U.S.-China Economic and Security Review Commission

Economics and Trade Bulletin

March 7, 2017

Highlights of this Month's Edition

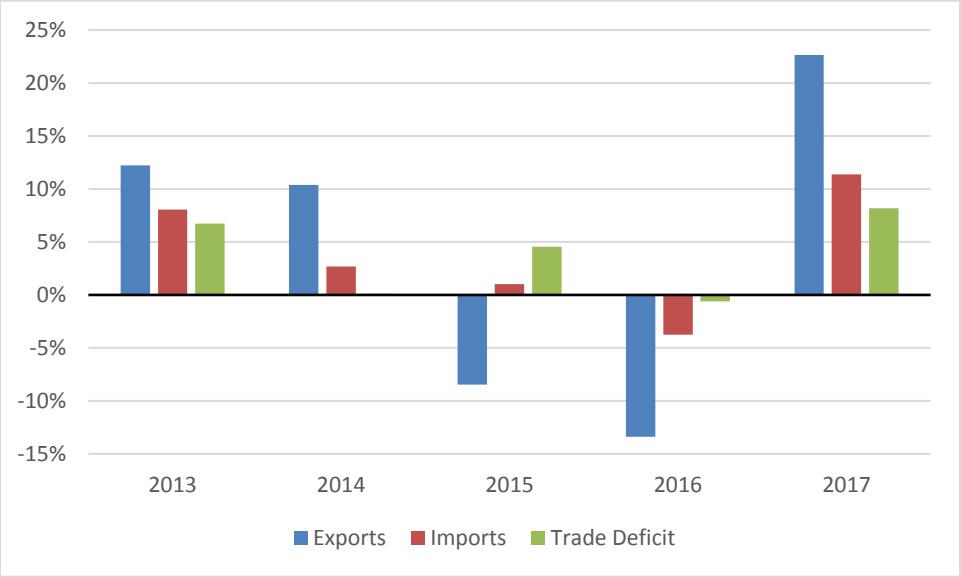
- **Bilateral trade:** U.S. exports and imports both rebounded in January increasing 22.6 percent and 11.4 percent year-on-year respectively.
- **Bilateral policy issues:** IP Commission issues an updated report on harm to U.S. economy from IP theft, spotlights China's continued outsized role; China bans four synthetic opioids, including carfentanil, in a decision hailed by U.S. law enforcement as a "game changer" for U.S. counternarcotic efforts.
- **Policy trends in China's economy:** Chinese steel capacity increased in 2016, despite plant closures and claims of cuts; despite persistent overcapacity, China dramatically reduces its 2017 targets for cutting capacity in coal mining compared to 2016, while many redundant coal power plants are still being planned or under construction.
- **Sector focus – Fertilizer:** Chinese fertilizer exports fall due to rising coal prices as U.S. fertilizer capacity grows alongside natural gas production; the U.S. Department of Commerce issues antidumping duties of 498 percent on Chinese ammonium sulfate fertilizer imports.

Bilateral Trade

U.S. Trade in Goods with China Rebounds after a Sluggish 2016

U.S. trade in goods with China rebounded in January after a sluggish start to the last two years (see Figure 1).[1] In January 2017, U.S. exports to China increased 22.6 percent year-on-year from a five-year low of $8.2 billion in 2016 to $10.1 billion in 2017.[2] Month-on-month, however, U.S. exports to China were down 13.4 percent due to a fall in soybean and aviation exports.[3] U.S. imports from China in January reached $41.4 billion, an 11.4 percent increase year-on-year.[4] Higher imports of apparel and footwear led to a 5.1 percent increase over December.[5] Overall, in January 2017, the United States recorded a $31.3 billion deficit, an 8.2 percent increase year-on-year and a 12.8 percent increase over December.[6]

Figure 1: Change in U.S. Exports, Imports, and the Trade Deficit with China in January, 2013–2017



Source: U.S. Census Bureau (Washington, DC: U.S. Department of Commerce, Foreign Trade Division, January 2017). *http://www.census.gov/foreign-trade/balance/c5700.html*.

Bilateral Policy Issues

IP Commission Scrutinizes China in a New Report

On February 27, 2017, the Commission on the Theft of American Intellectual Property (the IP Commission) released an update to its original report, published in 2013. The new report focuses on tracking new developments in the field of IP protection, and assesses progress on the recommendations made in the 2013 report. The IP Commission concludes that although there have been significant improvements in IP theft monitoring and protection since the publication of the 2013 report, "the annual cost to the U.S. economy continues to exceed $225 billion in counterfeit goods, pirated software, and theft of trade secrets and could be as high as $600 billion."[7]

In the IP Commission's assessment, China "remains the world's principal IP infringer," with industrial policies prioritizing acquisition of foreign technology and knowhow that have contributed to greater IP theft."[8] In particular:

> *China continues to obtain American IP from U.S. companies operating inside China, from entities elsewhere in the world, and of course from the United States directly through conventional as well as cyber means. These include coercive activities by the state designed to force outright IP transfer or give Chinese entities a better position from which to acquire or steal American IP.*[9]

While acknowledging China's efforts to strengthen IP protection, the IP Commission believes such efforts appear "to be more geared toward fostering stronger IP-intensive industries at home than developing the rule of law." [10] The IP Commission also put a spotlight on China's industrial plans, which identify specific strategic or high-tech industries (e.g., semiconductors, quantum computing, and nuclear energy) for government support. Foreign companies in such industries are "targeted by a greater number of advanced hackers sponsored by the Chinese government."*[11]

Other key conclusions from the report are summarized below:

* For additional discussion of China's cyber-enabled economic espionage, see U.S.-China Economic and Security Review Commission, "Commercial Cyber Espionage and Barriers to Digital Trade in China" in *2015 Annual Report to Congress*, November 2015. *https://www.uscc.gov/sites/default/files/Annual_Report/Chapters/Chapter%201%2C%20Section%204%20-%20Commercial%20Cyber%20Espionage%20and%20Barriers%20to%20Digital%20Trade%20in%20China.pdf*.

- *Counterfeit goods:* Based on data from the U.S. Customs and Border Patrol (CBP), the IP Commission estimates China and Hong Kong together account for 87 percent of seized counterfeit goods in the United States.[12]
- *Patent infringement:* The IP Commission did not present any quantitative data on economic costs of patent infringement, but concluded, based on anecdotal evidence, that "the cost to U.S. businesses from patent infringement abroad is at least in the billions of dollars."[13]
- *Theft of trade secrets:* The IP Commission identified trade secret theft as potentially most damaging to the U.S. economy, with impact estimated to have been anywhere between $180 billion and $540 billion in 2015.[14]

China Bans Carfentanil Following Spike of Opioid Overdoses in the United States

Effective March 1, 2017, China has banned carfentanil—a Schedule II substance and powerful synthetic opioid 5,000 times more potent than heroin—along with three similar fentanyl analogues[*] identified as a source of the United States' ongoing opioid epidemic.[15] Carfentanil is legally used as an animal tranquilizer for elephants and other large mammals, but has been linked to overdoses across the United States, including in Kentucky, Florida, and Ohio.[16] Between July and October 2016, the U.S. Drug Enforcement Administration (DEA) confirmed more than 400 seizures of carfentanil across eight U.S. states.[17] In September 2016, the DEA issued a public warning about the health and safety risks of carfentanil following a notable spike in carfentanil seizures and overdoses across the country.[18] The drug's potency has made it a popular additive in heroin and other opioids, often mixed into the drugs—either intentionally or without the user's knowledge—to increase their euphoric effects.[19]

