

JANUARY 12, 2009

# Technology Levels Playing Field in Race to Market Electric Car

By [NORHIKO SHIROUZU](#)

SHENZHEN, China -- It would seem like a lousy time to get into the car business, especially if you're a little-known company in the developing world. No start-up has grown into a major auto maker in at least half a century.

Wang Chuanfu, the founder and chairman of [BYD](#) Co., a Chinese battery and car maker, thinks he's got a shot.



*Bloomberg News/Landov*

Wang Chuanfu, BYD founder

Last month, BYD began selling a plug-in electric hybrid car in China, at least a year ahead of similar efforts in the U.S. and Japan. The car, called the F3DM, plugs into a home outlet and comes with a small gasoline engine that can recharge the battery on the go. It is the first of an array of electrified cars BYD plans to introduce around the world, starting in

China and then in the U.S. and Europe as early as 2010.

On Monday, Mr. Wang is expected to pitch the F3DM to U.S. consumers, during a news conference at Detroit's North American International Auto Show, which opens to the public Saturday. His venture has already attracted the attention of industry veterans and investors, including Warren Buffett.

Mr. Wang's strategy: capitalizing on the electric car's low barriers to entry. Few products are as complex to develop and produce as gasoline-powered automobiles, which are assembled with thousands of precisely engineered parts. But electric cars use only basic motors and gearboxes, and have relatively few parts. Aside from perfecting the battery itself, they're far easier and cheaper to build -- and that makes for a level playing field.

## [Chinese Carmaker Has an Eye to the Future](#)



In China, BYD Co. has developed a plug-in electric vehicle that can run as a gasoline-electric hybrid with the flip of a switch.

"It's almost hopeless for a latecomer like us to compete with GM and other established auto makers with a century of experience in gasoline engines," said Mr. Wang in an interview, pacing and juggling calls in BYD's headquarters on the outskirts of Shenzhen. "With electric vehicles, we're all at the same starting line."

It's still a bumpy road to a full-blown era of battery cars. Punishingly high gasoline prices have come down, potentially damping the public's willingness to embrace alternative-fuel vehicles. In addition to convincing consumers to try untested technology, BYD has to fight mistrust in the

West of Chinese-produced goods. Safety has also come into question, as some of the lithium-ion batteries -- widely believed to be the key to making viable electric cars -- have shown a tendency to overheat and sometimes catch fire.

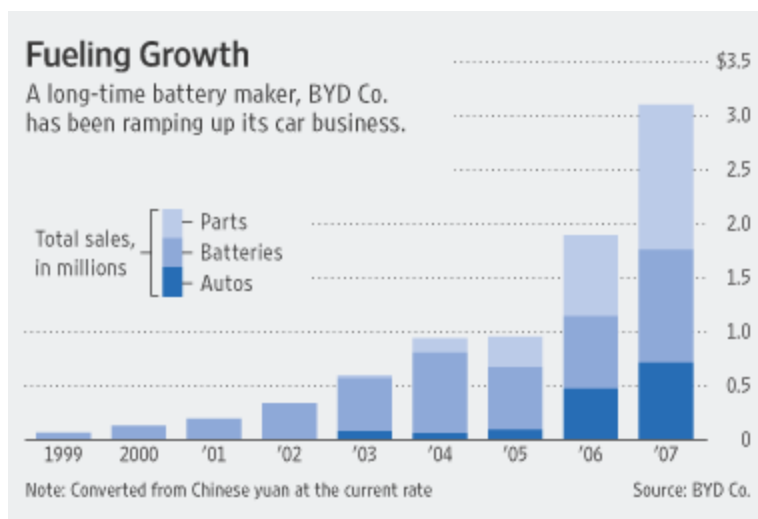
Mr. Wang says BYD's batteries use a new technology that makes them safer than other lithium-ion models. He also says cheap abundant labor helps keep his costs down, another factor that could sway consumers. In China, the F3DM is priced at 150,000 yuan, or \$22,000, and BYD expects it to sell for a similar amount in the U.S. The Chevrolet Volt, by contrast, may be priced at \$40,000 or more when it hits the market in late 2010.

Another potential BYD edge: more than a decade of experience specializing in making batteries. Mr. Wang started the company in 1995, borrowing \$300,000 from a cousin, and making batteries for cellphones. Today, BYD is the world's second-biggest producer of lithium-ion batteries. The company made 21.2 billion yuan (\$3.1 billion) in revenue last year and has a work force of 130,000. Last September, MidAmerican Energy Holdings Co., an Iowa-based energy producer, invested \$230 million in BYD for a 10% stake. Mr. Buffett is majority owner of MidAmerican.

BYD caught the investors' attention in part because of its army of 10,000 technicians and engineers, many fresh out of college and technical schools, says David Sokol, chairman of MidAmerican. "Mr. Wang has built high-quality but low-cost research and development capabilities in China," says Mr. Sokol.

The first of BYD's electric cars, the F3DM, is more of a purely electric car than the gasoline-electric hybrids on the road today. It can go about 50 to 60 miles exclusively on electricity when fully charged.

By contrast, [Toyota Motor](#) Corp.'s Prius is essentially a gasoline-fueled car with an electric engine that propels the car at low speeds and assists the gasoline engine when accelerating. The F3DM is similar in design to [General Motors](#) Corp.'s Chevy Volt. But it is being launched two years earlier than the Volt and one year ahead of Toyota's plug-in hybrid, which is due out for late 2009.



Other nontraditional players jumping into the fold include Think Global in Norway, Lightning Car Co. in the U.K. and Tesla Motors and Fisker Automotive, both in California. They all are planning to soon roll out or are already taking orders, albeit a very small number of them, for electric cars powered by lithium-ion batteries. The growing field of upstart competitors could pose a threat to Detroit, where the Big Three are betting that hybrids and battery cars can help fuel their

turnaround.

