# U.S.-China Economic and Security Review Commission

## Economics and Trade Bulletin

**December 10, 2018**

## Highlights of This Month's Edition

- **Bilateral trade:** In October 2018, the U.S. goods trade deficit increased 22.3 percent year-on-year to reach a record high of $43.1 billion; declines in export categories targeted by retaliatory tariffs contributed to the sharp deficit increase.
- **Bilateral policy issues:** Escalation in U.S. and Chinese tariffs halted for 90 days, but longstanding U.S. concerns about China's technology transfer, intellectual property (IP) theft, and innovation policies remain unaddressed; the Chinese government commits to take additional steps to combat illicit fentanyl flows, purchase U.S. agricultural products, but details of the agreement remain unclear; the U.S. government took action against Fujian Jinhua Integrated Circuit, citing IP violations, and trade secret theft from Micron (the largest U.S. memory chip maker), and risks to the U.S. military supply chain; Huawei executive arrested for allegedly violating U.S. sanctions.
- **Policy trends in China's economy:** Alibaba's Singles' Day sales reach another record high, but the pace of growth has slowed, reflecting a weaker Chinese economy and rising competition from other e-commerce platforms and promotional events.
- **In Focus – Lithium-ion batteries:** China has positioned itself to dominate global supply chains and production of lithium-ion batteries, a core technology enabling the adoption of electric vehicles and transportation.

## Contents




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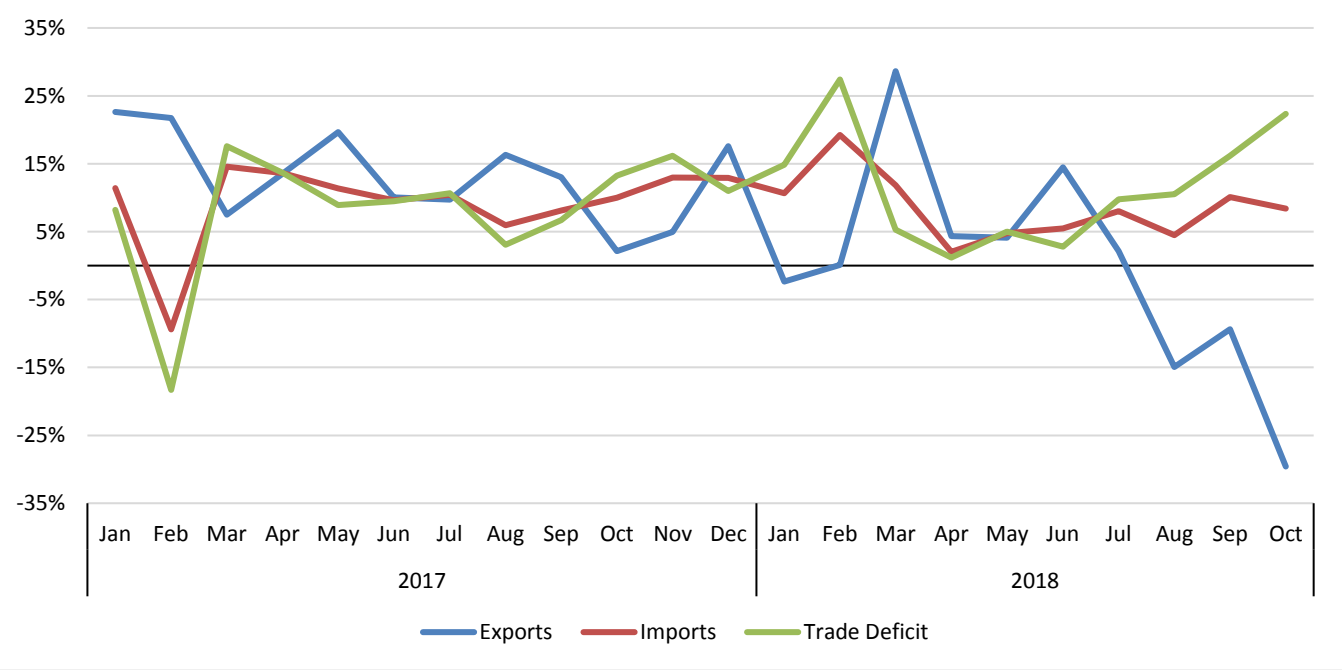
# Bilateral Trade

## Trade Deficit Reaches Record High on Falling Exports

In October 2018, the U.S. goods trade deficit with China rose 22.3 percent year-on-year to reach $43.1 billion (see Figure 1), setting a monthly record for the fourth consecutive month.[1] This month, U.S. exports to China declined to $9.1 billion, their lowest level since June 2016 and a 29.6 percent decrease year-on-year.[2] Reduced oilseed, mineral oil, and vehicle exports to China—major categories targeted by retaliatory tariffs—largely contributed to this decrease.[3] U.S. imports from China increased 8.4 percent year-on-year to reach $52.2 billion, with cellphones toys, games, and sporting goods continuing to be leading import categories.[4]

In the first ten months of 2018, the U.S. deficit with China totaled $344.5 billion, an 11.5 percent increase over the same period in 2017.[5]

**Figure 1: Year-on-Year Change in U.S. Goods Trade with China, January 2017–October 2018**




*Source:* U.S. Census Bureau, *Trade in Goods with China*, December 6, 2018. *https://www.census.gov/foreign-trade/balance/c5700.html*.

# Bilateral Policy Issues

## G20 Meeting Eases Trade Tensions but Major Questions Remain

On December 1, President Donald Trump and Chinese President and General Secretary of the Chinese Communist Party Xi Jinping had a dinner meeting on the sidelines of the G20 meeting in Argentina bringing a temporary truce to the ongoing economic tensions. Though both sides praised the outcomes of the agreement, observers remain concerned about the nature of the commitments made by China and the timeline for future steps. There was no joint statement, and each country published its own list of takeaways, some of which described the outcomes in different terms—or omitted some outcomes altogether—sowing confusion.[6] The White House statement said the United States and China would "immediately begin negotiations on structural change" to a host of market-distorting

Chinese practices, including forced technology transfer, cyber intrusions, and nontariff barriers to trade.[7] President Trump agreed that while the negotiations are ongoing, the 10 percent tariffs on $200 billion worth of Chinese exports will not increase to 25 percent as they were originally scheduled to do on January 1, 2019; however, if no agreement is reached within 90 days from December 1, the tariffs will be raised to 25 percent.[8] It is notable that the initial Chinese statement did not mention the 90-day deadline, though it was eventually acknowledged.[9] Other key points of the agreement are discussed further in this section.

