



Background

China is the world's most populous country and the largest energy consumer in the world. Rapidly increasing energy demand has made China extremely influential in world energy markets.

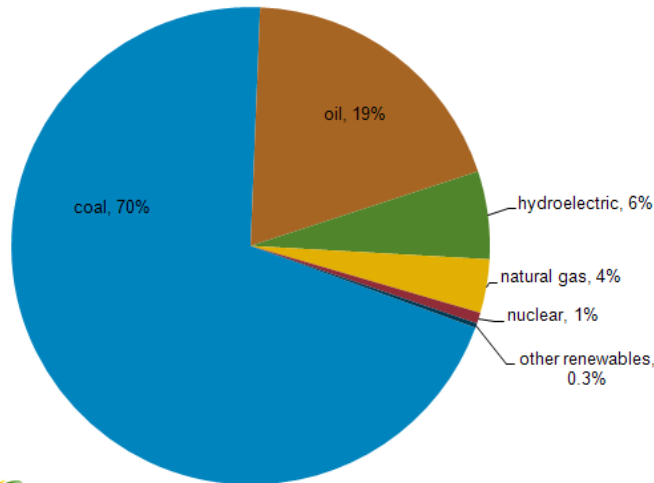
China is the world's most populous country and has a rapidly growing economy, which has driven the country's high overall energy demand and the quest for securing energy resources. According to the International Monetary Fund, China's real gross domestic product (GDP) grew at an estimated 9.2 percent in 2011 and 7.8 percent in the first half of 2012, after registering an average growth rate of 10 percent between 2000 and 2011. Economic growth continues to slow in 2012 as the global financial crisis unfolds, industrial production and exports decrease, and the government attempts to curb economic inflation and excessive investment in some markets. China mitigated the 2008 global financial crisis with a massive \$586 billion (4 trillion yuan) stimulus package spread over two years. The recent global downturn in 2012 has spurred China's government to begin incremental monetary easing measures and consider a second smaller fiscal stimulus package.

China is the world's second largest oil consumer behind the United States, and the largest global energy consumer, according to the International Energy Agency (IEA). The country was a net oil exporter until the early 1990s and became the world's second largest net importer of oil in 2009. China's oil consumption growth accounted for half of the world's oil consumption growth in 2011. Natural gas usage in China has also increased rapidly in recent years, and China has looked to raise natural gas imports via pipeline and liquefied natural gas (LNG). China is also the world's largest top coal producer and consumer and accounted for about half of the global coal consumption, an important factor in world energy-related CO₂ emissions.

Coal supplied the vast majority (70 percent) of China's total energy consumption of 90 quadrillion British thermal units (Btu) in 2009. Oil is the second-largest source, accounting for 19 percent of the country's total energy consumption. While China has made an effort to diversify its energy supplies, hydroelectric sources (6 percent), natural gas (4 percent), nuclear power (1 percent), and other renewables (0.3 percent) account for relatively small shares of China's energy consumption mix. The Chinese government set a target to raise non-fossil fuel energy consumption to 11.4 percent of the energy mix by 2015 as part of its new 12th Five Year Plan. EIA projects coal's share of the total energy mix to fall to 59 percent by 2035 due to anticipated higher energy efficiencies and China's goal to reduce its carbon intensity (carbon emissions per unit of GDP). However, absolute coal consumption is expected to double over this period, reflecting the large growth in total energy consumption.



Total energy consumption in China by type, 2009



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

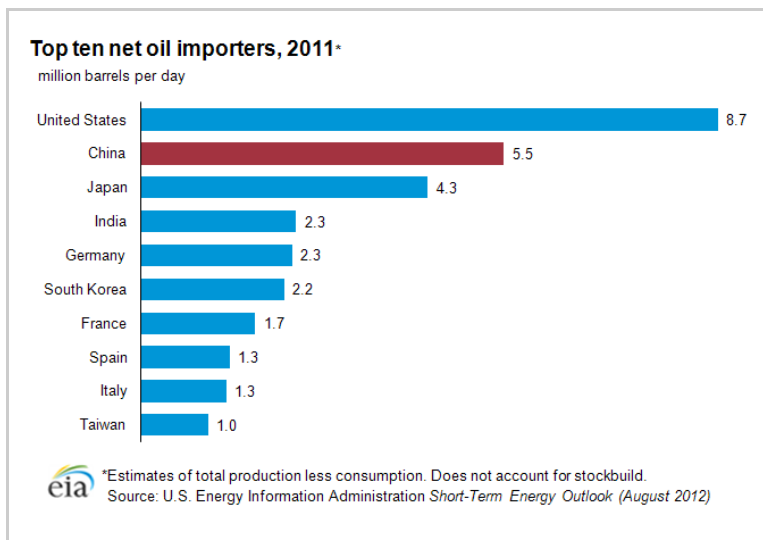
Oil

China is the world's second-largest consumer of oil behind the United States, and the second-largest net importer of oil as of 2009.

According to Oil & Gas Journal (OGJ), China holds 20.4 billion barrels of proven oil reserves as of January 2012, up over 4 billion barrels from three years ago and the highest in the Asia-Pacific region. China's largest and oldest oil fields are located in the northeast region of the country. China produced an estimated 4.3 million barrels per day (bbl/d) of total oil liquids in 2011, of which 95 percent was crude oil. China's oil production is forecast to rise by about 170 thousand bbl/d to nearly 4.5 million bbl/d by the end of 2013. Over the longer term, EIA predicts a flatter incline for China's production, reaching 4.7 million bbl/d by 2035.

China's oil consumption growth eased in 2011 from record high growth of 10 percent in 2010, reflecting the impact of the most recent global financial and economic downturn. However, the country still consumed an estimated 9.8 million bbl/d of oil in 2011, up 400 thousand bbl/d, or over 4 percent from 9.4 million bbl/d in 2010. In 2009, China became the second largest net oil importer in the world behind the United States, with net total oil imports reaching 5.5 million bbl/d in 2011. China's oil demand growth, particularly for petroleum products, 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 to grow during 2012 and 2013 at a moderate

pace. Even so, the anticipated oil growth of over 0.8 million bbl/d between 2011 and 2013 would represent 64 percent of projected world oil demand growth during the 2-year forecast period.



Sector organization

Energy policy

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) is the primary policymaking and regulatory authority in 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 in order 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. The NDRC is a department of China's State Council, the highest organ of executive power in the country. In January 2010, the government formed a National Energy Commission with the purpose of consolidating energy policy among the various agencies under the State Council.

National oil companies

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: 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 dominate 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 roughly 60 percent and 80 percent of China's total oil and gas output respectively. 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 nearly 80 percent of the company's revenues in recent years. The company seeks to acquire more upstream assets gradually.

Additional state-owned oil firms have emerged over the last 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 and CITIC Group have also expanded their presence in China's oil sector, although they are still relatively small.

Whereas onshore oil production in China is mostly limited to CNPC and CNOOC, international oil companies (IOCs) have been granted greater access to offshore oil prospects and unconventional gas fields, mainly through production sharing agreements and joint ventures. IOCs involved in offshore E&P work in China include: Conoco Phillips, Shell, Chevron, BP, Husky, Anadarko, and Eni, among others. China's NOCs must hold the majority participating interest in a production sharing contract (PSC) and can become the operator once development costs have 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 in turn is likely to attract downstream investment, ensure better profit margins for refiners, and reduce energy intensity caused by lower domestic prices and higher demand. The current oil product pricing system allows the NDRC to adjust retail prices when the moving average of imported crude prices fluctuates outside of a 4 percent range within 22 consecutive working days for diesel and gasoline.

When international crude oil prices increased in 2010 and 2011, the NDRC did not increase downstream fuel prices at the same rate, causing refiners, especially NOCs, to incur profit losses on their downstream businesses and increase their fuel product exports. Despite the price alterations, NOCs have experienced negative margins in 2012 and use their upstream and other business segments to offset losses on downstream sales. Volatility in international prices that has occurred in late 2011 and 2012 spurred China to react more quickly with price adjustments. NDRC raised retail oil prices twice at the beginning of 2012 to the highest levels recorded and reversed course by cutting prices three times by about 14 percent in mid-2012 to match dropping international oil prices and economic deceleration.

The NDRC plans to revise the pricing regime by shortening the adjustment period to 10 days and lower the 4-percent price boundary. They also plan to add more benchmark crude streams as part of China's basket of international crudes to reflect better the country's shifting sources of imported oil.

