Overview

China is the world's most populous country with a fast-growing economy that has led it to be the largest energy consumer and producer in the world. Rapidly increasing energy demand, especially for liquid fuels, has made China extremely influential in world energy markets.

China has quickly risen to the top ranks in global energy demand over the past few years. China is the world's second-largest oil consumer behind the United States and became the largest global energy consumer in 2010. The country was a net oil exporter until the early 1990s and became the world's second-largest net importer of crude oil and petroleum products in 2009. The U.S. Energy Information Administration projects that China will surpass the United States as the largest net oil importer by 2014, in part due to China's rising oil consumption. China's oil consumption growth accounted for one-third of the world's oil consumption growth in 2013, and EIA projects the same share in 2014.

Natural gas use in China has also increased rapidly in recent years, and China has sought to raise natural gas imports via pipeline and liquefied natural gas (LNG). China is the world's top coal producer, consumer, and importer and accounted for about half of global coal consumption, an important factor in world energy-related carbon dioxide emissions. China's rising coal production is the key driver behind the country becoming the world's largest energy producer in 2007. In line with its sizeable industrialization and swiftly modernizing economy, China also became the world's largest power generator in 2011.

China is the world's most populous country and has a rapidly growing economy, which has driven the country's high overall energy demand and the quest for securing energy resources. According to the International Monetary Fund, China's real gross domestic product (GDP) growth slowed to an estimated 7.8% in 2012 and 7.6% in the first half of 2013, after registering an average growth rate of 10% per year between 2000 and 2011. China mitigated the 2008 global financial crisis with a massive stimulus package spread over two years that helped bolster China's investments and industrial demand. Economic growth slowed in 2012 and 2013 as industrial production and exports decreased and as the government attempted to curb economic inflation and excessive investment in certain markets.

After 10 years a new leadership emerged in China in March 2013 when Xi Jinping became President and Li Keqiang assumed premiership. The new administration is keen to initiate economic and financial reform in China in the interest of greater long-term and sustainable growth. In November 2013 at the Third Plenum, a major policy meeting held every five years, the Chinese government outlined broad principles for economic reform in China. The government has proposed incremental policy and economic reforms to create more balanced economic growth and to shift away from an economy driven primarily by excessive investments and exports toward one characterized by greater domestic consumption. In the energy sector, the government is moving toward more market-based pricing schemes, energy efficiency measures, and competition among energy firms, as well as making greater investments in upstream hydrocarbon plays and renewable energy projects. China announced in late 2013 that it is assessing ways to attract more private investment in the energy sector by streamlining the project approval processes, implementing policies to foster more energy transmission infrastructure to link supply and demand centers, and relaxing some price controls.

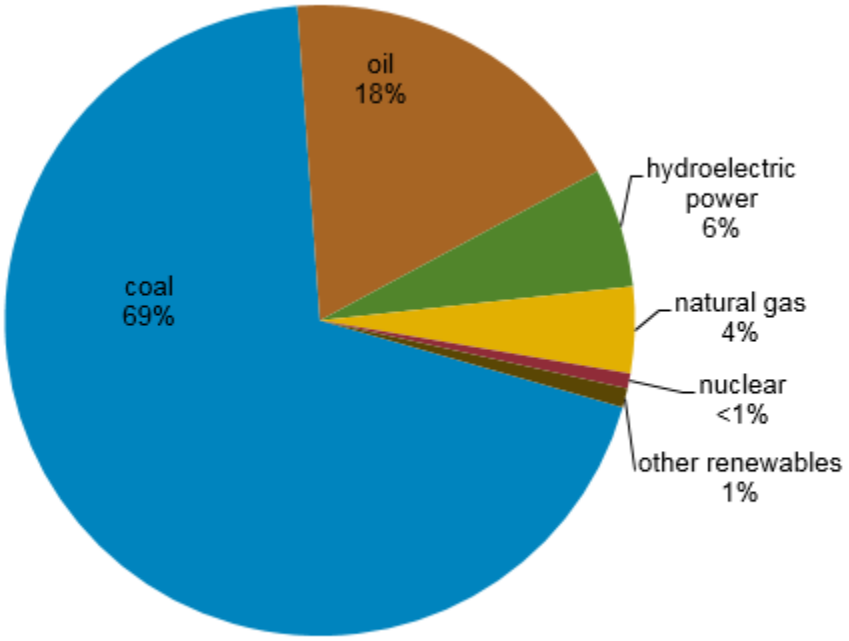
Source: Central Intelligence Agency, *The World Factbook*

Total Primary Energy Consumption

Coal supplied the vast majority (69%) of China's total energy consumption in 2011. Oil was the second-largest source, accounting for 18% of the country's total energy consumption. While China has made an effort to diversify its energy supplies, hydroelectric sources (6%), natural gas (4%), nuclear power (nearly 1%), and other renewables (1%) accounted for relatively small shares of China's energy consumption. The Chinese government plans to cap coal use to below 65% of total primary energy consumption by 2017 in an effort to reduce heavy air pollution that has afflicted certain areas of the country in recent years. The Chinese government set a target in its 12th Five-Year Plan to raise non-fossil fuel energy consumption to 15% of the energy mix by 2020 in efforts to ease the country's dependence on coal. EIA projects coal's share of the total energy mix to fall to 63% by 2020 and 55% by 2040 as a result of projected higher energy efficiencies and China's goal to increase its environmental sustainability. However, absolute coal consumption is expected to increase by over 50% during this forecast period, reflecting the large growth in total energy consumption.

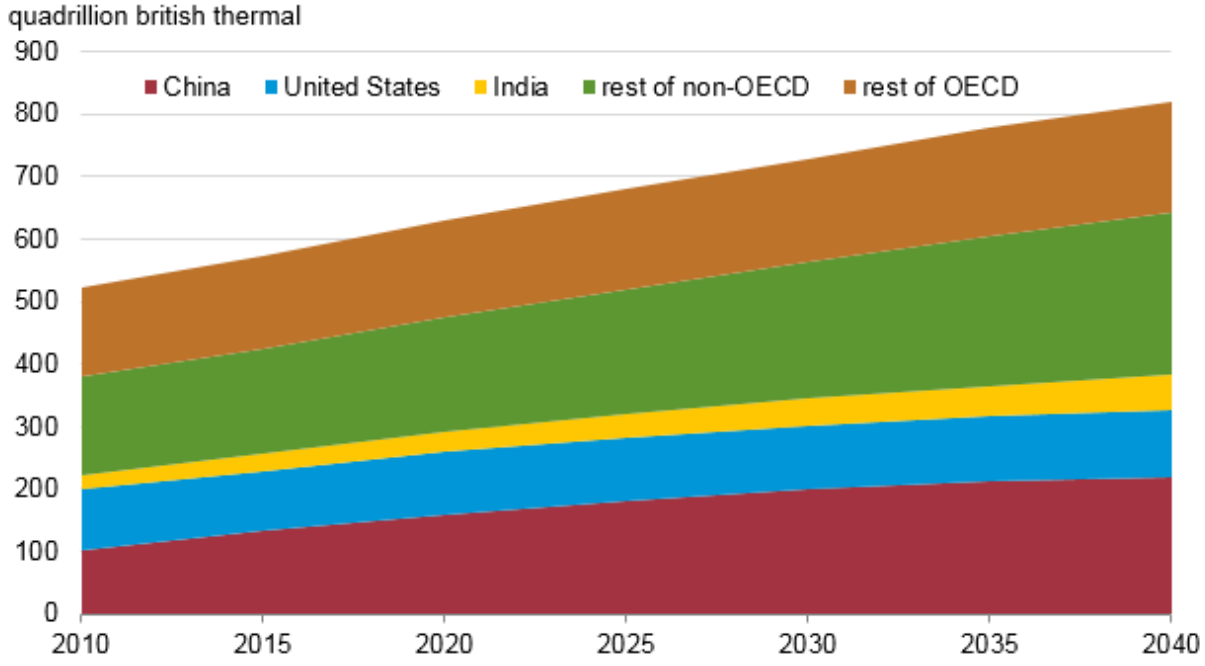
As a result of high coal consumption, China is also the world's leading energy-related CO_2 emitter, releasing 8,715 million metric tons of CO_2 in 2011. China's government plans to reduce carbon intensity (carbon emissions per unit of GDP) by 17% between 2010 and 2015 and energy intensity (energy use per unit of GDP) by 16% during the same period, according to the country's 12th Five-Year Plan. China also intends to reduce its overall CO_2 emissions by at least 40% between 2005 and 2020.

Total energy consumption in China by type, 2011

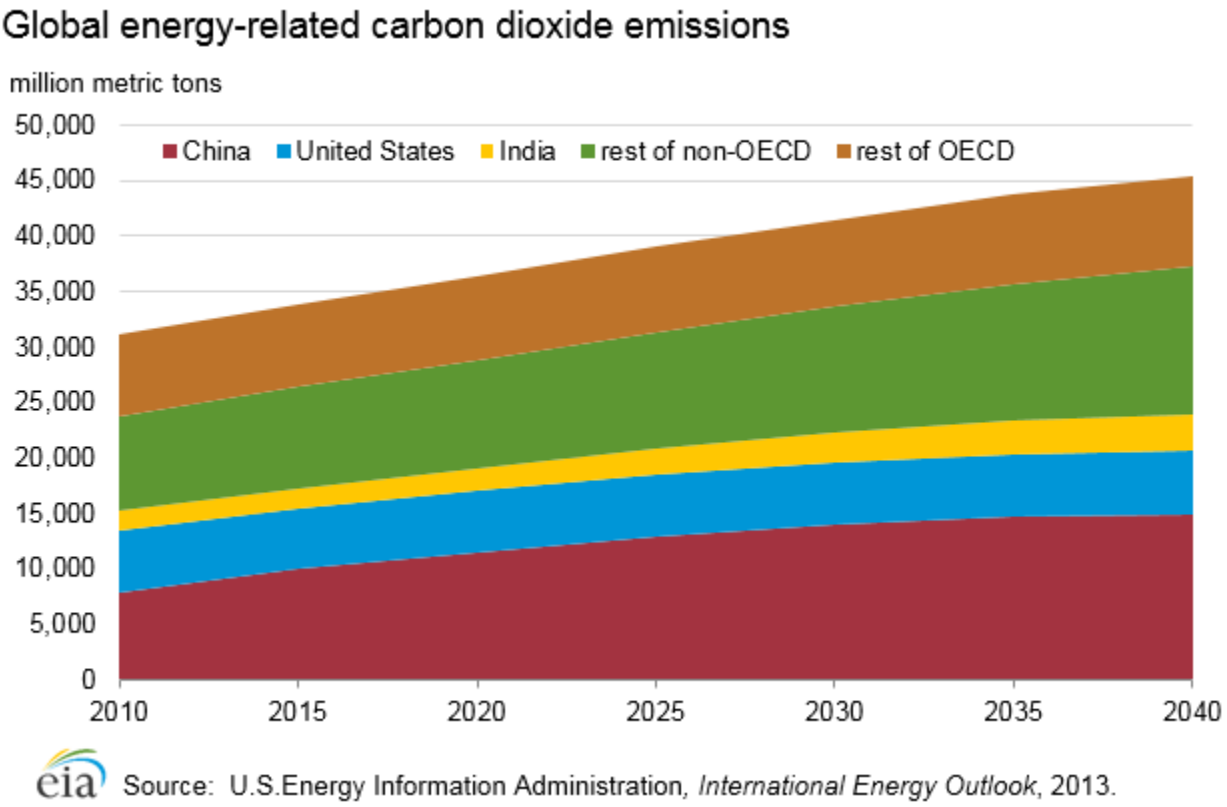


Note: Numbers may not add due to rounding.
Source: U.S. Energy Information Administration *International Energy Statistics*.

Global primary energy consumption



Source: U.S.Energy Information Administration, *International Energy Outlook*, 2013.



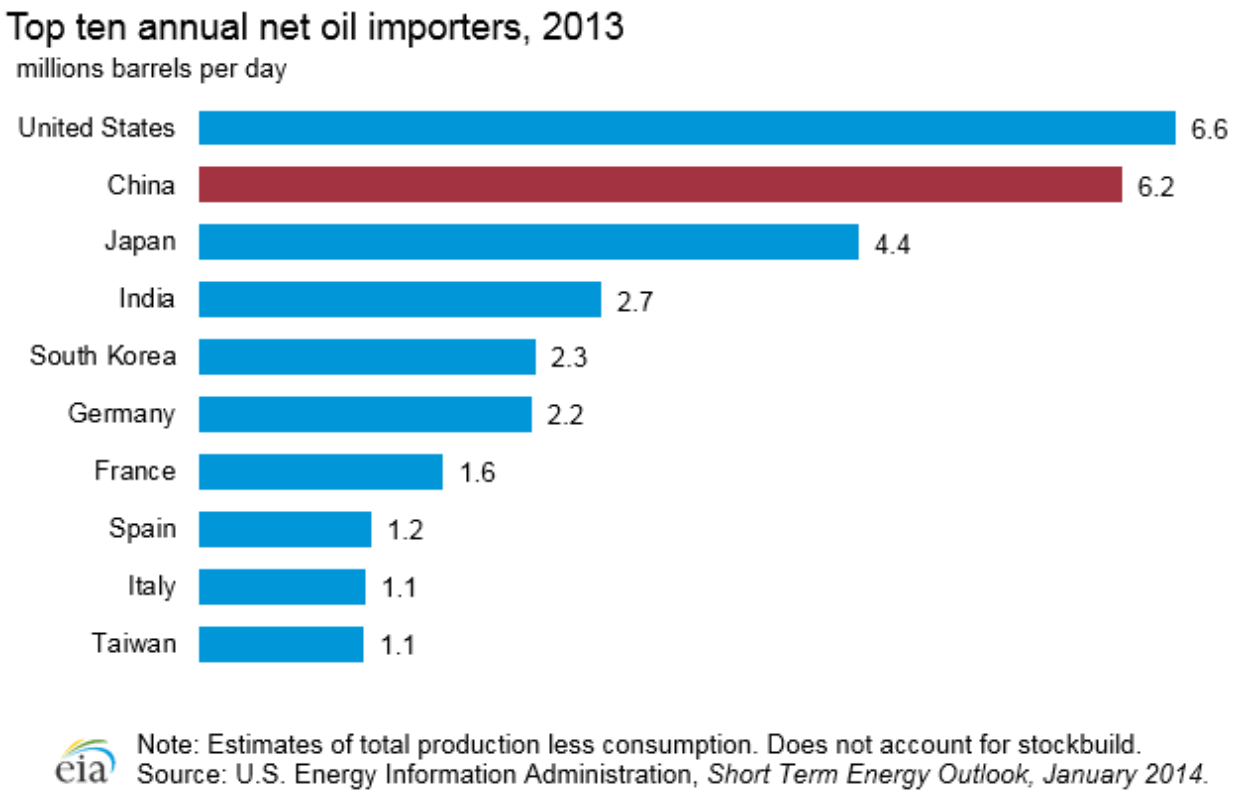
Oil

China is the world's second-largest consumer of oil and projected to move from second-largest net importer of oil to the largest in 2014.