## Trade Dispute Centers on Changes to China's Technology Transfer and Intellectual Property Policies

Over the past year, the U.S. government leveraged a variety of trade enforcement actions[*] to address its longstanding concerns about China's technology transfer, intellectual property (IP) theft, and innovation policies.[10] These actions include launching Section 201, Section 232, and Section 301 investigations,[†] enacting tariffs on Chinese exports to the United States, and bringing cases against China to the World Trade Organization.[‡] On November 20, 2018, the Office of the U.S. Trade Representative (USTR) assessed that following a year of negotiations and trade enforcement actions, China has "failed to take any substantive actions to address U.S. concerns."[11] Instead, the report found, the regulatory burden placed on the U.S. economy from Chinese government innovation policies and demands for transfer technology transfer and IP "continues to increase."[12]

At the Trump-Xi meeting, both sides agreed to begin negotiations and hold off on any escalation in tariffs over the next 90 days.[13] In a press statement, the United States demanded "structural changes with respect to [China's] forced technology transfer, intellectual property protection, non-tariff barriers, cyber intrusions and cyber theft, services and agriculture" and has threatened to raise existing 10 percent tariffs to 25 percent if an agreement is not reached.[14] The Chinese government stated that it will seek "to resolve the existing differences and problems," and acknowledged the 90-day timeframe in a later press statement.[15]

On December 4, the National Development and Reform Commission—China's industrial policy-making body—and several other Chinese government agencies released a memorandum of cooperation to strengthen government enforcement and 38 different punishments for IP theft and infringement, a potential step forward in addressing one of the key U.S. concerns.[16] Scott Kennedy, deputy director at the Center for Strategic and International Studies, said, "I think it's potentially significant if they are implemented and result in a reduction in IP theft" but cautioned that "we've been down this road with China many times on IP."[17]

[*] For an analysis of U.S. trade tools to address China's unfair practices, see U.S.-China Economic and Security Review Commission, "Chapter 1, Section 2: Tools to Address U.S.-China Economic Challenges," in *2018 Annual Report to Congress*, November 2018, 74–110. *https://www.uscc.gov/sites/default/files/Annual_Report/Chapters/Chapter%201%20Section%202-%20Tools%20to%20Address%20U.S.-China%20Economic%20Challenges_0.pdf*.

[†] The U.S. Department of Commerce launched Section 201 investigations on the increase in washing machine and solar panel imports and the Section 232 investigations on the national security risks from steel and aluminum imports to the United States. The USTR's Section 301 investigations examine whether China's technology transfer, IP theft, and innovation policies and practices are discriminatory or burdensome to U.S. commerce. U.S.-China Economic and Security Review Commission, "Chapter 1, Section 1: Year in Review – Economics and Trade," in *2018 Annual Report to Congress*, November 2018, 43–44. *https://www.uscc.gov/sites/default/files/Annual_Report/Chapters/Chapter%201%20Section%202-%20Tools%20to%20Address%20U.S.-China%20Economic%20Challenges_0.pdf*.

[‡] For more information on U.S. trade enforcement actions, see U.S.-China Economic and Security Review Commission, "Chapter 1, Section 1: Year in Review – Economics and Trade," in *2018 Annual Report to Congress*, November 2018, 43–49. *https://www.uscc.gov/sites/default/files/Annual_Report/Chapters/Chapter%201%20Section%202-%20Tools%20to%20Address%20U.S.-China%20Economic%20Challenges_0.pdf*; in addition, these steps are outlined in: Office of the U.S. Trade Representative, *Update Concerning China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, November 20, 2018, 5. *https://ustr.gov/sites/default/files/enforcement/301Investigations/301%20Report%20Update.pdf*.

## United States, China Agree to Control Fentanyl, but Details Remain Unclear

The U.S. and Chinese governments struck an informal agreement to crack down on illicit fentanyl flows from China, but the details remain unclear. Fentanyl, a synthetically produced opioid, is one of the leading causes of the current U.S. opioid epidemic, contributing to a record 29,400 synthetic opioid overdoses in 2017.[18] According to the U.S. Drug Enforcement Administration (DEA), China is the primary source of fentanyl and fentanyl-like substances in the United States.[19] Following the dinner between Presidents Trump and Xi, the White House issued a statement that China had committed to designating fentanyl as a controlled substance; however, fentanyl has been controlled in China since 2015, leaving analysts uncertain about what this announcement would mean in practical terms.[20] The Chinese government statement, meanwhile, agreed to control all fentanyl-related substances, a much more significant concession and a goal the DEA has been pursuing in its negotiations with Beijing.[*] Both statements are presented in Table 1.

**Table 1: U.S., Chinese Statements Regarding a Fentanyl Agreement**

| U.S. Statement | Chinese Statement |
|---|---|
| "President Xi, in a wonderful humanitarian gesture, has agreed to designate Fentanyl as a Controlled Substance, meaning that people selling Fentanyl to the United States will be subject to China's maximum penalty under the law."[21] | "The two sides also agreed to take proactive steps to strengthen cooperation on law enforcement and combating illicit drugs, including the synthetic drug fentanyl.... China has decided to list all the fentanyl-like substances as controlled substances and start working to adjust related regulations."[22] |

According to Jeremy Douglas, the regional representative of the UN Office on Drugs and Crime for Southeast Asia and the Pacific, a senior official in Beijing indicated to him in the days following the announcement that China would be establishing fentanyl as its own class of controlled substance.[23] The agreement would ensure all future fentanyl analogues are automatically controlled in China and traffickers are subjected to legal ramifications. This would represent a dramatic change from the current regulatory environment in China. The Chinese government has already controlled 25 fentanyl substances and two fentanyl precursors, but Chinese manufacturers are able to stay ahead of regulators by modifying controlled substances' chemical structure to create "new," uncontrolled substances that can be legally manufactured in and exported from China.[24] "Right now," Mr. Douglas told the *New York Times*, "there's nothing stopping a pharmaceutical company or supplier from selling related but noncontrolled [fentanyl] substances."[25]

The U.S. government recently took similar steps to control fentanyl products; in February 2018, the DEA issued a temporary order to automatically control all fentanyl-related substances as Schedule I substances[†] effective through February 2020.[26] The decision was "based on a finding by the [DEA] that the placement of these synthetic opioids in schedule I is necessary to avoid an imminent hazard to the public safety."[27]

If the Chinese government follows through on its announcement, the decision could take months (or more) to implement.[28] The Chinese government would need to amend its chemical control laws, a task further complicated by Beijing's recent efforts to reform broader chemical industry oversight, including restructuring the roles of major regulatory bodies responsible for overseeing the chemical industry like the Ministry of Environmental Protection, the State Administration of Work Safety, and the China Food and Drug Administration.[29]

[*] For more on the recent negotiations between the DEA and Chinese law enforcement on illicit fentanyl flows, see Sean O'Connor, "Fentanyl Flows from China: An Update since 2017," *U.S.-China Economic and Security Review Commission*, November 26, 2018. *https://www.uscc.gov/sites/default/files/Research/Fentanyl%20Flows%20from%20China.pdf*.

