COVER STORY

The Battery King

How did a Chinese company that few people have heard of manage to defeat German carmakers at their own game?

BY HENRY SANDERSON — JULY 31, 2022

Illustration by Sam Ward

In late 2019, residents of the German town of Arnstadt awoke to find diggers breaking ground on a new factory at the site of a defunct solar panel plant. Stretching over 23 hectares (around 100 football fields), the $2 billion plant was Germany's first large scale battery 'Gigafactory' with the capacity to pump out enough batteries for hundreds of thousands of electric cars every year.

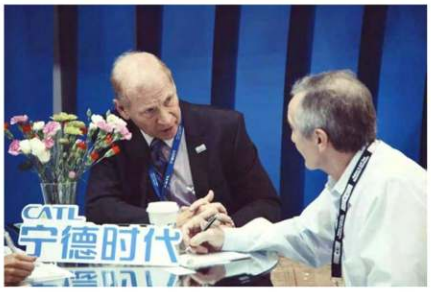
Germany invented the internal combustion engine in 1876 and makes the finest luxury cars in the world. The car industry helped power Germany's post-war *Wirtschaftswunder* with brands such as BMW, Mercedes-Benz and Audi becoming symbols of reliability and engineering expertise.

But the Arnstadt factory was not being built by a German carmaker. Instead it was being financed and constructed by a little-known Chinese company founded only eight years earlier in the mountainous eastern fishing town of Ningde, which is better known for its tea plantations and yellow croaker. The company, Contemporary Amperex Technology, or CATL, had already struck deals to supply batteries to Volkswagen and BMW as they sought to reinvent themselves and move away from producing internal combustion engines. It also had an agreement to supply batteries to Daimler's electric buses and trucks.

Aerial view of Contemporary Amperex Technology Thuringia GmbH (CATT), in Arnstadt, Thuringia, Germany. *Credit: CATL via LinkedIn*

German carmakers were turning to China for the core technology needed to switch their

entire industry to electric cars. In other words, China was providing them with the means for their own survival. Batteries, the most expensive part of an electric vehicle, were critical to its success as a mass-market item, and CATL had substantially lowered their costs.



Bob Galyen at The Battery Show in Michigan, 2016. Gaylen gave a presentation titled "How to Meet the Growing Demands of Large-Scale Battery Manufacturing." *Credit: CATL via LinkedIn*

"The rest of the world is playing catch-up," Bob Galyen, an American from Indianapolis who had worked as chief technology officer at CATL in Ningde, told me.

By 2019 Germany's largest industry faced a stark transition. To meet European Union climate change targets, the country's carmakers needed to go electric or they faced the prospect of large fines from Brussels. So carmakers such as Volkswagen had begun to make bold promises about the number of electric cars they would produce and the tens of billions of euros they would spend.

Yet European carmakers had no homegrown battery production or any presence in the broader battery supply chain. For years they had not really believed in electrification enough to invest money in large battery factories. That had left the ground open for Elon Musk's upstart Tesla Motors. As CATL's factory was breaking ground, Tesla was in negotiations to build a Gigafactory outside Berlin — another encroachment on Germany's home turf.

The move was called a 'declaration of war' by the *Frankfurter Allgemeine Zeitung* newspaper. German carmakers had no choice but to head to Asia with their checkbooks open to buy batteries in bulk and take stakes in Chinese battery companies.

> **Germany had made a "strategic error of neglecting the research and development of batteries," according to Stanford professor Fritz Prinz… "Perhaps it was thought that batteries would only be needed for smartphones and other portables, which was a mistake."**

"Our competitors are not based in Ulm or Munster," Wolf-Dieter Lukas, state secretary in the German Federal Ministry of Education and Research, said at a 2020 conference. "They are based in South Korea and China. The clear message is: we have to be at the forefront when the battery technology of the future is developed."