The U.S. government has repeatedly pressured China to crack down on its production and export of dangerous narcotic substances, with the DEA indicating China is the leading source of illicit fentanyl and fentanyl-like products in the United States.[†] [20] DEA reports reveal most of this Chinese-origin fentanyl is transported either directly to U.S.-based distributors or brought across the U.S.-Mexican border by drug cartels and other criminal organizations.[21] To address these flows, U.S. officials worked with their Chinese counterparts on the sidelines of the G20 Summit in September 2016, as well as at a meeting on law enforcement cooperation in October 2016.[22] Most recently, the DEA's acting administrator Chuck Rosenberg visited China in January 2017 to open a new DEA office in Guangzhou and improve counternarcotic cooperation.[23] Following the January 2017 meetings, Rosenberg said the "meetings underscore our improving relationship and cooperative efforts as we work to stem the flow of dangerous synthetic opioids and related chemicals."[24]

Despite U.S. law enforcement's ongoing efforts to work with the Chinese government, China's lax regulatory environment for chemical production, coupled with a massive chemical and pharmaceutical industry, have made it a global source of illicit fentanyl and other synthetic narcotics.[25] China's pharmaceutical market is the second largest in the world by revenue, while its chemical industry includes more than 160,000 chemical companies operating legally and illegally (with some chemical facilities manufacturing tons of chemicals every week and others producing over one million pills daily).[26] As a result, Chinese law enforcement and drug investigators struggle to effectively regulate the high volume of drugs and chemicals the country produces.[27] Meanwhile, the Chinese government has been slow to introduce regulations governing chemical production, with new chemicals typically taking around nine months to be added to the country's list of controlled substances.[28] China's inefficient regulatory system has allowed international drug traders to circumvent U.S. laws easily: an October 2016 investigation by the

[*] Fentanyl is a powerful synthetic painkiller about 50 times more potent than heroin and 100 times stronger than morphine. The fentanyl analogues banned starting March 1, 2017, include furanyl fentanyl, acryl fentanyl, and valeryl fentanyl. United States National Institute on Drug Abuse, *Fentanyl*. *https://www.drugabuse.gov/drugs-abuse/fentanyl*; Erika Kinetz, "China Carfentanil Ban a 'Game-Changer' for Opioid Epidemic," Associated Press, February 16, 2017. *http://bigstory.ap.org/article/733cfd073951495aa608df549b79a9f8/china-makes-deadly-opioid-carfentanil-controlled-substance*.

[†] For more on fentanyl flows from China to the United States, see Sean O'Connor, "Fentanyl: China's Deadly Export to the United States," *U.S.-China Economic and Security Review Commission*, February 1, 2017. *https://www.uscc.gov/sites/default/files/Research/USCC%20Staff%20Report_Fentanyl-China%E2%80%99s%20Deadly%20Export%20to%20the%20United%20States020117.pdf*.

Associated Press (AP), for instance, found that 12 Chinese businesses were willing to export carfentanil around the world without any hesitation.[29]

Even with the new ban, counternarcotic experts warn opioid flows will continue as Chinese exporters modify chemicals to create new synthetic substances.[30] This pattern was seen in October 2015, when China added 116 synthetic chemicals—including six fentanyl products—to its list of controlled chemical substances.[*] Although U.S. seizures of those targeted substances declined significantly following the ban in 2015, Chinese exporters began modifying the chemicals to create new, unregulated fentanyl-like substances.[31] This cycle is emblematic of the challenges U.S. law enforcement face, with banned substances consistently being replaced by new chemicals in circulation.[32] In response to these concerns, DEA spokesman Russell Baer conceded, "Of course Chinese chemists and global chemists will tweak molecular structures and that sort of thing," but he promised the challenges are "not going to diminish our aggressive approach to this problem."[33]

Still, the DEA has hailed the new carfentanil ban as a potential "game changer," with Baer saying, "It's a substantial step in the fight against opioids here in the United States.... We're persuaded it will have a definite impact."[34] The ban's impact was evident almost immediately, with reports from the AP revealing that following the announcement of the ban, carfentanil vendors in China had begun preparing to stop carfentanil production and sales on March 1.[35] With many precursor chemicals and other dangerous synthetic substances remaining unregulated in China, the DEA hopes this will be just the first announcement in China banning the production and export of dangerous narcotics; according to Baer, the DEA is "hopeful that additional scheduling actions are looming around the corner."[36]

Policy Trends in China's Economy

Greenpeace Reports Steel Capacity Increase in 2016, Despite Closures

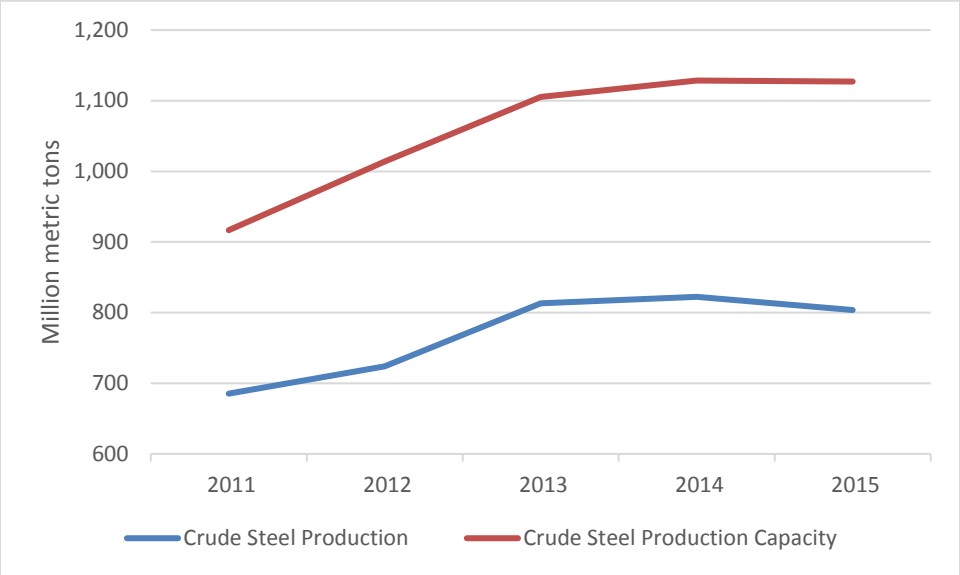
A February report commissioned by Greenpeace[†] claims China's steel industry saw a net increase in operating capacity in 2016, despite a high-profile closure program targeting small-scale and inefficient plants and government assurances that capacity reduction targets had been achieved.[37] In 2016, the growth in China's net operating capacity was 36.5 million metric tons, more than double the United Kingdom's annual steel production capacity.[38]

Growth in steel demand has been slowing in China since 2011, while overcapacity has worsened.[39] According to official data, China's total crude steel production capacity reached 1.1 billion metric tons at the end of 2015, about 300 million metric tons over actual production (see Figure 2).[40] In February 2016, China announced plans to eliminate 100 to 150 million metric tons of crude steel capacity and ban new steel projects over the next five years.[41] China's National Development and Reform Commission (NDRC) reported in October 2016 that the steel industry had met its 2016 target of cutting 45 million metric tons of crude steel, ahead of schedule.[42]

[*] The fentanyl products banned in China in October 2015 include acetyl-fentanyl, butyryl-fentanyl, beta-hydroxythio-fentanyl, para-fluoro-fentanyl, iso-butyr-fentanyl, and ocfentanyl. China Food and Drug Administration, *Notification of the Issuance of Managing Non-Medicinal Narcotics and Psychoactive Drugs*, September 29, 2015. Translation. *http://www.sfda.gov.cn/WS01/CL0056/130753.html*.

