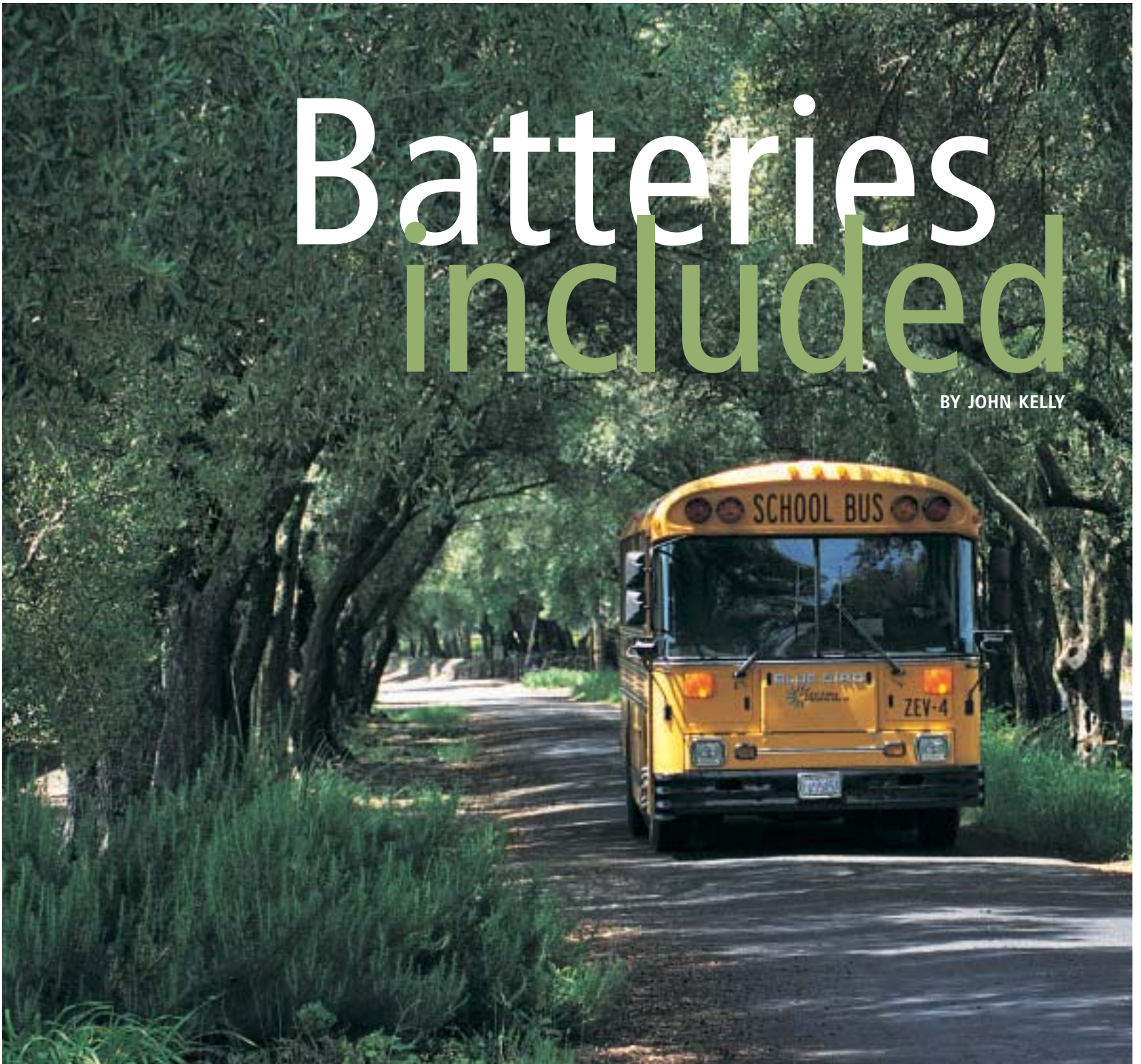


Batteries included

BY JOHN KELLY



An electric school bus, equipped with Texaco Ovonix's nickel metal hydride batteries, carries students to and from classes in California's Napa Valley.