It was a reversal of fortunes for Europe. Germany was used to being a supplier to China of advanced manufacturing; but now China had moved up the value chain and was a competitor. It was a trend that Europe had done little to stop: in 2016 Chinese home appliance maker Midea had bought the German robotics company Kuka, whose robots were critical to making batteries.

CATL's founder Robin Zeng[1] was fully aware of the historical significance of his company's deal to supply the Mercedes-Benz brand: "Mercedes invented the car more than 130 years ago and has developed its technology with countless innovations. This combined with CATL's expertise in battery, will be a decisive step in both parties' electrification strategies."

CATL founder Robin Zeng speaking at the Fifth International Summit on

Power Battery Application (CBIS), in Ningde, China. 16th October, 2020.

he said in a press release.

How had a Chinese company that few people had heard of managed to defeat the German carmakers at their own game? By 2020 CATL was supplying almost every electric carmaker, including Tesla, giving the company a dominant position in the transition away from fossil fuels. It also supplied batteries to some of Germany's competitors — a number of Chinese start-ups such as Nio and Xpeng. These companies, which were listed on U.S. stock exchanges, had started to export cars to Europe. MG, the British car company owned by China's state-owned SAIC, already sold its ZS EV using CATL batteries in the UK. CATL also owned stakes in lithium projects in Argentina and Australia, a nickel project in Indonesia and a cobalt deposit in the Democratic Republic of the Congo — giving it access to the resources it needed.

Data: CATL company website, news reports

By consolidating its hold over the battery industry, China hoped to build a world-leading electric car industry. The round-faced and diminutive Zeng was worth $51.6 billion and was the 25th richest person on earth, according to the 2021 Bloomberg Billionaires Index.[2] The company had created more billionaires than either Google or Facebook, and was already worth more than Volkswagen.

Germany had made a "strategic error of neglecting the research and development of batteries," according to Stanford professor Fritz Prinz, who was born in Austria. "Perhaps it was thought that batteries would only be needed for smartphones and other portables, which was a mistake."

GLOBALIZATION IN A NUTSHELL

The headquarters of CATL lie on the edge of Ningde, a stone's throw from ponds where farmers raise carp. Inside the giant factory, battery parts move silently on automated conveyor belts. There are few people — and none of the armies of migrant workers that typified the Chinese boomtown factories of the 2000s.

Once an impoverished city with little but tea plantations and mountains, Ningde is well known in China due to President Xi Jinping's stint as Party secretary in the city from 1988 to 1990.[3] At the time, it was a demotion for Xi, who was moved from the busy coastal city of Xiamen to

Xi Jinping in Ningde, 1988. *Credit: CCTV via YouTube*

Ningde after his father, Xi Zhongxun, a high-ranking Party member, had refused to support a crackdown on the liberal reformer Hu Yaobang. A year later, Hu's death was the spark for student protests in Tiananmen Square, which resulted in the violent crackdown by the People's Liberation Army in June 1989 that put an end to hopes for reform of China's political system. Xi was in Ningde as China was convulsed by the nationwide protests.

The same year, a young man called Robin Zeng made his way to southern China, to the bustling coastal city of Dongguan in southern Guangdong province near Hong Kong, which was embracing capitalism and openness to the world, despite the widespread crackdown on political speech that followed the Tiananmen violence. For an ambitious young man in 1989 moving to Dongguan was like heading to the center of the world, a place becoming connected to global supply chains where workers lived in crowded dormitories and could watch Hong Kong TV.

Zeng found work at a Hong Kong company called SAE Magnetic that made magnetic recording heads for computer hard drives — an industry Dongguan would come to dominate. Thin-film magnetic heads allow computers to be smaller and store more data. The company had been recently bought by Japan's electronic giant TDK.