According to the *Oil & Gas Journal* (*OGJ*), as of January 2014, China holds 24.4 billion barrels of proven oil reserves, up over 0.7 billion barrels from the 2013 level and the highest in the Asia-Pacific region. China's total oil and liquids production, the fourth largest in the world, has risen by about 54% over the past two decades and serves only its domestic market. However, the production growth has not kept pace with demand growth during this period. In 2013, China produced an estimated 4.5 million barrels per day (bbl/d) of total oil liquids, of which 93% was crude oil. EIA forecasts China's oil production to rise to about 4.6 million bbl/d by the end of 2014. Over the longer term, EIA projects a steady growth for China's oil and liquids production, reaching 4.6 million bbl/d in 2020 and 5.6 million bbl/d by 2040. Most of the growth over the long term is from non-petroleum liquids such as gas-to-liquids, coal-to-liquids, kerogen, and biofuels, as crude oil production remains relatively flat.

China's oil consumption growth has eased after a high of 14% in 2009, reflecting the effects of the most recent global financial and economic downturn. Despite the slower growth, the country still made up nearly a third of global oil demand growth in 2013, according to EIA estimates. China consumed an estimated 10.7 million bbl/d of oil in 2013, up 380 thousand bbl/d, or almost 4%, from 2012. In 2009, China became the second-largest net oil importer in the world behind the United States, and average net total oil imports reached 6.2 million bbl/d in 2013. Notably, for the fourth quarter of 2013, China actually became the largest global net importer of oil. EIA projects that China is likely to surpass the United States in net oil imports on an annual basis by 2014 as U.S. oil production and Chinese oil demand increase simultaneously. China's oil demand growth hinges on several factors, such as domestic economic growth and trade, power generation, transportation sector shifts, and refining capabilities. EIA

forecasts that China's oil consumption will continue growing through 2014 at a moderate pace of approximately 11.1 million bbl/d, and its net oil imports will reach 6.6 million bbl/d compared to 5.5 million bbl/d for the United States.



Note: Estimates of total production less consumption. Does not account for stockbuild.
Source: U.S. Energy Information Administration, *Short Term Energy Outlook, January 2014.*

Sector Organization

China's national oil companies dominate the oil and gas upstream and downstream sectors, although the government has granted international oil companies more access to technically challenging onshore and deep water offshore fields. China revised its oil price reform legislation in 2013 to further reflect international oil prices in the country's domestic demand.

The Chinese government's energy policies are dominated by the country's growing demand for oil and its reliance on oil imports. The National Development and Reform Commission (NDRC), a department of China's State Council, is the primary policymaking, planning, and regulatory authority of the energy sector, while four other ministries oversee various components of the country's oil policy. The government launched the National Energy Administration (NEA) in July 2008 to act as the key energy regulator. The NEA, linked with the NDRC, is charged with approving new energy projects in China, setting domestic wholesale energy prices, and implementing the central government's energy policies, among other duties. In January 2010, the government formed a National Energy Commission with the purpose of consolidating energy policies among the various agencies under the State Council. Reforms under the new government leadership include consolidating and streamlining ministries and expanding the NEA's purview.

National Oil Companies and Others

China's national oil companies (NOCs) wield a significant amount of influence in China's oil sector. Between 1994 and 1998, the Chinese government reorganized most state-owned oil and gas assets into

two vertically integrated firms that own both upstream and downstream assets: the China National Petroleum Corporation (CNPC) and the China Petroleum and Chemical Corporation (Sinopec). These two conglomerates operate a range of local subsidiaries, and together control China's upstream and downstream oil markets. CNPC is the leading upstream player in China and, along with its publicly-listed arm, PetroChina, accounts for an estimated 53% and 75% of China's total oil and natural gas output, respectively, according to FACTS Global Energy (FGE). CNPC's current strategy is to integrate its sectors and capture more downstream market share. Sinopec, on the other hand, has traditionally focused on downstream activities, such as refining and distribution, with these sectors making up over 76% of the company's revenues in recent years. The company seeks to acquire more upstream assets to capture more value from oil and gas production and diversify its revenue sources.

Additional state-owned oil firms have emerged over the past several years. The China National Offshore Oil Corporation (CNOOC), which is responsible for offshore oil exploration and production, has seen its role expand as a result of growing attention to offshore zones. Also, the company has proven to be a growing competitor to CNPC and Sinopec by not only increasing its exploration and production (E&P) expenditures in the South China Sea, but also extending its reach into the downstream sector, particularly in the southern Guangdong Province. The Sinochem Corporation, CITIC Group, and Yanchang Petroleum have also expanded their presence in China's oil sector, but these companies are still relatively small.

Whereas onshore oil production in China is mostly limited to China's NOCs, international oil companies (IOCs) have been granted greater access to offshore oil prospects and technically challenging gas fields, mainly through production-sharing contracts (PSCs) and joint ventures (JVs). IOCs involved in offshore exploration and production (E&P) working in China include: ConocoPhillips, Shell, Chevron, BP, BG, Husky, Anadarko, and Eni, among others. China's NOCs must hold the majority participating interest in a PSC and can become the operator once development costs have been recovered. IOCs offer their technical expertise in order to partner with a Chinese NOC and make a foray into the Chinese markets.

Pricing Reform

The Chinese government launched a fuel tax and reform of the domestic product pricing mechanism in 2009 in efforts to tie retail oil product prices more closely to international crude oil markets. This reform aimed to attract downstream investment, to ensure better profit margins for refiners who must sell fuel at regulated prices, and to reduce energy intensity caused by lower consumer prices and higher demand. The oil product pricing system adopted in 2009 allowed the NDRC to adjust retail prices when the moving average of imported crude prices fluctuated outside of a 4% range around the established price within 22 consecutive working days for diesel and gasoline.

Despite the price reform, international crude oil prices increased at a faster rate than revisions made by the NDRC to retail fuel prices, causing refiners to incur losses on their downstream businesses and increase their fuel product exports. To promote greater market transparency and global changes, the NDRC revised the pricing regime in March 2013 by shortening the retail fuel price adjustment period to every 10 working days when prices automatically adjust to international crude price fluctuations greater than 50 yuan per ton (roughly $1/barrel). However, the NDRC did not identify the slate of crude oil types that it uses for price determination. Since the revised pricing mechanism was established, the NDRC has approved 15 price changes.

In November 2011, China also installed an ad valorem resource tax of 5% on all oil and gas production, including unconventional resources output, in an attempt to increase revenues for local and regional governments and to encourage more efficient hydrocarbon production. The resource tax was extended in 2012 to projects involving JVs of international and Chinese firms.

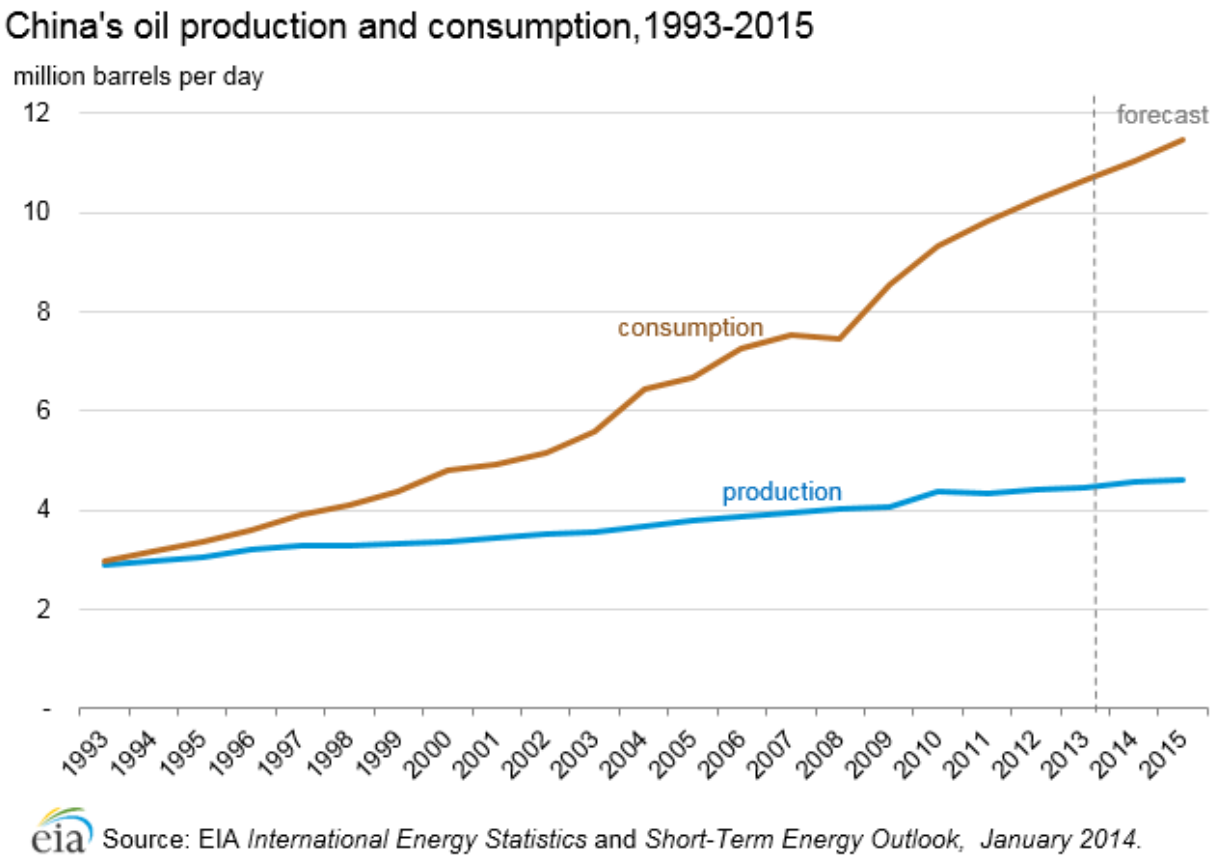
Exploration and Production

China's largest oil fields are mature, and production has peaked, leading companies to invest in techniques to sustain oil flows at the mature fields, while also focusing on

developing largely untapped reserves in the western interior provinces and offshore fields.

After bolstering domestic oil output in 2010, China experienced more moderate oil production growth. China boosted its domestic oil output by over 7% in 2010, after incremental growth in the previous two decades. Oil production in 2013 reached nearly 4.5 million bbl/d, about 50% higher than the level two decades ago. Approximately 81% of Chinese current crude oil production capacity is located onshore, while 19% of crude oil production is from shallow offshore reserves. New offshore production, enhanced oil recovery (EOR) of older onshore fields, and small discoveries in existing basins are the main contributors to incremental production increases. China's NOCs are investing a great deal in EOR techniques such as water injection, polymer flooding, and steam flooding, among others, to offset oil production declines from these mature, onshore fields.

Recent E&P activity has focused on the offshore areas of Bohai Bay and the South China Sea (SCS), as well as onshore oil and natural gas fields in western and central interior provinces such as Xinjiang, Sichuan, Gansu, and Inner Mongolia. China invested an estimated $13 billion in oil and gas exploration in 2013 so the country can reduce its dependence on hydrocarbon imports.



A vast majority of China's largest oil fields, located in the northeast and north central regions of the country, represent the backbone of the country's domestic production. However, these fields are mature and prone to declining production. CNPC's Daqing field, located in the Northeast, is one of China's oldest and most prolific fields, constituting 19% of China's overall production. In 2012, Daqing produced about 800,000 bbl/d of crude oil, according to FGE's most recent estimate, and has maintained this level for the past decade after declines of more than 1 million bbl/d. Sinopec's Shengli oil field near the Bohai Bay produced about 550,000 bbl/d of crude oil during 2012, making it China's second-largest oil-producing

field. The use of EOR in these fields has been able to slow decline rates. However, Daqing, Shengli, and other mature fields have been heavily exploited since the 1960s, and their output is expected to decline within the next decade.

CNPC's use of various EOR techniques on the Liaohe and Jilin fields in the Northeast, some of China's oldest onshore oil fields, has helped stem production declines in recent years. Liaohe, one of China's largest heavy oil fields, produced 200,000 bbl/d in 2012. Because CNPC began using more advanced EOR methods such as steam flooding and polymer flooding on a large scale, the company hopes to restore production to around 241,000 bbl/d by 2020. CNPC has used hydraulic fracturing and CO_2 injection at the Jilin field to mitigate further declines in hydrocarbon output.

China's interior provinces, such as the Northwest's Xinjiang Uygur Autonomous Region (including the Junggar and Tarim basins) and central Ordos basin (particularly the Changqing field), have attained strong production growth in recent years through the use of improved drilling and advanced oil extraction techniques to unlock complex geological oil reserves. As China constructs more storage and processing infrastructure in this region, it is heavily investing in developing the surrounding oil and gas fields. Total 2012 production from the Junggar and Tarim basins was estimated at 370,000 bbl/d. CNPC applied a new EOR technology to the ultra-heavy Fengcheng field in the Junggar basin in 2009 and expects production and recoverable reserves to increase in the next few years.

Production at Changqing, China's third-largest oil field, which is located in the north central Ordos basin, grew robustly over the past several years, averaging more than 13% annual growth between 2008 and 2012 when it reached 451,000 bbl/d. CNPC uses water injection, steam flooding, and hydraulic fracturing to boost Changqing's production. The map below shows the location of some of the major Chinese oil basins.

China's Largest Oil Fields

Source: Rigzone and International Energy Agency (IEA).

Offshore E&P activities, mostly driven by CNOOC, have focused on the Bohai Bay region in the Yellow Sea, the South China Sea (particularly the Pearl River Mouth Basin), and, to a lesser extent, the East China Sea. Most of these fields are small and mature faster than China's onshore fields, which urges CNOOC to explore deep water plays.

The Bohai Bay Basin, located in northeastern China east of Beijing, is the oldest oil-producing offshore zone and holds the bulk of proven offshore reserves in China. CNPC initiated the first phase of the Jidong Nanpu field development in 2007, and hoped to bring 200,000 bbl/d of crude oil production on stream by 2012. However, since then, the company claimed the reserves and production levels were overstated, and further exploration and reserve additions in the field would be necessary to meet its goals.

CNOOC's production in the Bohai Bay was 406,000 bbl/d in 2011, or two-thirds of the NOC's domestic oil production, according to PFC Energy. Following an oil leak at China's largest offshore crude oil field (Penglai 19-3) in July 2011, the government called for the field's production to cease. Production rates at Penglai 19-3 peaked at about 122,000 bbl/d prior to the shut-in. ConocoPhillips, a 49% stakeholder and operator of the field, and CNOOC resumed operations at Penglai 19-3 when they received government

approval in early 2013. Production from the Penglai project is processed at China's largest floating production, storage, and offloading (FPSO) vessel with an offloading capacity of 190,000 bbl/d. Further development phases of Penglai are underway. CNOOC has discovered other sizeable oil fields in the Bohai Bay such as Penglai 9-1, which the NOC claims to be its largest find in the Bohai Bay in recent years. The company made seven oil and gas discoveries and assessed seven more finds in 2012.

