, which can be used to create batteries that weigh far less and store more power than those in today's hybrids, will be the dominant technology. All Ener1 needs to ramp up is a \$480 million loan from Washington.

The big question is whether Ener1 or any other U.S. battery maker will be a major player by the time a mass market develops for electric cars, which could take a decade. The field is already crowded. Other U.S. companies claim to have prototypes that work at least as well as Gassenheimer's. They include A123 Systems, a Massachusetts Institute of Technology spin-off, and Franco-American venture Johnson Controls-Saft, which has snared contracts with Ford Motor ([F](#)), BMW, and Mercedes-Benz ([DAI](#)). But the Americans face Asian rivals with deeper pockets and far more lithium-ion experience.

ASIA'S DEEP POCKETS

Whoever prevails, some lithium-ion batteries will likely be assembled in America. The bigger stakes are over which companies will control the key technology—the lithium-ion cells stacked inside the batteries and the design of the car power system.

U.S. contenders such as Ener1 and A123 claim superior cell technology for cars. Johnson Controls ([JCI](#)), the world's biggest maker of conventional lead-acid car batteries, boasts of its automotive experience and alliance with France's Saft, which makes lithium-ion batteries for aerospace and industry. The Asians are counting on their dominance in lithium-ion devices for computers and appliances and on their ties with the hybrid programs of Toyota ([TM](#)) Motor and Honda Motor.

The Asians can also better afford the hundreds of millions of dollars needed to build large, state-of-the-art factories. U.S. investors are unwilling to risk such sums for startups—especially now that the recession and cheap oil have dimmed the future of hybrid cars. After surging this fall, Ener1's stock has fallen by half since mid-December, to around 4.

Should Uncle Sam provide billions in loans and grants to a promising but unproven business? Or should the government wait for the market to sort things out before it backs a U.S. company? The risk is that by then another major industry could go the way of memory chips, digital displays, the first solar panels, and the original lithium-ion batteries used in notebook PCs and cell phones. American scientists, funded by federal dollars, were at the forefront of each of those. Yet the industries—and the high-paying manufacturing jobs that go with them—quickly ended up in Asia. U.S. labor costs and taxes drove many operations abroad, but often industries fled simply because Asian governments, banks, and companies were more willing than Americans to risk big capital investments.

This time federal help could be on the way. Battery makers are expected to get some of the \$25 billion set aside last year under Washington's Advanced Technology Vehicle Manufacturing Program to speed the commercialization of green cars. EnerDel, a subsidiary of Ener1, has applied for a loan to build a plant capable of making 600,000 batteries a year. Rival A123 of Watertown, Mass., wants \$1.8 billion to build a car-battery factory in Michigan. Under the \$790 billion stimulus package under debate in Congress, U.S. lithium-ion makers also could compete for \$2 billion in grants to fund research and development and manufacturing.

Lithium ion is regarded as a core enabling technology for plug-in hybrid vehicles, which, unlike most current hybrids, can be recharged with normal household current and run much longer on electricity before a gas-powered engine takes over. Lithium-ion cells can store up to three times more juice and generate twice the power of the nickel-metal hydride batteries used in today's hybrids. The T-shaped lithium-ion battery for the Chevrolet Volt, due in 2011, will contain 200 such cells. "They aren't just another part. They are the car," says Masahiko Otsuka, president of Automotive Energy Supply, a joint venture between Nissan Motor ([NSANY](#)) and NEC that aims to invest \$275 million in new lithium-ion facilities.

MANAGING THE GRID, TOO

General Motors ([GM](#)) and Ford ([F](#)) both assert that a domestic lithium-ion industry is vital if the U.S. is to be a major player in green cars. Otherwise, Detroit's fate would be in the hands of suppliers half a world away. Besides, lithium-ion technologies can be used to help electric utilities manage their grids more efficiently—a potentially bigger market than cars. "As a country, we can rely on others," says Denise Gray, energy storage director at GM. "But we could fall behind." GM turned to South Korea's LG Chem to supply lithium-ion cells for the Volt because the carmaker says U.S. companies lacked sufficient manufacturing experience.