It was already a significant change from Zeng's childhood. He had been born into a farming family in the small mountain village of Lankou outside Ningde during the chaos of the Cultural Revolution in 1968. Zeng was naturally intelligent; he studied engineering at Shanghai Jiao Tong University and then earned a doctorate in condensed matter physics from the Chinese Academy of Sciences in Beijing. After graduating, he joined a state-owned company in Fujian province, where he could have led a comfortable life with an 'iron rice bowl' — a job that would have left his parents very satisfied and proud. But the entrepreneurial Zeng was not content to idle away his hours in the sleepy state sector and left after just three months.

Zeng stayed in Dongguan for ten years, rising to become the firm's only mainland-China-based director. During this period, he also started to learn about batteries and met businessmen with international connections. One was T.H. Chen, a Taiwanese who had been born in Hunan province, had a PhD in physical chemistry from the University of California at Berkeley and had previously worked for IBM. In 1999 Zeng formed ATL, with T.H. Chen becoming the chief executive.

The battery business had been dominated by Japan ever since Sony commercialized the first lithium-ion battery in 1991. China's Institute of Physics didn't develop its first lithium battery until 1995. Even by the year 2000, Japan accounted for 90 percent of the world's lithium-ion battery production with 500 million batteries, and China only producing 35 million.

In the beginning, ATL had little of its own intellectual property or any breakthrough technology. Instead, Zeng and his colleagues spent $1 million buying a lithium polymer patent from Bell Labs in the United States. But when they returned home, ATL found making the technology work was not as easy as they had thought — the battery expanded when it was repeatedly charged and was also at risk of exploding.

They spent two weeks trying different electrolyte combinations before they got the lithium polymer battery to work. Once they'd done that, they managed to rapidly cut the cost of production — a model Zeng would repeat later with electric car batteries. Right as the cell phone market was poised to grow considerably, ATL was producing batteries at half the cost compared to their Korean competitors. Their lithium polymer battery was also thinner than other models and could be shaped according to the device.

Open circuit voltage testing and packing at ATL's Research and Development lab. *Credit: ATL*

ATL was profitable within three months of the battery's production. By 2001 ATL shipped over one million batteries, and that same year China joined the World Trade Organization, which opened up the country to significant foreign investment.

In 2003, ATL received $30 million in investment from top-tier U.S. private equity company the Carlyle Group as well as 3i Group from the UK.

"ATL is a notable example of next generation Chinese businesses making a mark in the global technology arena," Carlyle said. "Its polymer batteries are thinner, more flexible and safer than traditional lithium-ion batteries, at the same time offering consumers a 10–20% higher energy density."

Gabriel Li, managing director of Carlyle Asia Technology Fund, noted that Dongguan was "the lowest manufacturing cost location in the world," from which ATL sold batteries to leading multinationals.

It was all the benefits of globalization in a nutshell for China: foreign technology, foreign money and a Chinese company producing high-value products.

In 2004 it entered Apple's supply chain, providing batteries to its iPod. A year later, Japan's TDK bought the whole of ATL for $100 million.

TDK had a deep and broad experience in consumer electronics, from cassette tapes to videotapes, and Zeng could have had a comfortable executive career there. But by the early 2010s Zeng could see that China's government was serious about supporting an electric car industry — both to clean up air pollution and reduce reliance on oil imports, but also to attempt to leapfrog Western carmakers and have a stake in the car industry of the future.

> **BMW's reputation in the industry has helped lift CATL out of obscurity and into stardom.**
>
> — *China Daily*

Starting in 2009, Beijing began paying people to buy electrics, using a mixture of generous subsidies and incentives. In Hangzhou, for instance, consumers received nearly $20,000 from central and local governments to buy an EV. Meanwhile, local governments vied with each other to buy electric taxi fleets or buses. Between 2009 and 2017 the Chinese government spent an estimated $60 billion on subsidies. It was an unprecedented — and expensive — industrial intervention that quickly made China's electric car industry the biggest in the world.