[†] Schedule I substances are outlawed completely in the United States due to their lack of acceptable medical uses and high potential for abuse. Schedules of Controlled Substances, codified at 21 C.F.R. § 1308 (September 2016).

There also remain concerns Beijing could renege on its promises. Following a meeting with Chinese officials on the sidelines of the G20 summit in 2016, the U.S. National Security Council released a statement indicating the Chinese government would commit to targeting U.S.-bound exports of substances controlled in the United States, but not in China.[30] A Chinese readout from the same discussion, however, did not include making the commitment, and Beijing never implemented the policy.[31]

### U.S. Agricultural Sector Hopeful but Uncertain

A post-G20 statement from the White House indicated China would resume purchasing U.S. agricultural products immediately, with a future agreement to "purchase a not yet agreed upon, but very substantial" amount of U.S. agricultural products.[32] China's Ministry of Foreign Affairs also released an initial statement praising the results of the dinner, but only indicating China would increase imports "according to the needs of the domestic market and the people" while making no mention of specific purchases or a timetable.[33] On December 6, China's Ministry of Commerce spokesperson Gao Feng affirmed that China would resume purchasing agricultural products.[34] Domestic media reported that elimination of all tariffs was the goal of the 90-day negotiation period.[35]

Markets reacted swiftly to the news, with soybean, corn, and wheat prices increasing in the United States; soybean futures returned to levels not seen since China implemented the first round of retaliatory tariffs on July 6.[36] China's 25 percent retaliatory tariffs on roughly 95 percent of U.S. agricultural exports, based on 2017 trading volumes, have effectively removed a key market for U.S. farmers: agricultural exports to China during the first ten months of the year declined to their lowest levels since 2007.[37] Soybean farmers, who sold $12.3 billion or 57.1 percent of exports to China in 2017, have stockpiled their 2018 harvest in the hopes that a resolution to trade tensions would come before the soybeans rot or Brazil begins harvesting a bumper crop.[38]

Even if the United States and China negotiate a deal within the prescribed 90-day window, uncertainty remains regarding whether the impact of trade tensions can be reversed for U.S. agricultural exports, both in the current marketing year[*] and in the longer term.[39] Within the current marketing year, Chinese traders have little incentive to purchase U.S. soybeans as long as China's 25 percent retaliatory tariffs remain in place, making Brazilian soybeans roughly $60 cheaper per ton.[40] In the longer term, continued uncertainty may prompt both sides to curb expectations of future trade. Prior to the meeting in Buenos Aires, the U.S. Department of Agriculture (USDA) released early predictions that U.S. soybean acreage will decrease by 7.4 percent in 2019 and not fully recover to 2018 levels within the next ten years,[41] the duration of the forecast. China has also taken measures to reduce dependence on U.S. agricultural exports: on October 26, the China Feed Industry Association enacted guidelines advising hog farmers to cut the use of oilseed in pork feed by an estimated 13 percent.[42]

## U.S. Government Takes Actions against Fujian Jinhua over IP Theft and Supply Chain Risks

Over the last two months, the U.S. Department of Commerce and U.S. Department of Justice took separate action against the Chinese provincial state-owned semiconductor firm Fujian Jinhua Integrated Circuit to address Fujian Jinhua's alleged IP infringement and trade secret theft from Micron[†] (the largest U.S. memory chip maker) and risks to the U.S. military supply chains.[43] Over the last four years, the Chinese government has employed a wide range

[*] A marketing year is period for reporting or analyzing the production and sale cycle of a commodity. The marketing year for soybeans runs from September 1 to August 31 for every U.S. state except Louisiana, Mississippi, and Texas. U.S. Department of Agriculture National Agricultural Statistics Service, *Agricultural Prices: 2008 Summary*, August 2009, 16. *http://usda.mannlib.cornell.edu/usda/current/AgriPricSu/AgriPricSu-08-05-2009.pdf.*

[†] For more information on the alleged theft of Micron's semiconductor technology, see U.S.-China Economic and Security Review Commission, *Economics and Trade Bulletin*, July 9, 2018. *https://www.uscc.gov/sites/default/files/trade_bulletins/July%202018.pdf*.

of strategies* to break China's dependence on semiconductor imports and transform domestic firms such as Fujian Jinhua into globally competitive semiconductor firms.[44]

On September 27, the U.S. Department of Justice (DOJ) indicted Jinhua, United Microelectronic Corp. (UMC)—a Taiwan partner of Fujian Jinhua UMC—and three individuals of "conspiracy to steal, convey, and possess stolen trade secrets of an American semiconductor company for the benefit of a company controlled by the [Chinese] government."[45] If convicted, the individual defendants each face 15 years in prison and a $5 million fine, and the companies face fines of more than $20 billion.[46] DOJ also filed an injunction to prevent U.S. importation of Jinhua and UMC products.[47] But it is not clear which products this injunction affects, as Jinhua has not yet begun production. More broadly, DOJ created a China Initiative to identify priority Chinese trade theft cases, as well as support work to investigate Chinese espionage in research labs and universities and to counter Chinese influence operations.[48]

This case is one of three related lawsuits involving Micron, Fujian Jinhua, and UMC. In August 2017, Taiwan authorities indicted former Micron employees for providing proprietary chip designs to UMC.[49] In December 2017, Micron sued UMC and Fujian Jinhua for trade secret theft and IP infringement in the U.S. District Court for the Northern District of California; the case is ongoing.†[50] In March and April 2018, Jinhua and UMC countersued in Fujian Province for patent infringement.[51] The Fujian court issued a preliminary injunction in July 2018 barring Micron from selling 26 products in China, affecting around 1 percent of Micron's annualized revenue; Micron has stated it would appeal the decision.[52]