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

[Exploration and production](#)

China's largest oil fields are mature and production has peaked, leading companies to focus

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

After experiencing an annual growth spurt of 7 percent in 2010 and reaching 4.3 million bbl/d, oil production flattened in 2011. New offshore production and enhanced oil recovery (EOR) of older fields were the main contributors to the growth in 2010. CNPC's Daqing field, located in the Northeast, produced about 800,000 bbl/d of crude oil in 2011, according to FACTS Global Energy's most recent estimate, and has maintained this level for the last 9 years after declines from over 1 million bbl/d. Sinopec's Shengli oil field in the Bohai Bay produced about 547,000 bbl/d of crude oil during 2011, making it China's second-largest oil field. However, Daqing, Shengli, and other aging fields have been heavily exploited since the 1960s, and output is expected to decline significantly in the coming years. NOCs are investing a great deal in EOR techniques such as water and polymer flooding, among others, to stabilize oil production and stem declines from these older fields. Recent exploration and production (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 interior provinces such as Xinjiang, Sichuan, Gansu, and Inner Mongolia.

Onshore

Roughly 85 percent of Chinese oil production capacity is located onshore, primarily in mature fields. Although offshore E&P activities have increased substantially in recent years, China's interior provinces, particularly in the northwest's Xinjiang Uygur Autonomous Region and central Ordos Basin, have also received significant attention. Recently, China announced its plan to make Xinjiang into one of the country's largest oil and gas production and storage bases by 2015.

The onshore Junggar, Turpan-Hami, and Ordos Basins have all been the site of increasing E&P work, although the Tarim Basin in northwest has been a key focus of new onshore oil prospects. Crude oil production from Sinopec and PetroChina's interests in Tarim grew 4 percent annually to 261,000 bbl/d in 2011, according to IHS Global Insight. PetroChina intends to boost production in the Junggar Basin, one of Xinjiang's oldest basins, from 218,000 bbl/d in 2011 to 400,000 bbl/d in 2015 by using more cost-effective and advanced oil extraction techniques for heavy oil field development.

CNPC's use of various EOR techniques on the Liaohe and Changqing (large, old onshore oil fields) has increased production levels in recent years. Liaohe, located in the Northeast, produced 200,000 bbl/d in 2011. Since CNPC made a significant discovery in the basin in 2011, the company hopes to restore production to 241,000 bbl/d by 2020. Production in Changqing, China's third largest oil field, grew robustly by 10 percent in 2011 to reach 400,000 bbl/d. CNPC plans to use water injection and fracturing to boost Changqing's production to over 1 million bbl/d by 2015. The map below delineates the location of some of the major Chinese oil basins.

Offshore

About 15 percent of overall Chinese oil production is from shallow offshore reserves, a large contributor of China's incremental oil production growth. Offshore E&P activities have focused on the Bohai Bay region, the [South China Sea](#) (particularly the Pearl River Mouth Basin), and, to a lesser extent, the [East China Sea](#).

The Bohai Bay Basin, located in northeastern China offshore Beijing, is the oldest oil-producing offshore zone and holds the bulk of proven offshore reserves in China.

PetroChina 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, PetroChina recently claimed the 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 (including volumes from the East China Sea) was 406,000 bbl/d in 2011, or two-thirds of the NOC's domestic oil production. Following an oil leak at China's largest offshore crude oil field, Penglai 19-3, the government implemented a complete shutdown of this CNOOC-owned field in September 2011. Production rates at Penglai 19-3 peaked at roughly 130,000 bbl/d prior to shut-in. ConocoPhillips, a 49 percent stakeholder and operator of the field, and CNOOC are waiting to restart the field once China approves normal operations can resume. CNOOC has discovered other sizeable oilfields in the Bohai Bay such as Penglai 9-1, which the NOC claims to be the largest find in the Bohai Bay in recent years.

The South China Sea is gas-rich, although CNOOC has also discovered several small oil fields and is focusing on deepwater 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 Lihua 16-2 in the Pearl River Mouth Basin of the SCS, opening further opportunities for exploration. CNOOC tendered licenses for 19 blocks in the SCS, most in the Pearl River Mouth Basin, in 2011. The NOC held another licensing round for 9 blocks in the South China Sea in June 2012, and companies will be allowed to bid on the blocks until June 2013 according to industry sources.

Territorial disputes

Territorial disputes in the [East China Sea](#) have so far limited large-scale development of fields in the region, where China and Japan's Exclusive Economic Zones (EEZs). 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 fields. However, in early 2009, the agreement unraveled when China asserted sovereignty over the fields. Tensions in the second half of 2010 have resurfaced between the two countries over the gas fields.

Continued territorial disagreements in the [South China Sea](#), including ownership of the Spratly and Paracel Islands, have hindered efforts for joint exploration by the various countries 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. Increasing appetites for oil and natural gas have exacerbated tensions particularly between Vietnam and China, as hydrocarbon development has moved into deepwater 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.

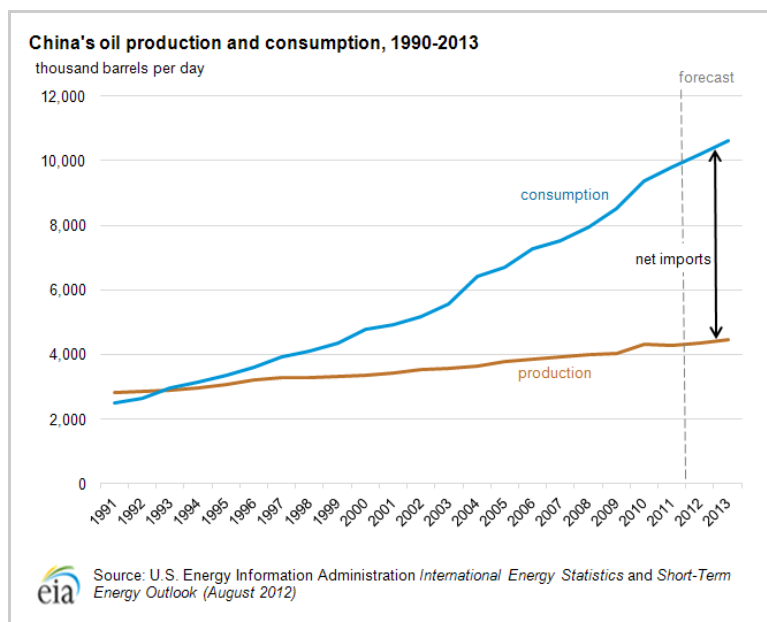
Overseas acquisitions

China's increasing dependence on oil imports, the need to secure and diversify energy supply, the need to develop technical expertise in unconventional resources, and attempts to capture value upstream are factors driving Chinese NOCs to invest in international projects and form strategic commercial partnerships with IOCs. China is taking advantage of the economic downturn to step up its global acquisitions and use its vast foreign exchange reserves (estimated at over \$3 trillion in 2012) to help purchase equity in projects

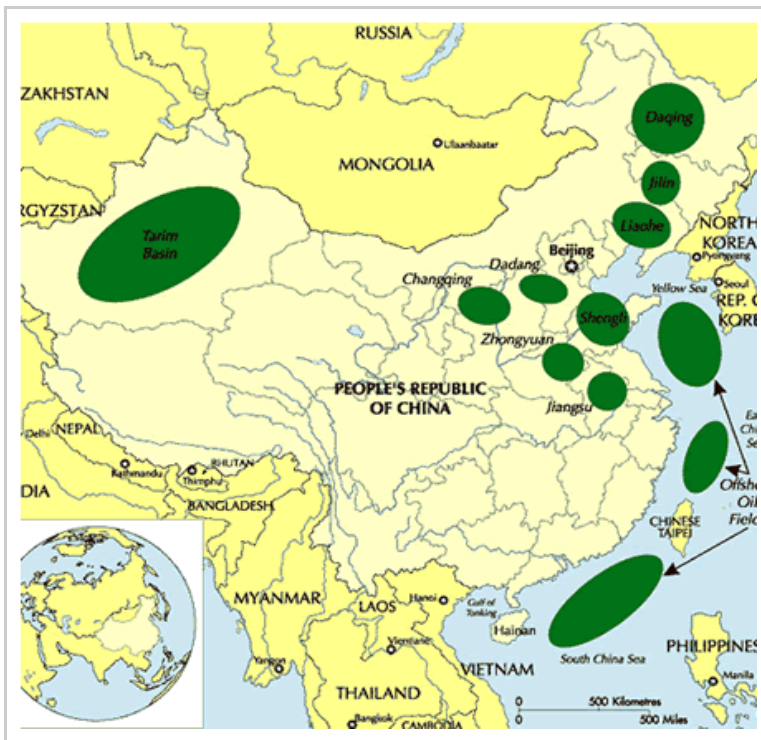
or acquire stakes in energy companies. Since 2009, the NOCs have purchased assets in the Middle East, North America, Latin America, Africa, and Asia. The NOCs invested \$18 billion in overseas oil and gas assets in 2011. The NOCs increased their natural gas purchases abroad and invested \$12 billion in 2011, out of a total \$18 billion of oil and gas purchases, to gain more access to LNG and unconventional gas.