In order to create a fully Chinese battery champion, CATL, whose Chinese name means 'the age of Ningde', was split off from ATL with the support of the Chinese government.[4]

One of CATL's earliest deals was with BMW's Chinese joint venture, BMW Brilliance. China had put pressure on BMW to help its joint venture develop EVs, and in 2013 it launched the Zinoro 1E, an electric SUV that used CATL batteries, with a range of 150

launched the Zinoro 1E, an electric SUV that used CATL batteries, with a range of 150 kilometers.

Click here to read a Big Picture about CATL by The Wire China*'s Eliot Chen.*

The deal was transformational: the rigorous testing of BMW helped improve CATL's standards, and BMW maintained a permanent floating cohort of staff checking on every step of the battery manufacturing process.

"BMW's reputation in the industry has helped lift CATL out of obscurity and into stardom," the state-owned China Daily said.

Between 2014 and 2017, CATL's sales increased at a compound annual growth rate of 263 percent. In 2016, according to Galyen, CATL's former chief technology officer, CATL delivered more battery packs to battery company Yutong Bus than Tesla had used in all of its cars since it began making them.

In 2017 CATL filed for an initial public offering (IPO) on the Shenzhen Stock Exchange, with the help of Goldman Sachs. The company raised $853 million and became the world's largest producer of electric car batteries with a 50 percent share of the Chinese market.

Robin Zeng speaking at a New-Energy Vehicle industrial chain discussion at the launch of BMW Brilliance's Zinoro 60H plug in hybrid SUV. *Credit: BMW Group*

'A VERITABLE SPERM WHALE'

How did CATL manage to grow so fast? One element was that Zeng had already helped build ATL into a globally successful battery producer. He and his colleagues had considerable knowledge and skill from the competitive global mobile phone market, and he took that manufacturing experience to CATL — where the company worked with machine manufacturers to design its own machines to make a high volume of batteries. Once the staff were educated in how to use them, this allowed for a higher throughput of batteries of a higher quality than other manufacturers.

Galyen called this magic combination 'man and machine' or 'M&Ms': "He [Zeng] already knew how to make batteries. All he had to do was make them bigger."

But the other crucial factor was brute protectionism from Beijing. China's subsidy machine was specifically designed to boost

machine was specifically designed to boost domestic companies and create a Chinese electric car ecosystem. Between 2016 and 2018, the Ministry of Industry and Information Technology produced an annual list of approved EV battery suppliers — all of which were Chinese companies.

A CATL lithium iron phosphate battery cell for use in electric buses in China. *Credit: Martin Schutt/picture-alliance/dpa/AP Images*

"The premise is that locally produced cars in China are obligated to use local batteries," Jochem Heizmann, chief executive of Volkswagen Group China, said.

Introduced in the world's largest electric car market just as sales were taking off, the policy was extremely powerful — effectively barring Korean battery companies LG Chem and Samsung SDI from competing.

"It was actually a brilliant strategy," Jim Greenberger, founder of NAATBatt, the North American trade association for advanced battery technology, told me. "CATL was the winner and they have used that scale to compete very effectively in the export market. That's the issue we're dealing with in the west: how to compete with Chinese companies that have gotten to scale, via use of industrial policy."

Under Zeng, however, CATL was far from complacent. He saw the battery industry as akin to a war.

> **The appearance of new technology not only encourages breakthrough economic development, but also changes the structure of global competition.**
>
> *— Robin Zeng*

"We are competing with gasoline cars," he said. "If we can't win against gasoline cars, there's no place for us in the market."

Zeng knew that CATL could not always rely on Chinese subsidies for help. In an internal email in 2017, he questioned a Chinese allegorical saying: "the typhoon is coming, even the pigs can fly," which suggests that with government support any company can do well. Zeng was not convinced. "But are the pigs flying? Once the typhoon passes, what is the situation for the pigs that are left?" he asked.

Neill Yang, head of marketing at CATL, put it more explicitly: "People think we're a big successful company, but we think we're in jeopardy every day. The market environment and technology changes so fast that if we don't follow the trend we could die in three months."