Although the South China Sea is known to be gas-rich, CNOOC has also discovered several small oil fields and is focusing on deep water discoveries. In 2011, CNOOC's total oil production in the SCS was 193,000 bbl/d. In 2010, CNOOC made significant discoveries of the Enping Trough and the Liuhua 16-2 in the eastern SCS, opening further opportunities for exploration. The NOC continues to explore and develop several fields to use EOR tactics to further produce from mature fields in the East SCS. CNOOC has held three licensing rounds since 2011 for foreign companies to joint CNOOC to explore and develop offshore blocks in the Bohai Bay, SCS, and ECS. The latest round occurred in 2013 with foreign companies and included 25 blocks, 15 of which reside in deep water areas.

Territorial Disputes

Territorial disputes in the East China Sea have to date limited large-scale development of oil and gas fields in the region, where China and Japan compete for territorial claims. The two countries have held negotiations to resolve the disputes. In June 2008, the two countries reached an agreement to develop jointly the Chunxiao/Shirakaba and Longjing/Asurao gas fields. However, in early 2009, the agreement unraveled when China asserted sovereignty over the fields. Since the agreement was signed, the countries have continued unilateral actions in attempts to develop the gas fields. Tensions escalated with territorial claims by Japan in 2012, China's installation of a production platform, and CNOOC's proposal to develop several gas fields in the contested area in 2013.

Continued territorial disagreements by countries bordering the South China Sea, including ownership of the Spratly and Paracel Islands, have hindered efforts for joint exploration of hydrocarbon resources in the area. ASEAN members signed the Declaration of Conduct in 2002 that encourages countries to use restraint and cooperate in the South China Sea, but no regulations were established. China stakes claims to the SCS using a "nine-dash line" to determine each country's maritime borders and resources. Increasing appetites for oil and natural gas have exacerbated tensions, particularly between China and Vietnam and between China and the Philippines, as hydrocarbon development has attracted interest in deep water areas. China has increased its naval activity in the contested areas, and CNOOC's June 2012 tender for nine offshore blocks in the disputed area overlaps several fields located within Vietnam's 200-nautical mile exclusive economic zone. China's current policy is to forge JV partnerships with the other SCS countries to explore and develop untapped hydrocarbon resources in the sea. More details covering the disputes in these two regions can be found in EIA's East China Sea and South China Sea regional briefs.

Overseas Acquisitions

China's national oil companies have rapidly expanded their purchases of international oil and gas assets since 2008 through direct acquisitions of equity and financial loans in exchange for oil supplies in order to secure more oil and gas supplies, make long-term commercial investments, and gain technical expertise in more challenging oil and natural gas plays.

China's increasing dependence on oil imports, the need for Chinese companies to develop technical expertise for their more challenging resources, and attempts to capture value upstream are key factors driving Chinese NOCs to invest in international projects and form strategic commercial partnerships with IOCs. China is taking advantage of the general economic downturn to increase its global acquisitions and use its vast foreign exchange reserves (estimated at $3.3 trillion in 2012) to help purchase equity in projects or acquire stakes in energy companies. Since 2008, the NOCs have purchased assets in the Middle East, North America, Latin America, Africa, and Asia and invested an estimated $34 billion in overseas oil and gas assets in 2012, according to the CNPC Economics Technology Research Institute.

China's oil production from its overseas equity shares and acquisitions grew significantly over the past decade from 140,000 bbl/d in 2000 to an estimated 2 million bbl/d in 2012, according to the International Energy Agency. CNPC holds the most equity production and investment overseas of all the NOCs, although Sinopec, CNOOC, and other smaller NOCs have rapidly expanded their overseas investment profiles over the past four years. Most of China's recent direct acquisitions were channeled to deep water oil plays off the coast of West Africa and Brazil, and oil sands and shale gas projects in North America.

CNPC, holding hydrocarbon assets in nearly 30 countries, produced a record 838,000 bbl/d from its stakes in overseas oil output by the end of 2011, up from 718,000 bbl/d in 2010. CNPC's overseas oil production remained relatively flat in 2012 as the NOC focused on shale gas acquisitions that year. About two-thirds of CNPC's international production was from its assets in Kazakhstan and Sudan, according to PFC Energy. Sinopec's overseas equity oil output reached 456,000 bbl/d in 2011, and the NOC plans to double production to 1 million bbl/d from overseas oil equity by 2015.

Although CNOOC produced about 88,000 bbl/d in 2011, just 6% of China's total overseas production, the NOC has swiftly increased oil and gas purchases since 2010 in an attempt to gain technical expertise and acreage in shale oil, shale gas, and coalbed methane and deep water hydrocarbon resources. Following approval from Canada, CNOOC purchased the Canadian oil company Nexen for $15.1 billion (plus $2.8 billion in Nexen's net debt) in 2013. This deal became China's largest overseas acquisition. The NOC anticipates this and other overseas deals will help it achieve an overall annual oil and gas production growth rate of 6% to 10% per year by 2015.

The other Chinese NOCs have also invested in overseas shale gas and tight gas formations to improve their technical capacities for developing these resources domestically and to secure gas supplies. As China rapidly expands its imports of liquefied natural gas (LNG), the NOCs are seeking supply contracts by purchasing stakes in the upstream developments and liquefaction terminals in the Asia-Pacific region, Canada, and the United States.

By the end of 2012, Chinese NOCs had secured bilateral oil-for-loan deals with several countries, amounting to around $108 billion according to FGE. China provided loans to countries that need capital to extract energy reserves and build energy infrastructure in exchange for oil and gas imports at established prices. China extended oil-for-loan deals with Russia, Kazakhstan, Venezuela, Brazil, Ecuador, Bolivia, Angola, and Ghana and has had a gas-for-loan agreement with Turkmenistan over the past decade. Venezuela and China signed several deals (including the most recent one in 2013) for about $40 billion in exchange for 600,000 bbl/d of crude oil and products. Based on China's trade data, Venezuela falls short of this amount, but the country's crude oil exports to China have ramped up markedly over the past four years, and were more than 300,000 bbl/d in 2012.

China also extended another $2 billion to Ecuador in early 2013 and is now Ecuador's primary oil buyer. CNPC and Russia's Rosneft signed an agreement in 2013 for China to lend $270 billion to Russia for an additional 300,000 bbl/d of oil through the ESPO pipeline, representing one of China's largest energy deals. The deal involves a JV between CNPC and Russia's Rosneft to develop Russia's East Siberian oil fields where CNPC holds a 49% stake, and it signals the growing energy ties between the neighboring countries and China's interest in gaining more access to Russian oil.

Oil Imports

Substantial oil demand growth and geopolitical uncertainties have increased pressure on China to import greater volumes of oil from a wide range of sources.

As China's oil demand continues to outstrip production at home, oil imports have increased dramatically over the past decade, reaching record highs in 2013. To ensure adequate oil supply and mitigate geopolitical uncertainties, China has diversified its sources of crude oil imports in recent years. China imported 5.4 million bbl/d of crude oil on average in 2012, rising 7% from 5.1 million bbl/d in 2011, according to China's customs data and FGE. In 2013, import growth slowed to about 4.4% from 2012

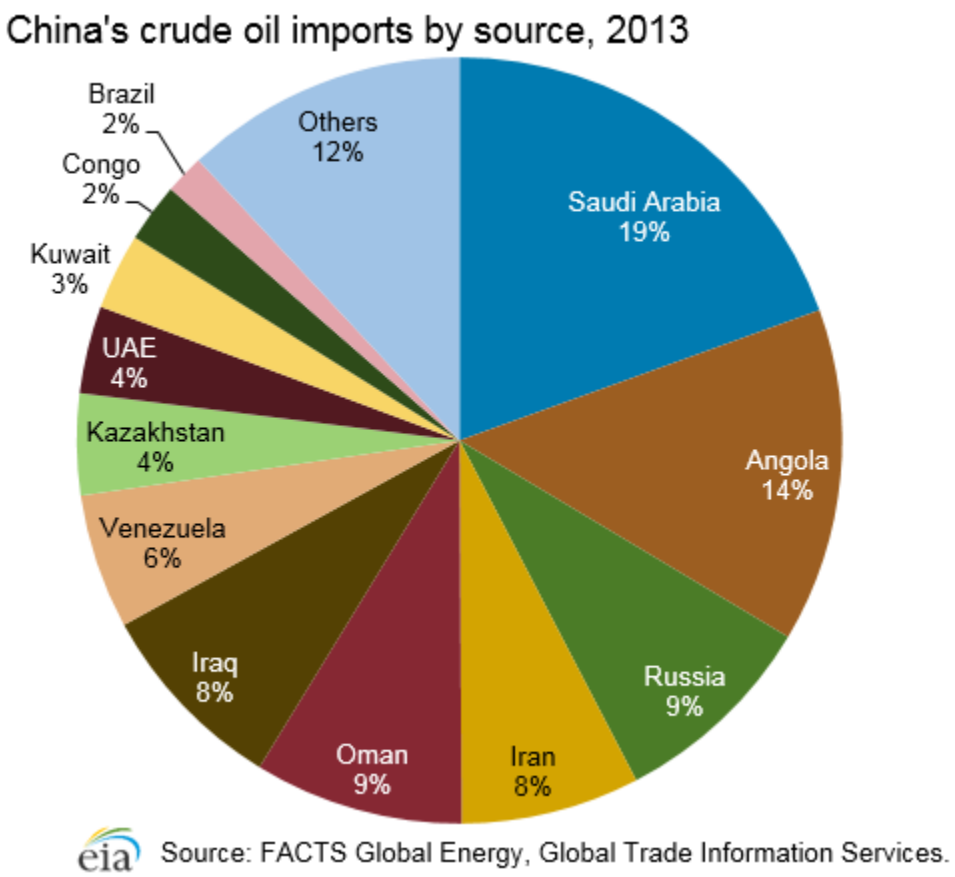
levels, and crude oil imports averaged 5.6 million bbl/d. Crude imports now outweigh domestic supply, and they made up over half of total oil consumption in 2013. The government's current Five-Year plan targets oil imports reaching no more than 61% of its demand by the end of 2015. EIA expects China to import over 66% of its total oil by 2020 and 72% by 2040 as demand is expected to grow faster than domestic crude supply.

The Middle East remains the largest source of China's crude oil imports, although African countries, particularly Angola, began contributing more to China's imports in recent years. As part of China's energy supply security policy, the country's NOCs are attempting to diversify supply sources in various regions through overseas investments and long-term contracts. In 2013, the Middle East supplied 2.9 million bbl/d (52%). Other regions that export to China include Africa with 1.3 million bbl/d (23%), the Americas with 562,000 bbl/d (10%), the Asia-Pacific region with 129,000 bbl/d (2%), and 736,000 bbl/d (13%) from other countries. Saudi Arabia and Angola are China's two largest sources of oil imports, together accounting for 33% of China's total crude oil imports.

Sudan and South Sudan became significant oil exporters to China until production was shut in at the beginning of 2012, following political conflicts between the two African nations over their oil resources. Exports from Sudan and South Sudan to China dropped from 260,000 bbl/d in 2011 to zero by April 2012. As production in the two African countries returned, China resumed a reduced level of imports. The ensuing shut-in of some of Libya's oil production during the latter half of 2013 from political uprisings has also affected oil exports to China.

China reduced imports from Iran, historically the third largest exporter to China, by 20% in 2012 to 439,000 bbl/d from a high of 555,000 bbl/d in 2011, as a result of a contract dispute between Sinopec, China's key oil importer, and Iran's state oil company. Iran fell to the sixth-largest crude oil exporter to China behind Saudi Arabia, Angola, Oman, Russia, and Iraq, and constituted 8% of China's crude oil imports in 2012 and 2013 compared to 11% in 2011. The contract dispute with Iran was settled by mid-2012, but China reduced its average oil import levels from Iran to maintain diplomatic ties with the United States and Europe as a result of global sanctions imposed regarding Iranian crude oil sales over disagreements on Iran's nuclear program. Iran shipped 429,000 bbl/d to China in 2013, according to China's customs data, or 2.3% below the 2012 level. China originally targeted a 5% annual reduction of oil intake from Iran in 2013, but it imported higher amounts of Iranian condensates during the second half of 2013. Negotiations between Iran and six countries, including the United States and China, at the end of 2013 allowed China and other buyers to maintain current import levels. Even if production resumes to pre-disruption levels from these countries, most analysts expect that China will continue to diversify import sources to reduce geopolitical risks and oil supply uncertainties.

China replaced the share of oil lost from Iran, Sudan and South Sudan, and Libya with imports from other Middle Eastern countries, Angola, Venezuela, and Russia. China and Russia have signed deals for Russia to send China close to 1 million bbl/d of crude oil by 2020 through various routes. China has significantly increased imports from Iraq, although future import growth is likely to depend on the pace of infrastructure development and the political situation in Iraq.



Pipeline Connections

China is making headway on improving its domestic oil pipeline network to integrate its oil supply and demand centers and to diversify its oil import sources through pipeline links with Kazakhstan, Russia, and Myanmar.

China has actively sought to improve the integration of the country's domestic oil pipeline network, as well as to establish international oil pipeline connections with neighboring countries to diversify oil import routes. According to CNPC, China had about 14,658 miles of total crude oil pipelines (67% managed by CNPC and the remaining 33% by other NOCs) and 11,795 miles of oil products pipelines in its domestic network at the end of 2012. The bulk of China's oil pipeline infrastructure serves the more industrialized coastal markets and the northeastern region. However, several long-distance pipeline links have been built or are under construction to deliver oil supplies from the northwestern region or from downstream refining centers to more remote markets in the central and southwestern regions.

China inaugurated its first transnational oil pipeline in May 2006, when it began receiving Kazakh and Russian oil from a pipeline originating in Kazakhstan. The 240,000-bbl/d pipeline spans 1,384 miles, connecting Atyrau in western Kazakhstan with Alashankou on the Chinese border in Xinjiang. The pipeline was developed by the Sino-Kazakh Pipeline Company, a joint venture between CNPC and Kazakhstan's KazMunaiGaz (KMG) and brings oil from the oilfields in central Kazakhstan to China. Expansions are underway on the Atasu-to-Alashankou section to nearly double capacity to 400,000 bbl/d in 2014. The two countries are considering a parallel second pipeline to supply crude oil from Kazakhstan's oilfields in the Caspian Sea region including the new Kashagan field.