China's overseas equity oil production grew significantly over the past decade from 140,000 bbl/d in 2000 to over 1.5 million bbl/d of oil production in 2011. CNPC has been the most active company, while Sinopec, CNOOC, and other smaller NOCs have also expanded their overseas investment profile. CNPC, holding hydrocarbon assets in 30 countries, produced a record 1 million bbl/d from overseas oil equity by the end of 2011, up from 865,000 bbl/d in 2010. CNPC also produced 4.9 Bcf/d of natural gas in 2010. Sinopec's overseas equity oil output reached 400,000 bbl/d in 2011, and the NOC targets producing 1 million bbl/d from overseas oil equity by 2015. CNOOC produced about 150,000 bbl/d in 2011 and is swiftly increasing oil and gas purchases in 2012 in attempts to gain technical knowledge and acreage in unconventional gas and deepwater hydrocarbon resources. CNOOC signed an agreement in 2012 to purchase Canadian oil company Nexen for over \$15 billion. Pending approval from Canada, this will be China's largest overseas acquisition to date. The NOC anticipates increasing its international share of its total oil and gas production from the current 20 percent to 30 percent by 2015 according to PFC Energy.

Since 2008, Chinese NOCs have secured bilateral oil-for-loan deals amounting to roughly \$100 billion with several countries in order to obtain hydrocarbon resources and mitigate lending risks with suppliers. China finalized oil-for-loan deals with Russia, Kazakhstan, Venezuela, Brazil, Ecuador, Bolivia, Angola, and Ghana - and a gas-for-loan agreement with Turkmenistan. Venezuela and China have signed oil-for-loan deals, including \$32 billion in exchange for 430,000 bbl/d of crude oil and products.



Source: Rigzone



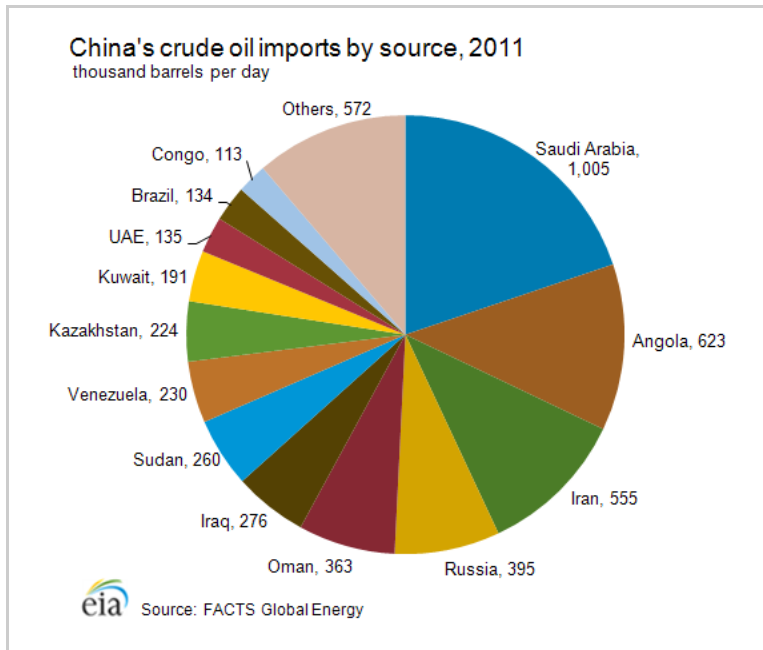
Oil imports

China's crude oil imports have grown robustly in the past several years, and reached a record-high 6 million bbl/d by May 2012. China imported nearly 5.1 million bbl/d of crude oil on average in 2011, rising 6 percent from 4.8 million bbl/d in 2010. In the first half of 2012, imports rose even higher to 5.6 million bbl/d. Crude imports now outweigh domestic supply, consisting of over half of total oil consumption in 2011. EIA expects China to import about 75 percent of its crude oil by 2035 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 2011, the Middle East supplied 2.6 million bbl/d (51 percent). Other regions that export to China include Africa with 1.2 million bbl/d (24 percent), Asia-Pacific region with 173,000 bbl/d (3 percent), and 1.1 million bbl/d (22 percent) from other countries. Saudi Arabia and Angola ranked as China's two largest sources of oil imports, together accounting for almost one-third of China's total crude oil imports. Sudan and South Sudan became significant oil exporters to China until production was shut in at the start 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.

China reduced imports from Iran, historically the third largest exporter to China, by 34 percent in the first quarter of 2012 to 345,000 bbl/d, in light of a contract dispute between Sinopec, China's key oil importer, and Iran's state oil company. China replaced the lost share of oil from Iran and [Sudan and South Sudan](#) with imports from other Middle Eastern countries, Venezuela, Russia, and Angola. The contract dispute with Iran was settled in early 2012, and oil imports from the country rebounded by May 2012 to prior-year levels. However, most analysts expect that China will continue to diversify import sources to reduce

risk of further global supply disruptions and uncertainty surrounding oil supplies from Iran as a result of U.S. and EU sanctions.



Pipelines

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. In March 2007, CNPC spearheaded the Beijing Oil & Gas Pipeline Control Center that monitors all long-distance pipelines.

Domestic system

According to IHS Global Insight, China has about 12,780 miles of total crude oil pipelines (70 percent managed by CNPC and the remaining 30 percent by other NOCs) and nearly 8,265 miles of oil products pipelines in its domestic network. At present, 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 newer oil-producing regions or from downstream centers to more remote markets. China plans to add 6,000 miles of crude oil pipelines and at least 6,000 miles of oil product pipelines to the system by 2015.

The 1,150-mile Western China Refined Oil Pipeline delivers petroleum products from Urumqi in Xinjiang Province to Lanzhou in Gansu Province. Gradually, this pipeline will connect with other regional spurs to deliver supplies to the coastal regions, as well as accommodate additional oil imports from Kazakhstan. In addition, the Western Pipeline consists of a crude oil line travelling from Xinjiang to the Lanzhou refinery. CNPC has commissioned various oil product pipelines to link from Lanzhou to more eastern and central provinces and other refinery centers, providing more distribution efficiency. The company launched the Lanzhou-Chengdu-Chongqing pipeline in 2008 and the 300,000 bbl/d Lanzhou-Zhengzhou-Changsha pipeline in 2010. CNPC continues to build spurs from Lanzhou and Zhengzhou.

International connections

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 200,000 bbl/d pipeline spans 620 miles, connecting Atasu in northern 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). Expansions have been made on the Kazakh side of the pipeline system in part to bring more oil from the country's western oilfields near the Caspian Sea to China. The pipeline to China is expected to double capacity to 400,000 bbl/d by 2014.

Russia's Far East has become another source for Chinese crude oil imports. Russian state-owned oil giant Transneft began construction in April 2006 of a pipeline that will extend 3,000 miles, from the Russian city of Taishet to the Pacific Coast. Known as the Eastern Siberia-Pacific Ocean Pipeline (ESPO), the project will be completed in two stages. The first stage of the project includes the construction of a 600,000 bbl/d pipeline from Taishet to Skovorodino. Furthermore, CNPC built a 597-mile pipeline linking the spur with the Daqing oil field in the Northeast. The pipeline spur through China became operational in January 2011, and delivers up to 300,000 bbl/d to the Chinese border under a 20-year supply deal. The second stage will deliver oil to the Russian Pacific port of Kozmino by 2013. China has requested access to the entire volume of the second phase; however Russia has not decided on supply agreements.

China has also revived its plans to construct an oil import pipeline from Myanmar through an agreement signed in March 2009. As Myanmar is not a significant oil producer, 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](#). CNPC expects to direct crude oil from the pipeline to serve the proposed Yunnan/Anning refinery. Initial capacity for the pipeline is slated to be 240,000 bbl/d, ramping up to 480,000 bbl/d, and could be constructed by 2013.