On October 29, 2018, the U.S. Department of Commerce added Fujian Jinhua to the Entity List,‡ requiring a license for "all exports, re-exports and transfers of commodities, software and technology" to Fujian Jinhua.[53] To comply, U.S. and European suppliers to Fujian Jinhua then in the midst of installing equipment immediately halted cooperation and recalled their staff.[54] UMC also suspended its research and development operations with Fujian Jinhua.[55] As a result, Fujian Jinhua's factory—originally scheduled to begin production in the next few months—has temporarily shut down.[56]

According to Secretary of Commerce Wilbur Ross, "Placing Jinhua on the Entity List will limit its ability to threaten the supply chain for essential components in our military systems."[57] This move was viewed as unusual because Fujian Jinhua has not yet begun production, and represented a broader interpretation of national security than is typically applied in such cases (e.g., supporting terrorism, sending exports to sanctioned countries like Iran or North Korea, or violating export controls).[58] China's Ministry of Commerce's criticized the decision, stating that "China opposes the U.S. overgeneralizing the concept of national security, abusing export control measures, imposing unilateral sanctions, and disturbing normal international trade and cooperation between enterprises. China urges the U.S. to take actions to end these wrong practices at once, provide facilitation for cooperation between Chinese and American businesses, and protect their lawful rights and interests."[59]

* For more information on China's state-led efforts to develop its semiconductor industry, see U.S.-China Economic and Security Review Commission, Chapter 1, Section 3, "China's 13th Five-Year Plan," in *2016 Annual Report to Congress*, November 2016, 155–161. *https://www.uscc.gov/sites/default/files/Annual_Report/Chapters/Chapter%201%2C%20Section%203%20-%2013th%20Five-Year%20Plan.pdf.*

† The law firm Wilson Sonsini Goodrich & Rosati estimated that U.S. district court cases on IP theft typically take an average of 2.4 years to conclude. James C. Yoon, "IP Litigation in the United States," *Wilson Sonsini Goodrich & Rosati*, August 4, 2016. *https://law.stanford.edu/wp-content/uploads/2016/07/Revised-Stanford-August-4-2016-Class-Presentation.pdf*.

‡ The Entity List identifies actors "reasonably believed" to be involved in activities "contrary to the national security or foreign policy interests of the United States." Department of Commerce Bureau of Industry and Security, Export Administration Regulations Supplement No. 4 § 744.16 Entity List. *https://www.bis.doc.gov/index.php/documents/regulation-docs/418-part-744-control-policy-end-user-and-end-use-based/file*.

## U.S. Warrant Leads to Arrest of Huawei Executive in Canada

On December 1, Canadian law enforcement arrested Meng Wanzhou, chief financial officer at Huawei and daughter of Huawei founder Ren Zhengfei, on an outstanding U.S. warrant for allegedly violating U.S. export control and sanction laws.[60] U.S. authorities allege Huawei had ties to Skycom Tech, a Hong Kong firm that was selling U.S. goods to Iran and doing business with companies there in violation of U.S. sanctions.[61] Ms. Meng reportedly knew about these operations but assured international financial institutions there was no connection between Huawei and Skycom.[62]

Ms. Meng is currently seeking bail as she awaits an extradition hearing to the United States.[63] The U.S. Department of Justice must present evidence supporting extradition to Canadian court within 60 days from the date of arrest.[64] In response to the arrest, the Chinese government has demanded that the United States drop the arrest warrant and summoned both the U.S. and Canadian ambassadors to China to complain about her detention.[65]

This case is similar to the U.S. 2016 case against ZTE. In that case, the U.S. Justice Department argued ZTE used "cutoff companies" to do business with Iran, North Korea, and other countries sanctioned by the U.S. government.[66] In 2018, the U.S. Department of Commerce's Bureau of Industry and Security (BIS) found ZTE violated its 2016 case settlement, leading to additional penalties.*

# Policy Trends in China's Economy

## Alibaba's Singles' Day Sales Reach Another Record High

Chinese e-commerce giant Alibaba saw $30.8 billion in gross merchandise volume (GMV)† during its 24-hour shopping holiday on November 11, known as Singles' Day, beating last year's record of $25.3 billion (see Figure 2).‡ [67] Singles' Day began as a relatively obscure social activity in Chinese universities during the 1990s for students to celebrate being single. Alibaba transformed the date into an annual online shopping event on its e-commerce platform Tmall in 2009, and it has become the world's largest online shopping event, outstripping the combined sales of major U.S. shopping holidays.[68] Sales during Amazon Prime Day in July 2018 reached $4.2 billion, while Black Friday brought in $6.2 billion in sales and Cyber Monday generated $7.9 billion in sales in November 2018.[69] This year, Alibaba reported that over 180,000 Chinese and international brands participated in Singles' Day and the number of delivery orders processed by Alibaba's Cainiao logistics network during the event topped one billion packages.[70]

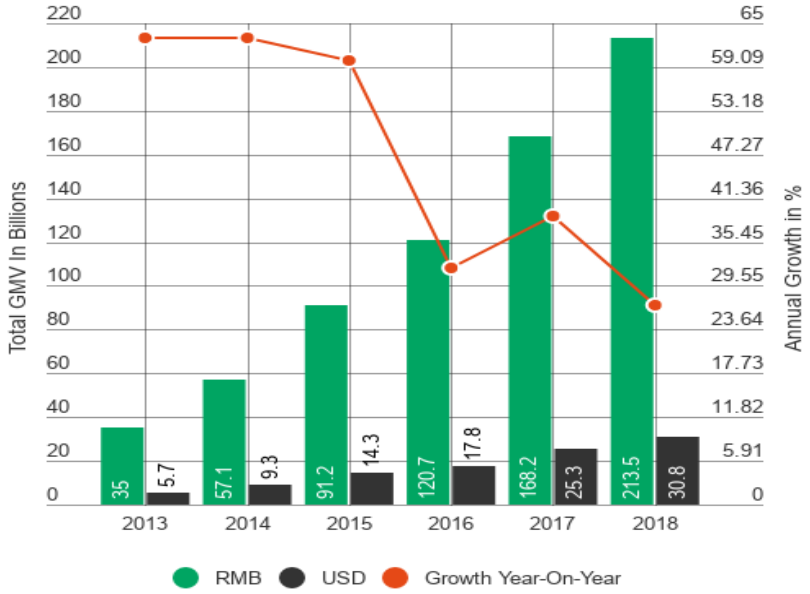
A number of Alibaba's other business units—including food delivery platform Ele.me, high-tech supermarket chain Hema, and Southeast Asian e-commerce platform Lazada—also participated in Singles' Day, reflecting Alibaba's strategy of expanding into wider industries and more international markets.[71] Alibaba is looking to make Singles' Day a global phenomenon; this year, the company brought Singles' Day to six Southeast Asian countries through Lazada.[72]