Russia's new East Siberian oil fields have become another source for Chinese crude oil imports. Russian state-owned oil giant Transneft constructed the Eastern Siberia-Pacific Ocean Pipeline (ESPO), extending 3,000 miles from the Russian city of Taishet to the Pacific Coast in two stages. The first stage of the project included the construction of a 600,000-bbl/d pipeline from Taishet to Skovorodino in Russia. CNPC also built a 597-mile pipeline linking the spur with the Daqing oil field in the Northeast. The pipeline spur to China became operational in January 2011, and delivers up to 300,000 bbl/d of Russian oil to the Chinese border under an original 20-year supply contract between the two countries. The second stage of ESPO came online at the end of 2012 and delivers oil to the Russian Pacific port of Kozmino. This port provides Russia the option to send more crude oil to China via a sea route. Russia anticipates expanding the ESPO transmission capacity to Skovorodino to 1.6 million bbl/d by 2018 and augmenting contracted supply to China through this route. In the meantime, Rosneft agreed to send 140,000 bbl/d of western Siberian oil to China through the expanded pipeline from Kazakhstan to western China starting in 2014 until the ESPO spur to China is brought to full capacity. This agreement allows Russia a western outlet for sending its contracted oil to China.

China also revived its plans to construct an oil import pipeline from Myanmar through an agreement signed in March 2009. Myanmar is not a significant oil producer, so the pipeline is envisioned as an alternative transport route for crude oil from the Middle East that would bypass the potential choke point of the Strait of Malacca, which approximately 80% of China's oil imports traverse based on crude oil import sources and routes. CNPC plans to direct crude oil from the pipeline to serve the proposed 200,000 bbl/d-Yunnan/Anning refinery. Maximum capacity for the pipeline is slated to be 440,000 bbl/d when it comes online in 2014.

Refining

As part of its goal to diversify crude oil import sources and meet oil product demand, China has steadily augmented its refining capacity, which climbed to over 13 million bbl/d in 2013.

China is steadily expanding its oil refining capacity to meet its strong demand growth and to process a wider range of crude oil types. The country now ranks behind the United States and the European Union in amount of refining capacity. China's installed crude refining capacity was an estimated 13 million bbl/d by the end of 2013, around 890,000 bbl/d higher than in 2012, according to FGE. These new refineries and expansions are expected to ramp up refinery runs in 2014 as crude oil supply becomes available and product demand rises in certain regions. Some of the new refineries are designed to accept all grades of crude oil, making Chinese refineries a strong regional competitor. The country not only plans to meet its swiftly growing domestic demand but also to export products within the region. Various sources estimate that China will add another 500,000 bbl/d of net capacity in 2014. FGE anticipates China adding 4.4 million bbl/d of net capacity between 2013 and 2020, pushing total capacity to over 17 million bbl/d.

Utilization rates have decreased to about 75% in the past year as Chinese companies continue to build refining capacity against a backdrop of slower oil demand growth in China and around the world. Some new refineries have encountered delays in startups over the past two years, as the refining sector deals with the current overcapacity.

Recent heavy pollution in certain areas of China prompted the NDRC to adopt stricter petroleum product specifications that are intended to lower sulfur emissions from gasoline and diesel use. The agency requires refineries to implement the equivalent of Euro IV standards for transportation fuels nationwide by the end of 2014 and Euro V standards by the end of 2017. Shanghai and Beijing are already supplying only fuels that meet Euro V standards. Sinopec and CNPC are investing in refinery upgrades to meet these emissions standards, but the small independent refineries are facing economic challenges of additional cost. Also, in 2013, the Ministry of Environment put a temporary ban on the approval of new refineries and expansion of current refineries in reaction to the NOCs missing emissions targets in 2011 and 2012. This ban could postpone some of the refineries proposed after 2015.

China's Notable Refinery Projects and Expansions

Company Owner	Location	Capacity (bbl/d)	Start Date	Notes
Sinopec	Yangzi	160,000	2014 Q2	Construction; Net refining addition of 90,000 bbl/d after removing 70,000 bbl/d from service
Sinopec	Caofeidian/Tianjin	240,000	2015	Construction; Plans to process crude oil from Saudi Arabia
Sinopec	Guangdong/Zhanjiang	300,000	2015 Q4	Construction; Developing with Kuwait Petroleum (30%) and TOTAL (20%)
Sinopec	Zhenhai/Zhejiang	350,000	2016	Expansion; Construction
Sinopec	Hainan	100,000	2015	Environmental approval received February 2013
Sinopec	Luoyang	160,000	2016	Expansion
CNPC	Pengzhou	200,000	2013 Q4	Trial operations
CNPC	Urumqi	120,000	2014 Q1	Construction; Doubles the existing capacity to 240,000 bbl/d
CNPC	Huabei	100,000	2015	Expansion; Construction
CNPC	Anning/Yunnan	200,000	2016	Construction; Plans to process oil from Saudi Arabia and Kuwait via the crude oil pipeline from Myanmar; JV with Saudi Aramco (39%) and local company (10%)
CNPC	Guangdong/Jieyang	400,000	2017	Construction; JV with PDVSA (40%)
CNPC	Karamay	100,000	2017	Expansion; Processes bitumen
CNPC	Chongqing	200,000	2017	Receive oil from China-Myanmar pipeline
CNPC	Jiangsu/ Taizhou	400,000	2017	NDRC approval; Environmental approval pending; JV with Qatar and Shell
CNPC	Lanzhou Lianhua	200,000	2017	N/A
CNPC	Tianjin	320,000	2020	Planning; FID expected in 2017; JV with Rosneft (49%)
CNPC	Shangqiu/Henan	200,000	2020	N/A
CNOOC	Ningbo Daxie/Zhejiang	140,000	2014 Q4	Construction
CNOOC	Huizhou	200,000	2015 Q4	Expansion; Construction
Sinochem	Quanzhou	241,000	2013 Q4	Trial operations
Sinochem	Ningbo	240,000	2020	Pending approval

Sources: U.S. Energy Information Administration based on FACTS Global Energy, PFC Energy, Reuters, Company information.

The oil refining sector has undergone modernization and consolidation in recent years, shutting down dozens of smaller, independent refineries (commonly known as teapots). These smaller refineries account for roughly 20% of total refinery capacity. The NDRC issued guidelines in 2011 to eliminate refineries smaller than 40,000 bbl/d by the end of 2013 in an effort to encourage economies of scale and energy efficiency measures. Several of these local refineries, mostly located in the eastern Shandong province, plan to expand their capacity or consolidate with larger firms to avoid closing. FGE estimates these independent refineries will add about 240,000 bbl/d in the last quarter of 2013.

Domestic price regulations for petroleum products resulted in revenue losses for Chinese refiners, particularly small ones, in the past few years when international oil prices were high. This price differential squeezed refineries' profit margins, leading to reduced processing rates at some independent refineries. The oil price reforms recently implemented by the NDRC have reduced some of these revenue losses and allowed refiners to be more responsive to domestic demand and global markets.

Although China remains an overall net oil product importer, the country became a net diesel fuel exporter in mid-2012 mostly to other Asian countries as the pace of growth in domestic oil product demand moderated. According to FGE, diesel is a key driver of China's oil products demand and consisted of 35% of total oil products demand in 2012. The NDRC issues export quotas on oil products to NOCs to ensure that domestic demand for major oil products is met, with the possibility to extend the quotas if supply exceeds demand, as happened at the end of 2013. In 2012, China imported approximately 1 million bbl/d and exported 575,000 bbl/d of petroleum products. As refining capacity expands beyond 2013, exports of products, particularly gasoline and diesel, are likely to grow.

NOC participation

Sinopec and CNPC are the two dominant players in China's oil refining sector, respectively accounting for 41% and 30% of the capacity in 2013, according to FGE. Sinopec, which operated nearly 5.5 million bbl/d of total oil processing capacity in China by 2013 and holds a significant refining presence in the coastal and southern areas of China, is the second-largest oil refiner in the world. Sinopec relies heavily on imported crude oil for its refineries, and most of the NOC's refineries are configured to handle crude oil higher in sulfur and acidity.

The other NOCs are now building refineries and pipelines to compete with Sinopec's strong presence in China's downstream markets. CNPC is expanding its downstream presence in southern China, and started trial operations of its 200,000-bbl/d Pengzhou refinery in Sichuan Province at the end of 2013. CNOOC entered the downstream sector through the commissioning of the company's first refinery, the 240,000-bbl/d Huizhou plant, in 2009. The NOC anticipates expanding this refinery by 200,000 bbl/d in 2015. Sinochem commissioned its first major refinery, Quanzhou, at the end of 2013.

National oil companies from Kuwait, Saudi Arabia, Russia, Qatar, and Venezuela have also entered into joint ventures with Chinese companies to build integrated refinery and petrochemical projects and gain a foothold into China's downstream oil sector.

Chinese companies have ventured into overseas refining opportunities. In addition to its strong domestic presence, Sinopec is gradually investing in refining assets overseas, and the company purchased a 37.5% stake in Saudi Arabia's 400,000-bbl/d Yanbu refinery, set to beginning processing heavy crude oils by the end of 2014. Sinopec recently entered into JV partnerships for two large refineries, Mthomobo in South Africa and Premium 1 in Brazil. CNPC branched out to acquire refinery stakes in other countries to move downstream and secure more global trading and arbitrage opportunities. The company's purchases of refinery shares in Singapore and Japan a few years ago are cases where CNPC was looking for a share in the region's refining opportunities. Also, CNPC has invested in refineries and pipelines in African countries in exchange for exploration and production rights.

Strategic Petroleum Reserves and Crude Oil Storage

China's plan to construct crude oil storage through both state-owned strategic petroleum reserves and commercial crude oil reserves is part of its need to secure energy in light of its growing reliance on oil imports. The government intends to build strategic crude oil storage capacity of at least 500 million barrels by 2020.

As part of China's need for energy security and its growing reliance on oil imports, the country is in the process of developing significant storage capacity to buffer geopolitical issues involving global oil supply. In China's 10th Five-Year Plan (2000-2005), Chinese officials decided to establish a government-administered strategic oil reserve program (SPR) to help shield the country from potential oil supply disruptions. The plan calls for China to construct facilities that can hold 500 million barrels of crude oil by 2020 in three phases. Currently, China's has over 160 million barrels of total storage capacity for the SPR, and several sites are under construction. Phase 1, completed in 2009, has a total storage capacity of 103 million barrels at four sites. Phase 2 is expected to add at least 169 million barrels to the SPR by 2015. The IEA reports that three Phase 2 sites, which add 58 million barrels to the capacity, are completed, . Three Phase 2 sites are located inland in western and central China, while the others are scattered along the eastern and southern coasts, allowing China to fill the facilities from various sources.

In addition to the strategic reserves of crude oil, China has between 250 and 400 million barrels of commercial crude oil storage capacity, which are operated almost exclusively by the major Chinese NOCs, according to various industry sources. The distinction between future strategic and commercial storage reserve capacity is not clearly defined, and there could be crossover between some of the facilities. Also, the government has discussed plans to create a strategic oil storage capacity for refined oil products, although details of this proposal are not yet known.

Stockpiling rates for strategic and commercial storage in China depend on factors such as supply security, crude oil prices, domestic demand, and domestic policy goals. The Chinese government reported the average Brent crude price was $58/barrel for purchasing oil in Phase 1. However, prices in the past few years have averaged over $100/barrel, making purchases for storage more expensive. While China's official stocks are not disclosed, commercial stocks have fluctuated over the past three years. Another driving factor for additional stock build in the next several years is China's goal to hold at least 90 days' worth of net oil imports by 2020.

Natural Gas

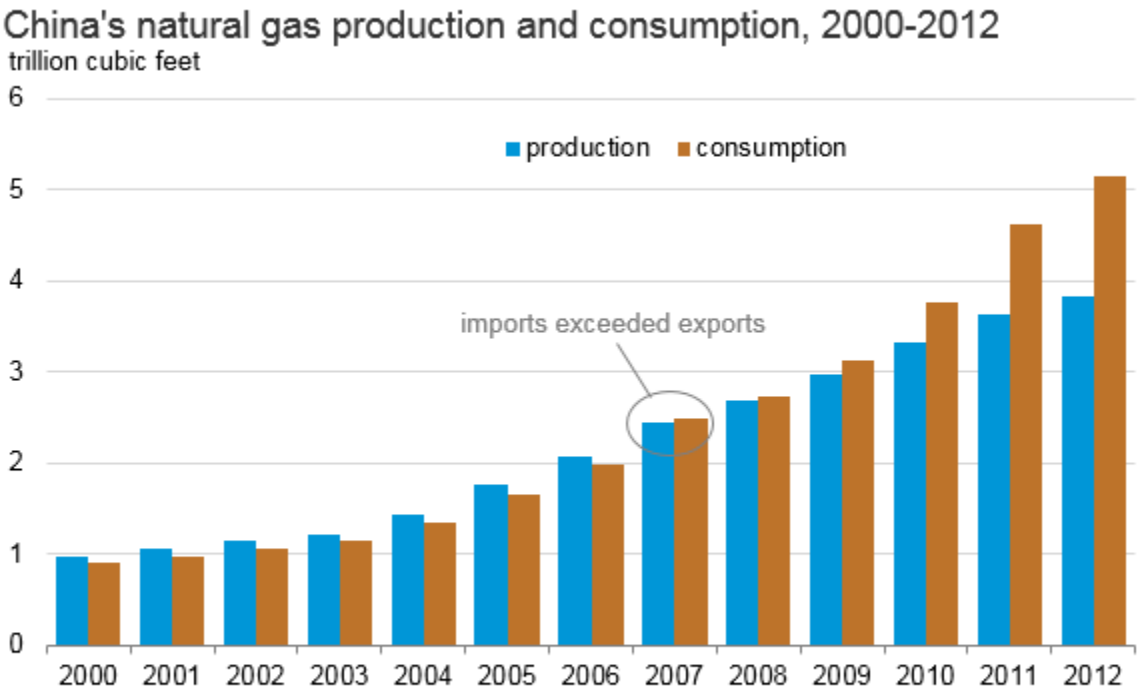
Although natural gas production and use is rapidly increasing in China, the fuel comprised only 4% of the country's total primary energy consumption in 2011. Heavy investments in upstream development and greater import opportunities are likely to underpin significant growth in China's natural gas sector.

According to *OGJ*, China held 155 trillion cubic feet (Tcf) of proven natural gas reserves as of January 2014, 14 Tcf higher than reserves estimated in 2013 and the largest in the Asia-Pacific region. China's natural gas production and demand have risen substantially in the past decade. China more than tripled natural gas production to 3.8 Tcf between 2002 and 2012. The government is planning to produce about 5.5 Tcf of natural gas by the end of 2015 in line with its desire to use more natural gas to replace other hydrocarbons in the country's energy portfolio. EIA projects long-term natural gas production to climb to 4.2 Tcf by 2020 and more than double from current levels to reach 10.1 Tcf by 2040.