[†] The research was conducted by Custeel, a Chinese metallurgical industry consultancy affiliated with the China Iron and Steel Association. On February 27, Greenpeace reported that Custeel has notified them of methodological issues with the report, which Greenpeace is currently reviewing. Greenpeace, "Despite Claims of Cuts, China Sees Steel Capacity Increase in 2016, Air Quality to Suffer," February 13, 2017. *www.greenpeace.org/eastasia/press/releases/climate-energy/2017/Despite-claims-of-cuts-China-sees-steel-capacity-increase-in-2016-air-quality-to-suffer---Greenpeace*.

Figure 2: Chinese Steel Production and Capacity, 2011–2015

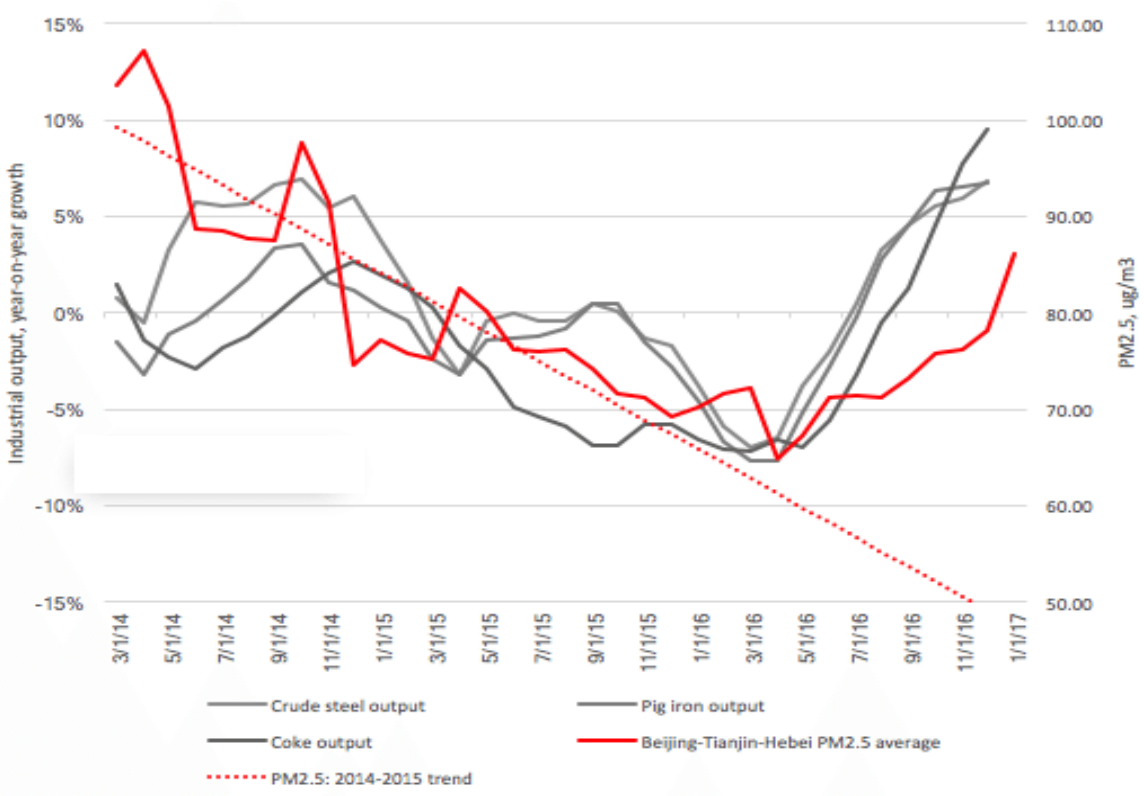


Source: China's National Bureau of Statistics via CEIC database.

However, the Greenpeace report found most of the cuts came from plants that were already idle.[43] Those closures reduced supply at the same time government stimulus policies boosted demand for steel, spurring mills to restart or increase production. According to the report, the restarted capacity plus the new capacity added in 2016 more than offset the cuts in operating capacity.[44] The report also found most of the capacity cuts came from closures of privately owned mills, suggesting local governments and state-owned enterprises have largely succeeded in protecting their economic interests.[45]

The steel sector's net increase in operating capacity is also linked to evidence of worsening air quality in northeastern China over the past few months. China's steel sector is the second-biggest producer of harmful sulphur dioxide and particle emissions, after coal-fired power.[46] The report found that 80 percent of the net increase in capacity occurred in Hebei, Shanxi, and Tianjin, which border Beijing.[47] A separate Greenpeace analysis of air quality data for Beijing showed the city's air quality deteriorated in the second half of 2016 just as steel production rebounded, reversing the steady progress made in air quality improvements since 2014, when the government declared a "war on pollution" (see Figure 3).[48]

Figure 3: Beijing Region Average Urban PM2.5 vs. Steel Industry Output



Note: PM2.5 are fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller. PM2.5 pollution is considered harmful to health. U.S. Environmental Protection Agency, "Particular Matter (PM) Basics." https://www.epa.gov/pm-pollution/particulate-matter-pm-basics.
Source: Greenpeace, "Return of the Smog: Heavy Industry Threatens Beijing's Pollution Fight," December 16, 2016. *http://energydesk.greenpeace.org/2016/12/16/return-smog-heavy-industry-threatens-beijings-pollution-fight*.

In response to the worsening air pollution, China's Vice Minister of Environmental Protection announced in February that steel mills in 28 cities across northeast China would be required to meet their annual capacity reduction goals ahead of schedule.[49] In addition, steel mills in Hebei—China's top steel-producing province—will be required to halve production during the winter season, when air pollution tends to be worse due to the increased use of coal for heating.[50] On March 1, China's Minister of Human Resources announced plans to cut 500,000 steel and coal jobs in 2017 as part of efforts to reduce excess capacity. About 726,000 steel and coal jobs were cut in 2016.[51]

As the world's top producer of steel, China accounts for most of global excess steelmaking capacity.[52] China's steel capacity cuts have so far done little to curb output, leading to a surge in cheap exports in global markets that the United States and EU contend are depressing global steel prices and hurting their domestic producers.[*] [53] The United States has pursued trade remedies in response, including tariff hikes on Chinese steel imports.[54] In 2016, U.S. steel imports from China dropped 63 percent year-on-year.[55]

Coal Industry Struggles with Overcapacity in Power Generation, Some Progress in Cutting Coal Production