Zeng plowed money into R&D, spending more than his rivals. By 2019 CATL had over 2,000 patents in batteries and battery charging, and it has relentlessly pursued innovations that helped push down the costs of batteries. For instance, it combined battery cells directly with aluminum battery packs and removed the battery modules, which saved materials and reduced the battery's weight. In 2020 it also became the first battery maker to announce it had developed a 'million-mile' battery that would last for 16 years. It was a significant achievement as it meant batteries could outlast the cars, and could be re-used, helping to push costs down even further.

CATL's EnerOne won the 2022 ees (electrical energy storage) Award. *Credit: CATL's website*

When Tesla built a factory in Shanghai in early 2020 it chose CATL as a provider — the company met both its cost and its technology requirements. The state-owned China Daily was metaphorically effusive over CATL: "in only a few years [CATL] has grown from an ordinary fish in the hatchery of China's new energy vehicle market into a veritable sperm whale."

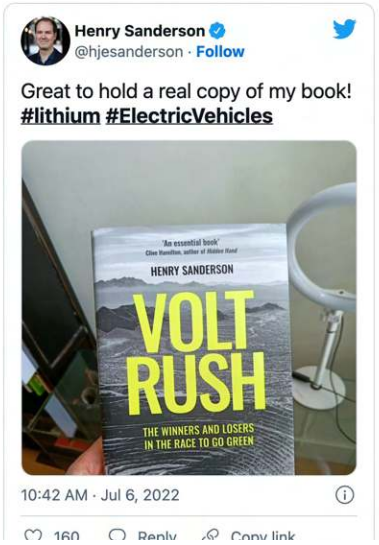
China's manufacturing prowess — in the form of CATL — had helped to significantly drive down the global cost of batteries, making electric cars increasingly cost-competitive against petrol cars. It was a similar process to what had happened in almost every other clean technology, from solar panels to polysilicon production. Subsidies had led to a rush to produce and overcapacity, but had ended up with China dominating global markets.

The cost of lithium-ion battery packs fell by 89 percent in real terms between 2010 and 2020 — going from $1,100 per kilowatt-hour (kWh) in 2010, to $137 per kWh in 2020, according to Bloomberg New Energy Finance.

CATL did an "outstanding job of taking an existing technology and scaling it — taking it from low volumes to high volumes in a very cost effective and high-quality way," Galyen, CATL's former chief technology officer, said. It would be hard for other countries and companies to catch up unless they invented a new battery chemistry, he added.

By 2021 CATL was the second-largest listed company in China with a market capitalization of over $200 billion. Zeng was keenly aware of the importance to China of having a strong battery and car industry. New technologies were closely connected to national power and strength, he said. Before the nineteenth century China had been a leader in the global economy thanks to ironware and the 'four great inventions': papermaking, printing, gunpowder and the compass. But the invention of the steam engine in the eighteenth century had caused the UK to become a global factory and China to "miss an opportunity, and to decline from a peak."

Nevertheless, in his view, over the last 40 years China had made some advancements in certain areas such as 5G technology. The current global economy was focused on renewable energy, electric cars, biotechnology and artificial intelligence, he said. The change in the car industry was an opportunity not seen in a hundred years. The battery industry could make China a "strong country," economically and politically.



"In the whole of human history, every period of new technology represents an advance in productivity," Zeng wrote. "The appearance of new technology not only encourages breakthrough economic development, but also

changes the structure of global competition."

Read 13 replies

Excerpted from VOLT RUSH: The Winners and Losers in the Race to Go Green *by Henry Sanderson, published by Oneworld.*

Henry Sanderson is the current Executive Editor for Benchmark Mineral Intelligence, and has written widely about the resource implications of moving towards clean energy. He was previously a reporter for *FT* in London, and for *Bloomberg* in China. He has been interviewed by the BBC, Bloomberg Television, CNBC, and Charlie Rose. @hjesanderson

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COVER STORY

New Kid on the Block

BY CHANG CHE

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