* For more information about U.S. sanctions on ZTE for exporting technologies to Iran, North Korea, and Cuba, see U.S.-China Economic and Security Review Commission, "Chapter 1, Section 1: Year in Review: Economics and Trade," in *2018 Annual Report to Congress*, November 2018, 47. *https://www.uscc.gov/sites/default/files/Annual_Report/Chapters/Chapter%201%20Section%202-%20Tools%20to%20Address%20U.S.-China%20Economic%20Challenges_0.pdf*

† Alibaba defines gross merchandise volume (GMV) as the total value of confirmed orders transacted on its marketplace platforms. GMV does not accurately reflect revenue because it does not factor in returns or cancellations. Paul Gillis, "Singles Day and GMV," *Seeking Alpha*, November 23, 2017. *https://seekingalpha.com/article/4127297-singles-day-gmv*; Zen Soo, "Explainer: What Is GMV (Gross Merchandise Volume) and Why Is It Such a Big Deal," *South China Morning Post*, November 13, 2017. *https://www.scmp.com/tech/e-commerce/article/2119589/explainer-what-gmv-gross-merchandise-volume.*

‡ For highlights from Alibaba's 2017 Singles' Day, see U.S.-China Economic and Security Review Commission, *Economics and Trade Bulletin*, December 5, 2017, 8–10. *https://www.uscc.gov/sites/default/files/Research/December%202017%20Trade%20Bulletin.pdf.*

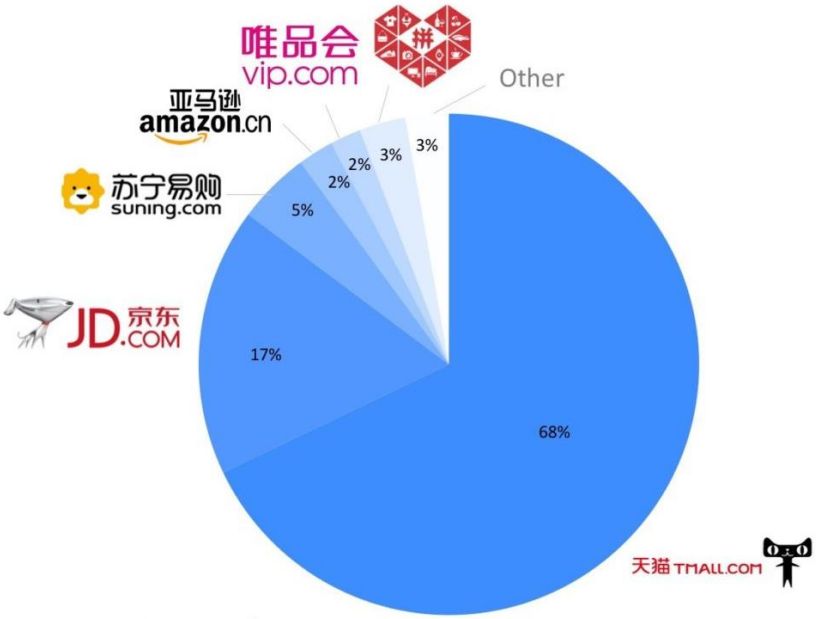
**Figure 2: Alibaba's Sales on Singles' Day, 2013–2018**




*Source:* Rita Liao, "Alibaba Sets New Singles' Day Record with $31B in Sales, but Growth Is Slowing," *TechCrunch*, November 11, 2018. *https://techcrunch.com/2018/11/11/alibaba-singles-day-2018-31b/.*

Despite another record-breaking GMV, the pace of growth fell from 39 percent last year to 27 percent—the slowest rate in the event's history—reflecting a weaker Chinese economy and growing competition from other e-commerce platforms and promotional events.[73] Many other Chinese e-commerce companies, including JD.com and Suning, now hold their own Singles' Day promotions, drawing consumers away from Alibaba (see Figure 3). In addition, the proliferation of online shopping holidays in China has made Singles' Day bargains less attractive to Chinese consumers.[74]

**Figure 3: Market Share of Singles' Day Sales, 2018**




*Source:* Thomas Graziani, "2018 Double 11 Data: Alibaba, WeChat, Pingduoduo and More," *Walk the Chat*, November 17, 2018. *https://walkthechat.com/2017-singles-day-sales-data-39-yoy-growth-tmall/.*

The top five product categories during Singles' Day were digital and electronic products, home appliances, cosmetics, food and beverage items, and infant formula.[75] However, growth in sales of big-ticket items has slowed as more Chinese consumers move toward using Singles' Day as an opportunity to stock up on basic household items and beauty products rather than large home appliances and smartphones.[76] Over 40 percent of Alibaba's Singles' Day shoppers bought from international brands, with foreign brands in the electronics, food, cosmetics, and sports apparel sectors performing particularly well.[77] Top performing international brands included Adidas, Apple, Dyson, Gap, L'Oréal, Olay, Nestlé, and Nike.[78] The top countries selling to China were Japan, the United States, South Korea, Australia, and Germany.[79]

Singles' Day has become a barometer of Chinese consumer spending, which has been a bright spot during previous downturns. This year, however, softening retail sales indicate Chinese consumers are tightening their purse strings.[80] In October 2018, retail sales of consumer goods rose 8.6 percent year-on-year, the slowest increase since May 2018.[81] According to China's National Bureau of Statistics, growth in online retail sales slowed to 24 percent in the third quarter of 2018, down from 36 percent in the previous quarter.[82]

Earlier in November, Alibaba trimmed its full-year sales outlook by around 5 percent, citing China's economic slowdown and trade tensions with the United States.[83] However, the company remains sanguine about the long-term prospects of Chinese consumption growth.[84] Alibaba Executive Vice Chairman Joe Tsai noted during a Singles' Day media briefing, "There are 300 million [in China's] middle class. In the next 10, 15 years, that number will double to 600 million. That number is not going to stop, trade war or no trade war."[85]

# In Focus: China's Pursuit of Leadership in Lithium-Ion Batteries

In the space of several years, China has positioned itself to dominate global lithium-ion (Li-ion) battery production, technology enabling consumer electronics, electric cars and buses, and clean energy integration. With electronics Li-ion battery manufacturing and chemicals sectors already established, Chinese chemical companies' acquisitions of mineral sources help cement vertical integration upstream in the supply chain. Downstream, Chinese industries like electric vehicles and renewable energy technologies stand to benefit enormously from this integration. Due to its key function in downstream industries, particularly electric vehicles, Li-ion battery technology could determine future competitiveness in those industries.