In China, BYD is already one of the fastest-growing independent auto makers. Demand for its traditional small cars, the F3 and the F0, is growing despite weakening car sales in China, allowing it to close in on Chery Automobile Co. and [Geely Holding](#) Group, the two biggest independent Chinese auto brands. The F3 was one of China's best-selling models during the last quarter of 2008. "BYD is probably the closest...to becoming the first Chinese auto maker to crack the Western auto markets," says Wolfgang Bernhart, a senior researcher for the German consulting firm Roland Berger.

By late 2009, BYD plans to mark another milestone by launching in China the BYD e6, an all-electric car capable of going 180 miles on a single full charge of its battery.

#### **The Battery Holdup**

The concept of an electric vehicle has been around for more than a century. But so far it has failed to become mainstream in large part because the batteries have been too heavy, bulky and costly. Until recently, no commercially available battery could store enough energy in a small space, such as under the car's back seat, recharge quickly and operate in all weather without overheating or failing.

Lithium-ion batteries, like the ones used in laptop computers and cellphones, hold the most promise. But the safety issues have slowed production. Both GM and Toyota say they are taking more time to roll out their electric cars to make sure their batteries are safe.

Mr. Wang says BYD's lithium-ion battery uses an iron-phosphate technology that is chemically stable and thus "inherently safe." He says it doesn't overheat to the point where it can catch fire.

The technology is similar in design to that developed by A123 Systems, a U.S. start-up battery maker led by a group of scientists from the Massachusetts Institute of Technology. GM is using their technology to power the Volt. Individuals close to A123 say the company plans to take apart BYD's battery cell to see if BYD has infringed on any of its technology. Officials at A123 declined to comment.

The Chinese company says it has spent more than 10 years developing its own iron-phosphate-based lithium-ion technology without infringing on others' intellectual property. "Sometimes foreigners think every Chinese company is stealing technology and design," says Luo Hongbin, a senior BYD engineer. But, he says, "we have been researching electric vehicles for so many years."

In early testing, reviewers said the car still has some kinks. The gasoline engine in the F3DM, for instance, rattles and can be noisy when it kicks in. The steering wheel also tends to get stiff when making a turn. Henry Li, a senior BYD executive in charge of overseas sales and marketing, says the company is working to resolve these issues before the car hits new markets: "We have plenty of time to make them perfect."

Mr. Wang, the 42-year-old Chinese entrepreneur, compares the simplicity of building electric cars to the simplicity of a digital watch. "Anyone can design and produce digital watches, but it's virtually impossible for a newcomer to match the precision of a Swiss wristwatch," Mr. Wang says.

Indeed, BYD's all-electric e6, has just two motors (45 parts each), one powering the front axle and the other the rear, and two gearboxes (60 parts each) to go with each of the motors. That means the whole system has 210 primary parts, excluding nuts and bolts. In comparison, BYD's

F6, a gasoline-fueled vehicle, has a total of 1,400 powertrain parts: a V6 engine composed of 840 parts and a transmission with 560 parts.

#### **Learning to Drive**

At BYD's plant in Shenzhen, electric motors and batteries are produced with little automation, creating a decidedly low-tech feeling to the place. Rows of workers, mostly women in their late teens and early 20s dressed in blue uniforms, assemble them largely by hand.

Mr. Wang's fascination with batteries harks back to his college days in the mid-1980s, when he studied metallurgical physics and chemistry. After receiving a master's degree, he found a research position at the General Research Institute of Nonferrous Metals in Beijing. He says it was a cushy job, but he grew bored and decided to go out on his own just as China's experiment with capitalism was going into full swing.

Mr. Wang set up BYD with two dozen engineers. Within a few years, the company was selling batteries to companies like Motorola Inc., Nokia Corp. and Samsung Electronics Co. The business doubled each year, Mr. Wang says. BYD went public on the Hong Kong stock exchange in 2002.

One industry that grabbed Mr. Wang's attention was cars, even though he didn't know how to drive at the time. (He has since learned and takes his Lexus to work.) In early 2003, Mr. Wang decided to acquire a small auto maker named Qinchuan Motors in Xian, but investors voiced strong opposition.

On a conference call, Mr. Wang disclosed that in 1998 he had instructed 20 of his top engineers to quietly scale up BYD's cellphone-battery technology so that it could be used to power cars some day. They developed an all-electric car, a clunky vehicle called the Flyer that was just a step above a golf cart.

Encouraged, investors blessed plans for BYD to first design a traditional gasoline car so the company could learn the basics of design and manufacturing. In mid-2005, BYD launched its first car, a small sedan called the F3. Foreign industry observers accused the F3 of being a copy of the Toyota Corolla. Mr. Wang says he was careful not to infringe on another company's intellectual property. "By synthesizing good ideas in China from Toyota and others, BYD created its own cars quickly," he says. He says he believed there was no better way to learn the ropes of the auto industry than "benchmarking" the industry's best.

A Toyota spokesman said the Japanese company doesn't intend to take BYD to court over the F3. "In general, we're always prepared to take legal action if we can determine there is a clear case of infringement," says company spokesman Hitoshi Yokoyama in Beijing.

Behind the scenes, BYD kept fine-tuning its electric cars. In April 2008, when Mr. Wang unveiled an e6 prototype at the Beijing auto show, it was an emotional moment for the executive, who grew up poor in Anhui Province and lost both of his rice-farmer parents to illness by the time he was 15.

Standing amid firecrackers and confetti, Mr. Wang declared the e6 marked the arrival of a new era in automobiles: "We have every confidence to surpass GM and Toyota and other global auto makers in electric-vehicle technology."

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