Source: IEA

Refining

China is steadily increasing its oil refining capacity in order to meet its strong demand growth and process a wider range of crude oils. IHS Global Insight estimates China's installed crude refining capacity is over 11.6 million bbl/d, doubling in size since 2000. China's goal is to augment crude oil refining capacity by around 3 million bbl/d and reach 14

million bbl/d by 2015, the end of the 12th Five Year Plan. FACTS Global Energy anticipates China adding 5 million bbl/d of net capacity between 2011 and 2020, pushing total capacity to over 16 million bbl/d. Refinery runs have risen in tandem with growing capacity and averaged 8.9 million bbl/d in 2011, up 5.3 percent from 2010 levels of 8.5 million bbl/d.

Sinopec and CNPC are the two dominant players in China's oil refining sector, accounting for 46 percent and 31 percent of the capacity, respectively. Sinopec is the second largest oil refiner in the world with around 5 million bbl/d of total oil processing capacity in China by 2012 and holds a significant refining presence in the coastal and southern areas of China. Sinopec is gradually investing in refining assets overseas such as its recent 37.5 percent stake in Saudi Arabia's 400,000 bbl/d Yanbu refinery. The other NOCs are swiftly building refineries to compete with Sinopec in China and move further into the downstream sector. CNPC is in the process of building refineries and expanding its downstream presence in southern China and plans to commission its 200,000 bbl/d Pengzhou refinery in Sichuan in late 2012. CNOOC entered the downstream sector through the commission of the company's first refinery, the 240,000 bbl/d Huizhou plant in 2009. Sinochem plans to commission Quanzhou, its first major processor, in 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. The Chinese NOCs recently expanded their refining portfolios through commissioning several major new refineries in the past few years including three at the end of 2011: Beihai in the South, Ningxia in the North, and Changling in the central Hunan Province - each with a capacity of 100,000 bbl/d. The NOCs are building several other facilities that will become operational by 2015.

PetroChina (CNPC) is branching out to acquire refinery stakes in other countries to move downstream and secure more global trading and arbitrage opportunities. The company's recent purchases of Singapore Petroleum Corporation and a portion of Japan's Osaka refinery are cases where PetroChina is looking for a foothold within the region's refining opportunities. Also, CNPC is making investments in refineries and pipelines in African countries in exchange for exploration and production rights. Also, Sinopec signed an MOU for a 37.5 percent equity stake to build the Yanbu refinery in Saudi Arabia.

The refining sector has undergone modernization and consolidation in recent years, shutting down dozens of small refineries ("teapots" and independent refiners), ranging from 40,000 bbl/d to 120,000 bbl/d and accounting for about 16 percent of total refinery capacity. The NDRC issued guidelines in 2011 that will eliminate refineries smaller than 40,000 bbl/d by 2013 in an effort to encourage economies of scale and energy efficiency measures. Several of these local refineries plan to expand capacity or consolidate with larger firms to avoid closing. The government restricts the feedstock independent refineries can use, so these refineries tend to accept heavy fuel oil and heavier and sour crude slates, such as those from Venezuela.

Domestic price regulations for petroleum products caused losses for Chinese refiners, particularly small ones, in the past few years when international oil prices were high. This price differential squeezes refineries' profit margins and can shut in production from some independent refineries. Regulated domestic prices for retail products compared to higher international market prices provide incentives for Chinese refiners, especially those run by national companies, to export high volumes of products. In 2011, China imported approximately 1 million bbl/d and exported 615,000 bbl/d of petroleum products, including LPG, gasoline, diesel, jet fuel, fuel oil, and lubricants. As refining capacity expands in 2012

and beyond, exports of products, particularly gasoline and diesel, could grow.

As China diversifies its crude oil import sources and expands oil production domestically, state-owned refiners are improving their ability to accept the variety of crude slates. Traditionally, many of China's refineries were built to handle relatively light and sweet crude oils. In recent years, refiners have built or upgraded facilities to support greater Middle Eastern and Latin American crude oil imports, which tend to be heavy and sour. Much of the country's planned new oil production in the offshore Bohai Bay is of a high-acid caliber, and China was the largest importer of Sudan's Dar Blend, a high-acid crude type, before the recent shut-in of much Sudanese production. High-acid crude oil tends to be light and sweet, but refiners must install stainless steel metallurgy or utilize other advanced processes to run these crude streams successfully.

Major proposed new refinery projects and upgrades in China

Owner	Location	Capacity	Planned start date	Notes
Sinopec	Maoming	200,000	2012 Q4	Upgrade
	Nanjing/Jinling	110,000	2012	Expansion; Construction
	Caofeidian/Tianjin	200,000	2013	Construction
	Guangdong / Zhanjiang	300,000	2015	Construction; developing with Kuwait Petroleum and TOTAL
	Zhenhai/Zhejiang	300,000	2015	Expansion; Planning
	Lianyungang / Jiangsu Fujian	240,000	2016	Planning; Phase 2 to double capacity
CNPC/PetroChina	Fujian	240,000	2018	Expansion with ExxonMobil and Aramco; Preparing EIS
	Pengzhou	200,000	2012 Q3	Construction
	Huabei	100,000	2013	Expansion; NDRC approval
	Anning/Yunnan	260,000	2014	Plans to use oil from Myanmar pipeline; Saudi Aramco to jointly develop
	Guangdong/ Jieyang	400,000	2014	NDRC approval; JV with PDVSA
	Huludao	200,000	2014	Construction
	Qinzhou	200,000	2015	Expansion
	Tianjin	260,000	2015	Feasibility stage; JV with Rosneft
	Changzhou	200,000	2015	Feasibility study
Chongqing	200,000	2016	Receive oil from China-Myanmar pipeline	
CNOOC	Jiangsu/ Taizhou	400,000	2017	NDRC approval; Environmental approval pending; JV with Qatar and Shell
	Huizhou	200,000	2017	Expansion
Sinochem	Quanzhou	240,000	2014	Environmental approval;
	Ningbo	240,000	2020	Pending approval

Sources: Global Insight, FACTS Global Energy, PFC Energy

Strategic oil reserves

In China's 10th 5-Year Plan (2000-2005), Chinese officials decided to establish a government-administered strategic oil reserve program (SPR) in three phases to help shield China from potential oil supply disruptions. In 2004, China started construction at four sites that would comprise the first phase of the country's strategic oil reserve program. Phase 1, completed in 2009, has a total storage capacity of 103 million barrels at four sites. Phase 2, recently under construction for 8 sites, is expected to more than double the total SPR capacity to 315 million barrels by 2013. Among the Phase 2 sites, Dushanzi and Lanzhou were completed at the end of 2011 and add 40 million barrels to storage. At least two more Phase 2 facilities are slated to come online in the second half of 2012, adding another 40 million barrels. Three Phase 2 sites are located inland in western China, while the other 5 are located in the East and South, allowing China to fill the facilities from various sources. Ultimately, Phase 3 is expected to bring total strategic oil reserve capacity in China to about 500 million barrels by 2020.

In addition to the strategic reserves of crude oil, China had between 170 and 310 million barrels of commercial crude oil storage capacity in 2010 according to various Chinese government and private sector sources. The distinction between future strategic and commercial storage reserves is not clearly defined yet, and there could be crossover between some of the facilities. Refined product storage capacity is estimated at 400 million barrels and the government has discussed plans to create a strategic refined oil stockpile.

Stockpiling rates for strategic and commercial storage in China depend on factors such as supply security, crude oil prices, 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 2011 averaged over \$90/bbl, making purchases for storage more expensive. Another driving factor for additional fills in the next several years is China's policy goal to hold 90 days worth of supply in its strategic and commercial crude oil reserves by 2020, an increase from an estimated 40 days at the end of 2011.