Another Asian contender is Toyota-controlled Panasonic EV Energy. Panasonic supplies 90% of the nickel-metal hydride batteries used in today's hybrids. Last year it agreed to buy Sanyo Electric, the largest maker of rechargeable batteries.

China has more than 10 manufacturers—Beijing has declared lithium ion a strategic industry. Mainland battery giant BYD Auto, in which Warren Buffett holds a 10% stake, turned heads at the Detroit car show with a small plug-in hybrid sedan, the F6DM, that it says can run 60 miles on a lithium-ion battery before the vehicle switches to gasoline. In China, BYD already sells a plug-in for \$22,000. The Volt is expected to cost \$40,000.

Analysts say no U.S. or Asian contender has solved all of the challenges of producing lithium-ion car batteries that are safe, reliable, and affordable: Questions linger over the battery's ability to last long enough to satisfy car buyers, for example. With no company in mass production, there is little real-world evidence to back up bold claims. Tokyo-based JPMorgan ([JPM](#)) analyst Yoshiharu Izumi thinks Panasonic is the most formidable player, but "it's too early to say who will win."

MASS MARKET DOUBTS

The U.S. is still in the race. The Energy Dept. has poured some \$600 million into lithium-ion research. A123 has blue-chip investors like General Electric (GE), Qualcomm (QCOM), and Sequoia Capital. It uses nanomaterials developed at MIT that it claims will deliver higher voltage and weigh less than rivals' batteries.

Ener1 began in the mid-80s as a telecom-equipment maker. It bought a lithium-ion battery developer in 2002 and formed EnerDel, a venture with Delphi (DPHIQ) that it eventually took over. Like A123, EnerDel also makes batteries for electric utilities. But a key customer, Norwegian electric carmaker Think, has struggled since the credit crunch.

The strongest U.S. player right now is Johnson Controls. Its French partner Saft has a cell plant, while Johnson's big edge is its supply and design relationships with the world's top automakers. But lithium-ion technology is vastly more complex than that of lead-acid batteries. Alex A. Molinaroli, president for power solutions, says Johnson understands better than its rivals how to design battery systems that fit with a vehicle's electronics. Johnson is also likely to apply for federal loans. "We are making aggressive plans to manufacture in the U.S.," Molinaroli says.

Skeptics counsel caution. Menahem Anderman, president of Total Battery Consulting in Oregon House, Calif., doubts there will be a mass market for electric cars within a decade. When gas cost \$4 a gallon last summer, he notes, consumers who shelled out the extra \$3,000 for a hybrid like the Prius, with nickel-metal hydride batteries, were close to breaking even. But next-generation lithium-ion batteries will add at least \$8,000 to the price of a plug-in when all the electronics are included. For drivers to save money on the Volt, Anderman calculates production will have to reach 1million cars a year, and gas will have to pass \$5 a gallon. Ener-Del program manager Sean Hendrix counters that electric carmakers are accelerating their plans. "This industry is happening now," he says.

Skeptics also question whether America needs to make lithium-ion cells rather than import them from low-cost Asian suppliers. "If the goal is to get the costs of the technology low enough so we can switch en masse from imported fuels, I don't think you need domestic manufacturing," says William G. Haines, director of a National Science Foundation program that makes small loans to U.S. tech companies. And there's no guarantee U.S. companies getting taxpayer help won't be acquired by bigger Asian rivals. Gassenheimer admits players like Ener1 "ultimately will be consolidated into another company." Lithium-ion car batteries are an exciting technology. Whether they will generate an exciting U.S. industry is anyone's guess.

With Kenji Hall and Ian Rowley in Tokyo, David Welch in Detroit, and Frederik Balfour in Hong Kong

BUSINESS EXCHANGE: READ, SAVE, AND ADD CONTENT ON BW'S NEW WEB 2.0 TOPIC NETWORK

A Charge Around the Corner

Finding ways to charge and replace lithium-ion batteries will be key for electric cars to reach the masses. Entrepreneur Shai Agassi's Better Place is testing battery-exchange stations in Israel and Japan.

To read about Agassi's venture, go to <http://bx.businessweek.com/electric-cars/reference/>

Engardio is an international senior writer for BusinessWeek.



SUBSCRIBE NOW AND SAVE 85%

CLICK HERE