## China Enters the Lithium-Ion Battery Race

In the past two years, Chinese Li-ion battery producers have reshaped the competitive landscape for batteries. Though "China is relatively late" in developing energy storage technology, according to Georgetown University researcher Joanna Lewis, it has ramped up "extremely quickly" in the past two years.[86] The industry was formerly dominated by Japanese companies like Panasonic and South Korean companies like LG Chem and Samsung SDI, but Chinese companies now account for seven of the top ten largest Li-ion battery producers.[87]

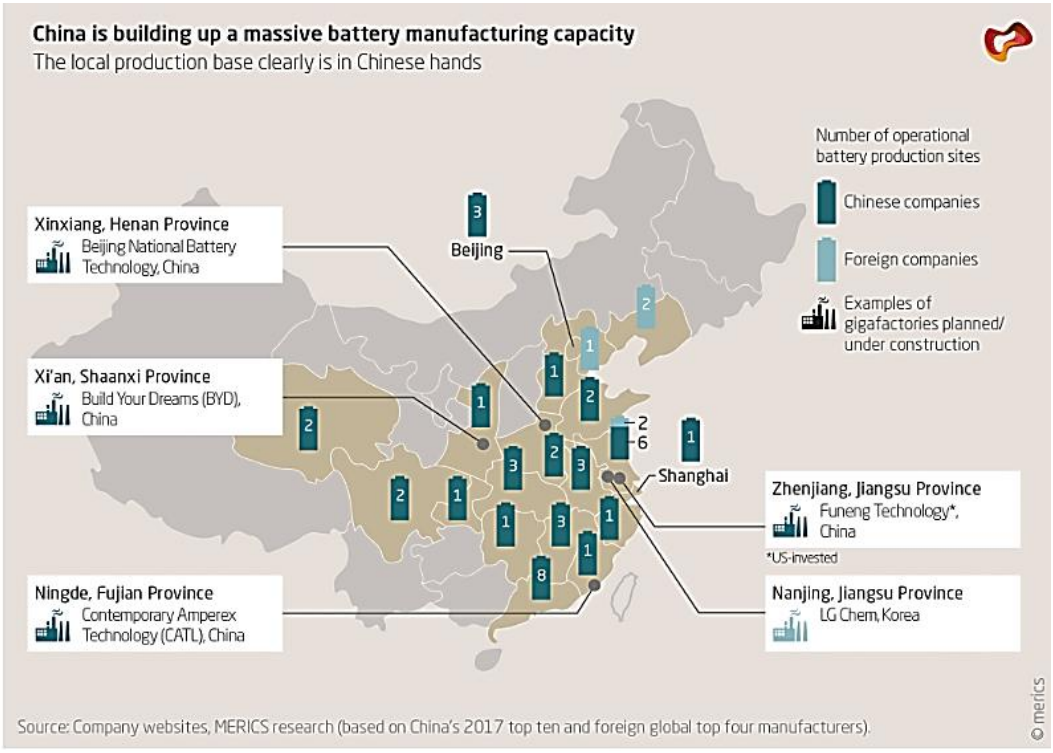
To support growth in this sector, a series of industrial policy measures promote local Li-ion battery manufacturing and sales. Chinese battery producers are assisted by the Ministry of Industry and Information Technology's downstream subsidy programs in electric vehicles, which require car manufacturers to source from the 57 approved suppliers to qualify—and nearly all of the approved suppliers are Chinese.[88] As explained by National Electric Vehicle Sweden (NEVS) research and development (R&D) director Anders Björnberg, "The Chinese government has a list of approved battery makers, and if you don't choose one of those, you will not be allowed to apply for subsidies in the Chinese market."[89] In 2017, of the 98 battery component companies in China, only six were foreign.[90]

With the assistance of these policies, China currently controls 60 percent of global Li-ion battery manufacturing capacity.[91] Domestic Chinese battery giants like Contemporary Amperex Technology (CATL); Build Your Dreams (BYD), a Shenzhen-based battery and electric vehicle maker; and others have aggressively expanded capacity (see

Figure 4). In June 2018, BYD opened a 24 gigawatt hour (GWh) "gigafactory" in Qinghai Province, with plans to expand capacity to 60 GWh;[92] CATL has also announced a 24 GWh factory to be completed in 2020.[*] [93] China's combined planned and existing Li-ion battery production capacity already exceeds 200 GWh per year; by comparison, the United States, South Korea, and Japan each claim less than 50 GWh per year.[94]

China is not the only country targeting Li-ion development, but it is well positioned to lead it. Battery production requires design, processing, and supply chain mastery. ETH-Zurich energy researchers argue that due to Li-ion battery design and manufacturing complexity, nascent battery manufacturers must rely on interaction with both upstream and downstream actors, experienced manufacturing personnel, a stable home market for testing products, and increasing demand to drive improvements in manufacturing equipment.[95] China possesses each of these attributes, with demand induced by government-mandated industry targets and regulations, and supply bolstered by subsidies and manufacturer requirements. Buoyed by upstream and downstream capabilities and investments, the Chinese supply chain can reap the benefits of vertical integration, and China is poised to dominate the Li-ion battery market for the next decade.[96]

**Figure 4: Battery Manufacturing Production Sites in China**




*Source:* Anna Holzmann, "China's Battery Industry Is Powering up for Global Competition," *Mercator Institute for China Research*, October 24, 2018. *https://www.merics.org/en/blog/chinas-battery-industry-powering-global-competition*.

[*] Electricity is measured in watts—the rate of electricity usage—supplied per hour. Household energy bills are commonly measured in kilowatt hours (kWh), or "one hour of using electricity at a rate of 1,000 watts." A gigawatt is equivalent to 1,000,000 kilowatts. Tesla's largest U.S. battery plant has a current capacity of 35 GWh. David M. Hart, "The State of the Global Race for Batteries: United States," Losing Power? The State of the Global Race for Batteries to Power Electric Vehicles and Modernize the Grid, Information Technology and Innovation Foundation, Washington, DC, November 7, 2018. *https://itif.org/events/2018/11/07/losing-power-state-global-race-batteries-power-electric-vehicles-and-modernize*; Union of Concerned Scientists, "How Is Electricity Measured?" *https://www.ucsusa.org/clean_energy/our-energy-choices/how-is-electricity-measured.html*.