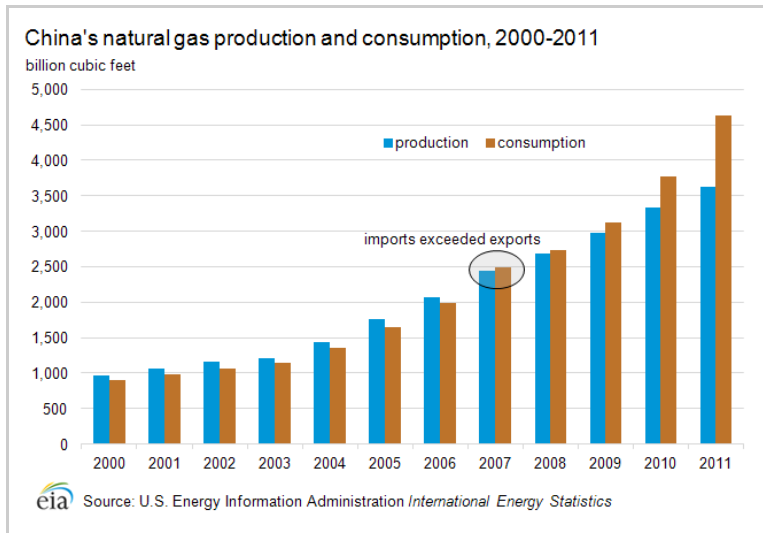
Natural gas

Although natural gas use is rapidly increasing in China, the fuel comprised less than 4 percent of the country's total primary energy consumption in 2009.

According to OGJ, China held 107 trillion cubic feet (Tcf) of proven natural gas reserves as of January 2012, 27 Tcf higher than reserves estimated in 2009 and the second largest in the Asia-Pacific region. China's natural gas production and demand have risen substantially in the past decade. In 2011, China produced 3.6 Tcf of natural gas, up around 9 percent from 2010, while the country consumed 4.6 Tcf. China's gas production more than tripled over the last decade. China became a net natural gas importer for the first time in almost two decades in 2007, and imports have increased dramatically in the past few years alongside China's thirst for natural gas and rapidly developing infrastructure. Gas imports have become a significant part of the gas portfolio, jumping from a 12-percent share of the consumption in 2010 to 22 percent in 2011.

The Chinese government anticipates boosting the share of natural gas as part of total energy consumption to 10 percent by 2020 to alleviate high pollution from the country's heavy coal use and diversify the fuel mix in all end-use sectors. Consumption in 2011 surged from 2009 levels by nearly 50 percent, and the country imported over 1,000 Bcf/y of liquefied natural gas (LNG) and pipeline gas to fill the gap. Although a majority share of the

gas consumption is dominated by industrial users (34 percent in 2011 according to FACTS Global Energy), the recent growth of gas consumption in the past few years stems from the power, utilities, and residential sectors. EIA projects gas demand to more than triple to over 11 Tcf/y by 2035, growing about 5 percent per year. To meet this demand, China is expected to continue importing natural gas via LNG and a number of potential import pipelines from neighboring countries. It will also have to tap into its expanding domestic reserves and establish a wider natural gas network and storage capacity.



Sector organization

National oil companies

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 shows that the company accounts for roughly 73 percent of China's total natural gas output. 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 co-develop upstream offshore projects and has the right to acquire up to a 51 percent 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 well below international market rates. China has typically favored manufacturing and fertilizer gas users by regulating the price these sectors pay. The gas market has become more complex as import sources are more expensive than domestic gas production and gas demand intensifies in certain areas. In order to bolster investment in the sector, particularly by foreign participants, create more transparency in the pricing system and responsiveness to market fluctuations, and make domestic gas competitive with other fuels and imported gas, the NDRC proposes linking gas prices indirectly to international oil prices, effectively raising prices for end-users.

In mid-2010, the NDRC raised the onshore wellhead prices by 25 percent, and some

Chinese cities raised end-user prices in the industrial and power sectors. China launched a pilot gas price reform in the southern provinces of Guangdong and Guangxi at the end of 2011, and essentially links the natural gas price to imported fuel oil and LPG instead of to the cost of gas production and assigns a price reference point for each province. The linked gas price is then discounted to some degree to encourage gas consumption. If the policy is successful, the NDRC plans to roll out the reform to the rest of the country. China opened its first natural gas spot trading market at the Shanghai Petroleum Exchange in July 2012 as part of its gas price liberalization.

Exploration and production

China's primary 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 dived into several offshore natural gas fields located in the Bohai Basin (Yellow Sea) and the Panyu complex of the Pearl River Mouth Basin (South China Sea) and is exploring more technically challenging areas, such as deepwater and unconventional resources, with foreign companies.

Southwest

The Sichuan Basin is the key gas producing area in the Southwest and holds about 9.8 Tcf of reserves. The largest recent discoveries in the southwestern region are Sinopec's find at the Yuanba and Puguang fields in Sichuan Province. Sinopec started commercial production at Puguang in early 2010 and anticipates the field peaking at 425 Bcf/y. The NOC anticipates Yuanba to produce 120 Bcf/y by 2015.

Sichuan Province also holds the high sulfur content fields at the Chuandongbei basin. In 2007, CNPC awarded a 30-year production sharing contract (PSC) to Chevron to bring this technically challenging field online by 2013, with a production rate of 219 Bcf/y.

Northwest

Xinjiang historically is one of China's largest gas producing provinces, with output of 827 Bcf in 2011. According to IHS Global Insight, major fields Kela-2 and Dina-2 in the Tarim Basin have proven gas reserves of 15 Tcf, though much of the basin is still underexplored. However, the basin's complex geological features and the distance from China's main consumption centers make development costs relatively high. PetroChina's two cross-country West-East Gas Pipelines, connecting Xinjiang Uygur Autonomous Region to Shanghai, Beijing and Guangdong, have greatly expanded the upstream potential of the Tarim Basin to supply markets in eastern China. Tarim was the second largest gas-producing area in China in 2011, with 602 Bcf/y or 16 percent of China's total production, and PetroChina is eager to increase production in order to feed the first West-to-East pipeline. The NOC is currently developing the Kela-2 and Dina-2 fields which together are producing over 500 Bcf/y. Other new discoveries in the Northwest that have high potential of gas supply are the Junggar Basin in Xinjiang Province and the Qaidam Basin in Qinghai Province.

Northeast

The Chanqing oil and gas province in the Ordos basin is the largest producing gas region in China and houses the Sulige gas field containing more than 35 Tcf of reserves.

Development of this region is geologically and technically challenging as some of the reserves are tight gas, though production has risen steadily this decade to 912 Bcf/y in 2011 or 25 percent of China's gas output. CNPC anticipates producing 1,130 Bcf/y in the region by 2015. Total and Shell Oil hold PSCs with CNPC for tight gas projects in the Sulige and Changbei fields and adding to China's technical capacity to perform advanced drilling techniques. The Songliao basin holds the Daqing oil and gas field which produced 110 Bcf in 2011. Also, China began the process of reinjecting carbon dioxide to enhance recovery rates for fields in this area.

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/y in 2011 in the shallow waters of the South China Sea (SCS). The West SCS accounts for about 57 percent of CNOOC's domestic gas production, although the NOC sees greater potential for development in the East SCS. The West SCS 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 124 Bcf/y of natural gas but has been in decline since 2007. Other fields have entered operations since 2005 and offset declines from Yacheng.

CNOOC's long term development plans include exploration of deepwater fields in the Pearl River Mouth and Qiongdongnan Basins. The NOC partnered with Husky Energy and began development of China's first deepwater gas project for the Liwan 3-1 field, slated for commercial production in 2013. As development continues, other deepwater fields such as Panyu 34-1 will feed into the main processing platform at Liwan. Other IOCs, namely Chevron, BG, and Eni, signed PSCs for deepwater hydrocarbon blocks in the SCS.

Unconventional gas resources

The unconventional gas industry in China is in nascent stages of development due to technical challenges, regulatory hurdles, transportation constraints, and competition with other fuels and conventional natural gas. However, China's potential wealth of unconventional gas resources such as coal bed methane (CBM) and shale gas has spurred the government to seek foreign investors with technical expertise to exploit these reserves.

China is estimated to have 10.2 Tcf so far of proven CBM reserves in 2011, though estimates for recoverable reserves are much higher at over 350 Tcf. Most of China's CBM volumes are from the basins in the North and Northeast, the Sichuan basin in the Southwest, and the Junggar and Tarim basins in the West. FACTS Global Energy estimates that total CBM production in 2010 was 315 Bcf/y, including 18 percent from surface wells and 82 percent from coal mine extractions, and expects production to rise to 1,570 Bcf/y by 2030, accounting for 12 percent of total natural gas production. As part of the 12th Five-Year Plan, China's NEA has a target of producing 1,060 Bcf/y by 2015. Another goal is to increase the utilization rates from less than 40 percent to over 60 percent by 2015, reducing the significant production waste. 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.