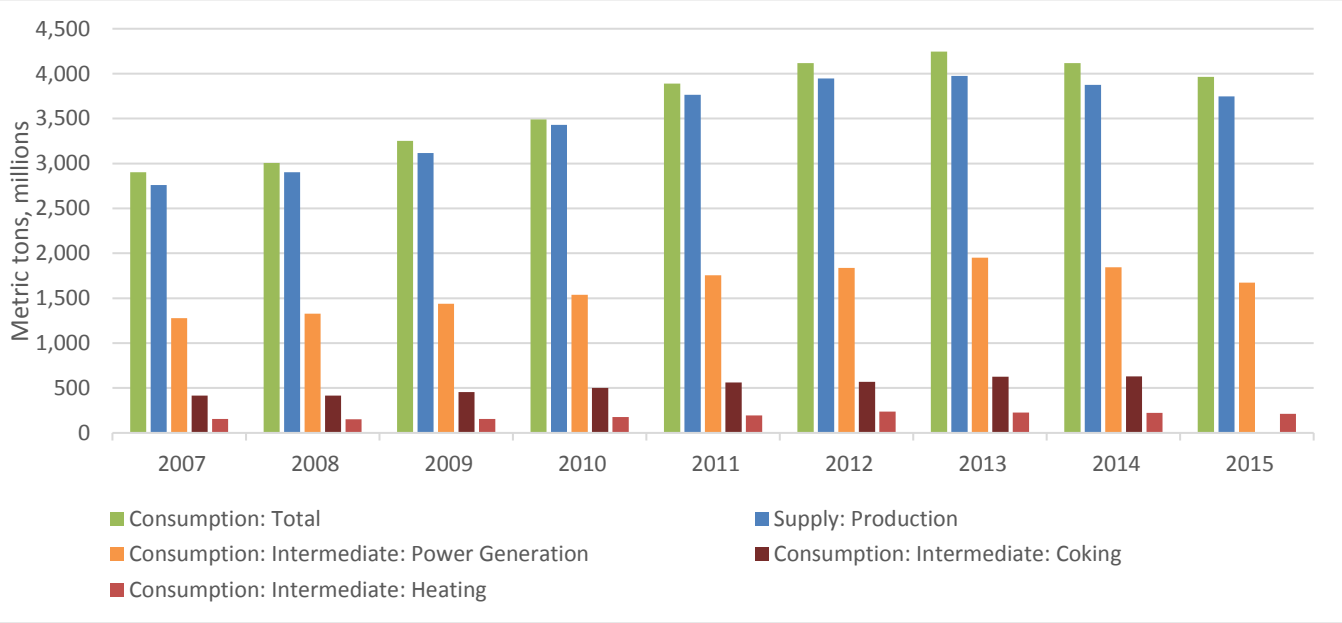
Coal has been the primary fuel supporting China's rapid industrial growth over the past 40 years. China has the third-largest proven reserves of any country, making coal a cheap and accessible resource.[56] Figure 4 presents a

[*] For more on the impact of Chinese overcapacity on U.S. steel producers, see U.S.-China Economic and Security Review Commission, "State-Owned Enterprises, Overcapacity, and China's Market Economy Status," in *2016 Annual Report to Congress*, November 2016, 109–112.

broad overview of total production and consumption of coal in China. Coal is primarily used for electric power generation, which comprised about 45 percent of consumption from 2007 through 2015.[57] Over the same period, the share of coal consumption for the production of coke* was about 15 percent, while heating comprised about 6 percent.[58] Coal consumption in China reached its highest level in 2013, at about 4.2 billion tons per year,[59] and declined in subsequent years as a result of the drop in overall energy intensity in China's economy as well as rapid growth in the capacity of non-fossil fuel energy sources. For example, wind capacity increased by 26 percent year-on-year in 2014, while nuclear and solar increased 36 percent and 67 percent, respectively.[60]

China's reliance on coal has had dramatic environmental impacts throughout China, causing severe health issues and widespread dissatisfaction among citizens. In response, China's economic planners have pushed strongly for alternative energy solutions. In September 2016, China and the United States ratified the Paris Climate Accords ahead of the G20 Summit in Hangzhou.[61] China committed to cap its CO_2 emissions by 2030 and to "make best efforts to peak earlier."[62] Beijing also committed to making non-fossil energy 20 percent of its energy consumption by 2030.[63] In its Five-Year Plan for power production published in January 2017, China's National Energy Administration (NEA) set a cap on the capacity of coal-fired power plants at 1,100 gigawatts (GW), or 55 percent of overall electricity generation by 2020.[64] China has already made meaningful progress in moving away from coal. From 2007 to 2016, the proportion of electricity coming from coal shrank from 80 percent to 62 percent.[65]

Figure 4: Production and Consumption of Coal in China, 2007–2015



Source: China's National Bureau of Statistics via CEIC database.

Overcapacity in Mining and Coal-Fired Power Generation

Over the last decade, wide swings in the price of coal have impacted the financial performance of the coal mining and electricity-generating sectors. In February 2015, international benchmark prices for coal had fallen nearly 50 percent to about $62 a metric ton and the U.S. benchmark has fallen 24 percent to $52.90 from a peak in 2012.[66] Prices for coking coal tumbled 55 percent from their 2012 peak to $102.8 a metric ton as domestic and international demand for coal slowed.[67]

China's mining sector has suffered due to the low price of coal. In 2008, the total operating profit of Chinese coal mining companies was about $253 billion.[68] Mining profits peaked in 2011 at $465 billion dollars, plummeted to $32 billion in 2015.[69] In 2008, about 1,000 out of 9,200 Chinese coal mining enterprises were loss making.[70] In

* Coke is a fuel with minimal impurities and a high carbon content. It is an essential input in steel production. Hardarshan S. Valia, "Coke Production for Blast Furnace Ironmaking," *SteelWorks*. *http://www.steel.org/making-steel/how-its-made/processes/processes-info/coke-production-for-blast-furnace-ironmaking.aspx*

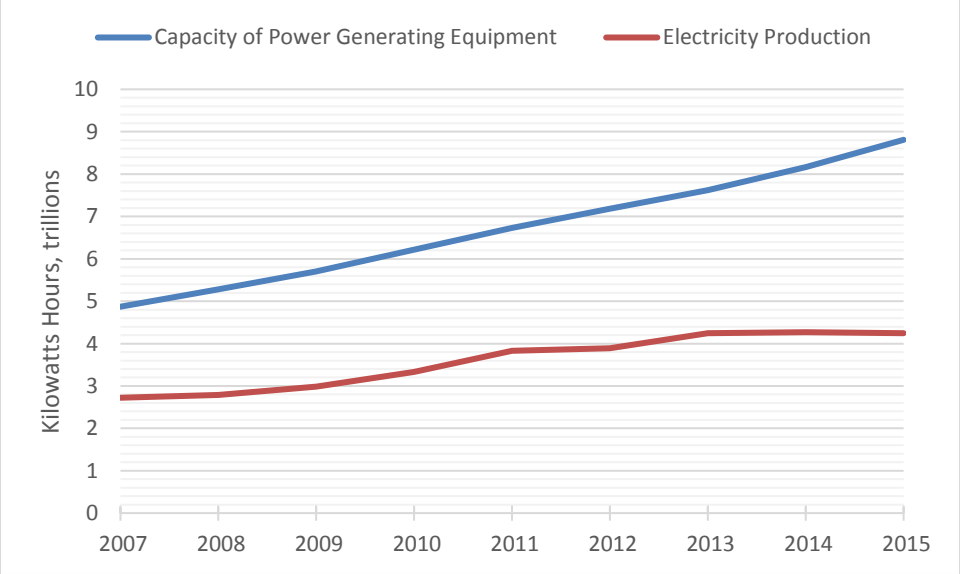
2015, the number of loss-making companies increased to 2,000 out of a total of about 6,000.[71] Smaller profits have increased the debt burden for the sector as a whole. The asset liability ratio for the coal mining sector increased ten points from 60 percent in 2008 to 70 percent in 2015, which is significantly higher than China's overall industrial asset liability ratio of 57 percent.[72]