The Chinese government anticipates boosting the share of natural gas as part of total energy consumption to around 8% by the end of 2015 and 10% by 2020 to alleviate high pollution resulting from the country's heavy coal use. Consumption in 2012 rose to nearly 5.2 Tcf, 11% greater than the 4.6 Tcf in 2011, and the country imported nearly 1.5 Tcf of liquefied natural gas (LNG) and pipeline gas to fill the

gap. Although the majority of gas consumption stems from industrial users, (48% in 2011, according to PFC Energy) the shares of gas consumption in the power, residential, and transportation sectors have been rising over the past decade. EIA projects gas demand to rise to 7.8 Tcf in 2020 and to more than triple to about 17 Tcf by 2040, growing by an annual average rate above 4%. To meet this demand, China is expected to continue importing natural gas in the form of LNG and from a number of new and proposed import pipelines from neighboring countries. It will also have to tap into its expanding domestic reserves and establish a wider domestic natural gas network and storage capacity.

China was traditionally a net gas exporter until 2007, when it became a net natural gas importer for the first time. Since then, gas imports have increased dramatically in tandem with rapidly developing pipeline and gas processing infrastructure. Natural gas imports, which met 29% of demand in 2012, have become an increasingly significant part of China's gas supply portfolio.



eia Source: U.S. Energy Information Administration, *International Energy Statistics*.

Sector Organization

The NOCs lead the natural gas development of China. Similar to oil E&P, these companies partner with international companies to develop projects requiring more technical expertise. The shifting landscape of China's natural gas supply sources towards greater imports and the need to bolster investment were the factors leading the government to implement the recent price reforms and align domestic natural gas prices more closely to market-based rates.

As with oil, the natural gas sector is dominated by the three principal state-owned oil and gas companies: CNPC, Sinopec, and CNOOC. CNPC is the country's largest natural gas company in both the upstream and downstream sectors. CNPC data show that the company accounts for roughly 73% of China's total natural gas production. Sinopec operates the Puguang natural gas field in Sichuan Province, one of China's most promising upstream assets. CNOOC led the development of China's first three LNG import

terminals at Shenzhen, Fujian, and Shanghai and manages much of the country's offshore production. CNOOC typically uses PSC agreements with foreign companies wanting to codevelop upstream offshore projects and has the right to acquire up to a 51% working interest in all offshore discoveries once the IOC recovers its development costs.

Pricing

China's natural gas prices, similar to retail oil prices, are regulated and generally below international market rates. China has typically favored manufacturing and fertilizer gas users by regulating the price these sectors pay, whereas residential and transportation sectors pay higher, unregulated prices. China's nascent natural gas market has flourished in the past few years and become more complex as relatively expensive gas imports compete with domestic production. In order to bolster investment in the natural gas sector, create more transparency in the pricing system and responsiveness to market fluctuations, and make domestic natural gas competitive with other fuels and imported gas, the NDRC implemented a new system linking gas prices more closely to higher international oil prices. Also, China opened its first natural gas spot trading market at the Shanghai Petroleum Exchange in July 2012 as part of its gas price liberalization.

The NDRC historically has made few adjustments to China's natural gas prices. In 2010, the NDRC raised the onshore wellhead gas prices by 25%, and some Chinese cities raised end-user prices in the industrial and power sectors. China launched a pilot program for natural gas price reform in the southern provinces of Guangdong and Guangxi at the end of 2011. The new system links the natural gas prices at the city gate (delivery point from a gas transmission line to a local distribution utility) to the price of imported fuel oil and liquefied petroleum gas. The linked natural gas price is discounted to some degree to encourage natural gas consumption.

In July 2013, the NDRC expanded the reform to the rest of the country and made an average upward price adjustment of 15% for all consumers apart from the residential sector. The new pricing scheme covers natural gas from imported pipeline gas and most domestic onshore sources. Prices from shale gas, coalbed methane, coal-to-gas, offshore domestic natural gas, and LNG are usually negotiated between the producer and the wholesale buyer. The price reform applies to incremental natural gas demand beyond 2012 levels. Although incremental demand represented approximately 9% of total gas demand in 2013 as calculated by the NDRC, this share is expected to increase over the next few years.

Exploration and Production

China contains several natural gas-producing regions, including the western and central parts of the country as well as offshore basins. While eager to develop older natural gas fields, China's oil companies are exploring more frontier plays such as deep water, shale gas, and gas derived from coal seams. The country's first deep water field is expected online by 2014.

China's primary onshore natural gas-producing regions are Sichuan Province in the Southwest (Sichuan Basin); the Xinjiang and Qinghai Provinces in the Northwest (Tarim, Junggar, and Qaidam Basins); and Shanxi Province in the North (Ordos Basin). China has delved into several offshore natural gas fields located in the Bohai Basin and the Panyu complex of the Pearl River Mouth Basin (South China Sea) and also is exploring more technically challenging areas such as deep water, coalbed methane, and shale gas reserves with foreign companies.

Southwest

The Sichuan Basin is China's key natural gas-producing area in the southwestern region. The largest recent discoveries in the southwestern region are Sinopec's finds at the Yuanba and Puguang fields in Sichuan Province. Sinopec started commercial production at Puguang in 2010 and ramped up to its peak capacity of 350 Bcf in 2012. Sinopec anticipates the field will produce at this level for about two decades. The NOC anticipates Yuanba will produce 120 Bcf/y by 2016.

Sichuan Province also holds five high-sulfur content (sour) gas fields in the Chuandongbei basin. In 2007, CNPC awarded a 30-year PSC to Chevron to bring the technically challenging fields online. Field development has encountered several delays, and initial production has been pushed back to the second half of 2014. Chevron is building two sour natural gas processing plants with a combined production capacity of 270 Bcf/y.

Northwest

Xinjiang historically is one of China's largest and most prolific gas-producing regions, with output of 827 Bcf in 2012. The Tarim Basin in Xinjiang was the second-largest gas-producing area in China in 2012, supplying 680 Bcf/y, or 18% of China's total production. According to CNPC, the Tarim Basin's major fields Kela-2 and Dina-2 have proven gas reserves of 16.2 Tcf, although much of the basin is still underexplored. The basin's complex geological features make development costs relatively high. CNPC's two cross-country West-East Gas Pipelines, connecting Xinjiang to Shanghai, Beijing, and Guangdong, have greatly expanded the upstream potential of the Tarim Basin to supply markets in eastern China. Other new discoveries in the Northwest that have high gas supply potential are the Junggar Basin in Xinjiang Province and the Qaidam Basin in Qinghai Province.

Northeast

The Changqing oil and gas area in the Ordos basin is China's largest gas-producing area and houses the Sulige gas field, containing over 35 Tcf of proven gas reserves. Development of this region is both geologically and technically challenging, and most of the reserves are tight gas (characterized by low permeability and low pressure and usually requiring hydraulic fracturing for commercial production). Partnering with IOCs Total and Shell Oil, CNPC is effectively using advanced drilling techniques and recovery methods to retrieve natural gas from projects in the South Sulige and Changbei fields. Changqing's production rose steadily this decade to 1,022 Bcf in 2012, and constituted 27% of China's total gas output. CNPC anticipates lifting production to 1,236 Bcf/y at Changqing by 2015. Sinopec's Danuidi field, also located in the Ordos basin, has achieved high growth rates in recent years and produced 130 Bcf in 2012.

The Songliao basin holds the Daqing oil and gas field, which produced 119 Bcf in 2012. Also, China began the process of re-injecting carbon dioxide to enhance recovery rates for the mature fields in this area. The Jilin oil field recently began using CO_2 injection produced from the associated Changling gas field for enhanced recovery.

Offshore

Offshore zones have also received increasing attention for upstream natural gas developments in China, and CNOOC is the primary stakeholder of exploration rights. The NOC produced about 200 Bcf in 2011 in the shallow waters of the South China Sea (SCS). The western South China Sea accounted for about 57% of CNOOC's domestic gas production, although the NOC sees great potential for development in the eastern South China Sea. The western South China Sea is home to the Yacheng 13-1 field, China's largest offshore natural gas field and a primary source of energy for Hong Kong's power stations. The Yacheng 13-1 field produces about 125 Bcf/y of natural gas but has declined since 2007. Other fields have entered operations since 2005 and offset some declines from Yacheng. CNOOC's long-term development plans include exploration of deep water fields in the Pearl River Mouth and Qiongdongnan Basins.

The eastern SCS is under intense exploration for gas finds. The NOC partnered with Husky Energy to develop China's first large-scale deep water gas project at Liwan, which is scheduled to begin production by 2014. CNOOC expects the Liwan gas project, which includes three fields and 4 to 6 Tcf of reserves, to produce up to 180 Bcf/y and to be one of the company's largest new sources of incremental gas production in the next few years. As development continues, other deep water fields such as Panyu 34-1 will feed into the main processing platform at Liwan. Other IOCs, namely Chevron, BG, BP, Anadarko, and Eni, signed PSCs for other deep water hydrocarbon blocks in the SCS.

Coalbed Methane, Coal-to-Gas, and Shale Gas

The coalbed methane (CBM), coal-to-gas (CTG) or synthetic natural gas (SNG), and shale gas industries in China are in early stages of development because of technical and water resource challenges, regulatory hurdles, transportation constraints, and competition with other fuels and conventional natural gas. However, China's potential wealth of these resources has spurred the government to seek foreign investors with technical expertise to exploit them.

Most of China's CBM volumes are from basins in the North and Northeast, the Sichuan basin in the Southwest, and the Junggar and Tarim basins in the West. FGE reported that CBM production in 2012 was 441 Bcf from both surface wells and coal mines, and China targets about 700 Bcf of output by the end of 2015, according to the IEA. China also intends to increase the utilization rates from less than 40% to over 60% by the end of 2015, reducing the significant production waste. Although CBM production is increasing, company developers face regulatory hurdles, technical challenges, a lack of pipeline infrastructure from coal mining areas to gas markets, and high development costs. At times, there are conflicting interests between governing bodies when dealing with mineral and land rights. The local governments hold rights to coal mines, whereas the central government has rights to natural gas and CBM. China's State Council issued a policy guideline in September 2013 encouraging investment in CBM exploration and development and more pipeline infrastructure through financial incentives and tax breaks to producers and reform of local price controls.

China's first commercial CBM pipeline became operational in late 2009, linking the Qinshui Basin with the West-East pipeline. Two additional long-distance pipelines have become operational, and several more are under construction. China also uses many small liquefaction plants and trucks to transport CBM to demand centers.

China is rapidly approving CTG projects as China encounters higher natural gas demand alongside supply shortfalls and as coal remains an abundant resource,. China is set to produce gas from its first CTG plant at the beginning of 2014. The Datang plant located in the northern province of Inner Mongolia is one of four CTG projects coming online to supply Beijing with more natural gas by 2015. These plants are slated to fulfill China's targeted CTG production of 530 Bcf by the end of 2015. Sinopec recently began construction of China's largest CTG project that will be located in the northwestern Xinjiang province and has a design capacity of 1,058 Bcf/y. The plant is scheduled to come online in 2017 and connect with pipelines carrying the natural gas towards eastern China. So far, the NDRC has approved 12 large-scale CTG projects with a total capacity of 2,800 Bcf/y that is scheduled to come online by 2017. Many more facilities are in the planning phases, but CTG projects face high capital costs required to develop the attendant infrastructure, require scarce water resources, and produce high levels of emissions. These factors could affect the potential construction of many of these projects.

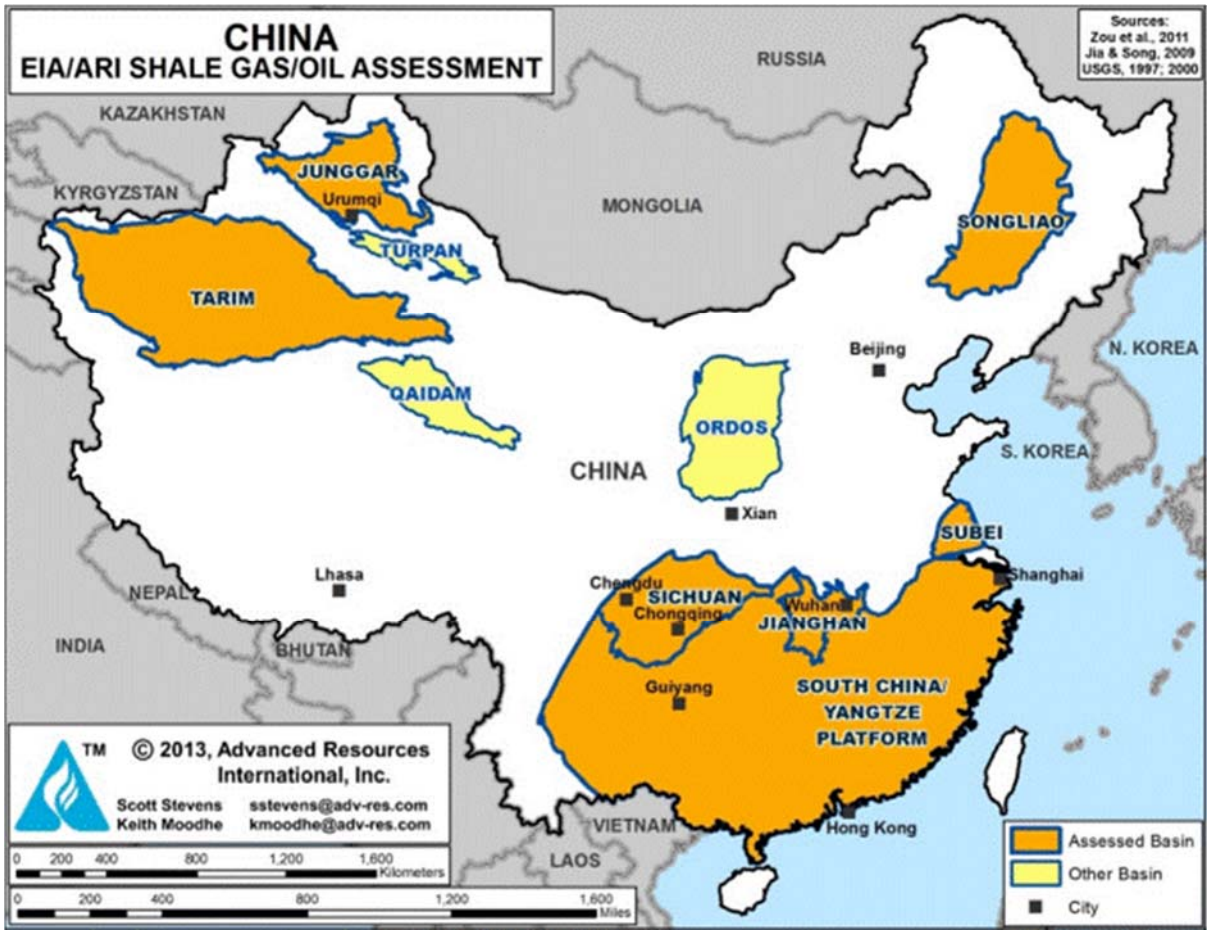
Most of China's proven shale gas resources reside in the Sichuan and Tarim basins in the southern and western regions and in the northern and northeastern basins. EIA estimates from its most recent report on shale oil and gas resources that China's technically recoverable shale gas reserves are 1,115 Tcf, the largest shale gas reserves in the world. Resource estimates of other sources are lower, and China's Ministry of Land and Resources (MLR) reported total shale gas technical reserves were 883 Tcf in 2012. Shale gas production in 2012 was only 1.8 Bcf from test drilling in the Sichuan basin, falling far short of the Ministry of Land Resources' goal to produce 230 Bcf of shale gas by the end of 2015 and at least 2,100 Bcf by 2020. CNPC and Sinopec own almost 80% of China's shale gas resources, according to FGE, and together targeted shale gas production at around 95 Bcf in 2015. However, Sinopec's recent success in developing its Fuling gas field resulted in the company to doubling its shale gas output goal, making the government's overall shale gas targets more feasible.