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 Northeast basins. EIA [estimates](#) that

China's technically recoverable shale gas resources are 1,275 Tcf. Although there is no commercial production of shale gas as of 2011, the Ministry of Land Resources set out goals to produce 230 Bcf/y of shale gas by 2015 and at least 2,100 Bcf/y by 2020. China's NOCs are in discussion with several IOCs for partnering on potential shale gas projects in order to gain necessary technical skills for developing such geologically challenging resources. CNPC and Shell signed the first PSC for a block of shale gas in the Sichuan Basin in March 2012. 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. 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. Tendering is available to not only NOCs but also private and local companies, and foreign investors may participate indirectly if they hold a PSC contract with a participating Chinese firm.

Pipelines

China had nearly 27,000 miles of main natural gas pipelines at the end of 2011. China's natural gas pipeline network is fragmented, though 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. The government plans to construct another 24,000 miles of new pipelines by 2015. While the major NOCs operate the trunk pipelines, local transmission networks are operated by various local distribution companies throughout China. This has prevented the emergence of a national gas transmission grid.

CNPC is the primary operator of the main gas pipelines, holding over three-quarters of the market share. CNPC moved into the downstream gas sector recently through investments in gas retail projects as well as investments in several pipeline projects to facilitate gas transportation for its growing gas supply. CNPC developed 3 parallel pipelines, 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. Sinopec is also a major player in the downstream transmission sector, operating pipelines in the Sichuan province. In 2010, the NOC commissioned the 1,000 mile, 425 Bcf/y pipeline running across 8 provinces from its recently operating Puguang field to Shanghai.

China lacks gas storage capacity, causing it to consume almost all of the gas it supplies. The government intends to increase storage capacity from nearly 70 Bcf to 1,100 Bcf in 2015.

West-East gas pipeline

PetroChina's first West-East Gas Pipeline, commissioned in 2004, is China's single-largest natural gas pipeline at 2,500 miles in length. 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. The Chinese government promoted the construction of the West-East Gas Pipeline to supply natural gas consumption to the eastern and southern regions of the country. The West-East pipeline has an annual capacity of 430 Bcf/y, capable of expansion to 600 Bcf/y, and contains numerous regional spurs along the main route, which has improved the interconnectivity of China's natural gas transport network.

CNPC completed construction of the second West-to-East trunk pipeline with a capacity of 1.1 Tcf/y and spanning over 5,200 miles, including the trunkline and 8 main branch lines in

2011. This pipeline connects at the Sino-Kazakh border with the Central Asian Gas Pipeline from Turkmenistan and transports gas across the country to key demand centers. 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 of the line runs from Zhongwei to serve markets in the southern Guangdong Province and Hong Kong.

In order to accommodate greater gas flows from Central Asia, CNPC will construct the third West-East Pipeline by 2015 to run partially parallel to the second West-East line and end in the southeastern provinces of Fujian and Guangdong. CNPC anticipates that the 1.1 Tcf/y pipeline will offtake gas from Turkmenistan's production and domestic output from the Junggar fields, though supply arrangements are still undefined. CNPC made a final investment decision in March 2012, and the pipeline will be partially funded with private capital. There are proposals for a fourth and fifth West-East pipelines in pre-feasibility stages.

Central Asian Gas Pipeline (CAGP) and international pipelines

China's first import natural gas pipeline is the Central Asian Gas Pipeline (CAGP), which spans 1,130 miles, has a capacity of 1.4 Tcf/y, and brings natural gas to China from Turkmenistan, Uzbekistan, and Kazakhstan. In December 2009, CNPC was awarded a PSC to develop natural gas resources at Turkmenistan's large South Yolotan gas fields, and signed a deal with Turkmenengaz, the state-owned gas company, to import natural gas supplies. The pipeline began operations in December 2009, and links to the second West-East pipeline at the Chinese border. China imported 1.4 Bcf/d (511 Bcf/y) from CAGP in 2011 and expects to increase imports as the pipelines on both sides of the border increase capacity. Turkmenistan and China signed a gas supply agreement in 2012 to extend an initial agreement from 1.1 Tcf/y to 1.9 Tcf/y. 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. CNPC and Turkmenengaz are developing the sizeable South Yolotan field which is anticipated to supply gas to China by 2013.

In April 2011, CNPC signed an agreement with Uzbekistan to deliver over 1 Bcf/d (360 Bcf/y) through a transmission line that would connect with the CAGP. Kazakhstan and China also signed a joint venture agreement in 2010 to jointly construct a pipeline starting in western Kazakhstan and link to the CAGP. The pipeline will add another 360 Bcf/y from Kazakhstan to the CAGP and commissioning could begin in 2015.

There are several proposed pipelines that could contribute to Chinese natural gas imports in the future.

- In 2006, CNPC officials signed a Memorandum of Understanding with Russia's Gazprom for two pipeline proposals, one from Russia's western Kovykta gas field to northwestern China with a pipeline capacity between 1 and 1.4 Tcf/y by 2015. A second proposed route, called the Eastern pipeline, would connect Russia's Far East and Sakhalin Island to northeastern China, and would have 1.1 to 1.4 Tcf/y of capacity. The countries have yet to agree on a price for the gas.
- CNPC signed a deal with Myanmar in March 2009 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. Construction began on the project which is due to commence by mid-2013.



Map source: PetroChina

Liquefied natural gas (LNG)

Roughly half of China's natural gas imports are in the form of LNG. Re-gasification capacity was almost 1,000 Bcf/y (2.7 Bcf/d) in mid-2012. Another 2 Bcf/d is being built by 2015. China's LNG imports are expected to rise as more terminal capacity comes online, though higher market-based LNG prices based versus lower prices from domestic gas sources as well as pipeline gas from Turkmenistan could cause more competition for LNG.

China imported its first LNG shipment in the summer 2006, and the country has quickly ramped up volumes since then, importing about 1,200 MMcf/d in 2010 and rising about 30 percent to 1,600 MMcf/d or 586 Bcf/y in 2011. LNG now enters the country through five terminals, with another four under construction and more receiving government approvals. CNOOC is the key LNG player in China and operates three existing plants, while CNPC operates the two most recent terminals.

Chinese NOCs must secure supply prior to gaining government approval to build a re-gasification terminal, and these firms are faced with competition from other regional buyers, mainly in Korea and Japan. Therefore, CNOOC, PetroChina, and Sinopec have signed several long terms supply contracts totaling about 3.8 Bcf/d. These contracts are primarily with Asian firms sourcing LNG from Indonesia, Malaysia, and Australia. QatarGas is also supplying LNG to China through long-term contracts and spot cargoes.

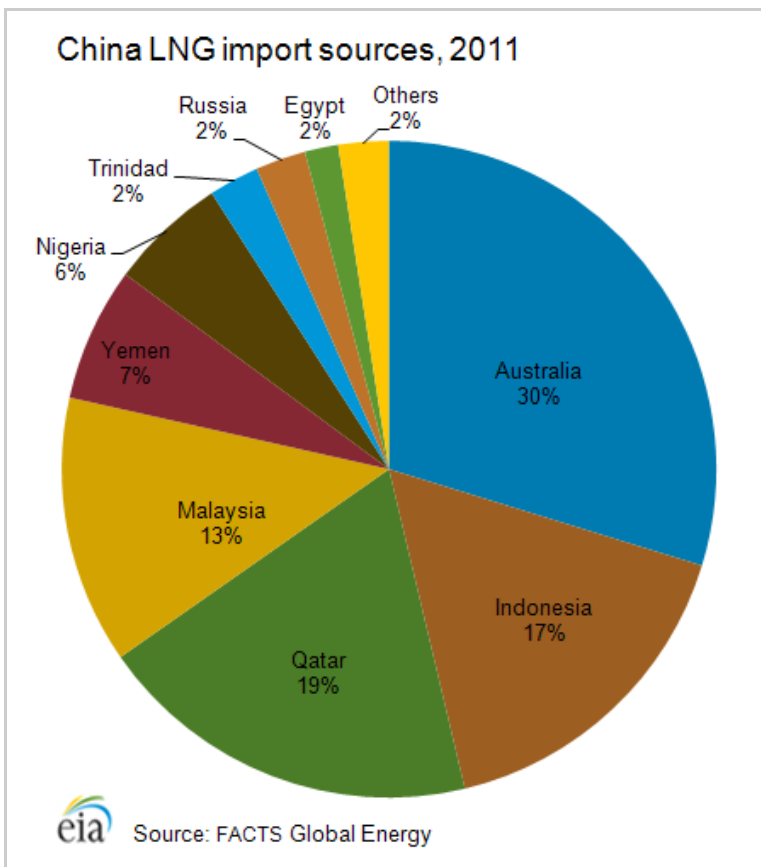
Several re-gasification terminals are in various phases of planning and construction. CNOOC is keenly interested in growing its LNG market as it has a competitive advantage thus far in the sector compared to the other NOCs. In addition, CNOOC is constructing 3 plants - Zhuhai, Zhejiang, and Hainan - and intends to expand the company's three existing terminals. PetroChina/CNPC recently entered the LNG market and commissioned its first two re-gasification terminals, Dalian and Jiangsu, in 2011 and is building the Tangshan terminal. Sinopec anticipates entering China's LNG market by 2014 with its Qingdao terminal.