Part start-up, part offshoot, the Advanced Batteries group is taking breakthrough technology out of the lab and into the marketplace.

ALICIA BOUTAN SEES FIRSTHAND HOW THE world of hydrocarbons hooks up with the "hydrogen economy." And she's finding more

complements than clashes. "Gasoline isn't going away," says Boutan, vice president of Advanced Batteries, a unit of ChevronTexaco Technology Ventures (CTTV). "The world runs on hydrocarbons. But it makes sense for an energy company to be involved in the electric side of the power train."

Boutan manages ChevronTexaco's interests in Texaco Ovonix Battery Systems, a CTTV



partnership with Ovonic Battery Co., a subsidiary of Energy Conversion Devices (ECD). The 50-50 joint venture was formed in July 2001, when Texaco bought General Motors' 60 percent share of GM Ovonic, itself an ECD joint venture formed in 1994.

The union brings together ChevronTexaco's manufacturing and marketing know-how — along with a \$178 million investment — and

ECD's technical expertise. ECD is the inventor and world leader in battery technology based on a chemical combination called nickel metal hydride (NiMH). It has more than 300 U.S. and international patents.

Texaco Ovonic, based in the Detroit suburb of Troy, Michigan, has reached a pivotal point in its brief life. Until now, the primary emphasis has been on research and development. With

the opening in April of a major manufacturing plant in Springboro, Ohio, the company now is intent on proving the commercial viability of its products. The company expects to show its first profit in 2006.

“The potential is enormous,” says Texaco Ovonic chief financial officer Steve Allen. “The real window of opportunity is right now.” ▶

The battery manufacturing plant at Springboro, Ohio, began operating April 1, just five months after its groundbreaking. Employees at the entrance are, left to right, Denise Shields, Gladys Barnes and Greg Kauffman.



Below, top: Key players in the advanced batteries business include, left to right, Scott Lindholm, Texaco Ovonic vice president of Transportation; Alicia Boutan, ChevronTexaco Technology Ventures vice president of Advanced Batteries; and Tom Neslage, Texaco Ovonic president.

Bottom: In Troy, Michigan, where prototypes are tested, technician Dave Borthwick oversees "formation," a process that activates the batteries.



The company estimates that within five years, its target transportation market will total about \$500 million. This includes batteries for electric and hybrid-electric (gasoline- and electric-powered) vehicles (EVs and HEVs) as well as for heavy-duty trucks, buses and military vehicles. Add to that a cool \$1 billion for the stationary market, which includes telecommunications, uninterruptible power supplies and distributed generation.

Battery basics

All batteries work in essentially the same way. They create electricity by means of a chemical reaction. Two dissimilar metals (the electrodes) undergo a chemical change in an acid solution (the electrolyte), thereby releasing electrons. Every battery has two terminals, a positive and a negative. If a circuit is provided, in the form of a wire, electrons flow from the negative to the positive terminal.

Batteries have been in use since 1800, when Italian physicist Alessandro Volta created his voltaic pile. He stacked alternating layers of zinc, silver and blotting paper soaked in salt water. By attaching a wire from the negative end (zinc) to the positive (silver), he caused electricity to flow and made history.

The Ovonic advantage

Texaco Ovonic is making its own history with technology based on the science of amorphous and disordered materials and discoveries made by ECD founder Stan Ovshinsky. (The

word "ovonic" is derived from "Ovshinsky" and "electronic.")

Paul Gifford, Texaco Ovonic vice president of Technology, explains. "Materials range from crystalline in structure, with atoms neatly lined up, to amorphous, with atoms randomly distributed. In between are disordered materials containing six or seven different crystal structures.