## Downstream Strategy: Competitiveness in Transport and Energy Technologies

Developing Li-ion battery technology compliments the Chinese government's downstream investments in electric vehicles and renewable energy technologies. The increasing adoption of electric vehicles and buses could transform the automotive industry and transportation more broadly. Battery technology could thus determine competitiveness in a suite of downstream industries.

### *Electric vehicles*

Li-ion batteries represent a potential lynchpin in the race to advance electric vehicles. While some observers argue batteries are only a commodity,[97] other researchers argue an electric vehicle's battery pack is not low-cost, substitutable, or easily sourced by auto manufacturers. It can determine car design, performance, and market strategy, similar to a conventional vehicle's combustion engine.[98] It also represents 40 percent of a vehicle's value, which could shift market power in the industry away from auto manufacturers to battery cell producers.*

The Chinese government has a target for electric vehicles to compose 20 percent of all new vehicle sales by 2025.[99] To that end, it has pushed an aggressive raft of industrial policies, subsidies, and regulations to accelerate local electric vehicle adoption. Dr. Kennedy estimated central and local government funding at 42 percent of total electric vehicle sales in China, or approximately $48 billion in expenditure between 2009 and 2017.[100] Chinese policymakers see a shift to electric as a way for local companies to gain a competitive edge in the auto industry, where foreign companies tend to dominate the conventional vehicle market. Though car imports only comprise 10 percent of the Chinese market, the Chinese automotive sector struggled to develop successful combustion-engine brands independent of foreign joint venture partners.[101] Electric vehicles could shift the sector's competitiveness. In 2015, China overtook the United States to become the largest market for electric vehicles.[102]

Chinese battery producers have developed important linkages with downstream electric vehicle manufacturers. A few Chinese electric vehicle manufacturers have developed alliances with Chinese battery makers. Chinese car company SAIC Motor established two joint ventures with CATL in 2017; another car maker, Dongfeng Motors, teamed up with CATL to build a jointly owned battery plant that began production in July 2018.[103]

### *Electric public and commercial transport*

Beyond passenger electric vehicles, several Chinese Li-ion battery producers and auto manufacturers have expanded production into electric buses, taxis, vans, and other commercial vehicles. Though non-Chinese manufacturers exist—Proterra in the United States and New Flyer Industries in Canada produce electric buses, and in October 2018 Tesla announced it would manufacture heavy commercial trucks [104]—Chinese companies lead the market for commercial electric vehicles.[105] According to Bloomberg New Energy Finance, 99 percent of the roughly 385,000 electric buses in use globally in 2017 were on the road in China.[106]

Driven by Chinese government targets, subsidies, purchases, and air quality regulations, electric bus sales accounted for 22 percent of new bus sales in 2017, up from 0.6 percent in 2011.[107] This raft of government support is most visible in Shenzhen: designated as a pilot city for electric transport in 2009, its electric bus fleet now exceeds the full bus fleets of New York, Los Angeles, New Jersey, and Chicago combined.[108] As electric buses were not initially cost competitive with diesel, central government subsidies reduced the cost of adoption. Prior to 2016, the central government reimbursed the city of Shenzhen $150,000 per 12-meter electric bus, more than half its cost.[109] BYD gained from the city's shift to electric: according to its financial statements, from 2013 to 2017 BYD received $590

* Tobias S. Schmidt, energy politics researcher at ETH-Zurich, gave the example of Korean battery producers' decision to increase prices over the protests of European car manufacturers. Tobias Schmidt, "The Global Lithium-Ion Battery Race and Europe's Role in It," Losing Power? The State of the Global Race for Batteries to Power Electric Vehicles and Modernize the Grid, Information Technology and Innovation Foundation, Washington, DC, November 7, 2018. *https://itif.org/events/2018/11/07/losing-power-state-global-race-batteries-power-electric-vehicles-and-modernize*.

million in government funding.[110] BYD has also manufactured about 80 percent of Shenzhen's new bus fleet, as well as over 4,000 of the city's 17,000 taxis.[111] By the end of 2018, the city of Shenzhen plans to phase out conventional combustion-engine buses and taxis entirely.[112]

Shenzhen is not the only city government replacing its bus fleet, and demand for electric buses and other automotive alternatives is set to increase. While electric buses only represented 13 percent of the global bus fleet in 2017, cities like Tokyo, London, Los Angeles, and Mexico City have pledged to end carbon-emitting bus purchases by 2025.[113]

## Upstream Strategy: Minerals, Chemicals, and Vertical Integration

With clear implications for Chinese industrial policies supporting downstream industries, China's Li-ion battery producers also benefit from close upstream connections with its robust chemicals industry. In the past few years, Chinese chemical companies have invested in, acquired, or signed long-term supply contracts with mine operators to secure key Li-ion battery mineral inputs.

### *Chemicals*

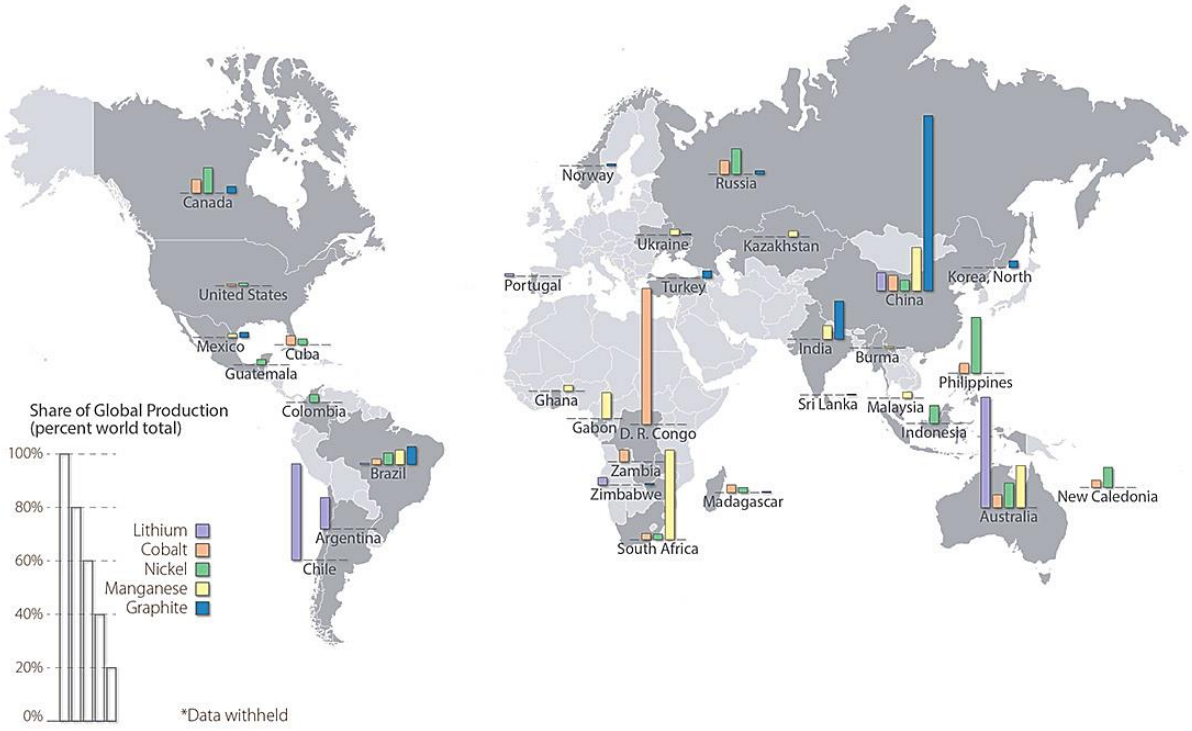
The chemicals industry plays a vital role in sourcing and processing battery inputs, and China's electronics industry has helped foster notable battery chemical producers. Battery makers increasingly seek to cement large supply contracts with chemical producers. In September 2018, Jiangxi Ganfeng Lithium Co. entered into substantial multiyear supply contracts with two of the largest battery producers, Tesla and LG Chem.[114] Benchmark Mineral Intelligence Managing Director Simon Moores commented that those deals "are dwarfing the size of the entire lithium hydroxide market from only a couple of years ago."[115] From a battery maker's perspective, chemical materials make up about 74 percent of the total cost of a Li-ion cell in battery production.[116]