Key LNG terminals — current and proposed

**Initial /
Expansion**

Terminal Name	Status/Online Date	Developer	Expansion Capacity (MMcf/d)	Possible Supplier
Dapeng/ Guangdong	Operational; Expansion / 2012	CNOOC; BP	880 / 300	Australia NWS
Fujian	Operational; Expansion / 2012	CNOOC	340 / 340	Indonesia - Tangguh
Shanghai	Operational; Expansion / 2012	CNOOC; Shanghai Shenergy	650 / 395	Malaysia - Petronas
Dalian	Operational; Expansion / 2015	CNPC	395 / 395	QatarGas IV; Australia; Iran
Rudong/Jiangsu	Operational; Expansion / 2014	CNPC;RGM Int'l; CITIC	460 / 395	QatarGas IV
Shenzhen	Permit from NDRC; Awaiting siting permits / 2014	CNPC; CLP	260 / 200	Australiaâs Gorgon LNG (ExxonMobil)
Zhejiang/Ningbo	Construction / 2012; Expansion	CNOOC	395 / 395	QatarGas III
Zhuhai	Construction / 2013; Expansion	CNOOC; Yudian Group	460 / 460	TBD
Qingdao/Shandong	Construction / 2014; Expansion	Sinopec; Huaneng Group	395 / 395	PNG LNG (ExxonMobil) and APLNG
Hainan	Construction / 2015; Expansion / 2018	CNOOC; Hainan Development	260 / 130	TBD
Caofeidian/ Tangshan	Construction / 2014; Expansion	CNPC; Beijing municipal government	460 / 390	Australia and Qatar
Beihai/Guangxi	Preliminary approval / 2015	Sinopec	395	PNG LNG (ExxonMobil) and APLNG
Jiangsu/Yancheng Floating terminal	Planning; Feasibility study complete / 2013	CNOOC; Yancheng Municipal	340	TBD
Shenzhen/Diefu	NDRC approval / 2015	CNOOC; Shenzhen Energy	526	TBD
Jieyang	NDRC approval / 2014	CNOOC	260	TBD

Sources: Global Insight, FACTS Global Energy, and Reuters



Coal

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

According to the World Energy Council, China held an estimated 128 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 percent of the world's total coal reserves. Coal production rose 9 percent from 3.5 billion short tons in 2010 to over 3.8 billion short tons in 2011, making China the largest coal producer in the world. There are 27 provinces in China that produce coal, and northern China, especially the provinces of Shanxi and Inner Mongolia, contains most of China's easily-accessible coal and virtually all of the large state-owned mines.

Coal comprises about 70 percent of China's total primary energy consumption. In 2011, China consumed an estimated 4 billion short tons of coal, representing about half of the world total. Coal consumption is about 3 times higher than it was in 2000, reversing the decline seen from 1996 to 2000. More than half of China's coal is used for power and heat generation; therefore, coal consumption generally tracks electricity demand and industrial growth. Industries such as steel and construction accounted for 30 percent of coal use in 2011.

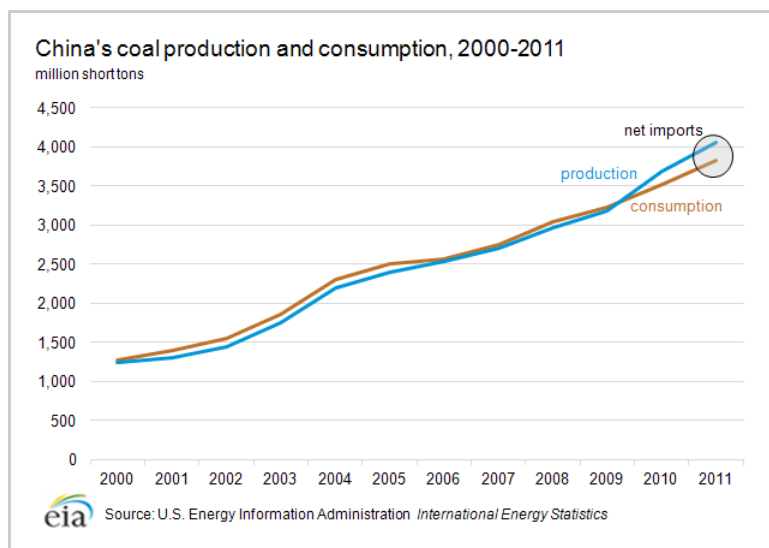
China, typically a net coal exporter, became a net coal importer in 2009 for the first time in over two decades. Total imports, rose to 240 million short tons in 2011, about 18 percent higher than 2010 levels, according to FACTS Global Energy. China sources coal from regional suppliers within Asia. Indonesia and Australia are the largest coal exporters to

China with over 50 percent of the market share of imports in 2011. Despite abundant domestic coal, several factors contribute to the sudden rise in imports, including the higher cost of domestic coal, bottlenecks in transporting domestic coal to power plants, coking coal resource restraints, environmental and safety concerns, and greater efficiencies in the industry.

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 less than 30 percent of the domestic coal. Shenhua Coal, the world's largest coal company, holds 10 percent of the domestic market in China.

China has tens of thousands of small local coal mines where insufficient investment, outdated equipment, and poor safety practices prevent the full utilization of coal resources. Though 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 consolidating the industry is to attract greater investment in new coal technologies and improve the safety and environmental record of coal mines. The government's 12th Five-Year Plan calls for a production ceiling of 4.4 billion short tons (3.9 billion metric tons) and capacity ceiling of 4.6 billion short tons (4.1 billion metric tons) by 2015 in an attempt to control the production growth. The NEA also plans to form 10 large and 10 medium-sized coal companies that will account for over 60 percent of the country's total coal production and cap the number of coal entities to 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 into the coal industry. The China National Coal Import and Export Corporation is the primary Chinese partner for foreign investors in the coal sector. Areas of interest in foreign investment include coal liquefaction, CBM production, coal-to-gas and slurry pipeline transportation projects. The Chinese government is actively promoting the development of a large coal-to-liquids industry. A Shenhua Group subsidiary commissioned the country's first coal-to-liquids plant in 2009. The facility is located in the Inner Mongolia Autonomous Region and has an initial capacity of approximately 24,000 bbl/d of diesel, ramping up to 240,000 bbl/d by 2015.



Electricity

China's electricity generation continues to be dominated by fossil fuel sources, particularly coal. The Chinese government has made the expansion of natural gas-fired and renewable power plants as well as electricity transmission a priority.

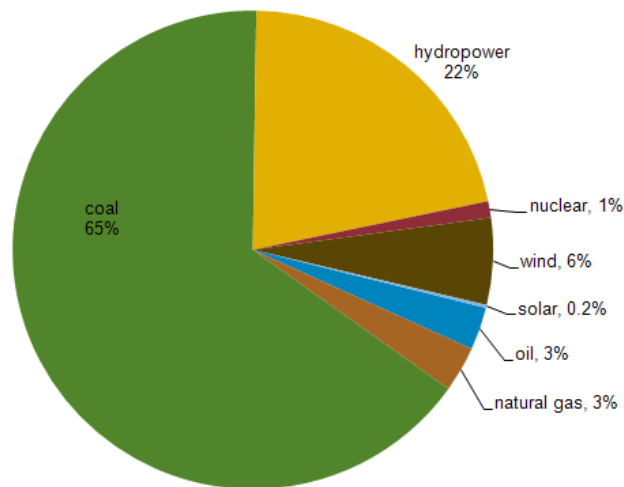
China had an estimated total installed electricity generating capacity of 1,073 gigawatts (GW) in 2011, according to FACTS Global Energy, giving it the largest power capacity in the world. China's capacity rose over 9 percent from 2010 and doubled in capacity from the 2005 level of 519 GW. Installed capacity is expected to grow over the next decade to meet rising demand, particularly from main urban areas in the East and South of the country. FACTS Global Energy expects installed capacity will double to 2,390 GW by 2030 as gas-fired capacity expands significantly. Thermal power has historically made up about three-quarters of installed capacity, and coal continues to dominate the mix with 65 percent of capacity in 2011. China intends to increase significantly its gas-fired power and hydroelectric and other renewable sources for generation and upgrade its coal-fired capacity by 2015.