Thanks to the lower price of coal, the thermal power* generating industry has become significantly more profitable despite decreasing demand for coal-powered electricity. In 2007, total profit from the thermal electricity generating sector was about $70 billion, and in 2008 the industry even reported a loss of $27 billion.[73] In 2015, however, coal-burning plants made profits of over $225 billion.[74] The industry's gross profit margin has gone from an average of about 8 percent in 2008 to close to 25 percent in 2015.[75] Importantly, asset liability ratios have decreased from about 72 percent to about 66 percent over the same period, though this is also significantly higher than the industrial average of 57 percent.[76] As coal prices rebound, leverage ratios in the coal power sector will likely increase once again.

High asset liability ratios in both mining and electricity producing sectors indicate a problem of overcapacity. Economic planners have identified 800 million metric tons of inefficient coal mining capacity that they will attempt to cut within three to five years.[77] On the electricity production side, China currently has over 900 GW of coal-fired capacity.[78] But demand has been decreasing since 2013, rendering about 200–300 GW of capacity redundant at 2015 demand levels.[79] Figure 5 compares the capacity of electricity generation in China to actual electricity production in terms of kilowatt hours.

Despite decreasing demand, a shift in permitting from central authorities to provincial authorities led to a tripling of plant approvals from 2015 to early 2016.[80] As of March 2016, China had another 200 GW of coal-fired capacity under construction, and a Greenpeace analysis identified a further 150 GW of projects that had already received permits from local governments to begin construction.[81] Average coal plant utilization rates in China fell from a high of 60 percent in 2011 to about 50 percent in 2015, and the Chinese government projects utilization rates will eventually fall to 45.7 percent.[82] Because of these low utilization rates, China was essentially adding the equivalent of more than one redundant coal power plant each week from 2015 until November 2016.[83]

Figure 5: Thermal Electricity Capacity and Production, 2007–2015



Source: China's National Bureau of Statistics via CEIC database.

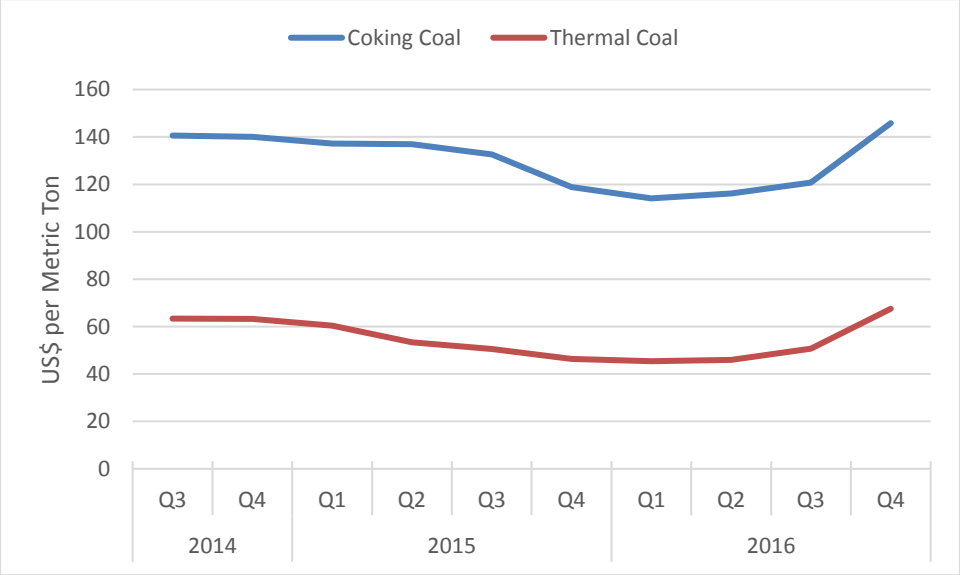
* Thermal power is mostly fueled by coal, although natural gas was estimated to make up about 8 percent of total energy consumption in China in 2015. U.S. Energy Information Administration, *Natural Gas Serves a Small, but Growing, Portion of China's Total Energy Demand*, August 18, 2014. *http://www.eia.gov/todayinenergy/detail.php?id=17591*; Simon Evans, "Official Data Confirms Chinese Coal Use Fell in 2014," *Carbon Brief*, February 26, 2015. *http://www.carbonbrief.org/official-data-confirms-chinese-coal-use-fell-in-2014*.

Chinese Government's Efforts to Cut Capacity

In its attempts to address coal overcapacity, the Chinese government has juggled competing priorities. Authorities want to keep energy prices low and control unemployment in depressed, coal-dependent provinces like Shanxi and Liaoning.[84] At the same time, planners seek to lower CO_2 emissions and reduce leverage in coal and electricity industries as part of the Xi Administration's supply-side reforms.[*] [85] The inconsistency of recent efforts to reduce capacity demonstrates how these priorities can often be at loggerheads.

Beijing made impressive cuts to coal production capacity in order to prop up prices and phase out old and outdated mines, but some aspects of overall capacity removal have been reversed in the face of economic pressures. In 2016, the NEA removed over 300 million metric tons of capacity, and the State Administration of Work Safety limited mine operations from 330 days a year to 276.[86] In February 2016, Minister of Human Resources Yin Weimin declared that the coal sector as a whole would shed 1.3 million jobs, or 10 percent of the workforce, over "a few years."[87]According to Minister Yin, the coal sector and steel sectors cut a combined 725,000 jobs in 2016.[†88] Coal output decreased 10 percent as result, and prices began to rise.[89] Between May and December 2016, the average price of thermal coal rose about 60 percent to $73 a metric ton (see Figure 6).[90] Coking coal rose 38 percent to $157 a metric ton.[91] As heating season began in November, authorities urgently pressed mining companies to increase supply. The government relaxed mine working day limits and encouraged companies to reopen idle mines.[92]

Figure 6: Price of Thermal and Coking Coal in China, 2014–2016[‡]



Source: National Development and Reform Commission's Price Monitoring Center via CEIC database.

The coal shortages in the winter of 2016 have negatively affected targets Chinese planners set for 2017. In its 2017 directives for energy work, the NEA stated it aims to close down coal mines representing a combined annual production capacity of 50 million metric tons, about one-fifth of the 250-million-ton goal set for 2016.[93]

[*] For a more detailed analysis of China's recent supply side reforms, see U.S.-China Economic Security Review Commission, Chapter 1, Section 2, "State–Owned Enterprises, Overcapacity, and China's Market Economy Status," in *2016 Annual Report to Congress*, November 2016, 91-136.

[†] Government officials have not specified how many jobs were cut in the coal sector individually, nor what ratio of job cuts came from mining rather than cuts in power generation.