China's NOCs are in discussion with several IOCs for partnering on potential shale gas projects in order to gain necessary technical skills and investment for developing these geologically challenging resources. CNPC and Shell signed the first PSC for the Fushun-Yonghchuan block of shale gas in the Sichuan Basin in March 2012. Shell also has partnered with Sinopec and CNOOC on two other shale gas plays. After investing $950 million between 2011 and 2013 on shale gas exploration in China, Shell plans to spend another $1 billion each year for the next five years to develop these resources. Sinopec is working with

Chevron and ConocoPhillips to explore shale gas resources in the Qiannan and Sichuan basins, respectively. On the reverse side, Chinese NOCs have been actively investing in shale oil and gas plays in North America to gain technical expertise in this arena.

China held its first shale gas licensing round in 2011 for four blocks in the Sichuan Basin and awarded the tenders to two Chinese companies, including Sinopec and Henan Coal. Tendering is available not only to NOCs but also to private and local companies, and foreign investors may participate indirectly if they hold a PSC contract with a participating Chinese firm. The State Council released shale gas from the jurisdiction of the NOCs, allowing the MLR to open a larger second bidding round in mid-2012. The MLR awarded 19 blocks to 16 domestic companies, mostly to coal producers, power companies, and local energy firms. Since these companies have limited shale gas experience and the capital required for such projects, they may partner with China's larger state-owned companies or foreign companies.

China's Shale Oil and Gas Basins



Source: EIA, *Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States, 2013.*

Pipeline Connections

China continues to invest in natural gas pipeline infrastructure to link production areas in the West and North with demand centers along the coast and to accommodate greater imports from Central Asia and Southeast Asia.

China had nearly 32,000 miles of main natural gas pipelines at the end of 2012. China's natural gas pipeline network is fragmented, although NOCs are rapidly investing in the expansion of the transmission

system to connect more supplies to demand centers along the coast and in the southern regions as well as integrating local gas distribution networks. While the major NOCs operate the trunk pipelines, local transmission networks are operated by various local distribution companies throughout China.

CNPC is the key operator of the main gas pipelines, including the West-to-East pipelines, and holds over three-fourths of the gas transmission in China. CNPC moved into the downstream gas sector recently through investments in gas retail projects as well as investments in several pipeline projects to facilitate transportation for its growing gas supply. CNPC developed three parallel pipelines, the Shan-Jing pipelines, linking the major Ordos basin in the North with Beijing and surrounding areas. The third Shan-Jing pipeline began operations in 2011. The NOC fully completed its Zhongwei to Guiyang Gas pipeline, which delivers gas from the West-to-East pipeline network in the north-central part of the country to the gas markets in southwestern China, in 2013. Sinopec is also a major player in the downstream transmission sector, operating pipelines in the Sichuan province.

West-to-East Gas Pipelines

The Chinese government promoted the construction of the West-to-East Gas Pipeline in 2002 to meet natural gas demand in the eastern and southern regions of the country with production from the western provinces and Central Asian countries. CNPC's first West-East Gas Pipeline, commissioned in 2004, is China's longest natural gas pipeline at 2,500 miles. The pipeline links major natural gas supply bases in western China (Tarim, Qaidam, and Ordos Basins) with markets in the eastern part of the country and ends in Shanghai. The initial West-East pipeline has an annual capacity of 420 Bcf/y and contains many regional spurs along the main route, which has improved the interconnectivity of China's natural gas transport network.

CNPC designed the second West-East trunk pipeline to connect with the Central Asian Gas Pipeline at the border with Kazakhstan and completed construction of this line in 2011. The second West-East pipeline has a capacity of 1.1 Tcf/y and spans over 5,200 miles, including the trunkline and eight main branch lines. This pipeline transports natural gas from Central Asia and western China to the key demand centers in the southeastern provinces. The western section of the line, running parallel to the first West-to-East Pipeline to Zhongwei in north-central China, became operational at the end of 2009. The eastern section, which began operating in late 2011, runs from Zhongwei to southern Guangdong province and Shanghai in the East.

To accommodate greater gas flows from Central Asia, CNPC began constructing the third West-East pipeline, set to become operational by 2015. This third pipeline will run partially parallel to the second West-East pipeline and end in the southeastern provinces of Fujian and Guangzhou. CNPC anticipates that the 1.1-Tcf/y pipeline will transport natural gas from Central Asia and domestically produced gas from the Xinjiang Province. Proposals for the fourth and fifth West-East pipelines are still in the planning stages, but China anticipates a capacity of nearly 1.6 Tcf/y for each line.

International Pipelines

Over the past three years, China has ramped up imports of natural gas via pipelines as production from Central Asia and Myanmar increased and as gas infrastructure in the region improved. China's first international natural gas pipeline connection, the Central Asian Gas Pipeline (CAGP), transports natural gas through twin parallel pipelines from Turkmenistan, Uzbekistan, and Kazakhstan to the border in western China. The CAGP's current capacity is 1.1 Tcf/y and spans 1,130 miles. The pipeline's first and second phases (Lines A and B) began operations in 2010 and link to the second West-East pipeline at the Sino-Kazak border.

CNPC has invested in upstream stakes in Turkmenistan to facilitate the gas supply development. The NOC operates the Bagtyyarlyk PSC that currently feeds the CAGP. In 2009, CNPC was awarded a production supply agreement to develop natural gas resources at Turkmenistan's massive Galkynysh gas field and signed a deal with Turkmengaz, the state-owned gas company. China imported over 2 Bcf/d (765 Bcf/y) from Turkmenistan and Uzbekistan in 2012 and expects to increase imports as the pipeline capacities on both sides of the border expand. Turkmenistan and China signed another gas supply

agreement in 2013 to extend supplies from 1.4 Tcf/y to 2.3 Tcf/y by 2020 as the new Galkynysh field ramps up production following its start of operations in September 2013.

The CAGP is undergoing expansion as more supply agreements are signed and as gas production capacity becomes available from Turkmenistan, Uzbekistan, and Kazakhstan. In 2010, CNPC signed an agreement with Uzbekistan to deliver 350 Bcf/y (1 Bcf/d) through a transmission line that connects with the CAGP. Uzbekistan began exporting natural gas to China in mid-2012 and quickly ramped up to around 400 MMcf/d by mid-2013. Kazakhstan and China also signed a joint venture agreement in 2010 to construct a pipeline starting in western Kazakhstan and connecting with the CAGP lines. The pipeline (known as Line C), the third phase of the CAGP, is expected to add another 880 Bcf/y of capacity from the three Central Asian countries to the CAGP and begin operations in 2014. This line corresponds with the commencement of the third West-to-East pipeline on the Chinese side. The second phase of the pipeline from Kazakhstan links the country's western fields to Line C of the CAGP and is scheduled to come online in 2015. CNPC signed another agreement with Uzbekneftegaz (the Uzbek NOC) in September 2013 to build a fourth line of the CAGP (Line D) that would supply natural gas from the second stage of the Galkynysh field development and traverse Turkmenistan, Uzbekistan, Tajikistan, and Kyrgyzstan. This pipeline is anticipated to come online in 2016 and increase the capacity by another 880 Bcf/y.

The China-Myanmar gas pipeline is likely to boost gas imports to China and diversify its supply in the future. CNPC signed a deal with Myanmar in 2008 to finance the construction of a 1,123-mile, 420-Bcf/y pipeline from two of Myanmar's offshore blocks to China's Yunnan and Guangxi provinces in the southwestern region. Initial production from the fields is 182 Bcf/y, with China expected to receive 146 Bcf/y. China began importing gas from Myanmar when the pipeline became operational in September 2013. The pipeline is projected to ramp up to full capacity as adjacent gas fields in Myanmar are developed.

CNPC and Gazprom signed a Memorandum of Understanding in 2006 for gas pipeline imports from Russia to China. However, negotiations have stalled over setting an import price and determining the supply route from western or eastern Russia. In September 2013, CNPC officials signed a framework agreement with Gazprom to purchase 1.3 Tcf/y of gas from the proposed East Siberian pipeline, which is expected to connect Russia's Far East and Sakhalin Island to northeastern China. The countries are still negotiating a price for the gas.

Key Oil and Natural Gas Pipelines in China

Source: PetroChina

Liquefied Natural Gas Imports

Robust growth in natural gas demand in recent years, particularly in the urban coastal areas, has led China to become the third largest LNG importer and to accelerate development of its LNG and pipeline infrastructure.

Since the country built its first regasification terminal, Dapeng LNG, in 2006, natural gas imports have risen dramatically, making China one of the largest LNG consumers in the world. Roughly half of China's total natural gas imports were in the form of LNG in 2012. In 2012, China imported 706 Bcf, a 20% increase from 581 Bcf in 2011. Data estimates for 2013 show LNG imports climbing even higher to 749 Bcf for the first 11 months of the year. China, consuming over 6% of the global LNG trade, quickly became the world's third-highest LNG importer, exceeding Spain for the first time in 2012.

Import regasification capacity was 1.5 Tcf/y (4.1 Bcf/d) by the end of 2013, and another 2 Bcf/d is being constructed by 2016. LNG now enters the country through nine major terminals, with another five under construction and more in various stages of construction and planning. China's LNG imports are expected to increase as more terminal capacity comes online, although higher market-based LNG prices compared to lower prices from domestic gas sources and the increasing pipeline gas supplied by Central Asia could lead to more competition for LNG imports.

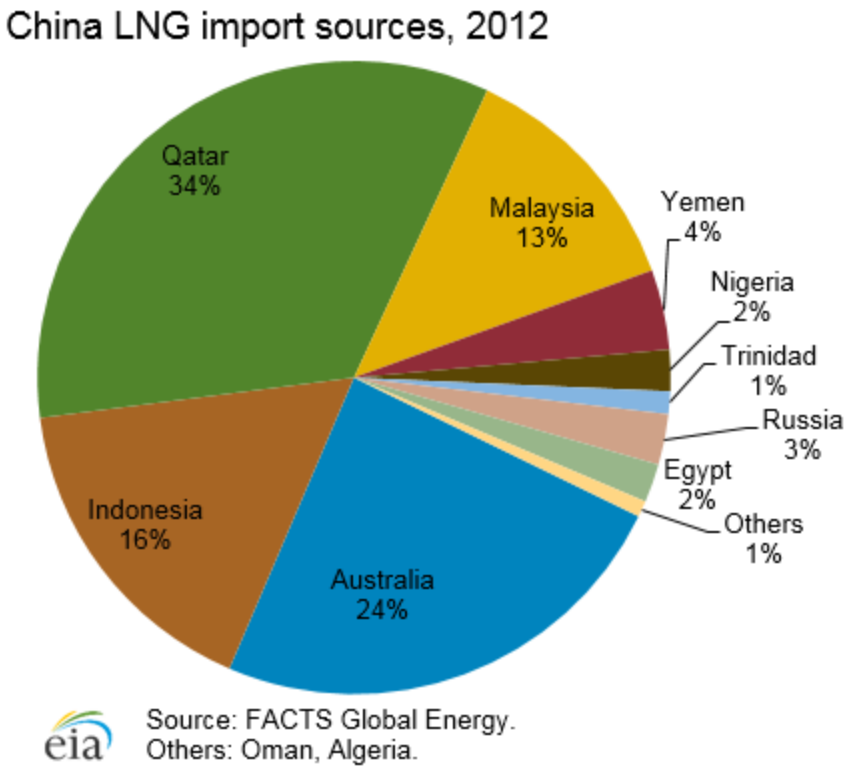
CNOOC is the pioneer of developing LNG regasification terminals and remains a key LNG player in China. The NOC operates six existing plants, including the Ningbo terminal at Zhejiang and the Zhuhai terminal, both of which came online in 2013. The company has held a competitive advantage thus far in China's LNG market compared to the other NOCs and continues to expand aggressively. CNOOC completed construction of China's first floating storage and regasification unit (FSRU) in Tianjin at the end of 2013. Generally, floating terminals are more expensive to build, but they can be developed more quickly than land-based terminals. China's rapidly growing demand and need for seasonal flexibility

makes the floating terminals attractive. CNOOC is constructing two regasification terminals in the southern region -- Hainan and Shenzhen/Diefu -- and intends to expand four of the company's existing terminals. In addition, CNOOC has proposed two other FSRU facilities that are scheduled to come online in 2014.

CNPC recently entered the LNG market and commissioned its first two regasification terminals, Dalian and Jiangsu, in 2011. The company's Tangshan terminal is slated to come online by the end of 2013. Sinopec anticipates entering China's LNG market with the advent of its Qingdao terminal in 2014.

Chinese NOCs must secure supply prior to gaining government approval to build a regasification terminal, and these firms are faced with competition from other regional buyers, mainly those in Korea and Japan. Chinese companies have signed long-term contracts to deliver at least 5.2 Bcf/d through 2030. Most of these contracts are with Asian firms sourcing LNG from Indonesia, Malaysia, Australia, and Papua New Guinea (PNG). Some contracts are tied to new liquefaction projects primarily located in Australia and PNG and slated to come online after 2014. In addition to purchasing supply, Chinese companies are investing in significant equity stakes in Australia's liquefaction projects, particularly ones involving coalbed methane. CNOOC owns a 50% stake in the Queensland Curtis LNG project, and Sinopec owns 25% of Australia Pacific LNG. Both of these terminals are scheduled to begin operations and supply natural gas to China by 2015.

To meet its rapidly growing demand, China is diversifying its LNG imports from other regions such as the Middle East and Africa. Qatar, which ships gas to China under long-term contracts and spot cargoes, supplied LNG to meet more than a third of China's demand and was the largest LNG supplier to China in 2012. Also, some long-term contracts involve gas supply from global LNG portfolios of major international oil companies. China started actively seeking potential LNG opportunities from North American shale gas plays by investing in upstream developments and LNG projects in Canada. CNPC owns a 20% share in the LNG Canada project, and CNOOC, through its wholly-owned Canadian company, Nexen, recently purchased land in western Canada to explore opportunities to develop a liquefaction terminal.