Two key mineral inputs, cobalt and lithium, are explored below.

### *Cobalt*

As of February 2018, China produced about 77 percent of refined cobalt chemicals.[117] In their efforts to secure upstream supply, Chinese chemical suppliers have made a string of cobalt mine investments and acquisitions. According to Benchmark Mineral Intelligence reports, cobalt is "the weakest link in the lithium-ion battery to [electric vehicle] supply chain" and thus particularly important to secure.[118] As shown in Figure 5, cobalt is primarily sourced from the Democratic Republic of the Congo.[119] China Molybdenum Co., in which state-owned Luoyang Mining Group has a noncontrolling investment,[120] took a 70 percent controlling stake in the Tenke Fungurume mine in 2016 for $2.65 billion in "one of China's biggest mining deals this decade."[121] Zhejiang Huayou Cobalt Co., the largest cobalt refiner internationally, receives about half of its cobalt supply from Congo Dongfang Mining, its subsidiary.[122] Jinchuan Group, the second-largest cobalt refiner in China, manages the Ruashi copper and cobalt mine in the Congo.[123] Instead of an acquisition, GEM Co.—one of CATL's key suppliers—signed a long-term supply contract with mining company Glencore in March 2018 for a third of its cobalt output.[124] Despite attempts to reduce cobalt content in Li-ion batteries, given frequent supply disruptions and dismal mining conditions, Chinese companies' investments reflect the reality that industry analysts do not expect cobalt to diminish in importance in the next five to ten years.[125]

**Figure 5: Share of Production–Key Mineral Inputs in Lithium-Ion Batteries by Country**




*Source:* Emma Elgqvist, "Lithium Ion Battery Key Elements – More than Just Lithium," *Clean Energy Manufacturing Analysis Center*, April 13, 2016. *http://www.manufacturingcleanenergy.org/blog-20160413.html*.

### *Lithium*

Li-ion batteries currently account for about 45 percent of lithium demand but will account for 70 percent by 2025, according to commodity analyst Wood Mackenzie.[126] Given current projections in demand for electric vehicles, demand for lithium is expected to more than double by 2025.[127] Most lithium is sourced from Chile, Argentina, and Australia, though other countries with large deposits, like Bolivia, seek to capitalize on rising demand.[128] As in the case of cobalt, Chinese chemical companies have also made acquisitions to guarantee lithium supply. In May 2018, Chinese state-owned Tianqi Lithium Corp. paid $4.1 billion for the second-largest stake in the Chilean mining company Sociedad Química y Minera.[*] Combined with other investments, including its controlling stake in the "massive" Greenbushes mine in Australia,[129] this move gave Tianqi Lithium a stake in nearly half of current global lithium production.[130] In August 2018, Sociedad Química y Minera sold a lithium project in Argentina to Jiangxi Ganfeng Lithium Co. for $87.5 million, with an additional $50 million if the project meets its sales goals.[131]

## Market Leadership Strategy: Technology Acquisitions

Beyond control of the Li-ion battery supply chain, Chinese companies have also invested in early-stage battery technology, in part through acquisitions of foreign battery startups. As chemist and clean energy technology journalist Akshat Rathi has noted, the challenge of commercializing battery technology has caused many early-

[*] When Chilean antitrust regulators moved to block this acquisition, China's ambassador to Chile, Xu Bu, warned they could "leave negative influences on the development of economic and commercial relations between both countries." Henry Sanderson, "China Warns Chile against Blocking $5bn SQM Lithium Deal," *Financial Times*, April 26, 2018. *https://www.ft.com/content/238bda20-48b0-11e8-8ee8-cae73aab7ccb*.

stage U.S. startups to scale too quickly, causing some to run out of financing and enter bankruptcy.[132] This pattern has led to notable partnerships with or acquisitions by Chinese companies:

- Boston-Power Inc.: This startup failed to receive a $100 million U.S. grant in 2009, after which the Chinese government offered a funding package of $125 million.[133] After bankruptcy, the company entered into partnership with the Beijing Automotive Industry Holding Company.[134]

- A123 Systems: A startup from the Massachusetts Institute of Technology, A123 Systems received $249 million in federal grants[135] under the Obama Administration to bring this technology to market. Dr. Rathi described this technology as "solid chemistry and product," but the company overspent on manufacturing and was acquired by a U.S.-based unit of Wanxiang Group, a car parts manufacturer. [136]

- Aquion Energy: Aquion gained recognition by developing inexpensive batteries for grids to integrate renewable energy like wind and solar power. After entering bankruptcy in March 2017, Aquion was acquired by a joint venture affiliated with China Titans Energy Technology Group, which focuses on grid technology.[137]

Thus, Chinese companies have been able to acquire promising technologies—including those originally backed by U.S. government investment—when U.S. funding sources dry up. With expertise in scaling and commercializing early-stage technology,[138] Chinese companies have benefitted from that funding gap.

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