[‡] The prices for this figure are measured as the coal is sold from the mine. The price for thermal coal represents the average taken from four different thermal categories which are assigned based on energy content, measured in kilocalories per kilogram (kcal/kg). The four categories are 4,500-5,000 kcal/kg, 5,000-5,500 kcal/kg, 5,500-6,000 kcal/kg, and 6,000 kcal/kg and above. The coking coal price is an average of four different types of coking coal divided into different grades by China's NDRC. The four categories are 1st grade, 8th grade, 9th grade, and 10th grade coking coal. National Development and Reform Commission's Price Monitoring Center via CEIC database.

Furthermore, the NEA predicted coal output in 2017 will increase 5.8 percent year-on-year to 3.65 billion metric tons as miners respond to price increases.[94] Most of the capacity cuts in 2016 were of already idle or defunct mines throughout the north and east parts of the country.[95] If the NDRC maintains this slower rate of capacity reduction, China will most likely not meet its target of cutting 800 million metric tons within a five-year period.

As China's government is substantially curtailing its coal production capacity cuts, it is also struggling to cap capacity growth in coal-powered electricity production. The central government ordered provincial governments to suspend new plant approvals in 13 provinces through 2017 and to halt initiation of new plant construction in 15 provinces and regions.[96] Furthermore, in January 2017 the NEA announced it had suspended 104 planned and under-construction coal power projects, representing 120 GW of capacity.[97] Beijing made these suspensions in order to enforce a coal capacity cap of 1,100 GW set forth in the NEA's Five-Year Plan for the power sector.[98] However, a cap of 1,100 GW is still a large increase from the 920 GW of current capacity, especially since the utilization rate of this capacity was only about 50 percent in 2015.[99] Carbon Tracker Initiative, a nonprofit financial think tank, estimated that every kilowatt of capacity in China costs about $800 million.[100] The construction of an additional 180 GW of capacity allowed under the Five-Year Plan will amount to an investment of $145 billion in redundant capacity.

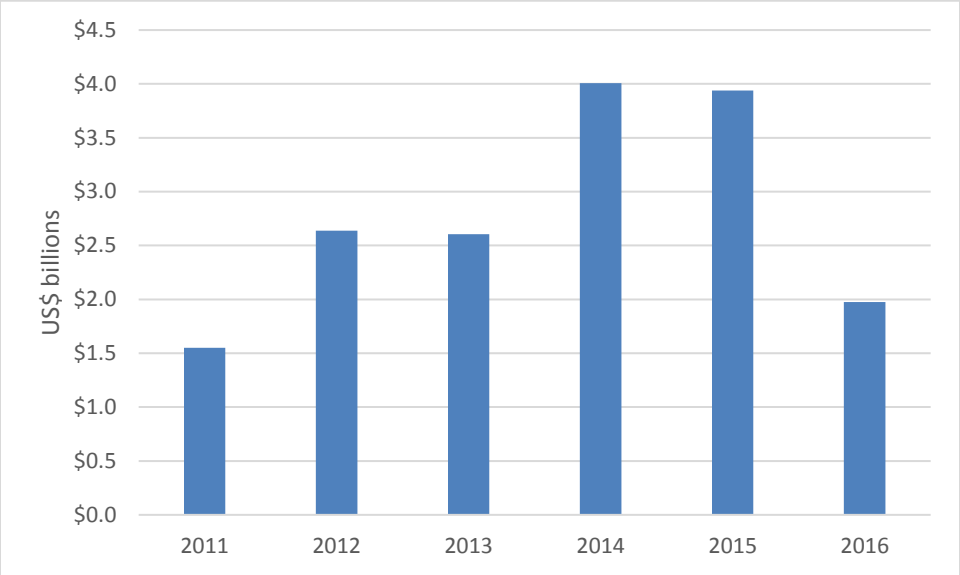
The medium-term future of the coal industry is uncertain. The government has made some progress in cutting jobs, closing mines, and suspending construction of new power plants, but it is difficult to determine how substantial these cuts actually were and whether the government is willing to make them permanent. In addition, authorities have already signaled a decreased appetite for maintaining capacity reduction. In February 2016, the NEA admitted that large reductions in coal mining capacity like those in 2016 cannot be made every year.[101] Planners have made some progress, however, in the paring down labor supply. The Human Resources Ministry plans to cut 500,000 jobs across the coal and steel sectors in 2017, and total job cuts from 2016 through 2017 for both steel and coal would be about 1.2 million.[102] If accurate, these numbers would indicate that economic planners are on track to meet the target—set in early 2016—of cutting 1.8 million jobs in both steel and coal.[103]

The outlook for the electricity generation sector is less promising. As previously mentioned, the official cap of 1,100 GW still allows for a significant increase in overall capacity. China needs a lower cap for coal-powered electricity capacity, but implementing stricter standards will be difficult. Since the caps were announced in late 2016, the government has only canceled about 70 GW of capacity actually undergoing construction.[104] This would leave about 120 GW of capacity that is currently underway.[105] Suspending work on these plants will be difficult, as provincial and county governments have already arranged funding and signed construction contracts.[106] Cancellation will most likely entail significant financial loss and protracted disputes for local governments. The extent to which China's economic planners can overcome these challenges to enforce, and perhaps improve, capacity targets through the period of the Five-Year Plan for energy will be a long-term indicator of how dedicated Beijing is to substantially reducing overcapacity in this sector.

Sector Focus: Chinese Fertilizer Exports Decline and U.S. Fertilizer Capacity Grows Due to Energy Market Developments

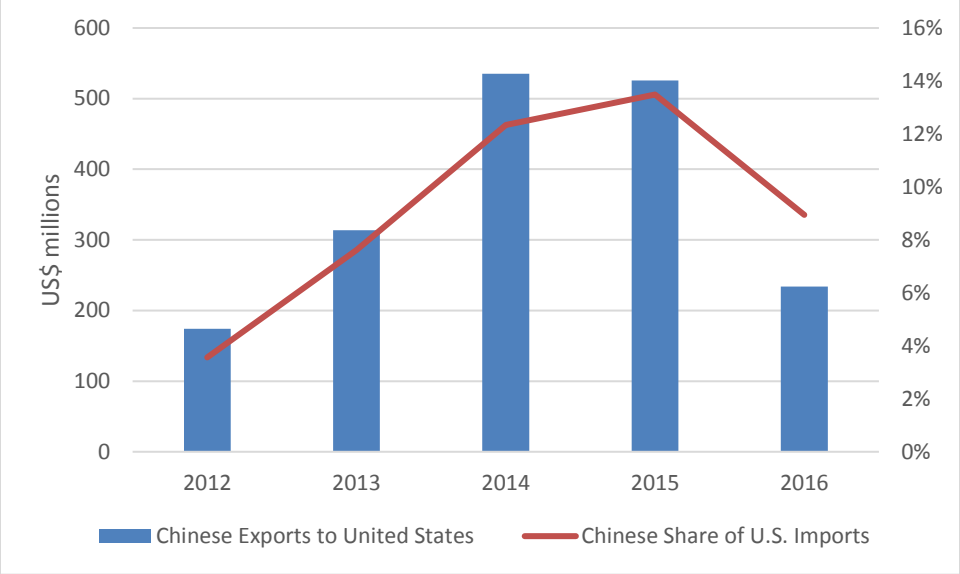
Chinese exports of nitrogen-based fertilizers dropped dramatically in 2016 due to rising prices for coal, which is the primary source ingredient for China's nitrogen fertilizers. As seen in Figure 7, Chinese exports of urea—an important source of nitrogen for fertilizing—declined 50 percent year-on-year in 2016 from $4 billion to $2 billion.[107] While China remains the largest exporter of urea internationally, its share of global urea production declined to 39 percent in 2016 from 43 percent the year before.[108] As seen in Figure 8, Chinese nitrogen-based fertilizer exports to the United States declined more than 55 percent in 2016 after steadily increasing from 2012 to 2015.[109] In 2016, China fell from the second-largest exporter of nitrogen fertilizer to the United States to the third largest behind Canada and Qatar.[110] By contrast, U.S. production of urea increased 10 percent in 2016 as new urea plants became operational.[111] While the United States is still a net importer of nitrogen-based fertilizers, total U.S. imports of nitrogen fertilizers fell 12 percent in 2016, from $13 billion to $11.4 billion, as domestic production increased.[112]