China's higher gas demand and a tighter LNG global supply market over the past few years have led to an increase in LNG import prices. According to PFC Energy, the average LNG import price was $10.43/MMbtu for all terminals in 2012, although import price for terminals that came online in the past two years were much higher. Also, as China has diversified its import sources to include more LNG from the Middle East and Africa, costs have increased. Average prices to import LNG at certain terminals, such as Jiangsu and Dalian, are over $17/MMbtu, which more closely reflects the higher Asian LNG prices, tied to international oil prices.

China's Major LNG Import Terminals – Current and Proposed

Terminal Name	Status/Online Date	Developer	Initial / Expansion Capacity (MMcf/d)	Possible Supplier
Dapeng/Guangdong	Operational; Second Expansion - 2014	CNOOC; BP	885 / 530	Australia NWS
Mengtougou Peaking Facility	Operational	Shanghai Gas Group	15	Spot cargoes
Fujian	Operational	CNOOC; Fujian Investment and Development Co.	345	Indonesia - Tangguh
Shanghai	Operational; Expansion - 2015	CNOOC; Shenergy Group	395 / 395	Malaysia - Petronas
Dalian	Operational; Expansion - 2015	CNPC	395 / 395	QatarGas IV; Australia
Rudong/Jiangsu	Operational; Expansion (Permitting) / 2014	CNPC; RGM International; CITIC	460 / 395	QatarGas IV
Zhejiang/Ningbo	Operational	CNOOC	395	QatarGas III
Zhuhai	Operational; Expansion / 2017	CNOOC; Yudian Group	460 / 460	Not determined
Tianjin FSRU	Operational; Onshore terminal expansion proposed	CNOOC	290 / 795	Not determined
Caofeidian/Tangshan	Operational	CNPC; Beijing municipal government	460	Australia and Qatar
Qingdao/ Shandong	Construction / 2014; Expansion	Sinopec; Huaneng Group	395 / 265	PNG LNG (ExxonMobil) and APLNG
Hainan	Construction / 2014; Expansion / 2017	CNOOC; Hainan Development	260 / 130	Not determined
Beihai/Guangxi	Construction / 2014; Expansion / 2020	Sinopec	395 / 395	Papua New Guinea LNG and Australia Pacific LNG

Shenzhen/Diefu	Construction / 2015	CNOOC; Shenzhen Energy	530	Not determined
Tianjin	Construction / 2016	Sinopec	395	Australia Pacific LNG
Shantou	Awaiting NDRC approval / 2014 (Phase 1) and 2017 (Phase 2)	SinoGas	160 / 240	Australia
Jiangsu/Yancheng FSRU	Planning; NEA approval received August 2013 / 2014	CNOOC	290	Not determined
Yantai, Shandong FSRU	Planning / 2013	CNOOC	200	Not determined
Shenzhen	NDRC approval; Awaiting siting permit / 2015	CNPC; CLP	400	Australia's Gorgon LNG (ExxonMobil)
Yuedong/Jieyang	Environmental approval; Awaiting NDRC approval / 2014 / Expansion in 2020	CNOOC	260 / 260	Not determined

Sources: FACTS Global Energy, PFC Energy, IHS Global Insight, Reuters, company websites.

Coal

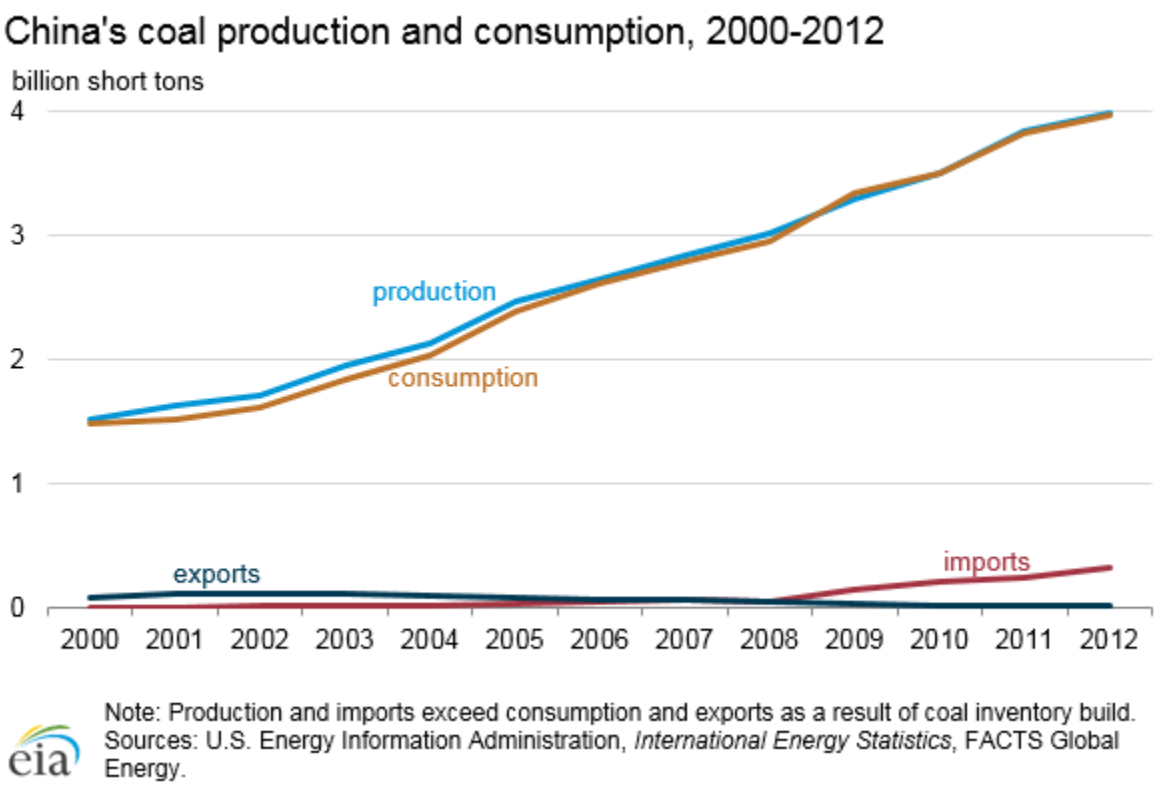
China is the largest producer and consumer of coal in the world and accounts for almost half of the world's coal consumption.

China's vast coal resources enable the fuel to remain the mainstay of the country's energy sector and allow it to be a key driver of massive economic growth over the past decade. China has been the world's leading coal producer and consumer in recent years and accounted for close to half of the global coal consumption, an important factor in world energy-related CO_2 emissions. According to the World Energy Council, China held an estimated 126 billion short tons of recoverable coal reserves in 2011, the third-largest in the world behind the United States and Russia, and equivalent to about 13% of the world's total coal reserves.

Coal production rose 4% from 3.8 billion short tons in 2011 to nearly 4 billion short tons in 2012, the slowest growth in over a decade. Although there are 28 provinces in China that produce coal, Shanxi, Inner Mongolia, Shaanxi, and Xinjiang contain most of China's coal resources and virtually all of the large state-owned mines. China currently has about 12,000 coal mines producing primarily bituminous coal and a fair amount of anthracite and lignite. These elements make up steam coal, used mainly to generate electricity and produce heat in the industrial sector, and coking coal, also known as metallurgical coal, used primarily to smelt iron ore and produce steel. Much of China's steam coal resources are located in the north central and northwestern regions, whereas coking coal reserves are found mostly in central and coastal parts of China.

Coal comprised 69% of China's total energy consumption in 2011. In 2012, China consumed an estimated 4 billion short tons of coal, representing close to half of the world total. Coal consumption in 2012 was more than two times higher than it was in 2000, reversing the relatively flat growth seen from 1996 to 2000. About half of China's coal is used for power generation. The industrial sector including steel, pig iron, cement, and coke currently, accounts for 45% of coal use. Coal consumption generally tracks economic growth, electricity demand, and industrial sector output. EIA projects that as industrial

growth moderates in the long run and the economy becomes less energy-intensive, electricity generation will increase its share of coal consumption to 57% by 2040 from 50% in 2010.



Note: Production and imports exceed consumption and exports as a result of coal inventory build.
Sources: U.S. Energy Information Administration, *International Energy Statistics*, FACTS Global Energy.

Prior to 2009, China's domestic coal production generally met all of its consumption requirements. However, in recent years, the country has ramped up its import volumes because of higher demand. Historically, a net coal exporter, China became a net coal importer in 2009 for the first time in over two decades. Total imports rose to 323 million short tons in 2012, about 30% higher than 2011 levels, according to FGE. Indonesia and Australia are the largest coal exporters to China, supplying more than 60% of China's imports in 2012.

The rise in imports is primarily driven by steady demand growth and the high coal transportation costs resulting from bottlenecks in China's railway capacity, which makes imported coal economically attractive, especially in Southeast China.. As the bulk of the coal production moved westwards, an increasing amount of coal needs to be transported over long distances from the supply regions in the west and the north to the demand centers along the coast and the southern and eastern provinces via rail and truck. In recent years, the country has struggled with transportation bottlenecks in bringing all the coal to market, creating regional imbalances. Also, international coal prices, which are currently low, have been slightly below China's domestic prices since 2011, making imports more commercially competitive with China's own coal supply, particularly along the coastal regions.

As coal demand growth eased in 2012, the country witnessed an oversupply of coal and rising inventories. Despite this surplus, some of China's major coal producers, particularly in key coal-producing provinces in northern and northwestern China that have larger and lower-cost mines, continued to increase domestic production, albeit at a more moderate pace. Producers in these regions are able to reduce their unit costs through higher output and economies of scale. Also, producers are taking advantage of the government's financial incentives and sector reforms to curtail taxes and provincial duties imposed on mines. However, some mines in Inner Mongolia that produce lower-calorific coal and transport most of their coal outside of the region have suspended their output in response to weaker

demand and revenue losses. Mines able to keep their costs low in the current low coal-price environment will be able to maintain higher production levels. China's current Five-Year Plan addresses the regional imbalance of coal supply and demand through investments in greater railway capacity and higher electricity transmission capacity to enable electricity generated from coal to travel long distances to demand centers.

China's coal industry has traditionally been fragmented among large state-owned coal mines, local state-owned coal mines, and thousands of town and village coal mines. The top-ten coal companies produced over a third of the domestic coal in 2011, according to FGE. Shenhua Group, the world's largest coal company, holds over 10% of the domestic market in China.

China has about 10,000 small local coal mines where insufficient investment, outdated equipment, and poor safety practices prevent greater utilization of coal resources. Although the smaller coal mines currently hold a sizeable portion of the market, they are inefficient and are ineffective in responding to market demand. The goal of industry consolidation is to attract greater investment in new coal technologies and improve the safety and environmental record of coal mines. The government's current 12th Five-Year Plan calls for a production ceiling of 4.4 billion short tons and a capacity ceiling of 4.6 billion short tons by the end of 2015 in an attempt to control the production growth. The Five-Year Plan also calls for streamlining the industry by forming 10 large coal companies that will account for about 60% of the country's total coal production and capping the number of coal mines at 4,000 through mergers and acquisitions.

In contrast to the past, China is becoming increasingly open to foreign investment in the coal sector in an effort to modernize existing large-scale mines and introduce new technologies in the coal industry. State-owned enterprises partner with foreign investors in the coal sector. Areas of interest in foreign investment include coal-to-liquids, CBM production, coal-to-gas, and slurry pipeline transportation projects.

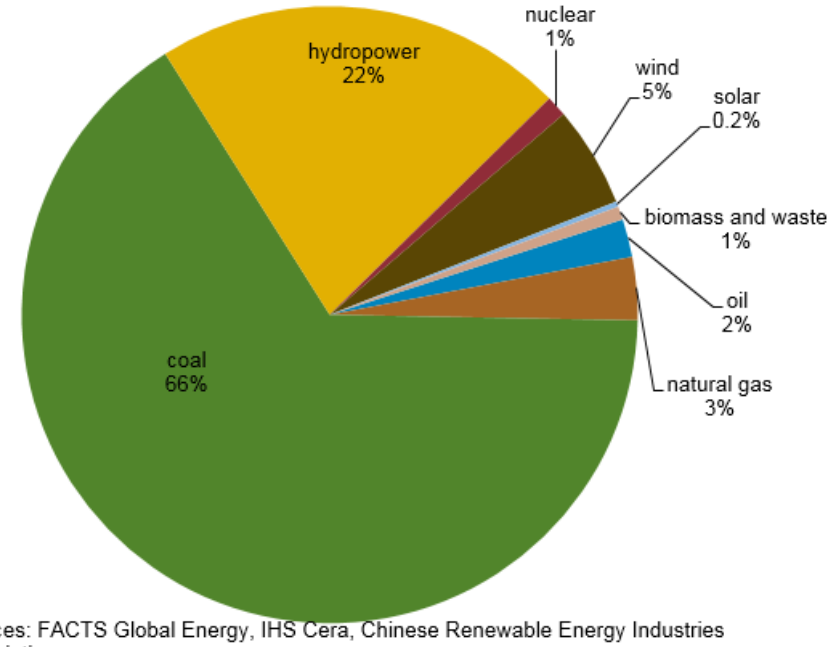
Electricity

China was the world's largest power generator as of 2011. Fossil fuels, particularly coal, continue to be the leading sources of the country's electricity generation and installed capacity.

China is the world's largest power generator, surpassing the United States in 2011. Net power generation was an estimated 4,476 Terawatt-hours (TWh) in 2011, up 15% from 2010, according to EIA. Electricity generation increased by more than 89% since 2005, and EIA projects total net generation will increase to 7,295 TWh by 2020 and 11,595 TWh by 2040, nearly three times the generation level in 2010. The industrial sector currently accounts for three-quarters of China's electricity consumption, according to FGE.