"The purest crystal had always been considered best for battery makers, but Ovshinsky turned science upside down. He found that disordered materials, because they are multifaceted, provide more places for chemical reactions to occur."

The disordered materials used in NiMH batteries are also environmentally benign. Essentially, the batteries store hydrogen ions as energy. "Hydrogen is the world's most abundant element and the purest fuel," says Tom Neslage, Texaco Ovonic president. "When it reacts to produce energy, the byproduct is water."

In NiMH batteries, the negative electrode is made of metal hydride; the positive, nickel hydroxide; and the electrolyte, potassium hydroxide — all ingredients in what's becoming known as the hydrogen economy.

Texaco Ovonic brings together a diverse group of employees. Veterans of the petroleum, auto and other industries mix with those hired fresh from university "future car" programs. "Ours

is not an entrenched culture,” says Neslage, who previously was president of Texaco Global Products. “We’re comfortable challenging one another.”

Bragging rights

Ray Wagner, vice president of Marketing Services, makes a convincing case for NiMH batteries. They provide more than twice the energy of lead-acid batteries (the type used in most autos) and are virtually maintenance-free. An additional benefit is their ability to recapture the energy from braking that’s typically lost as heat. Also, NiMH batteries have demonstrated a longer life than conventional lead-acid batteries: NiMH batteries were used in GM’s EV1 — the first electric vehicle to achieve a driving range of more than 220 miles (354 km) on a single charge.

In stationary applications, the energy density of NiMH batteries also is striking: They take up only one-third the space of conventional

batteries. That’s a critical factor for large power systems that back up data centers, production lines and telephone networks.

Texaco Ovonic has built numerous prototypes and tested its batteries in a variety of applications, from electric school buses in Napa, California, to hybrid prototypes for some of the world’s largest transportation companies. The company also is monitoring three stationary test projects at ChevronTexaco locations, with assistance from Chevron Energy Solutions and Chevron Pipe Line Co. NiMH batteries back up the fuel cell power supply at corporate headquarters in San Ramon, California, and also provide backup power for the Concord, California, data center and for a pipeline monitoring system near New Orleans, Louisiana.

Texaco Ovonic received a \$5.2 million two-year cost-sharing contract in July 2002 to continue developing NiMH technology for hybrid vehicles. The contract is under the sponsorship of the U.S. Department of Energy’s FreedomCAR Initiative.

The solutions provider

According to Texaco Ovonic, value creation will flow from sales of integrated systems, not individual batteries. “We take the commodity out of the business,” says Boutan. “We’re not a battery vendor; we’re a solutions provider.” Batteries for transportation uses, for example, are packaged as “plug and play” systems that include electronic controls, thermal management and wiring — whatever is needed to interface with the vehicle.

After being dried in an oven, the negative-electrode material is ready to be cut into individual electrodes.



Al Harville, vice president of Stationary Power Sales, sees “a rainbow of applications” for nickel metal hydride batteries.

That flexible approach also underlies the design of the new Springboro plant. “We can adjust production lines to meet market demands,” says Gary Absher, vice president of Manufacturing. The 170,000-square-foot (15,800-sq.-m) facility can produce more than 1 million electrodes a day and 1.2 million batteries a year.

Seeing green

Texaco Ovonic employees are now focused on turning a profit. When they talk about seeing green, however, it’s not just dollars they have in mind. Future environmental benefits are strong motivating factors. In fact, the previous manufacturing facility was ISO 14001 (Environmental Management System) certified, and the new Springboro plant is working toward recertification. “We’re well on our way to commercial success,” says Neslage. “We’re also excited to know we’re contributing to society.”

“We’re limited only by our imaginations,” says Scott Lindholm, vice president of Transportation Sales. “ChevronTexaco has given us the latitude to be creative, the freedom to act like a start-up.” At the same time, he says, the ChevronTexaco reputation “helps us every day by opening doors.” ■