Figure 7: Chinese Urea Exports, 2011–2016



Source: China's National Bureau of Statistics via CEIC database.

Figure 8: Chinese Nitrogen Fertilizer Exports to the United States, 2012–2016



Source: United Nations, "UN Comtrade Database." *https://comtrade.un.org/data/.*

Chinese Fertilizer Production Declines Due to Higher Coal Prices

The expansion of U.S. fertilizer capacity and downturn in Chinese production are driven by differences in U.S. and Chinese energy sources and policies. Nitrogen-based fertilizer is typically synthesized from natural gas. In China this gas is created from coal using the coal gasification process, which converts coal into a type of natural gas known as syngas that can be used either for energy production or chemical purposes. Although coal gasification is very water intensive and ultimately produces more carbon dioxide than simply burning coal for energy,[*] China has

[*] While carbon-capture processes can be applied to coal gasification, their application has been rare. Greenpeace estimates that if all of China's planned gasification plants are constructed, they would add over one billion tons of carbon dioxide to the atmosphere annually, equal to roughly one-eighth of China's total emissions in 2011. Christine Ottery, "China's Planned Coal-to-Gas Plants to Emit over One Billion Tons of CO2," *Greenpeace*, July 23, 2014. *http://energydesk.greenpeace.org/2014/07/23/chinas-planned-coal-gas-plants-emit-one-billion-tons-co2/.*

rapidly expanded its construction of coal gasification plants.[113] China has constructed four new gasification plants since 2013 and, according to Greenpeace, planned on constructing 50 new plants as of 2014.[114] While at least one advisor to the Chinese government has questioned the efficiency of coal gasification,[*] with an effective pipeline network, coal gasification would allow for coal to be processed in sparsely populated western provinces and shipped to eastern urban areas where it can be burned as comparatively cleaner gas, reducing local pollution in crowded areas.[115]

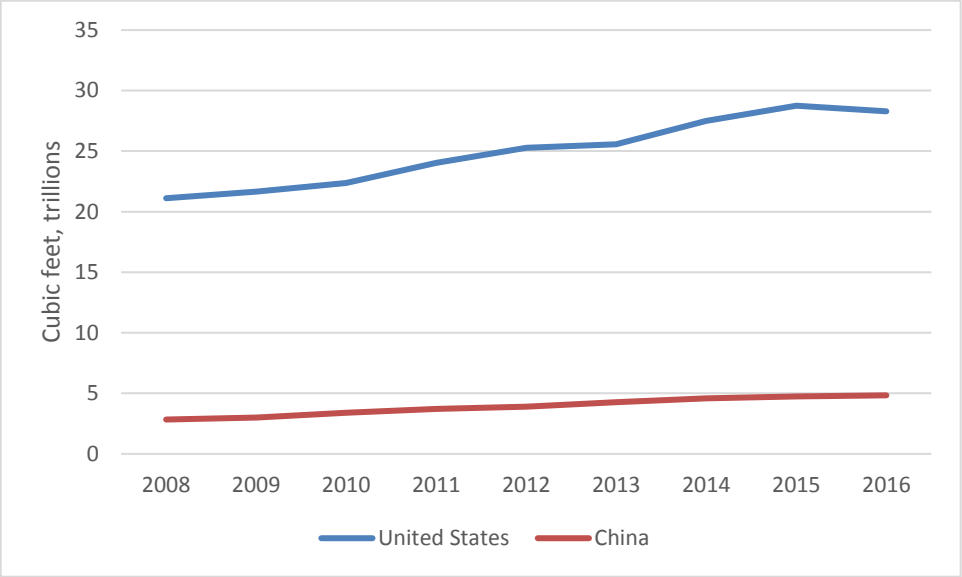
Since roughly three-quarters of China's urea is derived through coal gasification and the price of gas accounts for 60 to 80 percent of fertilizer production costs, China's nitrogen fertilizer production is closely tied to coal prices and production.[116] As China announced significant cuts in coal capacity last year, Chinese coal prices dramatically increased. In 2016, the Chinese government undertook several steps to reduce coal production, including restricting the number of working days per year at coal mines from 330 to 276.[117] These measures caused thermal coal prices to more than double, reaching $110 per ton, and production and exports of Chinese nitrogen fertilizers declined accordingly.[118] However, in the face of high coal prices, Chinese authorities have taken steps to soften the impact of these measures on coal mines. The NDRC has allowed 800 mines to return to 330 working days per year, and while 800 million metric tons of "outdated" coal capacity is targeted for removal under a new NDRC plan, it will be replaced by 500 million metric tons worth of "advanced" coal facilities.[119] Chinese fertilizer exports will likely increase to the extent that these new policies lower coal prices.

U.S. Fertilizer Capacity Grows Due to Natural Gas Production

In the United States, fertilizer production has been boosted by the development of natural gas from shale deposits. U.S. nitrogen fertilizer is mostly derived directly from natural gas, which produces fertilizer at a lower cost than syngas created from coal gasification. Production of a metric ton of urea in the United States currently costs roughly $130, compared to $180 to $200 for urea derived from Chinese coal.[120] Additionally, since 2008 U.S. natural gas production has expanded continuously, largely due to application of fracking to shale deposits, lowering prices and increasing availability. As seen in Figure 9, natural gas production in the United States increased 34 percent from 2008 to 2016, and today the United States is the largest producer of natural gas in the world.[121] This increased natural gas output, combined with the price advantage associated with natural gas, has attracted billions of dollars in investment in new U.S. fertilizer plants, as seen in Table 1. Since 2013, at least $10 billion has been invested in fertilizer-related plants.[122] As these new plants come online, U.S. fertilizer production has increased and U.S. imports will likely decline further as U.S. capacity grows. For urea production, ICIS—a market information firm—predicts U.S. capacity will grow 50 percent from 2015 to 2020.[123]

[*] Li Junfeng, an energy advisor to the Chinese government, commented in a publication managed by the *People's Daily* that it is "extremely irrational to develop coal-to-gas technology," and views the plants as "unfit to become a national strategy." Edward Wong, "'Irrational' Coal Plants May Hamper China's Climate Change Efforts," *New York Times*, February 7, 2017. *https://www.nytimes.com/2017/02/07/world/asia/china-coal-gas-plants-climate-change.html.*

Figure 9: U.S. and Chinese Natural Gas Production, 2008–2016



Source: U.S. Energy Information Administration, *Natural Gas*. *https://www.eia.gov/dnav/ng/hist/n9050us2a.htm*; China's National Bureau of Statistics via CEIC database.