China is the world's second largest power generator behind the US, and net power generation was 3,965 Terawatt-hours (TWh) in 2010, up 15 percent from 2009. Nearly 80 percent of generation is from conventional thermal sources, primarily coal. Both electricity generation and consumption have increased by over 50 percent since 2005, and EIA predicts total net generation will increase to 9,583 TWh by 2035, over 3 times the amount in 2010. Heavy and light industries account for over three-quarters of China's electricity consumption.

Rapid growth in electricity demand this past decade spurred significant investment in new power stations, but China still struggles with insufficient investment particularly in thermal capacity. Although much of the new investment was earmarked to alleviate electricity supply shortages, the economic crisis of late 2008 resulted in a lower demand for electricity. Power demand typically follows economic cycles and began to rebound in 2010 as the Chinese economy recovered. However, industry reports indicate a weaker power demand, coming in at less than 6 percent in the first half of 2012. The government is investing in further development of the transmission network, integration of regional networks, and bringing on planned new generating capacity.

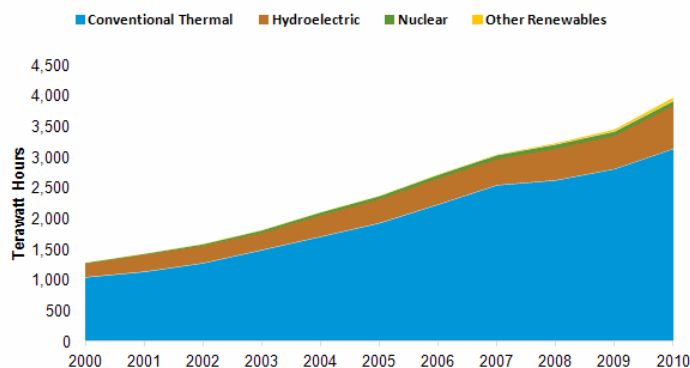
China's installed electricity capacity by fuel, 2011

installed capacity: 1,073 gigawatts



eia Source: FACTS Global Energy

China's electricity generation by fuel type, 2000-2010



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

Sector organization

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 dominated by five state-owned holding companies, namely China Huaneng Group, China Datang Group, China Huadian, Guodian Power, and China Power Investment. These five holding companies generate about half of China's electricity. Much of the remainder is generated by independent power producers (IPPs), often in partnership with the privately-listed arms of the state-owned companies. Deregulation and other reforms have opened the electricity sector to foreign investment, although this has so far been limited.

During the 2002 reforms, SPC divested all of its electricity transmission and distribution assets into two new companies, the Southern Power Company and the State Power Grid Company, which operate the 7 nation's power grids. The State Power Grid operates power transmission grids in the north while the Southern Power Company handles those in the south. Also in 2002, the State Electricity Regulatory Commission (SERC) was established, which is responsible for the overall regulation of the electricity sector and improving investment and competition in order to alleviate power shortages. China is seeking to improve system efficiency and the interconnections between the grids through ultra high-

voltage lines, as well as implement a smart grid plan. Phase 1 was completed by 2012 with 238 smart grid projects, and subsequent phases are slated for completion by 2020.

On-grid and retail electricity prices are determined and capped by the NDRC. The NDRC also determines a plan price that coal companies should sell to power producers for a certain level of supplies. Typically, generators negotiate directly with coal companies for long-term contracts. The NDRC made small changes to its pricing system, and in 2009, the agency allowed electricity producers and wholesale end-users such as industrial consumers to negotiate with each other directly. The government attempts to improve power generator margins by allowing higher power tariffs if coal prices rise substantially. Also, China is seeking ways to reform the retail rates to encourage demand side efficiency and introduced a tiered retail tariff for residential consumers in 2012.

Conventional thermal

Conventional thermal sources, primarily coal, currently make up nearly 79 percent of power generation and 71 percent of installed capacity. Coal and natural gas are expected to remain the dominant fuel in the power sector in the coming years. Oil-fired generation is expected to remain relatively flat in the next two decades. In 2010, China generated about 3,130 TWh from fossil fuel sources, up 11 percent annually. Installed thermal capacity was 766 GW in 2011, according to FACTS Global Energy.

Because of the large amount of reserves, coal will continue to dominate the fuel feedstock for the power capacity and generation, even as other cleaner fuels increase market share. As with coal mining, the Chinese government is looking to shut down or modernize many small and inefficient power plants in favor of medium-sized (300 to 600 MW) and large (1000 MW and higher) units. The NEA announced that the government had exceeded its target to remove 50 GW of coal-fired generation from small capacity generators between 2006 and 2010 and retired over 70 GW.

Natural gas currently plays a very small role in the power generation mix and consists of only 33 GW of installed capacity; however, the government plans to invest in more gas-fired power plants as a growing marginal fuel source. Gas prices declined in 2010, and China is able to source the fuel from growing domestic sources as well as growing import alternatives, though 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 the Guangdong and Shanghai. In May 2010, Huaneng Power International, China's largest listed electricity generation company, signed strategic agreements with CNOOC to explore opportunities for gas-fired power projects in the coastal areas near re-gasification terminals. China is actively promoting efficient cogeneration facilities through subsidies and plans to develop 10 GW of new capacity by 2020.

Hydroelectric and other renewables

The Three Gorges Dam hydroelectric facility, the largest hydroelectric project in the world, started operations in 2003 and completed construction in 2012.

China has a goal to generate at least 15 percent of total energy output by 2020 using renewable energy sources as the government aims to shift to a less-resource intense

economy. China invested \$264 million in renewable energy projects in 2011, and plans to spend \$473 billion on clean energy investments by 2015 as part of the latest Five-Year Plan.

China was the world's largest producer of hydroelectric power in 2010, generating 714 TWh of electricity from hydroelectric sources. This represented 18 percent of its total generation. Installed hydroelectric generating capacity was 231 GW in 2011, according to FACTS Global Energy, accounting for over a fifth of total installed capacity. The China Electricity Council has plans to increase hydro capacity to 342 GW by 2015. The world's largest hydro power project, the Three Gorges Dam along the Yangtze River, was completed in July 2012 and includes 32 generators with a total capacity of 22.7 GW. The dam's annual average power generation is anticipated to be 84.7 TWh.

Wind is the second leading renewable source for power generation, and China is the world's second largest wind producer, generating 48 TWh in 2010, about 100 percent higher than the 2009 level. China's installed wind capacity in 2011 was 63 GW, and has roughly doubled capacity each year since 2005. However, the lack of transmission infrastructure to connect to the grid in this sector has left a significant amount of capacity underutilized, with an operational rate of just 22 percent. The NDRC aims to increase wind capacity to 100 GW by 2015. China is also investing in solar power and hoping to increase capacity from a mere 2 GW in 2011 to 25 GW by 2020.

Nuclear

China generated about over 70 TWh of nuclear power in 2010, making up about 2 percent of total net generation. China is actively promoting nuclear power as a clean and efficient source of electricity generation. Although China's nuclear capacity of 12.5 GW makes up only a small fraction of the installed generating capacity, many of the major developments taking place in the Chinese electricity sector involve nuclear power. China's government plans to boost nuclear capacity to at least 70 GW by 2020. As of mid-2012, China had 15 operating reactors and 30 reactors with over 33 GW of capacity under construction, about half of the global nuclear power capacity being built. Following Japan's Fukushima Daiichi nuclear accident in March 2011, China suspended government approvals for new nuclear plants until safety reviews are completed for current plants and those under construction (finished at the end of 2011), and a safety framework for all nuclear facilities receives final approval by the State Council. The safety reviews were completed in late 2011, and the State Council approved a safety plan for all facilities in May 2012 allowing for new plant approvals to resume.

China also intends to build strategic and commercial uranium stockpiles through overseas purchases as well as further developing domestic production in Inner Mongolia and Xinjiang.

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