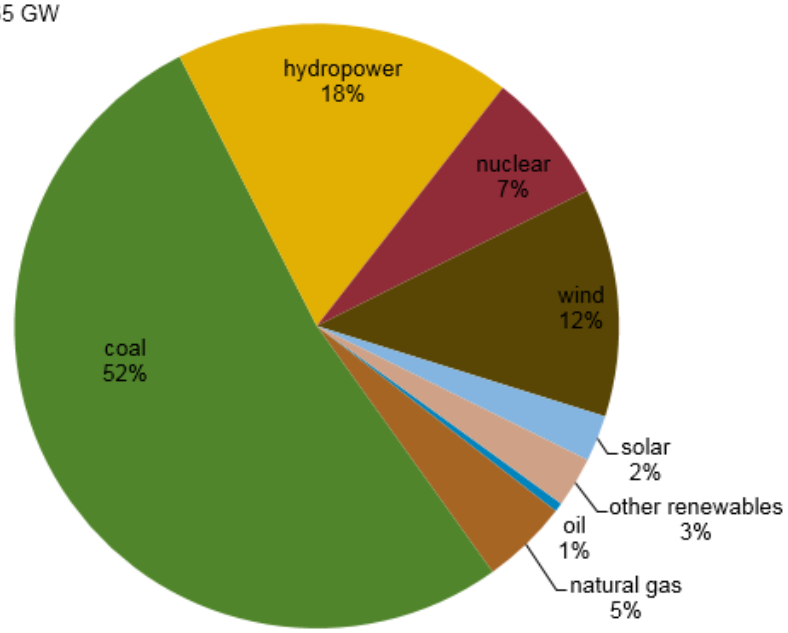
China plans to rely on more electric generation from nuclear, other renewable sources, and natural gas to replace some coal with the goal of reducing carbon emissions and the heavy air pollution in urban areas. China's installed electricity generating capacity was an estimated 1,145 gigawatts (GW) at the beginning of 2013, according to FGE, IHS Cera, and the Chinese Renewable Energy Industries Association. China's capacity rose 8% from a year earlier and more than doubled from 524 GW in 2005. As China's generating capacity has quickly expanded over the past several years in response to its economic development, the country's capacity is now roughly equivalent to that of the United States. Installed capacity is expected to grow over the next decade to meet rising demand, particularly in large urban areas in the eastern and southern regions of the country. EIA projects installed capacity will double to 2,265 GW by 2040, propelled by a combination of coal- and natural gas-fired capacity and renewable sources. Fossil-fired power has historically made up about three-fourths of installed capacity, and coal continued to dominate the electricity mix with 66% of total capacity in 2012.

China's installed electricity capacity by fuel, end 2012
installed capacity: 1,145 GW



Sources: FACTS Global Energy, IHS Cera, Chinese Renewable Energy Industries Association.

China installed electricity capacity by fuel, 2040
installed capacity: 2,265 GW



Source: EIA, *International Energy Outlook*, 2013.

Sector Organization

China's electric generation is controlled by state-owned holding companies, although limited reforms have opened up the electricity sector to some private and foreign investments. China is seeking to improve system efficiency, facilitate investment in the power grids, and alleviate power shortages.

In 2002, the Chinese government dismantled the monopoly State Power Corporation (SPC) into separate generation, transmission, and services units. Since the reform, China's electricity generation sector has been controlled by five state-owned generation companies -- China Huaneng Group, China Datang Group, China Huandian, Guodian Power, and China Power Investment. These five companies generate about half of China's electricity. Much of the remainder is generated by independent power producers (IPPs), often in partnership with privately-listed arms of the state-owned companies. Deregulation and other reforms have opened the electricity sector to foreign investment, although this has been limited so far.

During the 2002 reforms, the SPC divided all of its electricity transmission and distribution assets into two new companies, the Southern Power Grid Company and the State Power Grid Company, which operate the nation's seven power grids. The State Power Grid operates power transmission grids in the north while the Southern Power Company handles those in the south. China also established the State Electricity Regulatory Commission (SERC), responsible for the regulation enforcement of the electricity sector and facilitation of investment and competition in order to alleviate power shortages. As part of the new Chinese leadership's efforts to streamline government agencies, the government eliminated SERC in March 2013 and transferred agency's duties to the NEA. China is seeking to improve system efficiency and the interconnections between the grids through ultra high-voltage lines, as well as to implement a smart grid plan. The first phase was completed in 2012, and subsequent phases are slated for completion by 2020.

Electricity Prices

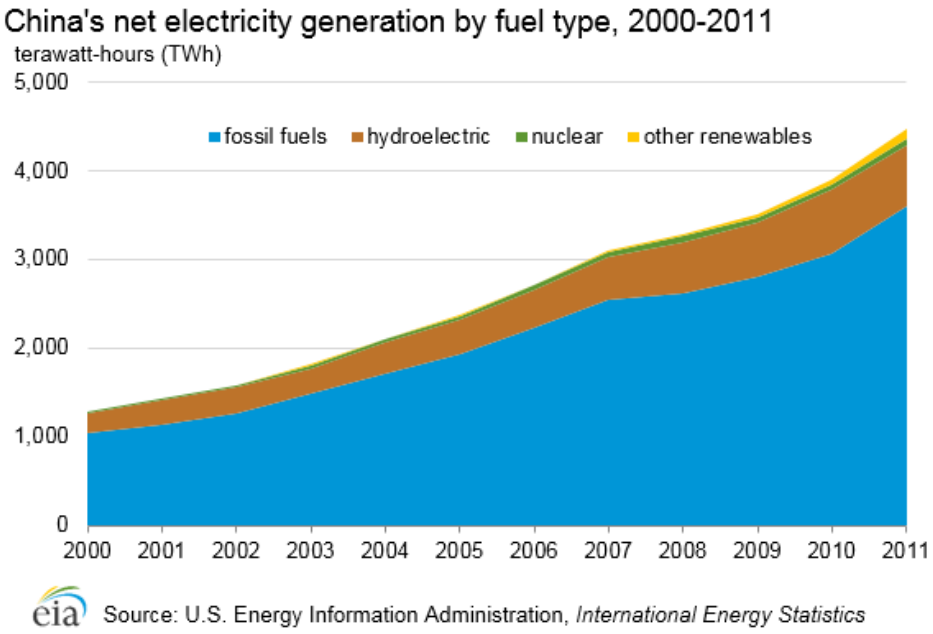
On-grid (electricity sold by generators to the grid) and retail electricity prices are determined and capped by the NDRC. The NDRC also determines the price that coal companies should receive from power producers for a certain level of supplies. High coal prices in 2011 and lower government-controlled power tariffs contributed to financial losses for electric generators. Coal prices declined in 2012, giving power producers some financial reprieve. This prompted the government to lower on-grid tariff rates for coal-fired power plants while raising the rates for natural gas fired plants in certain regions. The cost savings by power generators is designated for funding renewable energy subsidies. Additionally, the NDRC is raising the surcharge on renewable energy use to all end-users apart from the residential and agriculture sectors. These measures are designated to encourage more investment in renewable energy infrastructure and to facilitate a greater shift towards using alternative fuels.

Electricity Generation

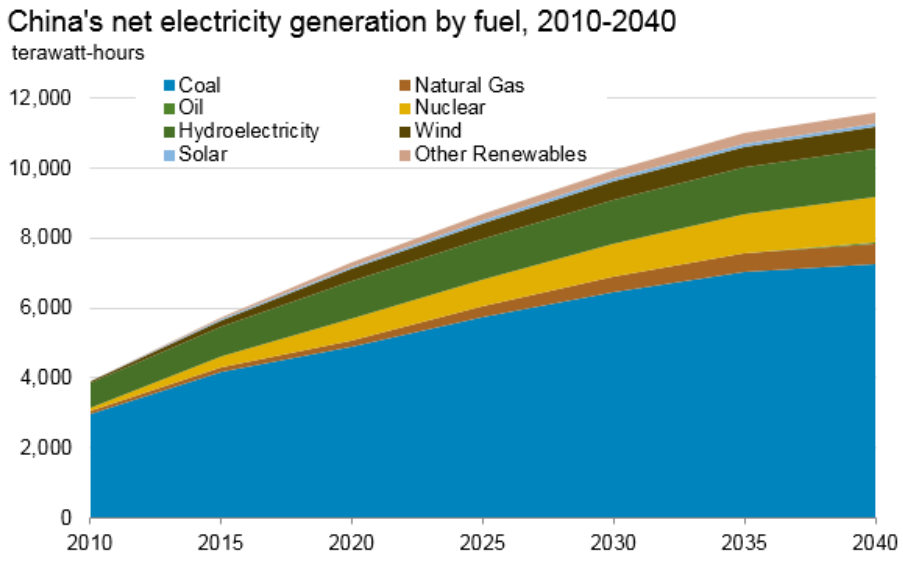
The Chinese government has prioritized the expansion of natural gas-fired and renewable power plants as well as the electricity transmission system to connect more remote power sources to population centers. Also, the Three Gorges Dam hydroelectric facility, the largest hydroelectric project in the world, started operations in 2003 and completed construction in 2012.

Rapid growth in electricity demand this past decade spurred significant investment in new power stations, but China still struggles with insufficient investment, particularly in fossil fuel-fired capacity. Although much of the new investment over the past several years was earmarked to alleviate power supply shortages, the economic crisis of 2008 resulted in a slower demand growth for electricity. Power demand typically follows economic cycles and began to rebound in 2010 as the Chinese economy recovered from the recession. However, FGE and IHS Cera indicate that power demand growth slowed considerably to 5% in 2012 and the first half of 2013 as a result of weaker industrial output. The government is investing

in development of the transmission network, integration of regional networks, and construction of new generating capacity.



eia Source: U.S. Energy Information Administration, *International Energy Statistics*



eia Source: U.S. Energy Information Administration, *International Energy Outlook*, 2013.

Fossil Fuels

Fossil fuels, primarily coal, currently make up about 80% of power generation and over 70% of installed capacity. Coal is expected to remain the dominant fuel in the power sector in the coming years, while natural gas is set to increase and replace some of the coal-fired capacity in the southeastern and coastal regions where power demand is higher. Oil-fired generation is expected to remain extremely small in the next two decades. In 2011, China generated about 3,596 TWh from fossil fuel sources, up 17% from 2010. Installed fossil fuel-fired capacity was 819 GW beginning in 2013, according to FGE.

Because of the large amount of domestic reserves, coal will continue to lead the fuel slate for power generation, even as China diversifies its fuel supply and uses cleaner fuels. As happened with coal mining, the Chinese government shut down 80 GW of small and inefficient plants between 2005 and 2010 and is looking to continue modernizing the coal fleet in favor of larger, more efficient units as well as technologically advanced ultra-supercritical units. Also, China has prohibited companies from building new coal-fired power plants around its three major cities – Beijing, Shanghai, and Guangzhou – as air pollution rates have become a problem in recent years. EIA projects China will bring on over 450 GW of new coal-fired capacity by 2040.

Natural gas currently plays a small role in overall power generation and consists of only 38 GW of installed capacity. However, the government plans to invest heavily in more gas-fired power plants as a growing marginal fuel source. China is able to obtain gas from growing domestic sources as well as growing import alternatives, but coal still remains the less expensive feedstock except in the large southern coastal cities where the fuel competition is higher. There are several examples of China's effort to bring new efficient gas-fired units online, some in conjunction with new LNG terminals such as those in Guangdong and Shanghai. In 2010, Huaneng Power International, China's largest listed electricity generation company, signed strategic agreements with CNOOC to explore opportunities for natural gas-fired power projects in the coastal areas near regasification terminals. Also, Beijing is planning to replace all of its coal-fired facilities, representing about 2.4 GW of capacity, with gas-fired plants by the end of 2014. Overall, China's effort to shift coal-fired generation to more gas-fired generation in the long term depends on the country's ability to increase domestic production through shale gas and offshore reserves and imported sources.

Nuclear

China generated 83 TWh of nuclear power in 2011, making up only 2% of total net generation. Although nuclear generation is a small portion of the country's total power generation portfolio, China is actively promoting nuclear power as a clean, efficient, and reliable source of electricity generation. China's installed nuclear capacity was 14.7 GW after the country added two reactors with 2.2 GW in 2013. China's government plans to boost nuclear capacity to 58 GW by 2020. At the end of 2013, China had 31 reactors with almost 35 GW of additional capacity under construction, almost half of the global nuclear power capacity being built. These plants are slated to become operational by 2017, more than tripling China's current capacity. There are several reactors and expansions, with a total capacity of 25 GW, that received approval from NDRC and are waiting to begin construction, according to FGE.

Following Japan's Fukushima Daiichi nuclear accident in March 2011, China suspended government approvals for new nuclear plants until safety reviews of all facilities were completed and a safety framework was approved by the State Council. New plant approvals and construction resumed in October 2012.

China also intends to build strategic and commercial uranium stockpiles through overseas purchases and continue to develop domestic production in Inner Mongolia and Xinjiang. Also, China is in the process of developing nuclear fuel reprocessing facilities expected to come online by 2017, according to the World Nuclear Association.

Hydroelectricity and Other Renewables

China has a goal to produce at least 15% of overall energy output by 2020 from renewable energy sources as the government aims to address environmental issues. Chinese companies invested $65 billion in renewable energy projects in 2012, 20% higher than investments in 2011, and they plan to spend $473 billion on clean energy investments between 2011 and 2015, according to the country's Five-Year Plan. China is encouraging investment in renewable energy and accompanying transmission infrastructure through a variety of financial and economic incentives.

Because of its cost-effectiveness and sizeable resource potential, hydroelectricity has become the key source of renewable energy in China. China was the world's largest producer of hydroelectric power in 2011. The country generated 687 TWh of electricity from hydroelectricity, representing 15% of the

country's total electricity generation. This level was down from 2010 because of a severe drought in the southwestern region.

Installed hydroelectric generating capacity was 249 GW in 2012, according to FGE, accounting for about one-fifth of total installed capacity. The world's largest hydropower project, the Three Gorges Dam along the Yangtze River, was completed in July 2012 and includes 32 generators with a total maximum capacity of 22.5 GW. The dam's annual average power generation is anticipated to be 84.7 TWh. The Chinese government plans to increase hydro capacity to 325 GW by the end of 2015. However, China has faced some delays on projects resulting from environmental concerns and complications of population displacement.

In 2011, China was the world's second-largest wind producer, generating 73 TWh, a level about 64% higher than in 2010. China's installed on-grid wind capacity, which almost doubled each year since 2005, was 61 GW in 2012. However, absolute wind power capacity stood at 75 GW, representing a lack of transmission infrastructure to connect wind farms to the electric grid. The NDRC aims to increase wind capacity to 100 GW by the end of 2015, and the government is encouraging grid development to improve utilization of wind capacity. China is also investing in solar power and hopes to increase capacity from about 3 GW in 2012 to 35 GW by the end of 2015.The NDRC is also providing greater financial incentives for solar powered generation.

Use of biomass in China is relatively small, mostly for heating, cooking, or for small-scale power projects. The NDRC has created price and tax incentives for biomass and waste incineration project investment through feed-in tariffs. In 2011, the total installed biomass power capacity in China was more than 8 GW, with a target to raise capacity to 13 GW by the end of 2015.

Notes

- Data presented in the text are the most recent available as of January 30, 2014.
- Data are EIA estimates unless otherwise noted.

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Oil and Gas Journal
Petroleum Economist
Petroleum Argus Weekly
Petroleum Intelligence Weekly
Petroleum Review
PFC Energy
Platts Commodity News
Reuters
Rigzone
Upstream
U.S. Commerce Department
U.S. Energy Information Administration
Wall Street Journal
World Gas Intelligence
World Nuclear Association
World Resources Institute
Xinhua News Agency