Table 1: Major Fertilizer-Associated Investments in the United States, 2012–2014

Firm	Announced Date of Investment	Type of Plant	Investment (US$ millions)	Capacity (thousands of tons per year)
Fatima Fertilizer Company	2014	Nitrogenous Fertilizer Plant	$2,400	2,590
Incitec Pivot, Dyno Nobel	2013	Ammonia Plant	$1,875	881
Yara	2013	Ammonia Plant	$600	823
Koch Nitrogen	2013	Urea Plant Expansion	$1,300	1,000
OCI	2013	Nitrogenous Fertilizer Plant	$2,000	2,000
CF Industries	2012	Urea and Ammonia Expansion	$2,000	2,288.55

Source: Various.[124]

Chinese Shale Gas Production Increases, but Lags behind Government Targets Due to Geological and Political Difficulties

While much of China's fertilizer production continues to be sourced from expensive coal gasification plants, the Chinese government has encouraged the development of China's natural gas resources and China's natural gas production has increased, albeit not in line with government targets. China has the world's largest shale gas reserves, but its natural gas production continues to lag significantly behind the United States, as shown in Figure 9.[125] Although China's natural gas production grew 43 percent from 2010 to 2016, the United States produced almost six times as much natural gas as China in 2016.[126]

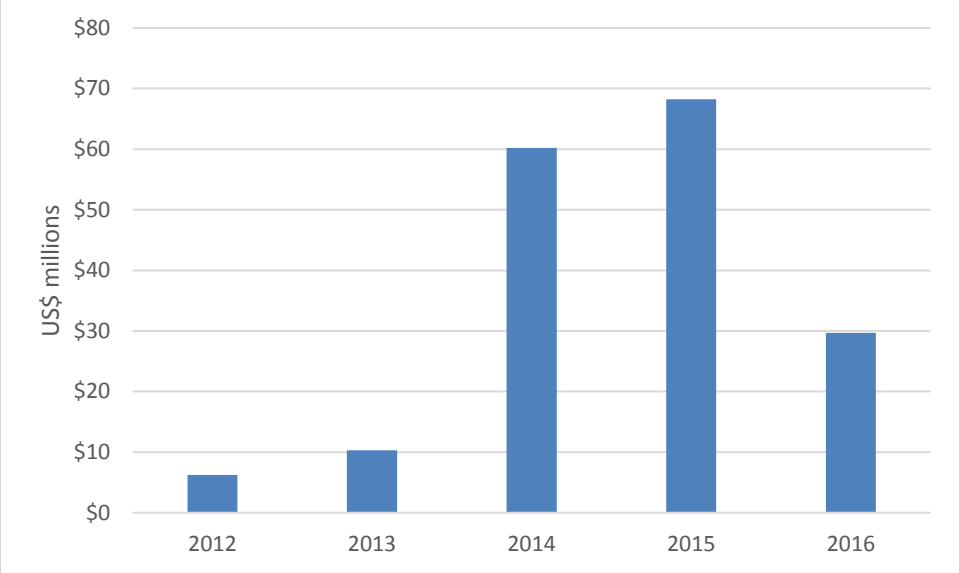
The Chinese government has set ambitious targets for the production of natural gas from shale deposits, but these targets have been scaled back due to difficult geology and a lack of infrastructure to shale deposits.[127] In 2015, Chinese shale gas production lagged 31 percent behind government targets, and that same year the Chinese

government reduced its shale gas target for 2020 by 66 percent, citing geological difficulties in extraction.* International firms have also had difficulty extracting Chinese shale gas. In addition to geological concerns, the Chinese government has classified geological data associated with mineral resources as a state secret and imprisoned a U.S. geologist who purchased geological information.[128] Drilling operations also often face protests from local residents.[129] For example, after encountering difficulties associated with local protests and challenging geological conditions, Royal Dutch Shell ended its investment in Chinese shale gas after five years in 2016, after initially planning to invest at least $1 billion in China's shale gas reserves.[130]

U.S. Department of Commerce Issues Duties against Chinese Ammonium Sulfate

Although Chinese fertilizer exports have recently declined, U.S. companies have accused Chinese fertilizer exporters of dumping ammonium sulfate—a nitrogen fertilizer linked to heavy industry production—into the United States at reduced prices and harming U.S. fertilizer manufacturers. These complaints have led the U.S. International Trade Commission (ITC) to authorize the U.S. Department of Commerce to issue antidumping duties of nearly 500 percent against all Chinese firms exporting ammonium sulfate to the United States after finding that U.S. producers had been harmed by underpriced Chinese ammonium sulfate in February 2017.[131] As seen in Figure 10, U.S. imports of Chinese ammonium sulfate grew more than fivefold from 2013 to 2015 and the price of Chinese ammonium sulfate fell from $218 to $164 per ton over this period, although Chinese ammonium sulfate imports fell 60 percent from 2015 to 2016, mirroring the decline in imports of other Chinese nitrogen fertilizers last year.† [132] These large quantities of ammonium sulfate were derived from China's sprawling heavy industry sector—roughly 80 percent of Chinese ammonium sulfate is created as a byproduct from Chinese steel and nylon manufacturing—and its commercialization and export may have been linked to government-encouraged efforts to increase the value of industrial byproducts.[133] China's steel industry has been struggling with excess capacity and diminished profits for several years—China used only 67 percent of its steel capacity in 2015.[134] These profitability issues incentivize Chinese steel firms to monetize byproducts like ammonium sulfate to improve their bottom line.

Figure 10: U.S. Imports of Chinese Ammonium Sulfate, 2012–2016



Source: United Nations, "UN Comtrade Database." *https://comtrade.un.org/data/.*

* China's shale gas reserves are typically located farther underground than similar reserves in the United States, resulting in greater pressure exerted on mining gear, which can lead to equipment failure. Brian Spegele, "Energy-Hungry China Struggles to Join Shale-Gas Revolution," *Wall Street Journal*, September 5, 2013. *https://www.wsj.com/articles/SB10001424127887323980604579030883246871124.*

† The fall in ammonium sulfate imports in 2016 may have also been tied to coal prices. Ammonium sulfate is produced from coking coal in the manufacture of steel, which also saw significant price increases in 2016. Tom Hancock, "China Targets Aggressive Coal Capacity Cuts to 2020," *Financial Times*, January 3, 2017. *https://www.ft.com/content/3d9d0c78-ce7b-11e6-864f-20dcb35cede2.*

The Department of Commerce also found that Chinese ammonium sulfate exports are subsidized, and the Chinese government has taken steps to encourage the export and production of ammonium sulfate and other fertilizers. In December 2016, the Chinese government removed export tariffs for most types of fertilizer.[135] The Chinese government has also provided fertilizer producers with several forms of support, including reduced electricity prices, soft loans, and transportation subsidies.[136]

For inquiries, please contact a member of our economics and trade team (Nargiza Salidjanova, Bart Carfagno, Michelle Ker, Katherine Koleski, Sean O'Connor, or Matt Snyder).

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